SECTION EC
ENGINE CONTROL SYSTEM

CONTENTS

VK56VD

PRECAUTION 29

PRECAUTIONS 29
- Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER" 29
- Precautions for Removing Battery Terminal 29
- Precaution for Procedure without Cowl Top Cover...30
- On Board Diagnostic (OBD) System of Engine and A/T 30
- General Precautions 30

PREPARATION 34

PREPARATION 34
- Special Service Tools 34
- Commercial Service Tools 34

SYSTEM DESCRIPTION 36

COMPONENT PARTS 36
- Component Parts Location 36
- Accelerator Pedal Position Sensor 40
- Air Fuel Ratio (A/F) Sensor 1 40
- ASCD Indicators 41
- ASCD Steering Switch 41
- Battery Current Sensor (With Battery Temperature Sensor) 41
- Brake Pedal Position Switch & Stop Lamp Switch...42
- Camshaft Position Sensor 42
- Crankshaft Position Sensor 42
- ECM 43
- Electric Throttle Control Actuator 43
- Engine Coolant Temperature Sensor 1 44
- Engine Coolant Temperature Sensor 2 44
- Engine Oil Pressure Sensor 45
- Engine Oil Temperature Sensor 45
- EVAP Control System Pressure Sensor 46
- EVAP Canister Vent Control Valve 46
- EVAP Canister Purge Volume Control Solenoid Valve 46
- Exhaust Gas Temperature Sensor 46
- Exhaust Valve Timing Control Position Sensor 47
- Exhaust Valve Timing Control Solenoid Valve 47
- Fan Clutch Assembly 47
- Fuel Injector 48
- Fuel Level Sensor 48
- Fuel Pump Control Module 48
- Fuel Rail Pressure Sensor 48
- Fuel Tank Temperature Sensor 49
- Heated Oxygen Sensor 2 49
- High Pressure Fuel Pump 49
- Ignition Coil With Power Transistor 50
- Intake Valve Timing Control Solenoid Valve 51
- Knock Sensor 51
- Low Pressure Fuel Pump 51
- Malfunction Indicator Lamp (MIL) 51
- Mass Air Flow Sensor (With Intake Air Temperature Sensor) 51
- Multi-way Control Valve 52
- Power Steering Pressure (PSP) Sensor 52
- Refrigerant Pressure Sensor 53
- VVEL Actuator Motor 53
- VVEL Actuator Motor Relay 53
- VVEL Control Module 53
- VVEL Control Shaft Position Sensor 53

STRUCTURE AND OPERATION 54
- Positive Crankcase Ventilation 54
- On Board Refueling Vapor Recovery (ORVR) 55

SYSTEM 56

ENGINE CONTROL SYSTEM 56
- ENGINE CONTROL SYSTEM : System Diagram...56
- ENGINE CONTROL SYSTEM : System Description 56
- ENGINE CONTROL SYSTEM : Fail-safe 57

DIRECT INJECTION GASOLINE SYSTEM 60

DIRECT INJECTION GASOLINE SYSTEM : System Diagram 60
DIRECT INJECTION GASOLINE SYSTEM : System Description 61

FUEL PRESSURE CONTROL 63
FUEL PRESSURE CONTROL : System Diagram ... 63
FUEL PRESSURE CONTROL : System Description 64

COOLING FAN CONTROL 65
COOLING FAN CONTROL : System Diagram 65
COOLING FAN CONTROL : System Description... 65

ELECTRIC IGNITION SYSTEM 65
ELECTRIC IGNITION SYSTEM : System Diagram 66
ELECTRIC IGNITION SYSTEM : System Description 66

INTAKE VALVE TIMING CONTROL 67
INTAKE VALVE TIMING CONTROL : System Diagram 67
INTAKE VALVE TIMING CONTROL : System Description 67

EXHAUST VALVE TIMING CONTROL 67
EXHAUST VALVE TIMING CONTROL : System Diagram 68
EXHAUST VALVE TIMING CONTROL : System Description 68

VVEL SYSTEM 68
VVEL SYSTEM : System Diagram 69
VVEL SYSTEM : System Description 69

EVAPORATIVE EMISSION SYSTEM 70
EVAPORATIVE EMISSION SYSTEM : System Diagram 70
EVAPORATIVE EMISSION SYSTEM : System Description 70

FUEL FILLER CAP WARNING SYSTEM 71
FUEL FILLER CAP WARNING SYSTEM : System Description 72

AIR CONDITIONING CUT CONTROL 73
AIR CONDITIONING CUT CONTROL : System Diagram 73
AIR CONDITIONING CUT CONTROL : System Description 73

THERMAL MANAGEMENT CONTROL 74
THERMAL MANAGEMENT CONTROL : System Description 74

ALTERNATOR POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM 75
ALTERNATOR POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM : System Description 75

AUTOMATIC SPEED CONTROL DEVICE (ASCD)... 75
AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Diagram 76
AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description 76

CAN COMMUNICATION 76
CAN COMMUNICATION : System Description 76

WARNING LAMPS/INDICATOR LAMPS 76
WARNING LAMPS/INDICATOR LAMPS : Engine Oil Pressure Warning Lamp 77
WARNING LAMPS/INDICATOR LAMPS : Malfunction Indicator Lamp (MIL) 78

INFORMATION DISPLAY (COMBINATION METER) 79
INFORMATION DISPLAY (COMBINATION METER) : ASCD Indicator 79
INFORMATION DISPLAY (COMBINATION METER) : Fuel Filler Cap Warning 79

WARNING/INDICATOR/CHIME LIST 80
WARNING/INDICATOR/CHIME LIST : Warning lamps/Indicator lamps 80
WARNING/INDICATOR/CHIME LIST : Warning/Indicator (On Information Display) 80

OPERATION 81

AUTMATIC SPEED CONTROL DEVICE (ASCD) ... 81
AUTMATIC SPEED CONTROL DEVICE (ASCD) : Switch Name and Function 81

ON BOARD DIAGNOSTIC (OBD) SYSTEM 83
Diagnosis Description 83
GST (Generic Scan Tool) 83

DIAGNOSIS SYSTEM (ECM) 84

DIAGNOSIS DESCRIPTION 84
DIAGNOSIS DESCRIPTION : 1st Trip Detection Logic and Two Trip Detection Logic 84
DIAGNOSIS DESCRIPTION : DTC and Freeze Frame Data 84
DIAGNOSIS DESCRIPTION : Counter System 85
DIAGNOSIS DESCRIPTION : Driving Pattern 88
DIAGNOSIS DESCRIPTION : System Readiness Test (SRT) Code 89
DIAGNOSIS DESCRIPTION : Permanent Diagnostic Trouble Code (Permanent DTC) 90
DIAGNOSIS DESCRIPTION : Malfunction Indicator Lamp (MIL) 91
On Board Diagnosis Function 91
CONSULT Function 94

ECU DIAGNOSIS INFORMATION 107

ECM 107
Reference Value 107
Fail-safe 131
DTC Inspection Priority Chart 134

DTC Index 136
Test Value and Test Limit 143

VVEL CONTROL MODULE 151
Reference Value 151

WIRING DIAGRAM 155

ENGINE CONTROL SYSTEM 155
Wiring Diagram 155

BASIC INSPECTION 185

DIAGNOSIS AND REPAIR WORKFLOW 185
Work Flow 185
Diagnostic Work Sheet 188

BASIC INSPECTION 190
Work Procedure 190

ADDITIONAL SERVICE WHEN REPLACING ECM 194
Description 194
Work Procedure 194

ADDITIONAL SERVICE WHEN REPLACING VVEL CONTROL MODULE 196
Description 196
Work Procedure 196

VIN REGISTRATION 197
Description 197
Work Procedure 197

ACCELERATOR PEDAL RELEASED POSITION LEARNING 198
Description 198
Work Procedure 198

THROTTLE VALVE CLOSED POSITION LEARNING 199
Description 199
Work Procedure 199

IDLE AIR VOLUME LEARNING 200
Description 200
Work Procedure 200

VVEL CONTROL SHAFT POSITION SENSOR ADJUSTMENT 202
Description 202
Work Procedure 202

MIXTURE RATIO SELF-LEARNING VALUE CLEAR 204
Description 204
Work Procedure 204

FUEL PRESSURE 205
Work Procedure 205

HOW TO SET SRT CODE 208
Description 208
SRT Set Driving Pattern 209
Work Procedure 211

HOW TO ERASE PERMANENT DTC 214
Description 214
Work Procedure (Group A) 215
Work Procedure (Group B) 217

DTC/CIRCUIT DIAGNOSIS 220

TROUBLE DIAGNOSIS - SPECIFICATION VALUE 220
Description 220
Component Function Check 220
Diagnosis Procedure 221

POWER SUPPLY AND GROUND CIRCUIT .. 227
Diagnosis Procedure 227

U0101 CAN COMM CIRCUIT 231
DTC Description 231
Diagnosis Procedure 231

U0113, U1003 CAN COMM CIRCUIT 232
DTC Description 232
Diagnosis Procedure 233

U0284 ACTIVE GRILLE SHUTTER 235
DTC Description 235
Diagnosis Procedure 235
Component Inspection (Active Grille Shutter) 237

U1001 CAN COMM CIRCUIT 238
DTC Description 238
Diagnosis Procedure 238

U1024 CAN COMM CIRCUIT 239
DTC Description 239
Diagnosis Procedure 239

U1040 ENG COMM CIRCUIT 241
DTC Description 241
Diagnosis Procedure 241

U1044 ENG COMM CIRCUIT 243
DTC Description 243
Diagnosis Procedure 243

P0011, P0021 IVT CONTROL 244
DTC Description 244
Diagnosis Procedure 245
Component Inspection (Intake Valve Timing Control Solenoid Valve) 247

P0012 INTAKE VALVE TIMING CONTROL ... 248
DTC Description 248
Diagnosis Procedure 249
Component Inspection (Intake Valve Timing Control Solenoid Valve) 251

P0014, P0024 EVT CONTROL 252

DTC Description 252
Diagnosis Procedure 253
Component Inspection (Echaust Valve Timing Control Solenoid Valve) 255

P0015 EXHAUST VALVE TIMING CONTROL 256
DTC Description 256
Diagnosis Procedure 257
Component Inspection (Echaust Valve Timing Control Solenoid Valve) 258

P0016 INTAKE VALVE TIMING CONTROL .. 260
DTC Description 260
Diagnosis Procedure 261
Component Inspection (Intake Valve Timing Control Solenoid Valve) 263

P0017 EXHAUST VALVE TIMING CONTROL 264
DTC Description 264
Diagnosis Procedure 265
Component Inspection (Echaust Valve Timing Control Solenoid Valve) 266

P0018 INTAKE VALVE TIMING CONTROL .. 268
DTC Description 268
Diagnosis Procedure 269
Component Inspection (Intake Valve Timing Control Solenoid Valve) 271

P0019 EXHAUST VALVE TIMING CONTROL 272
DTC Description 272
Diagnosis Procedure 273
Component Inspection (Echaust Valve Timing Control Solenoid Valve) 274

P0022 INTAKE VALVE TIMING CONTROL .. 276
DTC Description 276
Diagnosis Procedure 277
Component Inspection (Intake Valve Timing Control Solenoid Valve) 279

P0025 EXHAUST VALVE TIMING CONTROL 280
DTC Description 280
Diagnosis Procedure 281
Component Inspection (Echaust Valve Timing Control Solenoid Valve) 282

P0030, P0031, P0032, P0036, P0051, P0052 A/F SENSOR 1 HEATER 284
DTC Description 284
Diagnosis Procedure 285
Component Inspection (A/F Sensor 1 Heater) 286

P0037, P0038, P0057, P0058 HO2S2 HEATER 287
DTC Description 287
Diagnosis Procedure 288
Component Inspection (HO2 Sensor 2 Heater) 289

P0075, P0081 IVT CONTROL SOLENOID VALVE 290
DTC Description 290
Diagnosis Procedure 290
Component Inspection (Intake Valve Timing Control Solenoid Valve) 291

P0078, P0084 EVT CONTROL SOLENOID VALVE 293
DTC Description 293
Diagnosis Procedure 293
Component Inspection (Echaust Valve Timing Control Solenoid Valve) 294

P0087 FRP CONTROL SYSTEM 296
DTC Description 296
Diagnosis Procedure 298
Component Inspection (High Pressure Fuel Pump) 299

P0088 FRP CONTROL SYSTEM 300
DTC Description 300
Diagnosis Procedure 301
Component Inspection (High Pressure Fuel Pump) 301

P0090 HIGH PRESSURE FUEL PUMP 303
DTC Description 303
Diagnosis Procedure 304
Component Inspection (High Pressure Fuel Pump) 304

P00B3, P00B4 ENGINE COOLANT TEMPERATURE SENSOR 2 306
DTC Description 306
Diagnosis Procedure 307
Component Inspection (Engine Coolant Temperature Sensor 2) 308

P0101 MAF SENSOR 309
DTC Description 309
Diagnosis Procedure 310
Component Inspection (MAF sensor) 311

P0102, P0103 MAF SENSOR 314
DTC Description 314
Diagnosis Procedure 315
Component Inspection (MAF Sensor) 316

P0111 IAT SENSOR 319
DTC Description 319
Component Function Check 320
Diagnosis Procedure 320
Component Inspection 320

P0112, P0113 IAT SENSOR 321
DTC Description 321
Diagnosis Procedure 321
Component Inspection (Intake Air Temperature Sensor) 322

P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 323

DTC Description 323
Component Function Check 324
Diagnosis Procedure 324
Component Inspection 324

P0117, P0118 ENGINE COOLANT TEMPERATURE SENSOR 1 326
DTC Description 326
Diagnosis Procedure 327
Component Inspection (Engine Coolant Temperature Sensor 1) 327

P0122, P0123 TP SENSOR 329
DTC Description 329
Diagnosis Procedure 330
Component Inspection (Throttle Position Sensor). 331

P0125 ECT SENSOR 332
DTC Description 332
Diagnosis Procedure 333
Component Inspection (Engine Coolant Temperature Sensor 1) 333

P0127 IAT SENSOR 334
DTC Description 334
Diagnosis Procedure 335
Component Inspection (Intake Air Temperature Sensor) 335

P0130, P0150 A/F SENSOR 1 336
DTC Description 336
Diagnosis Procedure 338

P0131, P0151 A/F SENSOR 1 340
DTC Description 340
Diagnosis Procedure 341

P0132, P0152 A/F SENSOR 1 343
DTC Description 343
Diagnosis Procedure 344

P0137, P0157 HO2S2 346
DTC Description 346
Diagnosis Procedure 348
Component Inspection (HO2 sensor 2) 349

P0138, P0158 HO2S2 352
DTC Description 352
Diagnosis Procedure 355
Component Inspection (HO2 sensor 2) 357

P0139, P0159 HO2S2 360
DTC Description 360
Diagnosis Procedure 363
Component Inspection (HO2 sensor 2) 364

P014C, P014D, P014E, P014F, P015A, P015B, P015C, P015D A/F SENSOR 1 367
DTC Description 367
Diagnosis Procedure 370

P0171, P0174 FUEL INJECTION SYSTEM FUNCTION 373
DTC Description 373
Diagnosis Procedure 375

P0172, P0175 FUEL INJECTION SYSTEM FUNCTION 377
DTC Description 377
Diagnosis Procedure 378

P0181 FTT SENSOR 381
DTC Description 381
Diagnosis Procedure 383
Component Inspection 384

P0182, P0183 FTT SENSOR 385
DTC Description 385
Diagnosis Procedure 385
Component Inspection (Fuel Tank Temperature Sensor) 387

P0190, P0192, P0193 FRP SENSOR 388
DTC Description 388
Diagnosis Procedure 389
Component Inspection (Fuel Rail Pressure Sensor) 390

P0191 FRP SENSOR 392
DTC Description 392
Diagnosis Procedure 392
Component Inspection (Fuel Rail Pressure Sensor) 394

P0196 EOT SENSOR 395
DTC Description 395
Diagnosis Procedure 397
Component Inspection 398

P0197, P0198 EOT SENSOR 399
DTC Description 399
Diagnosis Procedure 399
Component Inspection (Engine Oil Temperature Sensor) 400

P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208 INJECTOR 401
DTC Description 401
Diagnosis Procedure 403

P0222, P0223 TP SENSOR 404
DTC Description 404
Diagnosis Procedure 405
Component Inspection (Throttle Position Sensor). 406

P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308 MISFIRE 407
DTC Description 407
Diagnosis Procedure 409

P0327, P0328, P0332, P0333 KS 414
DTC Description 414

Diagnosis Procedure 415
Component Inspection (Knock Sensor) 416

P0335 CKP SENSOR 417
DTC Description 417
Diagnosis Procedure 418
Component Inspection (Crankshaft Position Sensor) 419

P0340, P0345 CMP SENSOR 420
DTC Description 420
Diagnosis Procedure 421
Component Inspection (Camshaft Position Sensor) 423

P0420, P0430 THREE WAY CATALYST FUNCTION 425
DTC Description 425
Component Function Check 427
Diagnosis Procedure 427

P0441 EVAP CONTROL SYSTEM 431
DTC Description 431
Component Function Check 433
Diagnosis Procedure 433

P0443 EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE 437
DTC Description 437
Diagnosis Procedure 438
Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve) 440

P0444, P0445 EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE 441
DTC Description 441
Diagnosis Procedure 441
Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve) 443

P0447 EVAP CANISTER VENT CONTROL VALVE 444
DTC Description 444
Diagnosis Procedure 444
Component Inspection (EVAP Canister Vent Control Valve) 446

P0448 EVAP CANISTER VENT CONTROL VALVE 448
DTC Description 448
Diagnosis Procedure 449
Component Inspection (EVAP Canister Vent Control Valve) 450

P0451 EVAP CONTROL SYSTEM PRESSURE SENSOR 452
DTC Description 452
Diagnosis Procedure 453
Component Inspection (EVAP Control System Pressure Sensor) 454

P0452 EVAP CONTROL SYSTEM PRESSURE SENSOR 455
DTC Description 455
Diagnosis Procedure 456
Component Inspection (EVAP Control System Pressure Sensor) 457

P0453 EVAP CONTROL SYSTEM PRESSURE SENSOR 459
DTC Description 459
Diagnosis Procedure 460
Component Inspection (EVAP Control System Pressure Sensor) 462

P0456 EVAP CONTROL SYSTEM 464
DTC Description 464
Diagnosis Procedure 465
Component Inspection (Fuel Filler Cap) 469

P0460 FUEL LEVEL SENSOR 470
DTC Description 470
Diagnosis Procedure 470

P0461 FUEL LEVEL SENSOR 472
DTC Description 472
Component Function Check 472
Diagnosis Procedure 473

P0462, P0463 FUEL LEVEL SENSOR 474
DTC Description 474
Diagnosis Procedure 475

P0500 VSS 476
DTC Description 476
Diagnosis Procedure 477

P0506 ISC SYSTEM 478
DTC Description 478
Diagnosis Procedure 479

P0507 ISC SYSTEM 480
DTC Description 480
Diagnosis Procedure 481

P050A, P050B, P050E COLD START CONTROL 482
DTC Description 482
Diagnosis Procedure 483

P0520 EOP SENSOR 485
DTC Description 485
Diagnosis Procedure 485
Component Inspection (EOP sensor) 487

P0524 ENGINE OIL PRESSURE 488
DTC Description 488
Diagnosis Procedure 489
Component Inspection 490

P0527 COOLING FAN SPEED SENSOR 491
DTC Description 491

Diagnosis Procedure 491
Component Inspection (Cooling Fan Speed Sensor) 493

P0544, P0545 EXHAUST GAS TEMPERATURE SENSOR 494
DTC Description 494
Diagnosis Procedure 494

P0546, P2081 EXHAUST GAS TEMPERATURE SENSOR 497
DTC Description 497
Diagnosis Procedure 498

P0547, P0548 EXHAUST GAS TEMPERATURE SENSOR 500
DTC Description 500
Diagnosis Procedure 500

P0549, P2083 EXHAUST GAS TEMPERATURE SENSOR 503
DTC Description 503
Diagnosis Procedure 504

P0550 PSP SENSOR 506
DTC Description 506
Diagnosis Procedure 506
Component Inspection (Power Steering Pressure Sensor) 508

P059F ACTIVE GRILLE SHUTTER 509
DTC Description 509
Diagnosis Procedure 510
Component Inspection (Active Grille Shutter) 511

P0603 ECM 513
DTC Description 513
Diagnosis Procedure 513

P0604 ECM 515
DTC Description 515
Diagnosis Procedure 515

P0605 ECM 517
DTC Description 517
Diagnosis Procedure 517

P0606 ECM 519
DTC Description 519
Diagnosis Procedure 520

P0607 ECM 521
DTC Description 521
Diagnosis Procedure 521

P060A ECM 522
DTC Description 522
Diagnosis Procedure 522

P060B ECM 524
DTC Description 524
Diagnosis Procedure 524

P0611 ECM PROTECTION 526
DTC Description 526
Diagnosis Procedure 526

P062B ECM 527
DTC Description 527
Diagnosis Procedure 527

P062F CONTROL MODULE 529
DTC Description 529
Diagnosis Procedure 529

P0643 SENSOR POWER SUPPLY 530
DTC Description 530
Diagnosis Procedure 530

P0850 PNP SWITCH 533
DTC Description 533
Component Function Check 534
Diagnosis Procedure 534

P100A, P100B VVEL SYSTEM 536
DTC Description 536
Diagnosis Procedure 536
Component Inspection (VVEL ACTUATOR MOTOR) 538
Component Inspection (VVEL ACTUATOR HOUSING ASSEMBLY) 539

P1078, P1084 EVT CONTROL POSITION SENSOR 540
DTC Description 540
Diagnosis Procedure 540
Component Inspection (Exhaust Valve Timing Control Position Sensor) 542

P1087, P1088 VVEL SYSTEM 543
DTC Description 543
Diagnosis Procedure 543

P1089, P1092 VVEL CONTROL SHAFT POSITION SENSOR 544
DTC Description 544
Diagnosis Procedure 545

P1090, P1093 VVEL ACTUATOR MOTOR 547
DTC Description 547
Diagnosis Procedure 548
Component Inspection (VVEL ACTUATOR MOTOR ASSEMBLY) 549
Component Inspection (VVEL ACTUATOR HOUSING ASSEMBLY) 549

P1091 VVEL ACTUATOR MOTOR RELAY ... 551
DTC Description 551
Diagnosis Procedure 551
Component Inspection (VVEL Actuator Motor Relay) 553

P1148, P1168 CLOSED LOOP CONTROL 554
DTC Description 554

Diagnosis Procedure 554

P1197 OUT OF GAS 555
DTC Description 555
Diagnosis Procedure 556

P119A, P119B FUEL RAIL PRESSURE SENSOR 557
DTC Description 557
Diagnosis Procedure 559
Component Inspection (Fuel Rail Pressure Sensor) 561

P119C FUEL RAIL PRESSURE SENSOR 562
DTC Description 562
Diagnosis Procedure 563
Component Inspection (Fuel Rail Pressure Sensor) 565

P1212 TCS COMMUNICATION LINE 566
DTC Description 566
Diagnosis Procedure 566

P1217 ENGINE OVER TEMPERATURE 568
DTC Description 568
Component Function Check 569
Diagnosis Procedure 569

P1220 FUEL PUMP CONTROL MODULE (FPCM) 571
DTC Description 571
Diagnosis Procedure 571
Component Inspection (FPCM) 573

P1225 TP SENSOR 575
DTC Description 575
Diagnosis Procedure 575

P1226 TP SENSOR 576
DTC Description 576
Diagnosis Procedure 576

P1423, P1424 COLD START CONTROL 577
DTC Description 577
Diagnosis Procedure 578

P1550 BATTERY CURRENT SENSOR 579
DTC Description 579
Diagnosis Procedure 579
Component Inspection (Battery Current Sensor) ..580

P1551, P1552 BATTERY CURRENT SENSOR 582
DTC Description 582
Diagnosis Procedure 582
Component Inspection (Battery Current Sensor) ..584

P1553 BATTERY CURRENT SENSOR 585
DTC Description 585
Diagnosis Procedure 585
Component Inspection (Battery Current Sensor) ..586

P1554 BATTERY CURRENT SENSOR 588
DTC Description 588
Component Function Check 588
Diagnosis Procedure 589
Component Inspection (Battery Current Sensor) . 590

P1556, P1557 BATTERY TEMPERATURE SENSOR 591
DTC Description 591
Diagnosis Procedure 592
Component Inspection (Battery Temperature Sensor) 593

P1564 ASCD STEERING SWITCH 594
DTC Description 594
Diagnosis Procedure 595
Component Inspection (ASCD Steering Switch) .. 596

P1572 BRAKE PEDAL POSITION SWITCH ..598
DTC Description 598
Diagnosis Procedure 599
Component Inspection (Brake Pedal Position Switch) 602
Component Inspection (Stop Lamp Switch) 602

P1574 ASCD VEHICLE SPEED SENSOR 604
DTC Description 604
Diagnosis Procedure 605

P159F ACTIVE GRILLE SHUTTER 606
DTC Description 606
Diagnosis Procedure 607

P1606 VVEL CONTROL MODULE 608
DTC Description 608
Diagnosis Procedure 608

P1607 VVEL CONTROL MODULE 609
DTC Description 609
Diagnosis Procedure 609

P1608 VVEL SENSOR POWER SUPPLY 610
DTC Description 610
Diagnosis Procedure 610

P1805 BRAKE SWITCH 612
DTC Description 612
Diagnosis Procedure 612
Component Inspection (Stop Lamp Switch) 613

P2080 EXHAUST GAS TEMPERATURE SENSOR 615
DTC Description 615
Diagnosis Procedure 616

P2082 EXHAUST GAS TEMPERATURE SENSOR 618
DTC Description 618
Diagnosis Procedure 619

P2096, P2097, P2098, P2099 A/F SENSOR 1..621

DTC Description 621
Diagnosis Procedure 622

P2100, P2103 THROTTLE CONTROL MOTOR RELAY 626
DTC Description 626
Diagnosis Procedure 627

P2101 ELECTRIC THROTTLE CONTROL FUNCTION 628
DTC Description 628
Diagnosis Procedure 629
Component Inspection 630
Special Repair Requirement 630

P2118 THROTTLE CONTROL MOTOR 632
DTC Description 632
Diagnosis Procedure 632
Component Inspection (Electric Throttle Control Motor) 633

P2119 ELECTRIC THROTTLE CONTROL ACTUATOR 634
DTC Description 634
Diagnosis Procedure 635

P2122, P2123 APP SENSOR 636
DTC Description 636
Diagnosis Procedure 637
Component Inspection (Accelerator Pedal Position Sensor) 638

P2127, P2128 APP SENSOR 639
DTC Description 639
Diagnosis Procedure 639
Component Inspection (Accelerator Pedal Position Sensor) 641

P2135 TP SENSOR 642
DTC Description 642
Diagnosis Procedure 642
Component Inspection (Throttle Position Sensor). 644

P2138 APP SENSOR 645
DTC Description 645
Diagnosis Procedure 645
Component Inspection (Accelerator Pedal Position Sensor) 647

P219A, P219B AIR FUEL RATIO 649
DTC Description 649
Diagnosis Procedure 651

P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2, P21A3 AIR FUEL RATIO 654
DTC Description 654
Diagnosis Procedure 657

P2610 ECM INTERNAL TIMER 661
DTC Description 661
Diagnosis Procedure 662

P26A3 MULTI-WAY CONTROL VALVE MOTOR 663
DTC Description 663
Diagnosis Procedure 664
Component Inspection (Multi-way Control Valve).. 664

P26A5 MULTI-WAY CONTROL VALVE POSITION SENSOR 666
DTC Description 666
Diagnosis Procedure 667
Component Inspection (Multi-way Control Valve).. 668

P26A6 P26A7 MULTI-WAY CONTROL VALVE POSITION SENSOR 670
DTC Description 670
Diagnosis Procedure 671
Component Inspection (Multi-way Control Valve).. 672

P26AB MULTI-WAY CONTROL VALVE 673
DTC Description 673
Diagnosis Procedure 674
Component Inspection 675

ASCD INDICATOR 676
Component Function Check 676
Diagnosis Procedure 676

BRAKE PEDAL POSITION SWITCH 677
Component Function Check 677
Diagnosis Procedure 677
Component Inspection (Brake Pedal Position Switch) 678

COOLING FAN 680
Component Function Check 680
Diagnosis Procedure 680

ELECTRICAL LOAD SIGNAL 683
Description 683
Component Function Check 683
Diagnosis Procedure 683

FUEL INJECTOR 685
Component Function Check 685
Diagnosis Procedure 685
Component Inspection (Fuel Injector) 689
Component Inspection (Fuel Injector Relay) 689

HIGH PRESSURE FUEL PUMP 691
Component Function Check 691
Diagnosis Procedure 691
Component Inspection (High Pressure Fuel Pump Solenoid) 694
Component Inspection (High Pressure Fuel Pump And Injector Relay) 694

IGNITION SIGNAL 695
Component Function Check 695
Diagnosis Procedure 695
Component Inspection (Ignition Coil with Power Transistor) 698

Component Inspection (Condenser) 699

INFORMATION DISPLAY (ASCD) 700
Component Function Check 700
Diagnosis Procedure 700

LOW PRESSURE FUEL PUMP 701
Component Function Check 701
Diagnosis Procedure 701
Component Inspection (Low Pressure Fuel Pump) ..703
Component Inspection (FPCM) 703

MALFUNCTION INDICATOR LAMP 705
Component Function Check 705
Diagnosis Procedure 705

ON BOARD REFUELING VAPOR RECOVERY (ORVR) 706
Component Function Check 706
Diagnosis Procedure 706
Component Inspection (EVAP Vapor Cut Valve) ..708

REFRIGERANT PRESSURE SENSOR 710
Component Function Check 710
Diagnosis Procedure 710

SENSOR POWER SUPPLY 2 CIRCUIT 712
Description 712
Diagnosis Procedure 712

SENSOR POWER SUPPLY 3 CIRCUIT 714
Description 714
Diagnosis Procedure 714

SYMPTOM DIAGNOSIS 716

ENGINE CONTROL SYSTEM SYMPTOMS .. 716
Symptom Table 716

NORMAL OPERATING CONDITION 721
Description 721

PERIODIC MAINTENANCE 722

IDLE SPEED 722
Inspection 722

IGNITION TIMING 723
Inspection 723

EVAP LEAK CHECK 724
Inspection 724

POSITIVE CRANKCASE VENTILATION 726
Inspection 726

REMOVAL AND INSTALLATION 727

ECM 727
Removal and Installation 727

VVEL CONTROL MODULE 728
Removal and Installation 728

FUEL PUMP CONTROL MODULE (FPCM) ...729
Removal and Installation 729

SERVICE DATA AND SPECIFICATIONS (SDS) 730

SERVICE DATA AND SPECIFICATIONS (SDS) 730
Idle Speed 730
Ignition Timing 730
Calculated Load Value 730
Mass Air Flow Sensor 730

CUMMINS 5.0L

PRECAUTION 731

PRECAUTIONS 731
Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER" 731
On Board Diagnosis (OBD) System of Engine and A/T 731
Precaution 732

PREPARATION 735

PREPARATION 735
Special Service Tool 735
Commercial Service Tool 736

SYSTEM DESCRIPTION 737

COMPONENT PARTS 737
Component Parts Location 737
Accelerator Pedal Position Sensor 742
ASCD Steering Switch 743
Camshaft Position Sensor 743
Compressor Bypass Valve Solenoid 743
Coolant Level Sensor 743
Crankcase Pressure Sensor 744
Crankshaft Position Sensor 744
DEF Control Module 744
DEF Dosing Valve 744
DEF Quality Sensor 745
DEF Line Heater 745
DEF Supply Pump Assembly 745
DPF Temperature Sensor 745
DPF (Diesel Particulate Filter) Differential Pressure Sensor 745
Exhaust Gas Pressure Sensor 746
ECM 746
EGR Bypass Valve 746
EGR Temperature Sensor 746
EGR Valve 747
Engine Charge Air Cooler Outlet Pressure/Temperature Sensor 747
Engine Coolant Temperature Sensor 747
Fan Clutch Assembly 747

Fuel Injector 748
Fuel Pressure Sensor 748
Fuel Pressure Relief Valve 748
Fuel Pump Actuator 748
Fuel Rail Pressure Sensor 749
Fuel Temperature Sensor 749
Glow Plug Control Module 749
Glow Plug 749
Intake Manifold Temperature Sensor 750
Intake NOx Sensor 750
Lift Pump 750
Low Pressure Turbocharger Boost Pressure Sensor 750
Mass Air Flow Sensor 751
Oil Pressure Switch 751
Outlet NOx Sensor 751
Refrigerant Pressure Sensor 751
Rotary Turbine Control Valve Actuator 752
SCR Temperature Sensor Module 752
Stop Lamp Switch/ASCD Cancel Switch 752
Turbocharger Compressor Intake Pressure/Temperature Sensor 753
Turbocharger Speed Sensor 753
Water In Fuel Sensor 753

STRUCTURE AND OPERATION 754

TURBOCHARGER BOOST CONTROL 754
TURBOCHARGER BOOST CONTROL : System Diagram 754
TURBOCHARGER BOOST CONTROL : System Description 754

SYSTEM 757

ENGINE CONTROL SYSTEM 757
ENGINE CONTROL SYSTEM : System Description 757
ENGINE CONTROL SYSTEM : Fail safe 759

FUEL SUPPLY CONTROL 768
FUEL SUPPLY CONTROL : System Description.. 769

FUEL INJECTION CONTROL 771
FUEL INJECTION CONTROL : System Description 772

FUEL PRESSURE CONTROL 773
FUEL PRESSURE CONTROL : System Description 774

ENGINE TORQUE CONTROL 775
ENGINE TORQUE CONTROL : System Description 775

TURBOCHARGER BOOST CONTROL 776
TURBOCHARGER BOOST CONTROL : System Description 777

EGR SYSTEM 777
EGR SYSTEM : System Description 778

GLOW CONTROL 779
GLOW CONTROL : System Description 780

DEF CONTROL SYSTEM 781
DEF CONTROL SYSTEM : System Description ..782

AFTER TREATMENT SYSTEM 784
AFTER TREATMENT SYSTEM : System Description 785

AUTOMATIC SPEED CONTROL DEVICE (ASCD). 787
AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description 787

WARNING LAMPS/INDICATOR LAMPS 788
WARNING LAMPS/INDICATOR LAMPS : Engine Oil Pressure Warning Lamp 788
WARNING LAMPS/INDICATOR LAMPS : Malfunction Indicator Lamp (MIL) 789
WARNING LAMPS/INDICATOR LAMPS : Glow Indicator Lamp 790
WARNING LAMPS/INDICATOR LAMPS : DPF (Diesel Particulate Filter) Warning Lamp 792

INFORMATION DISPLAY (COMBINATION METER) 793
INFORMATION DISPLAY (COMBINATION METER) : ASCD Indicator 793
INFORMATION DISPLAY (COMBINATION METER) : Engine Oil Pressure Warning 793

WARNING/INDICATOR/CHIME LIST 795
WARNING/INDICATOR/CHIME LIST : Warning lamps/Indicator lamps 795
WARNING/INDICATOR/CHIME LIST : Warning/Indicator (On Information Display) 795

CAN COMMUNICATION 795
CAN COMMUNICATION : System Description 796

OPERATION 798

AUTOMATIC SPEED CONTROL DEVICE (ASCD). 798
AUTOMATIC SPEED CONTROL DEVICE (ASCD) : Switch Name and Function 798

OIL CONTROL SYSTEM 798
OIL CONTROL SYSTEM : Switch Name and Function 798

ON BOARD DIAGNOSTIC (OBD) SYSTEM .. 800
Diagnosis Description 800
GST (Generic Scan Tool) 800

DIAGNOSIS SYSTEM (ECM) 801
System Readiness Test (SRT) Code 801
Permanent Diagnostic Trouble Code (Permanent DTC) 802
Malfunction Indicator Lamp (MIL) 802
On Board Diagnosis Function 802
CONSULT Function 806

ECU DIAGNOSIS INFORMATION 817

ECM 817
Reference Value 817
Fail safe 829
DTC Index 838

WIRING DIAGRAM 856

ENGINE CONTROL SYSTEM 856
Wiring Diagram 856

BASIC INSPECTION 881

DIAGNOSIS AND REPAIR WORK FLOW 881
Work Flow 881
Diagnostic Work Sheet 883

SERVICE AFTER REPLACING OR REMOVING ENGINE PARTS 885
Description 885

ADDITIONAL SERVICE WHEN REPLACING ECM 886
Description 886
Work Procedure 886

DIESEL PARTICLE FILTER REGENERATION 888
Aftertreatment SCR Performance Test 888
Aftertreatment DPF Regeneration Test 889

DIESEL PARTICULATE FILTER DATA CLEAR 893
Description 893
Work Procedure 893

INJECTOR ADJUSTMENT VALUE REGISTRATION 894
Description 894
Work Procedure 894

VIN REGISTRATION 895
Description 895
Work Procedure 895

SNAP ACCELERATION TEST 896
Work Procedure 896

CYLINDER CUTOUT TEST 897
Description 897
Work Procedure 897

DEF SYSTEM LEAK TEST 898
Work Procedure 898

DEF DOSING UNIT OVERRIDE TEST 899
Work Procedure 899

ROTARY TURBINE CONTROL VALVE ACTUATOR TEST 901
Description 901
Work Procedure 901

ROTARY TURBINE CONTROL VALVE ACTUATOR CALIBRATION 902
Description 902
Work Procedure 902

FAN OVERRIDE TEST 903
Work Procedure 903

BASIC INSPECTION 904
Work Procedure 904

HOW TO SET SRT CODE 906
Description 906
SRT Set Driving Pattern 907
Work Procedure 909

HOW TO ERASE PERMANENT DTC 912
Description 912

DTC/CIRCUIT DIAGNOSIS 914

U0002 DRIVETRAIN CAN COMMUNICATION 914
DTC Description 914
Diagnosis Procedure 914

U0101 CAN COMM CIRCUIT 916
DTC Description 916
Diagnosis Procedure 916

U0106 LOST COMMUNICATION (GLOW OUTPUT STAGE) 918
DTC Description 918
Diagnosis Procedure 918

U010C CAN COMMUNICATION 922
DTC Description 922
Diagnosis Procedure 922

U010E CAN COMMUNICATION 927
DTC Description 927
Diagnosis Procedure 927

U029D COMMUNICATION WITH NOX SENSOR 1 931
DTC Description 931
Diagnosis Procedure 931

U029E COMMUNICATION WITH NOX SENSOR 2 935
DTC Description 935
Diagnosis Procedure 935

U02A2 CAN COMMUNICATION 939
DTC Description 939
Diagnosis Procedure 939

U0307 CAN COMMUNICATION 943
DTC Description 943
Diagnosis Procedure 943

U0402 DRIVETRAIN CAN COMMUNICATION (TCM) 944
DTC Description 944
Diagnosis Procedure 944

U0407 CAN COMMUNICATION 945
DTC Description 945
Diagnosis Procedure 945

U040D CAN COMMUNICATION 946
DTC Description 946
Diagnosis Procedure 946

U040F CAN COMMUNICATION 948
DTC Description 948
Diagnosis Procedure 949

U0415 CAN COMMUNICATION 951
DTC Description 951
Diagnosis Procedure 951

U0426 CAN COMMUNICATION (IMMOBILIZER) 953
DTC Description 953
Diagnosis Procedure 954

U059E CAN COMMUNICATION 955
DTC Description 955
Diagnosis Procedure 955

U059F CAN COMMUNICATION 957
DTC Description 957
Diagnosis Procedure 957

U1000 CAN COMMUNICATION CIRCUIT 959
DTC Description 959
Diagnosis Procedure 961

U1001 CAN COMM CIRCUIT 962
DTC Description 962
Diagnosis Procedure 962

U11C1 CAN COMMUNICATION 964
DTC Description 964
Diagnosis Procedure 964

U1611 CAN COMMUNICATION 967
DTC Description 967
Diagnosis Procedure 967

U1612 CAN COMMUNICATION 971
DTC Description 971
Diagnosis Procedure 971

U3017 CAN COMMUNICATION 975
DTC Description 975
Diagnosis Procedure 975

P0046 TC BOOST CONTROL CIRCUIT RANGE/PERFORMANCE 977
DTC Description 977
Diagnosis Procedure 977

P0047 TC BOOST CONTROL CIRCUIT LOW. 980
DTC Description 980
Diagnosis Procedure 980

P0049 TC TURBINE OVERSPEED 983
DTC Description 983
Diagnosis Procedure 983

P004E TC BOOST CONTROL CIRCUIT INTERMITTENT 986
DTC Description 986
Diagnosis Procedure 986

P007B CHARGE AIR COOLER TEMPERATURE SENSOR 988
DTC Description 988
Diagnosis Procedure 988

P007C CHARGE AIR COOLER TEMPERATURE SENSOR 992
DTC Description 992
Diagnosis Procedure 992

P007D CHARGE AIR COOLER TEMPERATURE SENSOR 995
DTC Description 995
Diagnosis Procedure 995

P0087 FUEL RAIL PRESSURE TOO LOW 998
DTC Description 998
Diagnosis Procedure 998

P0088 FUEL RAIL PRESSURE TOO HIGH ..1000
DTC Description 1000
Diagnosis Procedure 1000

P008A LOW FUEL PRESSURE CONTROL SYSTEM 1002
DTC Description 1002
Diagnosis Procedure 1002

P009C FUEL PRESSURE RELIEF CONTROL CIRCUIT LOW 1005
DTC Description 1005
Diagnosis Procedure 1005

P009D FUEL PRESSURE RELIEF CONTROL CIRCUIT HIGH 1008
DTC Description 1008
Diagnosis Procedure 1008

P009E FUEL PRESSURE RELIEF CONTROL PERFORMANCE 1011
DTC Description 1011
Diagnosis Procedure 1011

P00AF BOOST PRESSURE CONTROL 1015
DTC Description 1015
Diagnosis Procedure 1015

P00B7 COOLING SYSTEM 1017

DTC Description 1017
Diagnosis Procedure 1017

P00C6 FUEL RAIL PRESSURE 1018
DTC Description 1018
Diagnosis Procedure 1018

P0101 MAF SENSOR 1020
DTC Description 1020
Diagnosis Procedure 1021
Component Inspection 1023

P0102 MASS AIR FLOW SENSOR 1024
DTC Description 1024
Diagnosis Procedure 1024
Component Inspection 1027

P0103 MASS AIR FLOW SENSOR 1028
DTC Description 1028
Diagnosis Procedure 1028

P0106 MANIFOLD ABSOLUTE PRESSURE SENSOR 1031
DTC Description 1031
Diagnosis Procedure 1032

P0107 MAP SENSOR CIRCUIT LOW 1036
DTC Description 1036
Diagnosis Procedure 1036

P0108 MAP SENSOR CIRCUIT HIGH 1040
DTC Description 1040
Diagnosis Procedure 1040

P0111 IAT SENSOR 1044
DTC Description 1044
Diagnosis Procedure 1044

P0112 INTAKE AIR TEMPERATURE SENSOR 1047
DTC Description 1047
Diagnosis Procedure 1047

P0113 INTAKE AIR TEMPERATURE SENSOR 1050
DTC Description 1050
Diagnosis Procedure 1050

P0116 ECT SENSOR 1053
DTC Description 1053
Diagnosis Procedure 1053
Component Inspection 1055

P0117 COOLANT TEMPERATURE SENSOR1057
DTC Description 1057
Diagnosis Procedure 1057
Component Inspection 1059

P0118 COOLANT TEMPERATURE SENSOR1060
DTC Description 1060
Diagnosis Procedure 1060

P0127 IAT SENSOR 1063
DTC Description 1063
Diagnosis Procedure 1063

P0128 THERMOSTAT FUNCTION 1064
DTC Description 1064
Diagnosis Procedure 1064

P012B TC BOOST SENSOR 1066
DTC Description 1066
Diagnosis Procedure 1067

P012C TC COMPRESSOR INLET PRESSURE SENSOR CIRCUIT LOW 1069
DTC Description 1069
Diagnosis Procedure 1069

P012D TC COMPRESSOR INLET PRESSURE SENSOR CIRCUIT HIGH 1073
DTC Description 1073
Diagnosis Procedure 1073

P0168 FUEL TEMPERATURE SENSOR 1077
DTC Description 1077
Diagnosis Procedure 1077

P0169 INCORRECT FUEL COMPOSITION ..1078
DTC Description 1078
Diagnosis Procedure 1078

P0181 FUEL TEMPERATURE SENSOR 1079
DTC Description 1079
Diagnosis Procedure 1080

P0182 FUEL TEMPERATURE SENSOR 1082
DTC Description 1082
Diagnosis Procedure 1082

P0183 FUEL TEMPERATURE SENSOR 1085
DTC Description 1085
Diagnosis Procedure 1085

P0184 FUEL TEMPERATURE SENSOR 1088
DTC Description 1088
Diagnosis Procedure 1088

P0191 FUEL RAIL PRESSURE SENSOR 1089
DTC Description 1089
Diagnosis Procedure 1090

P0192 FUEL RAIL PRESSURE SENSOR 1092
DTC Description 1092
Diagnosis Procedure 1092

P0193 FUEL RAIL PRESSURE SENSOR 1096
DTC Description 1096
Diagnosis Procedure 1096

P0201 FUEL INJECTOR (CYLINDER 1) 1100
DTC Description 1100
Diagnosis Procedure 1101

P0202 FUEL INJECTOR (CYLINDER 2) 1103
DTC Description 1103
Diagnosis Procedure 1104

P0203 FUEL INJECTOR (CYLINDER 3) 1106
DTC Description 1106
Diagnosis Procedure 1107

P0204 FUEL INJECTOR (CYLINDER 4) 1109
DTC Description 1109
Diagnosis Procedure 1110

P0205 FUEL INJECTOR (CYLINDER 5) 1112
DTC Description 1112
Diagnosis Procedure 1113

P0206 FUEL INJECTOR (CYLINDER 6) 1115
DTC Description 1115
Diagnosis Procedure 1116

P0207 FUEL INJECTOR (CYLINDER 7) 1118
DTC Description 1118
Diagnosis Procedure 1119

P0208 FUEL INJECTOR (CYLINDER 8) 1121
DTC Description 1121
Diagnosis Procedure 1122

P020A FUEL INJECTOR CYLINDER 1 TIMING 1124
DTC Description 1124
Diagnosis Procedure 1124

P020B FUEL INJECTOR CYLINDER 2 TIMING 1126
DTC Description 1126
Diagnosis Procedure 1126

P020C FUEL INJECTOR CYLINDER 3 TIMING 1128
DTC Description 1128
Diagnosis Procedure 1128

P020D FUEL INJECTOR CYLINDER 4 TIMING 1130
DTC Description 1130
Diagnosis Procedure 1130

P020E FUEL INJECTOR CYLINDER 5 TIMING 1132
DTC Description 1132
Diagnosis Procedure 1132

P020F FUEL INJECTOR CYLINDER 6 TIMING 1134
DTC Description 1134
Diagnosis Procedure 1134

P0217 ENGINE OVER TEMPERATURE 1136
DTC Description 1136
Diagnosis Procedure 1136

P0219 ENGINE OVER SPEED 1137
DTC Description 1137
Diagnosis Procedure 1137

P021A FUEL INJECTOR CYLINDER 7 TIMING 1139
DTC Description 1139
Diagnosis Procedure 1139

P021B FUEL INJECTOR CYLINDER 8 TIMING 1141
DTC Description 1141
Diagnosis Procedure 1141

P0237 BOOST PRESSURE SENSOR 1143
DTC Description 1143
Diagnosis Procedure 1143

P0238 BOOST PRESSURE SENSOR 1147
DTC Description 1147
Diagnosis Procedure 1147

P0252 FUEL PUMP METERING CONTROL RANGE/PERFORMANCE 1151
DTC Description 1151
Diagnosis Procedure 1151

P0253 FUEL PUMP METERING CONTROL LOW 1154
DTC Description 1154
Diagnosis Procedure 1154

P0254 FUEL PUMP METERING CONTROL HIGH 1157
DTC Description 1157
Diagnosis Procedure 1157

P0257 FUEL PUMP METERING CONTROL RANGE/PERFORMANCE 1160
DTC Description 1160
Diagnosis Procedure 1160

P0261 FUEL INJECTOR (CYLINDER 1) 1163
DTC Description 1163
Diagnosis Procedure 1164

P0262 FUEL INJECTOR (CYLINDER 1) 1166
DTC Description 1166
Diagnosis Procedure 1166

P0263 CYLINDER 1 COMBUSTION DISORDER 1169
DTC Description 1169
Diagnosis Procedure 1169

P0264 FUEL INJECTOR (CYLINDER 2) 1171
DTC Description 1171
Diagnosis Procedure 1172

P0265 FUEL INJECTOR (CYLINDER 2) 1174
DTC Description 1174

Diagnosis Procedure 1174

P0266 CYLINDER 2 COMBUSTION DISORDER 1177
DTC Description 1177
Diagnosis Procedure 1177

P0267 FUEL INJECTOR (CYLINDER 3) 1179
DTC Description 1179
Diagnosis Procedure 1180

P0268 FUEL INJECTOR (CYLINDER 3) 1182
DTC Description 1182
Diagnosis Procedure 1182

P0269 CYLINDER 3 COMBUSTION DISORDER 1185
DTC Description 1185
Diagnosis Procedure 1185

P026A CHARGE AIR COOLER EFFICIENCY BELOW NORMAL 1187
DTC Description 1187
Diagnosis Procedure 1187

P026B INJECTION TIMING PERFORMANCE1189
DTC Description 1189
Diagnosis Procedure 1189

P0270 FUEL INJECTOR (CYLINDER 4) 1190
DTC Description 1190
Diagnosis Procedure 1191

P0271 FUEL INJECTOR (CYLINDER 4) 1193
DTC Description 1193
Diagnosis Procedure 1193

P0272 CYLINDER 4 COMBUSTION DISORDER 1196
DTC Description 1196
Diagnosis Procedure 1196

P0273 FUEL INJECTOR (CYLINDER 5) 1198
DTC Description 1198
Diagnosis Procedure 1199

P0274 FUEL INJECTOR (CYLINDER 5) 1201
DTC Description 1201
Diagnosis Procedure 1201

P0275 CYLINDER 5 COMBUSTION DISORDER 1204
DTC Description 1204
Diagnosis Procedure 1204

P0276 FUEL INJECTOR (CYLINDER 6) 1206
DTC Description 1206
Diagnosis Procedure 1207

P0277 FUEL INJECTOR (CYLINDER 6) 1209
DTC Description 1209
Diagnosis Procedure 1209

P0278 CYLINDER 6 COMBUSTION DISORDER 1212
DTC Description 1212
Diagnosis Procedure 1212

P0279 FUEL INJECTOR (CYLINDER 7) 1214
DTC Description 1214
Diagnosis Procedure 1215

P0280 FUEL INJECTOR (CYLINDER 7) 1217
DTC Description 1217
Diagnosis Procedure 1217

P0281 CYLINDER 7 COMBUSTION DISORDER 1220
DTC Description 1220
Diagnosis Procedure 1220

P0282 FUEL INJECTOR (CYLINDER 8) 1222
DTC Description 1222
Diagnosis Procedure 1223

P0283 FUEL INJECTOR (CYLINDER 8) 1225
DTC Description 1225
Diagnosis Procedure 1225

P0284 CYLINDER 8 COMBUSTION DISORDER 1228
DTC Description 1228
Diagnosis Procedure 1228

P0299 BOOST PRESSURE 1230
DTC Description 1230
Diagnosis Procedure 1230

P02EE FUEL INJECTOR (CYLINDER 1) 1233
DTC Description 1233
Diagnosis Procedure 1233

P02EF FUEL INJECTOR (CYLINDER 2) 1236
DTC Description 1236
Diagnosis Procedure 1236

P02F0 FUEL INJECTOR (CYLINDER 3) 1239
DTC Description 1239
Diagnosis Procedure 1239

P02F1 FUEL INJECTOR (CYLINDER 4) 1242
DTC Description 1242
Diagnosis Procedure 1242

P02F2 FUEL INJECTOR (CYLINDER 5) 1245
DTC Description 1245
Diagnosis Procedure 1245

P02F3 FUEL INJECTOR (CYLINDER 6) 1248
DTC Description 1248
Diagnosis Procedure 1248

P02F4 FUEL INJECTOR (CYLINDER 7) 1251
DTC Description 1251
Diagnosis Procedure 1251

P02F5 FUEL INJECTOR (CYLINDER 8) 1254
DTC Description 1254
Diagnosis Procedure 1254

P0300 MISFIRE 1257
DTC Description 1257
Diagnosis Procedure 1257

P0301 CYLINDER 1 MISFIRE 1259
DTC Description 1259
Diagnosis Procedure 1259

P0302 CYLINDER 2 MISFIRE 1261
DTC Description 1261
Diagnosis Procedure 1261

P0303 CYLINDER 3 MISFIRE 1263
DTC Description 1263
Diagnosis Procedure 1263

P0304 CYLINDER 4 MISFIRE 1265
DTC Description 1265
Diagnosis Procedure 1265

P0305 CYLINDER 5 MISFIRE 1267
DTC Description 1267
Diagnosis Procedure 1267

P0306 CYLINDER 6 MISFIRE 1269
DTC Description 1269
Diagnosis Procedure 1269

P0307 CYLINDER 7 MISFIRE 1271
DTC Description 1271
Diagnosis Procedure 1271

P0308 CYLINDER 8 MISFIRE 1273
DTC Description 1273
Diagnosis Procedure 1273

P0335 CKP SENSOR (POS) 1275
DTC Description 1275
Diagnosis Procedure 1276
Component Inspection 1279

P0340 CMP SENSOR (PHASE) 1280
DTC Description 1280
Diagnosis Procedure 1280

P0344 CKP - CMP CORRELATION 1284
DTC Description 1284
Diagnosis Procedure 1284

P0383 GLOW PLUG CONTROL MODULE CONTROL CIRCUIT LOW 1287
DTC Description 1287
Diagnosis Procedure 1287

P0384 GLOW PLUG CONTROL MODULE CONTROL CIRCUIT HIGH 1290
DTC Description 1290
Diagnosis Procedure 1290

P0401 FLOW IN THE EXHAUST GAS RECIRCULATION 1292
DTC Description 1292
Diagnosis Procedure 1292

P0402 FLOW IN THE EXHAUST GAS RECIRCULATION 1295
DTC Description 1295
Diagnosis Procedure 1295

P0405 EGR SENSOR CIRCUIT LOW 1297
DTC Description 1297
Diagnosis Procedure 1297

P0406 EGR SENSOR CIRCUIT HIGH 1301
DTC Description 1301
Diagnosis Procedure 1301

P040B EXHAUST GAS RECIRCULATION TEMPERATURE SENSOR 1305
DTC Description 1305
Diagnosis Procedure 1306

P040C EXHAUST GAS RECIRCULATION TEMPERATURE SENSOR 1308
DTC Description 1308
Diagnosis Procedure 1308

P040D EXHAUST GAS RECIRCULATION TEMPERATURE SENSOR 1311
DTC Description 1311
Diagnosis Procedure 1311

P0420 EFFICIENCY OF THE CATALYTIC CONVERTER 1314
DTC Description 1314
Diagnosis Procedure 1314

P0421 CATALYST EFFICIENCY BELOW THRESHOLD 1316
DTC Description 1316
Diagnosis Procedure 1316

P0461 FUEL LEVEL SENSOR 1318
DTC Description 1318
Diagnosis Procedure 1318

P0462 FUEL LEVEL SENSOR CIRCUIT LOW1320
DTC Description 1320
Diagnosis Procedure 1320

P0463 FUEL LEVEL SENSOR CIRCUIT HIGH 1321
DTC Description 1321
Diagnosis Procedure 1321

P046C EGR VOLUME CONTROL VALVE POSITION SENSOR 1322
DTC Description 1322
Diagnosis Procedure 1323

P0471 EXHAUST PRESSURE SENSOR 1326
DTC Description 1326
Diagnosis Procedure 1327

P0472 EXHAUST PRESSURE SENSOR 1330
DTC Description 1330
Diagnosis Procedure 1330

P0473 EXHAUST PRESSURE SENSOR 1334
DTC Description 1334
Diagnosis Procedure 1334

P0489 EGR CONTROL CIRCUIT LOW 1338
DTC Description 1338
Diagnosis Procedure 1338

P0490 EGR CONTROL CIRCUIT HIGH 1341
DTC Description 1341
Diagnosis Procedure 1341

P04DB CRANKCASE VENTILATION SYSTEM 1344
DTC Description 1344
Diagnosis Procedure 1344

P0501 VEHICLE SPEED SIGNAL 1347
DTC Description 1347
Diagnosis Procedure 1348

P0506 ISC SYSTEM 1349
DTC Description 1349
Diagnosis Procedure 1349

P0507 ISC SYSTEM 1351
DTC Description 1351
Diagnosis Procedure 1351

P0513 INCORRECT IMMOBILIZER KEY 1353
DTC Description 1353
Diagnosis Procedure 1353

P051B CRANKCASE PRESSURE SENSOR RANGE/PERFORMANCE 1354
DTC Description 1354
Diagnosis Procedure 1354

P051C CRANKCASE PRESSURE SENSOR CIRCUIT LOW 1357
DTC Description 1357
Diagnosis Procedure 1357

P051D CRANKCASE PRESSURE SENSOR CIRCUIT HIGH 1361
DTC Description 1361
Diagnosis Procedure 1361

P0521 ENGINE OIL PRESSURE 1365
DTC Description 1365
Diagnosis Procedure 1365

P0524 ENGINE OIL PRESSURE 1368
DTC Description 1368
Diagnosis Procedure 1368

P0532 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT LOW 1369
DTC Description 1369
Diagnosis Procedure 1369

P0533 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT HIGH 1372
DTC Description 1372
Diagnosis Procedure 1372

P053E CRANKCASE PRESSURE TOO HIGH1376
DTC Description 1376
Diagnosis Procedure 1376

P0544 EXHAUST GAS TEMPERATURE SENSOR 1378
DTC Description 1378
Diagnosis Procedure 1378

P0545 EXHAUST GAS TEMPERATURE SENSOR 1380
DTC Description 1380
Diagnosis Procedure 1380

P0546 EXHAUST GAS TEMPERATURE SENSOR 1381
DTC Description 1381
Diagnosis Procedure 1381

P054E IDLE FUEL QUANTITY LOWER THAN EXPECTED 1382
DTC Description 1382
Diagnosis Procedure 1382

P054F IDLE FUEL QUANTITY HIGHER THAN EXPECTED 1384
DTC Description 1384
Diagnosis Procedure 1384

P0562 SYSTEM VOLTAGE LOW 1386
DTC Description 1386
Diagnosis Procedure 1386

P0563 SYSTEM VOLTAGE HIGH 1389
DTC Description 1389
Diagnosis Procedure 1389

P0579 CRUISE CONTROL CIRCUIT RANGE/PERFORMANCE 1391
DTC Description 1391
Diagnosis Procedure 1391

P057E BRAKE PEDAL POSITION SENSOR 1393
DTC Description 1393
Diagnosis Procedure 1393
Component Inspection 1395

P0581 CRUISE CONTROL SIGNAL CIRCUIT HIGH 1397

DTC Description 1397
Diagnosis Procedure 1397

P0591 CRUISE CONTROL SYSTEM RANGE/ PERFORMANCE 1399
DTC Description 1399
Diagnosis Procedure 1399

P0601 ECM 1401
DTC Description 1401
Diagnosis Procedure 1401

P0604 ECM 1402
DTC Description 1402
Diagnosis Procedure 1402

P0605 ECM 1404
DTC Description 1404
Diagnosis Procedure 1404

P0606 ECM 1405
DTC Description 1405
Diagnosis Procedure 1405

P0607 ECM 1406
DTC Description 1406
Diagnosis Procedure 1407

P060A ECM 1409
DTC Description 1409
Diagnosis Procedure 1409

P060B ECM 1410
DTC Description 1410
Diagnosis Procedure 1410

P060C ECM 1411
DTC Description 1411
Diagnosis Procedure 1412

P0611 ECM 1414
DTC Description 1414
Diagnosis Procedure 1414

P061A ECM 1416
DTC Description 1416
Diagnosis Procedure 1416

P061B ECM 1418
DTC Description 1418
Diagnosis Procedure 1418

P061C ECM 1420
DTC Description 1420
Diagnosis Procedure 1420

P061E ECM 1422
DTC Description 1422
Diagnosis Procedure 1422

P0628 FUEL PUMP CONTROL 1424
DTC Description 1424
Diagnosis Procedure 1424

P0629 FUEL PUMP CONTROL 1427
DTC Description 1427
Diagnosis Procedure 1427

P062B ECM 1430
DTC Description 1430
Diagnosis Procedure 1430

P062C ECM 1432
DTC Description 1432
Diagnosis Procedure 1432

P0630 VIN NOT PROGRAMMED OR INCOMPATIBLE - ECM 1433
DTC Description 1433
Diagnosis Procedure 1433

P064C GLOW OUTPUT STAGE 1434
DTC Description 1434
Diagnosis Procedure 1434

P0652 SENSOR REFERENCE VOLTAGE B CIRCUIT LOW 1437
DTC Description 1437
Diagnosis Procedure 1437

P0653 SENSOR REFERENCE VOLTAGE B CIRCUIT HIGH 1445
DTC Description 1445
Diagnosis Procedure 1445

P0667 CONTROL MODULE INTERNAL TEMPERATURE SENSOR 1447
DTC Description 1447
Diagnosis Procedure 1447

P066A CYLINDER 1 GLOW PLUG CONTROL CIRCUIT LOW 1448
DTC Description 1448
Diagnosis Procedure 1448

P066B CYLINDER 1 GLOW PLUG CONTROL CIRCUIT HIGH 1450
DTC Description 1450
Diagnosis Procedure 1450

P066C CYLINDER 2 GLOW PLUG CONTROL CIRCUIT LOW 1452
DTC Description 1452
Diagnosis Procedure 1452

P066D CYLINDER 2 GLOW PLUG CONTROL CIRCUIT HIGH 1454
DTC Description 1454
Diagnosis Procedure 1454

P066E CYLINDER 3 GLOW PLUG CONTROL CIRCUIT LOW 1456
DTC Description 1456

Diagnosis Procedure 1456

P066F CYLINDER 3 GLOW PLUG CONTROL CIRCUIT HIGH 1458
DTC Description 1458
Diagnosis Procedure 1458

P0671 GLOW PLUG (CYLINDER 1) 1460
DTC Description 1460
Diagnosis Procedure 1460

P0672 GLOW PLUG (CYLINDER 2) 1463
DTC Description 1463
Diagnosis Procedure 1463

P0673 GLOW PLUG (CYLINDER 3) 1466
DTC Description 1466
Diagnosis Procedure 1466

P0674 GLOW PLUG (CYLINDER 4) 1469
DTC Description 1469
Diagnosis Procedure 1469

P0675 GLOW PLUG (CYLINDER 5) 1472
DTC Description 1472
Diagnosis Procedure 1472

P0676 GLOW PLUG (CYLINDER 6) 1475
DTC Description 1475
Diagnosis Procedure 1475

P0677 GLOW PLUG (CYLINDER 7) 1478
DTC Description 1478
Diagnosis Procedure 1478

P0678 GLOW PLUG (CYLINDER 8) 1481
DTC Description 1481
Diagnosis Procedure 1481

P067A CYLINDER 4 GLOW PLUG CONTROL CIRCUIT LOW 1484
DTC Description 1484
Diagnosis Procedure 1484

P067B CYLINDER 4 GLOW PLUG CONTROL CIRCUIT HIGH 1486
DTC Description 1486
Diagnosis Procedure 1486

P067C CYLINDER 5 GLOW PLUG CONTROL CIRCUIT LOW 1488
DTC Description 1488
Diagnosis Procedure 1488

P067D CYLINDER 5 GLOW PLUG CONTROL CIRCUIT HIGH 1490
DTC Description 1490
Diagnosis Procedure 1490

P067E CYLINDER 6 GLOW PLUG CONTROL CIRCUIT LOW 1492
DTC Description 1492
Diagnosis Procedure 1492

P067F CYLINDER 6 GLOW PLUG CONTROL CIRCUIT HIGH 1494
DTC Description 1494
Diagnosis Procedure 1494

P0687 ECM POWER RELAY CONTROL CIRCUIT HIGH 1496
DTC Description 1496
Diagnosis Procedure 1496

P068C CYLINDER 7 GLOW PLUG CONTROL CIRCUIT LOW 1499
DTC Description 1499
Diagnosis Procedure 1499

P068D CYLINDER 7 GLOW PLUG CONTROL CIRCUIT HIGH 1501
DTC Description 1501
Diagnosis Procedure 1501

P068E CYLINDER 8 GLOW PLUG CONTROL CIRCUIT LOW 1503
DTC Description 1503
Diagnosis Procedure 1503

P068F CYLINDER 8 GLOW PLUG CONTROL CIRCUIT HIGH 1505
DTC Description 1505
Diagnosis Procedure 1505

P0691 COOLING FAN 1507
DTC Description 1507
Diagnosis Procedure 1507

P0692 COOLING FAN 1510
DTC Description 1510
Diagnosis Procedure 1510

P0698 SENSOR REFERENCE VOLTAGE C CIRCUIT LOW 1513
DTC Description 1513
Diagnosis Procedure 1513

P0699 SENSOR REFERENCE VOLTAGE C CIRCUIT HIGH 1515
DTC Description 1515
Diagnosis Procedure 1515

P06A4 SENSOR REFERENCE VOLTAGE D CIRCUIT LOW 1517
DTC Description 1517
Diagnosis Procedure 1517

P06A5 SENSOR REFERENCE VOLTAGE D CIRCUIT HIGH 1520
DTC Description 1520
Diagnosis Procedure 1520

P06B8 ECM 1522

DTC Description 1522
Diagnosis Procedure 1522

P06B9 CYLINDER 1 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1523
DTC Description 1523
Diagnosis Procedure 1523

P06BA CYLINDER 2 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1525
DTC Description 1525
Diagnosis Procedure 1525

P06BB CYLINDER 3 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1527
DTC Description 1527
Diagnosis Procedure 1527

P06BC CYLINDER 4 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1530
DTC Description 1530
Diagnosis Procedure 1530

P06BD CYLINDER 5 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1533
DTC Description 1533
Diagnosis Procedure 1533

P06BE CYLINDER 6 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1535
DTC Description 1535
Diagnosis Procedure 1535

P06BF CYLINDER 7 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1537
DTC Description 1537
Diagnosis Procedure 1537

P06C0 CYLINDER 8 GLOW PLUG CIRCUIT RANGE/PERFORMANCE 1539
DTC Description 1539
Diagnosis Procedure 1539

P06D3 SENSOR REFERENCE VOLTAGE E CIRCUIT LOW 1541
DTC Description 1541
Diagnosis Procedure 1541

P06D4 SENSOR REFERENCE VOLTAGE E CIRCUIT HIGH 1544
DTC Description 1544
Diagnosis Procedure 1544

P06D7 SENSOR REFERENCE VOLTAGE F CIRCUIT LOW 1546
DTC Description 1546
Diagnosis Procedure 1546

P06D8 SENSOR REFERENCE VOLTAGE F CIRCUIT HIGH 1549
DTC Description 1549
Diagnosis Procedure 1549

P06E5 GLOW PLUG CONTROL MODULE PERFORMANCE 1551
DTC Description 1551
Diagnosis Procedure 1551

P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST) 1554
DTC Description 1554
Diagnosis Procedure 1554

P0A0F THE ENGINE DOES NOT START 1555
DTC Description 1555
Diagnosis Procedure 1555

P1191 TC INLET AIR TEMPERATURE SENSOR PERFORMANCE 1559
DTC Description 1559
Diagnosis Procedure 1560

P1192 TC INLET AIR TEMPERATURE SENSOR LOW 1562
DTC Description 1562
Diagnosis Procedure 1562

P1193 TC INLET AIR TEMPERATURE SENSOR HIGH 1565
DTC Description 1565
Diagnosis Procedure 1565

P1451 DIESEL PARTICULATE FILTER SYSTEM PERFORMANCE 1568
DTC Description 1568
Diagnosis Procedure 1568

P1484 CATALYST OVERHEAT DETECTION1570
DTC Description 1570
Diagnosis Procedure 1570

P1612 DATA COMMUNICATION 1572
DTC Description 1572
Diagnosis Procedure 1572

P1613 DPF TEMPERATURE SENSOR MODULE PERFORMANCE 1573
DTC Description 1573
Diagnosis Procedure 1574

P1614 DPF TEMPERATURE SENSOR MODULE SHORTED HIGH 1575
DTC Description 1575
Diagnosis Procedure 1575

P1615 DPF TEMPERATURE SENSOR MODULE SHORTED LOW 1578
DTC Description 1578
Diagnosis Procedure 1578

P1616 DPF TEMPERATURE SENSOR MODULE OVER TEMPERATURE 1581

DTC Description 1581
Diagnosis Procedure 1581

P1623 DPF TEMPERATURE SENSOR MODULE CIRCUIT 1583
DTC Description 1583
Diagnosis Procedure 1583

P1624 SCR TEMPERATURE SENSOR MODULE PERFORMANCE 1586
DTC Description 1586
Diagnosis Procedure 1587

P1625 SCR TEMPERATURE SENSOR MODULE SHORTED HIGH 1588
DTC Description 1588
Diagnosis Procedure 1588

P1626 SCR TEMPERATURE SENSOR MODULE SHORTED LOW 1591
DTC Description 1591
Diagnosis Procedure 1591

P1627 SCR TEMPERATURE SENSOR MODULE OVER TEMPERATURE 1594
DTC Description 1594
Diagnosis Procedure 1594

P1628 SCR TEMPERATURE SENSOR MODULE CIRCUIT 1596
DTC Description 1596
Diagnosis Procedure 1596

P1A11 ENGINE OVER TEMPERATURE 1599
DTC Description 1599
Diagnosis Procedure 1599

P1A12 CATALYST OVERHEAT DETECTION1600
DTC Description 1600
Diagnosis Procedure 1600

P1A62 TC ACTUATOR POSITION 1602
DTC Description 1602
Diagnosis Procedure 1602

P1A77 AFTERTREATMENT OVER TEMPERATURE 1604
DTC Description 1604
Diagnosis Procedure 1604

P1A78 FUEL SHUTOFF - FORCED ENGINE SHUTDOWN 1605
DTC Description 1605
Diagnosis Procedure 1605

P1A7A ENGINE COOLANT LEVEL LOW 1606
DTC Description 1606
Diagnosis Procedure 1606

P1C54 SCR NOX CATALYST MISSING 1607
DTC Description 1607
Diagnosis Procedure 1607

P1C55 NOX SENSOR 1/1 INTERMITTENT ...1610
DTC Description 1610
Diagnosis Procedure 1610

P1C56 NOX SENSOR 1/2 INTERMITTENT ...1612
DTC Description 1612
Diagnosis Procedure 1612

P1C70 SCR ERROR DETECTED - ENGINE DR-RATED 1614
DTC Description 1614
Diagnosis Procedure 1614

P200C DIESEL PARTICULATE FILTER 1615
DTC Description 1615
Diagnosis Procedure 1616

P200E CATALYST SYSTEM OVER TEMPERATURE BANK 1 1618
DTC Description 1618
Diagnosis Procedure 1618

P202B REDUCTANT TANK HEATER CONTROL CIRCUIT LOW 1620
DTC Description 1620
Diagnosis Procedure 1620

P202C REDUCTANT TANK HEATER CONTROL CIRCUIT HIGH 1623
DTC Description 1623
Diagnosis Procedure 1623

P202E REDUCTANT INJECTION VALVE CIRCUIT 1/1 1626
DTC Description 1626
Diagnosis Procedure 1626

P2031 UPSTREAM DPF TEMPERATURE SENSOR 1628
DTC Description 1628
Diagnosis Procedure 1628

P2032 TEMPERATURE SENSOR UPSTREAM DPF 1630
DTC Description 1630
Diagnosis Procedure 1630

P2033 TEMPERATURE SENSOR UPSTREAM DPF 1632
DTC Description 1632
Diagnosis Procedure 1632

P203B REDUCTANT LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE 1634
DTC Description 1634
Diagnosis Procedure 1634

P203C REDUCTANT LEVEL SENSOR CIRCUIT LOW .....

DTC Description 1637
Diagnosis Procedure 1637

P203D REDUCTANT LEVEL SENSOR CIRCUIT HIGH 1641
DTC Description 1641
Diagnosis Procedure 1641

P203F REDUCTANT LEVEL TOO LOW 1644
DTC Description 1644
Diagnosis Procedure 1644

P2044 REDUCTANT TEMPERATURE SENSOR CIRCUIT HIGH 1646
DTC Description 1646
Diagnosis Procedure 1646

P2045 REDUCTANT TEMPERATURE SENSOR CIRCUIT LOW 1648
DTC Description 1648
Diagnosis Procedure 1648

P2048 REDUCTANT INJECTION VALVE CIRCUIT LOW 1/1 1650
DTC Description 1650
Diagnosis Procedure 1650
Component Inspection 1652

P204A REDUCTANT PRESSURE SENSOR CIRCUIT 1653
DTC Description 1653
Diagnosis Procedure 1653

P204C REDUCTANT PRESSURE SENSOR CIRCUIT LOW 1656
DTC Description 1656
Diagnosis Procedure 1656

P204D REDUCTANT PRESSURE SENSOR CIRCUIT HIGH 1660
DTC Description 1660
Diagnosis Procedure 1660

P205C REDUCTANT TANK TEMPERATURE SENSOR CIRCUIT LOW 1663
DTC Description 1663
Diagnosis Procedure 1663

P205D REDUCTANT TANK TEMPERATURE SENSOR CIRCUIT HIGH 1666
DTC Description 1666
Diagnosis Procedure 1666

P205E REDUCTANT TANK TEMPERATURE SENSOR CIRCUIT INTERMITTENT 1669
DTC Description 1669
Diagnosis Procedure 1669

P206B REDUCTANT QUALITY SENSOR CIRCUIT 1672
DTC Description 1672
Diagnosis Procedure 1672

P206D REDUCTANT QUALITY SENSOR CIRCUIT HIGH 1674
DTC Description 1674
Diagnosis Procedure 1674

P207F REDUCTANT QUALITY PERFORMANCE 1676
DTC Description 1676
Diagnosis Procedure 1676

P2080 EXHAUST GAS TEMPERATURE SENSOR 1 1678
DTC Description 1678
Diagnosis Procedure 1678

P208A REDUCTANT PUMP CONTROL CIRCUIT OPEN 1680
DTC Description 1680
Diagnosis Procedure 1680

P208C REDUCTANT PUMP CONTROL CIRCUIT LOW 1683
DTC Description 1683
Diagnosis Procedure 1683

P208D REDUCTANT PUMP CONTROL CIRCUIT HIGH 1686
DTC Description 1686
Diagnosis Procedure 1686

P209F REDUCTANT TANK HEATER CONTROL CIRCUIT PERFORMANCE 1689
DTC Description 1689
Diagnosis Procedure 1689

P20B7 REDUCTANT METERING UNIT HEATER CONTROL CIRCUIT LOW 1692
DTC Description 1692
Diagnosis Procedure 1692

P20B8 REDUCTANT METERING UNIT HEATER CONTROL CIRCUIT HIGH 1695
DTC Description 1695
Diagnosis Procedure 1695

P20B9 REDUCTANT HEATER CONTROL CIRCUIT OPEN 1698
DTC Description 1698
Diagnosis Procedure 1698
Component Inspection 1700

P20BB REDUCTANT HEATER CONTROL CIRCUIT LOW 1701
DTC Description 1701
Diagnosis Procedure 1701

P20BC REDUCTANT HEATER CONTROL CIRCUIT HIGH 1704
DTC Description 1704

Diagnosis Procedure 1704

P20E8 REDUCTANT PRESSURE TOO LOW1706
DTC Description 1706
Diagnosis Procedure 1706

P20E9 REDUCTANT PRESSURE TOO HIGH1709
DTC Description 1709
Diagnosis Procedure 1709

P20EE SCR NOX CATALYST EFFICIECY 1711
DTC Description 1711
Diagnosis Procedure 1711

P20FF REDUCTANT CONTROL MODULE PERFORMANCE 1714
DTC Description 1714
Diagnosis Procedure 1714

P2121 ACCELERATOR PEDAL POSITION SENSOR 1 1716
DTC Description 1716
Diagnosis Procedure 1717

P2122 ACCELERATOR PEDAL POSITION SENSOR 1 1720
DTC Description 1720
Diagnosis Procedure 1721

P2123 ACCELERATOR PEDAL POSITION SENSOR 1 1724
DTC Description 1724
Diagnosis Procedure 1725

P2127 ACCELERATOR PEDAL POSITION SENSOR 2 1728
DTC Description 1728
Diagnosis Procedure 1729

P2128 ACCELERATOR PEDAL POSITION SENSOR 2 1732
DTC Description 1732
Diagnosis Procedure 1733

P2146 FUEL INJECTOR GROUP 1 POWER CIRCUIT 1736
DTC Description 1736
Diagnosis Procedure 1736
Component Inspection 1739

P2149 FUEL INJECTOR GROUP 2 POWER CIRCUIT 1740
DTC Description 1740
Diagnosis Procedure 1740
Component Inspection 1743

P214A SCR NOX CATALYST INLET TEMPERATURE TOO HIGH 1744
DTC Description 1744
Diagnosis Procedure 1744

P214B SCR NOX CATALYST INLET TEMPERATURE TOO HIGH DURING REGEN 1746
DTC Description 1746
Diagnosis Procedure 1746

P214C SCR NOX CATALYST OUTLET TEMPERATURE TOO HIGH 1748
DTC Description 1748
Diagnosis Procedure 1748

P214D SCR NOX CATALYST OUTLET TEMPERATURE TOO HIGH DURING REGEN 1750
DTC Description 1750
Diagnosis Procedure 1750

P218F REDUCTANT NO FLOW DETECTED 1752
DTC Description 1752
Diagnosis Procedure 1752

P21C4 REDUCTANT HEATER RELAY CONTROL CIRCUIT HIGH 1754
DTC Description 1754
Diagnosis Procedure 1754

P21CA REDUCTANT SUPPLY VOLTAGE INTERMITTENT 1756
DTC Description 1756
Diagnosis Procedure 1756

P21CB REDUCTANT SUPPLY VOLTAGE LOW 1759
DTC Description 1759
Diagnosis Procedure 1759

P21CC REDUCTANT SUPPLY VOLTAGE HIGH 1762
DTC Description 1762
Diagnosis Procedure 1762

P2201 NOX SENSOR 1 1764
DTC Description 1764
Diagnosis Procedure 1764

P2202 NOX SENSOR 1 1766
DTC Description 1766
Diagnosis Procedure 1766

P2204 NOX SENSOR 1 1768
DTC Description 1768
Diagnosis Procedure 1768

P2209 NOX SENSOR HEATER SENSE CIRCUIT 1/1 1770
DTC Description 1770
Diagnosis Procedure 1770

P220A NOX SENSOR 1 1773
DTC Description 1773
Diagnosis Procedure 1773

P220B NOX SENSOR 2 1776

DTC Description 1776
Diagnosis Procedure 1776

P221A NOX SENSOR 1/2 CORRELATION BANK 1 1779
DTC Description 1779
Diagnosis Procedure 1779

P225C AFTERTREATMENT INTAKE OXYGEN SENSOR HIGH 1782
DTC Description 1782
Diagnosis Procedure 1782

P225D AFTERTREATMENT INTAKE OXYGEN SENSOR LOW 1784
DTC Description 1784
Diagnosis Procedure 1784

P225E AFTERTREATMENT OUTLET OXYGEN SENSOR HIGH 1786
DTC Description 1786
Diagnosis Procedure 1786

P225F AFTERTREATMENT OUTLET OXYGEN SENSOR LOW 1788
DTC Description 1788
Diagnosis Procedure 1788

P2262 TC BOOST PRESSURE NOT DETECTED 1790
DTC Description 1790
Diagnosis Procedure 1790

P2263 TC BOOST CONTROL SYSTEM 1793
DTC Description 1793
Diagnosis Procedure 1794

P2267 WATER IN FUEL SENSOR CIRCUIT HIGH 1797
DTC Description 1797
Diagnosis Procedure 1797
Component Inspection 1799

P2269 WATER IN FUEL CONDITION 1800
DTC Description 1800
Diagnosis Procedure 1800
Component Inspection 1803

P226C TC BOOST CONTROL SLOW RESPONSE 1804
DTC Description 1804
Diagnosis Procedure 1804

P2280 INTAKE AIR SYSTEM 1807
DTC Description 1807
Diagnosis Procedure 1807

P2299 ACCELERATOR/BRAKE PEDAL POSITION INCONSISTENCY 1809
DTC Description 1809
Diagnosis Procedure 1809

P229E NOX SENSOR 2 1811
DTC Description 1811
Diagnosis Procedure 1811

P229F NOX SENSOR 2 1813
DTC Description 1813
Diagnosis Procedure 1813

P22A2 AFTERTREATMENT 1 INTAKE NOX OUT OF CALIBRATION 1815
DTC Description 1815
Diagnosis Procedure 1815

P22A7 NOX SENSOR HEATER SENSE CIRCUIT 1/2 1817
DTC Description 1817
Diagnosis Procedure 1818

P22CB TC OUTLET SWITCHING VALVE CONTROL CIRCUIT LOW 1820
DTC Description 1820
Diagnosis Procedure 1820

P22CC TC OUTLET SWITCHING VALVE CONTROL CIRCUIT HIGH 1823
DTC Description 1823
Diagnosis Procedure 1823

P22CD TC OUTLET SWITCHING VALVE STUCK OPEN 1826
DTC Description 1826
Diagnosis Procedure 1827

P22CE TC OUTLET SWITCHING VALVE STUCK CLOSED 1829
DTC Description 1829
Diagnosis Procedure 1830

P2413 EGR SYSTEM 1835
DTC Description 1835
Diagnosis Procedure 1835

P242B EGT SENSOR 3 1838
DTC Description 1838
Diagnosis Procedure 1838

P242C EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW 1/3 1840
DTC Description 1840
Diagnosis Procedure 1841

P242D EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH 1/3 1842
DTC Description 1842
Diagnosis Procedure 1843

P242F DIESEL PARTICULATE FILTER 1844
DTC Description 1844
Diagnosis Procedure 1844

P244A DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE 1846
DTC Description 1846
Diagnosis Procedure 1847

P244D EXHAUST TEMPERATURE TOO HIGH FOR PF REGENERATION 1848
DTC Description 1848
Diagnosis Procedure 1849

P2453 PARTICULATE FILTER PRESSURE SENSOR A RANGE/PERFORMANCE 1850
DTC Description 1850
Diagnosis Procedure 1851

P2454 DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR 1854
DTC Description 1854
Diagnosis Procedure 1854

P2455 DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR 1858
DTC Description 1858
Diagnosis Procedure 1858

P2456 PARTICULATE FILTER PRESSURE SENSOR A INTERMITTENT 1862
DTC Description 1862
Diagnosis Procedure 1863

P2457 EGR COOLER 1867
DTC Description 1867
Diagnosis Procedure 1867

P2459 REGENERATION FREQUENCY OF DIESEL PARTICULATE FILTER 1871
DTC Description 1871
Diagnosis Procedure 1871

P245C EGR COOLER BYPASS CONTROL CIRCUIT LOW 1876
DTC Description 1876
Diagnosis Procedure 1876

P245D EGR COOLER BYPASS CONTROL CIRCUIT HIGH 1879
DTC Description 1879
Diagnosis Procedure 1879

P245F PARTICULATE FILTER PRESSURE SENSOR B RANGE/PERFORMANCE 1881
DTC Description 1881
Diagnosis Procedure 1882

P2460 PARTICULATE FILTER PRESSURE SENSOR CIRCUIT LOW 1885
DTC Description 1885
Diagnosis Procedure 1885

P2461 PARTICULATE FILTER PRESSURE SENSOR CIRCUIT HIGH 1889
DTC Description 1889
Diagnosis Procedure 1889

P2462 PARTICULATE FILTER PRESSURE SENSOR CIRCUIT INTERMITTENT 1893
DTC Description 1893
Diagnosis Procedure 1894

P2463 DIESEL PARTICULATE FILTER 1897
DTC Description 1897
Diagnosis Procedure 1897

P2470 EXHAUST GAS TEMPERATURE SENSOR 4 1899
DTC Description 1899
Diagnosis Procedure 1900

P2471 EXHAUST GAS TEMPERATURE SENSOR 4 1901
DTC Description 1901
Diagnosis Procedure 1902

P2472 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT INTERMITTENT 1/4 1903
DTC Description 1903
Diagnosis Procedure 1903

P1191 TC INLET AIR TEMPERATURE SENSOR PERFORMANCE 1905
DTC Description 1905
Diagnosis Procedure 1906

P2481 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW 1/5 1908
DTC Description 1908
Diagnosis Procedure 1909

P2482 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH 1/5 1910
DTC Description 1910
Diagnosis Procedure 1911

P2483 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT INTERMITTENT 1/5 1912
DTC Description 1912
Diagnosis Procedure 1912

P2493 EGR COOLER BYPASS POSITION SENSOR INTERMITTENT 1914
DTC Description 1914
Diagnosis Procedure 1914

P2494 EGR COOLER BYPASS POSITION SENSOR CIRCUIT LOW 1918
DTC Description 1918
Diagnosis Procedure 1918

P2495 EGR COOLER BYPASS POSITION SENSOR CIRCUIT HIGH 1922
DTC Description 1922
Diagnosis Procedure 1922

P249E CLOSED LOOP REDUCTANT INJECTION FLOW TOO HIGH 1926
DTC Description 1926
Diagnosis Procedure 1926

P24A0 DPF REGENERATION TEMPERATURE TOO LOW 1929
DTC Description 1929
Diagnosis Procedure 1929

P24A2 PARTICULATE FILTER REGENERATION INCOMPLETE 1931
DTC Description 1931
Diagnosis Procedure 1931

P2509 ECM POWER INPUT SIGNAL INTERMITTENT 1935
DTC Description 1935
Diagnosis Procedure 1935

P2540 LOW FUEL PRESSURE SENSOR 1939
DTC Description 1939
Diagnosis Procedure 1939

P2541 FUEL PRESSURE SENSOR 1943
DTC Description 1943
Diagnosis Procedure 1943

P2542 FUEL PRESSURE SENSOR 1947
DTC Description 1947
Diagnosis Procedure 1947

P2558 ENGINE COOLANT LEVEL SENSOR CIRCUIT LOW 1951
DTC Description 1951
Diagnosis Procedure 1951

P2559 ENGINE COOLANT LEVEL SENSOR CIRCUIT HIGH 1954
DTC Description 1954
Diagnosis Procedure 1954

P2560 ENGINE COOLANT LEVEL LOW 1957
DTC Description 1957
Diagnosis Procedure 1957

P2579 TC SPEED SENSOR CIRCUIT RANGE/PERFORMANCE 1958
DTC Description 1958
Diagnosis Procedure 1958

P2580 TC SPEED SENSOR CIRCUIT LOW .1961
DTC Description 1961
Diagnosis Procedure 1961

P2581 TURBOCHARGER SPEED SENSOR CIRCUIT HIGH 1964
DTC Description 1964
Diagnosis Procedure 1964

P262A FUEL INJECTOR - PILOT INJECTION NOT LEARNED 1967
DTC Description 1967
Diagnosis Procedure 1967

P262D SENSOR REFERENCE VOLTAGE CIRCUIT LOW 1968
DTC Description 1968
Diagnosis Procedure 1968

P263E GLOW PLUG CONTROL MODULE OVER TEMPERATURE 1970
DTC Description 1970
Diagnosis Procedure 1970

P268C FUEL INJECTOR 1 INJECTION QUANTITY ADJUSTMENT VALUE 1972
DTC Description 1972
Diagnosis Procedure 1972

P268D FUEL INJECTOR 2 INJECTION QUANTITY ADJUSTMENT VALUE 1973
DTC Description 1973
Diagnosis Procedure 1973

P268E FUEL INJECTOR 3 INJECTION QUANTITY ADJUSTMENT VALUE 1974
DTC Description 1974
Diagnosis Procedure 1974

P268F FUEL INJECTOR 4 INJECTION QUANTITY ADJUSTMENT VALUE 1975
DTC Description 1975
Diagnosis Procedure 1975

P2690 INJECTOR SOLENOID DRIVER CYLINDER 5 1976
DTC Description 1976
Diagnosis Procedure 1976

P2691 INJECTOR SOLENOID DRIVER CYLINDER 6 1977
DTC Description 1977
Diagnosis Procedure 1977

P2692 INJECTOR SOLENOID DRIVER CYLINDER 7 1978
DTC Description 1978
Diagnosis Procedure 1978

P2693 INJECTOR SOLENOID DRIVER CYLINDER 8 1979
DTC Description 1979
Diagnosis Procedure 1979

P2BA7 UREA TANK LEVEL 1980
DTC Description 1980
Diagnosis Procedure 1980

P2BAC NOX CONCENTRATION 1981
DTC Description 1981

Diagnosis Procedure 1981

P2BAD NOX CONCENTRATION EXCEEDED 1982
DTC Description 1982
Diagnosis Procedure 1982

P2BAF NOX SYSTEM DRIVER INDUCEMENT ACTIVE 1984
DTC Description 1984
Diagnosis Procedure 1984

SYMPTOM DIAGNOSIS 1986

ENGINE CONTROL SYSTEM SYMPTOMS ..1986
Symptom Table 1986

PERIODIC MAINTENANCE 1989

IDLE SPEED 1989
Inspection 1989

EXHAUST SYSTEM 1990
Exhaust System Diagnostics 1990

REMOVAL AND INSTALLATION 1994

ECM 1994
Removal and Installation 1994

GLOW CONTROL UNIT 1996
Exploded View 1996
Removal and Installation 1996

SCR CONTROL UNIT 1999
Exploded View 1999
Removal and Installation 1999

SERVICE DATA AND SPECIFICATIONS (SDS) 2001

SERVICE DATA AND SPECIFICATIONS (SDS) 2001
Fuel Pressure 2001
Fuel Rail Pressure 2001
Engine Coolant Temperature Sensor 2001
Crankshaft Position Sensor 2001
Camshaft Position Sensor 2001
Exhaust Restriction 2001
DEF 2001

SUPPLEMENTAL INFORMATION 2002

PRECAUTION

PRECAUTIONS

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

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The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER”, used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the “SRS AIR BAG” and “SEAT BELT” of this Service Manual.

WARNING:

Always observe the following items for preventing accidental activation.

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision that would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see “SRS AIR BAG”.**
- **Never use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.**

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

WARNING:

Always observe the following items for preventing accidental activation.

- **When working near the Air Bag Diagnosis Sensor Unit or other Air Bag System sensors with the ignition ON or engine running, never use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.**
- **When using air or electric power tools or hammers, always switch the ignition OFF, disconnect the battery or batteries, and wait at least 3 minutes before performing any service.**

Precautions for Removing Battery Terminal

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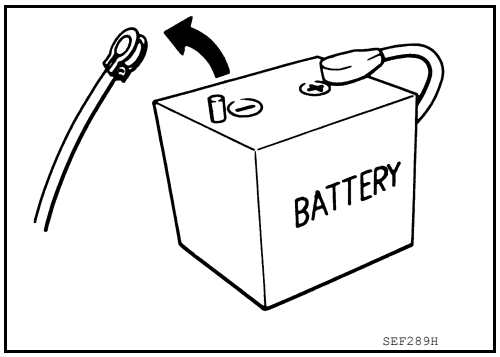
When disconnecting the battery terminal, pay attention to the following.

- Always use a 12V battery as power source.
- Never disconnect battery terminal while engine is running.
- When removing the 12V battery terminal, turn OFF the ignition switch and wait at least 30 seconds.
- For vehicles with the engine listed below, remove the battery terminal after a lapse of the specified time:

BR08DE	: 4 minutes	YD25DDTi	: 2 minutes
D4D engine	: 20 minutes	YS23DDT	: 4 minutes
HRA2DDT	: 12 minutes	YS23DDTT	: 4 minutes
K9K engine	: 4 minutes	ZD30DDTi	: 60 seconds
M9R engine	: 4 minutes	ZD30DDTT	: 60 seconds
R9M engine	: 4 minutes		
V9X engine	: 4 minutes		



NOTE:

ECU may be active for several tens of seconds after the ignition switch is turned OFF. If the battery terminal is removed before ECU stops, then a DTC detection error or ECU data corruption may occur.

- After high-load driving, if the vehicle is equipped with the V9X engine, turn the ignition switch OFF and wait for at least 15 minutes to remove the battery terminal.

NOTE:

- Turbocharger cooling pump may operate in a few minutes after the ignition switch is turned OFF.
- Example of high-load driving
  - Driving for 30 minutes or more at 140 km/h (86 MPH) or more.

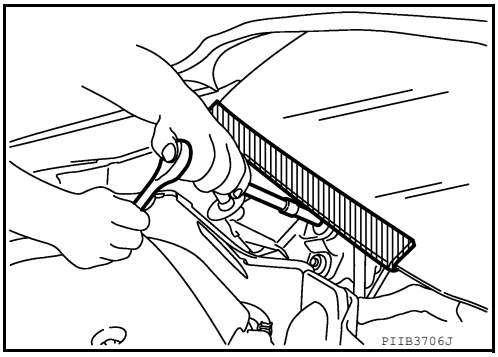
- Driving for 30 minutes or more on a steep slope.

- For vehicles with the 2-batteries, be sure to connect the main battery and the sub battery before turning ON the ignition switch.
  NOTE:
  If the ignition switch is turned ON with any one of the terminals of main battery and sub battery disconnected, then DTC may be detected.
- After installing the 12V battery, always check "Self Diagnosis Result" of all ECUs and erase DTC.
  NOTE:
  The removal of 12V battery may cause a DTC detection error.

Precaution for Procedure without Cowl Top Cover

INFOID:0000000014419332

When performing the procedure after removing cowl top cover, cover the lower end of windshield with urethane, etc to prevent damage to windshield.



On Board Diagnostic (OBD) System of Engine and A/T

INFOID:0000000014419333

The ECM has an on board diagnostic system. It will illuminate the malfunction indicator lamp (MIL) to warn the driver of a malfunction causing emission deterioration.

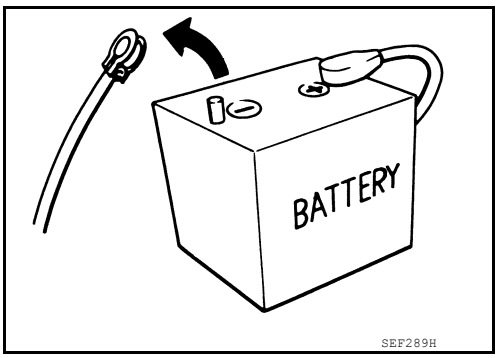
CAUTION:

- **Always turn the ignition switch OFF and disconnect the negative battery cable before any repair or inspection work. The open/short circuit of related switches, sensors, solenoid valves, etc. will cause the MIL to illuminate.**
- **Always connect and lock the connectors securely after work. A loose (unlocked) connector will cause the MIL to illuminate due to the open circuit. (Be sure the connector is free from water, grease, dirt, bent terminals, etc.)**
- **Certain systems and components, especially those related to OBD, may use a new style slide-locking type harness connector. For description and how to disconnect, refer to EC-83, "Diagnosis Description".**
- **Always route and secure the harnesses properly after work. The interference of the harness with a bracket, etc. may cause the MIL to illuminate due to the short circuit.**
- **Always connect rubber tubes properly after work. A misconnected or disconnected rubber tube may cause the MIL to illuminate due to the malfunction of the EVAP system or fuel injection system, etc.**
- **Always erase the unnecessary malfunction information (repairs completed) from the ECM and TCM (Transmission control module) before returning the vehicle to the customer.**

General Precautions

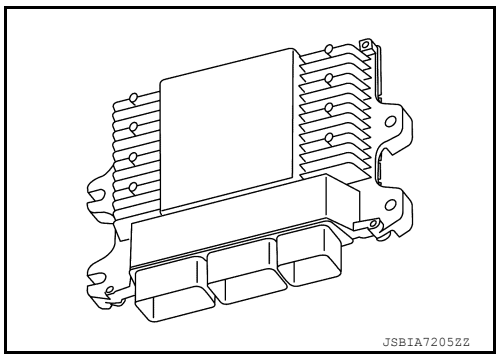
INFOID:0000000014419334

- **Always use a 12 volt battery as power source.**
- **Never attempt to disconnect battery cables while engine is running.**
- **Before connecting or disconnecting the ECM harness connector, turn ignition switch OFF and disconnect negative battery cable. Failure to do so may damage the ECM because battery voltage is applied to ECM even if ignition switch is turned OFF.**
- **Before removing parts, turn ignition switch OFF and then disconnect battery ground cable.**

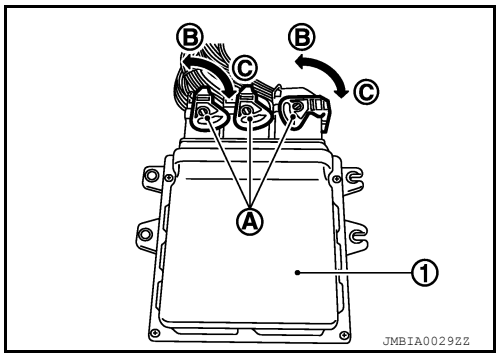


- **Never disassemble ECM.**
- **If a battery cable is disconnected, the memory will return to the ECM value.**
  The ECM will now start to self-control at its initial value. Thus, engine operation can vary slightly in this case. However, this is not an indication of a malfunction. Never replace parts because of a slight variation.
- **If the battery is disconnected, the following emission-related diagnostic information will be lost within 24 hours.**

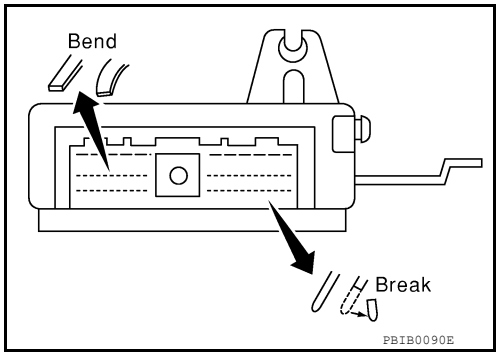
- **Diagnostic trouble codes**
- **1st trip diagnostic trouble codes**
- **Freeze frame data**
- **1st trip freeze frame data**
- **System readiness test (SRT) codes**
- **Test values**

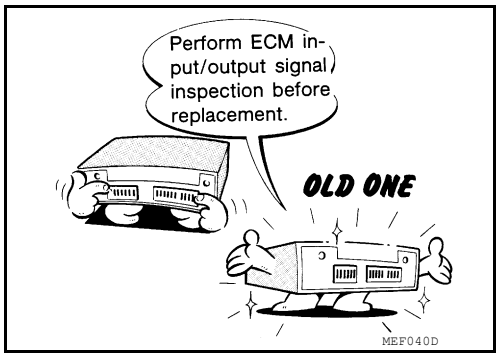


- **When connecting ECM harness connector (A), fasten (B) it securely with a lever as far as it will go as shown in the figure.**
- ECM (1)
- Loosen (C)

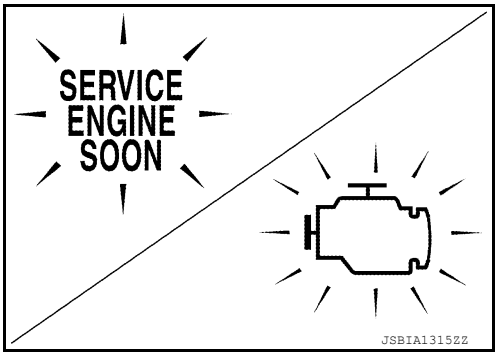


- **When connecting or disconnecting pin connectors into or from ECM, never damage pin terminals (bends or break).**
  Check that there are not any bends or breaks on ECM pin terminal, when connecting pin connectors.
- **Securely connect ECM harness connectors.**
  A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- **Keep engine control system harness at least 10 cm (4 in) away from adjacent harness, to prevent engine control system malfunctions due to receiving external noise, degraded operation of ICs, etc.**
- **Keep engine control system parts and harness dry.**
- **Before replacing ECM, perform ECM Terminals and Reference Value inspection and check that ECM functions properly. Refer to EC-107, "Reference Value".**
- **Handle mass air flow sensor carefully to avoid damage.**
- **Never clean mass air flow sensor with any type of detergent.**
- **Never disassemble electric throttle control actuator.**
- **Even a slight leakage in the air intake system can cause serious incidents.**
- **Never shock or jar the camshaft position sensor, crankshaft position sensor.**

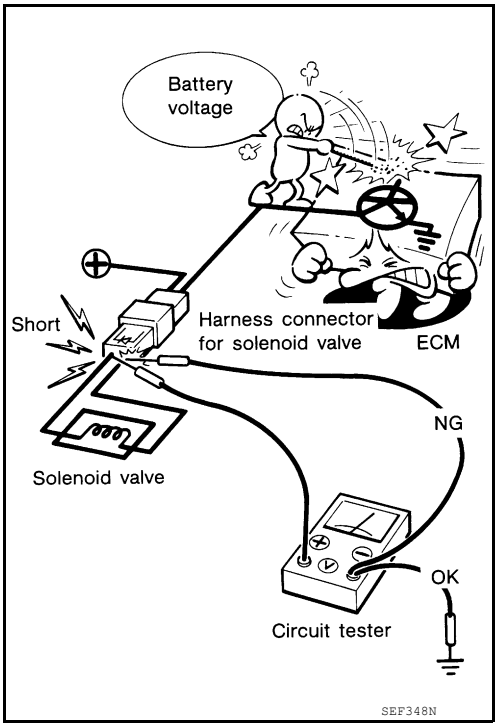




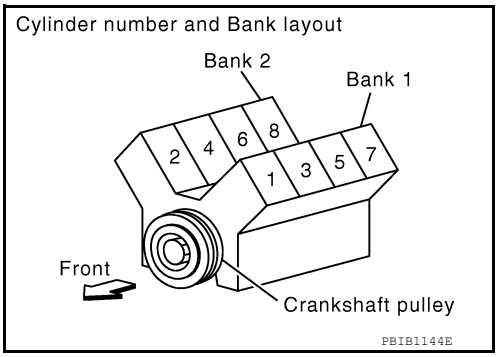
- **After performing each TROUBLE DIAGNOSIS, perform DTC Confirmation Procedure or Component Function Check.**
  The DTC should not be displayed in the DTC Confirmation Procedure if the repair is completed. The Component Function Check should be a good result if the repair is completed.



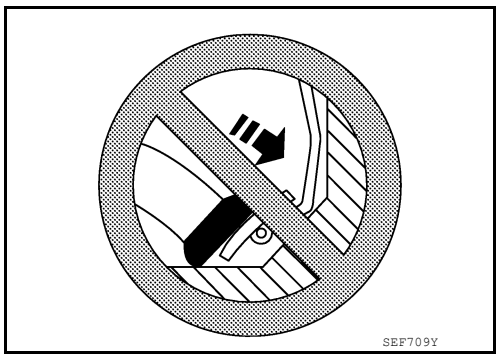
- **When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.



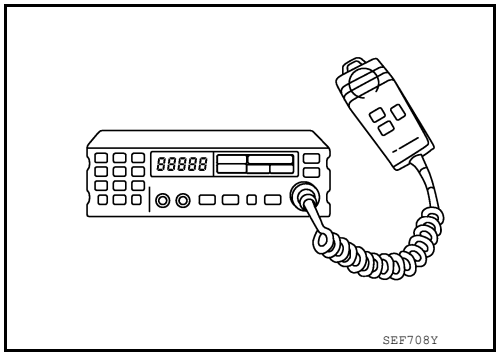
- **B1 indicates bank 1, B2 indicates bank 2 as shown in the figure.**
- **Never operate fuel pump when there is no fuel in lines.**
- **Tighten fuel hose clamps to the specified torque.**



- **Never depress accelerator pedal when starting.**
- **Immediately after starting, never rev up engine unnecessarily.**
- **Never rev up engine just prior to shutdown.**



- **When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on installation location.**
  - **Keep the antenna as far as possible from the electronic control units.**
  - **Keep the antenna feeder line more than 20 cm (8 in) away from the harness of electronic controls.**
    Never let them run parallel for a long distance.
  - **Adjust the antenna and feeder line so that the standing-wave ratio can be kept smaller.**
  - **Be sure to ground the radio to vehicle body.**

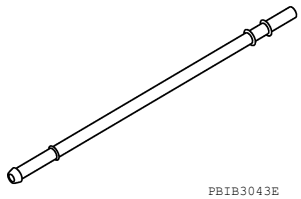


PREPARATION

PREPARATION

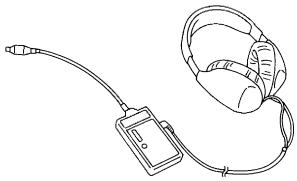
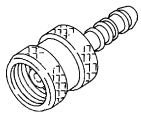
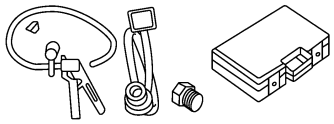
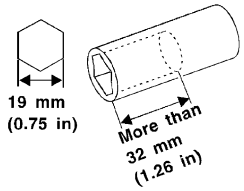
Special Service Tools

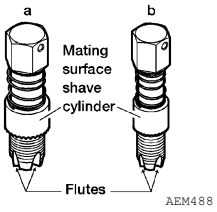
INFOID:0000000014419335

Tool number (TechMate No.) Tool name	Description
KV10118400 (—) Fuel tube adapter  PBIB3043E	Measures fuel pressure

Commercial Service Tools

INFOID:0000000014419336

Tool name (TechMate No.)	Description
Leak detector i.e.: (J-41416)  S-NT703	Locates the EVAP leak
EVAP service port adapter i.e.: (J-41413-OBD)  S-NT704	Applies positive pressure through EVAP service port
Fuel filler cap adapter i.e.: (J-42909)  ALBIA1353ZZ	Checks fuel tank vacuum relief valve opening pressure
Socket wrench  S-NT705	Removes and installs engine coolant temperature sensor

Tool name (TechMate No.)		Description
Oxygen sensor thread cleaner i.e.: (J-43897-18) (J-43897-12)		Reconditions the exhaust system threads before installing a new oxygen sensor. Use with anti-seize lubricant shown below. **a: 18 mm diameter with pitch 1.5 mm for Zirconia Oxygen Sensor** **b: 12 mm diameter with pitch 1.25 mm for Titania Oxygen Sensor**
Anti-seize lubricant i.e.: (Permatex™ 133AR or equivalent meeting MIL specification MIL-A-907)		Lubricates oxygen sensor thread cleaning tool when reconditioning exhaust system threads.

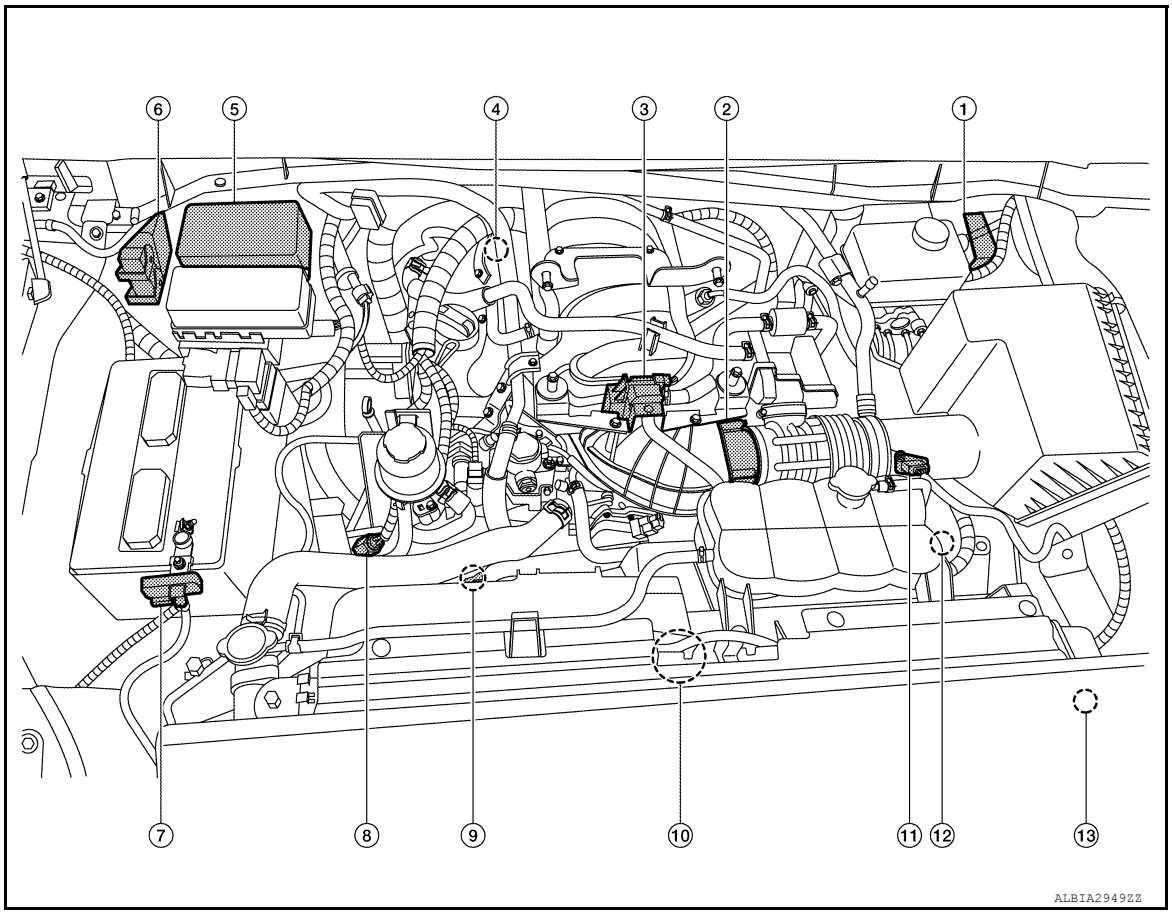
SYSTEM DESCRIPTION

COMPONENT PARTS

Component Parts Location

INFOID:0000000014419337

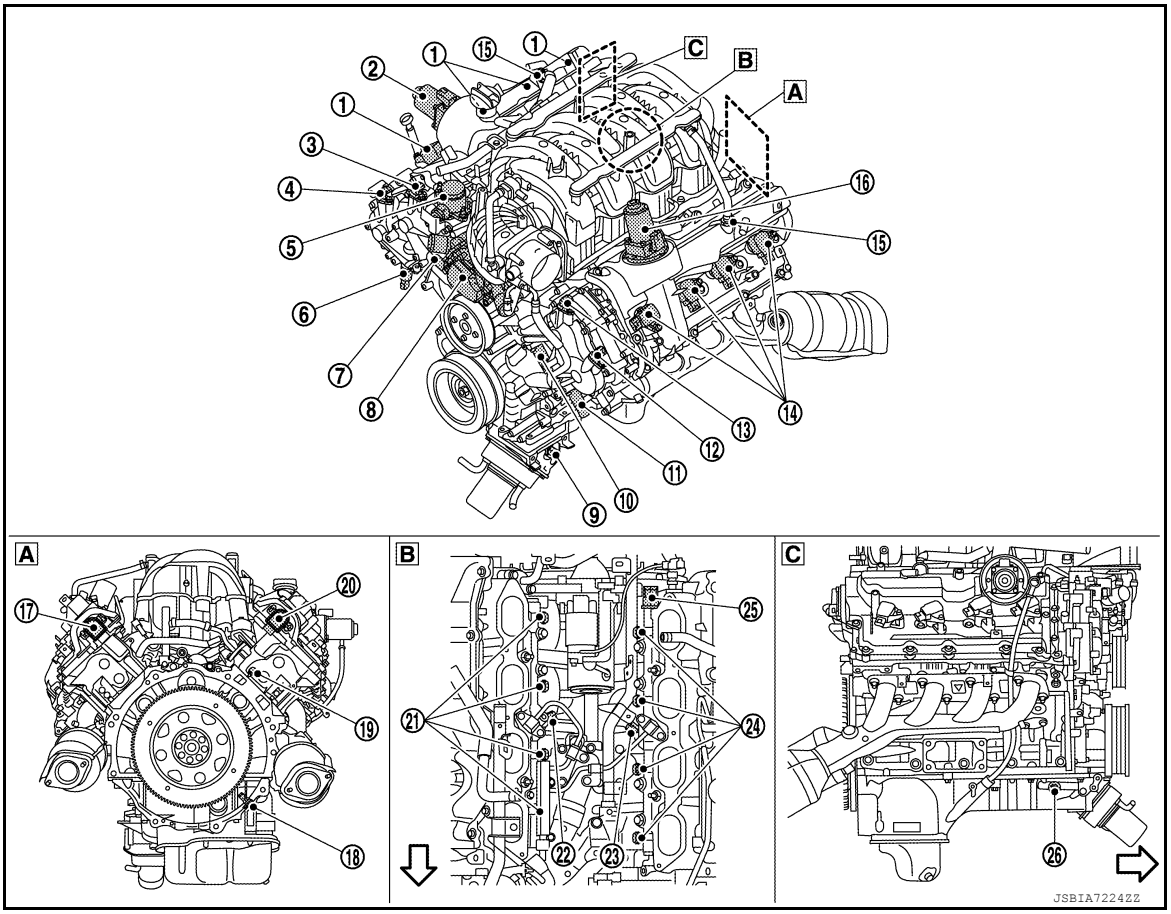
ENGINE ROOM COMPARTMENT



No.	Component parts	Function
①	VVEL control module	EC-53, "VVEL Control Module"
②	Electric throttle control actuator	EC-43, "Electric Throttle Control Actuator"
③	EVAP canister purge volume control solenoid valve	EC-46, "EVAP Canister Purge Volume Control Solenoid Valve"
④	Engine coolant temperature sensor 2	EC-44, "Engine Coolant Temperature Sensor 2"
⑤	IPDM E/R	IPDM E/R control the internal relays and the actuators. When CAN communication with ECM is impossible, IPDM E/R performs fail-safe control. • PCS-8, "POWER CONSUMPTION CONTROL SYSTEM : System Description" • PCS-22, "Fail Safe"
⑥	ECM	EC-43, "ECM"
⑦	Battery current sensor (with battery temperature sensor)	EC-41, "Battery Current Sensor (With Battery Temperature Sensor)"
⑧	Power steering pressure sensor	EC-52, "Power Steering Pressure (PSP) Sensor"
⑨	Alternator	CHG-10, "POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM : System Description"

No.	Component parts	Function
⑩	Fan clutch assembly	EC-47, "Fan Clutch Assembly"
⑪	Mass air flow sensor (with intake air temperature sensor)	EC-51, "Mass Air Flow Sensor (With Intake Air Temperature Sensor)"
⑫	Engine coolant temperature sensor 1	EC-44, "Engine Coolant Temperature Sensor 1"
⑬	Refrigerant pressure sensor	EC-53, "Refrigerant Pressure Sensor"

ENGINE COMPARTMENT



A Rear view of the engine

B Top view of the engine (View with intake manifold is removed)

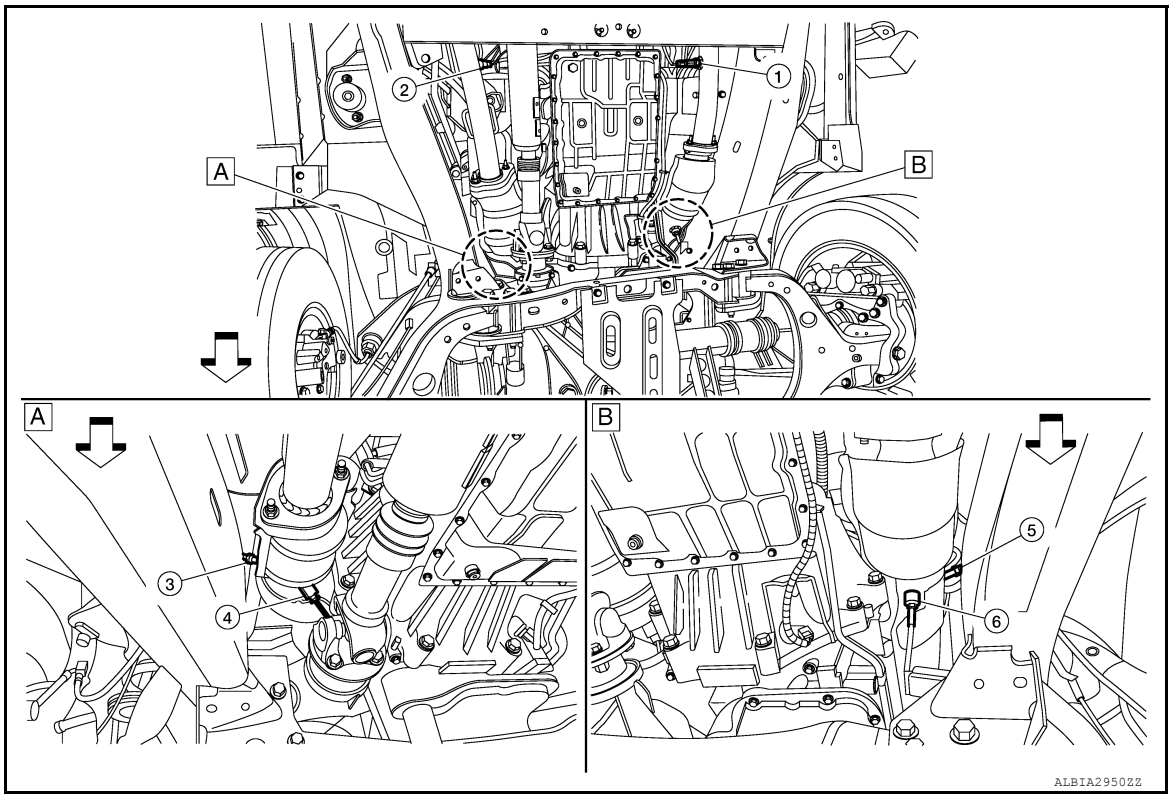
C Right side view of the engine

⇦ : Engine front

No.	Component parts	Function
①	Ignition coil (with power transistor) and spark plug (bank 2)	EC-50, "Ignition Coil With Power Transistor"
②	VVEL actuator motor (bank 2)	EC-53, "VVEL Actuator Motor"
③	Camshaft position sensor (bank 2)	EC-42, "Camshaft Position Sensor"
④	Exhaust valve timing control position sensor (bank 2)	EC-47, "Exhaust Valve Timing Control Position Sensor"
⑤	High pressure fuel pump	EC-49, "High Pressure Fuel Pump"
⑥	Exhaust valve timing control solenoid valve (bank 2)	EC-47, "Exhaust Valve Timing Control Solenoid Valve"
⑦	Intake valve timing control solenoid valve (bank 2)	EC-51, "Intake Valve Timing Control Solenoid Valve"
⑧	Multi–way control valve	EC-52, "Multi-way Control Valve"
⑨	Engine oil temperature sensor	EC-45, "Engine Oil Temperature Sensor"

No.	Component parts	Function
⑩	Intake valve timing control solenoid valve (bank 1)	EC-51, "Intake Valve Timing Control Solenoid Valve"
⑪	Exhaust valve timing control solenoid valve (bank 1)	EC-47, "Exhaust Valve Timing Control Solenoid Valve"
⑫	Exhaust valve timing control position sensor (bank 1)	EC-47, "Exhaust Valve Timing Control Position Sensor"
⑬	Camshaft position sensor (bank 1)	EC-42, "Camshaft Position Sensor"
⑭	Ignition coil (with power transistor) and spark plug (bank 1)	EC-50, "Ignition Coil With Power Transistor"
⑮	Positive crankcase ventilation (PCV) valve	EM-38, "Exploded View"
⑯	VVEL actuator motor (bank 1)	EC-53, "VVEL Actuator Motor"
⑰	VVEL control shaft position sensor (bank 1)	EC-53, "VVEL Control Shaft Position Sensor"
⑱	Crankshaft position sensor	EC-42, "Crankshaft Position Sensor"
⑲	Engine coolant temperature sensor 1	EC-44, "Engine Coolant Temperature Sensor 1"
⑳	VVEL control shaft position sensor (bank 2)	EC-53, "VVEL Control Shaft Position Sensor"
㉑	Fuel injector (bank 2)	EC-48, "Fuel Injector"
㉒	Knock sensor (bank 2)	EC-51, "Knock Sensor"
㉓	Knock sensor (bank 1)	EC-51, "Knock Sensor"
㉔	Fuel injector (bank 1)	EC-48, "Fuel Injector"
㉕	Fuel rail pressure sensor	EC-48, "Fuel Rail Pressure Sensor"
㉖	Engine oil pressure sensor	EC-45, "Engine Oil Pressure Sensor"

EXHAUST COMPARTMENT

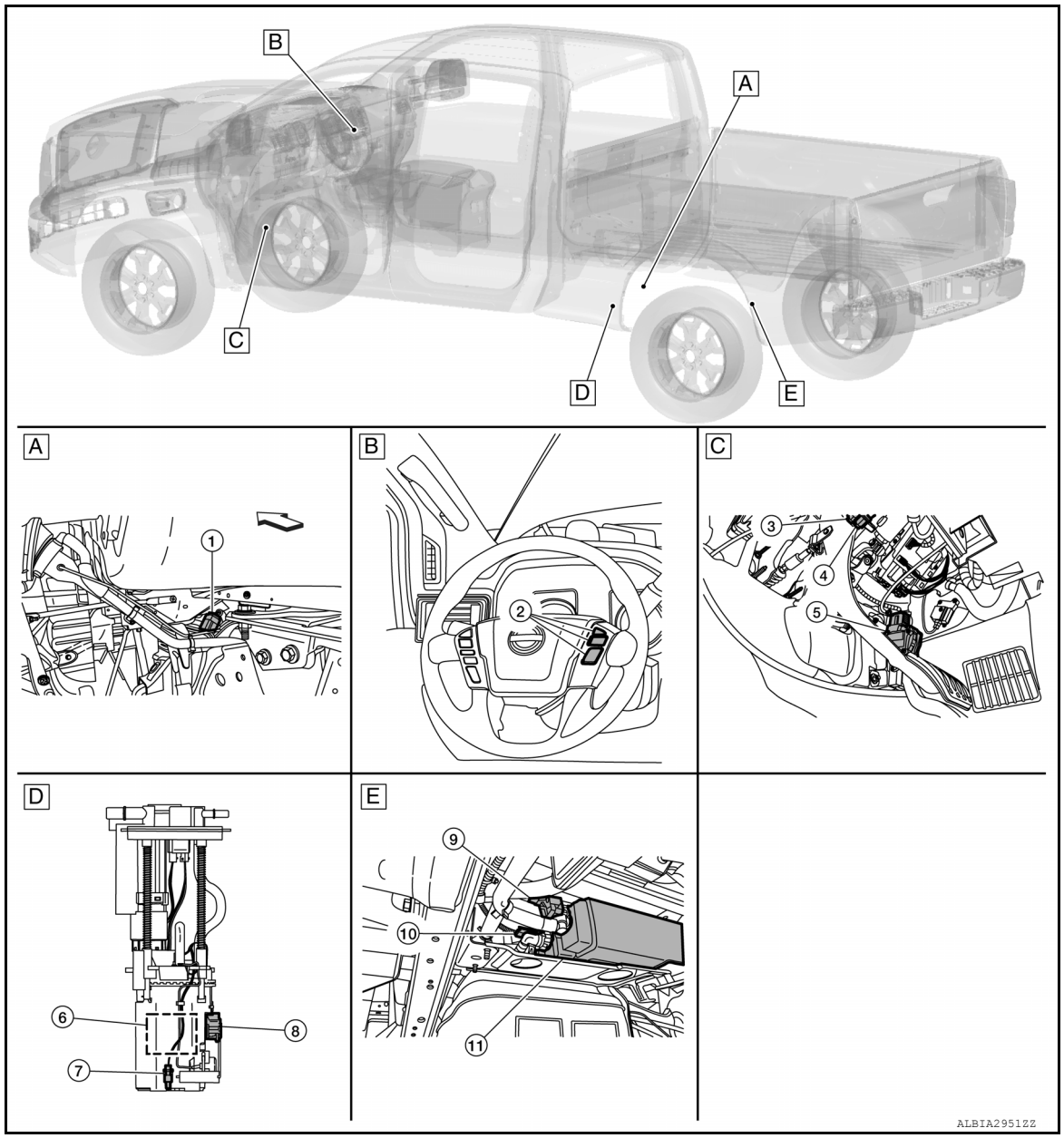


A Rear left under view of the engine B Rear right under view of the engine

⇦ : Vehicle front

No.	Component parts	Function
①	Heated oxygen sensor 2 (bank 2)	EC-49, "Heated Oxygen Sensor 2"
②	Heated oxygen sensor 2 (bank 1)	EC-49, "Heated Oxygen Sensor 2"
③	A/F sensor 1 (bank 1)	EC-40, "Air Fuel Ratio (A/F) Sensor 1"
④	Exhaust gas temperature sensor (bank 1)	EC-46, "Exhaust Gas Temperature Sensor"
⑤	A/F sensor 1 (bank 2)	EC-40, "Air Fuel Ratio (A/F) Sensor 1"
⑥	Exhaust gas temperature sensor (bank 2)	EC-46, "Exhaust Gas Temperature Sensor"

BODY COMPARTMENT



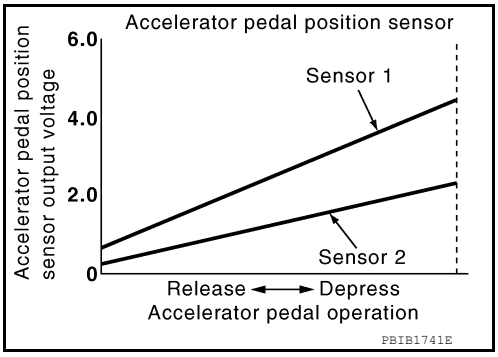
A Left rear wheel area
B Steering wheel
C Pedal peripherye
D Inside fuel tank
E Behind fuel tank
⇦ : Vehicle front

No.	Component parts	Function
①	Fuel Pump Control Module (FPCM)	EC-48, "Fuel Pump Control Module"
②	ASCD steering switch	EC-41, "ASCD Steering Switch"
③	Stop lamp switch	EC-42, "Brake Pedal Position Switch & Stop Lamp Switch"
④	Brake pedal position switch	
⑤	Accelerator pedal position sensor	EC-40, "Accelerator Pedal Position Sensor"
⑥	Fuel pump	EC-48, "Fuel Pump Control Module"
⑦	Fuel tank temperature sensor	
⑧	Fuel level sensor unit	
⑨	EVAP canister vent control valve	EC-46, "EVAP Canister Vent Control Valve"
⑩	EVAP control system pressure sensor	EC-46, "EVAP Control System Pressure Sensor"
⑪	EVAP Canister	FL-14, "Exploded View"

Accelerator Pedal Position Sensor

INFOID:0000000014419338

The accelerator pedal position (APP) sensor is installed on the accelerator pedal assembly. The sensor detects the accelerator position and sends a signal to the ECM.
Accelerator pedal position sensor has two sensors. These sensors are a kind of potentiometer which transform the accelerator pedal position into output voltage, and emit the voltage signals to the ECM. The ECM judges the current opening angle of the accelerator pedal from these signals and controls the throttle control motor based on these signals.
Idle position of the accelerator pedal is determined by the ECM receiving the signal from the accelerator pedal position sensor. The ECM uses this signal for engine operations such as fuel cut.

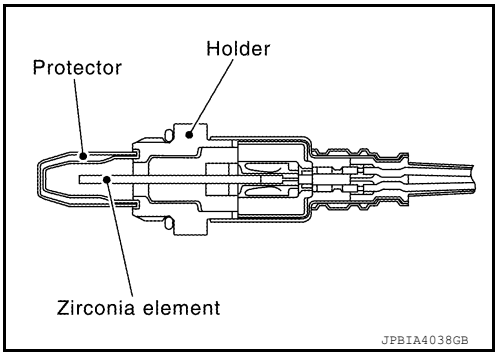


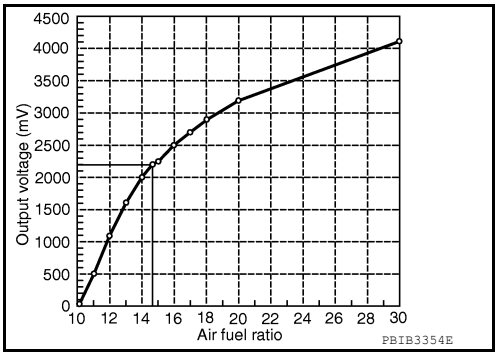
Air Fuel Ratio (A/F) Sensor 1

INFOID:0000000014419339

Description

The A/F sensor 1 is mounted on the exhaust manifold, and transmits the signal of detected oxygen concentration in the exhaust gas to ECM.
While O2 sensor changes output voltage by ON/OFF (rich/lean) mode within a narrow range of the stoichiometric ratio, the A/F sensor changes output voltage between 0 - 4 V for a wide range of air fuel ratio.
ECM judges the state of air fuel ratio with this signal, and precisely controls air fuel ratio to match the stoichiometric ratio.Also, the sensor is equiped with heater for maintaining the activated state.





A/F SENSOR 1 HEATER

A/F sensor 1 heater is integrated in the sensor.
The ECM performs ON/OFF duty control of the A/F sensor 1 heater corresponding to the engine operating condition to keep the temperature of A/F sensor 1 element within the specified range.

ASCD Indicators

INFOID:0000000014419340

ASCD operation status is indicated by CRUISE indicator in combination meter.
ECM transmits the ASCD status signal to the combination meter via CAN communication according to ASCD operation.

ASCD Steering Switch

INFOID:0000000014419341

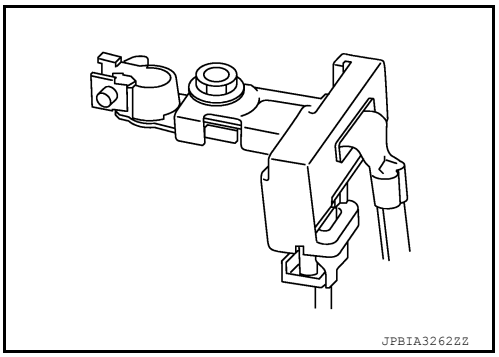
ASCD steering switch has variant values of electrical resistance for each button. ECM reads voltage variation of switch, and determines which button is operated.

Battery Current Sensor (With Battery Temperature Sensor)

INFOID:0000000014419342

OUTLINE

The power generation voltage variable control enables fuel consumption to be decreased by reducing the engine load which is caused by the power generation of the generator.
Based on sensor signals, ECM judges whether or not the power generation voltage variable control is performed. When performing the power generation voltage variable control, ECM calculates the target power generation voltage based on the sensor signal. And ECM sends the calculated value as the power generation command value to IPDM E/R. For the details of the power generation voltage variable control, refer to CHG-10, "CHARGING SYSTEM : System Description- with VK56VD".



CAUTION:
Never connect the electrical component or the ground wire directly to the battery terminal. The connection causes the malfunction of the power generation voltage variable control, and then the battery discharge may occur.

BATTERY CURRENT SENSOR

The battery current sensor is installed to the battery cable at the negative terminal. The sensor measures the charging/discharging current of the battery.

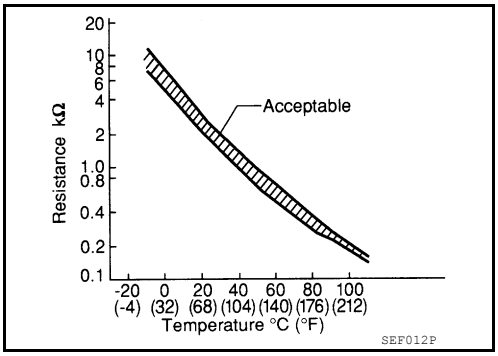
BATTERY TEMPERATURE SENSOR

Battery temperature sensor is integrated in battery current sensor.
The sensor measures ambient temperature around the battery.
The electrical resistance of the thermistor decreases as temperature increases.

<Reference data>

Temperature [°C (°F)]	Voltage* (V)	Resistance (kΩ)
25 (77)	3.333	1.9 - 2.1
90 (194)	0.969	0.222 - 0.258

*: These data are reference values and are measured between ECM terminals.



Brake Pedal Position Switch & Stop Lamp Switch

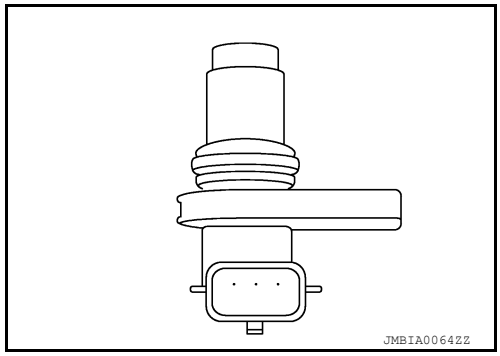
INFOID:0000000014419343

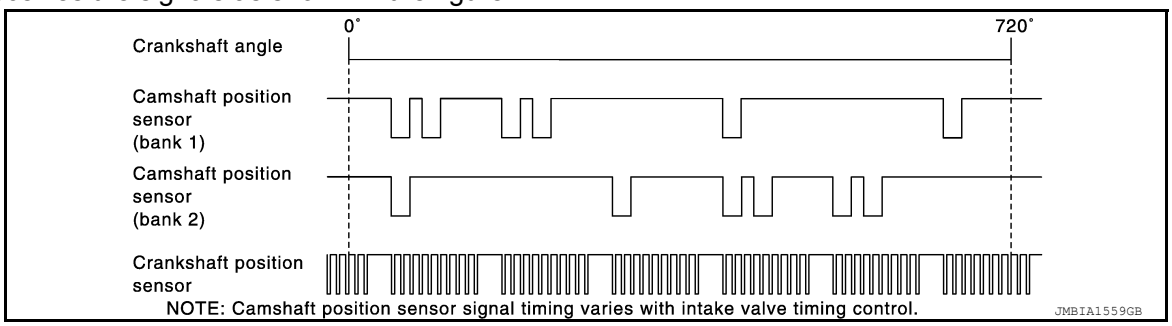
Stop lamp switch and brake pedal position switch are installed to brake pedal bracket.
When the brake pedal is depressed, brake pedal position switch is turned OFF and stop lamp switch is turned ON.
ECM detects the state of the brake pedal by those two types of input (ON/OFF signal).

Camshaft Position Sensor

INFOID:0000000014419344

The camshaft position (CMP) sensor senses the protrusion of the signal plate installed to the camshaft (INT) front end to identify a particular cylinder. The camshaft position sensor senses the piston position.
The sensor consists of a permanent magnet and Hall IC.
When engine is running, the high and low parts of the teeth cause the gap with the sensor to change.
The changing gap causes the magnetic field near the sensor to change.
Due to the changing magnetic field, the voltage from the sensor changes.
When the crankshaft position sensor system becomes inoperative, the camshaft position sensor provides various controls of engine parts instead, utilizing timing of cylinder identification signals.
ECM receives the signals as shown in the figure.

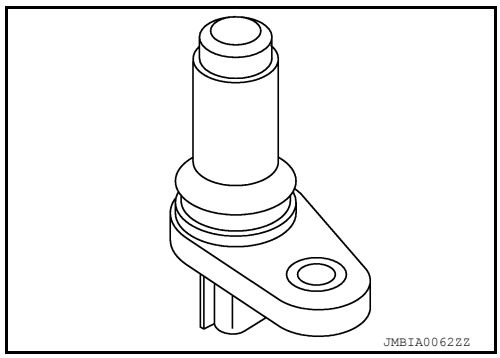




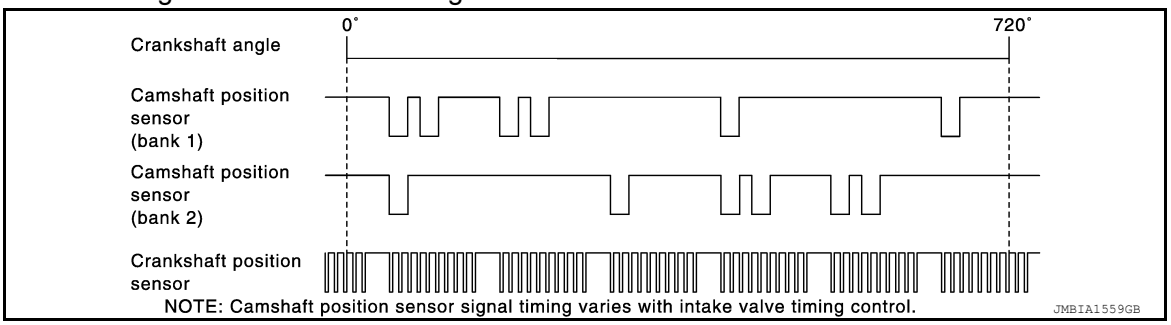
Crankshaft Position Sensor

INFOID:0000000014419345

The crankshaft position (CKP) sensor senses the protrusion of the signal plate installed to the drive plate to identify fluctuation of the engine revolution.
The sensor consists of a permanent magnet and Hall IC.
When the engine is running, the high and low parts of the teeth cause the gap with the sensor to change.
The changing gap causes the magnetic field near the sensor to change.
Due to the changing magnetic field, the voltage from the sensor changes.
The ECM receives the voltage signal and detects the fluctuation of the engine revolution.



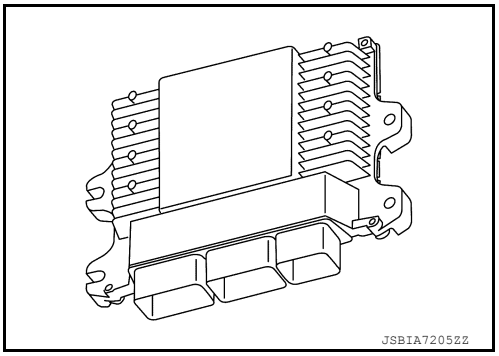
ECM receives the signals as shown in the figure.



ECM

INFOID:0000000014419346

- ECM (Engine Control Module) controls the engine.
- The ECM consists of a microcomputer and connectors for transmitting/receiving signals and for supplying power. Furthermore, the ECM is equipped with an injector driver unit and actuates the fuel injector at a high voltage (approximately 70 V at the maximum).
- ECM is equipped with ECM temperature sensors. If ECM is overheated, ECM controls output torque to prevent damage to itself.
- Battery voltage is supplied to the ECM even when the ignition switch is turned OFF for the ECM memory function of the DTC memory, the air-fuel ratio feedback compensation value memory, the idle air volume learning value memory, etc.

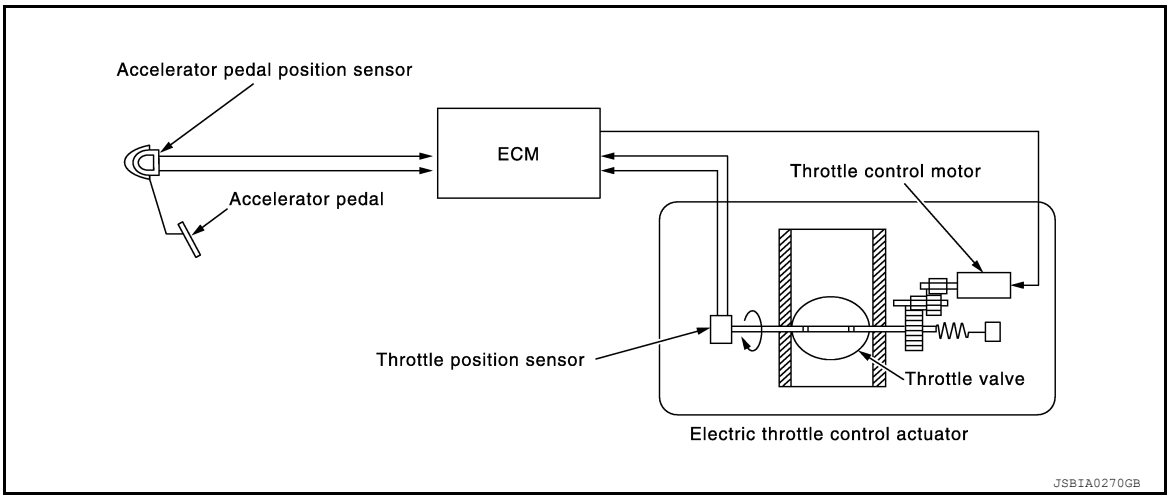


Electric Throttle Control Actuator

INFOID:0000000014419347

OUTLINE

Electric throttle control actuator consists of throttle body, throttle valve, throttle control motor and throttle position sensor.

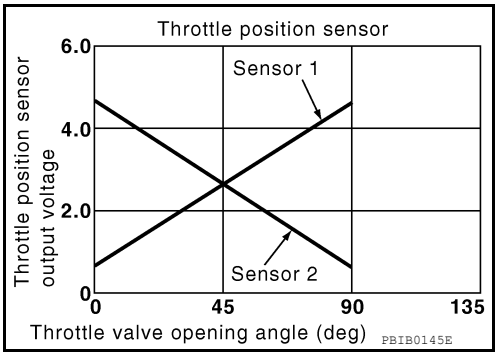


THROTTLE CONTROL MOTOR

The throttle control motor is operated by the ECM and it opens and closes the throttle valve.
The current opening angle of the throttle valve is detected by the throttle position sensor. The throttle position sensor provides feedback to the ECM, when opens/closes the throttle valve in response to driving conditions via the throttle control motor.

THROTTLE POSITION SENSOR

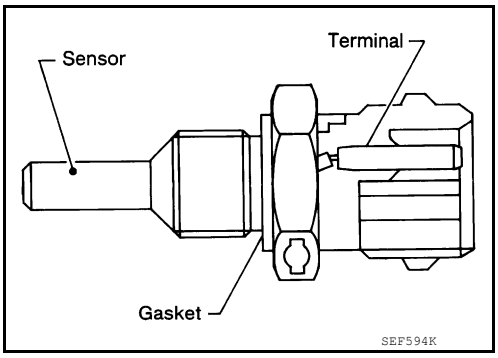
The throttle position (TP) sensor responds to the throttle valve movement.
The throttle position sensor has two sensors. These sensors are a kind of potentiometer which transform the throttle valve position into output voltage, and emit the voltage signal to the ECM. The ECM judges the current opening angle of the throttle valve from these signals and controls the throttle valve opening angle in response to driving conditions via the throttle control motor.



Engine Coolant Temperature Sensor 1

INFOID:0000000014419348

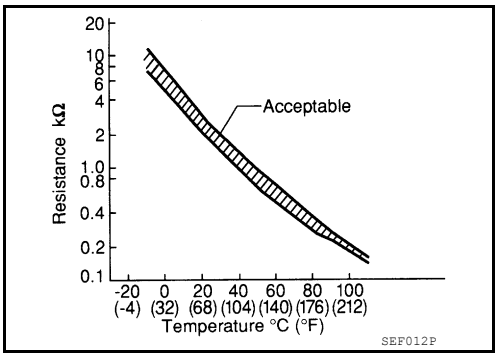
The engine coolant temperature (ECT) sensor 1 is used to detect the engine coolant temperature. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the engine coolant temperature input. The sensor uses a thermistor which is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.



<Reference data>

Engine coolant temperature [°C (°F)]	Voltage* (V)	Resistance (kΩ)
−10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.35 - 2.73
50 (122)	2.2	0.68 - 1.00
90 (194)	1.0	0.236 - 0.260

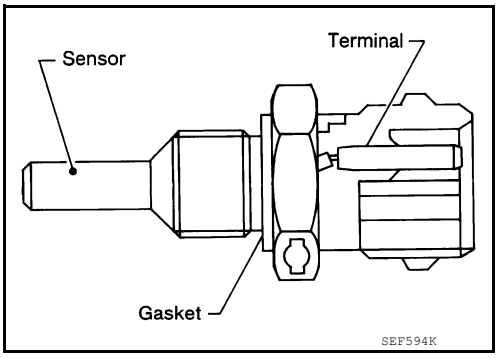
*: These data are reference values and are measured between ECM terminals.



Engine Coolant Temperature Sensor 2

INFOID:0000000014419349

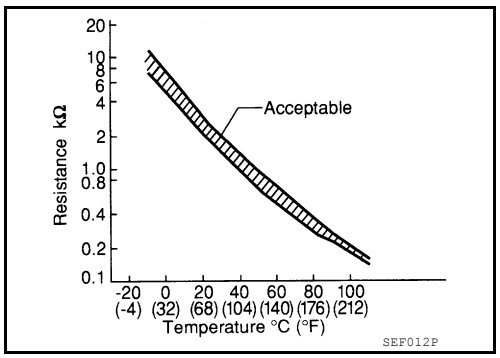
The engine coolant temperature (ECT) sensor 2 is used to detect the engine coolant temperature. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the engine coolant temperature input. The sensor uses a thermistor which is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.



<Reference data>

Engine coolant temperature [°C (°F)]	Voltage* (V)	Resistance (kΩ)
–10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.35 - 2.73
50 (122)	2.2	0.68 - 1.00
90 (194)	1.0	0.236 - 0.260

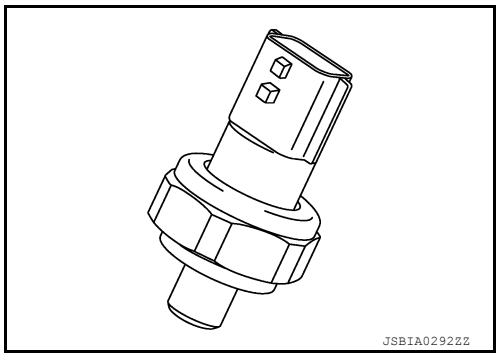
*: These data are reference values and are measured between ECM terminals.



Engine Oil Pressure Sensor

INFOID:0000000014419350

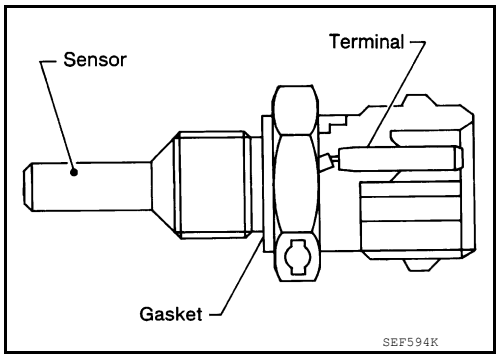
The engine oil pressure (EOP) sensor is detects engine oil pressure and transmits a voltage signal to the ECM.



Engine Oil Temperature Sensor

INFOID:0000000014419351

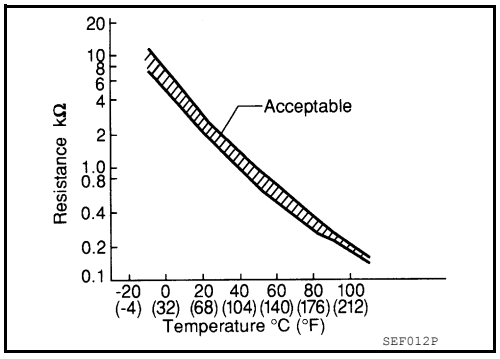
The engine oil temperature sensor is used to detect the engine oil temperature. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the engine oil temperature input. The sensor uses a thermistor which is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.



<Reference data>

Engine oil temperature [°C (°F)]	Voltage* (V)	Resistance (kΩ)
–10 (14)	4.4	7.0 - 11.4
20 (68)	3.5	2.35 - 2.73
50 (122)	2.2	0.68 - 1.00
90 (194)	0.9	0.236 - 0.260
110 (230)	0.6	0.143 - 0.153

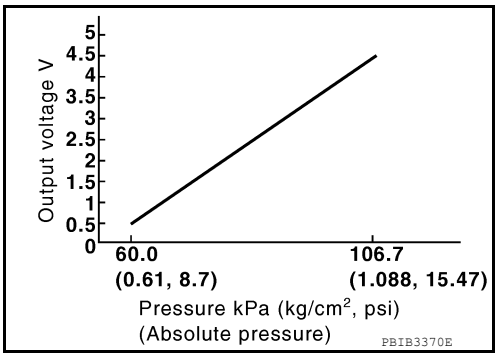
*: These data are reference values and are measured between ECM terminals.



EVAP Control System Pressure Sensor

INFOID:0000000014419352

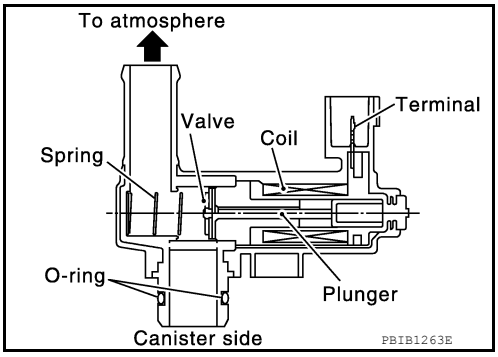
The EVAP control system pressure sensor detects pressure in the purge line. The sensor output voltage to the ECM increases as pressure increases.



EVAP Canister Vent Control Valve

INFOID:0000000014419353

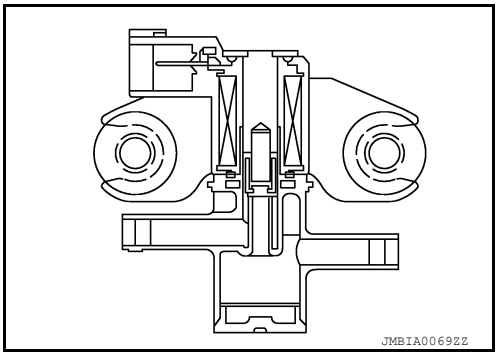
The EVAP canister vent control valve is located on the EVAP canister and is used to seal the canister vent.
This solenoid valve responds to signals from the ECM. When the ECM sends an ON signal, the coil in the solenoid valve is energized. A plunger will then move to seal the canister vent. The ability to seal the vent is necessary for the on board diagnosis of other evaporative emission control system components.
This solenoid valve is used only for diagnosis, and usually remains opened.
When the vent is closed, under normal purge conditions, the evaporative emission control system is depressurized and allows “EVAP Control System” diagnosis.



EVAP Canister Purge Volume Control Solenoid Valve

INFOID:0000000014419354

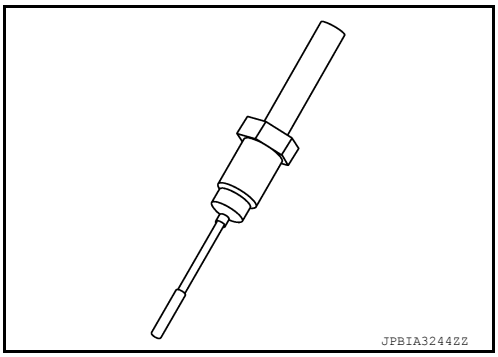
The EVAP canister purge volume control solenoid valve is used to control the flow rate of fuel vapor from the EVAP canister. The EVAP canister purge volume control solenoid valve is moved by ON/OFF pulses from the ECM. The longer the ON pulse, the greater the amount of fuel vapor that will flow through the valve.



Exhaust Gas Temperature Sensor

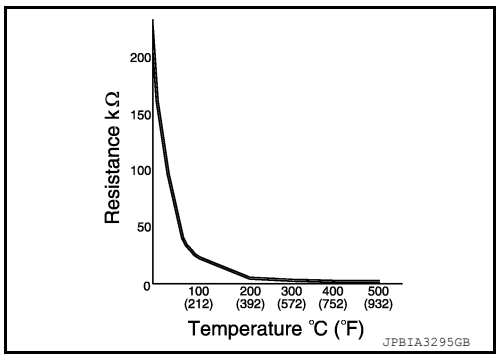
INFOID:0000000014419355

Exhaust gas temperature sensor (EGT sensor) is installed exhaust manifold. Exhaust gas temperature sensor uses a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rises.



<Reference data>

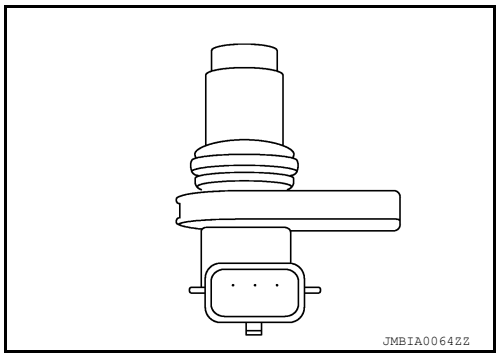
Exhaust gas temperature	Voltage	Resistance
100°C (212°F)	4.74 V	18.25 kΩ
200°C (392°F)	4.00 V	4.00 kΩ
400°C (752°F)	1.96 V	0.64 kΩ
600°C (1112°F)	0.85 V	0.20 kΩ



Exhaust Valve Timing Control Position Sensor

INFOID:0000000014419356

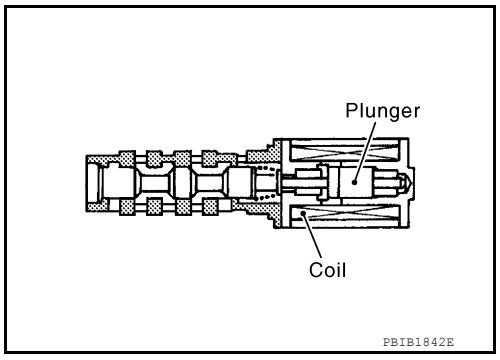
Exhaust valve timing control position sensor detects the protrusion of the signal plate installed to the exhaust camshaft front end.
This sensor signal is used for sensing a position of the exhaust camshaft.
This sensor uses a Hall IC.
Based on the position of the exhaust camshaft, ECM controls exhaust valve timing control solenoid valve to optimize the shut/open timing of exhaust valve for the driving condition.



Exhaust Valve Timing Control Solenoid Valve

INFOID:0000000014419357

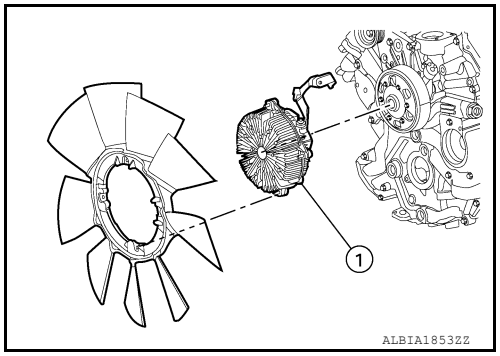
Exhaust valve timing control solenoid valve is activated by ON/OFF pulse duty (ratio) signals from the ECM.
The exhaust valve timing control solenoid valve changes the oil amount and direction of flow through exhaust valve timing control unit or stops oil flow.
The longer pulse width retards valve angle.
The shorter pulse width advances valve angle.
When ON and OFF pulse widths become equal, the solenoid valve stops oil pressure flow to fix the exhaust valve angle at the control position.



Fan Clutch Assembly

INFOID:0000000014419358

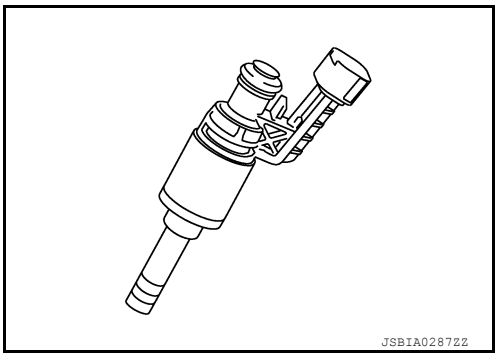
- A cooling fan clutch (1) is utilized to control cooling fan operation. This fan clutch is controlled by the ECM. The ECM monitors coolant temperature and intake manifold temperature to determine when to engage the cooling fan. There are also additional sensors monitored by the ECM for fan control (for example, air conditioner pressure). The fan clutch is an electro-viscous fan clutch.



Fuel Injector

INFOID:0000000014419359

For the fuel injector, a high pressure fuel injector is used and this enables a high-pressure fuel injection at a high voltage within a short time. The ECM is equipped with an injector driver unit and actuates the fuel injector at a high voltage (approximately 65 V at the maximum).



Fuel Level Sensor

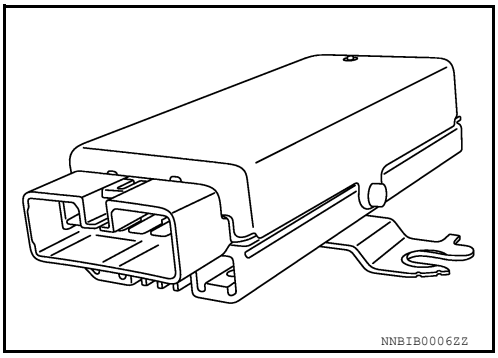
INFOID:0000000014419360

The fuel level sensor is mounted in the fuel level sensor unit.
The sensor detects a fuel level in the fuel tank and transmits a signal to the combination meter. The combination meter sends the fuel level sensor signal to the ECM via the CAN communication line.
It consists of two parts, one is mechanical float and the other is variable resistor. Fuel level sensor output voltage changes depending on the movement of the fuel mechanical float.

Fuel Pump Control Module

INFOID:0000000014419361

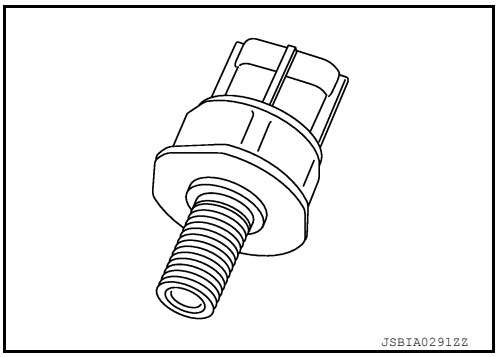
The fuel pump control module (FPCM) controls the discharging volume of the fuel pump by transmitting the FPCM control signals (Low/Mid/High) depending on driving conditions.



Fuel Rail Pressure Sensor

INFOID:0000000014419362

The fuel rail pressure (FRP) sensor is placed to the fuel rail and measures fuel pressure in the fuel rail. The sensor transmits voltage signal to the ECM. As the pressure increases, the voltage rises. The ECM controls the fuel pressure in the fuel rail by operating high pressure fuel pump. The ECM uses the signal from fuel rail pressure sensor as a feedback signal.

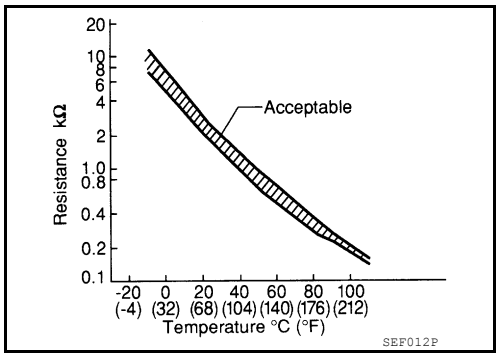


Fuel Tank Temperature Sensor

INFOID:0000000014419363

The fuel tank temperature sensor is used to detect the fuel temperature inside the fuel tank. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the fuel temperature input. The sensor uses a thermistor which is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.

<Reference data>



Fuel temperature [°C (°F)]	Voltage* (V)	Resistance (kΩ)
20 (68)	3.5	2.3 - 2.7
50 (122)	2.2	0.79 - 0.90

*: These data are reference values and are measured between ECM terminals.

Heated Oxygen Sensor 2

INFOID:0000000014419364

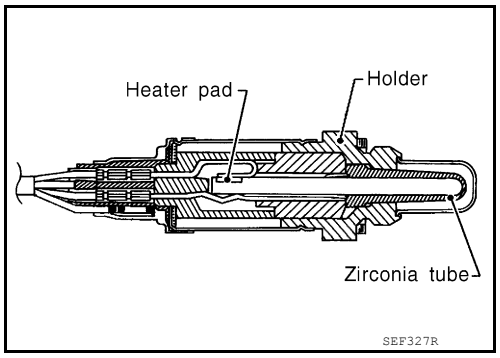
DESCRIPTION

The heated oxygen sensor 2, after three way catalyst (manifold), monitors the oxygen level in the exhaust gas on each bank.

Even if switching characteristics of the air fuel ratio (A/F) sensor 1 are shifted, the air fuel ratio is controlled to stoichiometric, by the signal from the heated oxygen sensor 2.

This sensor is made of ceramic zirconia. The zirconia generates voltage from approximately 1 V in richer conditions to 0 V in leaner conditions.

Under normal conditions the heated oxygen sensor 2 is not used for engine control operation.



HEATED OXYGEN SENSOR 2 HEATER

Heated oxygen sensor 2 heater is integrated in the sensor.

The ECM performs ON/OFF control of the heated oxygen sensor 2 heater corresponding to the engine speed, amount of intake air and engine coolant temperature.

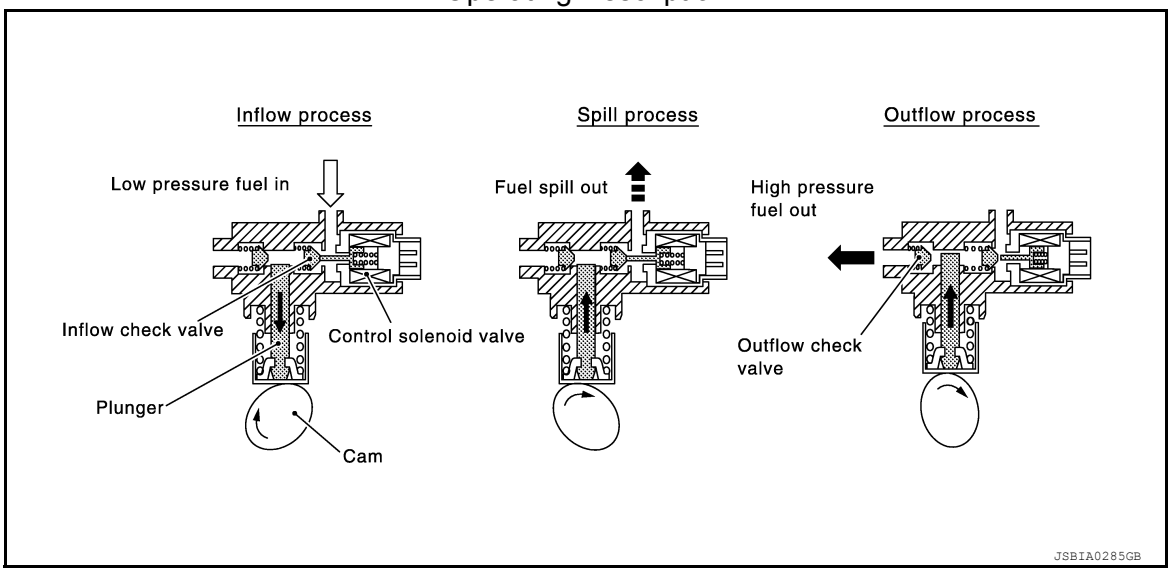
Engine speed	Heated oxygen sensor 2 heater
Above 3,600 rpm	OFF
Below 3,600 rpm after the following conditions are met. • Engine: After warming up • Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load	ON

High Pressure Fuel Pump

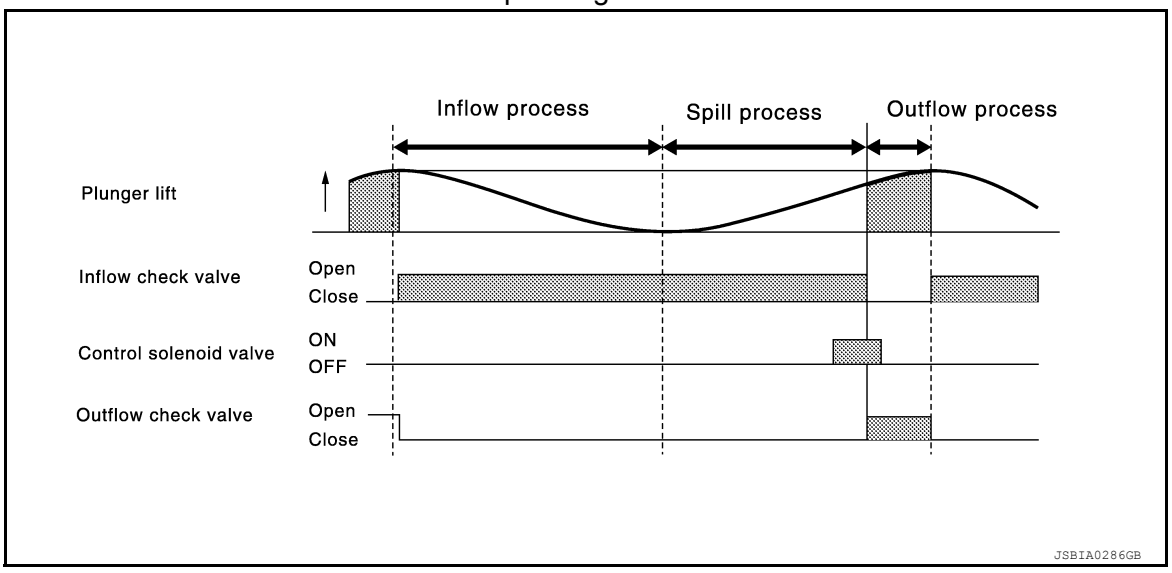
INFOID:0000000014419365

The high pressure fuel pump is installed at the front of the engine bank 2 side and activated by the camshaft. ECM controls the high pressure fuel pump control solenoid valve built into the high pressure fuel pump and adjusts the amount of discharge by changing the suction timing of the low pressure fuel.

Operating Description



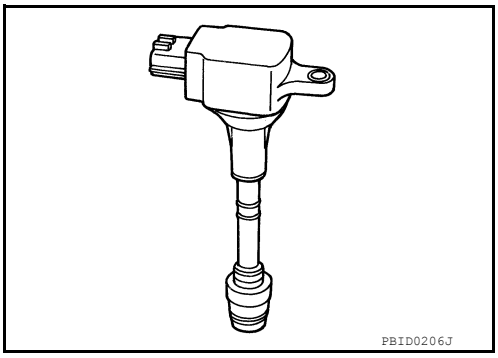
Operating Chart



Ignition Coil With Power Transistor

INFOID:0000000014419366

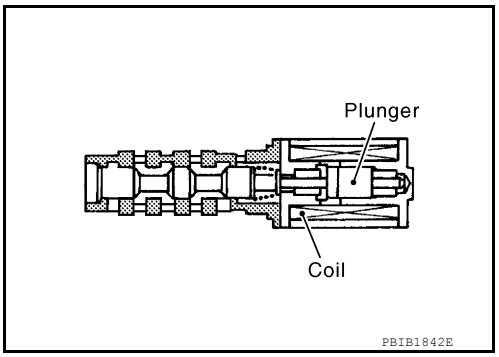
The ignition signal from the ECM is sent to and amplified by the power transistor. The power transistor turns ON and OFF the ignition coil primary circuit. This ON/OFF operation induces the proper high voltage in the coil secondary circuit.



Intake Valve Timing Control Solenoid Valve

INFOID:0000000014419367

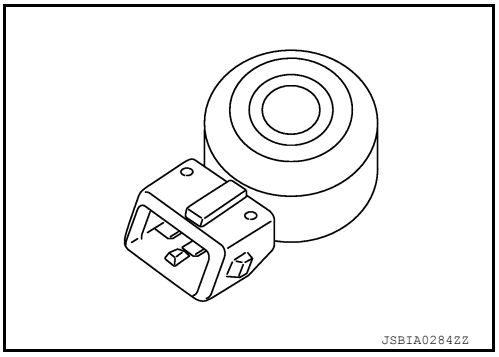
Intake valve timing control solenoid valve is activated by ON/OFF pulse duty (ratio) signals from the ECM.
The intake valve timing control solenoid valve changes the oil amount and direction of flow through intake valve timing control unit or stops oil flow.
The longer pulse width advances valve angle.
The shorter pulse width retards valve angle.
When ON and OFF pulse widths become equal, the solenoid valve stops oil pressure flow to fix the intake valve angle at the control position.



Knock Sensor

INFOID:0000000014419368

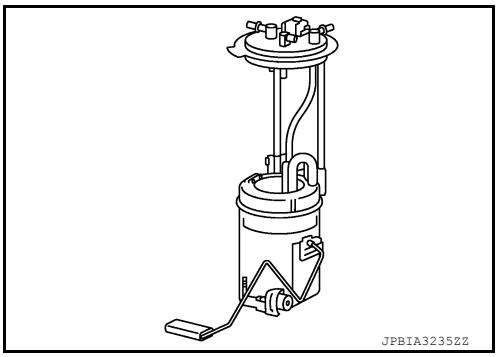
The knock sensor is attached to the cylinder block. It senses engine knocking using a piezoelectric element. A knocking vibration from the cylinder block is sensed as vibrational pressure. This pressure is converted into a voltage signal and sent to the ECM.



Low Pressure Fuel Pump

INFOID:0000000014419369

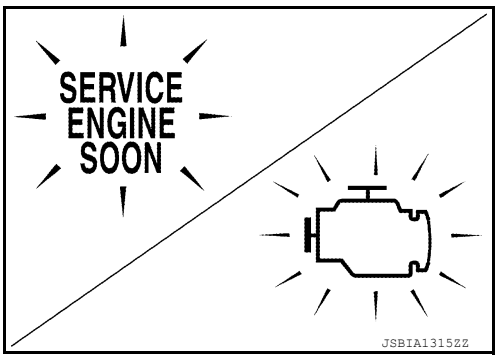
The low pressure fuel pump is integrated with a fuel pressure regulator and a fuel filter. This pump is build into the fuel tank.
ECM controls the low pressure fuel pump via FPCM.



Malfunction Indicator Lamp (MIL)

INFOID:0000000014419370

The Malfunction Indicator Lamp (MIL) is located on the combination meter.
The MIL will illuminate when the ignition switch is turned ON without the engine running. This is a bulb check.
When the engine is started, the MIL should turn off. If the MIL remains illuminated, the on board diagnostic system has detected an engine system malfunction.
For details, refer to EC-83, "Diagnosis Description".

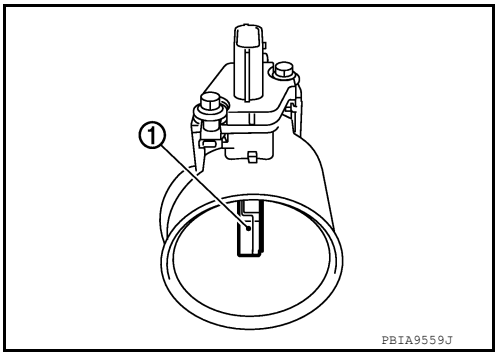


Mass Air Flow Sensor (With Intake Air Temperature Sensor)

INFOID:0000000014419371

MASS AIR FLOW SENSOR

The mass air flow (MAF) sensor (1) is placed in the stream of intake air. It measures the intake flow rate by measuring a part of the entire intake flow. The mass air flow sensor controls the temperature of the hot wire to a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The greater air flow, the greater the heat loss.
Therefore, the electric current supplied to hot wire is changed to maintain the temperature of the hot wire as air flow increases. The ECM detects the air flow by means of this current change.



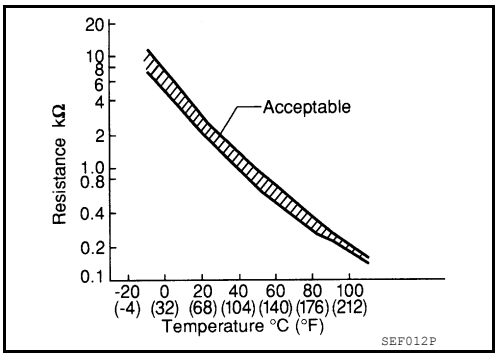
INTAKE AIR TEMPERATURE SENSOR

The intake air temperature (IAT) sensor is built-into the mass air flow sensor. The sensor detects intake air temperature and transmits a signal to the ECM.
The temperature sensing unit uses a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the rise in temperature.

<Reference data>

Intake air temperature [°C (°F)]	Voltage* (V)	Resistance (kΩ)
25 (77)	3.3	1.94 - 2.06
80 (176)	1.2	0.293 - 0.349

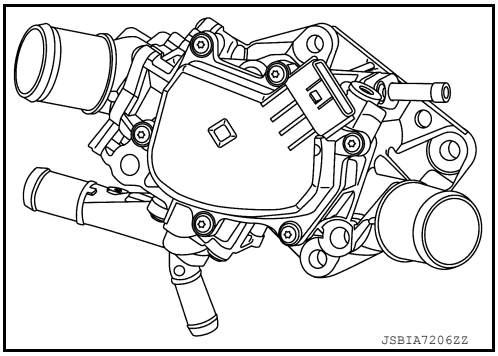
*: These data are reference values and are measured between ECM terminals.



Multi-way Control Valve

INFOID:0000000014419372

The multi-way control valve changes flow paths to Heater, Oil cooler, and Radiator, according to coolant temperature and driving conditions.



Power Steering Pressure (PSP) Sensor

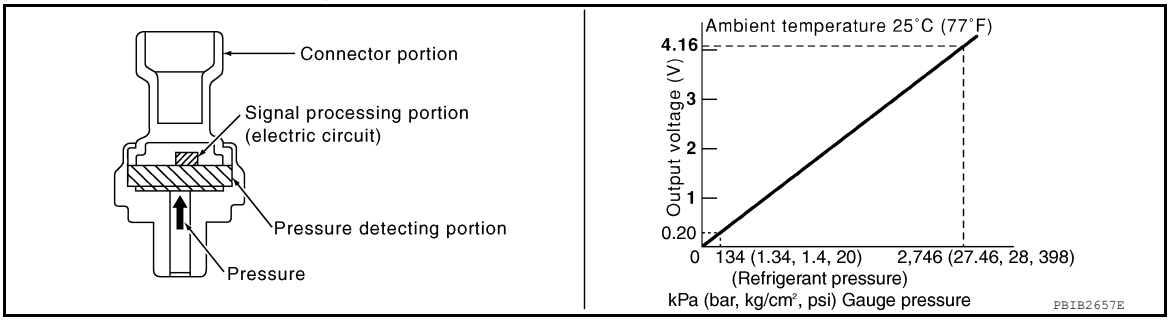
INFOID:0000000014419373

Power steering pressure (PSP) sensor is installed to the power steering high-pressure tube and detects a power steering load.
This sensor is a potentiometer which transforms the power steering load into output voltage, and emits the voltage signal to the ECM. The ECM controls the electric throttle control actuator and adjusts the throttle valve opening angle to increase the engine speed and adjusts the idle speed for the increased load.

Refrigerant Pressure Sensor

INFOID:0000000014419374

The refrigerant pressure sensor is installed at the condenser of the air conditioner system. The sensor uses an electrostatic volume pressure transducer to convert refrigerant pressure to voltage. The voltage signal is sent to ECM, and ECM controls cooling fan system.



VVEL Actuator Motor

INFOID:0000000014419375

The VVEL actuator motor rotates the control shaft according to the control signal from the VVEL control module. The VVEL control module judges whether the VVEL actuator motor controls the angle properly by the VVEL control shaft position sensor signal.

VVEL Actuator Motor Relay

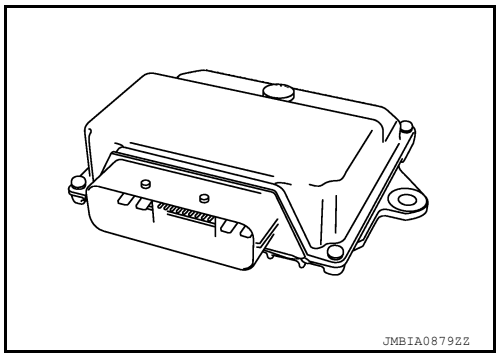
INFOID:0000000014419376

Power supply for the VVEL actuator motor is provided to the VVEL control module via VVEL actuator motor relay. VVEL actuator motor relay is ON/OFF controlled by the VVEL control module. In addition, when the VVEL actuator motor relay cannot be controlled by the VVEL control module for some reason, it ON/OFF controlled by ECM.

VVEL Control Module

INFOID:0000000014419377

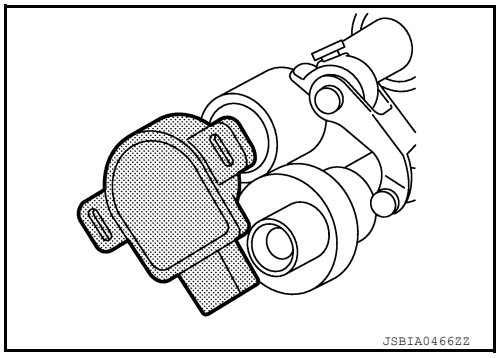
The VVEL control module consists of a microcomputer and connectors for signal input and output and for power supply. The VVEL control module controls VVEL system.



VVEL Control Shaft Position Sensor

INFOID:0000000014419378

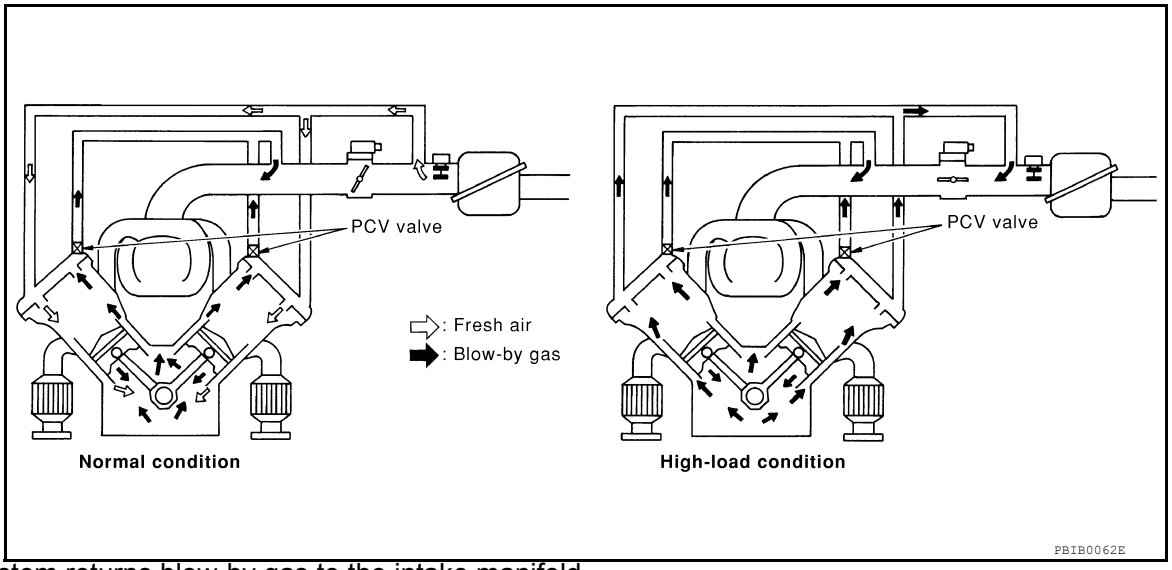
VVEL control shaft position sensor detects the control shaft position angle.
A magnet is installed to the tip of the control shaft.
The magnetic field changes as the control shaft rotates. This changes output voltage of the VVEL control shaft position sensor.
VVEL control module detects the actual position angle through the voltage change and sends the signal to ECM.



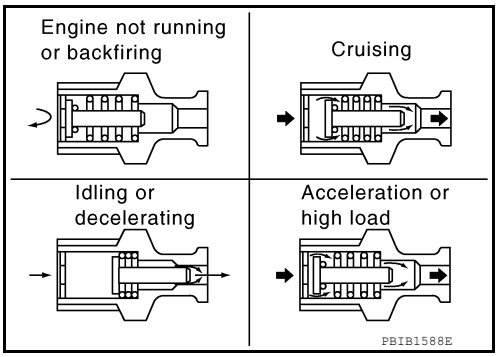
STRUCTURE AND OPERATION

Positive Crankcase Ventilation

INFOID:0000000014419379

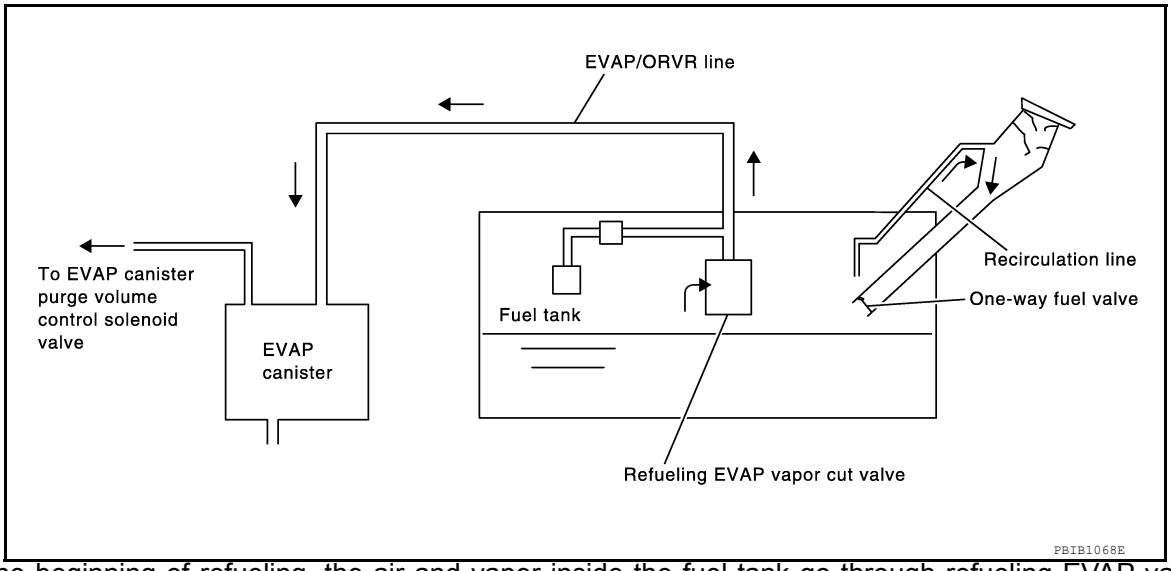


This system returns blow-by gas to the intake manifold.
The positive crankcase ventilation (PCV) valve is provided to conduct crankcase blow-by gas to the intake manifold.
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the PCV valve.
Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.
The ventilating air is drawn from the air inlet tubes into the crankcase. In this process the air passes through the hose connecting air inlet tubes to rocker cover.
Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve. The flow goes through the hose connection in the reverse direction.
On vehicles with an excessively high blow-by, the valve does not meet the requirement. This is because some of the flow will go through the hose connection to the air inlet tubes under all conditions.



On Board Refueling Vapor Recovery (ORVR)

INFOID:0000000014419380



From the beginning of refueling, the air and vapor inside the fuel tank go through refueling EVAP vapor cut valve and EVAP/ORVR line to the EVAP canister. The vapor is absorbed by the EVAP canister and the air is released to the atmosphere.

When the refueling has reached the full level of the fuel tank, the refueling EVAP vapor cut valve is closed and refueling is stopped because of auto shut-off. The vapor which was absorbed by the EVAP canister is purged during driving.

WARNING:

When conducting inspections below, be sure to observe the following:

- **Put a "CAUTION: FLAMMABLE" sign in workshop.**
- **Never smoke while servicing fuel system. Keep open flames and sparks away from work area.**
- **Always furnish the workshop with a CO_2 fire extinguisher.**

CAUTION:

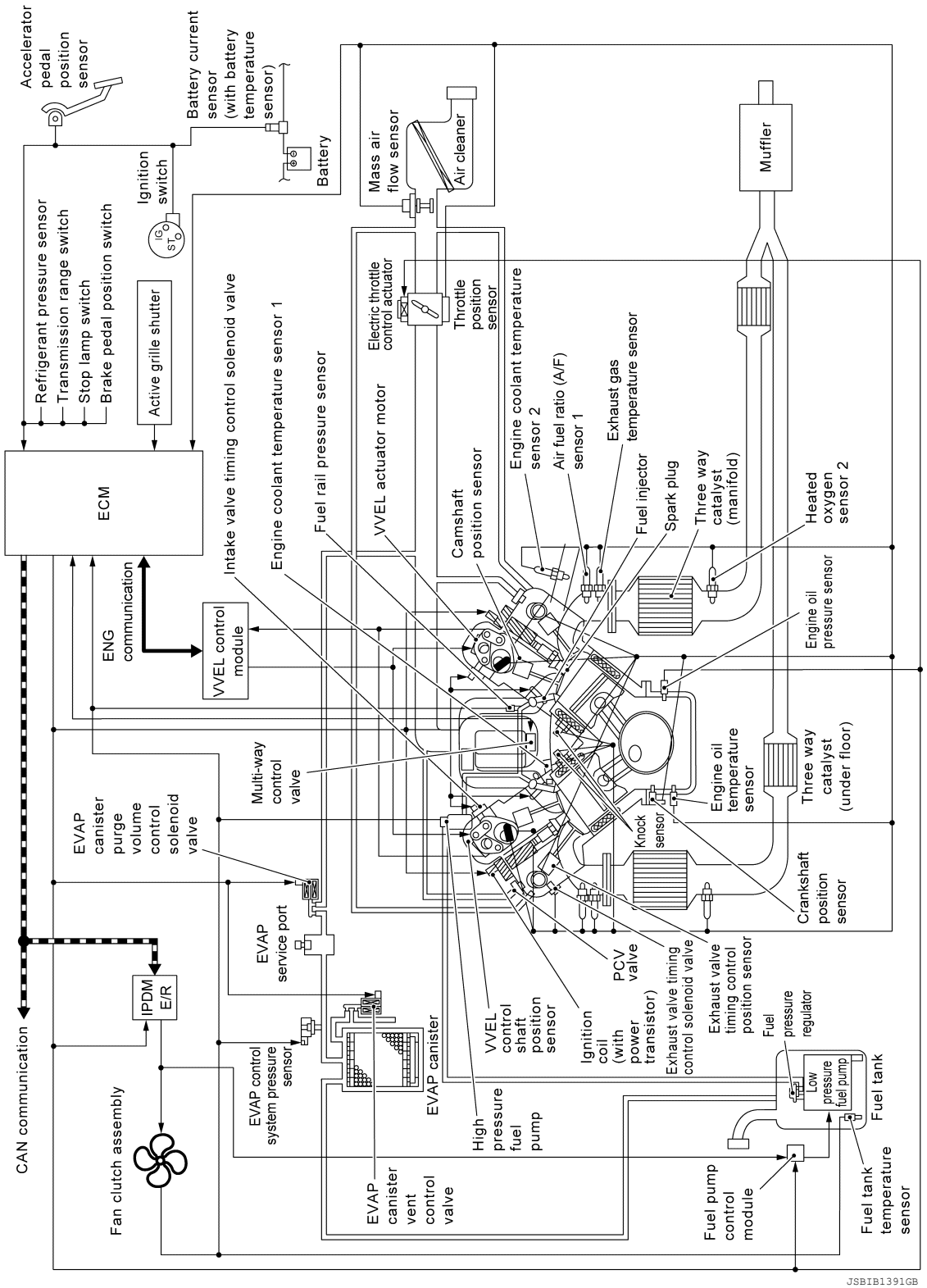
- **Before removing fuel line parts, carry out the following procedures:**
  - **Put drained fuel in an explosion-proof container and put lid on securely.**
  - **Release fuel pressure from fuel line. Refer to EC-205, "Work Procedure".**
  - **Disconnect battery ground cable.**
- **Always replace O-ring when the fuel gauge retainer is removed.**
- **Never kink or twist hose and tube when they are installed.**
- **Never tighten hose and clamps excessively to avoid damaging hoses.**
- **After installation, run engine and check for fuel leaks at connections.**
- **Never attempt to top off the fuel tank after the fuel pump nozzle shuts off automatically. Continued refueling may cause fuel overflow, resulting in fuel spray and possibly a fire.**

SYSTEM

ENGINE CONTROL SYSTEM

ENGINE CONTROL SYSTEM : System Diagram

INFOID:0000000014419381



ENGINE CONTROL SYSTEM : System Description

INFOID:0000000014419382

ECM controls the engine by various functions.

Function	Reference
Direct injection gasoline system	EC-61, "DIRECT INJECTION GASOLINE SYSTEM : System Description"
Fuel pressure control	EC-64, "FUEL PRESSURE CONTROL : System Description"
Cooling fan control	EC-65, "COOLING FAN CONTROL : System Description"
Electric ignition system	EC-66, "ELECTRIC IGNITION SYSTEM : System Description"
Intake valve timing control	EC-67, "INTAKE VALVE TIMING CONTROL : System Description"
Exhaust Valve Timing Control	EC-68, "EXHAUST VALVE TIMING CONTROL : System Description"
VVEL (Variable Valve Event & Lift) system	EC-69, "VVEL SYSTEM : System Description"
Evaporative emission system	EC-70, "EVAPORATIVE EMISSION SYSTEM : System Description"
Fuel filler cap warning system	EC-72, "FUEL FILLER CAP WARNING SYSTEM : System Description"
Air conditioning cut control	EC-73, "AIR CONDITIONING CUT CONTROL : System Description"
Thermal management control	EC-74, "THERMAL MANAGEMENT CONTROL : System Description"
Alternator power generation voltage control system	EC-75, "ALTERNATOR POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM : System Description"
Automatic speed control device (ASCD)	EC-76, "AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description"
CAN communication	EC-76, "CAN COMMUNICATION : System Description"
Active grille shutter system	EXT-12, "ACTIVE GRILLE SHUTTER SYSTEM : System Description"

ENGINE CONTROL SYSTEM : Fail-safe

INFOID:0000000014721331

DTC No.	Detected items	Engine operating condition in fail-safe mode
U0113 U1003 U1024	Can communication circuit	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
U0284	Active grille shutter	ECM operates active grille shutter to fully-open position.
U1040 U1044	LIN communication line	ECM operates active grille shutter to fully-open position.
P0011 P0012 P0016 P0018 P0021 P0022	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.
P0014 P0015 P0017 P0019 P0024 P0025	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.
P0087	FRP control system	• Engine torque is limited. • VVEL value is maintained at a fixed angle.
P0088		Engine speed is limited.
P0090	FRP control system	• Engine torque is limited. • VVEL value is maintained at a fixed angle.

<table>
<tr><th>DTC No.</th><th>Detected items</th><th colspan="2">Engine operating condition in fail-safe mode</th></tr>
<tr><td>P00B3
P00B4</td><td>Engine coolant temperature sensor 2</td><td colspan="2">High coolant temperature control does not function.</td></tr>
<tr><td>P0102
P0103</td><td>Mass air flow sensor circuit</td><td colspan="2">Engine speed will not rise more than 2,400 rpm due to the fuel cut.</td></tr>
<tr><td rowspan="6">P0117
P0118</td><td rowspan="6">Engine coolant temperature sensor 1 circuit</td><td colspan="2">Engine coolant temperature will be determined by ECM based on the following condition.
CONSULT displays the engine coolant temperature decided by ECM.</td></tr>
<tr><td>Condition</td><td>Engine coolant temperature decided
(CONSULT display)</td></tr>
<tr><td>Just as ignition switch is turned ON or START</td><td>40°C (104°F)</td></tr>
<tr><td>Approx. 4 minutes or more after engine starting</td><td>80°C (176°F)</td></tr>
<tr><td>Except as shown above</td><td>40 - 80°C (104 - 176°F)
(Depends on the time)</td></tr>
<tr><td colspan="2">When the fail-safe system for engine coolant temperature sensor 1 is activated, the cooling fan operates while engine is running.</td></tr>
<tr><td>P0122
P0123
P0222
P0223
P2135</td><td>Throttle position sensor</td><td colspan="2">The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees.
The ECM regulates the opening speed of the throttle valve to be slower than the normal condition.
Therefore, the acceleration will be poor.</td></tr>
<tr><td>P0190</td><td>FRP sensor</td><td colspan="2">• Engine speed is limited.
• High pressure fuel pump is activated at maximum discharge pressure.</td></tr>
<tr><td>P0196
P0197
P0198</td><td>Engine oil temperature sensor</td><td colspan="2">Exhaust valve timing control does not function.</td></tr>
<tr><td>P0201
P0202
P0203
P0204
P0205
P0206
P0207
P0208</td><td>Injector</td><td colspan="2">• Engine torque is limited.
• Fuel injection shut-off of malfunction cylinder.
• Mixture ratio feedback control does not function.
• Idle engine speed is increased.</td></tr>
<tr><td>P0500</td><td>Vehicle speed sensor</td><td colspan="2">The cooling fan operates (Highest) while engine is running.</td></tr>
<tr><td>P0524</td><td>Engine oil pressure</td><td colspan="2">• ECM illuminates oil pressure warning lamp on the combination meter.
• Engine speed will not rise more than 4,000 rpm due to the fuel cut.
• Fail-safe is canceled when ignition switch OFF → ON.</td></tr>
<tr><td>P059F</td><td>Active grille shutter</td><td colspan="2">• When a voltage and temperature related malfunction is detected, the active grille shutter stops at the position of detection.
• Except for the above case, operates the active grille shutter to fully opened position.</td></tr>
<tr><td>P0603
P0607</td><td>ECM</td><td colspan="2">Engine torque may be limited.</td></tr>
<tr><td>P0604</td><td>ECM</td><td colspan="2">• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring.
• The position of the following components is fixed.
- Intake valve timing control solenoid valve
- Exhaust valve timing control solenoid valve
• ASCD operation may be deactivated.</td></tr>
<tr><td>P0605
P0606
P060B</td><td>ECM</td><td colspan="2">NOTE:
Fail-safe may not occur depending on malfunction type.
• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring.
• The position of the following components is fixed.
- Intake valve timing control solenoid valve
- Exhaust valve timing control solenoid valve
• ASCD operation may be deactivated.</td></tr>
</table>

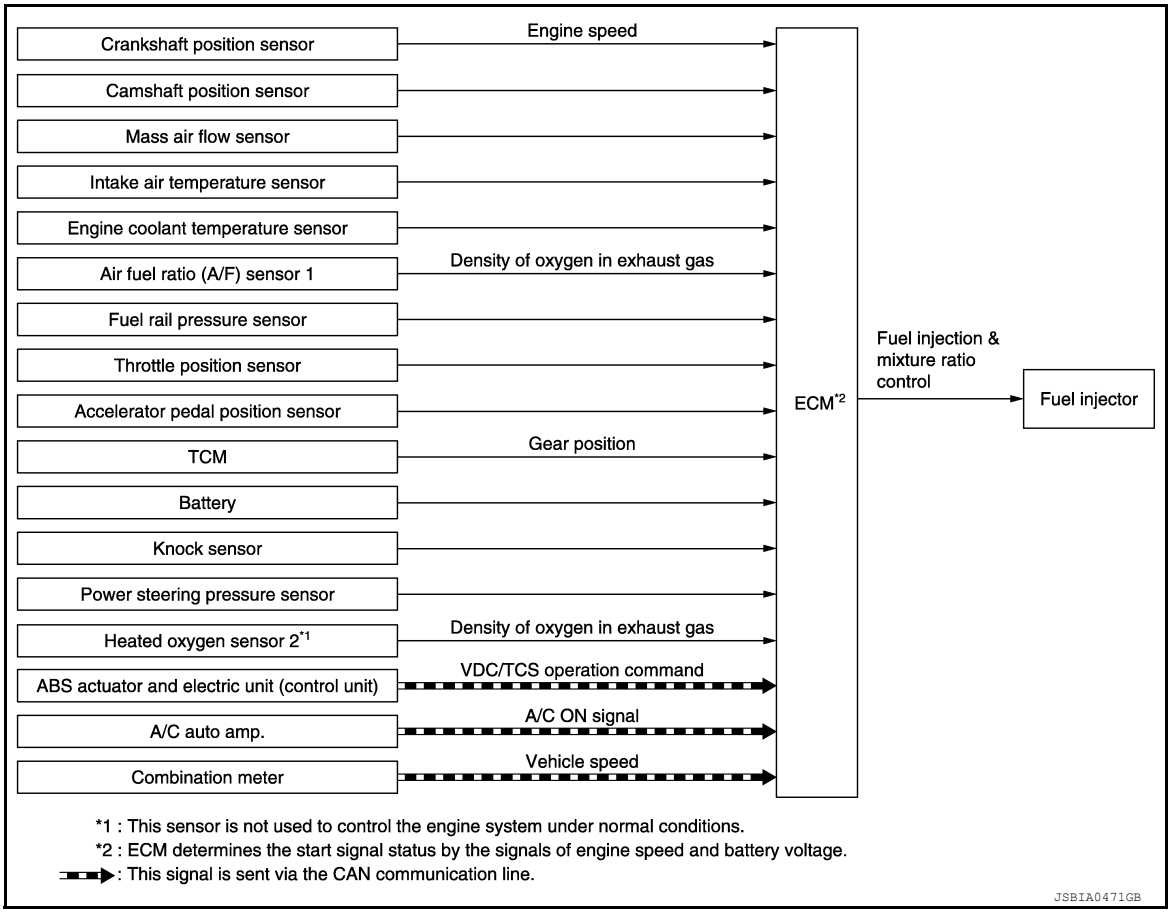
<table>
<tr><th>DTC No.</th><th>Detected items</th><th>Engine operating condition in fail-safe mode</th></tr>
<tr><td>P060A</td><td>ECM</td><td>NOTE:
Fail-safe may not occur depending on malfunction type.
• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring.
• The position of the following components is fixed.
- Intake valve timing control solenoid valve
- Exhaust valve timing control solenoid valve
• Engine torque may be limited.
• ASCD operation may be deactivated.</td></tr>
<tr><td rowspan="2">P062B</td><td rowspan="2">ECM</td><td>Type1
• Engine torque is limited.
• Idle engine speed is increased.
• Fuel injector power supply shut-off.
• High fuel pressure limitation.</td></tr>
<tr><td>Type2
• Engine torque is limited.
• Fuel injection shut-off of malfunction cylinder.
• Mixture ratio feedback control does not function.
• Idle engine speed is increased.</td></tr>
<tr><td>P0643</td><td>ECM</td><td>• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring.
• The position of the following components is fixed.
- Intake valve timing control solenoid valve
- Exhaust valve timing control solenoid valve</td></tr>
<tr><td>P1087
P1088</td><td>VVEL control function</td><td>VVEL of normal bank is controlled at VVEL angle of abnormal bank.
Engine speed will not rise more than 3,500 rpm due to the fuel cut.</td></tr>
<tr><td>P1089
P1092</td><td>VVEL control shaft position sensor</td><td>VVEL value is maintained at a fixed angle.
Engine speed will not rise more than 3,500 rpm due to the fuel cut</td></tr>
<tr><td rowspan="2">P1090
P1093</td><td rowspan="2">VVEL actuator motor</td><td>VVEL of normal bank is controlled at VVEL angle of abnormal bank.
Engine speed will not rise more than 3,500 rpm due to the fuel cut.</td></tr>
<tr><td>VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle.
Engine speed will not rise more than 3,500 rpm due to the fuel cut.</td></tr>
<tr><td>P1091</td><td>VVEL actuator motor relay</td><td>VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle.
Engine speed will not rise more than 3,500 rpm due to the fuel cut.</td></tr>
<tr><td>P1197</td><td>Out of gas</td><td>• Engine torque is limited.
• VVEL value is maintained at a fixed angle.</td></tr>
<tr><td>P1606</td><td>VVEL control module</td><td>VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle.
Engine speed will not rise more than 3,500 rpm due to the fuel cut.</td></tr>
<tr><td>P1608</td><td>VVEL control shaft position sensor</td><td>VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle.
Engine speed will not rise more than 3,500 rpm due to the fuel cut.</td></tr>
<tr><td rowspan="4">P1805</td><td rowspan="4">Brake switch</td><td>ECM controls the electric throttle control actuator by regulating the throttle opening to a small range.
Therefore, acceleration will be poor.</td></tr>
<tr><td>Vehicle condition / Driving condition</td></tr>
<tr><td>When engine is idling / Normal</td></tr>
<tr><td>When accelerating / Poor acceleration</td></tr>
<tr><td>P2100
P2103</td><td>Throttle control motor relay</td><td>ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.</td></tr>
<tr><td>P2101</td><td>Electric throttle control function</td><td>ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.</td></tr>
<tr><td>P2118</td><td>Throttle control motor</td><td>ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.</td></tr>
</table>

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2119	Electric throttle control actuator	(When electric throttle control actuator does not function properly due to the return spring malfunction:) ECM controls the electric throttle actuator by regulating the throttle opening around the idle position. The engine speed will not rise more than 2,000 rpm.
		(When throttle valve opening angle in fail-safe mode is not in specified range:) ECM controls the electric throttle control actuator because of regulating the throttle opening to 20 degrees or less.
		(When ECM detects the throttle valve is stuck open:) While the vehicle is being driven, it slows down gradually by fuel cut. After the vehicle stops, the engine stalls. The engine can restart in the N or P position, and engine speed will not exceed 1,000 rpm or more.
P2122 P2123 P2127 P2128 P2138	Accelerator pedal position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.
P26A3 P26A5 P26A6 P26A7	Multi-way control valve	• When detecting a malfunction with the valve closed, ECM fully opens the valve. • When detecting a malfunction with the valve opened, ECM maintains valve angle. • When detecting a malfunction in sensor, ECM fully opens the valve. • ECM limits the engine output depending on malfunctions.

DIRECT INJECTION GASOLINE SYSTEM

DIRECT INJECTION GASOLINE SYSTEM : System Diagram

INFOID:0000000014419383



NOTE:
Both “Engine coolant temperature sensor” and “Engine coolant temperature sensor 1” are used in this manual. These indicate the same part.

DIRECT INJECTION GASOLINE SYSTEM : System Description

INFOID:0000000014419384

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed*2	Fuel injection & mixture ratio control	Fuel injector
Camshaft position sensor	Camshaft position		
Mass air flow sensor	Amount of intake air		
Intake air temperature sensor	Intake air temperature		
Engine coolant temperature sensor 1	Engine coolant temperature		
Air fuel ratio (A/F) sensor 1	Density of oxygen in exhaust gas		
Fuel rail pressure sensor	Fuel rail pressure		
Throttle position sensor	Throttle position		
Accelerator pedal position sensor	Accelerator pedal position		
TCM	Gear position		
Battery	Battery voltage*2		
Knock sensor	Engine knocking condition		
Power steering pressure sensor	Power steering operation		
Heated oxygen sensor 2*1	Density of oxygen in exhaust gas		
ABS actuator and electric unit (control unit)	VDC/TCS operation command		
A/C auto amp.	A/C ON signal		
Combination meter	Vehicle speed		

*1: This sensor is not used to control the engine system under normal conditions.

*2: ECM determines the start signal status by the signals of engine speed and battery voltage.

SYSTEM DESCRIPTION

The adoption of the direct fuel injection method enables more accurate adjustment of fuel injection quantity by injecting atomized high-pressure fuel directly into the cylinder. This method allows high-powered engine, low fuel consumption, and emissions-reduction.

The amount of fuel injected from the fuel injector is determined by the ECM. The ECM controls the length of time the valve remains open (injection pulse duration). The amount of fuel injected is a program value in the ECM memory. The program value is preset by engine operating conditions. These conditions are determined by input signals (for engine speed and intake air and fuel rail pressure) from the crankshaft position sensor, camshaft position sensor, mass air flow sensor and the fuel rail pressure sensor.

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

In addition, the amount of fuel injected is compensated to improve engine performance under various operating conditions as listed below.

<Fuel increase>
- During warm-up
- When starting the engine
- During acceleration
- Hot-engine operation
- When selector lever position is changed from N to D
- High-load, high-speed operation

<Fuel decrease>
- During deceleration
- During high engine speed operation

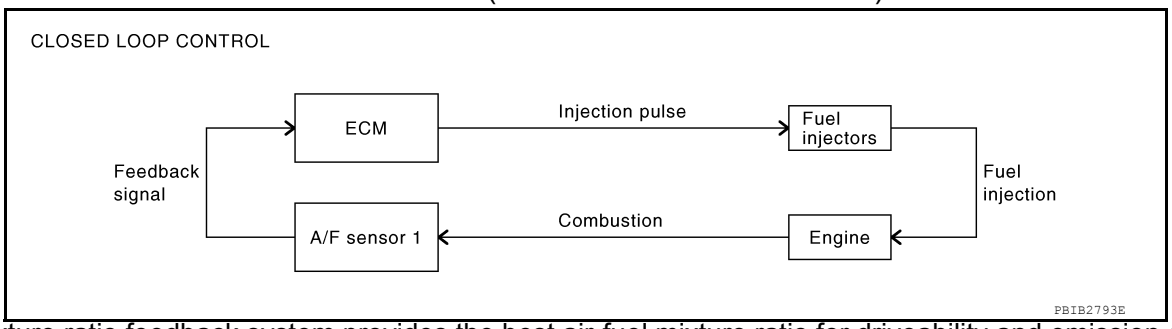
FUEL INJECTION CONTROL

Stratified-charge Combustion

Stratified-charge combustion is a combustion method which enables extremely lean combustion by injecting fuel in the latter half of a compression process, collecting combustible air-fuel around the spark plug, and forming fuel-free airspace around the mixture.
Right after a start with the engine cold, the catalyst warm-up is accelerated by stratified-charge combustion.

Homogeneous Combustion
Homogeneous combustion is a combustion method that fuel is injected during intake process so that combustion occurs in the entire combustion chamber, as is common with conventional methods.
As for a start except for starts with the engine cold, homogeneous combustion occurs.

MIXTURE RATIO FEEDBACK CONTROL (CLOSED LOOP CONTROL)

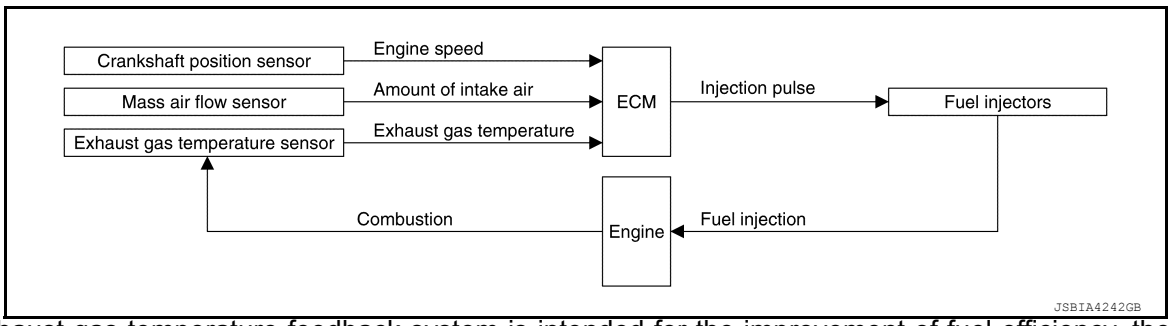


The mixture ratio feedback system provides the best air-fuel mixture ratio for driveability and emission control. The three way catalyst (manifold) can better reduce CO, HC and NOx emissions. This system uses A/F sensor 1 in the exhaust manifold to monitor whether the engine operation is rich or lean. The ECM adjusts the injection pulse width according to the sensor voltage signal. For more information about A/F sensor 1, refer to EC-40, "Air Fuel Ratio (A/F) Sensor 1". This maintains the mixture ratio within the range of stoichiometric (ideal air-fuel mixture).
This stage is referred to as the closed loop control condition.
Heated oxygen sensor 2 is located downstream of the three way catalyst (manifold). Even if the switching characteristics of A/F sensor 1 shift, the air-fuel ratio is controlled to stoichiometric by the signal from heated oxygen sensor 2.

- Open Loop Control
  The open loop system condition refers to when the ECM detects any of the following conditions. Feedback control stops in order to maintain stabilized fuel combustion.

- Deceleration and acceleration
- High-load, high-speed operation
- Malfunction of A/F sensor 1 or its circuit
- Insufficient activation of A/F sensor 1 at low engine coolant temperature
- High engine coolant temperature
- During warm-up
- After shifting from N to D
- When starting the engine

EXHAUST GAS TEMPERATURE FEEDBACK CONTROL



The exhaust gas temperature feedback system is intended for the improvement of fuel efficiency, the reduction in exhaust gas (CO and HC), and the protection of parts.This system monitors the upstream temperature of catalyst by using an exhaust gas temperature sensor and lowers the combustion temperature to prevent damage to the exhaust system related parts by increasing fuel injection when exhaust gas becomes hot.

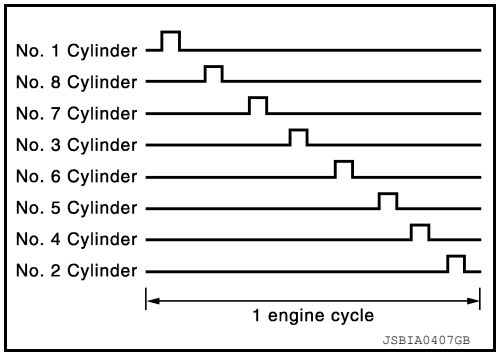
MIXTURE RATIO SELF-LEARNING CONTROL

The mixture ratio feedback control system monitors the mixture ratio signal transmitted from A/F sensor 1. This feedback signal is then sent to the ECM. The ECM controls the basic mixture ratio as close to the theoret-

ical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. Both manufacturing differences (i.e., mass air flow sensor hot wire) and characteristic changes during operation (i.e., fuel injector clogging) directly affect mixture ratio.
Accordingly, the difference between the basic and theoretical mixture ratios is monitored in this system. This is then computed in terms of “injection pulse duration” to automatically compensate for the difference between the two ratios.
“Fuel trim” refers to the feedback compensation value compared against the basic injection duration. Fuel trim includes “short-term fuel trim” and “long-term fuel trim”.
“Short term fuel trim” is the short-term fuel compensation used to maintain the mixture ratio at its theoretical value. The signal from A/F sensor 1 indicates whether the mixture ratio is RICH or LEAN compared to the theoretical value. The signal then triggers a reduction in fuel volume if the mixture ratio is rich, and an increase in fuel volume if it is lean.
“Long-term fuel trim” is overall fuel compensation carried out over time to compensate for continual deviation of the “short-term fuel trim” from the central value. Continual deviation will occur due to individual engine differences, wear over time and changes in the usage environment.

FUEL INJECTION TIMING

Sequential Direct Injection Gasoline System
Fuel is injected into each cylinder during each engine cycle according to the ignition order.



STRATIFIED-CHARGE START CONTROL

The use of the stratified-charge combustion method enables emissions-reduction when starting the engine with engine coolant temperature between 5°C (41°F) and 40°C (104°F).

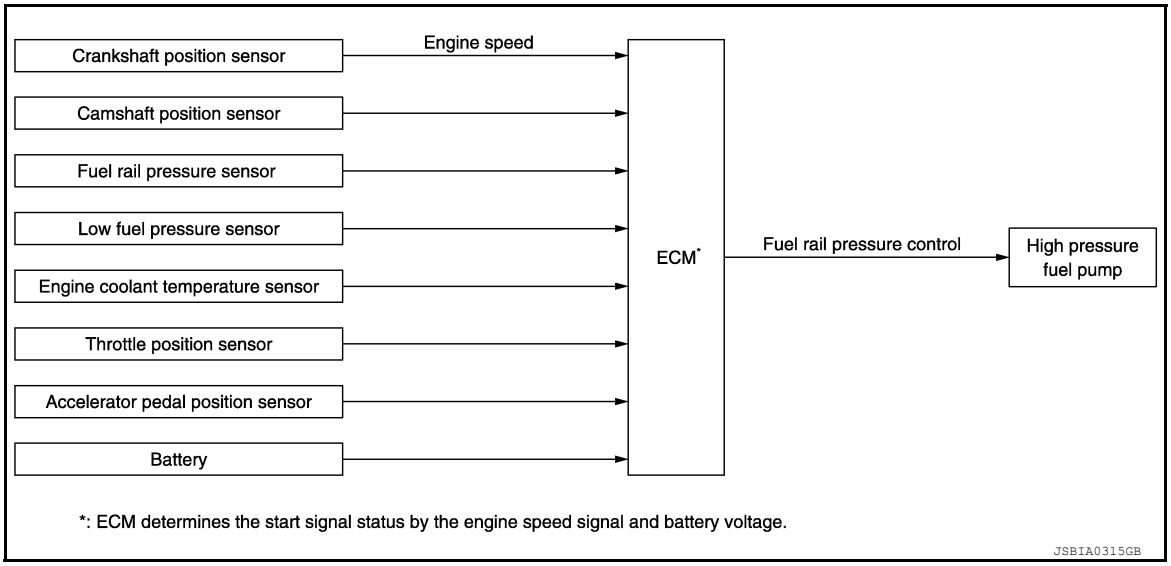
FUEL SHUT-OFF

Fuel to each cylinder is shut-off during deceleration, operation of the engine at excessively high speed or operation of the vehicle at excessively high speed.

FUEL PRESSURE CONTROL

FUEL PRESSURE CONTROL : System Diagram

INFOID:0000000014419385



NOTE:
- Low fuel pressure sensor is not used.

• Both “Engine coolant temperature sensor” and “Engine coolant temperature sensor 1” are used in this manual. These indicate the same part.

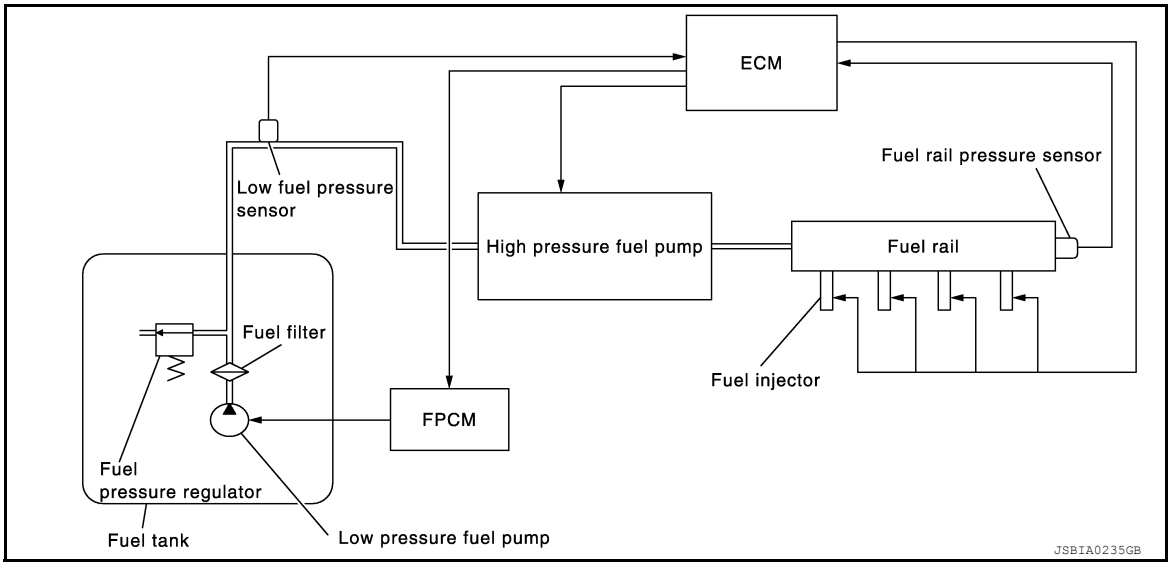
FUEL PRESSURE CONTROL : System Description

INFOID:0000000014419386

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed	Fuel injection & mixture ratio control	High pressure fuel pump
Camshaft position sensor	Camshaft position		
Fuel rail pressure sensor	Fuel rail pressure		
Engine coolant temperature sensor 1	Engine coolant temperature		
Throttle position sensor	Throttle position		
Accelerator pedal position sensor	Accelerator pedal position		
Battery	Battery voltage		

SYSTEM DESCRIPTION



NOTE:
Low fuel pressure sensor is not used.

Low fuel pressure control

• The low fuel pressure pump is controlled by the fuel pump control module (FPCM) and pumps fuel according to a driving condition. The pumped fuel passes through the fuel filter and is sent to the high pressure fuel pump. FPCM controls the low pressure fuel pump, according to a signal from ECM as shown in the table below.

Conditions	Amount of fuel flow	Supplied voltage
After a laps of 1 second after ignition ON	OFF	0 V
• For 1 second after turning ignition switch ON • Engine is running under low load and low speed conditions	Low	Approximately 8.5 V
• Engine cranking • Engine coolant temperature is below 10°C (50°F) • Engine is running under high load and high speed conditions	High	Battery voltage (11 – 14 V)
Except the above	Mid	Approximately 10 V

• Low fuel pressure is adjusted by the fuel pressure regulator.

High fuel pressure control

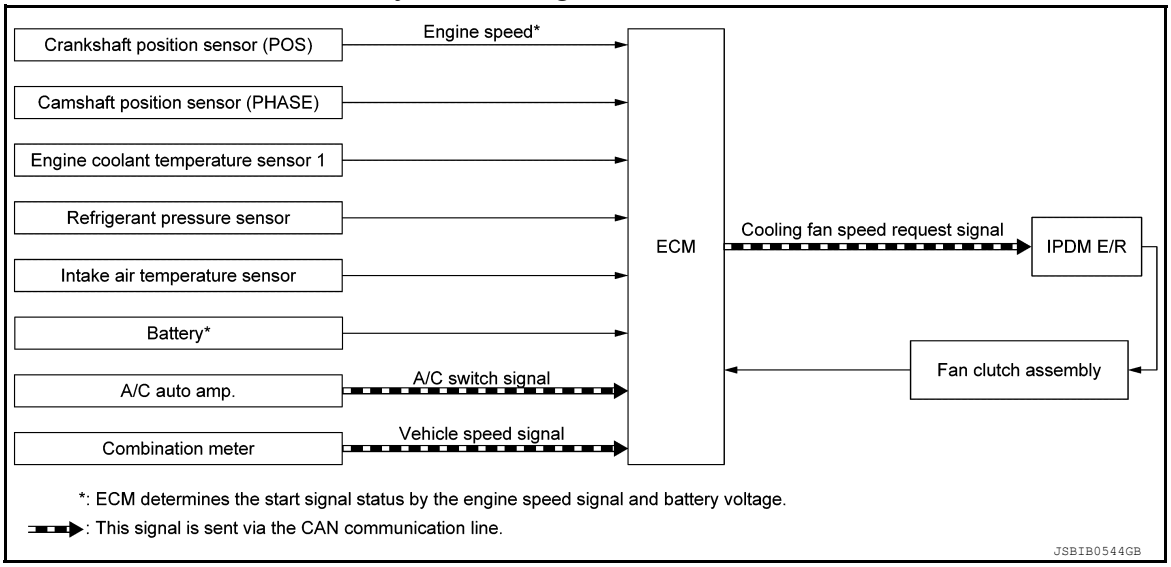
• The high pressure fuel pump raises the pressure of the fuel sent from the low pressure fuel pump. Actuated by the camshaft, the high pressure fuel pump activates the high pressure fuel pump solenoid based on a sig-

nal received from ECM, and adjusts the amount of discharge by changing the timing of closing the inlet check valve to control fuel rail pressure.

COOLING FAN CONTROL

COOLING FAN CONTROL : System Diagram

INFOID:0000000014419387



COOLING FAN CONTROL : System Description

INFOID:0000000014419388

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed*1	Cooling fan speed request signal*2	IPDM E/R ↓ Fan clutch assembly
Camshaft position sensor	Camshaft position		
Engine coolant temperature sensor 1	Engine coolant temperature		
Refrigerant pressure sensor	Refrigerant pressure		
Intake air temperature sensor	Intake air temperature		
Battery	Battery voltage		
Combination meter	Vehicle speed signal*2		
BCM	A/C switch signal*2		
Fan clutch assembly	Cooling fan speed		

*1: The ECM determines the engine speed by the signals of crankshaft position and camshaft position.

*2: This signal is sent to ECM via the CAN communication line.

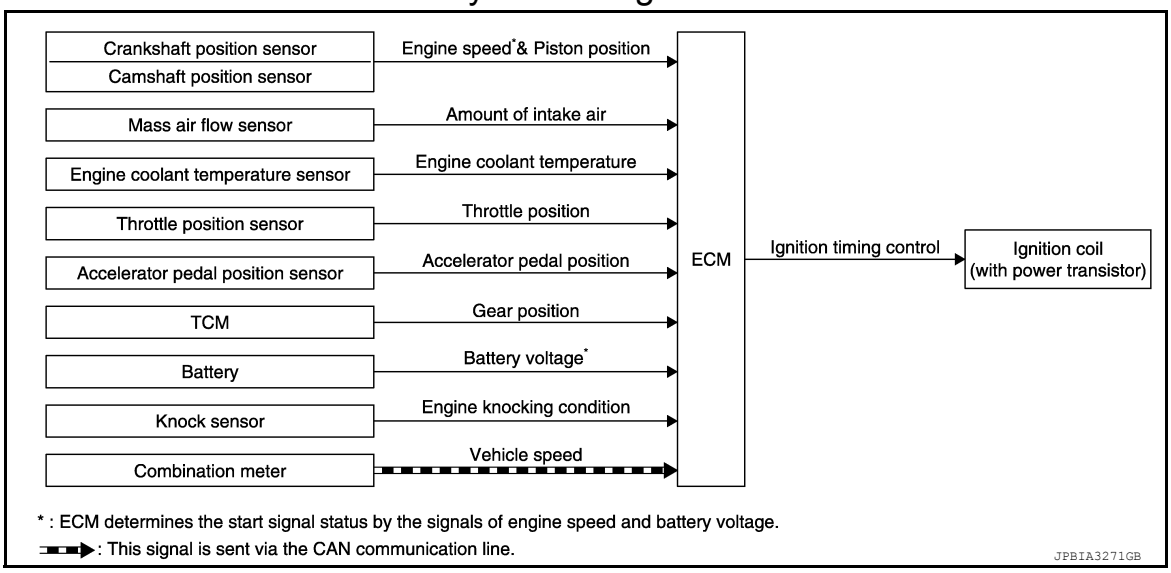
SYSTEM DESCRIPTION

- Based on a signal transmitted from each sensor, ECM calculates a target fan speed responsive to a driving condition. In addition, ECM calculates a fan pulley speed according to an engine speed and transmits a cooling fan request signal to IPDM E/R via the CAN communication line to satisfy the target fan speed. Then, IPDM E/R transmits ON/OFF pulse duty signal to fan clutch assembly.
  The cooling fan speed sensor detects a cooling fan speed and transmits the detection result to ECM.
- ECM judges the start signal state from the engine speed signal and battery voltage.

ELECTRIC IGNITION SYSTEM

ELECTRIC IGNITION SYSTEM : System Diagram

INFOID:0000000014419389



NOTE:
Both “Engine coolant temperature sensor” and “Engine coolant temperature sensor 1” are used in this manual. These indicate the same part.

ELECTRIC IGNITION SYSTEM : System Description

INFOID:0000000014419390

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed*1 Piston position	Ignition timing control	Ignition coil (with power transistor)
Camshaft position sensor			
Mass air flow sensor	Amount of intake air		
Engine coolant temperature sensor 1	Engine coolant temperature		
Throttle position sensor	Throttle position		
Accelerator pedal position sensor	Accelerator pedal position		
TCM	Gear position		
Battery	Battery voltage*1		
Knock sensor	Engine knocking condition		
Combination meter	Vehicle speed*2		

*1: ECM determines the start signal status by the signals of engine speed and battery voltage.

*2: This signal is sent to the ECM via the CAN communication line.

SYSTEM DESCRIPTION

Ignition order: 1 - 8 - 7 - 3 - 6 - 5 - 4 - 2
The ignition timing is controlled by the ECM to maintain the best air-fuel ratio for every running condition of the engine. The ignition timing data is stored in the ECM.
The ECM receives information such as the injection pulse width and camshaft position sensor signal. Computing this information, ignition signals are transmitted to the power transistor.
During the following conditions, the ignition timing is revised by the ECM according to the other data stored in the ECM.
- At starting
- During warm-up
- At idle
- At low battery voltage
- During acceleration

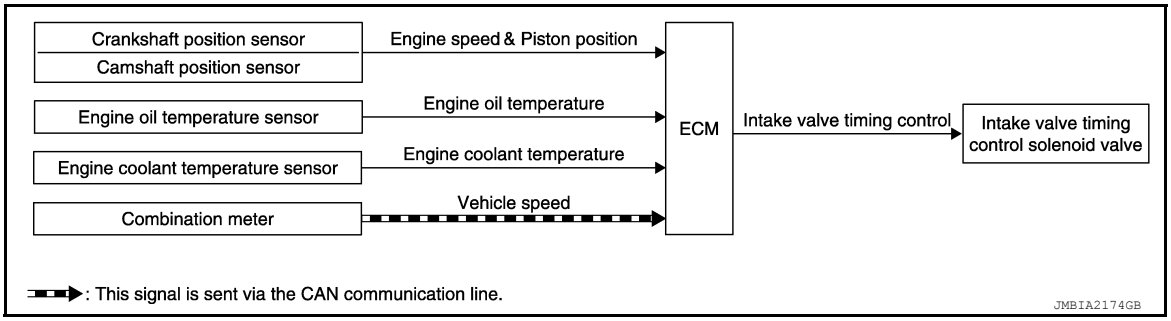
The knock sensor retard system is designed only for emergencies. The basic ignition timing is programmed within the anti-knocking zone, if recommended fuel is used under dry conditions. The retard system does not

operate under normal driving conditions. If engine knocking occurs, the knock sensor monitors the condition. The signal is transmitted to the ECM. The ECM retards the ignition timing to eliminate the knocking condition.

INTAKE VALVE TIMING CONTROL

INTAKE VALVE TIMING CONTROL : System Diagram

INFOID:0000000014419391



NOTE:
Both “Engine coolant temperature sensor” and “Engine coolant temperature sensor 1” are used in this manual. These indicate the same part.

INTAKE VALVE TIMING CONTROL : System Description

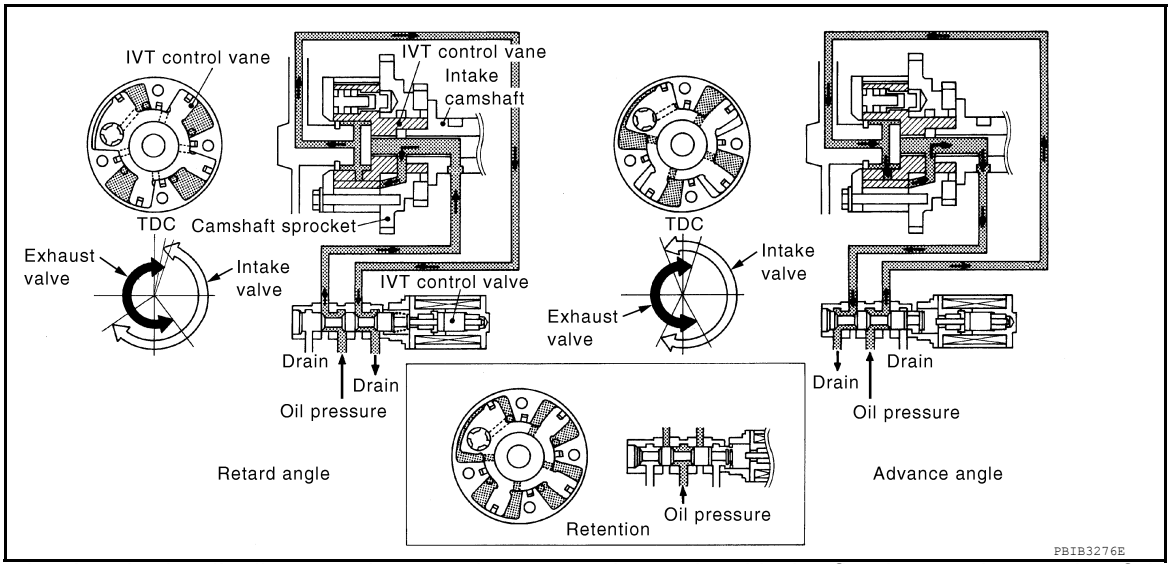
INFOID:0000000014419392

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed and piston position	Intake valve timing control	Intake valve timing control solenoid valve
Camshaft position sensor			
Engine oil temperature sensor	Engine oil temperature		
Engine coolant temperature sensor 1	Engine coolant temperature		
Combination meter	Vehicle speed*		

*: This signal is sent to the ECM via the CAN communication line.

SYSTEM DESCRIPTION

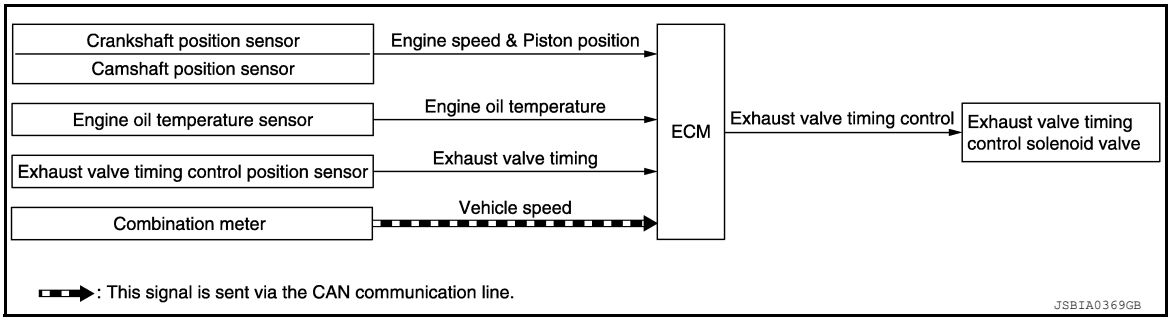


This mechanism hydraulically controls cam phases continuously with the fixed operating angle of the intake valve.
The ECM receives signals such as crankshaft position, camshaft position, engine speed, and engine coolant temperature. Then, the ECM sends ON/OFF pulse duty signals to the intake valve timing control solenoid valve depending on driving status. This makes it possible to control the shut/open timing of the intake valve to increase engine torque in low/mid speed range and output in high speed range.

EXHAUST VALVE TIMING CONTROL

EXHAUST VALVE TIMING CONTROL : System Diagram

INFOID:0000000014419393



EXHAUST VALVE TIMING CONTROL : System Description

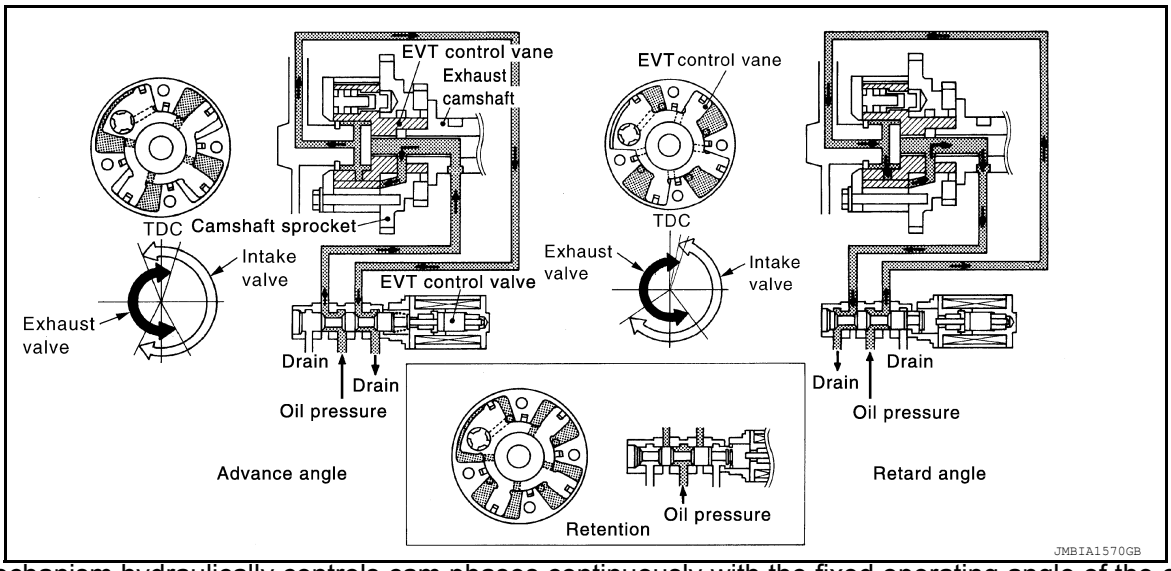
INFOID:0000000014419394

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed and piston position	Exhaust valve timing control	Exhaust valve timing control solenoid valve
Camshaft position sensor			
Engine oil temperature sensor	Engine oil temperature		
Exhaust valve timing control position sensor	Exhaust valve timing signal		
Combination meter	Vehicle speed*		

*: This signal is sent to the ECM via the CAN Communication line

SYSTEM DESCRIPTION



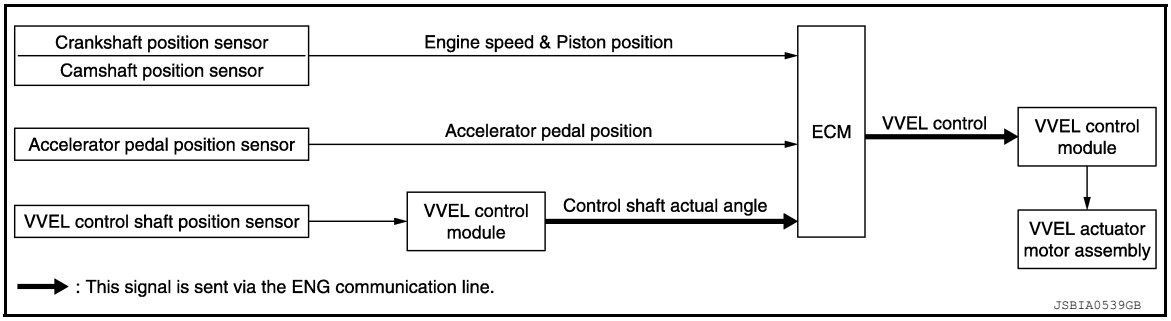
This mechanism hydraulically controls cam phases continuously with the fixed operating angle of the exhaust valve.

The ECM receives signals such as crankshaft position, camshaft position, engine speed, and engine oil temperature. Then, the ECM sends ON/OFF pulse duty signals to the exhaust valve timing control solenoid valve depending on driving status. This makes it possible to control the shut/open timing of the exhaust valve to increase engine torque and output in a range of high engine speed.

VVEL SYSTEM

VVEL SYSTEM : System Diagram

INFOID:0000000014419395



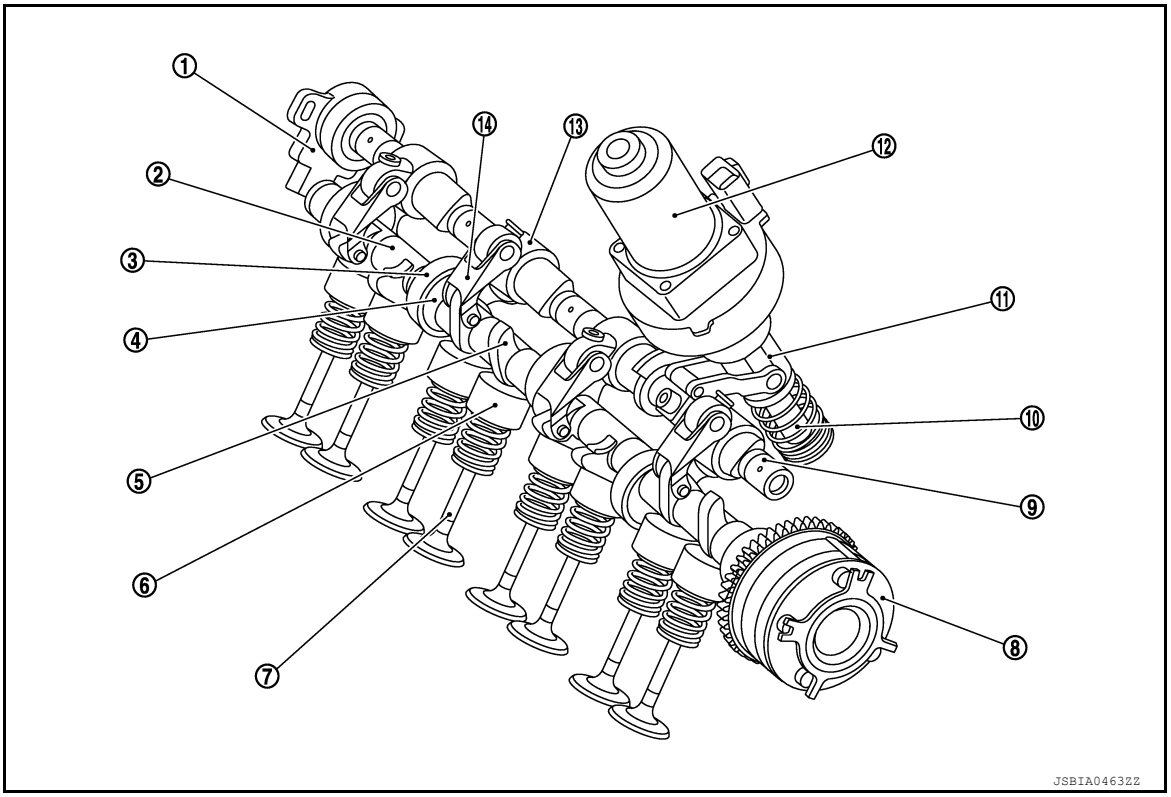
VVEL SYSTEM : System Description

INFOID:0000000014419396

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Camshaft position sensor Crankshaft position sensor	Engine speed and piston position	VVEL control	VVEL control module ↓ VVEL actuator motor assembly
Accelerator pedal position sensor	Accelerator pedal position		
VVEL control shaft position sensor ↓ VVEL control module	Control shaft actual angle		

SYSTEM DESCRIPTION

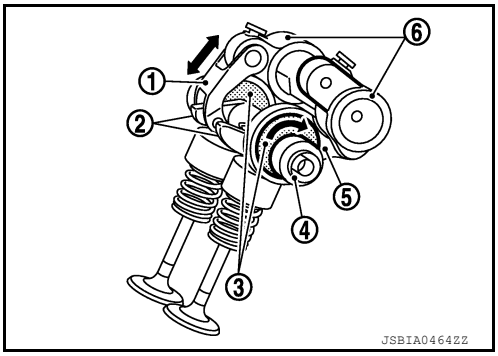


1. VVEL control shaft position sensor
2. Drive shaft
3. Link A
4. Eccentric cam
5. Output cam
6. Valve lifter
7. Intake valve
8. Intake camshaft sprocket
9. Control shaft
10. Ball screw shaft
11. Ball screw nut
12. VVEL actuator motor assembly
13. Rocker arm
14. Link B

VVEL (Variable Valve Event & Lift) is a system that controls valve event and valve lift continuously.
ECM decides the target valve lift according to the driving condition and sends the command signal to the VVEL control module via ENG communication line.

VALVE LIFT OPERATION

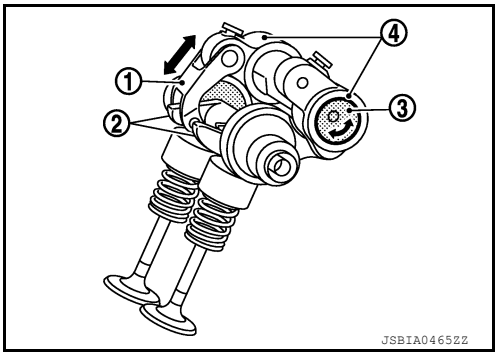
Rotational movement of the drive shaft equipped with eccentric cam is transmitted to output cam via the rocker arm and two kinds of links to depress the intake valve.



1. Link B
2. Output cam
3. Eccentric cam
4. Drive shaft
5. Link A
6. Rocker arm

VARIABLE OPERATION

VVEL control module controls the rotation of the control shaft using the VVEL actuator motor assembly and changes the movement of the output cam by shifting the link supporting point. As a result, valve lift changes continuously to improve engine output and response.

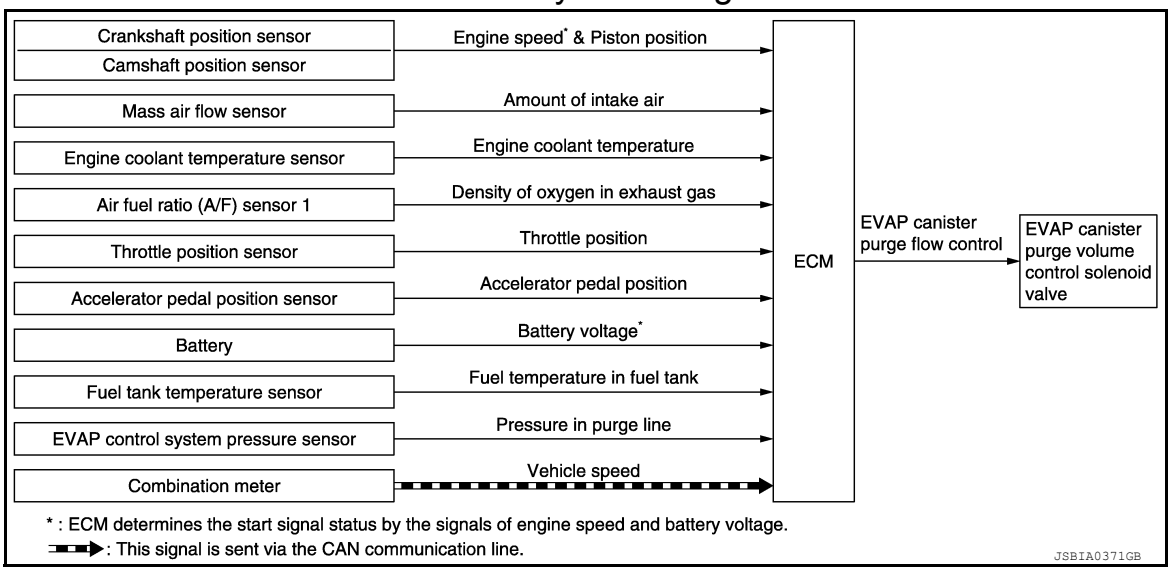


1. Link B
2. Output cam
3. Control shaft
4. Rocker arm

EVAPORATIVE EMISSION SYSTEM

EVAPORATIVE EMISSION SYSTEM : System Diagram

INFOID:0000000014419397



NOTE:
Both “Engine coolant temperature sensor” and “Engine coolant temperature sensor 1” are used in this manual. These indicate the same part.

EVAPORATIVE EMISSION SYSTEM : System Description

INFOID:0000000014419398

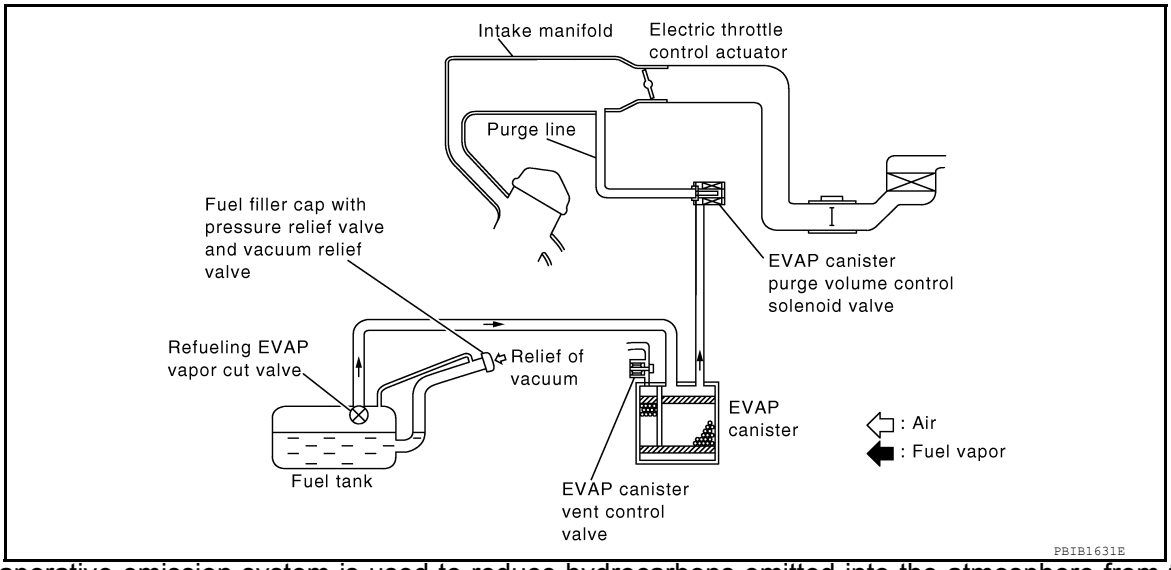
INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor Camshaft position sensor	• Engine speed*1 • Piston position	EVAP canister purge flow control	EVAP canister purge volume control solenoid valve
Mass air flow sensor	Amount of intake air		
Engine coolant temperature sensor 1	Engine coolant temperature		
Battery	Battery voltage*1		
Throttle position sensor	Throttle position		
Accelerator pedal position sensor	Accelerator pedal position		
Air fuel ratio (A/F) sensor 1	Density of oxygen in exhaust gas (Mixture ratio feedback signal)		
Fuel tank temperature sensor	Fuel temperature in fuel tank		
EVAP control system pressure sensor	Pressure in purge line		
Combination meter	Vehicle speed*2		

*1: ECM determines the start signal status by the signals of engine speed and battery voltage.

*2: This signal is sent to the ECM via the CAN communication line.

SYSTEM DESCRIPTION



The evaporative emission system is used to reduce hydrocarbons emitted into the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the EVAP canister.

The fuel vapor in the sealed fuel tank is led into the EVAP canister which contains activated carbon and the vapor is stored there when the engine is not operating or when refueling to the fuel tank.

The vapor in the EVAP canister is purged by the air through the purge line to the intake manifold when the engine is operating. EVAP canister purge volume control solenoid valve is controlled by ECM. When the engine operates, the flow rate of vapor controlled by EVAP canister purge volume control solenoid valve is proportionally regulated as the air flow increases.

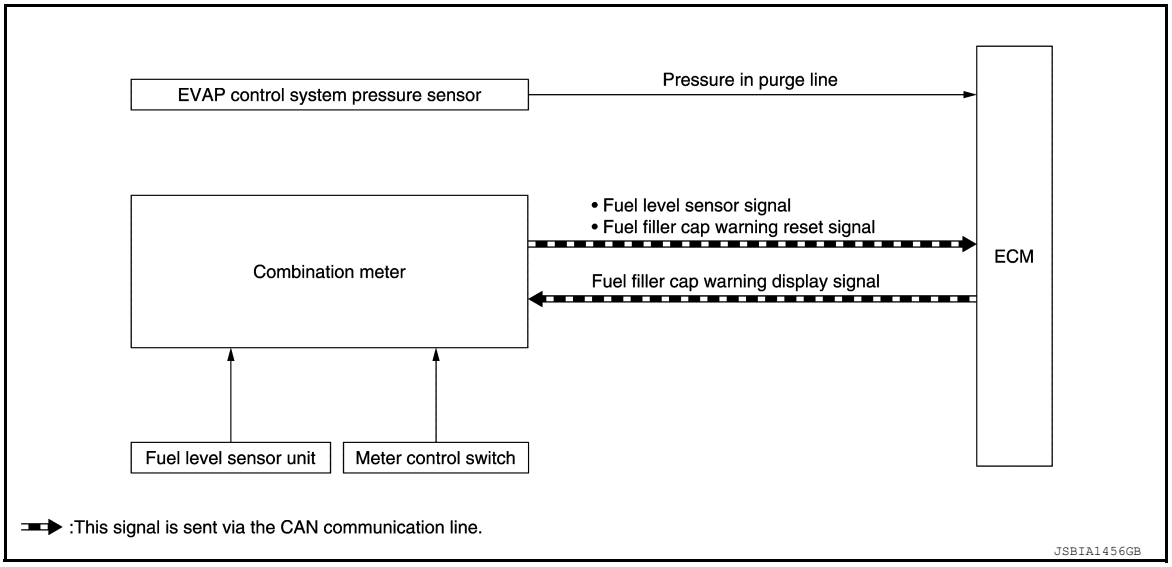
EVAP canister purge volume control solenoid valve also shuts off the vapor purge line during decelerating and idling.

FUEL FILLER CAP WARNING SYSTEM

FUEL FILLER CAP WARNING SYSTEM : System Description

INFOID:0000000014419399

SYSTEM DIAGRAM



NOTE:
Meter control switch means trip computer switch.

INPUT/OUTPUT SIGNAL CHART

Input

Unit/Sensor	Input signal to ECM	ECM function
EVAP control system pressure sensor	Pressure in purge line	Fuel filler cap warning control
Combination meter	Fuel level sensor signal*	
	Fuel filler cap warning reset signal*	

*: This signal is sent to the ECM via the CAN communication line.

Output

Unit	Output signal	Actuator
ECM	Fuel filler cap warning display signal*	Combination meter

*: This signal is sent to the combination meter via the CAN communication line.

SYSTEM DESCRIPTION

The fuel filler cap warning system alerts the driver to the prevention of the fuel filler being left uncapped and malfunction occurrences after refueling, by turning ON the fuel filler cap warning display on the combination meter.
ECM judges a refueled state, based on a fuel level signal transmitted from the combination meter.
When a very small leak is detected through the EVAP leak diagnosis performed after judging the refueled state, ECM transmits a fuel filler cap warning display signal (request for display ON) to the combination meter via CAN communication.
When receiving the signal, the combination meter turns ON the fuel filler cap warning display.

CAUTION:
Check fuel filler cap installation condition when the fuel filler cap warning display turns ON.

Reset Operation

The fuel filler cap warning lamp tunes OFF, according to any condition listed below:

- Reset operation is performed by operating the meter control switch (trip computer switch) on the combination meter.
  - When the reset operation is performed, the combination meter transmits a fuel filler cap warning reset signal to ECM via CAN communication. ECM transmits a fuel filler cap warning display signal (request for display OFF) to the combination meter via CAN communication. When receiving the signal, the combination meter turns OFF the fuel filler cap warning display.
- EVAP leak diagnosis result is normal.
- Fuel refilled.

• DTC erased by using CONSULT.

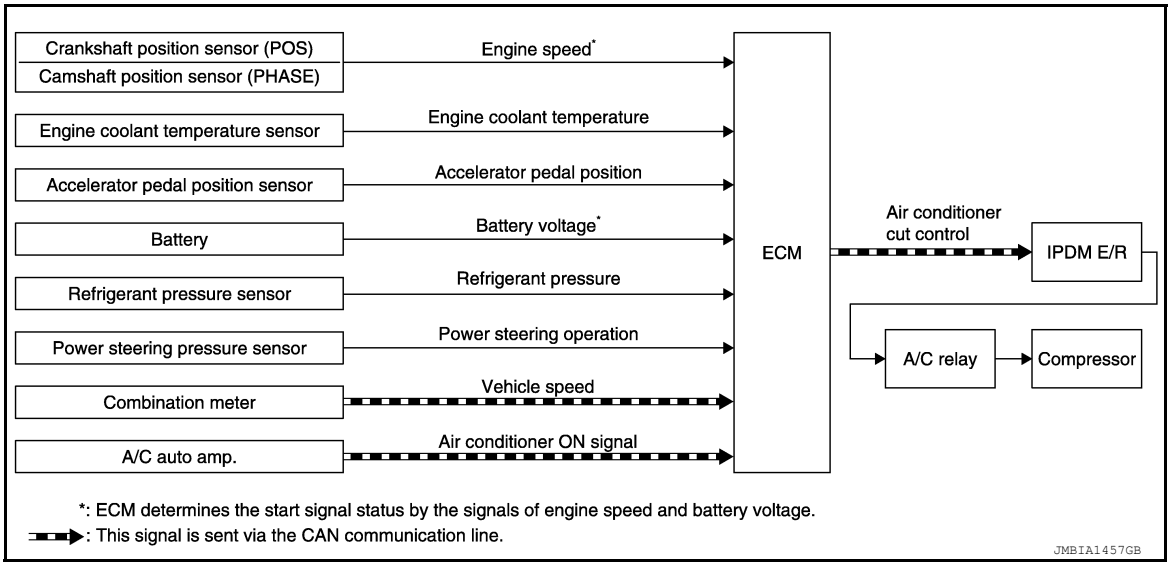
NOTE:

MIL turns ON if a malfunction is detected in leak diagnosis results again at the trip after the fuel filler cap warning display turns ON/OFF.

AIR CONDITIONING CUT CONTROL

AIR CONDITIONING CUT CONTROL : System Diagram

INFOID:0000000014419400



NOTE:

Both “Engine coolant temperature sensor” and “Engine coolant temperature sensor 1” are used in this manual. These indicate the same part.

AIR CONDITIONING CUT CONTROL : System Description

INFOID:0000000014419401

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor Camshaft position sensor	Engine speed*2	Air conditioner cut control	IPDM E/R ↓ A/C relay ↓ Compressor
Engine coolant temperature sensor 1	Engine coolant temperature		
Accelerator pedal position sensor	Accelerator pedal position		
Battery	Battery voltage*2		
Refrigerant pressure sensor	Refrigerant pressure		
Power steering pressure sensor	Power steering operation		
A/C auto amp.	A/C ON signal*1		
	A/C evaporator temperature*1		
	Target A/C evaporator temperature*1		
	Blower fan ON signal		
Combination meter	Vehicle speed*1		

*1: This signal is sent to the ECM via the CAN communication line.

*2: ECM determines the start signal status by the signals of engine speed and battery voltage.

SYSTEM DESCRIPTION

This system improves engine operation when the air conditioner is used.

Under the following conditions, the air conditioner is turned OFF.

• When the accelerator pedal is fully depressed.
• When cranking the engine.
• At high engine speeds.
• When the engine coolant temperature becomes excessively high.

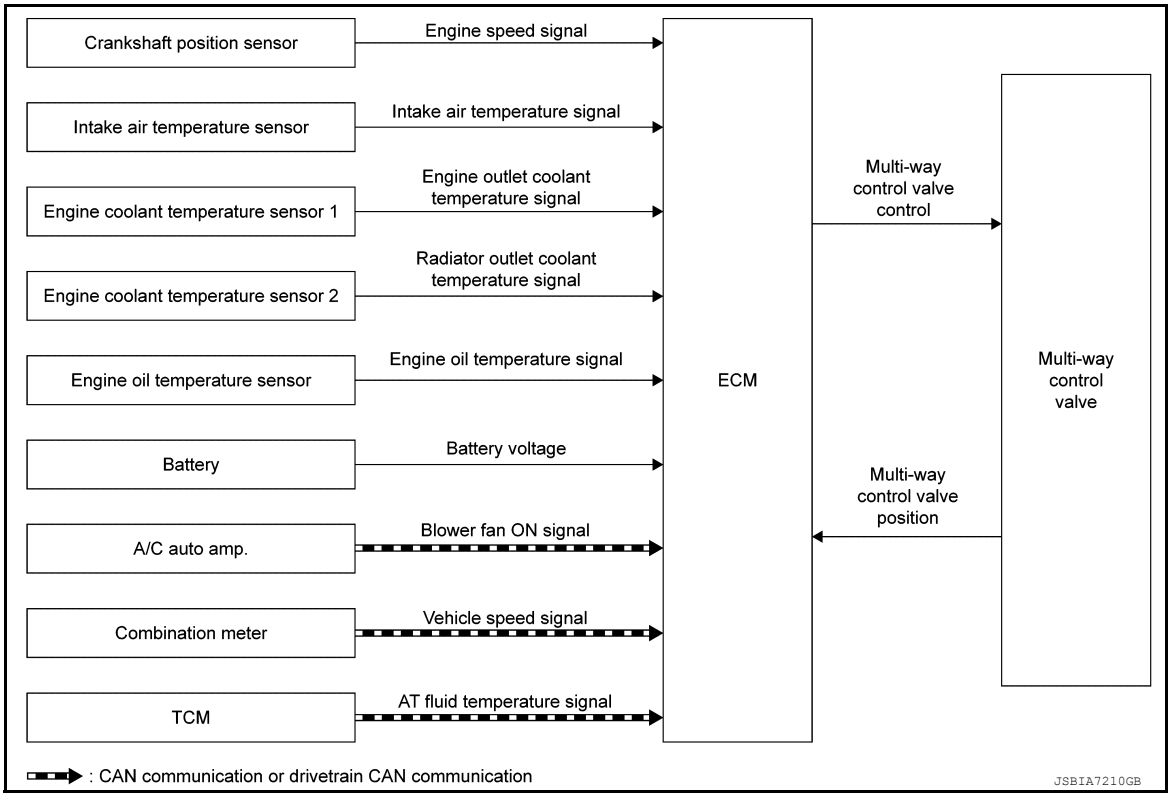
- When operating power steering during low engine speed or low vehicle speed.
- When engine speed is excessively low.
- When refrigerant pressure is excessively low or high.

THERMAL MANAGEMENT CONTROL

THERMAL MANAGEMENT CONTROL : System Description

INFOID:0000000014419402

SYSTEM DIAGRAM

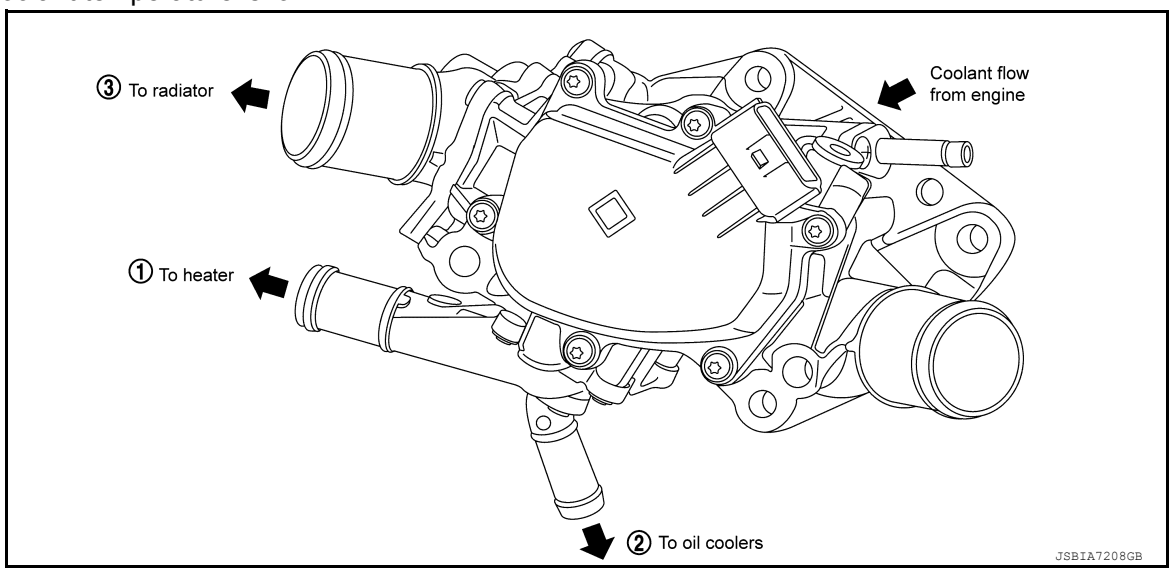


SYSTEM DESCRIPTION

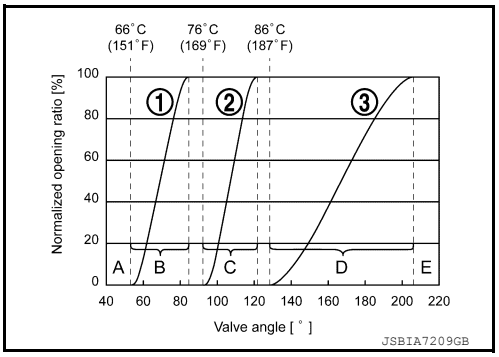
The multi-way control valve changes the paths to heater, oil cooler, and radiator according to engine coolant temperature and driving conditions.
When coolant temperature is low, the paths to heater, oil cooler, and radiator are closed and coolant is circulated only inside the engine to accelerate engine warm-up.
When coolant temperature is high, the paths to heater, oil cooler, and radiator are opened and coolant is refrigerated. This raises the coolant temperature and oil temperature rapidly and improves the fuel economy by reducing friction among parts.

Operation
When the ignition switch is OFF, the valve is fully opened to accelerate bleeding the coolant channels.

When receiving a blower fan ON signal and/or an A/C ON signal, ECM opens the flow path to the heater even when coolant temperature is low.



Valve position	①	②	③
	Heater	Oil cooler	Radiator
A	Full close	Full close	Full close
B	Open	Full close	Full close
C	Full open	Open	Full close
D	Full open	Full open	Open
E	Full open	Full open	Full open



A: Closes all flow paths ①, ②, and ③ and circulates coolant only inside the engine.
B: Opens the flow path to Heater and circulates coolant to Heater.
C: Opens the flow path to oil cooler and circulates coolant to Heater and oil cooler.
D: Opens the flow path to radiator and circulates coolant to Heater, oil cooler, and radiator.
E: Opens all the flow paths ①, ②, and ③.

The high coolant temperature control is performed by opening/closing the flow path to the radiator to raise the engine oil temperature even when the coolant temperature is high. When engine load is high, the high coolant temperature control is not performed because of the knocking control.
When detecting a malfunction in multi-way control valve, ECM fully opens the valve to secure cooling paths.

ALTERNATOR POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM

ALTERNATOR POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM : System Description

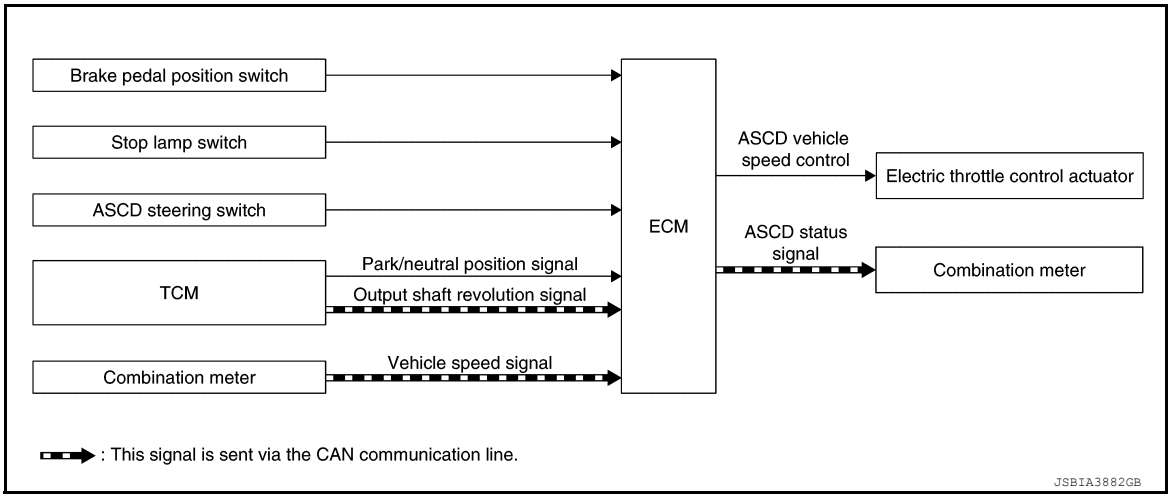
INFOID:0000000014419403

The alternator power generation voltage variable control system controls the amount of power generation, according to a battery loaded condition. ECM judges a battery condition, according to a signal received from the battery current sensor which detects a charge/discharge current. ECM then transmits a signal to IPDM E/R to command power generation via CAN communication. IPDM E/R transmits a power generation control signal to the alternator so that the system can control the amount of power generation. The voltage of power generation is lowered during battery low-load conditions and boosted under heavy load conditions. In this way, the system reduces the engine load through the adequate power generation control.
For details, refer to CHG-10, "POWER GENERATION VOLTAGE VARIABLE CONTROL SYSTEM : System Description".

AUTOMATIC SPEED CONTROL DEVICE (ASCD)

AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Diagram

INFOID:0000000014419404



AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description

INFOID:0000000014419405

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
ASCD steering switch	ASCD steering switch operation	ASCD vehicle speed control	• Electric throttle control actuator • Combination meter
Brake pedal position switch	Brake pedal operation		
Stop lamp switch			
TCM	Park/neutral position signal		
	Output shaft revolution signal*		
Combination meter	Vehicle speed signal*		

*: This signal is sent to the ECM via the CAN communication line

BASIC ASCD SYSTEM

- Automatic Speed Control Device (ASCD) allows a driver to keep vehicle at predetermined constant speed without depressing accelerator pedal. Driver can be set the vehicle speed in the set speed range.
- ECM controls throttle angle of electric throttle control actuator to regulate engine speed.
- Operation status of ASCD is indicated in combination meter.
- If any malfunction occurs in the ASCD system, it automatically deactivates the ASCD control.

Refer to EC-81, "AUTMATIC SPEED CONTROL DEVICE (ASCD) : Switch Name and Function" for ASCD operating instructions.

CAUTION:

Always drive vehicle in a safe manner according to traffic conditions and obey all traffic laws.

CAN COMMUNICATION

CAN COMMUNICATION : System Description

INFOID:0000000014419406

CAN (Controller Area Network) is a serial communication line for real time application. It is an on-vehicle multiplex communication line with high data communication speed and excellent error detection ability. Many electronic control units are equipped onto a vehicle, and each control unit shares information and links with other control units during operation (not independent). In CAN communication, control units are connected with 2 communication lines (CAN H line, CAN L line) allowing a high rate of information transmission with less wiring. Each control unit transmits/receives data but selectively reads required data only.

Refer to LAN-74, "CAN COMMUNICATION SYSTEM : CAN Communication Signal Chart", about CAN communication for detail.

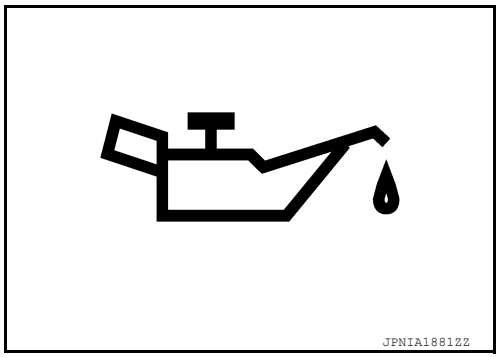
WARNING LAMPS/INDICATOR LAMPS

WARNING LAMPS/INDICATOR LAMPS : Engine Oil Pressure Warning Lamp

INFOID:0000000014419407

DESIGN/PURPOSE

When engine oil pressure is low, the oil pressure warning lamp informs the driver of low oil pressure to prevent damage to the engine.



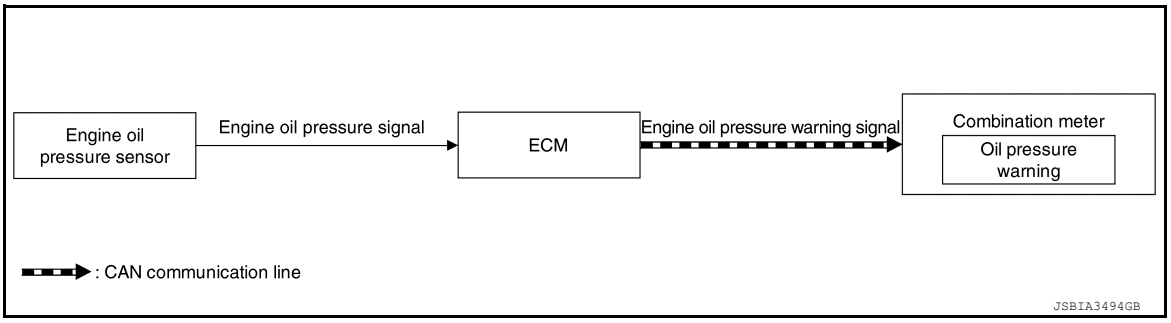
BULB CHECK

Not applicable

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL

For the operation for CAN communications blackout or abnormal signal reception, refer to MWI-35, "Fail-safe" (TYPE A), MWI-139, "Fail-safe" (TYPE B).

SYSTEM DIAGRAM



SIGNAL PATH

ECM calculates an engine oil pressure according to a signal transmitted from the engine oil pressure sensor. When the engine oil pressure is low, ECM transmits the engine oil pressure warning lamp signal to combination meter via CAN communication. Then the engine oil pressure warning lamp illuminates.

LIGHTING CONDITION

When any of the following conditions is satisfied:

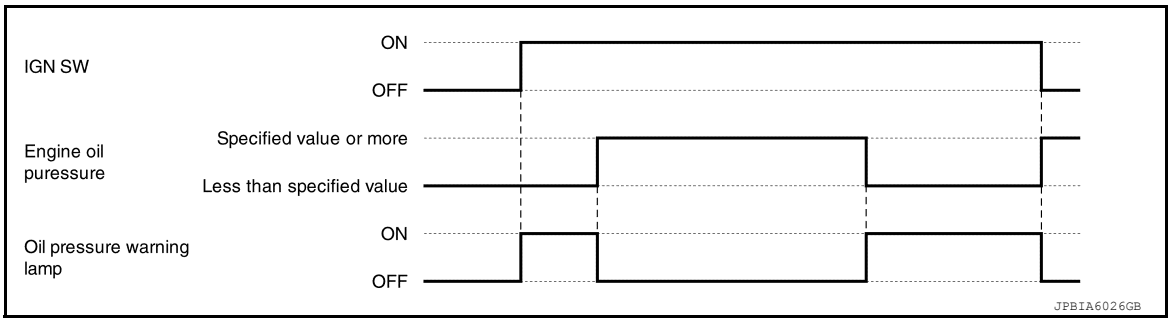
- Ignition switch: OFF
- Engine oil pressure is the specified value or more.

SHUTOFF CONDITION

When any of the following conditions is satisfied:

- Ignition switch: OFF
- Engine oil pressure is the specified value or more.

TIMING CHART



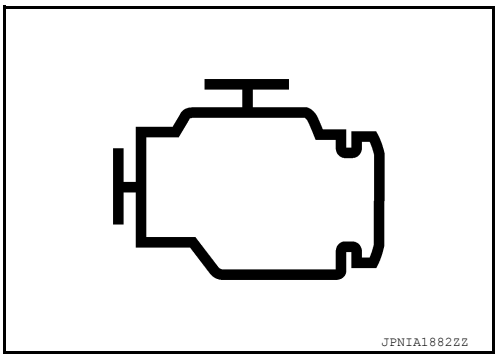
WARNING LAMPS/INDICATOR LAMPS : Malfunction Indicator Lamp (MIL)

INFOID:0000000014419408

DESIGN/PURPOSE

When a malfunction which increases exhaust gases is detected, ECM turns ON MIL and informs the driver of the necessity of inspection and repair.

When a malfunction which causes damage to the catalyst is detected, ECM immediately blinks MIL to alert the driver.



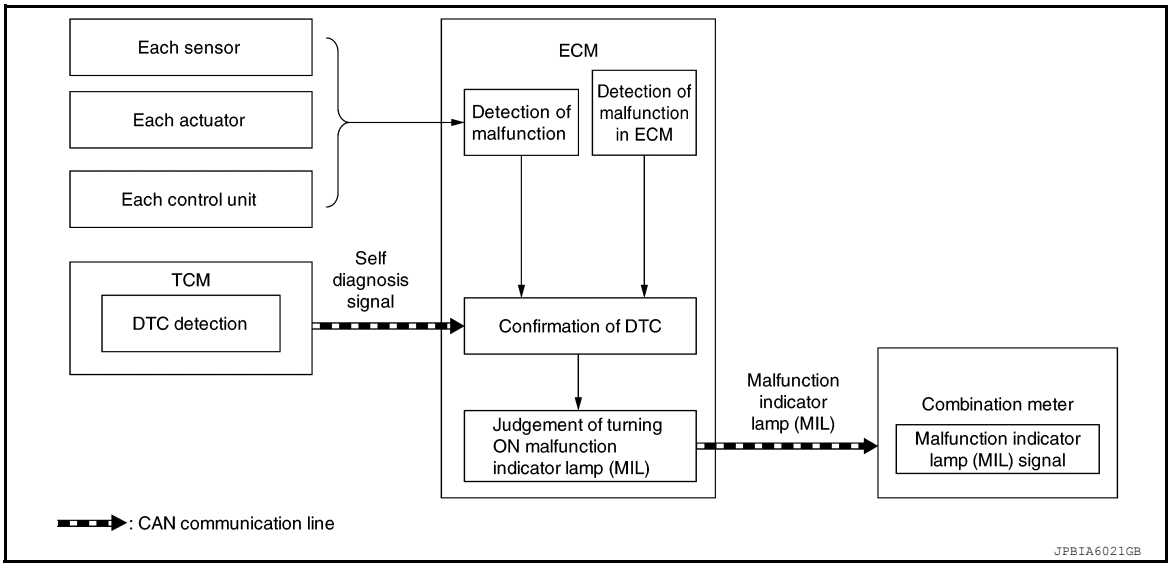
BULB CHECK

The bulb turns ON after turning ON the ignition switch (engine stop) and turns OFF after restarting the engine.

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL

For the operation for CAN communication blackout in the combination meter, refer to MWI-35, "Fail-safe" (TYPE A), MWI-139, "Fail-safe" (TYPE B).

SYSTEM DIAGRAM



SIGNAL PATH

- When the lighting conditions of the malfunction indicator lamp (MIL) are satisfied, ECM transmits a malfunction indicator lamp (MIL) signal to the combination meter via CAN communication.

- The combination meter turns ON or blinks the malfunction indicator lamp (MIL), according to a signal received from ECM.

LIGHTING CONDITION

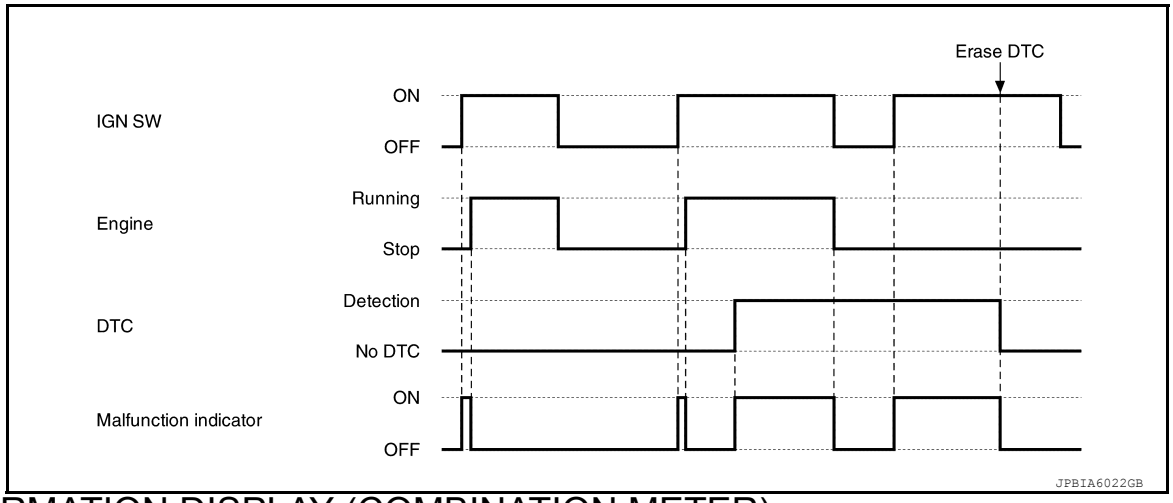
When all of the following conditions are satisfied:
- Ignition switch: ON
- DTC which influences on exhaust gasses is judged.

For DTCs that the malfunction indicator lamp turns ON and the number of DTC diagnosis trips, refer to EC-136, "DTC Index".

SHUTOFF CONDITION

When any of the following conditions is satisfied:
- Ignition switch: OFF
- Erase DTC

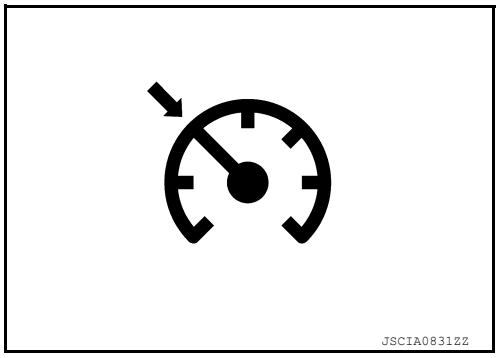
TIMING CHART



INFORMATION DISPLAY (COMBINATION METER)

INFORMATION DISPLAY (COMBINATION METER) : ASCD Indicator

INFOID:0000000014419409

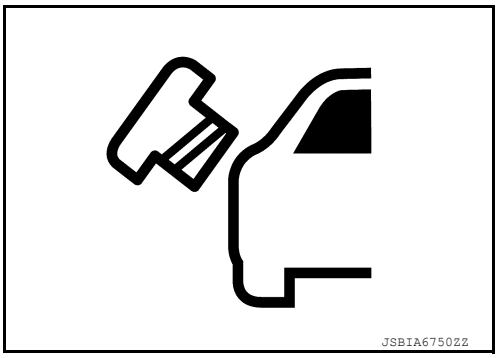
Item	Symbol	Function
ASCD indicator	 JSCIA0831ZZ Message: - - Km/h / - - MPH	For detail of ASCD function, refer to EC-81, "AUTOMATIC SPEED CONTROL DEVICE (ASCD) : Switch Name and Function".

INFORMATION DISPLAY (COMBINATION METER) : Fuel Filler Cap Warning

INFOID:0000000014419410

DESIGN/PURPOSE

Warn the driver that the fuel filler cap is left opened.

Symbol	Message
	Loose Fuel Cap

For detailes, refer to EC-72, "FUEL FILLER CAP WARNING SYSTEM : System Description".

WARNING/INDICATOR/CHIME LIST

WARNING/INDICATOR/CHIME LIST : Warning lamps/Indicator lamps

INFOID:0000000014419411

Name	Design	Arrangement/Function
Oil pressure warning lamp		Regarding the arrangement. Refer to MWI-11, "METER SYSTEM : Design" (TYPE A), MWI-117, "METER SYSTEM : Design" (TYPE B).
		Regarding the function. Refer to EC-77, "WARNING LAMPS/INDICATOR LAMPS : Engine Oil Pressure Warning Lamp".
Malfunction indicator lamp (MIL)		Regarding the arrangement. Refer to MWI-11, "METER SYSTEM : Design" (TYPE A), MWI-117, "METER SYSTEM : Design" (TYPE B).
		Regarding the function. Refer to EC-78, "WARNING LAMPS/INDICATOR LAMPS : Malfunction Indicator Lamp (MIL)".

WARNING/INDICATOR/CHIME LIST : Warning/Indicator (On Information Display)

INFOID:0000000014419412

Name	Function
ASCD indicator	Refer to EC-79, "INFORMATION DISPLAY (COMBINATION METER) : ASCD Indicator".
Fuel filler cap warning	Refer to EC-79, "INFORMATION DISPLAY (COMBINATION METER) : Fuel Filler Cap Warning".

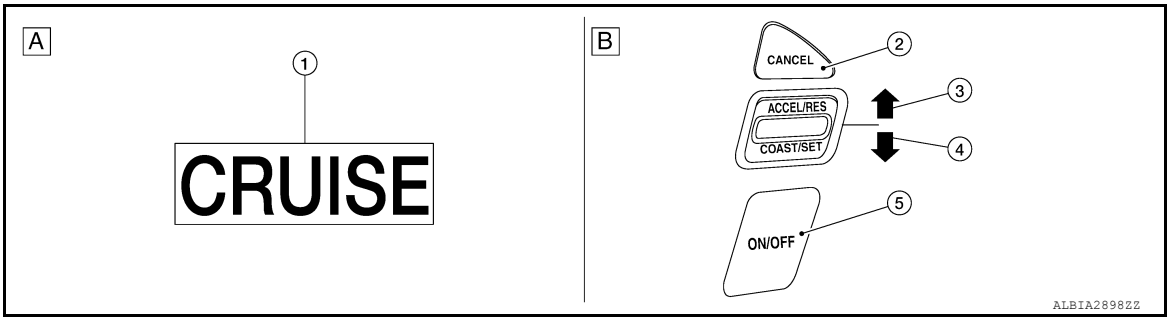
OPERATION

AUTMATIC SPEED CONTROL DEVICE (ASCD)

AUTMATIC SPEED CONTROL DEVICE (ASCD) : Switch Name and Function

INFOID:0000000014419413

SWITCHES AND INDICATORS



1. CRUISE indicator lamp
2. CANCEL switch
3. ACCELERATE/RESUME switch
4. COAST/SET switch
5. ASCD MAIN switch
A. On the combination meter
B. On the steering wheel

SET SPEED RANGE

ASCD system can be set the following vehicle speed.

Minimum speed (Approx.)	Maximum speed (Approx.)
40 km/h (25 MPH)	143 km/h (88 MPH)

SWITCH OPERATION

Item	Function
CANCEL switch	Cancels the cruise control driving.
ACCELERATE/RESUME switch	• Resumes the set speed. • Increases speed incrementally during cruise control driving.
COAST/SET switch	• Sets desired cruise speed. • Decreases speed incrementally during cruise control driving.
ASCD MAIN switch	Master switch to activate the ASCD system. (CRUISE indicator lamp is turned ON when ASCD system is ON.)

CANCEL CONDITION

- When any of following conditions exist, the cruise operation is canceled.
  - CANCEL switch is pressed
  - ASCD MAIN switch pressed (Set speed is cleared)
  - More than two switches at ASCD steering switch are pressed at the same time (Set speed is cleared)
  - Brake pedal is depressed
  - Selector lever position is changed to N, P or R
  - Vehicle speed decreased to 13 km/h (8 MPH) lower than the set speed
  - TCS system is operated
- When the ECM detects any of the following conditions, the ECM cancels the cruise operation and informs the driver by blinking CRUISE indicator lamp.
  - Engine coolant temperature is slightly higher than the normal operating temperature. Then CRUISE indicator lamp is blinked slowly.

    NOTE:

    Engine coolant temperature decreases to the normal operating temperature, CRUISE indicator lamp stop blinking and the cruise operation is able to work.
  - Malfunction for some self-diagnoses regarding ASCD system. CRUISE indicator lamp is blinked quickly.

- When ASCD MAIN switch is turned to OFF during the cruise control driving, all of ASCD operations is canceled and vehicle speed memory is erased.

ON BOARD DIAGNOSTIC (OBD) SYSTEM

Diagnosis Description

INFOID:0000000014419414

This system is an on board diagnostic system that records exhaust emission-related diagnostic information and detects a sensors/actuator-related malfunction. A malfunction is indicated by the malfunction indicator lamp (MIL) and stored in control module memory as a DTC. The diagnostic information can be obtained with the diagnostic tool (GST: Generic Scan Tool).

GST (Generic Scan Tool)

INFOID:0000000014419415

When GST is connected with a data link connector equipped on the vehicle side, it will communicate with the control module equipped in the vehicle and then enable various kinds of diagnostic tests. Refer to GI-55, "Description".

NOTE:
Service $0A is not applied for regions where it is not mandated.

DIAGNOSIS SYSTEM (ECM)
DIAGNOSIS DESCRIPTION
DIAGNOSIS DESCRIPTION : 1st Trip Detection Logic and Two Trip Detection Logic

INFOID:0000000014419416

When a malfunction is detected for the first time, 1st trip DTC and 1st trip Freeze Frame data are stored in the ECM memory. The MIL will not illuminate at this stage. <1st trip>
If the same malfunction is detected again during the next drive, the DTC and Freeze Frame data are stored in the ECM memory, and the MIL illuminates. The MIL illuminates at the same time when the DTC is stored. <2nd trip> The “trip” in the “Two Trip Detection Logic” means a driving mode in which self-diagnosis is performed during vehicle operation. Specific on board diagnostic items will cause the ECM to illuminate or blink the MIL, and store DTC and Freeze Frame data, even in the 1st trip, as shown below.

×: Applicable —: Not applicable

Items	MIL				DTC		1st trip DTC	
	1st trip		2nd trip		1st trip displaying	2nd trip displaying	1st trip displaying	2nd trip displaying
	Blinking	Illuminate	Blinking	Illuminate				
Misfire (Possible three way catalyst damage) — DTC: P0300 - P0308 is being detected	×	—	—	—	—	—	×	—
Misfire (Possible three way catalyst damage) — DTC: P0300 - P0308 is being detected	—	—	×	—	—	×	—	—
One trip detection diagnoses (Refer to EC-136, "DTC Index".)	—	×	—	—	×	—	—	—
Except above	—	—	—	×	—	×	×	—

DIAGNOSIS DESCRIPTION : DTC and Freeze Frame Data

INFOID:0000000014419417

DTC AND 1ST TRIP DTC

The 1st trip DTC (whose number is the same as the DTC number) is displayed for the latest self-diagnostic result obtained. If the ECM memory was cleared previously, and the 1st trip DTC did not recur, the 1st trip DTC will not be displayed.
If a malfunction is detected during the 1st trip, the 1st trip DTC is saved in the ECM memory. The MIL will not light up (two trip detection logic). If the same malfunction is not detected in the 2nd trip (meeting the required driving pattern), the 1st trip DTC is cleared from the ECM memory. If the same malfunction is detected in the 2nd trip, both the 1st trip DTC and DTC are saved in the ECM memory and the MIL lights up. In other words, the DTC is stored in the ECM memory and the MIL lights up when the same malfunction occurs in two consecutive trips. If a 1st trip DTC is stored and a non-diagnostic operation is performed between the 1st and 2nd trips, only the 1st trip DTC will continue to be stored. For malfunctions that blink or light up the MIL during the 1st trip, the DTC and 1st trip DTC are stored in the ECM memory.
For malfunctions in which 1st trip DTCs are displayed, refer to EC-136, "DTC Index". These items are required by legal regulations to continuously monitor the system/component. In addition, the items monitored non-continuously are also displayed on CONSULT.
1st trip DTC is specified in Service $07 of SAE J1979/ISO 15031-5. 1st trip DTC detection occurs without illuminating the MIL and therefore does not warn the driver of a malfunction.
When a 1st trip DTC is detected, check, print out or write down and erase (1st trip) DTC and Freeze Frame data as specified in Work Flow procedure Step 2, refer to EC-185, "Work Flow". Then perform DTC Confirmation Procedure or Component Function Check to try to duplicate the malfunction. If the malfunction is duplicated, the item requires repair.

FREEZE FRAME DATA AND 1ST TRIP FREEZE FRAME DATA

The ECM records the driving conditions such as fuel system status, calculated load value, engine coolant temperature, short term fuel trim, long term fuel trim, engine speed, vehicle speed, absolute throttle position, base fuel schedule and intake air temperature at the moment a malfunction is detected.
Data which are stored in the ECM memory, along with the 1st trip DTC, are called 1st trip freeze frame data. The data, stored together with the DTC data, are called freeze frame data and displayed on CONSULT or GST. The 1st trip freeze frame data can only be displayed on the CONSULT screen.

Only one set of freeze frame data (either 1st trip freeze frame data or freeze frame data) can be stored in the ECM. 1st trip freeze frame data is stored in the ECM memory along with the 1st trip DTC. There is no priority for 1st trip freeze frame data and it is updated each time a different 1st trip DTC is detected. However, once freeze frame data (2nd trip detection/MIL on) is stored in the ECM memory, 1st trip freeze frame data is no longer stored. Remember, only one set of freeze frame data can be stored in the ECM. The ECM has the following priorities to update the data.

Priority	Items	
1	Freeze frame data	Misfire — DTC: P0300 - P0308 Fuel Injection System Function — DTC: P0171, P0172, P0174, P0175
2		Except the above items
3	1st trip freeze frame data	

For example, the EGR malfunction (Priority: 2) was detected and the freeze frame data was saved in the 2nd trip. After that when the misfire (Priority: 1) is detected in another trip, the freeze frame data will be updated from the EGR malfunction to the misfire. The 1st trip freeze frame data is updated each time a different malfunction is detected. There is no priority for 1st trip freeze frame data. However, once freeze frame data is stored in the ECM memory, 1st trip freeze data is no longer stored (because only one freeze frame data or 1st trip freeze frame data can be stored in the ECM). If freeze frame data is stored in the ECM memory and freeze frame data with the same priority occurs later, the first (original) freeze frame data remains unchanged in the ECM memory.
Both 1st trip freeze frame data and freeze frame data (along with the DTCs) are cleared when the ECM memory is erased.

DIAGNOSIS DESCRIPTION : Counter System

INFOID:0000000014419418

RELATIONSHIP BETWEEN MIL, 1ST TRIP DTC, DTC, AND DETECTABLE ITEMS

- When a malfunction is detected for the first time, the 1st trip DTC and the 1st trip freeze frame data are stored in the ECM memory.
- When the same malfunction is detected in two consecutive trips, the DTC and the freeze frame data are stored in the ECM memory, and the MIL will come on.
- The MIL will turn OFF after the vehicle is driven 3 times (driving pattern B) with no malfunction. The drive is counted only when the recorded driving pattern is met (as stored in the ECM). If another malfunction occurs while counting, the counter will reset.
- The DTC and the freeze frame data will be stored until the vehicle is driven 40 times (driving pattern A) without the same malfunction recurring (except for Misfire and Fuel Injection System). For Misfire and Fuel Injection System, the DTC and freeze frame data will be stored until the vehicle is driven 80 times (driving pattern C) without the same malfunction recurring. The “TIME” in “SELF-DIAGNOSTIC RESULTS” mode of CONSULT will count the number of times the vehicle is driven.
- The 1st trip DTC is not displayed when the self-diagnosis results in OK for the 2nd trip.

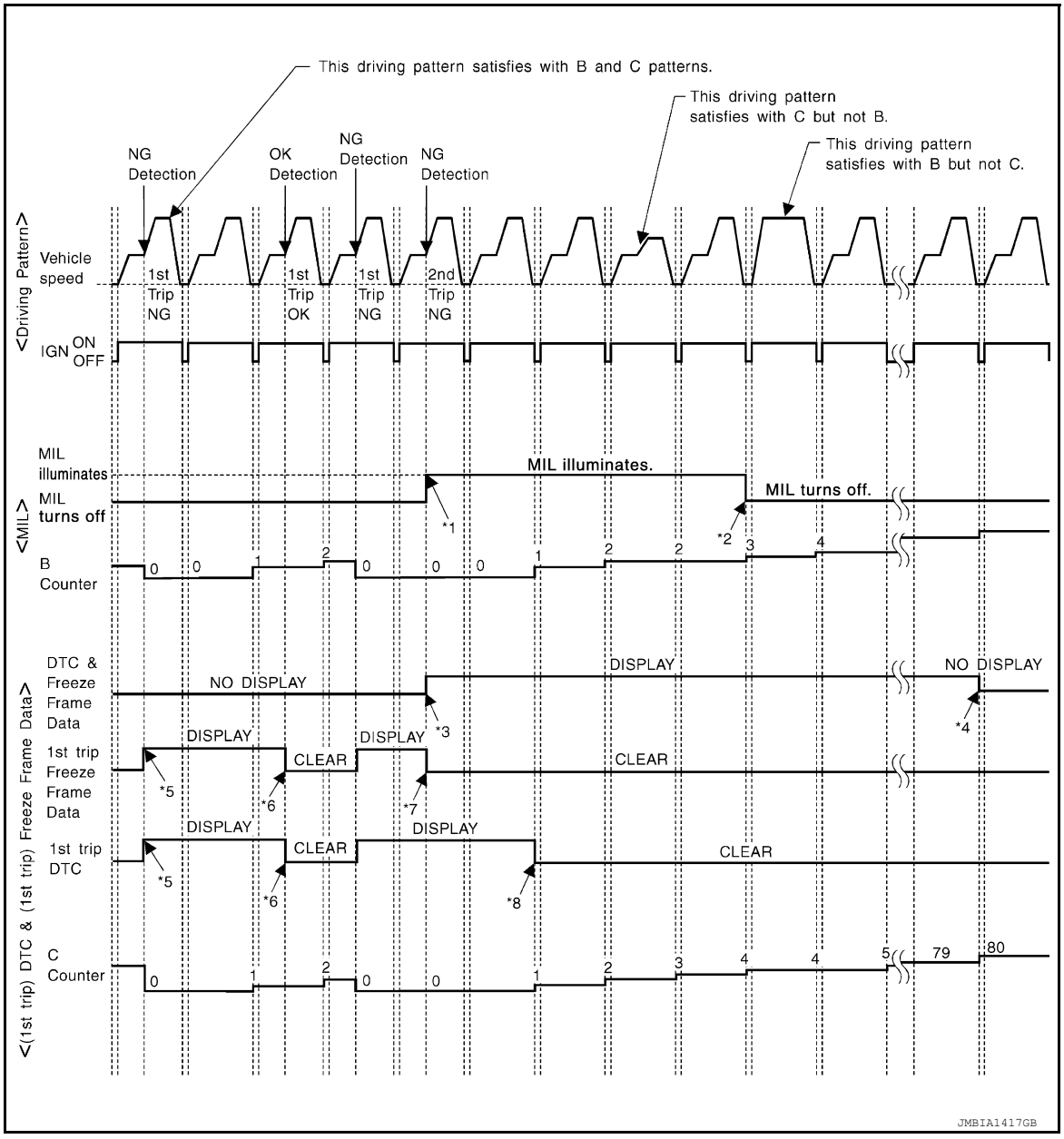
COUNTER SYSTEM CHART

Items	Fuel Injection System	Misfire	Other
MIL (turns OFF)	3 (pattern B)	3 (pattern B)	3 (pattern B)
DTC, Freeze Frame Data (no display)	80 (pattern C)	80 (pattern C)	40 (pattern A)
1st Trip DTC (clear)	1 (pattern C), *1	1 (pattern C), *1	1 (pattern B)
1st Trip Freeze Frame Data (clear)	*1, *2	*1, *2	1 (pattern B)

For details about patterns B and C under “Fuel Injection System” and “Misfire”, see “EXPLANATION FOR DRIVING PATTERNS FOR “MISFIRE <EXHAUST QUALITY DETERIORATION>”, “FUEL INJECTION SYSTEM”.
For details about patterns A and B under Other, see “EXPLANATION FOR DRIVING PATTERNS FOR “MISFIRE <EXHAUST QUALITY DETERIORATION>”, “FUEL INJECTION SYSTEM”.

- *1: Clear timing is at the moment OK is detected.
- *2: Clear timing is when the same malfunction is detected in the 2nd trip.

Relationship Between MIL, DTC, 1st Trip DTC and Driving Patterns for “Misfire <Exhaust Quality Deterioration>”, “Fuel Injection System”



*1: When the same malfunction is detected in two consecutive trips, MIL will light up.

*2: MIL will turn OFF after vehicle is driven 3 times (pattern B) without any malfunctions.

*3: When the same malfunction is detected in two consecutive trips, the DTC and the freeze frame data will be stored in ECM.

*4: The DTC and the freeze frame data will not be displayed any longer after vehicle is driven 80 times (pattern C) without the same malfunction. (The DTC and the freeze frame data still remain in ECM.)

*5: When a malfunction is detected for the first time, the 1st trip DTC and the 1st trip freeze frame data will be stored in ECM.

*6: The 1st trip DTC and the 1st trip freeze frame data will be cleared at the moment OK is detected.

*7: When the same malfunction is detected in the 2nd trip, the 1st trip freeze frame data will be cleared.

*8: 1st trip DTC will be cleared when vehicle is driven once (pattern C) without the same malfunction after DTC is stored in ECM.

Explanation for Driving Patterns for “Misfire <Exhaust Quality Deterioration>”, “Fuel Injection System”

Driving Pattern B
Refer to EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

Driving Pattern C

Refer to EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

Example:

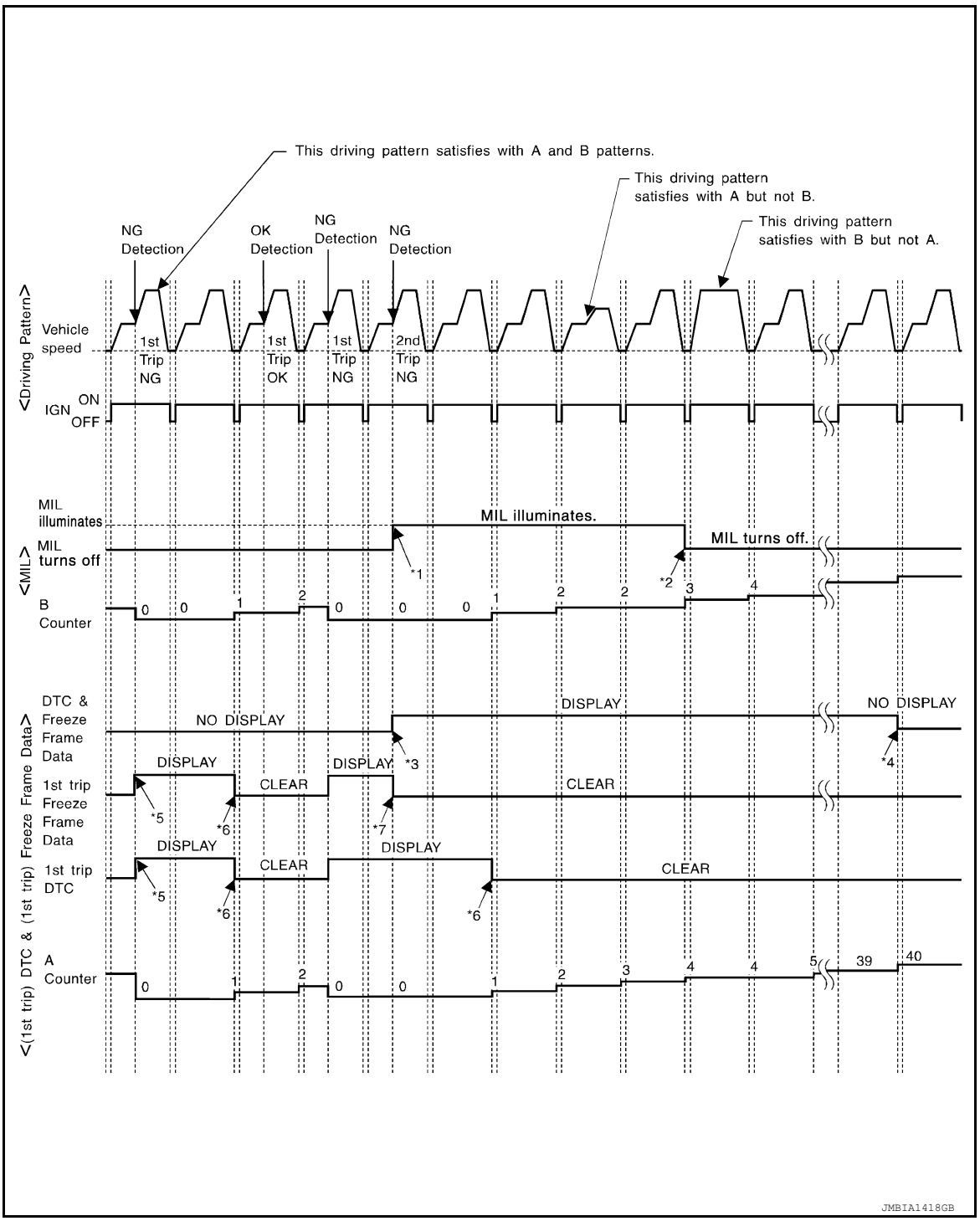
If the stored freeze frame data is as per the following:

Engine speed: 850 rpm, Calculated load value: 30%, Engine coolant temperature: 80°C (176°F)

To be satisfied with driving pattern C, the vehicle should run under the following conditions:

Engine speed: 475 – 1,225 rpm, Calculated load value: 27 – 33%, Engine coolant temperature: more than 70°C (158°F)

Relationship Between MIL, DTC, 1st Trip DTC and Driving Patterns Except For “Misfire <Exhaust Quality Deterioration>”, “Fuel Injection System”



*1: When the same malfunction is detected in two consecutive trips, MIL will light up.

*2: MIL will turn OFF after vehicle is driven 3 times (pattern B) without any malfunctions.

*3: When the same malfunction is detected in two consecutive trips, the DTC and the freeze frame data will be stored in ECM.

*4: The DTC and the freeze frame data will not be displayed any longer after vehicle is driven 40 times (pattern A) without the same malfunction. (The DTC and the freeze frame data still remain in ECM.)

*5: When a malfunction is detected for the first time, the 1st trip DTC and the 1st trip freeze frame data will be stored in ECM.

*6: 1st trip DTC will be cleared after vehicle is driven once (pattern B) without the same malfunction.

*7: When the same malfunction is detected in the 2nd trip, the 1st trip freeze frame data will be cleared.

Explanation for Driving Patterns Except for “Misfire <Exhaust Quality Deterioration>”, “Fuel Injection System”

Driving Pattern A
Refer to EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

Driving Pattern B
Refer to EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

DIAGNOSIS DESCRIPTION : Driving Pattern

INFOID:0000000014419419

CAUTION:
Always drive at a safe speed.

DRIVING PATTERN A

Driving pattern A means a trip satisfying the following conditions.
- Engine speed reaches 400 rpm or more.
- Engine coolant temperature rises by 20°C (68°F) or more after starting the engine.
- Engine coolant temperature reaches 70°C (158°F) or more.
- The ignition switch is turned from ON to OFF.

NOTE:
- When the same malfunction is detected regardless of driving conditions, reset the counter of driving pattern A.
- When the above conditions are satisfied without detecting the same malfunction, reset the counter of driving pattern A.

DRIVING PATTERN B

Driving pattern B means a trip satisfying the following conditions.
- Engine speed reaches 400 rpm or more.
- Engine coolant temperature reaches 70°C (158°F) or more.
- Vehicle speed of 70 – 120 km/h (44 – 75 MPH) is maintained for 60 seconds or more under the control of closed loop.
- Vehicle speed of 30 – 60 km/h (19 – 37 MPH) is maintained for 10 seconds or more under the control of closed loop.
- Under the closed loop control condition, the following state reaches 12 seconds or more in total: Vehicle speed of 4 km/h (2 MPH) or less with idling condition.
- The state of driving at 10 km/h (7 MPH) or more reaches 10 minutes or more in total.
- A lapse of 22 minutes or more after engine start.

NOTE:
- Drive the vehicle at a constant velocity.
- When the same malfunction is detected regardless of driving conditions, reset the counter of driving pattern B.
- When the above conditions are satisfied without detecting the same malfunction, reset the counter of driving pattern B.

DRIVING PATTERN C

Driving pattern C means operating vehicle as per the following:
The following conditions should be satisfied at the same time:
Engine speed: (Engine speed in the freeze frame data) ±375 rpm

Calculated load value: (Calculated load value in the freeze frame data) x (1±0.1) [%]
Engine coolant temperature condition:
- When the freeze frame data shows lower than 70°C (158°F), engine coolant temperature should be lower than 70°C (158°F).
- When the freeze frame data shows higher than or equal to 70°C (158°F), engine coolant temperature should be higher than or equal to 70°C (158°F).

NOTE:
- When the same malfunction is detected regardless of the above vehicle conditions, reset the counter of driving pattern C.
- When the above conditions are satisfied without detecting the same malfunction, reset the counter of driving pattern C.
- The 1st trip DTC will be cleared when C counter is counted once without the same malfunction after DTC is stored in ECM.

DRIVING PATTERN D

Driving pattern D means a trip satisfying the following conditions.
- The state of driving at 40 km/h (25 MPH) reaches 300 seconds or more in total.
- Idle speed lasts 30 seconds or more.
- A lapse of 600 seconds or more after engine start.

NOTE:
- When the same malfunction is detected regardless of driving conditions, reset the counter of driving pattern D.
- When the above conditions are satisfied without detecting the same malfunction, reset the counter of driving pattern D.

DIAGNOSIS DESCRIPTION : System Readiness Test (SRT) Code

INFOID:0000000014419420

System Readiness Test (SRT) code is specified in Service $01 of SAE J1979/ISO 15031-5.
As part of an enhanced emissions test for Inspection & Maintenance (I/M), certain states require the status of SRT be used to indicate whether the ECM has completed self-diagnosis of major emission systems and components. Completion must be verified in order for the emissions inspection to proceed.
If a vehicle is rejected for a State emissions inspection due to one or more SRT items indicating “INCMP”, use the information in this Service Manual to set the SRT to “CMPLT”.
In most cases the ECM will automatically complete its self-diagnosis cycle during normal usage, and the SRT status will indicate “CMPLT” for each application system. Once set as “CMPLT”, the SRT status remains “CMPLT” until the self-diagnosis memory is erased.
Occasionally, certain portions of the self-diagnostic test may not be completed as a result of the customer's normal driving pattern; the SRT will indicate “INCMP” for these items.

NOTE:
The SRT will also indicate “INCMP” if the self-diagnosis memory is erased for any reason or if the ECM memory power supply is interrupted for several hours.
If, during the state emissions inspection, the SRT indicates “CMPLT” for all test items, the inspector will continue with the emissions test. However, if the SRT indicates “INCMP” for one or more of the SRT items the vehicle is returned to the customer untested.

NOTE:
If permanent DTC is stored or MIL illuminates during the state emissions inspection, the vehicle is also returned to the customer untested even though the SRT indicates “CMPLT” for all test items. Therefore, it is important to check SRT (“CMPLT”), DTC (No DTCs) and permanent DTC (NO permanent DTCs) before the inspection.

SRT SET TIMING

SRT is set as “CMPLT” after self-diagnosis has been performed one or more times. Completion of SRT is done regardless of whether the result is OK or NG. The set timing is different between OK and NG results and is shown in the table below.

Self-diagnosis result		Example				
		Diagnosis	Ignition cycle ← ON →	OFF	← ON →	OFF ← ON → OFF ← ON →
All OK	Case 1	P0400	OK (1)	— (1)	OK (2)	— (2)
		P0402	OK (1)	— (1)	— (1)	OK (2)
		P1402	OK (1)	OK (2)	— (2)	— (2)
		SRT of EGR	“CMPLT”	“CMPLT”	“CMPLT”	“CMPLT”
	Case 2	P0400	OK (1)	— (1)	— (1)	— (1)
		P0402	— (0)	— (0)	OK (1)	— (1)
		P1402	OK (1)	OK (2)	— (2)	— (2)
		SRT of EGR	“INCMP”	“INCMP”	“CMPLT”	“CMPLT”
NG exists	Case 3	P0400	OK	OK	—	—
		P0402	—	—	—	—
		P1402	NG	—	NG	NG (Consecutive NG)
		(1st trip) DTC	1st trip DTC	—	1st trip DTC	DTC (= MIL ON)
		SRT of EGR	“INCMP”	“INCMP”	“INCMP”	“CMPLT”

OK: Self-diagnosis is carried out and the result is OK.

NG: Self-diagnosis is carried out and the result is NG.

—: Self-diagnosis is not carried out.

When all SRT related self-diagnoses show OK results in a single cycle (Ignition OFF-ON-OFF), the SRT will indicate “CMPLT”. → Case 1 above

When all SRT related self-diagnoses show OK results through several different cycles, the SRT will indicate “CMPLT” at the time the respective self-diagnoses have at least one OK result. → Case 2 above

If one or more SRT related self-diagnoses show NG results in 2 consecutive cycles, the SRT will also indicate “CMPLT”. → Case 3 above

The table above shows that the minimum number of cycles for setting SRT as “INCMP” is the number one (1) for each self-diagnosis (Case 1 & 2) or the number two (2) for one of self-diagnoses (Case 3). However, in preparation for the state emissions inspection, it is unnecessary for each self-diagnosis to be executed twice (Case 3) for the following reasons:

- The SRT will indicate “CMPLT” at the time the respective self-diagnoses have one (1) OK result.
- The emissions inspection requires “CMPLT” of the SRT only with OK self-diagnosis results.
- During SRT driving pattern, the 1st trip DTC (NG) is detected prior to “CMPLT” of SRT and the self-diagnosis memory must be erased from the ECM after repair.
- If the 1st trip DTC is erased, all the SRT will indicate “INCMP”.

NOTE:

SRT can be set as “CMPLT” together with the DTC(s). Therefore, DTC check must always be carried out prior to the state emission inspection even though the SRT indicates “CMPLT”.

DIAGNOSIS DESCRIPTION : Permanent Diagnostic Trouble Code (Permanent DTC)

INFOID:0000000014419421

Permanent DTC is defined in SAE J1979/ISO 15031-5 Service $0A.

ECM stores a DTC issuing a command of turning on MIL as a permanent DTC and keeps storing the DTC as a permanent DTC until ECM judges that there is no presence of malfunction.

Permanent DTCs cannot be erased by using the erase function of CONSULT or Generic Scan Tool (GST) and by disconnecting the battery to shut off power to ECM. This prevents a vehicle from passing the in-use inspection without repairing a malfunctioning part.

When not passing the in-use inspection due to more than one permanent DTC, permanent DTCs should be erased, referring to this manual.

NOTE:

- The important items in in-use inspection are that MIL is not ON, SRT test items are set, and permanent DTCs are not included.
- Permanent DTCs do not apply for regions that permanent DTCs are not regulated by law.

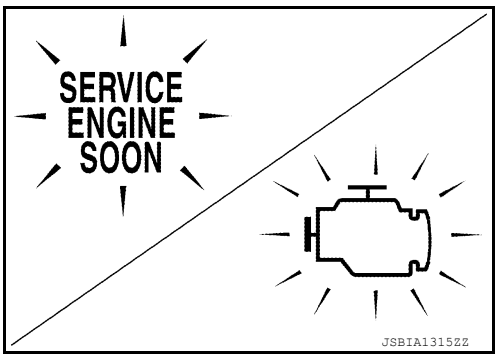
PERMANENT DTC SET TIMING

The setting timing of permanent DTC is stored in ECM with the lighting of MIL when a DTC is confirmed.

DIAGNOSIS DESCRIPTION : Malfunction Indicator Lamp (MIL)

INFOID:0000000014419422

When emission-related ECU detects a malfunction in the emission control systems components and/or the powertrain control components (which affect vehicle emissions), it turns on/blinks MIL to inform the driver that a malfunction has been detected.



1. The MIL illuminates when ignition switch is turned ON (engine is not running).
   NOTE:
   Check the MIL circuit if MIL does not illuminate. Refer to EC-705, "Component Function Check".
2. When the engine is started, the MIL should go off.
   NOTE:
   If MIL continues to illuminate/blink, perform self-diagnoses and inspect/repair accordingly because an emission-related ECU has detected a malfunction in the emission control systems components and/or the powertrain control components (which affect vehicle emissions).

On Board Diagnosis Function

INFOID:0000000014419423

ON BOARD DIAGNOSIS ITEM

The on board diagnostic system has the following functions.

Diagnostic test mode	Function
Bulb check	MIL can be checked.
SRT status	ECM can read if SRT codes are set.
Malfunction warning	If ECM detects a malfunction, it illuminates or blinks MIL to inform the driver that a malfunction has been detected.
Self-diagnostic results	DTCs or 1st trip DTCs stored in ECM can be read.
Accelerator pedal released position learning	ECM can learn the accelerator pedal released position. Refer to EC-198, "Description".
Throttle valve closed position learning	ECM can learn the throttle valve closed position. Refer to EC-199, "Description".
Idle air volume learning	ECM can learn the idle air volume. Refer to EC-200, "Description".
VVEL control shaft position sensor adjustment	The initial position of the VVEL control shaft position sensor can be adjusted. Refer to EC-202, "Description".

BLUB CHECK MODE

Description

This function allows damage inspection in the MIL bulb (blown, open circuit, etc.).

Operation Procedure

1. Turn ignition switch ON.
2. The MIL on the instrument panel should stay ON.
   If it remains OFF, check MIL circuit. Refer to EC-705, "Diagnosis Procedure".

SRT STATUS MODE

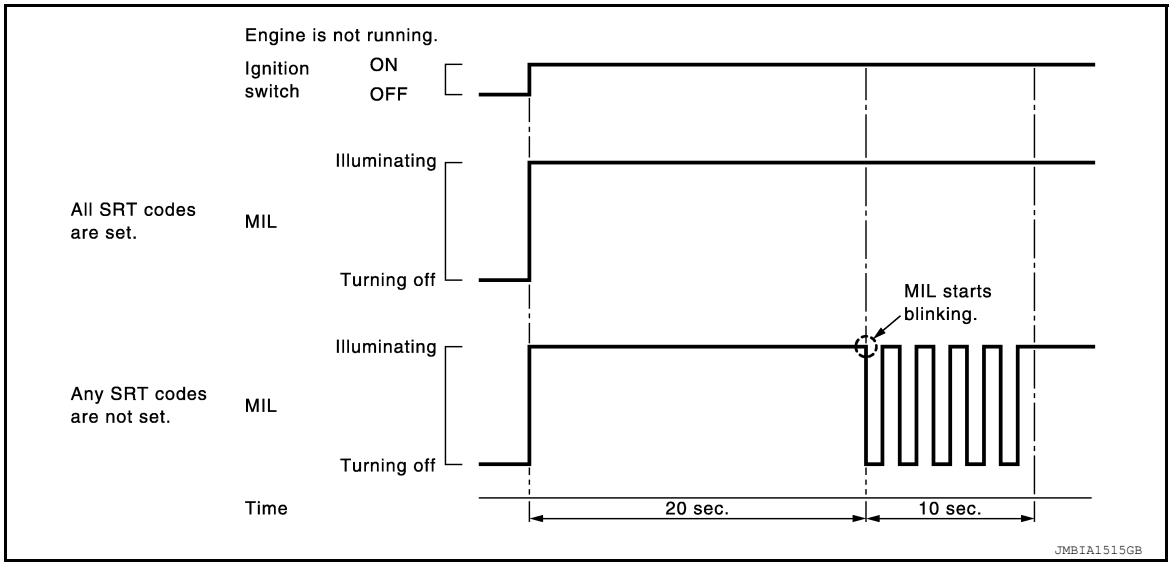
Description

This function allows to read if ECM has completed the self-diagnoses of major emission control systems and components. For SRT, refer to EC-89, "DIAGNOSIS DESCRIPTION : System Readiness Test (SRT) Code".

Operation Procedure

1. Turn ignition switch ON and wait 20 seconds.
2. SRT status is indicated as shown blow.
   • ECM continues to illuminate MIL if all SRT codes are set.

- ECM blinks MIL for about 10 seconds if all SRT codes are not set.



MALFUNCTION WARNING MODE

Description

In this function ECM turns on or blinks MIL when it detects a malfunction in the emission control system components and/or the powertrain control components (which affect vehicle emissions) to inform the driver that a malfunction has been detected.

Operation Procedure

1. Turn ignition switch ON.
2. Check that MIL illuminates.
   If it remains OFF, check MIL circuit. Refer to EC-705, "Diagnosis Procedure".
3. Start engine and let it idle.
   - For two trip detection logic diagnoses, ECM turns on MIL when it detects the same malfunction twice in the two consecutive driving cycles.
   - For 1st trip detection logic diagnoses, ECM turns on MIL when it detects a malfunction in one driving cycle.
   - ECM blinks MIL when it detects a malfunction that may damage the three way catalyst (misfire).

SELF-DIAGNOSTIC RESULTS MODE

Description

This function allows to indicate DTCs or 1st trip DTCs stored in ECM according to the number of times MIL is blinking.

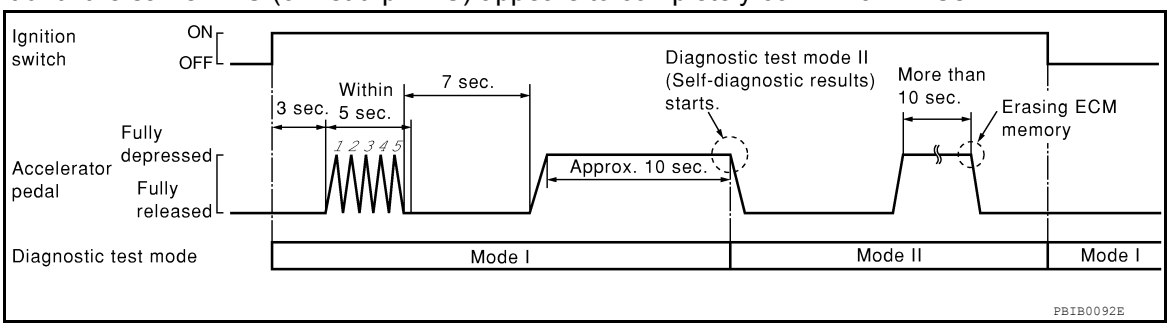
How to Set Self-diagnostic Results Mode

NOTE:

- It is better to count the time accurately with a clock.
- It is impossible to switch the diagnostic mode when an accelerator pedal position sensor circuit has a malfunction.
- After ignition switch is turned off, ECM is always released from the “Self-diagnostic results” mode.

1. Confirm that accelerator pedal is fully released, turn ignition switch ON and wait 3 seconds.
2. Repeat the following procedure quickly five times within 5 seconds.
   - Fully depress the accelerator pedal.
   - Fully release the accelerator pedal.
3. Wait 7 seconds, fully depress the accelerator pedal and keep it depressed for approx. 10 seconds until the MIL starts blinking.
   NOTE:
   Do not release the accelerator pedal for 10 seconds if MIL starts blinking during this period. This blinking is displaying SRT status and is continued for another 10 seconds.
4. Fully release the accelerator pedal.
   ECM has entered to Self-diagnostic results mode.

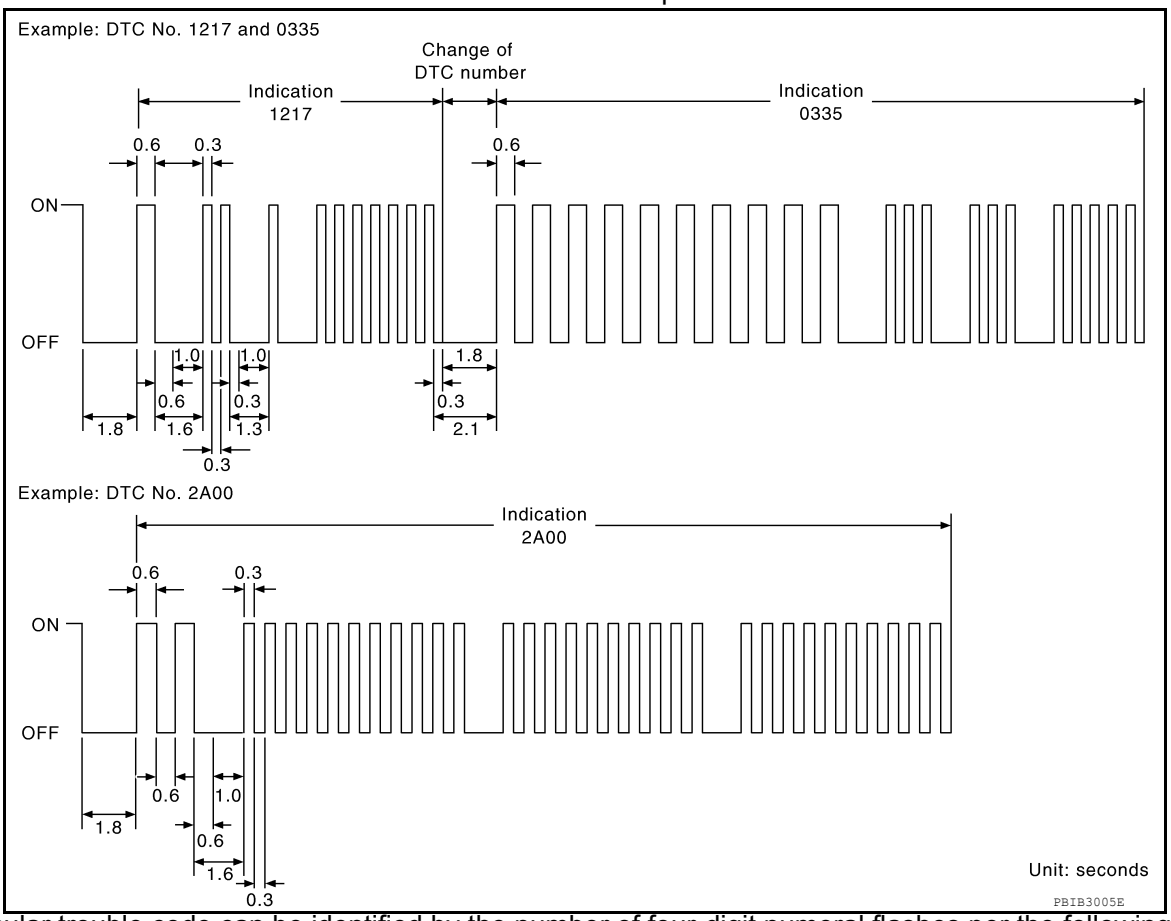
NOTE:
Wait until the same DTC (or 1st trip DTC) appears to completely confirm all DTCs.



How to Read Self-diagnostic Results

The DTC and 1st trip DTC are indicated by the number of blinks of the MIL as shown below.

The DTC and 1st trip DTC are displayed at the same time. If the MIL does not illuminate in diagnostic test mode I (Malfunction warning), all displayed items are 1st trip DTCs. If only one code is displayed when the MIL illuminates in “malfunction warning” mode, it is a DTC; if two or more codes are displayed, they may be either DTCs or 1st trip DTCs. DTC No. is same as that of 1st trip DTC. These unidentified codes can be identified by using the CONSULT or GST. A DTC will be used as an example for how to read a code.



A particular trouble code can be identified by the number of four-digit numeral flashes per the following.

Number	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Flashes	10	1	2	3	4	5	6	7	8	9	11	12	13	14	15	16

The length of time the 1,000th-digit numeral flashes on and off is 1.2 seconds consisting of an ON (0.6-seconds) - OFF (0.6-seconds) cycle.

The 100th-digit numeral and lower digit numerals consist of a 0.3-seconds ON and 0.3-seconds OFF cycle.

A change from one digit numeral to another occurs at an interval of 1.0-second OFF. In other words, the later numeral appears on the display 1.3 seconds after the former numeral has disappeared.

A change from one trouble code to another occurs at an interval of 1.8-seconds OFF.

In this way, all the detected malfunctions are classified by their DTC numbers. The DTC 0000 refers to no malfunction. Refer to EC-136, "DTC Index".

How to Erase Self-diagnostic Results

By performing this procedure, ECM memory is erased and the following diagnostic information is erased as well.

- Diagnostic trouble codes
- 1st trip diagnostic trouble codes
- Freeze frame data
- 1st trip freeze frame data
- System readiness test (SRT) codes
- Test values

NOTE:

Also, if a battery terminal is disconnected, ECM memory is erased and the diagnostic information as listed above is erased. (The amount of time required for erasing may vary from a few seconds to several hours.)

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Set ECM in “Self-diagnostic” results.
6. The diagnostic information has been erased from the backup memory in the ECM.
   Fully depress the accelerator pedal and keep it depressed for more than 10 seconds.
7. Fully release the accelerator pedal, and confirm the DTC 0000 is displayed.

CONSULT Function

INFOID:0000000014419424

FUNCTION

Diagnostic test mode	Function
Self Diagnostic Result	Self-diagnostic results such as 1st trip DTC, DTCs and 1st trip freeze frame data or freeze frame data can be read and erased quickly.*
Data Monitor	Input/Output data in the ECM can be read.
Work support	This mode enables a technician to adjust some devices faster and more accurately by following the indications on the CONSULT unit.
Active Test	Diagnostic Test Mode in which CONSULT drives some actuators apart from the ECMs and also shifts some parameters in a specified range.
ECU Identification	ECM part number can be read.
DTC Work Support	The status of system monitoring tests and the self-diagnosis status/results can be confirmed.

*: The following emission-related diagnostic information is cleared when the ECM memory is erased.

- Diagnostic trouble codes
- 1st trip diagnostic trouble codes
- Freeze frame data
- 1st trip freeze frame data
- System readiness test (SRT) codes
- Test values

SELF DIAGNOSTIC RESULT MODE

Self Diagnostic Item

Regarding items of DTC and 1st trip DTC, refer to EC-136, "DTC Index".

How to Read DTC and 1st Trip DTC

DTCs and 1st trip DTCs related to the malfunction are displayed in “Self-diag results”.

- When ECM detects a 1st trip DTC, “1t” is displayed for “TIME”.
- When ECM has detected a current DTC, “0” is displayed for “TIME”.
- If “TIME” is neither “0” nor “1t”, the DTC occurred in the past and ECM shows the number of times the vehicle has been driven since the last detection of the DTC.

How to Erase DTC and 1st Trip DTC

NOTE:

- If the ignition switch stays ON after repair work, be sure to turn ignition switch OFF once. Wait at least 10 seconds and then turn it ON (engine stopped) again.
- If the DTC is not for A/T related items (see EC-136, "DTC Index"), skip step 1.

1. Erase DTC in TCM. Refer to TM-316, "Diagnosis Description".
2. Select “ENGINE” with CONSULT.
3. Select “SELF-DIAG RESULTS”.
4. Touch “ERASE”. (DTC in ECM will be erased.)

Freeze Frame Data and 1st Trip Freeze Frame Data

Freeze frame data item*	Description
DIAG TROUBLE CODE [PXXXX]	• The engine control component part/control system has a trouble code the is displayed as PXXXX. (Refer to EC-136, "DTC Index".)
CAL/LD VALUE [%]	• The calculated load value at the moment a malfunction is detected is displayed.
COOLANT TEMP [°C] or [°F]	• The engine coolant temperature at the moment a malfunction is detected is displayed.
L-FUEL TRM-B1 [%] L-FUEL TRM-B2 [%]	• “Long-term fuel trim” at the moment a malfunction is detected is displayed. • The long-term fuel trim indicates much more gradual feedback compensation to the base fuel schedule than short-term fuel trim.
S-FUEL TRM-B1 [%] S-FUEL TRM-B2 [%]	• “Short-term fuel trim” at the moment a malfunction is detected is displayed. • The short-term fuel trim indicates dynamic or instantaneous feedback compensation to the base fuel schedule.
ENGINE SPEED [rpm]	• The engine speed at the moment a malfunction is detected is displayed.
VEHICL SPEED [km/h] or [mph]	• The vehicle speed at the moment a malfunction is detected is displayed.
INT MANI PRES [kPa]	• These items are displayed but are not applicable to this model.
ABSOL TH·P/S [%]	• The throttle valve opening angle at the moment a malfunction is detected is displayed.
B/FUEL SCHDL [msec]	• The base fuel schedule at the moment a malfunction is detected is displayed.
INT/A TEMP SE [°C] or [°F]	• The intake air temperature at the moment a malfunction is detected is displayed.
FUEL SYS-B1 FUEL SYS-B2	• “Fuel injection system status” at the moment a malfunction is detected is displayed. • One of the following mode is displayed. Mode2: Open loop due to detected system malfunction Mode3: Open loop due to driving conditions (power enrichment, deceleration enleanment) Mode4: Closed loop - using oxygen sensor(s) as feedback for fuel control Mode5: Open loop - has not yet satisfied condition to go to closed loop
COMBUST CONDITION	• These items are displayed but are not applicable to this model.
FUEL RAIL PRESSURE [MPa]	• The fuel rail pressure at the moment a malfunction is detected is displayed.
TARGET FUEL RAIL PRESSURE [MPa]	• The target fuel rail pressure at the moment a malfunction is detected is displayed.
BATTERY VOLTAGE [V]	• The battery voltage at the moment a malfunction is detected is displayed.
FUEL LEVEL [%]	• The fuel level at the moment a malfunction is detected is displayed.

*: The items are the same as those of 1st trip freeze frame data.

DATA MONITOR MODE

NOTE:

The following table includes information (items) inapplicable to this vehicle. For information (items) applicable to this vehicle, refer to CONSULT display items.

Monitored Item

For reference values of the following items, refer to EC-107, "Reference Value".

×: Applicable

Monitored item	Unit	Description	Remarks
ENG SPEED	rpm	• Indicates the engine speed computed from the signal of the crankshaft position sensor and camshaft position sensor.	• Accuracy becomes poor if engine speed drops below the idle rpm. • If the signal is interrupted while the engine is running, an abnormal value may be indicated.
MAS A/F SE-B1	V	• The signal voltage of the mass air flow sensor is displayed.	• When the engine is stopped, a certain value is indicated. • When engine is running, specification range is indicated in “SPEC”.
B/FUEL SCHDL	ms	• “Base fuel schedule” indicates the fuel injection pulse width programmed into ECM, prior to any learned on board correction.	• When engine is running, specification range is indicated in “SPEC”.
A/F ALPHA-B1 A/F ALPHA-B2	%	• The mean value of the air-fuel ratio feedback correction factor per cycle is indicated.	• When the engine is stopped, a certain value is indicated. • This data also includes the data for the air-fuel ratio learning control. • When engine is running, specification range is indicated in “SPEC”.
COOLAN TEMP/S	°C or °F	• The engine coolant temperature (determined by the signal voltage of the engine coolant temperature sensor 1) is displayed.	• When the engine coolant temperature sensor 1 is open or short-circuited, ECM enters fail-safe mode. The engine coolant temperature determined by the ECM is displayed.
A/F SEN1 (B1) A/F SEN1 (B2)	V	• The A/F signal computed from the input signal of the air fuel ratio (A/F) sensor 1 is displayed.	
HO2S2 (B1) HO2S2 (B2)	V	• The signal voltage of the heated oxygen sensor 2 is displayed.	
HO2S2 MNTR (B1) HO2S2 MNTR (B2)	RICH/LEAN	• Display of heated oxygen sensor 2 signal: RICH: means the amount of oxygen after three way catalyst is relatively small. LEAN: means the amount of oxygen after three way catalyst is relatively large.	• When the engine is stopped, a certain value is indicated.
VHCL SPEED SE	km/h or mph	• The vehicle speed computed from the vehicle speed signal sent from combination meter is displayed.	
BATTERY VOLT	V	• The power supply voltage of ECM is displayed.	
ACCEL SEN 1 ACCEL SEN 2	V	• The accelerator pedal position sensor signal voltage is displayed.	• ACCEL SEN 2 signal is converted by ECM internally. Thus, they differs from ECM terminal voltage signal.
TP SEN 1-B1 TP SEN 2-B1	V	• The throttle position sensor signal voltage is displayed.	• TP SEN 2-B1 signal is converted by ECM internally. Thus, they differs from ECM terminal voltage signal.
FUEL T/TMP SE	°C or °F	• The fuel temperature (determined by the signal voltage of the fuel tank temperature sensor) is displayed.	
EVAP SYS PRES	V	• The signal voltage of EVAP control system pressure sensor is displayed.	

Monitored item	Unit	Description	Remarks
FUEL LEVEL SE	V	• The signal voltage of the fuel level sensor is displayed.	
START SIGNAL	ON/OFF	• Indicates start signal status [ON/OFF] computed by the ECM according to the signals of engine speed and battery voltage.	• After starting the engine, [OFF] is displayed regardless of the starter signal.
CLSD THL POS	ON/OFF	• Indicates idle position [ON/OFF] computed by ECM according to the accelerator pedal position sensor signal.	
AIR COND SIG	ON/OFF	• Indicates [ON/OFF] condition of the air conditioner switch as determined by the air conditioner signal.	
PW/ST SIGNAL	ON/OFF	• [ON/OFF] condition of the power steering system (determined by the signal voltage of the power steering pressure sensor signal) is indicated.	
LOAD SIGNAL	ON/OFF	• Indicates [ON/OFF] condition from the electrical load signal. ON: Rear window defogger switch is ON and/or lighting switch is in 2nd position. OFF: Both rear window defogger switch and lighting switch are OFF.	
IGNITION SW	ON/OFF	• Indicates [ON/OFF] condition from ignition switch signal.	
HEATER FAN SW	ON/OFF	• Indicates [ON/OFF] condition from the blower fan ON signal.	
BRAKE SW	ON/OFF	• Indicates [ON/OFF] condition from the stop lamp switch signal.	
IGN TIMING	BTDC	• Indicates the ignition timing computed by ECM according to the input signals.	• When the engine is stopped, a certain value is indicated.
COMBUSTION	—	• These items are displayed but are not applicable to this model.	
CAL/LD VALUE	%	• “Calculated load value” indicates the value of the current air flow divided by peak air flow.	
MASS AIRFLOW	g/s	• Indicates the mass air flow computed by ECM according to the signal voltage of the mass air flow sensor.	
PURG VOL C/V	%	• Indicates the EVAP canister purge volume control solenoid valve control value computed by the ECM according to the input signals. • The opening becomes larger as the value increases.	
INT/V SOL (B1)	%	• The control value of the intake valve timing control solenoid valve (determined by ECM according to the input signals) is indicated. • The advance angle becomes larger as the value increases.	
INT/V SOL (B2)			
AIR COND RLY	ON/OFF	• The air conditioner relay control condition (determined by ECM according to the input signals) is indicated.	
VENT CONT/V	ON/OFF	• The control condition of the EVAP canister vent control valve (determined by ECM according to the input signals) is indicated. ON: Closed OFF: Open	
THRTL RELAY	ON/OFF	• Indicates the throttle control motor relay control condition determined by the ECM according to the input signals.	

Monitored item	Unit	Description	Remarks
A/F S1 HTR (B1)	%	• Air fuel ratio (A/F) sensor 1 heater control value computed by ECM according to the input signals. • The current flow to the heater becomes larger as the value increases.	
A/F S1 HTR (B2)			
HO2S2 HTR (B1)	ON/OFF	• Indicates [ON/OFF] condition of heated oxygen sensor 2 heater determined by ECM according to the input signals.	
HO2S2 HTR (B2)			
ALT DUTY SIG	ON/OFF	• The control condition of the power generation voltage variable control (determined by ECM according to the input signals) is indicated. ON: Power generation voltage variable control is active. OFF: Power generation voltage variable control is inactive.	
I/P PULLY SPD	rpm	• Indicates the engine speed computed from the input speed sensor signal.	
VEHICLE SPEED	km/h or mph	• The vehicle speed computed from the vehicle speed signal sent from TCM is displayed.	
IDL A/V LEARN	YET/CMPLT	• Displays the condition of Idle Air Volume Learning YET: Idle air volume learning has not been performed yet. CMPLT: Idle air volume learning has already been performed successfully.	
TRVL AFTER MIL	km or mile	• Distance traveled while MIL is activated.	
SNOW MODE SW	ON/OFF	• Indicates [ON/OFF] condition from the snow mode switch signal.	
ENG OIL TEMP	°C or °F	• The engine oil temperature (determined by the signal voltage of the engine oil temperature sensor) is displayed.	
MAIN SW	ON/OFF	• Indicates [ON/OFF] condition from MAIN switch signal.	
CANCEL SW	ON/OFF	• Indicates [ON/OFF] condition from CANCEL switch signal.	
RESUME/ACC SW	ON/OFF	• Indicates [ON/OFF] condition from ACCELERATE/RESUME switch signal.	
SET SW	ON/OFF	• Indicates [ON/OFF] condition from COAST/SET switch signal.	
BRAKE SW1	ON/OFF	• Indicates [ON/OFF] condition from brake pedal position switch signal.	
BRAKE SW2	ON/OFF	• Indicates [ON/OFF] condition of stop lamp switch signal.	
DIST SW	ON/OFF	• Indicates [ON/OFF] condition from DISTANCE switch signal.	
CRUISE LAMP	ON/OFF	• Indicates [ON/OFF] condition of CRUISE indicator determined by the ECM according to the input signals.	
AC EVA TEMP	°C or °F	• Indicates A/C evaporator temperature sent from A/C auto amp.	
AC EVA TARGET	°C or °F	• Indicates target A/C evaporator temperature sent from A/C auto amp.	
FAN DUTY	%	• Indicates a command value for cooling fan. The value is calculated by ECM based on input signals.	
ALT DUTY	%	• Indicates the duty ratio of the power generation command value. The ratio is calculated by ECM based on the battery current sensor signal.	

Monitored item	Unit	Description	Remarks
BAT CUR SEN	mV	• The signal voltage of battery current sensor is displayed.	
A/F ADJ-B1	—	• Indicates the correction of a factor stored in ECM. The factor is calculated from the difference between the target air-fuel ratio stored in ECM and the air-fuel ratio calculated from A/F sensor 1 signal.	
A/F ADJ-B2			
P/N POSI SW	ON/OFF	• Indicates [ON/OFF] condition from the park/neutral position (PNP) signal.	
INT/A TEMP SE	°C or °F	• The intake air temperature (determined by the signal voltage of the intake air temperature sensor) is indicated.	
AC PRESS SEN	V	• The signal voltage from the refrigerant pressure sensor is displayed.	
FUEL PRES SEN	MPa	• Indicates the fuel rail pressure computed by ECM according to the input signals	
FUEL INJ B1	msec	• ECM-calculated injection pulse width of the fuel injector on the Bank 1 side.	
FUEL INJ B2	msec	• ECM-calculated injection pulse width of the fuel injector on the Bank 2 side.	
INT/V TIM (B1)	°CA	• Indicates [°CA] of intake camshaft advance angle.	
INT/V TIM (B2)			
MAP SENSOR	V	• The signal voltage from the manifold absolute pressure (MAP) sensor is displayed.	
EVAP LEAK DIAG	YET/CMPLT	• Indicates the condition of EVAP leak diagnosis. YET: EVAP leak diagnosis has not been performed yet. CMPLT: EVAP leak diagnosis has been performed successfully.	
EVAP DIAG READY	ON/OFF	• Indicates the ready condition of EVAP leak diagnosis. ON: Diagnosis has been ready condition. OFF: Diagnosis has not been ready condition.	
VVEL LEARN	YET/DONE	• Display the condition of VVEL learning YET: VVEL learning has not been performed yet. DONE: VVEL learning has already been performed successfully.	
VVEL SEN LEARN-B1	V	• Indicates the VVEL learning value.	
VVEL SEN LEARN-B2			
VVEL POSITION SEN-B1	V	• The VVEL control shaft position sensor signal voltage is displayed.	
VVEL POSITION SEN-B2			
VVEL TIM-B1	deg	• Indicates [deg] of VVEL control shaft angle.	
VVEL TIM-B2			
FPCM	HI/MID/LOW/OFF	• The control condition of the fuel pump control module (FPCM) (determined by ECM according to the input signals) is indicated.	
BAT TEMP SEN	V	• The signal voltage from the battery temperature sensor is displayed.	
COOLING FAN SPD	rpm	• Displays a cooling fan speed from a signal of fan clutch assembly.	
THRTL STK CNT B1*	—	—	

Monitored item	Unit	Description	Remarks
HO2 S2 DIAG1(B1)	INCMP/CMPLT	• Indicates DTC P0139 self-diagnosis (delayed response) condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
HO2 S2 DIAG1(B2)	INCMP/CMPLT	• Indicates DTC P0159 self-diagnosis (delayed response) condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
HO2 S2 DIAG2(B1)	INCMP/CMPLT	• Indicates DTC P0139 self-diagnosis (slow response) condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
HO2 S2 DIAG2(B2)	INCMP/CMPLT	• Indicates DTC P0159 self-diagnosis (slow response) condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
FUEL INJ TIMG	deg	• Indicates the fuel injection timing computed by ECM according to the input signals.	
H/P FUEL PUMP DEG	deg	• Displays ECM-calculated fuel discharge position of the high pressure fuel pump.	
FUEL PRES SEN V	mV	• The signal voltage of FRP sensor is displayed.	
L/FUEL PRES SEN	MPa	• Displays a pressure value calculated from a low fuel pressure sensor voltage.	
L/FUEL PRES SEN V	mV	• The signal voltage of low fuel pressure sensor is displayed.	
ECM TEMP 1	°C or °F	• Displays a temperature calculated from a signal of ECM temperature sensor 1.	
ECM TEMP 2	°C or °F	• Displays a temperature calculated from a signal of ECM temperature sensor 2.	
FUEL PUMP DUTY	%	• The control condition of the fuel pump control module (FPCM) (determined by ECM according to the input signals) is indicated.	
A/F SEN1 DIAG1 (B1)	INCMP/CMPLT	• Indicates DTC P015A or P015B self-diagnosis condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
A/F SEN1 DIAG1 (B2)	INCMP/CMPLT	• Indicates DTC P015C or P015D self-diagnosis condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
A/F SEN1 DIAG2 (B1)	INCMP/CMPLT	• Indicates DTC P014C or P014D self-diagnosis condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
A/F SEN1 DIAG2 (B2)	INCMP/CMPLT	• Indicates DTC P014E or P014F self-diagnosis condition. INCMP: Self-diagnosis is incomplete. CMPLT: Self-diagnosis is complete.	
A/F SEN1 DIAG3 (B1)	ABSNT/PRSNT	• Indicates DTC P014C, P014D, P015A or P015B self-diagnosis condition. ABSNT: The vehicle condition is not within the diagnosis range. PRSNT: The vehicle condition is within the diagnosis range.	

Monitored item	Unit	Description	Remarks
A/F SEN1 DIAG3 (B2)	ABSNT/ PRSNT	• Indicates DTC P014E, P014F, P015C or P015D self-diagnosis condition. ABSNT: The vehicle condition is not within the diagnosis range. PRSNT: The vehicle condition is within the diagnosis range.	
SYSTEM 1 DIAGNOSIS A B1	INCMP/CMPLT	• Indicates DTC P219A self-diagnosis condition. - INCMP: Self-diagnosis is incomplete. - CMPLT: Self-diagnosis is complete.	
SYSTEM 1 DIAGNOSIS A B2	INCMP/CMPLT	• Indicates DTC P219B self-diagnosis condition. - INCMP: Self-diagnosis is incomplete. - CMPLT: Self-diagnosis is complete.	
SYSTEM 1 DIAGNOSIS B B1	ABSNT/ PRSNT	• Indicates DTC P219A self-diagnosis condition. - ABSNT: Self-diagnosis standby - PRSNT: Under self-diagnosis	
SYSTEM 1 DIAGNOSIS B B2	ABSNT/ PRSNT	• Indicates DTC P219B self-diagnosis condition. - ABSNT: Self-diagnosis standby - PRSNT: Under self-diagnosis	
A/F-S ATMSPHRC CRCT B1	—	• Displays a determined value of atmospheric correction factor necessary for correcting an A/F sensor signal input to ECM. The signal used for the correction is an A/F sensor signal transmitted while driving under atmospheric pressure.	
A/F-S ATMSPHRC CRCT B2	—	• Displays a determined value of atmospheric correction factor necessary for correcting an A/F sensor signal input to ECM. The signal used for the correction is an A/F sensor signal transmitted while driving under atmospheric pressure.	
A/F-S ATMSPHRC CRCT UP B1	count	• Displays the number of updates of the A/F sensor atmospheric correction factor.	
A/F-S ATMSPHRC CRCT UP B2	count	• Displays the number of updates of the A/F sensor atmospheric correction factor.	
EXH/V TIM B1	°CA	• Indicates [°CA] of exhaust camshaft retard angle.	
EXH/V TIM B2			
EXH V/T LEARN	YET/CMPLT	• Display the condition of Exhaust Valve Timing Control Learning YET: Exhaust Valve Timing Control Learning has not been performed yet. CMPLT: Exhaust Valve Timing Control Learning has already been performed successfully.	
EXHAUST GAS TEMP SEN 1 B1	mV	• The signal voltage of exhaust gas temperature sensor (bank 1) is displayed.	
EXHAUST GAS TEMP SEN 1 B2	mV	• The signal voltage of exhaust gas temperature sensor (bank 2) is displayed.	
EOP SENSOR	mV	• The signal voltage of engine oil pressure sensor is displayed.	
RADIATOR COOLANT TEMP	°C or °F	Description: The radiator coolant temperature (determined by the signal voltage of the radiator coolant temperature sensor) is displayed.	
ENGINE COOLANT B/V POSI	deg	Description: The Multi-way Control Valve position detected by the position sensor is displayed.	
A/F IMBALNC DIAG-CPS STAT	ABSNT/ PRSNT	• Indicates DTC P219C - P219F and P21A0 - P21A3 self-diagnosis condition. ABSNT: The vehicle condition is not within the diagnosis range. PRSNT: The vehicle condition is within the diagnosis range.	

Monitored item	Unit	Description	Remarks
A/F IMBALNC DIAG-CPS CMPLT	INCMP/CMPLT	• Indicates DTC P219C - P219F and P21A0 - P21A3 self-diagnosis condition. - INCMP: Self-diagnosis is incomplete. - CMPLT: Self-diagnosis is complete.	
A/GRLL SHTTR POSITION	F/CLOSE MOVING F/OPEN UNIDTF	Indicates the status of active grille shutter. • F/CLOSE: Active grille shutter is fully closed. • MOVING: Active grille shutter is in motion. • F/OPEN: Active grille shutter is fully opened. • UNIDTF: Unable to specify the shutter position.	
A/GRLL SHTTR CALIBRATION	INCMP/CMPLT	• Indicates initial position learning status of active grille shutter. - CMPLT: The leaning is complete. - INCOMP: The learning is incomplete.	
A/GRLL SHTTR CIRCUIT DIAG	OK/NG	• Indicates the diagnosis result of active grille shutter circuit. - OK: Normal. - NG: Malfunction detected.	
A/GRLL SHTTR TEMP DIAG	OK/NG	• Indicates the diagnosis result of active grille shutter actuator temperature status. - OK: Normal - NG: Abnormal temperature detected.	
A/GRLL SHTTR VOLT DIAG	OK/NG	• Indicates the diagnosis result of active grille shutter actuator voltage status. - OK: Normal - NG: Abnormal temperature detected.	
A/GRLL SHTTR OVER RUN	OK/NG	• Indicates active grille shutter moves beyond normal moving limit. - OK: Normal - NG: Malfunction detected.	
A/GRLL SHTTR STUCK	OK/NG	• Indicates the diagnosis result of active grille shutter stuck or the operation range less than normal. - OK: Normal - NG: Malfunction detected.	
A/GRLL SHTTR CALIB DIAG	OK/NG	• Indicates the diagnosis result of initial position learning of active grille shutter. - OK: Normal - NG: Deficiency detected.	

*: The item is indicated, but not used.

NOTE:

Any monitored item that does not match the vehicle being diagnosed is deleted from the display automatically.

WORK SUPPORT MODE

Work Item

WORK ITEM	CONDITION	USAGE
IDLE AIR VOL LEARN	• THE IDLE AIR VOLUME THAT KEEPS THE ENGINE WITHIN THE SPECIFIED RANGE IS MEMORIZED IN ECM.	When learning the idle air volume
EVAP SYSTEM CLOSE	CLOSE THE EVAP CANISTER VENT CONTROL VALVE IN ORDER TO MAKE EVAP SYSTEM CLOSE UNDER THE FOLLOWING CONDITIONS. • IGN SW ON • ENGINE NOT RUNNING • AMBIENT TEMPERATURE IS ABOVE 0°C (32°F). • NO VACUUM AND NO HIGH PRESSURE IN EVAP SYSTEM • FUEL TANK TEMP. IS MORE THAN 0°C (32°F). • WITHIN 10 MINUTES AFTER STARTING “EVAP SYSTEM CLOSE” • WHEN TRYING TO EXECUTE “EVAP SYSTEM CLOSE” UNDER THE CONDITION EXCEPT ABOVE, CONSULT WILL DISCONTINUE IT AND DISPLAY APPROPRIATE INSTRUCTION. **NOTE:** **WHEN STARTING ENGINE, CONSULT MAY DISPLAY “BATTERY VOLTAGE IS LOW. CHARGE BATTERY”, EVEN WHEN USING A CHARGED BATTERY.**	When detecting EVAP vapor leak in the EVAP system
FUEL PRESSURE RELEASE	• FUEL PUMP WILL STOP BY TOUCHING “START” DURING IDLING. CRANK A FEW TIMES AFTER ENGINE STALLS.	When releasing fuel pressure from fuel line
SELF-LEARNING CONT	• THE COEFFICIENT OF SELF-LEARNING CONTROL MIXTURE RATIO RETURNS TO THE ORIGINAL COEFFICIENT.	When clearing mixture ratio self-learning value
TARGET IDLE RPM ADJ*	• IDLE CONDITION	When setting target idle speed
VIN REGISTRATION	• IN THIS MODE, VIN IS REGISTERED IN ECM.	When registering VIN in ECM
TARGET IGN TIM ADJ*	• IDLE CONDITION	When adjusting target ignition timing
CLSD THL POS LEARN	• IGNITION ON AND ENGINE STOPPED.	When learning the throttle valve closed position
VVEL POS SEN ADJ PREP	• USE THIS ITEM ONLY WHEN REPLACING VVEL ACTUATOR SUB ASSEMBLY. • IGNITION ON AND ENGINE STOPPED.	When adjusting VVEL control shaft position sensor
SAVING DATA FOR REPLC CPU	In this mode, save data that is in ECM.	When ECM is replaced.
WRITING DATA FOR REPLC CPU	In this mode, write data stored by “SAVE DATA FOR CPU REPLC” in work support mode to ECM.	When ECM is replaced.
ENGINE COOLANT BYPASS VALVE	Condition: The valve is in the full opening position	When filing with coolant.

*: This function is not necessary in the usual service procedure.

ACTIVE TEST MODE

Test Item

TEST ITEM	CONDITION	JUDGMENT	CHECK ITEM (REMEDY)
VENT CONTROL/V	• Ignition switch: ON (Engine stopped) • Turn solenoid valve ON and OFF with the CONSULT and listen to operating sound.	Solenoid valve makes an operating sound.	• Harness and connectors • Solenoid valve
ENG COOLANT TEMP	• Engine: Return to the original non-standard condition • Change the engine coolant temperature using CONSULT.	If malfunctioning symptom disappears, see CHECK ITEM.	• Harness and connectors • Engine coolant temperature sensor 1 • Fuel injector

TEST ITEM	CONDITION	JUDGMENT	CHECK ITEM (REMEDY)
FUEL INJECTION	• Engine: Return to the original non-standard condition • Change the amount of fuel injection using CONSULT.	If malfunctioning symptom disappears, see CHECK ITEM.	• Harness and connectors • Fuel injector • Air fuel ratio (A/F) sensor 1
FUEL/T TEMP SEN	• Change the fuel tank temperature using CONSULT.		
PURG VOL CONT/V	• Engine: After warming up, run engine at 1,500 rpm. • Change the EVAP canister purge volume control solenoid valve opening percent using CONSULT.	Engine speed changes according to the opening percent.	• Harness and connectors • Solenoid valve
FAN DUTY CONTROL*	• Ignition switch: ON • Change duty ratio using CONSULT.	Cooling fan speed changes.	• Harness and connectors • Cooling fan motor • Cooling fan relay • Cooling fan control module • IPDM E/R
ALTERNATOR DUTY	• Engine: Idle • Change duty ratio using CONSULT.	Battery voltage changes.	• Harness and connectors • IPDM E/R • Alternator
EXH V/T ASSIGN ANGLE	• Engine: Return to the original non-standard condition • Change exhaust valve timing using CONSULT.	If malfunctioning symptom disappears, see CHECK ITEM.	• Harness and connectors • Exhaust valve timing control magnet retarder
POWER BALANCE	• Engine: After warming up, idle the engine. • A/C switch OFF • Selector lever: P or N • Cut off each injector signal one at a time using CONSULT.	Engine runs rough or stops.	• Harness and connectors • Compression • Fuel injector • Power transistor • Spark plug • Ignition coil
IGNITION TIMING	• Engine: Return to the original non-standard condition • Timing light: Set • Retard the ignition timing using CONSULT.	If malfunctioning symptom disappears, see CHECK ITEM.	• Perform Idle Air Volume Learning.
V/T ASSIGN ANGLE	• Engine: Return to the original non-standard condition • Change intake valve timing using CONSULT.	If malfunctioning symptom disappears, see CHECK ITEM.	• Harness and connectors • Intake valve timing control solenoid valve
FPCM	• Engine: Return to the original trouble condition • Select “LOW”, “MID” and “HI” with CONSULT.	Fuel pump speed changes or stops.	• Harness and connectors • Fuel pump control module (FPCM)
ACTIVE GRILLE SHUTTER	**NOTE:** Initial position learning is required every time when the ignition switch is turned OFF. 1. Engine: Idle speed 2. Touch “CALIBRTN” to perform initial position learning. 3. Touch “OPEN” or “CLOSE” to operate active grille shutter.	Active grille shutter fully opens or fully closes.	• Harness or connector • Active grille shutter actuator • Active grille shutter

*: Leaving cooling fan OFF with CONSULT while engine is running may cause the engine to overheat.

DTC WORK SUPPORT MODE

Test mode	Test item	Corresponding DTC No.	Reference page
HO2S2	HO2S2 (B1) P1146	P0138	EC-352, "DTC Description"
	HO2S2 (B1) P1147	P0137	EC-346, "DTC Description"
	HO2S2 (B1) P0139	P0139	EC-360, "DTC Description"
	HO2S2 (B2) P1166	P0158	EC-352, "DTC Description"
	HO2S2 (B2) P1167	P0157	EC-346, "DTC Description"
	HO2S2 (B2) P0159	P0159	EC-360, "DTC Description"
A/F SEN1	A/F SEN1 (B1) P1278/P1279	—	
	A/F SEN1 (B1) P1276	P0130	EC-336, "DTC Description"
	A/F SEN1 (B2) P1288/P1289	—	
	A/F SEN1 (B2) P1286	P0150	EC-336, "DTC Description"
EVAPORATIVE SYSTEM	EVP V/S LEAK P0456/P1456*	P0456	EC-464, "DTC Description"
	PURG VOL CN/V P1444	P0443	EC-437, "DTC Description"
	PURG FLOW P0441	P0441	EC-431, "DTC Description"

*: DTC P1456 does not apply but appears in DTC Work Support Mode screens.

SRT & P-DTC MODE

SRT STATUS Mode

- For items whose SRT codes are set, “CMPLT” is displayed on the CONSULT screen; for items whose SRT codes are not set, “INCMP” is displayed.
- “SRT STATUS” provides the presence or absence of permanent DTCs stored in ECM memory.

PERMANENT DTC STATUS Mode

How to display permanent DTC status

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select “PERMANENT DTC STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
   NOTE:
   Permanent DTCs stored in ECM memory are displayed on the CONSULT screen to show if a driving pattern required for erasing permanent DTCs is complete (CMPLT) or incomplete (INCMP).
   CAUTION:

Since the "PERMANENT DTC STATUS" screen displays the previous trip information, repeat the following twice to update the information: "Ignition switch OFF", "Wait for more than 10 seconds" and "Ignition switch ON".

PERMANENT DTC & SRT CONFIRMATION : PERMANENT DTC STATUS

CAUTION:
Turn ignition switch from ON to OFF twice to update the information on the status screen.

PERMANENT DTC	DRIVING PATTERN B	DRIVING PATTERN D
XXXX	INCMP	INCMP
XXXX	CMPLT	INCMP
XXXX	INCMP	CMPLT
XXXX	CMPLT	INCMP
XXXX	INCMP	INCMP
XXXX	INCMP	INCMP

The previous trip information is displayed.

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NOTE:
This mode is not used in regions that permanent DTCs are not regulated by law.

SRT WORK SUPPORT Mode
This mode enables a technician to drive a vehicle to set the SRT while monitoring the SRT status.

PERMANENT DTC WORK SUPPORT Mode
This mode enables a technician to drive a vehicle to complete the driving pattern that is required for erasing permanent DTC.
NOTE:
This mode is not used in regions that permanent DTCs are not regulated by law.

ECU DIAGNOSIS INFORMATION

ECM

Reference Value

INFOID:0000000014419425

VALUES ON THE DIAGNOSIS TOOL

NOTE:

- The following table includes information (items) inapplicable to this vehicle. For information (items) applicable to this vehicle, refer to CONSULT display items.
- Numerical values in the following table are reference values.
- These values are input/output values that ECM receives/transmits and may differ from actual operations.
  Example:
  The ignition timing shown by the timing light may differ from the ignition timing displayed on the data monitor. This occurs because the timing light shows a value calculated by ECM according to signals received from the cam shaft position sensor and other sensors related to ignition timing.

For outlines of following items, refer to EC-94, "CONSULT Function".

CONSULT MONITOR ITEM

Monitor Item	Condition		Values/Status
ENG SPEED	• Run engine and compare CONSULT value with the tachometer indication.		Almost the same speed as the tachometer indication
MAS A/F SE-B1	See EC-220, "Description".		
B/FUEL SCHDL	See EC-220, "Description".		
A/F ALPHA-B1	See EC-220, "Description".		
A/F ALPHA-B2	See EC-220, "Description".		
COOLANT TEMP/S	• Ignition switch: ON		Indicates engine coolant temperature
A/F SEN1 (B1)	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	Fluctuates around 2.2 V
A/F SEN1 (B2)	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	Fluctuates around 2.2 V
HO2S2 (B1)	• Revving engine from idle up to 3,000 rpm quickly after the following conditions are met. - Engine: After warming up - After keeping engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load		0 - 0.3 V ⇔ Approx. 0.6 - 1.0 V
HO2S2 (B2)	• Revving engine from idle up to 3,000 rpm quickly after the following conditions are met. - Engine: After warming up - After keeping engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load		0 - 0.3 V ⇔ Approx. 0.6 - 1.0 V
HO2S2 MNTR (B1)	• Revving engine from idle up to 3,000 rpm quickly after the following conditions are met. - Engine: After warming up - After keeping engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load		LEAN ⇔ RICH
HO2S2 MNTR (B2)	• Revving engine from idle up to 3,000 rpm quickly after the following conditions are met. - Engine: After warming up - After keeping engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load		LEAN ⇔ RICH
VHCL SPEED SE	• Turn drive wheels and compare CONSULT value with the speedometer indication.		Almost the same speed as speedometer indication
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14 V
ACCEL SEN 1	• Ignition switch: ON (Engine stopped)	Accelerator pedal: Fully released	0.5 - 1.0 V
		Accelerator pedal: Fully depressed	4.2 - 4.8 V

Monitor Item	Condition		Values/Status
ACCEL SEN 2*1	• Ignition switch: ON (Engine stopped)	Accelerator pedal: Fully released	0.5 - 1.0 V
		Accelerator pedal: Fully depressed	4.2 - 4.8 V
TP SEN 1-B1	• Ignition switch: ON (Engine stopped) • Selector lever: D position	Accelerator pedal: Fully released	More than 0.36 V
		Accelerator pedal: Fully depressed	Less than 4.75 V
TP SEN 2-B1*1	• Ignition switch: ON (Engine stopped) • Selector lever: D position	Accelerator pedal: Fully released	More than 0.36 V
		Accelerator pedal: Fully depressed	Less than 4.75 V
FUEL T/TMP SE	• Ignition switch: ON		Indicates fuel tank temperature
EVAP SYS PRES	• Ignition switch: ON		Approx. 1.8 - 4.8 V
FUEL LEVEL SE	• Ignition switch: ON		Depending on fuel level of fuel tank
START SIGNAL	• Ignition switch: ON → START → ON		OFF → ON → OFF
CLSD THL POS	• Ignition switch: ON (Engine stopped)	Accelerator pedal: Fully released	ON
		Accelerator pedal: Slightly depressed	OFF
AIR COND SIG	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	OFF
		Air conditioner switch: ON (Compressor operates.)	ON
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel: Not being turned	OFF
		Steering wheel: Being turned	ON
LOAD SIGNAL	• Ignition switch: ON	Rear window defogger switch: ON and/or Lighting switch: 2nd position	ON
		Rear window defogger switch and lighting switch: OFF	OFF
IGNITION SW	• Ignition switch: ON → OFF → ON		ON → OFF → ON
HEATER FAN SW	• Engine: After warming up, idle the engine	Heater fan switch: ON	ON
		Heater fan switch: OFF	OFF
BRAKE SW	• Ignition switch: ON	Brake pedal: Fully released	OFF
		Brake pedal: Slightly depressed	ON
IGN TIMING	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	1 - 4°BTDC
		2,000 rpm	25 - 45°BTDC
COMBUSTION	—		These items are displayed but are not applicable to this model.
CAL/LD VALUE	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	5 - 35%
		2,500 rpm	5 - 35%
MASS AIRFLOW	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	2.0 - 6.0 g/s
		2,500 rpm	7.0 - 20.0 g/s
PURG VOL C/V	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle (Accelerator pedal: Not depressed even slightly, after engine starting.)	0%
		2,000 rpm	5%

Monitor Item	Condition		Values/Status
INT/V SOL (B1)	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	0 - 2%
		2,000 rpm	Approx. 0 - 50%
INT/V SOL (B2)	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	0 - 2%
		2,000 rpm	Approx. 0 - 50%
AIR COND RLY	• Engine: After warming up, idle the engine	A/C switch: OFF	OFF
		A/C switch: ON (Compressor operates)	ON
VENT CONT/V	• Ignition switch: ON		OFF
THRTL RELAY	• Ignition switch: ON		ON
A/F S1 HTR (B1)	• Engine: After warming up, idle the engine (More than 140 seconds after starting engine)		4 - 100%
A/F S1 HTR (B2)	• Engine: After warming up, idle the engine (More than 140 seconds after starting engine)		4 - 100%
HO2S2 HTR (B1)	• Engine speed: Below 3,600 rpm after the following conditions are met. - Engine: After warming up - Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load		ON
	• Engine speed: Above 3,600 rpm		OFF
HO2S2 HTR (B2)	• Engine speed: Below 3,600 rpm after the following conditions are met. - Engine: After warming up - Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load		ON
	• Engine speed: Above 3,600 rpm		OFF
ALT DUTY SIG	• Power generation voltage variable control: Operating		ON
	• Power generation voltage variable control: Not operating		OFF
I/P PULLY SPD	• Vehicle speed: More than 20 km/h (12 MPH)		Almost the same speed as the tachometer indication
VEHICLE SPEED	• Turn drive wheels and compare CONSULT value with the speedometer indication.		Almost the same speed as the speedometer indication
IDL A/V LEARN	• Engine: Running	Idle air volume learning has not been performed yet.	YET
		Idle air volume learning has already been performed successfully.	CMPLT
TRVL AFTER MIL	• Ignition switch: ON	Vehicle has traveled after MIL has illuminated.	0 - 65,535 km (0 - 40,723 miles)
SNOW MODE SW	• Ignition switch: ON	Snow mode switch: ON	ON
		Snow mode switch: OFF	OFF
ENG OIL TEMP	• Engine: After warming up		More than 70°C (158°F)
MAIN SW	• Ignition switch: ON	MAIN switch: Pressed	ON
		MAIN switch: Released	OFF
CANCEL SW	• Ignition switch: ON	CANCEL switch: Pressed	ON
		CANCEL switch: Released	OFF
RESUME/ACC SW	• Ignition switch: ON	ACCELERATE/RESUME switch: Pressed	ON
		ACCELERATE/RESUME switch: Released	OFF

Monitor Item	Condition		Values/Status
SET SW	• Ignition switch: ON	COAST/SET switch: Pressed	ON
		COAST/SET switch: Released	OFF
BRAKE SW1 (Brake pedal position switch)	• Ignition switch: ON	Brake pedal: Fully released	ON
		Brake pedal: Slightly depressed	OFF
BRAKE SW2 (Stop lamp switch)	• Ignition switch: ON	Brake pedal: Fully released	OFF
		Brake pedal: Slightly depressed	ON
DIST SW	• Ignition switch: ON	DISTANCE switch: Pressed	ON
		DISTANCE switch: Released	OFF
CRUISE LAMP	• Ignition switch: ON	MAIN switch: Pressed at the 1st time → at the 2nd time	ON → OFF
AC EVA TEMP	• Engine: Running		Indicates A/C evaporator temperature sent from “unified meter and A/C amp.”.
AC EVA TARGET	• Engine: Running		Indicates target A/C evaporator temperature sent from “unified meter and A/C amp.”.
FAN DUTY	• Engine: Running		0 - 100%
ALT DUTY	• Engine: Idle		0 - 80%
BAT CUR SEN	• Engine speed: Idle • Battery: Fully charged*2 • Selector lever: P or N position • A/C switch: OFF • No load		Approx. 2,600 - 3,500 mV
A/F ADJ-B1	• Engine: Running		−0.330 - 0.330
A/F ADJ-B2	• Engine: Running		−0.330 - 0.330
P/N POSI SW	• Ignition switch: ON	Selector lever: P or N	ON
		Selector lever: Except above position	OFF
INT/A TEMP SE	• Ignition switch: ON		Indicates intake air temperature
AC PRESS SEN	• Engine: Idle • Both A/C switch and blower fan switch: ON (Compressor operates)		1.0 - 4.0 V
FUEL PRES SEN	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 2.74 Mpa
		2,000 rpm	Approx. 3.0 Mpa
FUEL INJ B1	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 1.4 msec
		2,000 rpm	Approx. 1.0 msec
FUEL INJ B2	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 1.4 msec
		2,000 rpm	Approx. 1.0 msec
INT/V TIM (B1)	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	−5 - 5°CA
		2,000 rpm	Approx. 0 - 30°CA
INT/V TIM (B2)	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	−5 - 5°CA
		2,000 rpm	Approx. 0 - 30°CA

Monitor Item	Condition		Values/Status
MAP SENSOR	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 1.0 V
		2,000 rpm	Approx. 1.35 V
EVAP LEAK DIAG	• Ignition switch: ON		Indicates the condition of EVAP leak diagnosis.
EVAP DIAG READY	• Ignition switch: ON		Indicates the ready condition of EVAP leak diagnosis.
VVEL LEARN	• Ignition switch: OFF → ON (After warming up)	VVEL learning has not been performed yet.	YET
		VVEL learning has already been performed successfully.	DONE
VVEL SEN LEARN-B1	• VVEL learning has already been performed successfully		Approx. 0.30 - 0.80 V
VVEL SEN LEARN-B2	• VVEL learning has already been performed successfully		Approx. 0.30 - 0.80 V
VVEL POSITION SEN-B1	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 0.25 - 1.50 V
		When revving engine up to 2,000 rpm quickly	Approx. 0.25 - 4.75 V
VVEL POSITION SEN-B2	• Engine: After warming up • Selector lever: P or N position • Air conditioner switch: OFF • No load	Idle	Approx. 0.25 - 1.50 V
		When revving engine up to 2,000 rpm quickly	Approx. 0.25 - 4.75 V
VVEL TIM-B1	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 0 - 23 deg
		When revving engine up to 2,000 rpm quickly	Approx. 0 - 90 deg
VVEL TIM-B2	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 0 - 23 deg
		When revving engine up to 2,000 rpm quickly	Approx. 0 - 90 deg
FPCM	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	• Engine: Cranking	HI
		• Revving engine from idle to 4,000 rpm quickly	MID
		• Engine: Idle • Engine coolant temperature: More than 10°C (50°F)	LOW
BAT TEMP SEN	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Indicates the temperature around the battery.
COOLING FAN SPD	• Engine speed: Idle • Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Water temp: Less than 98°C	Approx. 100 – 200 rpm
		Water temp: More than 98°C	Approx. 600 – 700 rpm
THRTL STK CNT B1	**NOTE:** The item is indicated, but not used.		—
HO2 S2 DIAG1(B1)	DTC P0139 self-diagnosis (delayed response) has not been performed yet.		INCMP
	DTC P0139 self-diagnosis (delayed response) has already been performed successfully.		CMPLT
HO2 S2 DIAG1(B2)	DTC P0159 self-diagnosis (delayed response) has not been performed yet.		INCMP
	DTC P0159 self-diagnosis (delayed response) has already been performed successfully.		CMPLT

Monitor Item	Condition		Values/Status
HO2 S2 DIAG2(B1)*3	DTC P0139 self-diagnosis (slow response) has not been performed yet.		INCMP
	DTC P0139 self-diagnosis (slow response) has already been performed successfully.		CMPLT
HO2 S2 DIAG2(B2)*3	DTC P0159 self-diagnosis (slow response) has not been performed yet.		INCMP
	DTC P0159 self-diagnosis (slow response) has already been performed successfully.		CMPLT
FUEL INJ TIMG	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 16 deg
		2,000 rpm	Approx. −170 deg
H/P FUEL PUMP DEG	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 211.0 deg
		2,000 rpm	Approx. 206.0 deg
FUEL PRES SEN V	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 820 – 1.220 mV
		Revving engine from idle to 4,000 rpm quickly	Approx. 820 – 3.060 mV
L/FUEL PRES SEN	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 0.45 MPa
		2,000 rpm	Approx. 0.45 MPa
L/FUEL PRES SEN V	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 3250 mV
		3,000 rpm	Approx. 3100 mV
ECM TEMP 1	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Indicates the temperature of ECM internal circuit 1.
ECM TEMP 2	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Indicates the temperature of ECM internal circuit 2.
FUEL PUMP DUTY	• Engine: After warming up • Shift lever: P or N • Air conditioner switch: OFF • No load	Engine speed: Idle	30 - 40%
A/F SEN1 DIAG1 (B1)	DTC P015A and P015B self-diagnosis incomplete.		INCMP
	DTC P015A and P015B self-diagnosis is complete.		CMPLT
A/F SEN1 DIAG1 (B2)	DTC P015C and P015D self-diagnosis incomplete.		INCMP
	DTC P015C and P015D self-diagnosis is complete.		CMPLT
A/F SEN1 DIAG2 (B1)	DTC P014C and P014D self-diagnosis incomplete.		INCMP
	DTC P014C and P014D self-diagnosis is complete.		CMPLT
A/F SEN1 DIAG2 (B2)	DTC P014E and P014F self-diagnosis incomplete.		INCMP
	DTC P014E and P014F self-diagnosis is complete.		CMPLT
A/F SEN1 DIAG3 (B1)	The vehicle condition is not within the diagnosis range of DTC P014C, P014D, P015A or P015B.		ABSNT
	The vehicle condition is within the diagnosis range of DTC P014C, P014D, P015A or P015B.		PRSNT
A/F SEN1 DIAG3 (B2)	The vehicle condition is not within the diagnosis range of DTC P014E, P014F, P015C or P015D.		ABSNT
	The vehicle condition is within the diagnosis range of DTC P014E, P014F, P015C or P015D.		PRSNT

Monitor Item	Condition		Values/Status
SYSTEM 1 DIAGNOSIS A B1	DTC P219A self-diagnosis is incomplete.		INCMP
	DTC P219A self-diagnosis is complete.		CMPLT
SYSTEM 1 DIAGNOSIS A B2	DTC P219B self-diagnosis is incomplete.		INCMP
	DTC P219B self-diagnosis is complete.		CMPLT
SYSTEM 1 DIAGNOSIS B B1	DTC P219A self-diagnosis is on standby.		ABSENT
	DTC P219A self-diagnosis is under diagnosis.		PRSENT
SYSTEM 1 DIAGNOSIS B B2	DTC P219B self-diagnosis is on standby.		ABSENT
	DTC P219B self-diagnosis is under diagnosis.		PRSENT
A/F-S ATMSPHRC CRCT B1	Engine: After warming up, idle the engine		Varies depending on vehicle environment.
A/F-S ATMSPHRC CRCT B2	Engine: After warming up, idle the engine		Varies depending on vehicle environment.
A/F-S ATMSPHRC CRCT UP B1	Engine: Running		Varies depending on the number of updates.
A/F-S ATMSPHRC CRCT UP B2	Engine: Running		Varies depending on the number of updates.
EXH/V TIM B1	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	0° - 1.5°CA
		Around 2,500 rpm while the engine speed is rising	Approx. 0 - 30°CA
EXH/V TIM B2	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	0 - 1.5°CA
		Around 2,500 rpm while the engine speed is rising	Approx. 0 - 30°CA
EXH V/T LEARN	• Engine: Running	Exhaust Valve Timing Control Learning has not been performed yet.	YET
		Exhaust Valve Timing Control Learning has not been performed yet.	CMPLT
EXHAUST GAS TEMP SEN 1 B1	• Engine: After warming up • Idle speed		1,290 – 2,940 mV Output voltage varies with exhaust gas temperature.
EXHAUST GAS TEMP SEN 1 B2	• Engine: After warming up • Idle speed		1,290 – 2,940 mV Output voltage varies with exhaust gas temperature.
EOP SENSOR	• Engine: After warming up • Selector lever: P or N position • A/C switch: OFF • No load	Idle	Approx. 1200 mV
		2,000 rpm	Approx. 2800 mV
RADIATOR COOLANT TEMP	Engine: running		0 - 4.8 V
ENGINE COOLANT B/V POSI	• Ignition switch: ON • Cold condition		Approx. 0 deg
	Engine: Idle	Engine coolant temperature: 66°C (151°F)	Approx. 51 deg
		Engine coolant temperature: 76°C (169°F)	Approx. 89 deg
		Engine coolant temperature: 86°C (187°F)	Approx. 131 deg
A/F IMBALNC DIAG-CPS STAT	The vehicle condition is not within the diagnosis range of DTC P219C - P219F and P21A0 - P21A3.		ABSENT
	The vehicle condition is within the diagnosis range of DTC P219C - P219F and P21A0 - P21A3.		PRSENT

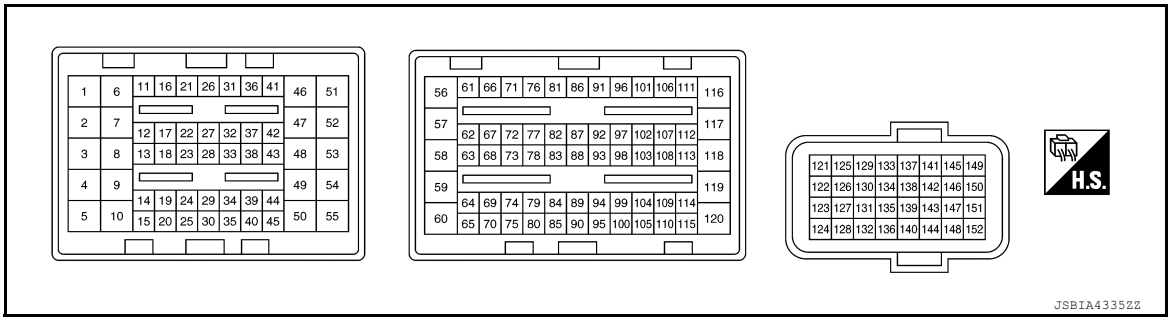
Monitor Item	Condition	Values/Status
A/F IMBLNC DIAG-CPS CMPLT	Self-diagnosis of DTC P219C - P219F and P21A0 - P21A3 is incomplete.	INCMP
	Self-diagnosis of DTC P219C - P219F and P21A0 - P21A3 is complete.	CMPLT
A/GRLL SHTTR POSITION	• Engine RPM: idle speed. • Vehicle speed: 0 km/h (0 MPH).	F/OPEN
	• Vehicle speed: 30 km/h (19 MPH) or faster. (Comply the condition of active grille shutter operation).	F/OPEN →MOVING→F/CLOSE
A/GRLL SHTTR CALIBRATION	• Turn ignition switch OFF→ ON • Drive the vehicle at a speed more than 6 km/h (4 MPH) for the first time.	CMPLT
	• Turn ignition switch OFF → ON. • When the vehicle speed does not reach 6 km/h (4 MPH).	INCMP
A/GRLL SHTTR CIRCUIT DIAG	Malfunction of active grill shutter power supply is detected.	NG
	Malfunction of active grill shutter power supply is not detected.	OK
A/GRLL SHTTR TEMP DIAG	Abnormal temperature of active grill shutter actuator is detected.	NG
	Abnormal temperature of active grill shutter actuator is not detected.	OK
A/GRLL SHTTR VOLT DIAG	Abnormal voltage of active grill shutter actuator is detected.	NG
	Abnormal voltage of active grill shutter actuator is not detected.	OK
A/GRLL SHTTR OVERRUN	Active grill shutter does not stop within normal moving limit.	NG
	Active grill shutter stops within normal moving limit	OK
A/GRLL SHTTR STUCK	Detecting the active grille shutter stuck or the operation range less than normal.	NG
	Not detecting the active grille shutter stuck or the operation range less than normal.	OK
A/GRLL SHTTR CALIB DIAG	Malfunction of active grill shutter initial position learning is detected.	NG
	Malfunction of active grill shutter initial position learning is not detected.	OK

*1: Accelerator pedal position sensor 2 signal and throttle position sensor 2 signal are converted by ECM internally. Thus, they differ from ECM terminals voltage signal.

*2: Before measuring the terminal voltage, confirm that the battery is fully charged. Refer to PG-175, "How to Handle Battery".

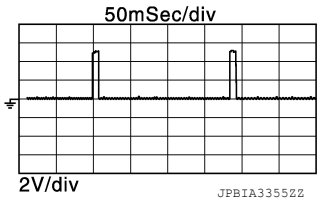
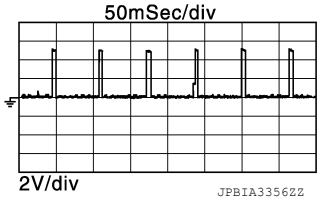
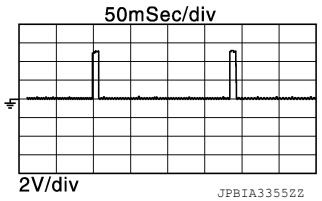
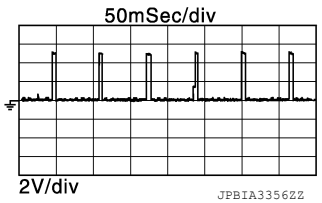
*3: For America and Canada.

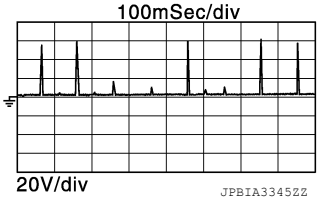
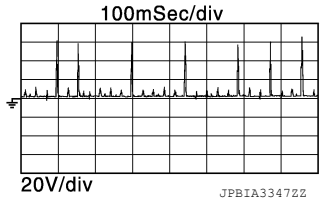
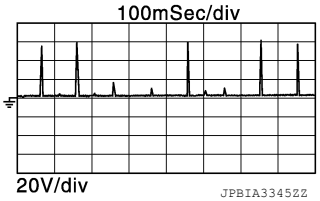
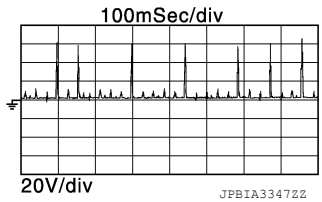
TERMINAL LAYOUT

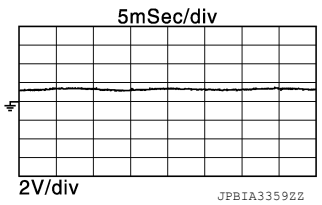
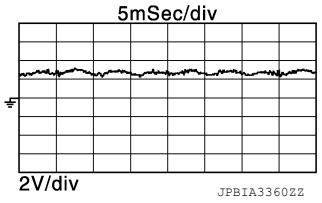


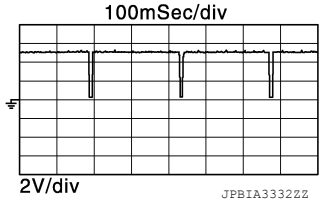
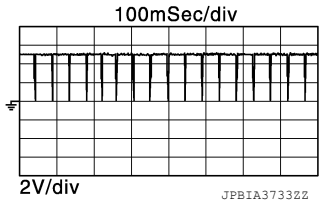
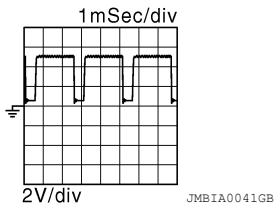
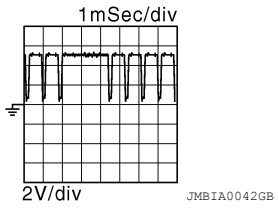
PHYSICAL VALUES

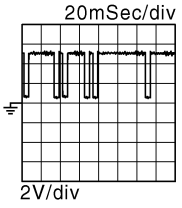
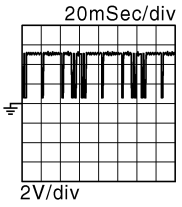
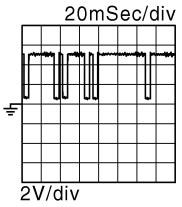
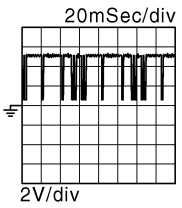
NOTE:
- Specification data are reference values and are measured between each terminals.
- Pulse signal is measured by CONSULT.

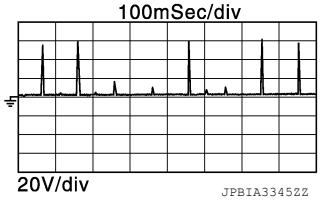
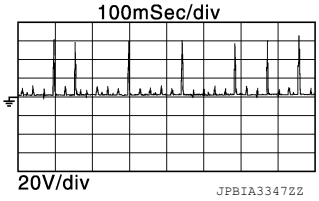
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
1 (R)	152 (B)	Fuel injector driver power supply	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
2 (SB)	152 (B)	High pressure fuel pump driver power supply	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
3 (B/R) 8 (B/W)	50 (B)	Fuel injector No. 8 (LO) Fuel injector No. 5 (LO)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
4 (O) 9 (R/W)	50 (B)	Fuel injector No. 3 (LO) Fuel injector No. 2 (LO)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 

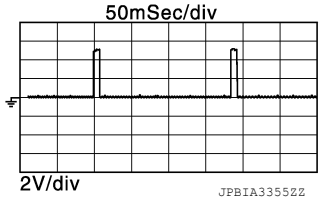
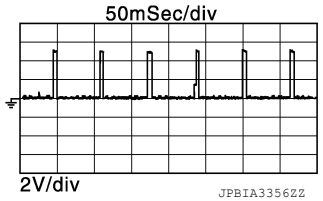
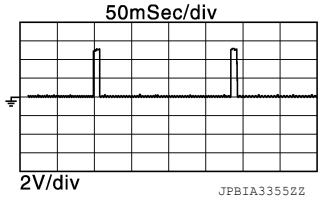
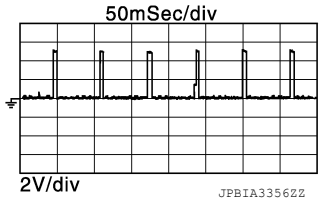
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
5 (G)	50 (B)	Fuel injector No. 2 (HI) Fuel injector No. 3 (HI)	Output	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
6 (R)	152 (B)	Fuel injector driver power supply	Output	[Engine is running] • Warm-up condition • Idle speed	BATTERY VOLTAGE (11 - 14 V)
				[Ignition switch: OFF]	1.5 V
7 (V/B)	50 (B)	Fuel injector No. 5 (HI) Fuel injector No. 8 (HI)	Output	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
10 (B)	—	ECM ground	—	—	—
12 (L/Y)	13 (W/L)	Refrigerant pressure sensor	Input	[Engine is running] • Warm-up condition • Both A/C switch and blower fan motor switch: ON (Compressor operates)	1.0 - 4.0 V
13 (W/L)	—	Sensor ground (Fuel rail pressure sensor/Engine oil pressure sensor/Refrigerant pressure sensor/Power steering pressure sensor)	—	—	—
14 (—)	—	Shield	—	—	—

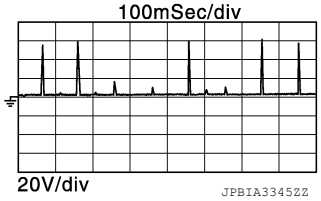
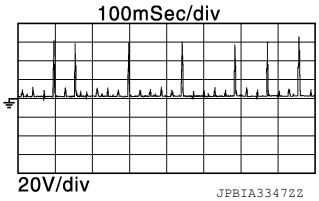
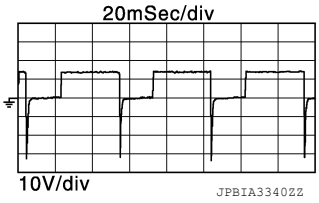
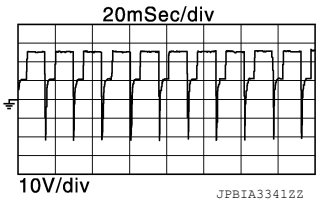
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
15 (W)	20 (—)	Knock sensor (bank 1)	Input	[Engine is running] • Idle speed	2.0 V*1
17 (V)	43 (R)	Exhaust gas temperature sensor (bank 2)	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1.29 – 2.94 V Output voltage varies with exhaust gas temperature.
18 (W)	20 (—)	Knock sensor (bank 2)	Input	[Engine is running] • Idle speed	2.0 V*1
19 (GR/ R)	43 (R)	Exhaust gas temperature sensor (bank 1)	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1.29 – 2.94 V Output voltage varies with exhaust gas temperature.
20 (—)	—	Sensor ground (Knock sensor)	—	—	—
22 (L/Y)	43 (R)	Engine oil temperature sensor	Input	[Engine is running]	0 - 4.8 V Output voltage varies with engine oil temperature.
23 (L/Y)	13 (W/L)	Engine oil pressure sensor	Input	[Engine is running] • Warm-up condition • Idle speed	1.2 V★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	2.8 V★ 
24 (P/ GR)	13 (W/L)	Power steering pressure sensor	Input	[Engine is running] • Steering wheel: Being turned	0.5 - 4.5 V
				[Engine is running] • Steering wheel: Not being turned	0.4 - 0.8 V
25 (V/W)	13 (W/L)	Fuel rail pressure sensor	Input	[Engine is running] • Warm-up condition • Idle speed	0.82 - 1.22 V
				[Engine is running] • Warm-up condition • Revving engine from idle to 4,000 rpm quickly	0.82 - 3.06 V
27 (W/G)	44 (G/W)	Sensor power supply (Crankshaft position sensor)	—	[Ignition switch: ON]	5 V
28 (Y/R)	45 (BR/ W)	Sensor power supply [Camshaft position sensor (bank 1)/Exhaust valve timing control position sensor (bank 1)]	—	[Ignition switch: ON]	5 V

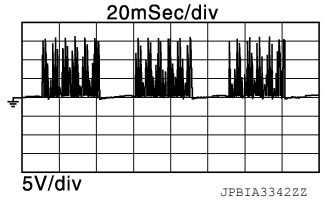
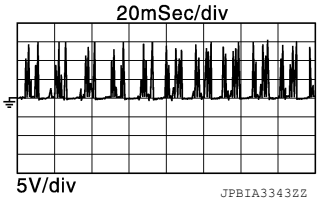
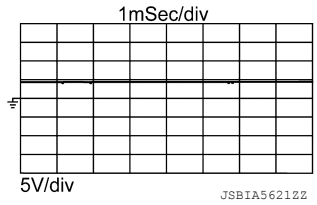
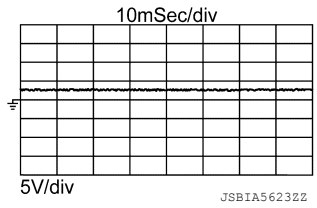
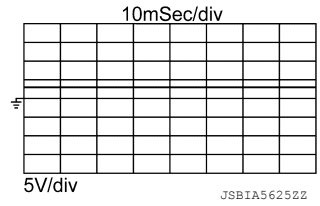
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
29 (SB)	13 (W/L)	Sensor power supply (Fuel rail pressure sensor/Engine oil pressure sensor/Refrigerant pressure sensor/Power steering pressure sensor)	—	[Ignition switch: ON]	5 V
30 (SB)	43 (R)	Sensor power supply (Battery current sensor/Fan clutch assembly/Multi-way control valve)	—	[Ignition switch: ON]	5 V
31 (BR)	152 (B)	Cooling fan speed	Input	[Ignition switch: ON] • Engine stopped	5 V
				[Engine is running] • Idle speed • After warm-up condition	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Idle speed • Before warm-up condition	BATTERY VOLTAGE (11 - 14 V)★ 
32 (LG)	152 (B)	Battery temperature sensor	Input	[Engine is running] • Battery temperature: 25°C • Idle speed	3.3 V
33 (R/W)	44 (G/W)	Crankshaft position sensor (POS)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	4.0 - 5.0 V★ 
				[Engine is running] • Engine speed: 2,000 rpm	4.0 - 5.0 V★ 
35 (R/W)	43 (R)	Engine coolant temperature sensor 1	Input	[Engine is running]	0 - 4.8 V Output voltage varies with engine coolant temperature.
36 (G/O)	42 (R)	Intake air temperature sensor	Input	[Engine is running]	0 - 4.8 V Output voltage varies with intake air temperature.

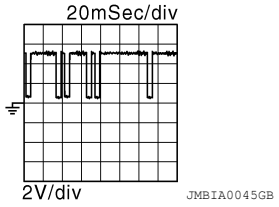
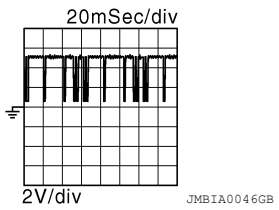
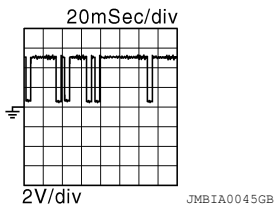
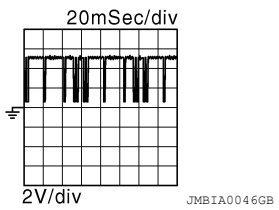
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
37 (G/B)	42 (R)	Mass air flow sensor	Input	[Engine is running] • Warm-up condition • Idle speed	0.7 - 1.2 V
				[Engine is running] • Warm-up condition • Engine speed: 2,500 rpm	1.4 - 1.9 V
38 (V)	43 (R)	Battery current sensor	Input	[Engine is running] • Battery: Fully charged*2 • Idle speed	2.6 - 3.5 V
40 (L/R)	45 (BR/ W)	Camshaft position sensor (PHASE) (bank 1)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	3.0 - 5.0 V★ 
				[Engine is running] • Engine speed: 2,000 rpm	3.0 - 5.0 V★ 
41 (P)	45 (BR/ W)	Exhaust valve timing control position sensor (bank 1)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	3.0 - 5.0 V★ 
				[Engine is running] • Engine speed: 2,000 rpm	3.0 - 5.0 V★ 
42 (R)	—	Sensor ground (Mass air flow sensor/Intake air temperature sensor)	—	—	—

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
43 (R)	—	Sensor ground [Fan clutch assembly/Battery current sensor/Multi-way control valve/Heated oxygen sensor 2 (bank 1)/Heated oxygen sensor 2 (bank 2)/Engine coolant temperature sensor 1/Engine coolant temperature sensor 2/Engine oil temperature sensor/Exhaust gas temperature sensor (bank 1)/Exhaust gas temperature sensor (bank 2)]	—	—	—
44 (G/W)	—	Sensor ground (Crankshaft position sensor)	—	—	—
45 (BR/ W)	—	Sensor ground [Camshaft position sensor (bank 1)/Exhaust valve timing control position sensor (bank 1)]	—	—	—
46 (SB)	152 (B)	High pressure fuel pump driver power supply	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
				[Ignition switch: OFF]	1.5 V
47 (BR)	50 (B)	Fuel injector No. 1 (HI) Fuel injector No. 6 (HI)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 

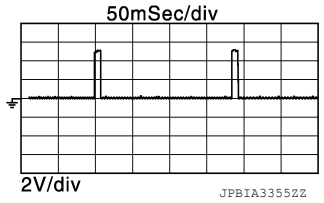
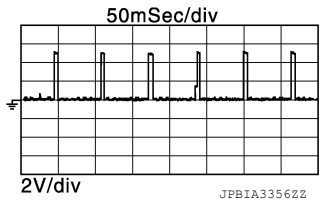
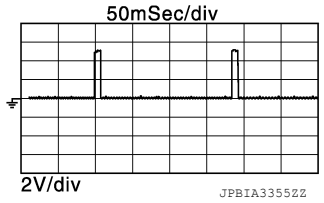
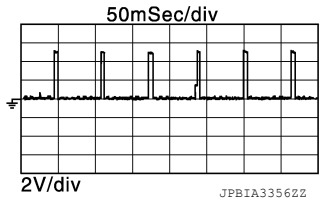
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
48 (Y) 52 (R)	50 (B)	Fuel injector No. 1 (LO) Fuel injector No. 6 (LO)	Output	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
49 (L) 53 (V)	50 (B)	Fuel injector No. 4 (LO) Fuel injector No. 7 (LO)	Output	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
50 (B)	—	ECM ground	—	—	—
51 (P)	152 (B)	High pressure fuel pump driver power supply	Input	[Engine is running] • Warm-up condition • Idle speed	BATTERY VOLTAGE (11 - 14 V)

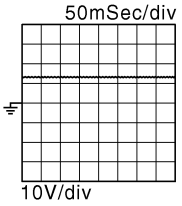
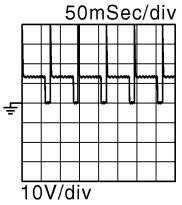
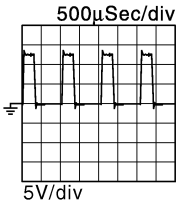
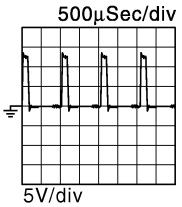
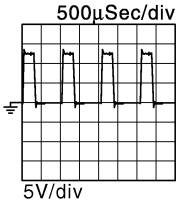
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
54 (W)	50 (B)	Fuel injector No. 4 (HI) Fuel injector No. 7 (HI)	Output	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
55 (B)	—	ECM ground	—	—	—
56 (V)	152 (B)	Multi-way control valve power supply	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
57 (R)	58 (B)	Multi-way control valve motor (–)	Output	[Ignition switch: ON] • Cold condition	0 V
58 (B)	57 (R)	Multi-way control valve motor (+)	Output	[Ignition switch: ON] • Cold condition	0 V
59 (B)	50 (B)	High pressure fuel pump (HI)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 

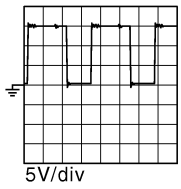
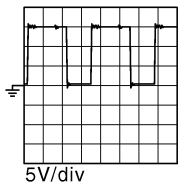
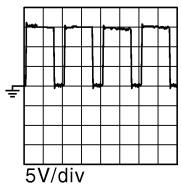
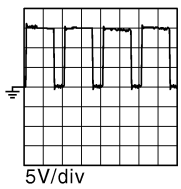
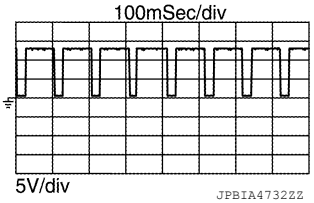
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
60 (W)	50 (B)	High pressure fuel pump (LO)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 
61 (BR)	43 (R)	Multi-way control valve position sensor	Input	[Ignition switch: ON] • Cold condition	4.5 V★ 
				[Engine is running] • Engine speed: Idle speed • Engine coolant temperature: 66°C (151°F)	1.8 V
				[Engine is running] • Engine speed: Idle speed • Engine coolant temperature: 76°C (169°F)	2.4 V★ 
				[Engine is running] • Engine speed: Idle speed • Engine coolant temperature: 86°C (187°F)	2.8 V★ 
62 (B/R)	152 (B)	PNP signal	Input	[Ignition switch: ON] • Selector lever: P or N position	BATTERY VOLTAGE (11 - 14 V)
				[Ignition switch: ON] • Selector lever: Except above position	0 V

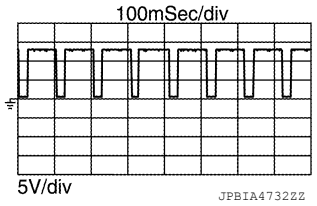
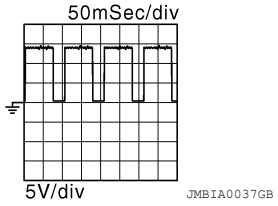
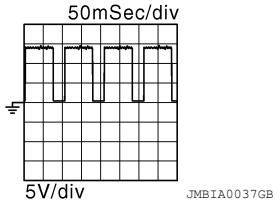
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
63 (LG/ B)	—	Sensor ground [Camshaft position sensor (bank 2)/Exhaust valve timing control position sensor (bank 2)]	—	—	—
64 (—)	—	Shield	—	—	—
65 (W)	43 (R)	Engine coolant temperature sensor 2	Input	[Engine is running]	0 - 4.8 V Output voltage varies with engine coolant temperature.
66 (P)	63 (LG/ B)	Camshaft position sensor (bank 2)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	3.0 - 5.0 V★ 
				[Engine is running] • Engine speed: 2,000 rpm	3.0 - 5.0 V★ 
68 (P)	63 (LG/ B)	Exhaust valve timing control position sensor (bank 2)	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	3.0 - 5.0 V★ 
				[Engine is running] • Engine speed: 2,000 rpm	3.0 - 5.0 V★ 
69 (L/W)	152 (B)	A/F sensor 1 (bank 2)	Input	[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	1.8 V Output voltage varies with air fuel ratio.
70 (Y/B)	152 (B)	A/F sensor 1 (bank 2)	Input	[Ignition switch: ON]	2.2 V
73 (LG/ R)	63 (LG/ B)	Sensor power supply [Camshaft position sensor (bank 2)/Exhaust valve timing control position sensor (bank 2)]	—	[Ignition switch: ON]	5 V
74 (R)	152 (B)	A/F sensor 1 (bank 1)	Input	[Ignition switch: ON]	2.2 V

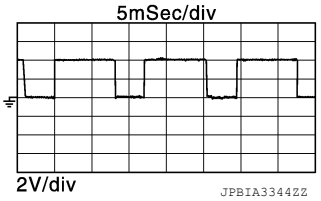
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
77 (L/W)	43 (R)	Heated oxygen sensor 2 (bank 2)	Input	[Engine is running] • Revving engine from idle to 3,000 rpm quickly after the following conditions are met - Engine: after warming up - Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load	0 - 1.0 V
78 (R/L)	85 (L)	Throttle position sensor 1	Input	[Ignition switch: ON] • Engine: Stopped • Selector lever: D position • Accelerator pedal: Fully released	More than 0.36 V
				[Ignition switch: ON] • Engine: Stopped • Selector lever: D position • Accelerator pedal: Fully depressed	Less than 4.75 V
79 (W)	152 (B)	A/F sensor 1 (bank 1)	Input	[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	1.8 V Output voltage varies with air fuel ratio.
80 (B/W)	85 (L)	Throttle position sensor 2	Input	[Ignition switch: ON] • Engine: Stopped • Selector lever: D position • Accelerator pedal: Fully released	Less than 4.75 V
				[Ignition switch: ON] • Engine: Stopped • Selector lever: D position • Accelerator pedal: Fully depressed	More than 0.36 V
83 (V/G)	85 (L)	Sensor power supply (Throttle position sensor)	—	[Ignition switch: ON]	5 V
84 (W/R)	43 (R)	Heated oxygen sensor 2 (bank 1)	Input	[Engine is running] • Revving engine from idle to 3,000 rpm quickly after the following conditions are met - Engine: after warming up - Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load	0 - 1.0 V
85 (L)	—	Sensor ground (Throttle position sensor)	—	—	—
86 (L/G)	—	LIN communication	Input/ Output	—	—
88 (L/LG)	152 (B)	ECM relay (Self shut-off)	Output	[Engine is running] [Ignition switch: OFF] • A few seconds after turning ignition switch OFF	0 - 1.5 V
				[Ignition switch: OFF] • More than a few seconds after turning ignition switch OFF	BATTERY VOLTAGE (11 - 14 V)

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
90 (BR/ W)	152 (B)	VVEL actuator motor relay abort signal (VVEL control module)	Input	[Ignition switch: ON]	0 V
91 (L/B) 92 (BR/ Y) 95 (Y) 104 (LG/ R)	152 (B)	Ignition signal No. 1 Ignition signal No. 2 Ignition signal No. 3 Ignition signal No. 4	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	0 - 0.2 V★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	0.1 - 0.4 V★ 
93 (GR)	152 (B)	Fuel pump relay	Output	[Ignition switch: ON] • For 1 second after turning ignition switch ON [Engine is running]	0 - 1.0 V
94 (Y/R) 101 (O) 102 (P/L) 105 (G/Y)	152 (B)	Ignition signal No. 5 Ignition signal No. 6 Ignition signal No. 7 Ignition signal No. 8	Input	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	0 - 0.2 V★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	0.1 - 0.4 V★ 
99 (V/R)	152 (B)	Throttle control motor relay	Output	[Ignition switch: ON → OFF]	0 - 1.0 V ↓ BATTERY VOLTAGE (11 - 14 V) ↓ 0 V
				[Ignition switch: ON]	0 - 1.0 V

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
106 (V/W)	152 (B)	EVAP canister purge volume control solenoid valve	Output	[Engine is running] • Idle speed • Accelerator pedal: Not depressed even slightly, after engine starting	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Engine speed: About 2,000 rpm (More than 100 seconds after starting engine)	BATTERY VOLTAGE (11 - 14 V)★ 
107 (W)	152 (B)	Throttle control motor (Open)	Output	[Ignition switch: ON] • Engine: Stopped • Selector lever: D • Accelerator pedal: Fully depressed	0 - 14 V★ 
				[Ignition switch: ON] • Engine: Stopped • Selector lever: D position • Accelerator pedal: Fully released	0 - 14 V★ 
108 (R)	152 (B)	Throttle control motor (Close)	Output	[Ignition switch: ON] • Engine: Stopped • Selector lever: D position • Accelerator pedal: In the middle of releasing operation	0 - 14 V★ 
111 (O)	152 (B)	Throttle control motor power supply	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
112 (LG/ B)	152 (B)	Intake valve timing control solenoid valve (bank 1)	Output	[Engine is running] • Warm-up condition • Idle speed	BATTERY VOLTAGE (11 - 14 V)
				[Engine is running] • Warm-up condition • Engine speed: 2,000rpm	7 - 12 V★  5V/div JMBIA0038GB
113 (LG/ R)	152 (B)	Intake valve timing control solenoid valve (bank 2)	Output	[Engine is running] • Warm-up condition • Idle speed	BATTERY VOLTAGE (11 - 14 V)
				[Engine is running] • Warm-up condition • Engine speed: 2,000rpm	7 - 12 V★  5V/div JMBIA0038GB
114 (LG/ B)	152 (B)	Exhaust valve timing control solenoid valve (bank 1)	Output	[Engine is running] • Warm-up condition • Idle speed	BATTERY VOLTAGE (11 - 14 V)
				[Engine is running] • Warm-up condition • Around 2,500 rpm while the engine speed is rising	7 - 12 V★  5V/div JMBIA0034GB
115 (LG/ R)	152 (B)	Exhaust valve timing control solenoid valve (bank 2)	Output	[Engine is running] • Warm-up condition • Idle speed	BATTERY VOLTAGE (11 - 14 V)
				[Engine is running] • Warm-up condition • Around 2,500 rpm while the engine speed is rising	7 - 12 V★  5V/div JMBIA0034GB
116 (L/W)	152 (B)	A/F sensor 1 heater (bank 1)	Output	[Engine is running] • Warm-up condition • Idle speed (More than 140 seconds after starting engine)	2.9 - 8.8 V★  100mSec/div 5V/div JPBIA4732ZZ

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
117 (SB)	152 (B)	A/F sensor 1 heater (bank 2)	Output	[Engine is running] • Warm-up condition • Idle speed (More than 140 seconds after starting engine)	2.9 - 8.8 V★ 
118 (LG)	152 (B)	Heated oxygen sensor 2 heater (bank 1)	Output	[Engine is running] • Engine speed: Below 3,600 rpm after the following conditions are met - Engine: after warming up - Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load	10 V★ 
				[Ignition switch: ON] • Engine: Stopped [Engine is running] • Engine speed: Above 3,600 rpm	BATTERY VOLTAGE (11 - 14 V)
119 (L/R)	152 (B)	Heated oxygen sensor 2 heater (bank 2)	Output	[Engine is running] • Engine speed: Below 3,600 rpm after the following conditions are met - Engine: after warming up - Keeping the engine speed between 3,500 and 4,000 rpm for 1 minute and at idle for 1 minute under no load	10 V★ 
				[Ignition switch: ON] • Engine: Stopped [Engine is running] • Engine speed: Above 3,600 rpm	BATTERY VOLTAGE (11 - 14 V)
120 (L)	152 (B)	Power supply for ECM (Back-up)	Input	[Ignition switch: OFF]	BATTERY VOLTAGE (11 - 14 V)
121 (O/B)	148 (R)	EVAP control system pressure sensor	Input	[Ignition switch: ON]	1.8 - 4.8 V
123 (P)	—	CAN communication line (CAN-L)	—	—	—
124 (L)	—	CAN communication line (CAN-H)	—	—	—
125 (SB)	148 (R)	Sensor power supply (EVAP control system pressure sensor)	—	[Ignition switch: ON]	5 V
128 (V/W)	152 (B)	Fuel temperature sensor	Input	[Engine is running] • Warm-up condition	2.8 V
130 (R/W)	152 (B)	Fuel pump control module (FPCM) check	Input	[When cranking engine]	0 V
				[Engine is running] • Warm-up condition • Idle speed	9 V
133 (W)	152 (B)	Ignition switch	Input	[Ignition switch: OFF]	0 V
				[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
134 (G/Y)	135 (B/Y)	ASCD steering switch	Input	[Ignition switch: ON] • ASCD steering switch: OFF	4 V
				[Ignition switch: ON] • MAIN switch: Pressed	0 V
				[Ignition switch: ON] • CANCEL switch: Pressed	1 V
				[Ignition switch: ON] • ACCELERATE/RESUME switch: Pressed	3 V
				[Ignition switch: ON] • COAST/SET switch: Pressed	2 V
135 (B/Y)	—	Sensor ground (ASCD steering switch)	—	—	—
136 (GR)	152 (B)	Fuel pump control module (FPCM)	Output	[When cranking engine]	0 - 0.5 V
				[Engine is running] • Warm-up condition	0 - 4.0 V★ 
137 (R/W)	—	ENG communication line (CAN-L)	—	—	—
138 (W)	—	ENG communication line (CAN-H)	—	—	—
139 (R/G)	152 (B)	Stop lamp switch	Input	[Ignition switch: OFF] • Brake pedal: Fully released	0 V
				[Ignition switch: OFF] • Brake pedal: Slightly depressed	BATTERY VOLTAGE (11 - 14 V)
140 (G/Y)	152 (B)	Brake pedal position switch	Input	[Ignition switch: ON] • Brake pedal: Slightly depressed	0 V
				[Ignition switch: ON] • Brake pedal: Fully released	BATTERY VOLTAGE (11 - 14 V)
141 (Y)	152 (B)	EVAP canister vent control valve	Output	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
142 (L/W)	144 (P/L)	Sensor power supply (Accelerator pedal position sensor 2)	—	[Ignition switch: ON]	5 V
143 (O)	144 (P/L)	Accelerator pedal position sensor 2	Input	[Ignition switch: ON] • Engine: Stopped • Accelerator pedal: Fully released	0.25 - 0.5 V
				[Ignition switch: ON] • Engine: Stopped • Accelerator pedal: Fully depressed	2.0 - 2.5 V
144 (P/L)	—	Sensor ground (Accelerator pedal position sensor 2)	—	—	—
145 (W)	152 (B)	Power supply for ECM	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
146 (W/G)	151 (R/Y)	Sensor power supply (Accelerator pedal position sensor 1)	—	[Ignition switch: ON]	5 V
147 (B)	—	ECM ground	—	—	—
148 (R)	—	Sensor ground (EVAP control system pressure sensor)	—	—	—
149 (B)	—	ECM ground	—	—	—
150 (W/R)	151 (R/Y)	Accelerator pedal position sensor 1	Input	[Ignition switch: ON] • Engine: Stopped • Accelerator pedal: Fully released	0.5 - 1.0 V
				[Ignition switch: ON] • Engine: Stopped • Accelerator pedal: Fully depressed	4.2 - 4.8 V
151 (R/Y)	—	Sensor ground (Accelerator pedal position sensor 1)	—	—	—
152 (B)	—	ECM ground	—	—	—

★: Average voltage for pulse signal (Actual pulse signal can be confirmed by oscilloscope.)

*1: This may vary depending on internal resistance of the tester.

*2: Before measuring the terminal voltage, confirm that the battery is fully charged. Refer to PG-175, "How to Handle Battery".

Fail-safe

INFOID:0000000014419426

DTC No.	Detected items	Engine operating condition in fail-safe mode
U0113 U1003 U1024	Can communication circuit	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
U0284	Active grille shutter	ECM operates active grille shutter to fully-open position.
U1040 U1044	LIN communication line	ECM operates active grille shutter to fully-open position.
P0011 P0012 P0016 P0018 P0021 P0022	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.
P0014 P0015 P0017 P0019 P0024 P0025	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.
P0087	FRP control system	• Engine torque is limited. • VVEL value is maintained at a fixed angle.
P0088		Engine speed is limited.

<table>
<tr><th>DTC No.</th><th>Detected items</th><th colspan="2">Engine operating condition in fail-safe mode</th></tr>
<tr><td>P0090</td><td>FRP control system</td><td colspan="2">• Engine torque is limited.
• VVEL value is maintained at a fixed angle.</td></tr>
<tr><td>P00B3
P00B4</td><td>Engine coolant temperature sensor 2</td><td colspan="2">High coolant temperature control does not function.</td></tr>
<tr><td>P0102
P0103</td><td>Mass air flow sensor circuit</td><td colspan="2">Engine speed will not rise more than 2,400 rpm due to the fuel cut.</td></tr>
<tr><td rowspan="6">P0117
P0118</td><td rowspan="6">Engine coolant temperature sensor 1 circuit</td><td colspan="2">Engine coolant temperature will be determined by ECM based on the following condition.
CONSULT displays the engine coolant temperature decided by ECM.</td></tr>
<tr><td>Condition</td><td>Engine coolant temperature decided
(CONSULT display)</td></tr>
<tr><td>Just as ignition switch is turned ON or START</td><td>40°C (104°F)</td></tr>
<tr><td>Approx. 4 minutes or more after engine starting</td><td>80°C (176°F)</td></tr>
<tr><td>Except as shown above</td><td>40 - 80°C (104 - 176°F)
(Depends on the time)</td></tr>
<tr><td colspan="2">When the fail-safe system for engine coolant temperature sensor 1 is activated, the cooling fan operates while engine is running.</td></tr>
<tr><td>P0122
P0123
P0222
P0223
P2135</td><td>Throttle position sensor</td><td colspan="2">The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees.
The ECM regulates the opening speed of the throttle valve to be slower than the normal condition.
Therefore, the acceleration will be poor.</td></tr>
<tr><td>P0190</td><td>FRP sensor</td><td colspan="2">• Engine speed is limited.
• High pressure fuel pump is activated at maximum discharge pressure.</td></tr>
<tr><td>P0196
P0197
P0198</td><td>Engine oil temperature sensor</td><td colspan="2">Exhaust valve timing control does not function.</td></tr>
<tr><td>P0201
P0202
P0203
P0204
P0205
P0206
P0207
P0208</td><td>Injector</td><td colspan="2">• Engine torque is limited.
• Fuel injection shut-off of malfunction cylinder.
• Mixture ratio feedback control does not function.
• Idle engine speed is increased.</td></tr>
<tr><td>P0500</td><td>Vehicle speed sensor</td><td colspan="2">The cooling fan operates (Highest) while engine is running.</td></tr>
<tr><td>P0524</td><td>Engine oil pressure</td><td colspan="2">• ECM illuminates oil pressure warning lamp on the combination meter.
• Engine speed will not rise more than 4,000 rpm due to the fuel cut.
• Fail-safe is canceled when ignition switch OFF → ON.</td></tr>
<tr><td>P059F</td><td>Active grille shutter</td><td colspan="2">• When a voltage and temperature related malfunction is detected, the active grille shutter stops at the position of detection.
• Except for the above case, operates the active grille shutter to fully opened position.</td></tr>
<tr><td>P0603
P0607</td><td>ECM</td><td colspan="2">Engine torque may be limited.</td></tr>
<tr><td>P0604</td><td>ECM</td><td colspan="2">• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring.
• The position of the following components is fixed.
- Intake valve timing control solenoid valve
- Exhaust valve timing control solenoid valve
• ASCD operation may be deactivated.</td></tr>
</table>

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0605 P0606 P060B	ECM	**NOTE:** Fail-safe may not occur depending on malfunction type. • ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • ASCD operation may be deactivated.
P060A	ECM	**NOTE:** Fail-safe may not occur depending on malfunction type. • ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • Engine torque may be limited. • ASCD operation may be deactivated.
P062B	ECM	Type1 • Engine torque is limited. • Idle engine speed is increased. • Fuel injector power supply shut-off. • High fuel pressure limitation.
		Type2 • Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0643	ECM	• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve
P1087 P1088	VVEL control function	VVEL of normal bank is controlled at VVEL angle of abnormal bank. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
P1089 P1092	VVEL control shaft position sensor	VVEL value is maintained at a fixed angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut
P1090 P1093	VVEL actuator motor	VVEL of normal bank is controlled at VVEL angle of abnormal bank. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
		VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
P1091	VVEL actuator motor relay	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
P1197	Out of gas	• Engine torque is limited. • VVEL value is maintained at a fixed angle.
P1606	VVEL control module	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
P1608	VVEL control shaft position sensor	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
P1805	Brake switch	ECM controls the electric throttle control actuator by regulating the throttle opening to a small range. Therefore, acceleration will be poor.
		Vehicle condition: When engine is idling — Driving condition: Normal
		Vehicle condition: When accelerating — Driving condition: Poor acceleration
P2100 P2103	Throttle control motor relay	ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2101	Electric throttle control function	ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.
P2118	Throttle control motor	ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.
P2119	Electric throttle control actuator	(When electric throttle control actuator does not function properly due to the return spring malfunction:) ECM controls the electric throttle actuator by regulating the throttle opening around the idle position. The engine speed will not rise more than 2,000 rpm.
		(When throttle valve opening angle in fail-safe mode is not in specified range:) ECM controls the electric throttle control actuator because of regulating the throttle opening to 20 degrees or less.
		(When ECM detects the throttle valve is stuck open:) While the vehicle is being driven, it slows down gradually by fuel cut. After the vehicle stops, the engine stalls. The engine can restart in the N or P position, and engine speed will not exceed 1,000 rpm or more.
P2122 P2123 P2127 P2128 P2138	Accelerator pedal position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.
P26A3 P26A5 P26A6 P26A7	Multi-way control valve	• When detecting a malfunction with the valve closed, ECM fully opens the valve. • When detecting a malfunction with the valve opened, ECM maintains valve angle. • When detecting a malfunction in sensor, ECM fully opens the valve. • ECM limits the engine output depending on malfunctions.

DTC Inspection Priority Chart

INFOID:0000000014419427

If some DTCs are displayed at the same time, perform inspections one by one based on the following priority chart.

Priority	Detected items (DTC)
1	• U0100 CAN communication line • U0101 CAN communication line • U0284 Active grille shutter • U0113 U1003 CAN communication line • U1001 CAN communication line • U1024 VVEL CAN communication line • U1040 U1044 Engine communication line • P00B3 P00B4 Engine coolant temperature sensor 2 • P0101 P0102 P0103 Mass air flow sensor • P0111 P0112 P0113 P0127 Intake air temperature sensor • P0116 P0117 P0118 P0125 Engine coolant temperature sensor 1 • P0122 P0123 P0222 P0223 P1225 P1226 P2135 Throttle position sensor • P0181 P0182 P0183 Fuel tank temperature sensor • P0196 P0197 P0198 Engine oil temperature sensor • P0327 P0328 P0332 P0333 Knock sensor • P0335 Crankshaft position sensor • P0340 P0345 Camshaft position sensor • P0460 P0461 P0462 P0463 Fuel level sensor • P0500 Vehicle speed sensor • P0520 Engine oil pressure sensor • P0527 Cooling fan speed sensor • P0544 P0545 P0546 P0547 P0548 P0549 P2080 P2081 P2082 P2083 Exhaust gas tempereture sensor • P0603 P0604 P0605 P0606 P0607 P060A P060B P0611 P062B P2610 ECM • P062F Control module • P0643 Sensor power supply • P0705 P0850 Transmission range switch • P1089 P1092 P1608 VVEL control shaft position sensor • P1197 Out of gas* • P1220 Fuel pump control module (FPCM) • P1423 P1424 Cold start control • P1550 P1551 P1552 P1553 P1554 Battery current sensor • P1556 P1557 Battery temperature sensor • P1606 P1607 VVEL control module • P1610 - P1615 NATS • P2122 P2123 P2127 P2128 P2138 Accelerator pedal position sensor • P26A5 P26A6 P26A7 P26AB Multi-way control valve position sensor

Priority	Detected items (DTC)
2	• P0030 P0031 P0032 P0036 P0051 P0052 Air fuel ratio (A/F) sensor 1 heater • P0037 P0038 P0057 P0058 Heated oxygen sensor 2 heater • P0075 P0081 Intake valve timing control solenoid valve • P0078 P0084 Exhaust valve timing control solenoid valve • P0130 P0131 P0132 P014C P014D P014E P014F P0150 P0151 P0152 P015A P015B P015C P015D P2096 P2097 P2098 P2099 Air fuel ratio (A/F) sensor 1 • P0137 P0138 P0139 P0157 P0158 P0159 Heated oxygen sensor 2 • P0190 - P0193 P119A P0119B P119C FRP sensor • P0441 EVAP control system purge flow monitoring • P0443 P0444 P0445 EVAP canister purge volume control solenoid valve • P0447 P0448 EVAP canister vent control valve • P0451 P0452 P0453 EVAP control system pressure sensor • P0550 Power steering pressure sensor • P059F P159F Active grille shutter • P0710 P0717 P0720 P0729 P0730 P0731 P0732 P0733 P0734 P0735 P0740 P0744 P0745 P0750 P0775 P0780 P0795 P1730 P1734 P2713 P2722 P2731 P2807 A/T related sensors, solenoid valves and switches • P1078 P1084 Exhaust valve timing control position sensor • P1087 P1088 VVEL system • P1090 P1093 VVEL actuator motor • P1091 VVEL actuator motor relay • P1217 Engine over temperature (OVERHEAT) • P1805 Brake switch • P2100 P2103 Throttle control motor relay • P2101 Electric throttle control function • P2118 Throttle control motor • P26A3 Multi-way control valve
3	• P0011, P0012, P0016, P0018, P0021, P0022 Intake valve timing control • P0014, P0015, P0017, P0019, P0024, P0025 Exhaust valve timing control • P0087, P0088, P0090 FRP control system • P0171 P0172 P0174 P0175 Fuel injection system function • P0201 - P0208 Injector • P0300 - P0308 Misfire • P0420 P0430 Three way catalyst function • P0456 EVAP control system (VERY SMALL LEAK) • P0506 P0507 Idle speed control system • P050A P050B P050E Cold start control • P0524 Engine oil pressure • P100A P100B VVEL system • P1148 P1168 Closed loop control • P1212 TCS communication line • P1564 ASCD steering switch • P1572 Brake pedal position switch • P1574 ASCD vehicle speed sensor • P2119 Electric throttle control actuator • P219A P219B P219C P219D P219E P219F P21A0 P21A1 P21A2 P21A3 Air fuel ratio (A/F) sensor 1

NOTE:

*: If “P1197” is displayed with other DTC in priority 1, perform trouble diagnosis for “P1197” first.

DTC Index

INFOID:0000000014419428

×:Applicable —: Not applicable

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
U0100	0100	LOST COMM (ECM A)	—	1	×	B	TM-364
U0101	0101	LOST COMM (TCM)	—	1	×	B	EC-231
U0113	0113	CAN COMM CIRCUIT	—	1	×	B	EC-232
U0284	0284	LOST COMM (A/GRLL SHTTR MDL A)	—	2	×	B	EC-235
U1001	1001*4	CAN COMM CIRCUIT	—	1 or 2	—	—	EC-238

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
U1003	1003	CAN COMM CIRCUIT	—	2	—	—	EC-232
U1024	1024	VVEL CAN COMM CIRCUIT	—	1	×	B	EC-239
U1040	1040	ENG COMM CIRCUIT	—	2	—	—	EC-241
U1044	1044	ENG COMM CIRCUIT	—	2	—	—	EC-243
P0000	**0000**	**NO DTC IS DETECTED. FURTHER TESTING MAY BE REQUIRED.**	—	—	**Blinking***6	—	**—**
P0011	0011	INT/V TIM CONT-B1	×	2	×	A or B	EC-244
P0012	0012	A camshaft position B1	×	2	×	A	EC-248
P0014	0014	EXH/V TIM CONT-B1	—	2	×	A or B	EC-252
P0015	0015	B camshaft position B1	×	2	×	A	EC-256
P0016	0016	Crankshaft position B1 sensor A	×	2	×	A	EC-260
P0017	0017	Crankshaft position B1 sensor B	×	2	×	A	EC-264
P0018	0018	Crankshaft position B2 sensor A	×	2	×	A	EC-268
P0019	0019	Crankshaft position B2 sensor B	×	2	×	A	EC-272
P0021	0021	INT/V TIM CONT-B2	×	2	×	A or B	EC-244
P0022	0022	A camshaft position B2	×	2	×	A	EC-276
P0024	0024	EXH/V TIM CONT-B2	—	2	×	A or B	EC-252
P0025	0025	B camshaft position B2	×	2	×	A	EC-280
P0030	0030	A/F SEN1 HTR (B1)	—	2	×	B	EC-284
P0031	0031	A/F SEN1 HTR (B1)	—	2	×	B	EC-284
P0032	0032	A/F SEN1 HTR (B1)	—	2	×	B	EC-284
P0036	0036	A/F SEN1 HTR (B2)	—	2	×	B	EC-284
P0037	0037	HO2S2 HTR (B1)	—	2	×	B	EC-287
P0038	0038	HO2S2 HTR (B1)	—	2	×	B	EC-287
P0051	0051	A/F SEN1 HTR (B2)	—	2	×	B	EC-284
P0052	0052	A/F SEN1 HTR (B2)	—	2	×	B	EC-284
P0057	0057	HO2S2 HTR (B2)	—	2	×	B	EC-287
P0058	0058	HO2S2 HTR (B2)	—	2	×	B	EC-287
P0075	0075	INT/V TIM V/CIR-B1	—	2	×	B	EC-290
P0078	0078	EX V/T ACT/CIRC-B1	—	2	×	B	EC-293
P0081	0081	INT/V TIM V/CIR-B2	—	2	×	B	EC-290
P0084	0084	EX V/T ACT/CIRC-B2	—	2	×	B	EC-293
P0087	0087	LOW FUEL PRES	—	2	×	A or B	EC-296
P0088	0088	HIGH FUEL PRES	—	2	×	A or B	EC-300
P0090	0090	FUEL PUMP	—	2	×	B	EC-303
P00B3	00B3	RADIATOR COOLANT TEMP SEN	—	2	—	B	EC-306
P00B4	00B4	RADIATOR COOLANT TEMP SEN	—	2	—	B	EC-306
P0101	0101	MAF SEN/CIRCUIT-B1	—	2	×	B	EC-309

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
P0102	0102	MAF SEN/CIRCUIT-B1	—	1	×	B	EC-314
P0103	0103	MAF SEN/CIRCUIT-B1	—	1	×	B	EC-314
P0111	0111	IAT SENSOR1 B1	—	2	×	A	EC-319
P0112	0112	IAT SEN/CIRCUIT-B1	—	2	×	B	EC-321
P0113	0113	IAT SEN/CIRCUIT-B1	—	2	×	B	EC-321
P0116	0116	ECT SEN/CIRC	—	2	×	A	EC-323
P0117	0117	ECT SEN/CIRC	—	1	×	B	EC-326
P0118	0118	ECT SEN/CIRC	—	1	×	B	EC-326
P0122	0122	TP SEN 2/CIRC-B1	—	1	×	B	EC-329
P0123	0123	TP SEN 2/CIRC-B1	—	1	×	B	EC-329
P0125	0125	ECT SENSOR	—	2	×	B	EC-332
P0127	0127	IAT SENSOR-B1	—	2	×	B	EC-334
P0130	0130	A/F SENSOR1 (B1)	×	2	×	A	EC-336
P0131	0131	A/F SENSOR1 (B1)	—	2	×	B	EC-340
P0132	0132	A/F SENSOR1 (B1)	—	2	×	B	EC-343
P0137	0137	HO2S2 (B1)	×	2	×	A	EC-346
P0138	0138	HO2S2 (B1)	×	2	×	A	EC-352
P0139	0139	HO2S2 (B1)	×	2	×	A	EC-360
P014C	014C	A/F SENSOR1 (B1)	×	2	×	A	EC-360
P014D	014D	A/F SENSOR1 (B1)	×	2	×	A	EC-360
P014E	014E	A/F SENSOR1 (B2)	×	2	×	A	EC-360
P014F	014F	A/F SENSOR1 (B2)	×	2	×	A	EC-360
P0150	0150	A/F SENSOR1 (B2)	×	2	×	A	EC-336
P0151	0151	A/F SENSOR1 (B2)	—	2	×	B	EC-340
P0152	0152	A/F SENSOR1 (B2)	—	2	×	B	EC-343
P0157	0157	HO2S2 (B2)	×	2	×	A	EC-346
P0158	0158	HO2S2 (B2)	×	2	×	A	EC-352
P0159	0159	HO2S2 (B2)	×	2	×	A	EC-360
P015A	015A	A/F SENSOR1 (B1)	×	2	×	A	EC-360
P015B	015B	A/F SENSOR1 (B1)	×	2	×	A	EC-360
P015C	015C	A/F SENSOR1 (B2)	×	2	×	A	EC-360
P015D	015D	A/F SENSOR1 (B2)	×	2	×	A	EC-360
P0171	0171	FUEL SYS-LEAN-B1	—	2	×	B	EC-373
P0172	0172	FUEL SYS-RICH-B1	—	2	×	B	EC-377
P0174	0174	FUEL SYS-LEAN-B2	—	2	×	B	EC-373
P0175	0175	FUEL SYS-RICH-B2	—	2	×	B	EC-377
P0181	0181	FTT SENSOR	—	2	×	A and B	EC-381
P0182	0182	FTT SEN/CIRCUIT	—	2	×	B	EC-385
P0183	0183	FTT SEN/CIRCUIT	—	2	×	B	EC-385
P0190	0190	FUEL PRES SEN/CIRC	—	1	×	B	EC-388
P0191	0191	FRP SENSOR A	—	2	×	A	EC-392
P0192	0192	FRP SEN/CIRC	—	2	×	B	EC-388

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
P0193	0193	FRP SEN/CIRC	—	2	×	B	EC-388
P0196	0196	EOT SENSOR	—	2	×	A and B	EC-395
P0197	0197	EOT SEN/CIRC	—	2	×	B	EC-399
P0198	0198	EOT SEN/CIRC	—	2	×	B	
P0201	0201	INJECTOR CIRC-CYL1	—	2	×	B	EC-401
P0202	0202	INJECTOR CIRC-CYL2	—	2	×	B	
P0203	0203	INJECTOR CIRC-CYL3	—	2	×	B	
P0204	0204	INJECTOR CIRC-CYL4	—	2	×	B	
P0205	0205	INJECTOR CIRC-CYL5	—	2	×	B	
P0206	0206	INJECTOR CIRC-CYL6	—	2	×	B	
P0207	0207	INJECTOR CIRC-CYL7	—	2	×	B	
P0208	0208	INJECTOR CIRC-CYL8	—	2	×	B	
P0222	0222	TP SEN 1/CIRC-B1	—	1	×	B	EC-404
P0223	0223	TP SEN 1/CIRC-B1	—	1	×	B	
P0300	0300	MULTI CYL MISFIRE	—	1 or 2	×	B	EC-407
P0301	0301	CYL 1 MISFIRE	—	1 or 2	×	B	
P0302	0302	CYL 2 MISFIRE	—	1 or 2	×	B	
P0303	0303	CYL 3 MISFIRE	—	1 or 2	×	B	
P0304	0304	CYL 4 MISFIRE	—	1 or 2	×	B	
P0305	0305	CYL 5 MISFIRE	—	1 or 2	×	B	
P0306	0306	CYL 6 MISFIRE	—	1 or 2	×	B	
P0307	0307	CYL 7 MISFIRE	—	1 or 2	×	B	
P0308	0308	CYL 8 MISFIRE	—	1 or 2	×	B	
P0327	0327	KNOCK SEN/CIRC-B1	—	2	—	—	EC-414
P0328	0328	KNOCK SEN/CIRC-B1	—	2	—	—	
P0332	0332	KNOCK SEN/CIRC-B2	—	2	—	B	
P0333	0333	KNOCK SEN/CIRC-B2	—	2	—	B	
P0335	0335	CKP SEN/CIRCUIT	—	2	×	B	EC-417
P0340	0340	CMP SEN/CIRC-B1	—	2	×	B	EC-420
P0345	0345	CMP SEN/CIRC-B2	—	2	×	B	
P0420	0420	TW CATALYST SYS-B1	×	2	×	A	EC-425
P0430	0430	TW CATALYST SYS-B2	×	2	×	A	
P0441	0441	EVAP PURG FLOW/MON	×	2	×	A	EC-431
P0443	0443	PURG VOLUME CONT/V	—	2	×	A	EC-437
P0444	0444	PURG VOLUME CONT/V	—	2	×	B	EC-441
P0445	0445	PURG VOLUME CONT/V	—	2	×	B	
P0447	0447	VENT CONTROL VALVE	—	2	×	B	EC-444
P0448	0448	VENT CONTROL VALVE	—	2	×	B	EC-448
P0451	0451	EVAP SYS PRES SEN	—	2	×	A	EC-452
P0452	0452	EVAP SYS PRES SEN	—	2	×	B	EC-455
P0453	0453	EVAP SYS PRES SEN	—	2	×	B	EC-459
P0456	0456	EVAP VERY SML LEAK	×*8	2	×	A	EC-464

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
P0460	0460	FUEL LEV SEN SLOSH	—	2	×	A	EC-470
P0461	0461	FUEL LEVEL SENSOR	—	2	×	B	EC-472
P0462	0462	FUEL LEVL SEN/CIRC	—	2	×	B	EC-474
P0463	0463	FUEL LEVL SEN/CIRC	—	2	×	B	EC-474
P0500	0500	VEH SPEED SEN/CIRC*5	—	2	×	B	EC-476
P0506	0506	ISC SYSTEM	—	2	×	B	EC-478
P0507	0507	ISC SYSTEM	—	2	×	B	EC-480
P050A	050A	COLD START CONTROL	—	2	×	A	EC-482
P050B	050B	COLD START CONTROL	—	2	×	A	EC-482
P050E	050E	COLD START CONTROL	—	2	×	A	EC-482
P0520	0520	EOP SENSOR/SWITCH	—	2	—	B	EC-485
P0524	0524	ENGINE OIL PRESSURE	—	1	—	—	EC-488
P0527	0527	COOLING FAN SPD SEN	—	2	—	—	EC-491
P0544	0544	EXHAUST GAS TEMP SENSOR 1 B1	—	2	×	B	EC-494
P0545	0545	EXHAUST GAS TEMP SENSOR 1 B1	—	2	×	B	EC-494
P0546	0546	EXHAUST GAS TEMP SENSOR 1 B1	—	2	×	B	EC-497
P0547	0547	EXHAUST GAS TEMP SENSOR 1 B2	—	2	×	B	EC-500
P0548	0548	EXHAUST GAS TEMP SENSOR 1 B2	—	2	×	B	EC-500
P0549	0549	EXHAUST GAS TEMP SENSOR 1 B2	—	2	×	B	EC-503
P0550	0550	PW ST P SEN/CIRC	—	2	—	—	EC-506
P059F	059F	ACTIVE GRILLE AIR SHUTTER A	—	2	×	B	EC-509
P0603	0603	ECM BACK UP/CIRCUIT	—	2	—	B	EC-513
P0604	0604	ECM	—	1	×	B	EC-515
P0605	0605	ECM	—	1 or 2	×	B	EC-517
P0606	0606	CONTROL MODULE	—	1	× or —	B	EC-519
P0607	0607	ECM	—	1 or 2	× or —	B	EC-521
P060A	060A	CONTROL MODULE	—	1	×	B	EC-522
P060B	060B	CONTROL MODULE	—	1	×	B	EC-524
P0611	0611	FIC MODULE	—	2	×	B	EC-526
P062B	062B	ECM	—	2	×	B	EC-527
P062F	062F	CONTROL MODULE	—	1	×	B	EC-529
P0643	0643	SENSOR POWER/CIRC	—	1	×	B	EC-530
P0705	0705	T/M RANGE SENSOR A	—	2	×	B	TM-372
P0710	0710	FLUID TEMP SENSOR*7	—	2	×	B	TM-374
P0717	0717	INPUT SPEED SENSOR A	—	2	×	B	TM-377
P0720	0720	OUTPUT SPEED SENSOR*5	—	2	×	B	TM-379
P0729	0729	6GR INCORRECT RATIO*7	—	2	×	B	TM-383

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
P0730	0730	INCORRECT GR RATIO	—	2	×	B	TM-386
P0731	0731	1GR INCORRECT RATIO*7	—	2	×	B	TM-388
P0732	0732	2GR INCORRECT RATIO*7	—	2	×	B	TM-391
P0733	0733	3GR INCORRECT RATIO*7	—	2	×	B	TM-394
P0734	0734	4GR INCORRECT RATIO*7	—	2	×	B	TM-397
P0735	0735	5GR INCORRECT RATIO*7	—	2	×	B	TM-400
P0740	0740	TORQUE CONVERTER	—	2	×	B	TM-403
P0744	0744	TORQUE CONVERTER	—	2	×	B	TM-405
P0745	0745	PC SOLENOID A	—	2	×	B	TM-407
P0750	0750	SHIFT SOLENOID A	—	2	×	B	TM-408
P0775	0775	PC SOLENOID B	—	2	×	B	TM-410
P0780	0780	SHIFT	—	1	×	B	TM-412
P0795	0795	PC SOLENOID C	—	2	×	B	TM-414
P0850	0850	P-N POS SW/CIRCUIT	—	2	×	B	EC-533
P100A	100A	VVEL SYSTEM-B1	—	2	×	B	EC-536
P100B	100B	VVEL SYSTEM-B2	—	2	×	B	EC-536
P1078	1078	EXH TIM SEN/CIRC-B1	—	2	×	B	EC-540
P1084	1084	EXH TIM SEN/CIRC-B2	—	2	×	B	EC-540
P1087	1087	VVEL SYSTEM-B1	—	1	×	B	EC-543
P1088	1088	VVEL SYSTEM-B2	—	1	×	B	EC-543
P1089	1089	VVEL POS SEN/CIRC-B1	—	1	×	B	EC-544
P1090	1090	VVEL ACTR MOT-B1	—	1	×	B	EC-547
P1091	1091	VVEL ACTR MOT PWR	—	1 or 2	×	B	EC-551
P1092	1092	VVEL POS SEN/CIRC-B2	—	1	×	B	EC-544
P1093	1093	VVEL ACTR MOT-B2	—	1	×	B	EC-547
P1148	1148	CLOSED LOOP-B1	—	1	×	A	EC-554
P1168	1168	CLOSED LOOP-B2	—	1	×	A	EC-554
P1197	1197	FUEL RUN OUT	—	2	—	—	EC-555
P119A	119A	FUEL PRESSURE SENSOR	—	2	×	A	EC-557
P119B	119B	FUEL PRESSURE SENSOR	—	2	×	A	EC-557
P119C	119C	FUEL PRESSURE SENSOR	—	2	×	B	EC-562
P1212	1212	TCS/CIRC	—	2	—	—	EC-566
P1217	1217	ENG OVER TEMP	—	1	×	B	EC-568
P1220	1220	FPCM	—	1	—	—	EC-571
P1225	1225	CTP LEARNING-B1	—	2	—	—	EC-575
P1226	1226	CTP LEARNING-B1	—	2	—	—	EC-576
P1423	1423	COLD START CONTROL	—	2	×	A	EC-577
P1424	1424	COLD START CONTROL	—	2	×	A	EC-577
P1550	1550	BAT CURRENT SENSOR	—	2	—	—	EC-579
P1551	1551	BAT CURRENT SENSOR	—	2	—	—	EC-582
P1552	1552	BAT CURRENT SENSOR	—	2	—	—	EC-582
P1553	1553	BAT CURRENT SENSOR	—	2	—	—	EC-585

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
P1554	1554	BAT CURRENT SENSOR	—	2	—	—	EC-588
P1556	1556	BAT TMP SEN/CIRC	—	2	—	—	EC-591
P1557	1557	BAT TMP SEN/CIRC	—	2	—	—	EC-591
P1564	1564	ASCD SW	—	1	—	—	EC-594
P1572	1572	ASCD BRAKE SW	—	1	—	—	EC-598
P1574	1574	ASCD VHL SPD SEN	—	1	—	—	EC-604
P159F	159F	ACTIVE GRILLE AIR SHUTTER A	—	2	—	—	EC-606
P1606	1606	VVEL CONTROL MODULE	—	1 or 2	× or —	B	EC-608
P1607	1607	VVEL CONTROL MODULE	—	1	×	B	EC-609
P1608	1608	VVEL SENSOR POWER/CIRC	—	1	×	B	EC-610
P1610	1610	LOCK MODE	—	2	—	—	SEC-71
P1611	1611	ID DISCORD IMMU-ECM	—	2	—	—	SEC-73
P1612	1612	CHAIN OF ECM-IMMU	—	2	—	—	SEC-75
P1615	1615	DIFFERENCE OF KEY	—	2	—	—	SEC-77
P1730	1730	INTERLOCK	—	2	×	B	TM-421
P1734	1734	7GR INCORRECT RATIO*7	—	2	×	B	TM-423
P1805	1805	BRAKE SW/CIRCUIT	—	2	—	—	EC-612
P2080	2080	EXHAUST GAS TEMP SENSOR 1 B1	—	2	×	B	EC-615
P2081	2081	EXHAUST GAS TEMP SENSOR 1 B1	—	2	×	B	EC-497
P2082	2082	EXHAUST GAS TEMP SENSOR 1 B2	—	2	×	B	EC-618
P2083	2083	EXHAUST GAS TEMP SENSOR 1 B2	—	2	×	B	EC-503
P2096	2096	POST CAT FUEL TRIM SYS B1	—	2	×	A	EC-621
P2097	2097	POST CAT FUEL TRIM SYS B1	—	2	×	A	EC-621
P2098	2098	POST CAT FUEL TRIM SYS B2	—	2	×	A	EC-621
P2099	2099	POST CAT FUEL TRIM SYS B2	—	2	×	A	EC-621
P2100	2100	ETC MOT PWR-B1	—	1	×	B	EC-626
P2101	2101	ETC FNCTN/CIRC-B1	—	1	×	B	EC-628
P2103	2103	ETC MOT PWR	—	1	×	B	EC-626
P2118	2118	ETC MOT-B1	—	1	×	B	EC-632
P2119	2119	ETC ACTR-B1	—	1	×	B	EC-634
P2122	2122	APP SEN 1/CIRC	—	1	×	B	EC-636
P2123	2123	APP SEN 1/CIRC	—	1	×	B	EC-636
P2127	2127	APP SEN 2/CIRC	—	1	×	B	EC-639
P2128	2128	APP SEN 2/CIRC	—	1	×	B	EC-639
P2135	2135	TP SENSOR-B1	—	1	×	B	EC-642
P2138	2138	APP SENSOR	—	1	×	B	EC-645

DTC*1		Items (CONSULT screen terms)	SRT code	Trip	MIL	Permanent DTC group*9	Reference page
CONSULT GST*2	ECM*3						
P219A	219A	AIR FUEL RATIO IMBALANCE B1	×	2	×	A	EC-649
P219B	219B	AIR FUEL RATIO IMBALANCE B2	×	2	×	A	EC-649
P219C	219C	CYLINDER 1 AIR-FUEL RATIO	×	2	×	A	EC-654
P219D	219D	CYLINDER 2 AIR-FUEL RATIO	×	2	×	A	EC-654
P219E	219E	CYLINDER 3 AIR-FUEL RATIO	×	2	×	A	EC-654
P219F	219F	CYLINDER 4 AIR-FUEL RATIO	×	2	×	A	EC-654
P21A0	21A0	CYLINDER 5 AIR-FUEL RATIO	×	2	×	A	EC-654
P21A1	21A1	CYLINDER 6 AIR-FUEL RATIO	×	2	×	A	EC-654
P21A2	21A2	CYLINDER 7 AIR-FUEL RATIO	×	2	×	A	EC-654
P21A3	21A3	CYLINDER 8 AIR-FUEL RATIO	×	2	×	A	EC-654
P2610	2610	ECM/PCM INTERNAL ENG OFF TIMER	—	2	×	A and B	EC-661
P26A3	26A3	ENGINE COOLANT BYPASS VALVE	—	1 or 2	×	B	EC-663
P26A5	26A5	ENGINE COOLANT B/V A POSI SEN	—	2	×	A	EC-666
P26A6	26A6	ENGINE COOLANT B/V A POSI SEN	—	2	×	B	EC-670
P26A7	26A7	ENGINE COOLANT B/V A POSI SEN	—	2	×	B	EC-670
P26AB	26AB	ENGINE COOLANT B/V A POSI SEN	—	2	×	A	EC-673
P2713	2713	PRESS CONTROL SOL D	—	2	×	B	TM-429
P2722	2722	PRESS CONTROL SOL E	—	2	×	B	TM-431
P2731	2731	PRESS CONTROL SOL F	—	2	×	B	TM-433
P2807	2807	PRESS CONTROL SOL G	—	2	×	B	TM-435

*1: 1st trip DTC No. is the same as DTC No.

*2: This number is prescribed by SAE J2012/ISO 15031-6.

*3: In Diagnostic Test Mode II (Self-diagnostic results), this number is controlled by NISSAN.

*4: The troubleshooting for this DTC needs CONSULT.

*5: When the fail safe operations for both self-diagnoses occur, the MIL illuminates.

*6: When the ECM is in the mode that displays SRT status, MIL may blink. For the details, refer to “How to Display SRT Status”.

*7: When erasing this DTC, always use CONSULT or GST.

*8: SRT code will not be set if the self-diagnostic result is NG.

*9: Refer to EC-214, "Description", “HOW TO ERASE PERMANENT DTC”.

Test Value and Test Limit

INFOID:0000000014658068

The following is the information specified in Service $06 of SAE J1979/ISO 15031-5.
The test value is a parameter used to determine whether a system/circuit diagnostic test is OK or NG while being monitored by the ECM during self-diagnosis. The test limit is a reference value which is specified as the maximum or minimum value and is compared with the test value being monitored.
These data (test value and test limit) are specified by On Board Monitor ID (OBDMID), Test ID (TID), Unit and Scaling ID and can be displayed on the GST screen.
The items of the test value and test limit will be displayed with GST screen which items are provided by the ECM. (e.g., if bank 2 is not applied on this vehicle, only the items of bank 1 are displayed)

Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
HO2S	01H	Air fuel ratio (A/F) sensor 1 (Bank 1)	P0131	83H	0BH	Minimum sensor output voltage for test cycle
			P0131	84H	0BH	Maximum sensor output voltage for test cycle
			P0130	85H	0BH	Minimum sensor output voltage for test cycle
			P0130	86H	0BH	Maximum sensor output voltage for test cycle
			P0133	87H	04H	Response rate: Response ratio (lean to rich)
			P0133	88H	04H	Response rate: Response ratio (rich to lean)
			P2A00 or P2096	89H	84H	The amount of shift in air fuel ratio (too lean)
			P2A00 or P2097	8AH	84H	The amount of shift in air fuel ratio (too rich)
			P0130	8BH	0BH	Difference in sensor output voltage
			P0133	8CH	83H	Response gain at the limited frequency
			P014C	8DH	04H	O2 sensor slow response - Rich to lean bank 1 sensor 1
			P014C	8EH	04H	O2 sensor slow response - Rich to lean bank 1 sensor 1
			P014D	8FH	84H	O2 sensor slow response - Lean to rich bank 1 sensor 1
			P014D	90H	84H	O2 sensor slow response - Lean to rich bank 1 sensor 1
			P015A	91H	01H	O2 sensor delayed response - Rich to lean bank 1 sensor 1
			P015A	92H	01H	O2 sensor delayed response - Rich to lean bank 1 sensor 1
			P015B	93H	01H	O2 sensor delayed response - Lean to rich bank 1 sensor 1
			P015B	94H	01H	O2 sensor delayed response - Lean to rich bank 1 sensor 1
			P0133	95H	04H	Response rate: Response ratio (lean to rich)
			P0133	96H	84H	Response rate: Response ratio (rich to lean)

Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
HO2S	02H	Heated oxygen sensor 2 (Bank 1)	P0138	07H	0CH	Minimum sensor output voltage for test cycle
			P0137	08H	0CH	Maximum sensor output voltage for test cycle
			P0138	80H	0CH	Sensor output voltage
			P0139	81H	0CH	Difference in sensor output voltage
			P0139	82H	11H	Rear O2 sensor delay response diagnosis
	03H	Heated oxygen sensor 3 (Bank 1)	P0143	07H	0CH	Minimum sensor output voltage for test cycle
			P0144	08H	0CH	Maximum sensor output voltage for test cycle
			P0146	80H	0CH	Sensor output voltage
			P0145	81H	0CH	Difference in sensor output voltage
	05H	Air fuel ratio (A/F) sensor 1 (Bank 2)	P0151	83H	0BH	Minimum sensor output voltage for test cycle
			P0151	84H	0BH	Maximum sensor output voltage for test cycle
			P0150	85H	0BH	Minimum sensor output voltage for test cycle
			P0150	86H	0BH	Maximum sensor output voltage for test cycle
			P0153	87H	04H	Response rate: Response ratio (lean to rich)
			P0153	88H	04H	Response rate: Response ratio (rich to lean)
			P2A03 or P2098	89H	84H	The amount of shift in air fuel ratio (too lean)
			P2A03 or P2099	8AH	84H	The amount of shift in air fuel ratio (too rich)
			P0150	8BH	0BH	Difference in sensor output voltage
			P0153	8CH	83H	Response gain at the limited frequency
			P014E	8DH	04H	O2 sensor slow response - Rich to lean bank 2 sensor 1
			P014E	8EH	04H	O2 sensor slow response - Rich to lean bank 2 sensor 1
			P014F	8FH	84H	O2 sensor slow response - Lean to rich bank 2 sensor 1
			P014F	90H	84H	O2 sensor slow response - Lean to rich bank 2 sensor 1
			P015C	91H	01H	O2 sensor delayed response - Rich to lean bank 2 sensor 1
			P015C	92H	01H	O2 sensor delayed response - Rich to lean bank 2 sensor 1
			P015D	93H	01H	O2 sensor delayed response - Lean to rich bank 2 sensor 1

Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
HO2S	05H	Air fuel ratio (A/F) sensor 1 (Bank 2)	P015D	94H	01H	O2 sensor delayed response - Lean to rich bank 2 sensor 1
			P0153	95H	04H	Response rate: Response ratio (lean to rich)
			P0153	96H	84H	Response rate: Response ratio (rich to lean)
	06H	Heated oxygen sensor 2 (Bank 2)	P0158	07H	0CH	Minimum sensor output voltage for test cycle
			P0157	08H	0CH	Maximum sensor output voltage for test cycle
			P0158	80H	0CH	Sensor output voltage
			P0159	81H	0CH	Difference in sensor output voltage
			P0159	82H	11H	Rear O2 sensor delay response diagnosis
	07H	Heated oxygen sensor 3 (Bank2)	P0163	07H	0CH	Minimum sensor output voltage for test cycle
			P0164	08H	0CH	Maximum sensor output voltage for test cycle
			P0166	80H	0CH	Sensor output voltage
			P0165	81H	0CH	Difference in sensor output voltage
CATALYST	21H	Three way catalyst function (Bank1)	P0420	80H	01H	O2 storage index
			P0420	82H	01H	Switching time lag engine exhaust index value
			P2423	83H	0CH	Difference in 3rd O2 sensor output voltage
			P2423	84H	84H	O2 storage index in HC trap catalyst
	22H	Three way catalyst function (Bank2)	P0430	80H	01H	O2 storage index
			P0430	82H	01H	Switching time lag engine exhaust index value
			P2424	83H	0CH	Difference in 3rd O2 sensor output voltage
			P2424	84H	84H	O2 storage index in HC trap catalyst
EGR SYSTEM	31H	EGR function	P0400	80H	96H	Low flow faults: EGR temp change rate (short term)
			P0400	81H	96H	Low flow faults: EGR temp change rate (long term)
			P0400	82H	96H	Low flow faults: Difference between max EGR temp and EGR temp under idling condition
			P0400	83H	96H	Low flow faults: Max EGR temp
			P1402	84H	96H	High Flow Faults: EGR temp increase rate
			P0402	85H	FCH	EGR differential pressure high flow
			P0401	86H	37H	EGR differential pressure low flow
			P2457	87H	96H	EGR temperature

Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
VVT SYSTEM	35H	VVT Monitor (Bank1)	P0011	80H	9DH	VTC intake function diagnosis (VTC alignment check diagnosis)
			P0014	81H	9DH	VTC exhaust function diagnosis (VTC alignment check diagnosis)
			P0011	82H	9DH	VTC intake function diagnosis (VTC drive failure diagnosis)
			P0014	83H	9DH	VTC exhaust function diagnosis (VTC drive failure diagnosis)
			P100A	84H	10H	VEL slow response diagnosis
			P1090	85H	10H	VEL servo system diagnosis
			P0011	86H	9DH	VTC intake intermediate lock function diagnosis (VTC intermediate position alignment check diagnosis)
			Advanced: P052A Retarded: P052B	87H	9DH	VTC intake intermediate lock system diagnosis (VTC intermediate lock position check diagnosis)
	36H	VVT Monitor (Bank2)	P0021	80H	9DH	VTC intake function diagnosis (VTC alignment check diagnosis)
			P0024	81H	9DH	VTC exhaust function diagnosis (VTC alignment check diagnosis)
			P0021	82H	9DH	VTC intake function diagnosis (VTC drive failure diagnosis)
			P0024	83H	9DH	VTC exhaust function diagnosis (VTC drive failure diagnosis)
			P100B	84H	10H	VEL slow response diagnosis
			P1093	85H	10H	VEL servo system diagnosis
			P0021	86H	9DH	VTC intake intermediate lock function diagnosis (VTC intermediate position alignment check diagnosis)
			Advanced: P052C Retarded: P052D	87H	9DH	VTC intake intermediate lock system diagnosis (VTC intermediate lock position check diagnosis)
EVAP SYSTEM	39H	EVAP control system leak (Cap Off)	P0455	80H	0CH	Difference in pressure sensor output voltage before and after pull down
	3BH	EVAP control system leak (Small leak)	P0442	80H	05H	Leak area index (for more than 0.04 inch)
	3CH	EVAP control system leak (Very small leak)	P0456	80H	05H	Leak area index (for more than 0.02 inch)
			P0456	81H	FDH	Maximum internal pressure of EVAP system during monitoring
			P0456	82H	FDH	Internal pressure of EVAP system at the end of monitoring
	3DH	Purge flow system	P0441	83H	0CH	Difference in pressure sensor output voltage before and after vent control valve close

Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
O2 SENSOR HEATER	41H	A/F sensor 1 heater (Bank 1)	Low Input: P0031 High Input: P0032	81H	0BH	Converted value of heater electric current to voltage
			P0030	83H	0BH	A/F sensor heater circuit malfunction
	42H	Heated oxygen sensor 2 heater (Bank 1)	Low Input: P0037 High Input: P0038	80H	0CH	Converted value of heater electric current to voltage
			P0141	81H	14H	Rear O2 sensor internal impedance
	43H	Heated oxygen sensor 3 heater (Bank 1)	P0043	80H	0CH	Converted value of heater electric current to voltage
	45H	A/F sensor 1 heater (Bank 2)	Low Input: P0051 High Input: P0052	81H	0BH	Converted value of heater electric current to voltage
			P0050	83H	0BH	A/F sensor heater circuit malfunction
	46H	Heated oxygen sensor 2 heater (Bank 2)	Low Input: P0057 High Input: P0058	80H	0CH	Converted value of heater electric current to voltage
			P0161	81H	14CH	Rear O2 sensor internal impedance
	47H	Heated oxygen sensor 3 heater (Bank 2)	P0063	80H	0CH	Converted value of heater electric current to voltage
SECONDARY AIR	71H	Secondary air system	P0411	80H	01H	Secondary air injection system incorrect flow detected
			Bank1: P0491 Bank2: P0492	81H	01H	Secondary air injection system insufficient flow
			P2445	82H	01H	Secondary air injection system pump stuck off
			P2448	83H	01H	Secondary air injection system high airflow
			Bank1: P2440 Bank2: P2442	84H	01H	Secondary air injection system switching valve stuck open
			P2440	85H	01H	Secondary air injection system switching valve stuck open
			P2444	86H	01H	Secondary air injection system pump stuck on

Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
MISFIRE	A1H	Multiple cylinder misfires	P0301	80H	24H	Misfiring counter at 1000 revolution of the first cylinder
			P0302	81H	24H	Misfiring counter at 1000 revolution of the second cylinder
			P0303	82H	24H	Misfiring counter at 1000 revolution of the third cylinder
			P0304	83H	24H	Misfiring counter at 1000 revolution of the fourth cylinder
			P0305	84H	24H	Misfiring counter at 1000 revolution of the fifth cylinder
			P0306	85H	24H	Misfiring counter at 1000 revolution of the sixth cylinder
			P0307	86H	24H	Misfiring counter at 1000 revolution of the seventh cylinder
			P0308	87H	24H	Misfiring counter at 1000 revolution of the eighth cylinder
			P0300	88H	24H	Misfiring counter at 1000 revolution of the multiple cylinders
			P0301	89H	24H	Misfiring counter at 200 revolution of the first cylinder
			P0302	8AH	24H	Misfiring counter at 200 revolution of the second cylinder
			P0303	8BH	24H	Misfiring counter at 200 revolution of the third cylinder
			P0304	8CH	24H	Misfiring counter at 200 revolution of the fourth cylinder
			P0305	8DH	24H	Misfiring counter at 200 revolution of the fifth cylinder
			P0306	8EH	24H	Misfiring counter at 200 revolution of the sixth cylinder
			P0307	8FH	24H	Misfiring counter at 200 revolution of the seventh cylinder
			P0308	90H	24H	Misfiring counter at 200 revolution of the eighth cylinder
			P0300	91H	24H	Misfiring counter at 1000 revolution of the single cylinder
			P0300	92H	24H	Misfiring counter at 200 revolution of the single cylinder
			P0300	93H	24H	Misfiring counter at 200 revolution of the multiple cylinders

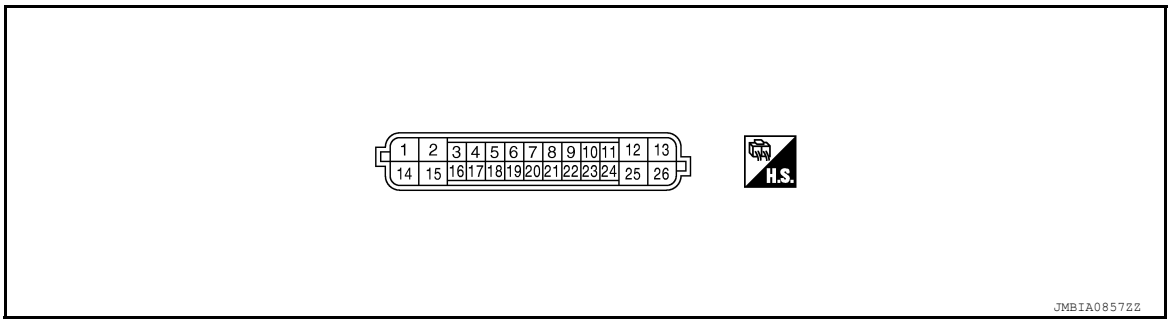
Item	OBD-MID	Self-diagnostic test item	DTC	Test value and Test limit (GST display)		Description
				TID	Unit and Scaling ID	
MISFIRE	A2H	No. 1 cylinder misfire	P0301	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0301	0CH	24H	Misfire counts for last/current driving cycles
	A3H	No. 2 cylinder misfire	P0302	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0302	0CH	24H	Misfire counts for last/current driving cycles
	A4H	No. 3 cylinder misfire	P0303	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0303	0CH	24H	Misfire counts for last/current driving cycles
	A5H	No. 4 cylinder misfire	P0304	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0304	0CH	24H	Misfire counts for last/current driving cycles
	A6H	No. 5 cylinder misfire	P0305	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0305	0CH	24H	Misfire counts for last/current driving cycles
	A7H	No. 6 cylinder misfire	P0306	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0306	0CH	24H	Misfire counts for last/current driving cycles
	A8H	No. 7 cylinder misfire	P0307	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0307	0CH	24H	Misfire counts for last/current driving cycles
	A9H	No. 8 cylinder misfire	P0308	0BH	24H	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles
			P0308	0CH	24H	Misfire counts for last/current driving cycles

VVEL CONTROL MODULE

Reference Value

INFOID:0000000014419430

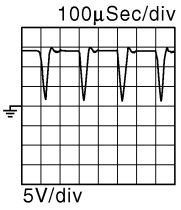
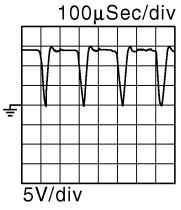
TERMINAL LAYOUT

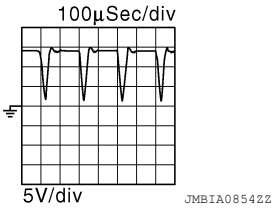
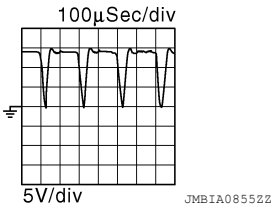


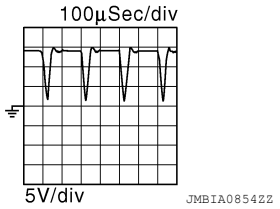
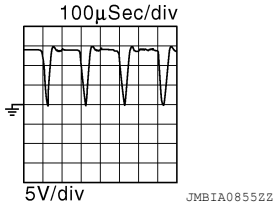
PHYSICAL VALUES

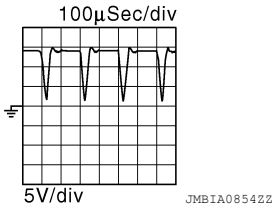
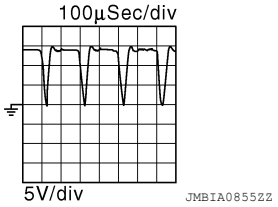
NOTE:

- Specification data are reference values and are measured between each terminals.
- Pulse signal is measured by CONSULT.

Terminal No.		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
1 (R)	14 (B)	VVEL actuator motor power supply (bank 2)	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14V)
2 (B)	14 (B)	VVEL actuator motor (High lift) (bank 2)	Output	[Engine is running] • Warm-up condition • Idle speed	0 - 14 V★ 
				[Engine is running] • Warm-up condition • When revving engine up to 2,000 rpm quickly	0 - 14 V★ 
3 (W)	6 (R)	VVEL control shaft position sensor 1 (bank 1)	Input	[Engine is running] • Warm-up condition • Idle speed	0.25 - 1.40 V
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0.25 - 4.75 V
4 (W/G)	—	Sensor ground [VVEL control shaft position sensor 1 (bank 2)]	—	—	—

Terminal No.		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
5 (L/G)	4 (W/G)	VVEL control shaft position sensor 1 (bank 2)	Input	[Engine is running] • Warm-up condition • Idle speed	0.25 - 1.40 V
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0.25 - 4.75 V
6 (R)	—	Sensor ground [VVEL control shaft position sensor 1 (bank 1)]	—	—	—
7 (B)	6 (R)	Sensor power supply [VVEL control shaft position sensor 1 (bank 1)]	—	[Ignition switch: ON]	5 V
8 (W)	14 (B)	Power supply for VVEL control module	—	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
9 (L)	4 (W/G)	Sensor power supply [VVEL position sensor 1 (bank 2)]	—	[Ignition switch: ON]	5 V
11 (W)	—	ENG communication line	Input/ Output	—	—
12 (B)	14 (B)	VVEL actuator motor (High lift) (bank 1)	Output	[Engine is running] • Warm-up condition • Idle speed	0 - 14 V★ 
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0 - 14 V★ 
13 (R)	14 (B)	VVEL actuator motor power supply (bank 1)	Input	[Ignition switch: ON]	BATTERY VOLTAGE (11 - 14 V)
14 (B)	—	VVEL control module ground	—	—	—

Terminal No. +	Terminal No. –	Description: Signal name	Description: Input/ Output	Condition	Value (Approx.)
15 (W)	14 (B)	VVEL actuator motor (Low lift) (bank 2)	Output	[Engine is running] • Warm-up condition • Idle speed	0 - 14 V★ 
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0 - 14 V★ 
16 (L/G)	19 (L)	VVEL control shaft position sensor 2 (bank 1)	Input	[Engine is running] • Warm-up condition • Idle speed	3.50 - 4.75 V
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0.25 - 4.75 V
17 (O)	—	Sensor ground [VVEL control shaft position sensor 2 (bank 2)]	—	—	—
18 (O/L)	17 (O)	VVEL control shaft position sensor 2 (bank 2)	Input	[Engine is running] • Warm-up condition • Idle speed	3.50 - 4.75 V
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0.25 - 4.75 V
19 (L)	—	Sensor ground [VVEL control shaft position sensor 2 (bank 1)]	—	—	—
20 (W/G)	19 (L)	Sensor power supply [VVEL control shaft position sensor 2 (bank 1)]	—	[Ignition switch: ON]	5 V
21 (BR/ W)	14 (B)	VVEL actuator motor relay abort signal (ECM)	Input	[Engine is running] • Warm-up condition • Idle speed	0 V
22 (L/G)	17 (O)	Sensor power supply [VVEL control shaft position sensor 2 (bank 2)]	—	[Ignition switch: ON]	5 V
23 (BR/Y)	14 (B)	VVEL control motor relay	Output	[Ignition switch: OFF]	BATTERY VOLTAGE (11 - 14 V)
				[Ignition switch: ON]	0 - 1.0 V
24 (R/W)	—	ENG communication line	Input/ Output	—	—

Terminal No.		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
25 (W)	14 (B)	VVEL control motor (Low lift) (bank 1)	Output	[Engine is running] • Warm-up condition • Idle speed	0 - 14 V★ 
				[Engine is running] • Warm-up condition • When revving engine up to 3,000 rpm quickly	0 - 14 V★ 

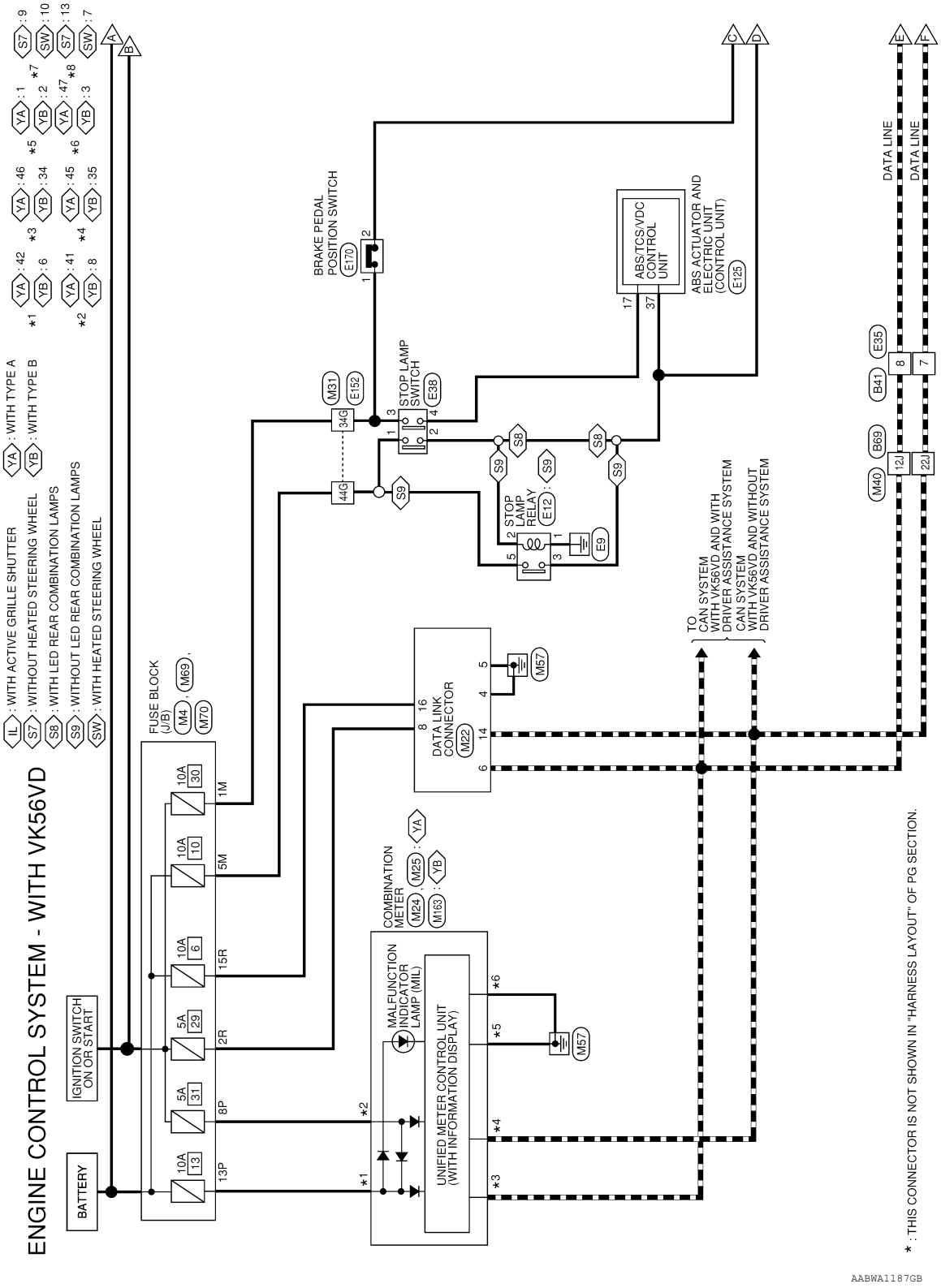
★: Average voltage for pulse signal (Actual pulse signal can be confirmed by oscilloscope.)

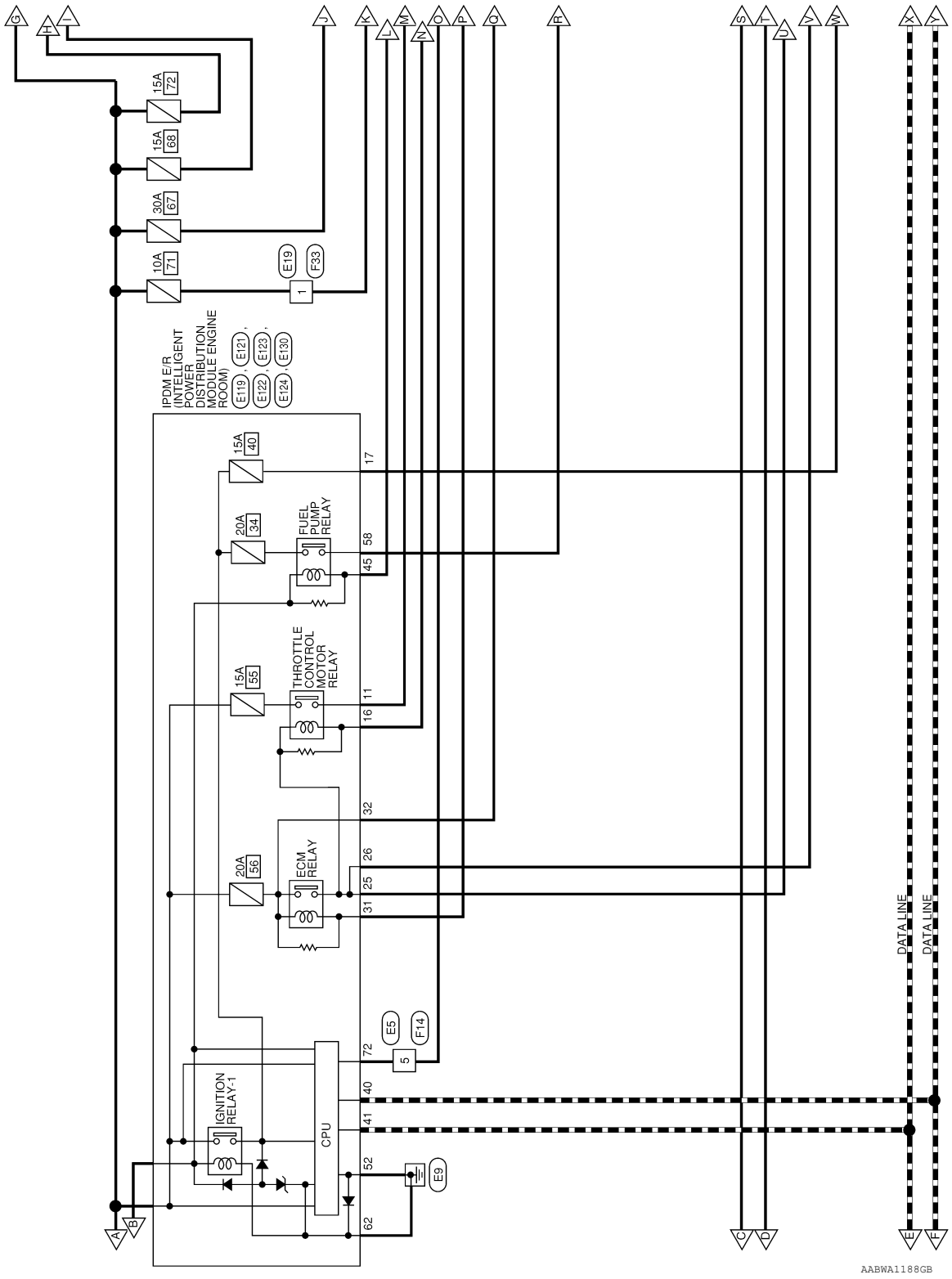
WIRING DIAGRAM

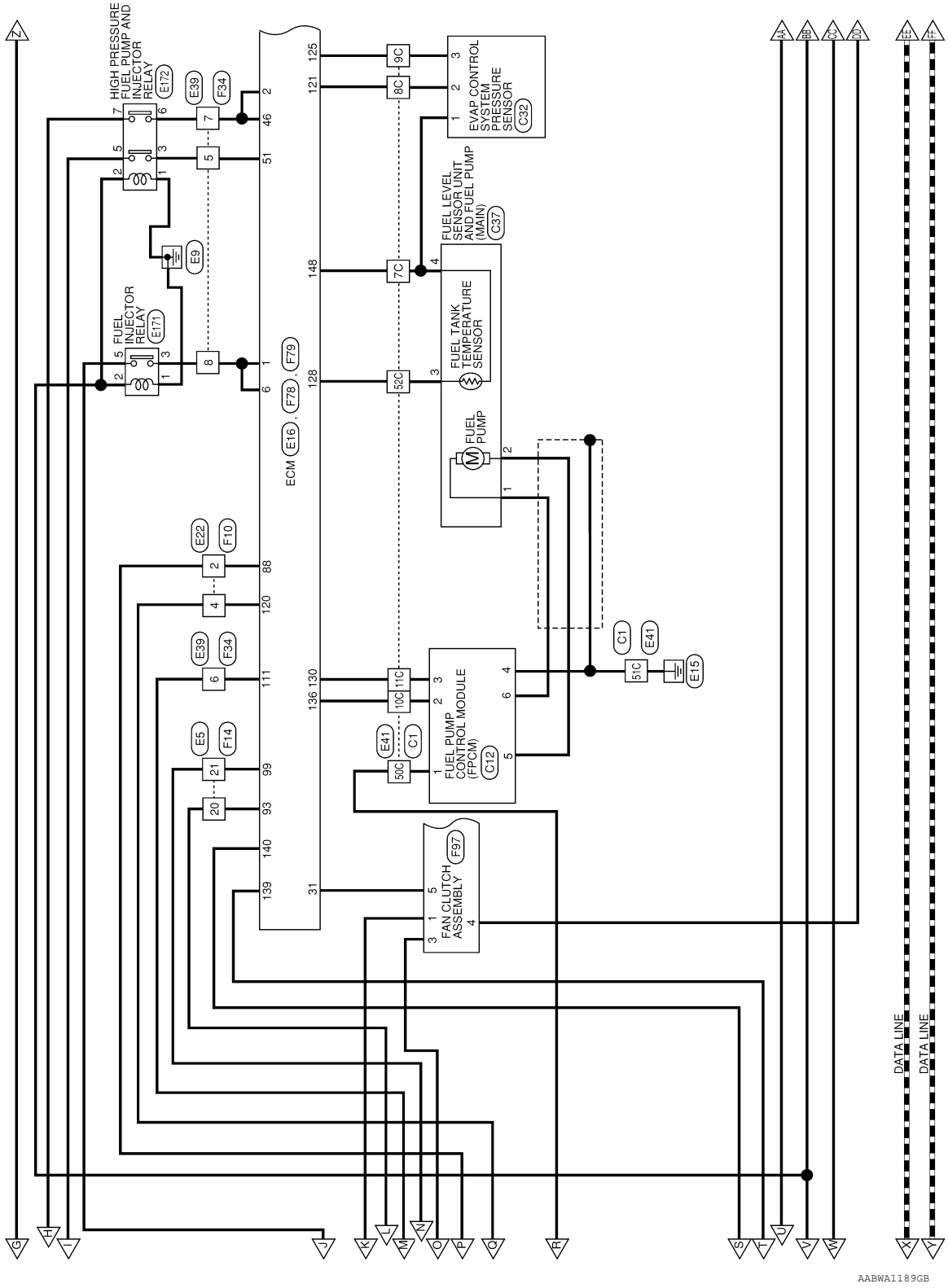
ENGINE CONTROL SYSTEM

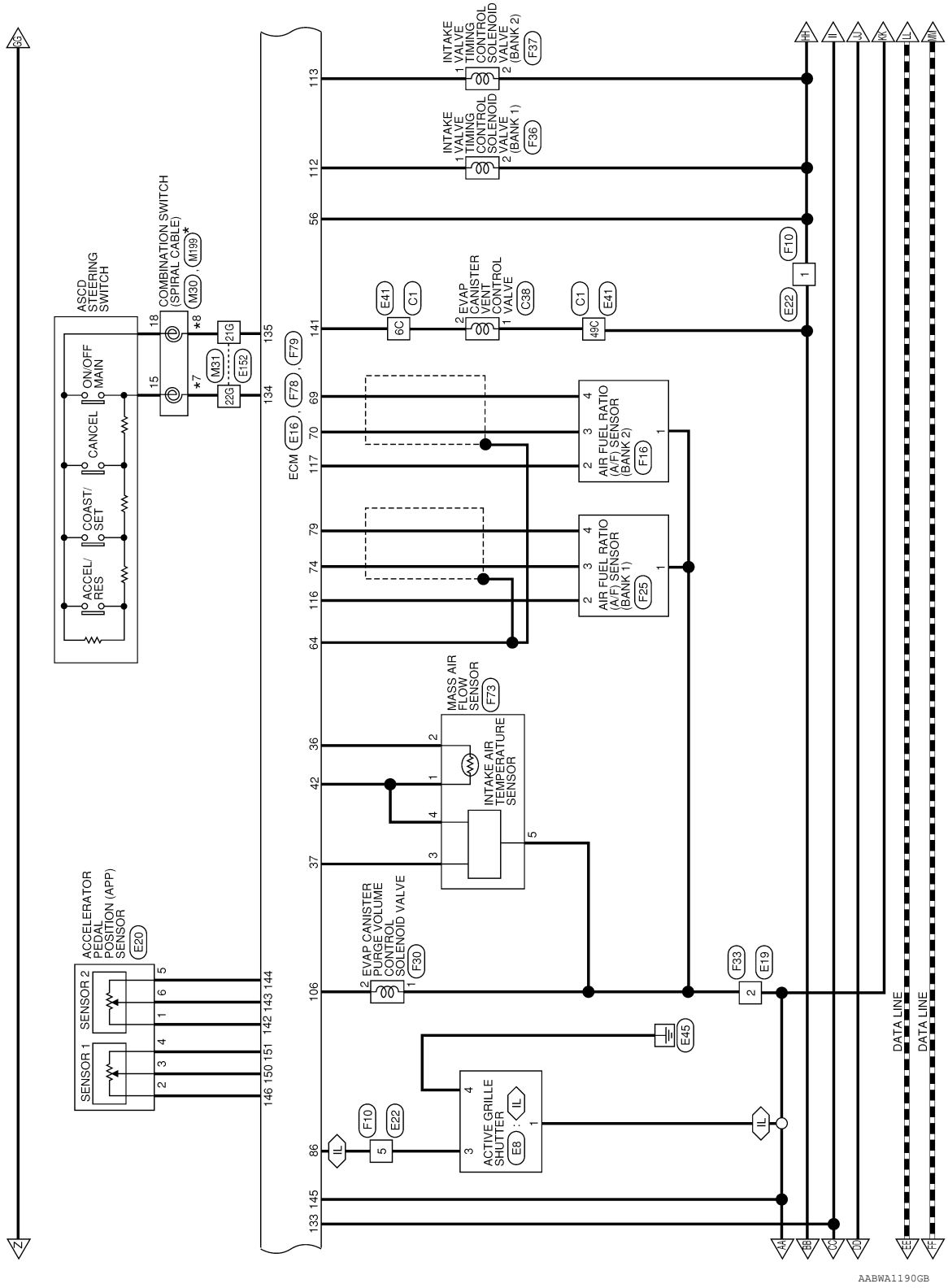
Wiring Diagram

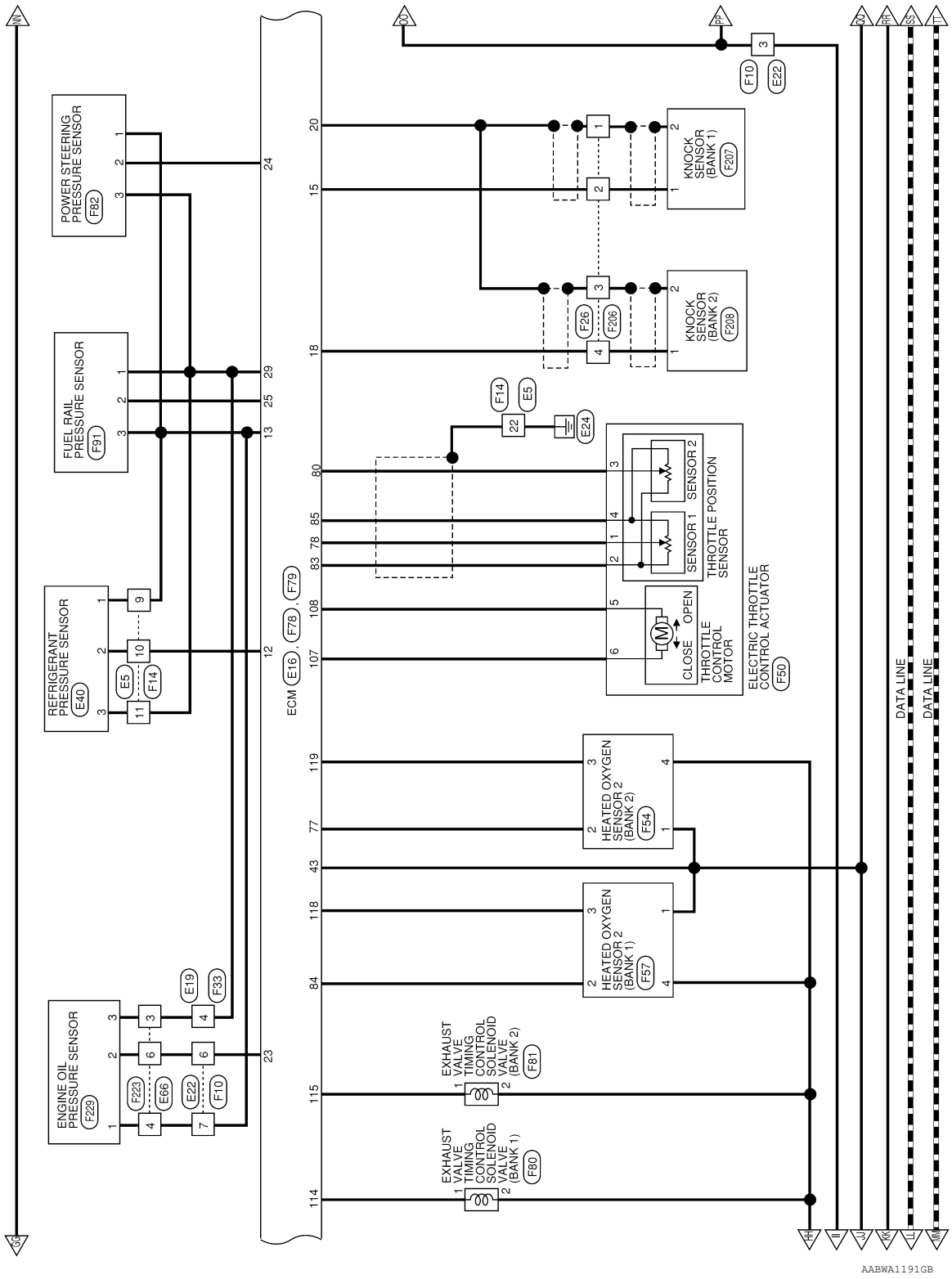
INFOID:0000000014419431

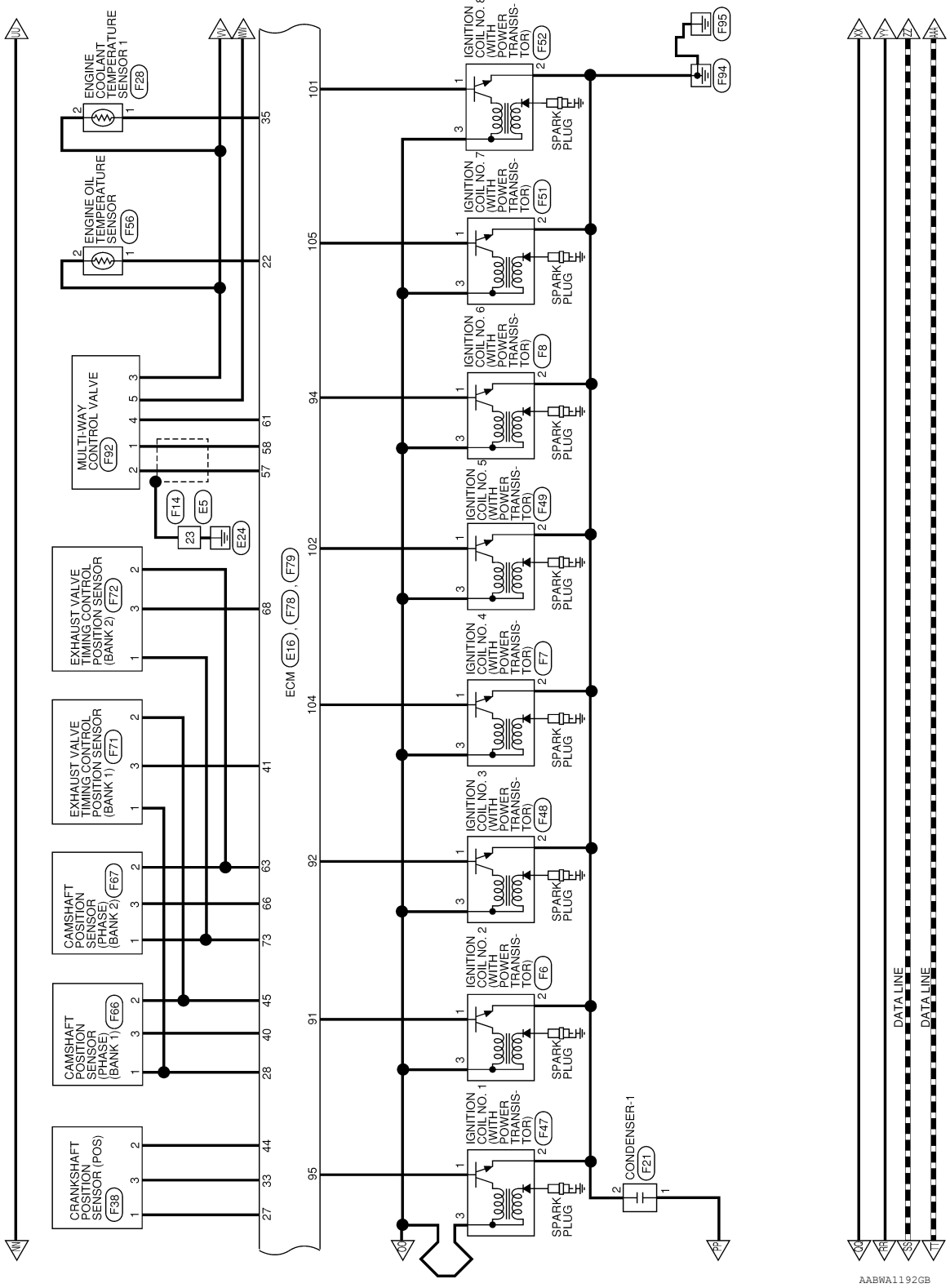


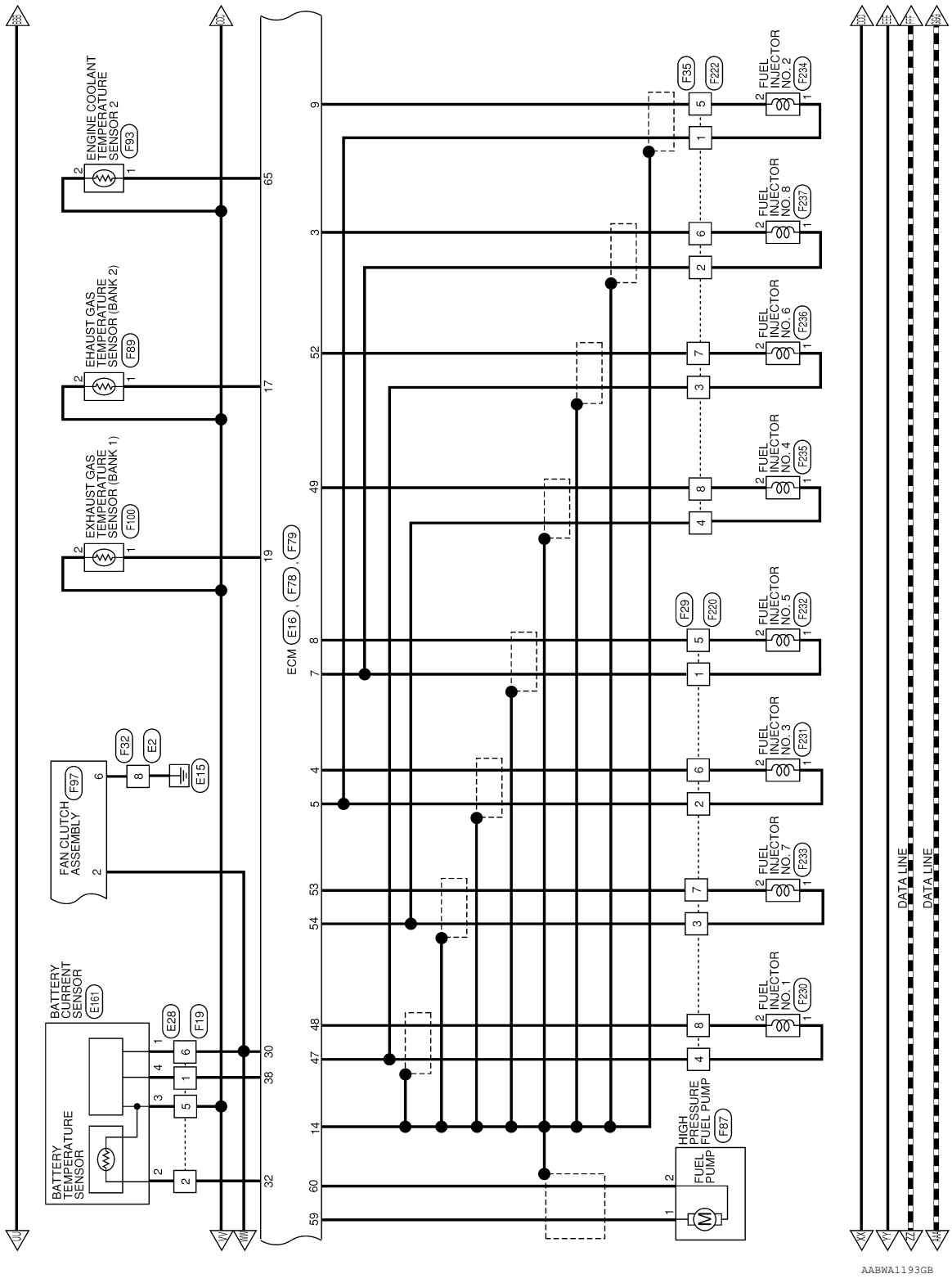

15A 72
15A 68
30A 67
10A 71
E19
F33
1
IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
(E119), (E121), (E122), (E123), (E124), (E130)
15A 40
17
20A 34
FUEL PUMP RELAY
58
45
15A 55
THROTTLE CONTROL MOTOR RELAY
11
16
32
20A 56
ECM RELAY
26
25
31
E5
F14
5
72
40
41
IGNITION RELAY-1
CPU
52
62
E9
DATA LINE
DATA LINE
AABWA1188GB

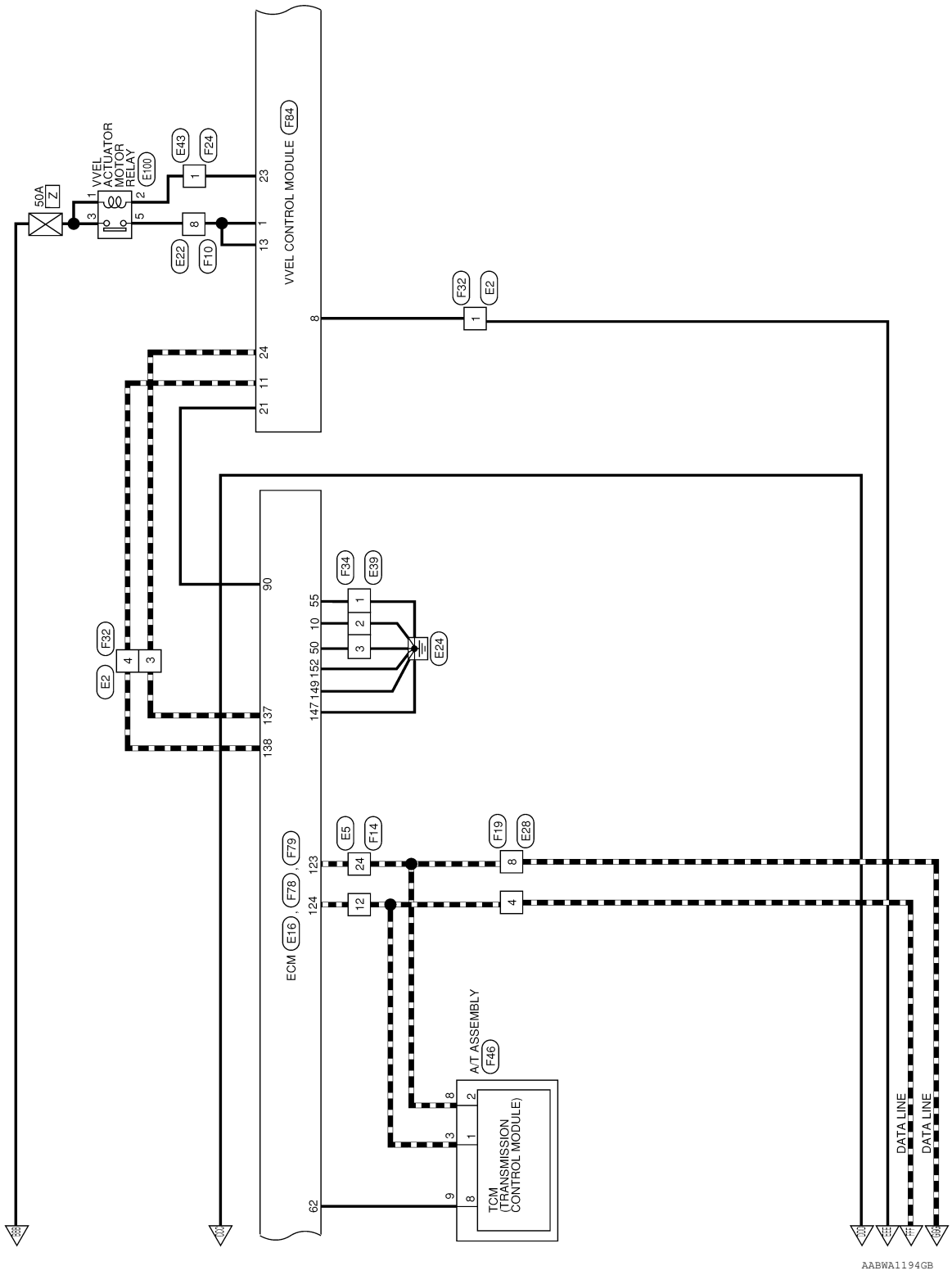

HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY
E172
E39
F34
FUEL INJECTOR RELAY
E171
E9
ECM
E16
F78
F79
EVAP CONTROL SYSTEM PRESSURE SENSOR
C32
FUEL LEVEL SENSOR UNIT AND FUEL PUMP (MAIN)
C37
FUEL TANK TEMPERATURE SENSOR
FUEL PUMP
E22
F10
E5
F14
FUEL PUMP CONTROL MODULE (FPCM)
C12
C1
E41
E15
FAN CLUTCH ASSEMBLY
F97
DATA LINE
DATA LINE
AABWA1189GB

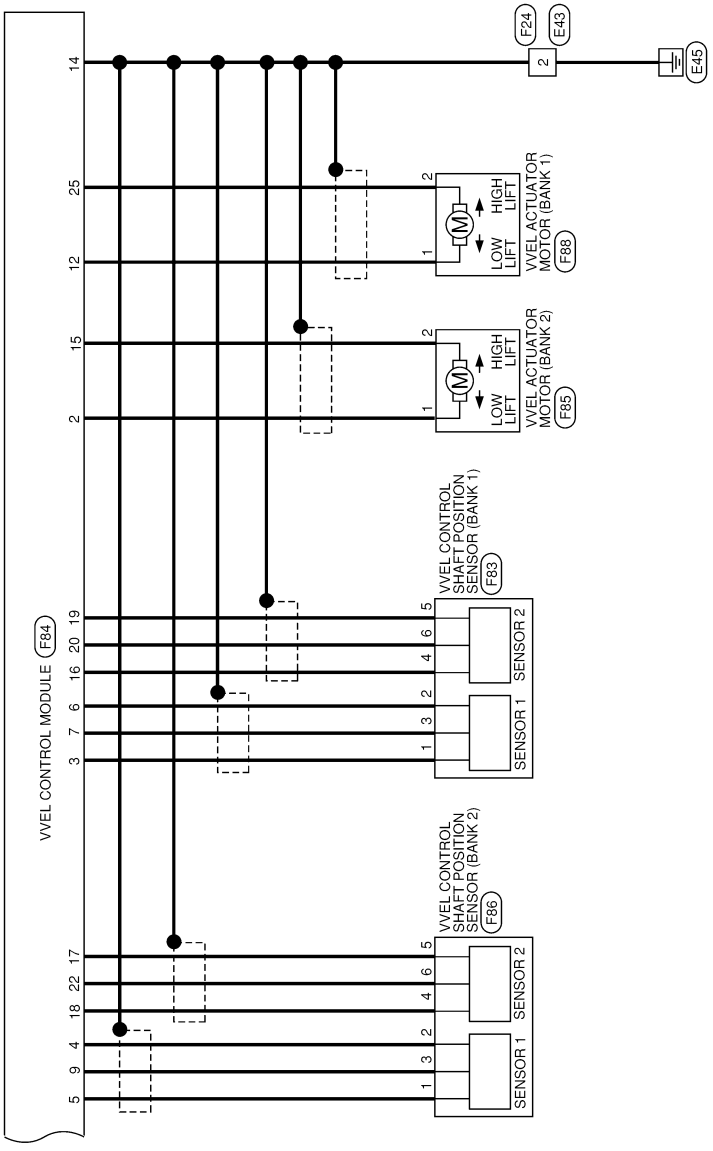

ASCD STEERING SWITCH
ON/OFF MAIN
CANCEL
COAST/ SET
ACCEL/ RES
COMBINATION SWITCH (SPIRAL CABLE) M30, M139
M31
E152
21G
22G
ECM E16, F78, F79
INTAKE VALVE TIMING CONTROL SOLENOID VALVE (BANK 2) F37
INTAKE VALVE TIMING CONTROL SOLENOID VALVE (BANK 1) F36
EVAP CANISTER VENT CONTROL VALVE C38
AIR FUEL RATIO (A/F) SENSOR (BANK 2) F16
AIR FUEL RATIO (A/F) SENSOR (BANK 1) F25
MASS AIR FLOW SENSOR F73
INTAKE AIR TEMPERATURE SENSOR
EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE F30
ACCELERATOR PEDAL POSITION (APP) SENSOR E20
SENSOR 1
SENSOR 2
ACTIVE GRILLE SHUTTER E8
IL
E45
F33
E19
F10
E22
C1
E41
6C
49C
DATA LINE
DATA LINE
AABWA1190GB


POWER STEERING PRESSURE SENSOR F82
FUEL RAIL PRESSURE SENSOR F91
REFRIGERANT PRESSURE SENSOR E40
ENGINE OIL PRESSURE SENSOR F223
ECM E16, F78, F79
KNOCK SENSOR (BANK 1) F207
KNOCK SENSOR (BANK 2) F208
F26
F206
F14
E5
E24
THROTTLE POSITION SENSOR
SENSOR 1
SENSOR 2
THROTTLE CONTROL MOTOR
CLOSE
OPEN
ELECTRIC THROTTLE CONTROL ACTUATOR F50
HEATED OXYGEN SENSOR 2 (BANK 2) F54
HEATED OXYGEN SENSOR 2 (BANK 1) F57
EXHAUST VALVE TIMING CONTROL SOLENOID VALVE (BANK 2) F81
EXHAUST VALVE TIMING CONTROL SOLENOID VALVE (BANK 1) F80
E19
F33
F223
E66
E22
F10
F10
E22
DATA LINE
DATA LINE
AABWA1191GB


ENGINE COOLANT TEMPERATURE SENSOR 1 F28
ENGINE OIL TEMPERATURE SENSOR F56
MULTI-WAY CONTROL VALVE F92
EXHAUST VALVE TIMING CONTROL POSITION SENSOR (BANK 2) F72
EXHAUST VALVE TIMING CONTROL POSITION SENSOR (BANK 1) F71
CAMSHAFT POSITION SENSOR (PHASE) (BANK 2) F67
CAMSHAFT POSITION SENSOR (PHASE) (BANK 1) F66
CRANKSHAFT POSITION SENSOR (POS) F38
F14
E5
23
E24
ECM E16, F78, F79
IGNITION COIL NO. 8 (WITH POWER TRANSISTOR) F52
IGNITION COIL NO. 7 (WITH POWER TRANSISTOR) F51
IGNITION COIL NO. 6 (WITH POWER TRANSISTOR) F8
IGNITION COIL NO. 5 (WITH POWER TRANSISTOR) F49
IGNITION COIL NO. 4 (WITH POWER TRANSISTOR) F7
IGNITION COIL NO. 3 (WITH POWER TRANSISTOR) F48
IGNITION COIL NO. 2 (WITH POWER TRANSISTOR) F6
IGNITION COIL NO. 1 (WITH POWER TRANSISTOR) F47
SPARK PLUG
CONDENSER-1 F21
F95
F94
DATA LINE
DATA LINE
AABWA1192GB


ENGINE COOLANT TEMPERATURE SENSOR 2
F93
EHAUST GAS TEMPERATURE SENSOR (BANK 2)
F89
EXHAUST GAS TEMPERATURE SENSOR (BANK 1)
F100
FAN CLUTCH ASSEMBLY
F97
BATTERY CURRENT SENSOR
E161
BATTERY TEMPERATURE SENSOR
ECM E16, E78, F79
FUEL INJECTOR NO. 1 F230
FUEL INJECTOR NO. 2 F234
FUEL INJECTOR NO. 3 F231
FUEL INJECTOR NO. 4 F235
FUEL INJECTOR NO. 5 F232
FUEL INJECTOR NO. 6 F236
FUEL INJECTOR NO. 7 F233
FUEL INJECTOR NO. 8 F237
HIGH PRESSURE FUEL PUMP F87
FUEL PUMP
DATA LINE
DATA LINE
AABWA1193GB


50A
Z
VVEL ACTUATOR MOTOR RELAY
E100
E43
F24
E22
F10
VVEL CONTROL MODULE
F84
F32
E2
E24
F34
E39
ECM
E16
F78
F79
E5
F14
F19
E28
A/T ASSEMBLY
F46
TCM (TRANSMISSION CONTROL MODULE)
DATA LINE
DATA LINE
AABWA1194GB



AABWA1195GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	B41
Connector Name	WIRE TO WIRE
Connector Type	NS12MW-CS
Connector Color	WHITE

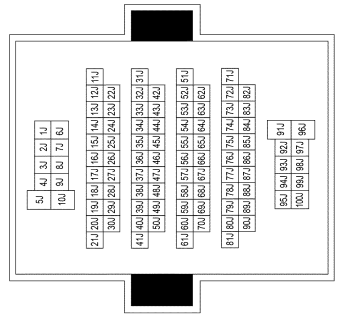
H.S.

1	2	3		4	5
6	7	8	9	10	11	12

Terminal No.	Color of Wire	Signal Name
1	Y	TO ENGINE ROOM HARNESS
2	V	TO ENGINE ROOM HARNESS
3	L	TO ENGINE ROOM HARNESS
4	L/G	TO ENGINE ROOM HARNESS
5	R/G	TO ENGINE ROOM HARNESS
6	SB	TO ENGINE ROOM HARNESS
7	P	TO ENGINE ROOM HARNESS
8	L	TO ENGINE ROOM HARNESS
9	SHIELD	TO ENGINE ROOM HARNESS
10	W/G	TO ENGINE ROOM HARNESS
11	L	TO ENGINE ROOM HARNESS
12	BR	TO ENGINE ROOM HARNESS

Connector No.	B69
Connector Name	WIRE TO WIRE
Connector Type	TH80MW-CS16-TM4
Connector Color	WHITE

H.S.



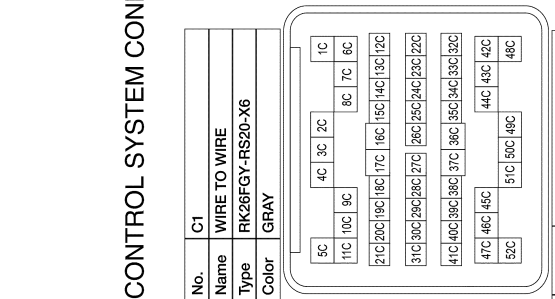
Terminal No.	Color of Wire	Signal Name
1J	P	TO MAIN HARNESS
2J	R/Y	TO MAIN HARNESS
3J	L	TO MAIN HARNESS
4J	L/B	TO MAIN HARNESS
5J	G/W	TO MAIN HARNESS
6J	LG/Y	TO MAIN HARNESS
7J	BR/LG	TO MAIN HARNESS
8J	SB/BR	TO MAIN HARNESS
9J	BR	TO MAIN HARNESS
10J	BR	TO MAIN HARNESS
11J	O/B	TO MAIN HARNESS
12J	L	TO MAIN HARNESS
13J	SB/O	TO MAIN HARNESS
14J	Y	TO MAIN HARNESS
15J	–	TO MAIN HARNESS
16J	R	TO MAIN HARNESS
17J	G	TO MAIN HARNESS
18J	SB	TO MAIN HARNESS
19J	O	TO MAIN HARNESS
20J	O/B	TO MAIN HARNESS
21J	Y/R	TO MAIN HARNESS
22J	P	TO MAIN HARNESS
23J	W	TO MAIN HARNESS
24J	W/R	TO MAIN HARNESS
25J	V	TO MAIN HARNESS
26J	L	TO MAIN HARNESS
27J	R	TO MAIN HARNESS
28J	L	TO MAIN HARNESS
29J	G/O	TO MAIN HARNESS
30J	SB	TO MAIN HARNESS
31J	LG	TO MAIN HARNESS
32J	R	TO MAIN HARNESS
33J	L	TO MAIN HARNESS
34J	Y	TO MAIN HARNESS
35J	P	TO MAIN HARNESS
36J	G/R	TO MAIN HARNESS
37J	LG/B	TO MAIN HARNESS
38J	SB	TO MAIN HARNESS
39J	Y/L	TO MAIN HARNESS
40J	BR	TO MAIN HARNESS
41J	L	TO MAIN HARNESS
42J	L	TO MAIN HARNESS
43J	SB	TO MAIN HARNESS
44J	BR	TO MAIN HARNESS
45J	BG	TO MAIN HARNESS
46J	P/Y	TO MAIN HARNESS
47J	Y/GR	TO MAIN HARNESS
48J	V	TO MAIN HARNESS
49J	BR/Y	TO MAIN HARNESS
50J	G/W	TO MAIN HARNESS
51J	–	TO MAIN HARNESS
52J	SHIELD	TO MAIN HARNESS
53J	R	TO MAIN HARNESS
54J	L	TO MAIN HARNESS
55J	R	TO MAIN HARNESS
56J	W	TO MAIN HARNESS
57J	L/G	TO MAIN HARNESS
58J	O	TO MAIN HARNESS
59J	–	TO MAIN HARNESS
60J	SHIELD	TO MAIN HARNESS
61J	G	TO MAIN HARNESS
62J	–	TO MAIN HARNESS
63J	R/W	TO MAIN HARNESS
64J	L/W	TO MAIN HARNESS
65J	SHIELD	TO MAIN HARNESS
66J	B	TO MAIN HARNESS
67J	SHIELD	TO MAIN HARNESS
68J	O/L	TO MAIN HARNESS
69J	SHIELD	TO MAIN HARNESS
70J	BR	TO MAIN HARNESS
71J	L/W	TO MAIN HARNESS
72J	–	TO MAIN HARNESS
72J	–	TO MAIN HARNESS
73J	–	TO MAIN HARNESS
74J	SHIELD	TO MAIN HARNESS
75J	LG/B	TO MAIN HARNESS
76J	R	TO MAIN HARNESS
77J	SHIELD	TO MAIN HARNESS
78J	GR/B	TO MAIN HARNESS
79J	B	TO MAIN HARNESS
80J	W	TO MAIN HARNESS
81J	SHIELD	TO MAIN HARNESS
82J	L/R	TO MAIN HARNESS
83J	–	TO MAIN HARNESS
84J	–	TO MAIN HARNESS
85J	Y/B	TO MAIN HARNESS
86J	G	TO MAIN HARNESS
87J	B/R	TO MAIN HARNESS
88J	SHIELD	TO MAIN HARNESS
89J	GR/R	TO MAIN HARNESS
90J	L	TO MAIN HARNESS
91J	L/B	TO MAIN HARNESS
92J	SB	TO MAIN HARNESS
93J	B	TO MAIN HARNESS
94J	L	TO MAIN HARNESS
95J	LG	TO MAIN HARNESS
96J	R	TO MAIN HARNESS
97J	B/Y	TO MAIN HARNESS
98J	L/B	TO MAIN HARNESS
99J	W/L	TO MAIN HARNESS
100J	SB	TO MAIN HARNESS

AABIA2143GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	C1
Connector Name	WIRE TO WIRE
Connector Type	RK26FGY-RS20-X6
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1C	Y/V	TO ENGINE ROOM HARNESS
2C	W/L	TO ENGINE ROOM HARNESS
3C	B	TO ENGINE ROOM HARNESS
4C	BR/W	TO ENGINE ROOM HARNESS
5C	BR/Y	TO ENGINE ROOM HARNESS
6C	Y	TO ENGINE ROOM HARNESS
7C	G/R	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
7C	R	TO ENGINE ROOM HARNESS - (WITH VK56VD)
8C	B	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
8C	O/B	TO ENGINE ROOM HARNESS - (WITH VK56VD)
9C	W/L	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
9C	SB	TO ENGINE ROOM HARNESS - (WITH VK56VD)
10C	GR/R	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
10C	GR	TO ENGINE ROOM HARNESS - (WITH VK56VD)
11C	B	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
11C	R/W	TO ENGINE ROOM HARNESS - (WITH VK56VD)
12C	Y	TO ENGINE ROOM HARNESS
13C	B	TO ENGINE ROOM HARNESS
14C	BG	TO ENGINE ROOM HARNESS
15C	Y	TO ENGINE ROOM HARNESS
16C	B	TO ENGINE ROOM HARNESS
17C	V	TO ENGINE ROOM HARNESS
18C	BG	TO ENGINE ROOM HARNESS
19C	L	TO ENGINE ROOM HARNESS
20C	W	TO ENGINE ROOM HARNESS
21C	LG	TO ENGINE ROOM HARNESS
22C	SHIELD	TO ENGINE ROOM HARNESS
23C	G/B	TO ENGINE ROOM HARNESS
24C	G/B	TO ENGINE ROOM HARNESS
25C	W	TO ENGINE ROOM HARNESS
26C	B	TO ENGINE ROOM HARNESS
27C	LG	TO ENGINE ROOM HARNESS
28C	G/W	TO ENGINE ROOM HARNESS
29C	R/LG	TO ENGINE ROOM HARNESS
30C	R/L	TO ENGINE ROOM HARNESS
31C	B	TO ENGINE ROOM HARNESS
32C	R	TO ENGINE ROOM HARNESS
33C	L/W	TO ENGINE ROOM HARNESS
34C	L	TO ENGINE ROOM HARNESS
35C	R/W	TO ENGINE ROOM HARNESS
36C	L	TO ENGINE ROOM HARNESS
37C	Y	TO ENGINE ROOM HARNESS
38C	GR	TO ENGINE ROOM HARNESS
39C	R	TO ENGINE ROOM HARNESS
40C	P	TO ENGINE ROOM HARNESS
41C	V	TO ENGINE ROOM HARNESS
42C	LG/B	TO ENGINE ROOM HARNESS
43C	Y/B	TO ENGINE ROOM HARNESS
44C	R	TO ENGINE ROOM HARNESS
45C	G	TO ENGINE ROOM HARNESS
46C	BR	TO ENGINE ROOM HARNESS
47C	B	TO ENGINE ROOM HARNESS
48C	Y/R	TO ENGINE ROOM HARNESS
49C	R/Y	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
49C	V	TO ENGINE ROOM HARNESS - (WITH VK56VD)
50C	B	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
50C	B/Y	TO ENGINE ROOM HARNESS - (WITH VK56VD)
51C	V	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
51C	B	TO ENGINE ROOM HARNESS - (WITH VK56VD)
52C	V/W	TO ENGINE ROOM HARNESS

Connector No.	C12
Connector Name	FUEL PUMP CONTROL MODULE (FPCM)
Connector Type	E06FGY-RS
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	B/Y	BATTERY
2	GR	FPC INPUT SIGNAL
3	R/W	DIAG OUTPUT SIGNAL
4	B	GROUND
5	L	FUEL PUMP -
6	BR	FUEL PUMP +

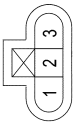
Connector No.	C37
Connector Name	FUEL LEVEL SENSOR UNIT AND FUEL PUMP
Connector Type	E06FGY-RS
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	BR	PUMP +
2	L	PUMP -
3	V/W	TEMP +
4	R	TEMP -
5	BR/Y	SENDER +
6	Y/V	SENDER -

Connector No.	C32
Connector Name	EVAP CONTROL SYSTEM PRESSURE SENSOR
Connector Type	E03FGY-RS
Connector Color	GRAY

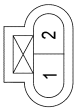
H.S.



Terminal No.	Color of Wire	Signal Name
1	R	GND
2	O/B	OUT
3	SB	VCC

Connector No.	C38
Connector Name	EVAP CANISTER VENT CONTROL VALVE
Connector Type	E02FB-RS
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	V	IGNITION
2	Y	CDCV

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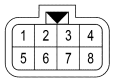
ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	E2
Connector Name	WIRE TO WIRE
Connector Type	RS08MGY-PR
Connector Color	GRAY

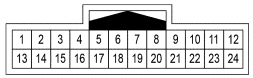
H.S.



Terminal No.	Color of Wire	Signal Name
1	W	TO ENGINE CONTROL HARNESS
2	L	TO ENGINE CONTROL HARNESS
3	R/W	TO ENGINE CONTROL HARNESS
4	W	TO ENGINE CONTROL HARNESS
5	SHIELD	TO ENGINE CONTROL HARNESS
6	GR/R	TO ENGINE CONTROL HARNESS
7	BR	TO ENGINE CONTROL HARNESS
8	B	TO ENGINE CONTROL HARNESS

Connector No.	E5
Connector Name	WIRE TO WIRE
Connector Type	TH24MW-NH
Connector Color	WHITE

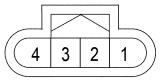
H.S.



Terminal No.	Color of Wire	Signal Name
1	L/R	TO ENGINE CONTROL HARNESS
2	BR	TO ENGINE CONTROL HARNESS
3	V	TO ENGINE CONTROL HARNESS
4	L/O	TO ENGINE CONTROL HARNESS
5	W	TO ENGINE CONTROL HARNESS
6	B/R	TO ENGINE CONTROL HARNESS
7	Y/R	TO ENGINE CONTROL HARNESS
8	BR	TO ENGINE CONTROL HARNESS
9	W/L	TO ENGINE CONTROL HARNESS
10	L/Y	TO ENGINE CONTROL HARNESS
11	SB	TO ENGINE CONTROL HARNESS
12	L	TO ENGINE CONTROL HARNESS
13	W/R	TO ENGINE CONTROL HARNESS
14	Y	TO ENGINE CONTROL HARNESS
15	B	TO ENGINE CONTROL HARNESS
16	B	TO ENGINE CONTROL HARNESS
17	R	TO ENGINE CONTROL HARNESS
18	B	TO ENGINE CONTROL HARNESS
19	B/R	TO ENGINE CONTROL HARNESS
20	GR	TO ENGINE CONTROL HARNESS
21	V/R	TO ENGINE CONTROL HARNESS
22	B	TO ENGINE CONTROL HARNESS
23	B	TO ENGINE CONTROL HARNESS
24	P	TO ENGINE CONTROL HARNESS

Connector No.	E8
Connector Name	ACTIVE GRILLE SHUTTER
Connector Type	RH04FB
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	W	VBAT
2	–	–
3	L	LIN
4	B	GND

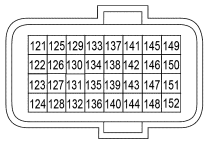
Connector No.	E12
Connector Name	STOP LAMP RELAY
Connector Type	MS02FL-M2-LC
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	GROUND
2	W	RELAY CONTROL
3	R/G	STOP LAMPS
5	R/Y	BATTERY

Connector No.	E16
Connector Name	ECM (WITH VK56VD)
Connector Type	MAA24FB-MEA8-RH
Connector Color	BLACK

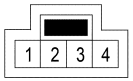
H.S.



Terminal No.	Color of Wire	Signal Name
121	O/B	EVAP CONTROL SYSTEM PRESSURE SENSOR
122	–	–
123	P	CAN COMMUNICATION LINE (CAN-L)
124	L	CAN COMMUNICATION LINE (CAN-H)
125	SB	SENSOR POWER SUPPLY
126	–	–
127	–	–
128	V/W	FUEL TEMPERATURE SENSOR
129	–	–
130	R/W	FUEL PUMP CONTROL MODULE (FPCM) CHECK
131	–	–
132	–	–
133	W	IGNITION SWITCH
134	G/Y	ASCD STEERING SWITCH
135	B/Y	SENSOR GROUND
136	GR	FUEL PUMP CONTROL MODULE (FPCM)
137	R/W	ENG COMMUNICATION LINE
138	W	ENG COMMUNICATION LINE
139	R/G	STOP LAMP SWITCH
140	G/Y	BRAKE PEDAL POSITION SWITCH
141	Y	EVAP CANISTER VENT CONTROL VALVE
142	L/W	SENSOR POWER SUPPLY
143	O	ACCELERATOR PEDAL POSITION SENSOR 2
144	P/L	SENSOR GROUND
145	W	POWER SUPPLY FOR ECM
146	W/G	SENSOR POWER SUPPLY
147	B	ECM GROUND
148	R	SENSOR GROUND
149	B	ECM GROUND
150	W/R	ACCELERATOR PEDAL POSITION SENSOR 1
151	R/Y	SENSOR GROUND
152	B	ECM GROUND

Connector No.	E19
Connector Name	WIRE TO WIRE
Connector Type	NS04MW-CS
Connector Color	WHITE

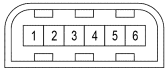
H.S.



Terminal No.	Color of Wire	Signal Name
1	L	TO ENGINE CONTROL HARNESS
2	W	TO ENGINE CONTROL HARNESS
3	P	TO ENGINE CONTROL HARNESS
4	SB	TO ENGINE CONTROL HARNESS

Connector No.	E20
Connector Name	ACCELERATOR PEDAL POSITION (APP) SENSOR
Connector Type	AEY06FB-RH
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	B	PPS2 SUPPLY - (WITH CUMMINS 5.0L)
1	L/W	AVCC2 APS 2 (WITH VK56VD)
2	W	PPS1 SUPPLY- (WITH CUMMINS 5.0L)
2	W/G	AVCC1 APS 1 (WITH VK56VD)
3	BR	PPS1 SIGNAL - (WITH CUMMINS 5.0L)
3	W/R	APS 1 (WITH VK56VD)
4	R	PPS1 RETURN - (WITH CUMMINS 5.0L)
4	R/Y	GND A APS1 (WITH VK56VD)
5	R	PPS2 RETURN - (WITH CUMMINS 5.0L)
5	P/L	GND A APS 2 (WITH VK56VD)
6	L	PPS2 SIGNAL - (WITH CUMMINS 5.0L)
6	O	APS 2 (WITH VK56VD)

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ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	E22
Connector Name	WIRE TO WIRE
Connector Type	M08MB-LC
Connector Color	BLACK

H.S.

1	2	3	4
5	6	7	8

Terminal No.	Color of Wire	Signal Name
1	V	TO ENGINE CONTROL HARNESS
2	L	TO ENGINE CONTROL HARNESS
3	W	TO ENGINE CONTROL HARNESS
4	L	TO ENGINE CONTROL HARNESS
5	L	TO ENGINE CONTROL HARNESS
6	L/Y	TO ENGINE CONTROL HARNESS
7	W/L	TO ENGINE CONTROL HARNESS
8	R	TO ENGINE CONTROL HARNESS

Connector No.	E28
Connector Name	WIRE TO WIRE
Connector Type	RH08MB
Connector Color	BLACK

H.S.

1	2	3	4
5	6	7	8

Terminal No.	Color of Wire	Signal Name
1	V	TO ENGINE CONTROL HARNESS
2	G	TO ENGINE CONTROL HARNESS
3	–	TO ENGINE CONTROL HARNESS
4	L	TO ENGINE CONTROL HARNESS
5	R	TO ENGINE CONTROL HARNESS
6	SB	TO ENGINE CONTROL HARNESS
7	L	TO ENGINE CONTROL HARNESS
8	P	TO ENGINE CONTROL HARNESS

Connector No.	E35
Connector Name	WIRE TO WIRE
Connector Type	NS12FW-CS
Connector Color	WHITE

H.S.

5	4		3	2	1
12	11	10	9	8	7	6

Terminal No.	Color of Wire	Signal Name
1	Y	TO BODY HARNESS
2	V	TO BODY HARNESS
3	L	TO BODY HARNESS
4	W	TO BODY HARNESS
5	R/G	TO BODY HARNESS
6	SB	TO BODY HARNESS
7	P	TO BODY HARNESS
8	L	TO BODY HARNESS
9	SHIELD	TO BODY HARNESS
10	B	TO BODY HARNESS
11	R	TO BODY HARNESS
12	BR	TO BODY HARNESS

Connector No.	E38
Connector Name	STOP LAMP SWITCH
Connector Type	M04FW-LC
Connector Color	WHITE

H.S.

3	4
1	2

Terminal No.	Color of Wire	Signal Name
1	R/Y	BATTERY
2	W	RELAY CONT - (WITHOUT LED REAR COMBINATION LAMPS)
2	R/G	STOP LAMPS - (WITH LED REAR COMBINATION LAMPS)
3	GR	IGNITION
4	R/B	STOP 2

Connector No.	E39
Connector Name	WIRE TO WIRE
Connector Type	M08MW-GY-LC
Connector Color	GRAY

H.S.

1	2	3	4
5	6	7	8

Terminal No.	Color of Wire	Signal Name
1	B	TO ENGINE CONTROL HARNESS
2	B	TO ENGINE CONTROL HARNESS
3	B	TO ENGINE CONTROL HARNESS
4	W/R	TO ENGINE CONTROL HARNESS
5	P	TO ENGINE CONTROL HARNESS
6	O	TO ENGINE CONTROL HARNESS
7	SB	TO ENGINE CONTROL HARNESS
8	R	TO ENGINE CONTROL HARNESS

Connector No.	E40
Connector Name	REFRIGERANT PRESSURE SENSOR (WITH VK56VD)
Connector Type	RK03FB
Connector Color	BLACK

H.S.

1	2	3

Terminal No.	Color of Wire	Signal Name
1	W/L	GND A PRESS
2	L/Y	PD PRES
3	SB	AVCC2 PRESS

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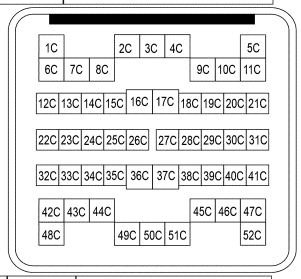
ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	E41
Connector Name	WIRE TO WIRE
Connector Type	RK26MGY-RS20-X6
Connector Color	GRAY

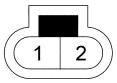
H.S.



Terminal No.	Color of Wire	Signal Name
1C	Y/V	TO CHASSIS HARNESS
2C	W/L	TO CHASSIS HARNESS
3C	B	TO CHASSIS HARNESS
4C	BR/W	TO CHASSIS HARNESS
5C	BR/Y	TO CHASSIS HARNESS
6C	Y	TO CHASSIS HARNESS
7C	G/R	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
7C	R	TO CHASSIS HARNESS - (WITH VK56VD)
8C	B	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
8C	O/B	TO CHASSIS HARNESS - (WITH VK56VD)
9C	W/L	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
9C	SB	TO CHASSIS HARNESS - (WITH VK56VD)
10C	GR/R	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
10C	GR	TO CHASSIS HARNESS - (WITH VK56VD)
11C	B	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
11C	R/W	TO CHASSIS HARNESS - (WITH VK56VD)
12C	Y	TO CHASSIS HARNESS
13C	B	TO CHASSIS HARNESS
14C	BG	TO CHASSIS HARNESS
15C	Y	TO CHASSIS HARNESS
16C	B	TO CHASSIS HARNESS
17C	V	TO CHASSIS HARNESS
18C	BG	TO CHASSIS HARNESS
19C	L	TO CHASSIS HARNESS
20C	BG	TO CHASSIS HARNESS
21C	B	TO CHASSIS HARNESS
22C	SHIELD	TO CHASSIS HARNESS
23C	G/B	TO CHASSIS HARNESS
24C	G/Y	TO CHASSIS HARNESS
25C	W	TO CHASSIS HARNESS
26C	B	TO CHASSIS HARNESS
27C	LG	TO CHASSIS HARNESS
28C	G/W	TO CHASSIS HARNESS
29C	R/G	TO CHASSIS HARNESS - (WITHOUT BULB CHECK)
29C	G/R	TO CHASSIS HARNESS - (WITH BULB CHECK)
30C	R/L	TO CHASSIS HARNESS
31C	B	TO CHASSIS HARNESS
32C	R	TO CHASSIS HARNESS
33C	L/W	TO CHASSIS HARNESS
34C	L	TO CHASSIS HARNESS
35C	R/W	TO CHASSIS HARNESS
36C	L	TO CHASSIS HARNESS
37C	Y	TO CHASSIS HARNESS
38C	BR	TO CHASSIS HARNESS
39C	R	TO CHASSIS HARNESS
40C	P	TO CHASSIS HARNESS
41C	V	TO CHASSIS HARNESS
42C	G/B	TO CHASSIS HARNESS
43C	Y/B	TO CHASSIS HARNESS
44C	R	TO CHASSIS HARNESS
45C	G	TO CHASSIS HARNESS
46C	BR	TO CHASSIS HARNESS
47C	B	TO CHASSIS HARNESS
48C	Y/R	TO CHASSIS HARNESS
49C	R/Y	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
49C	V	TO CHASSIS HARNESS - (WITH VK56VD)
50C	B	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
50C	B/Y	TO CHASSIS HARNESS - (WITH VK56VD)
51C	V	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
51C	B	TO CHASSIS HARNESS - (WITH VK56VD)
52C	B	TO CHASSIS HARNESS - (WITHOUT FFV)
52C	L	TO CHASSIS HARNESS - (WITH FFV)
52C	V/W	TO CHASSIS HARNESS

Connector No.	E43
Connector Name	WIRE TO WIRE
Connector Type	X02MB
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	BR/Y	TO ENGINE CONTROL HARNESS
2	B	TO ENGINE CONTROL HARNESS

Connector No.	E66
Connector Name	WIRE TO WIRE
Connector Type	RS06MGY
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	BR	TO ENGINE ROOM SUB-HARNESS
2	Y	TO ENGINE ROOM SUB-HARNESS
3	SB	TO ENGINE ROOM SUB-HARNESS
4	W/L	TO ENGINE ROOM SUB-HARNESS
5	Y/B	TO ENGINE ROOM SUB-HARNESS
6	L/Y	TO ENGINE ROOM SUB-HARNESS

Connector No.	E100
Connector Name	VVEL ACTUATOR MOTOR RLY
Connector Type	24347_9F900
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	W	BATTERY
2	BR/Y	M RLY
3	W	BATTERY
5	R	IGNITION

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ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	E119
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS16FW-CS
Connector Color	WHITE

H.S.

9	8	7	6		5	4	3
18	17	16	15	14	13	12	11	10

Terminal No.	Color of Wire	Signal Name
3	–	–
4	B/R	NP SW
5	L/W	H/LAMP HI RH
6	G	H/LAMP HI LH
7	L	H/LAMP LO LH
8	R/Y	H/LAMP LO RH
9	G/W	FR FOG/L LH
10	–	–
11	P	ETC VB - (WITH CUMMINS 5.0L)
11	O	ETC VB - (WITH VK56VD)
12	W/R	FR FOG/L RH
13	Y/R	A/T ECU IGN
14	G	REVERSE LAMP IGN
15	GR	ABS ECU IGN
16	G	ETC RLY CONT - (WITH CUMMINS 5.0L)
16	V/R	ETC RLY CONT - (WITH VK56VD)
17	L/W	IGN COIL - (WITH CUMMINS 5.0L)
17	W	IGN COIL - (WITH VK56VD)
18	–	–

Connector No.	E121
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS12FBR-CS
Connector Color	BROWN

H.S.

29	28		27	26	25
36	35	34	33	32	31	30

Terminal No.	Color of Wire	Signal Name
25	BR	ECM VB - (WITH CUMMINS 5.0L)
25	W	ECM VB - (WITH VK56VD)
26	V	O2 SENS - (WITH VK56VD)
27	R/L	PARKING RH
28	R/L	TAIL 1
29	Y	FR WIPER HI
30	–	–
31	L	ECM RLY CONT
32	L	ECM BAT - (WITH VK56VD)
33	R/L	PARKING LH
34	R/W	TAIL 2
35	BR	FR WIPER LO
36	–	–

Connector No.	E122
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	TH12FW-NH
Connector Color	WHITE

H.S.

42	41	40	39	38	37
48	47	46	45	44	43

Terminal No.	Color of Wire	Signal Name
37	–	–
38	–	–
39	L/Y	WIPER AUTO STOP SW
40	P	CAN-L
41	L	CAN-H
42	BR	DTRL RLY
43	–	–
44	W/B	START CONT
45	GR	FUEL RLY CONT
46	Y	HOOD SW
47	Y	ALT C - (WITH VK56VD)
48	R/W	HORN RLY CONT

Connector No.	E123
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS08FBR-CS
Connector Color	BROWN

H.S.

51		50	49
56	55	54	53	52

Terminal No.	Color of Wire	Signal Name
49	Y/B	A/C COMP - (WITH CUMMINS 5.0L)
49	GR/R	A/C COMP - (WITH VK56VD)
50	BR	TRAILER TOW
51	–	–
52	B	S-GND
53	–	–
54	–	–
55	–	–
56	–	–

Connector No.	E124
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	M06FB-LC
Connector Color	BLACK

H.S.

59	58	57
62	61	60

Terminal No.	Color of Wire	Signal Name
57	W/B	RR DEF
58	BR	FUEL PUMP - (WITH CUMMINS 5.0L)
58	B/Y	FUEL PUMP - (WITH VK56VD)
59	–	–
60	–	–
61	–	–
62	B	P GND

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ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	E125
Connector Name	ABS ACTUATOR AND ELECTRIC UNIT (CONTROL UNIT)
Connector Type	SAZ42FB-SJZ4
Connector Color	BLACK

H.S.

46	45	44	43	42	41	40	39	38	37	36	35	34	33
32	31	30	29	28	27	26	25	24	23	22	21	20	19
18	17	16	15	14	13	12	11	10	9	8	7	6	5

Terminal No.	Color of Wire	Signal Name
1	G	ABS SOL
2	B	GND 1
3	B	GND 2
4	W	MTR POWER 1
5	–	–
6	–	–
7	–	–
8	–	–
9	BR	YG CAN-H
10	LG	YG CAN-L
11	–	–
12	–	–
13	P/B	LBL
14	–	–
15	–	–
16	–	–
17	R/B	STP2
18	GR	IGN 1
19	V	FR SENS-
20	SB	FL SENS+
21	R	RR SENS-
22	V	RL SENS+
23	–	–
24	–	–
25	–	–
26	–	–
27	P	CAN-L
28	–	–
29	–	–
30	–	–
31	–	–
32	–	–
33	LG	FR SENS+
34	LG	FL SENS-
35	BR	RR SENS+
36	P	RL SENS-
37	R/G	STP
38	–	–
39	G	VDC OFF
40	–	–
41	L	CAN-H
42	–	–
43	G/W	HDC ON
44	–	–
45	–	–
46	W	STPO

Connector No.	E130
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	TH10FB-NH
Connector Color	BLACK

H.S.

67	66	65	64	63
72	71	70	69	68

Terminal No.	Color of Wire	Signal Name
63	–	–
64	R	DETENT SW
65	–	–
66	P	PUSH START SW
67	–	–
68	L	IGN SIGNAL
69	–	–
70	–	–
71	SB	HOOD SW2
72	W	E-CPLG - (WITH VK56VD)

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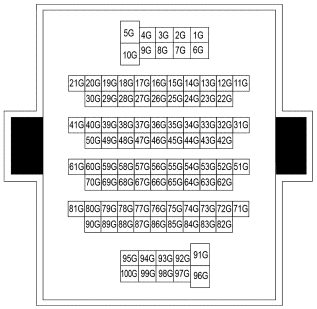
ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	E152
Connector Name	WIRE TO WIRE
Connector Type	TH80MW-CS16-TM4
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
1G	G	TO MAIN HARNESS
2G	B/R	TO MAIN HARNESS
3G	W/B	TO MAIN HARNESS
4G	BR/W	TO MAIN HARNESS
5G	BR	TO MAIN HARNESS
6G	P	TO MAIN HARNESS - (WITH VK56VD)
6G	R/W	TO MAIN HARNESS - (WITH CUMMINS 5.0L)
7G	Y	TO MAIN HARNESS
8G	G	TO MAIN HARNESS
9G	R	TO MAIN HARNESS
10G	W	TO MAIN HARNESS
11G	R/G	TO MAIN HARNESS
12G	W/B	TO MAIN HARNESS
13G	BR	TO MAIN HARNESS
14G	Y/B	TO MAIN HARNESS
15G	G/W	TO MAIN HARNESS
16G	G	TO MAIN HARNESS
17G	G/Y	TO MAIN HARNESS
18G	G/Y	TO MAIN HARNESS
19G	Y/V	TO MAIN HARNESS
20G	G/Y	TO MAIN HARNESS
21G	B/Y	TO MAIN HARNESS
22G	G/R	TO MAIN HARNESS
23G	Y/R	TO MAIN HARNESS
24G	G/B	TO MAIN HARNESS
25G	R/W	TO MAIN HARNESS
26G	R	TO MAIN HARNESS
27G	LG	TO MAIN HARNESS
28G	G/B	TO MAIN HARNESS
29G	G/B	TO MAIN HARNESS
30G	BR/Y	TO MAIN HARNESS
31G	P	TO MAIN HARNESS - (WITH CUMMINS 5.0L)
31G	R	TO MAIN HARNESS - (WITH VK56VD)
32G	P	TO MAIN HARNESS
33G	Y/L	TO MAIN HARNESS
34G	GR	TO MAIN HARNESS
35G	G/R	TO MAIN HARNESS
36G	SB	TO MAIN HARNESS
37G	R/W	TO MAIN HARNESS
38G	BR	TO MAIN HARNESS
39G	BR	TO MAIN HARNESS
40G	–	TO MAIN HARNESS
41G	R/G	TO MAIN HARNESS
42G	O	TO MAIN HARNESS
43G	B	TO MAIN HARNESS - (WITH CUMMINS 5.0L)
43G	G	TO MAIN HARNESS - (WITH VK56VD)
44G	R/Y	TO MAIN HARNESS
45G	G	TO MAIN HARNESS
46G	LG	TO MAIN HARNESS
47G	R	TO MAIN HARNESS
48G	W	TO MAIN HARNESS
49G	–	TO MAIN HARNESS
50G	BR	TO MAIN HARNESS
51G	R	TO MAIN HARNESS
52G	L	TO MAIN HARNESS
53G	W	TO MAIN HARNESS
54G	W	TO MAIN HARNESS
55G	G	TO MAIN HARNESS
56G	W	TO MAIN HARNESS
57G	Y	TO MAIN HARNESS
58G	BG	TO MAIN HARNESS
59G	BG	TO MAIN HARNESS
60G	BG	TO MAIN HARNESS
61G	B	TO MAIN HARNESS
62G	W	TO MAIN HARNESS
63G	R	TO MAIN HARNESS
64G	W/L	TO MAIN HARNESS
65G	W/R	TO MAIN HARNESS
66G	BG	TO MAIN HARNESS
67G	BG	TO MAIN HARNESS
68G	B	TO MAIN HARNESS
69G	Y	TO MAIN HARNESS
70G	L	TO MAIN HARNESS
71G	R/W	TO MAIN HARNESS
72G	L/W	TO MAIN HARNESS
73G	SHIELD	TO MAIN HARNESS
74G	W	TO MAIN HARNESS
75G	R	TO MAIN HARNESS
76G	R/G	TO MAIN HARNESS
77G	G	TO MAIN HARNESS
78G	W	TO MAIN HARNESS
79G	–	TO MAIN HARNESS
80G	R	TO MAIN HARNESS
81G	L	TO MAIN HARNESS
82G	R	TO MAIN HARNESS
83G	L	TO MAIN HARNESS
84G	L	TO MAIN HARNESS
85G	W/B	TO MAIN HARNESS
86G	B/R	TO MAIN HARNESS
87G	W/B	TO MAIN HARNESS
88G	P	TO MAIN HARNESS
89G	L	TO MAIN HARNESS
90G	G	TO MAIN HARNESS
91G	G	TO MAIN HARNESS
92G	V/W	TO MAIN HARNESS
93G	BR	TO MAIN HARNESS
94G	G	TO MAIN HARNESS
95G	G	TO MAIN HARNESS
96G	W	TO MAIN HARNESS
97G	R	TO MAIN HARNESS
98G	W/B	TO MAIN HARNESS
99G	BR	TO MAIN HARNESS
100G	GR/W	TO MAIN HARNESS

Connector No.	E161
Connector Name	BATTERY CURRENT SENSOR
Connector Type	SAZ04FGY
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	SB	SENSOR POWER SUPPLY
2	G	BATTERY TEMPERATURE SENSOR
3	R	SENSOR GROUND
4	V	BATTERY CURRENT SENSOR

Connector No.	E170
Connector Name	BRAKE PEDAL POSITION SWITCH
Connector Type	M02FBR-LC
Connector Color	BROWN

H.S.

Terminal No.	Color of Wire	Signal Name
1	GR	IGNITION
2	G/Y	BNC SW

Connector No.	E171
Connector Name	FUEL INJECTOR RELAY
Connector Type	MS02FL-M2-LC
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	GND
2	V	IGNITION
3	R	VINJ1 A
5	G/W	BATTERY

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ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

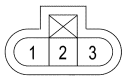
Connector No.	E172
Connector Name	HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY
Connector Type	M06FBR-R-LC
Connector Color	BROWN

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	GND
2	V	IGNITION
3	P	VB PUMP
5	L/Y	BATTERY
6	SB	VINJ2 A/B
7	G/Y	BATTERY

Connector No.	F6
Connector Name	IGNITION COIL NO. 2 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

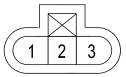
H.S.



Terminal No.	Color of Wire	Signal Name
1	L/B	IGN 2
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F7
Connector Name	IGNITION COIL NO. 4 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

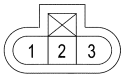
H.S.



Terminal No.	Color of Wire	Signal Name
1	LG/R	IGN 4
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F8
Connector Name	IGNITION COIL NO. 6 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

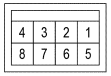
H.S.



Terminal No.	Color of Wire	Signal Name
1	Y/R	IGN 6
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F10
Connector Name	WIRE TO WIRE
Connector Type	M08FB-LC
Connector Color	BLACK

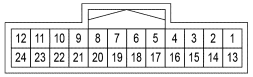
H.S.



Terminal No.	Color of Wire	Signal Name
1	V	TO ENGINE ROOM HARNESS
2	L/LG	TO ENGINE ROOM HARNESS
3	W	TO ENGINE ROOM HARNESS
4	L	TO ENGINE ROOM HARNESS
5	L/G	TO ENGINE ROOM HARNESS
6	L/Y	TO ENGINE ROOM HARNESS
7	W/L	TO ENGINE ROOM HARNESS
8	R	TO ENGINE ROOM HARNESS

Connector No.	F14
Connector Name	WIRE TO WIRE
Connector Type	TH24FW-NH
Connector Color	WHITE

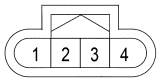
H.S.



Terminal No.	Color of Wire	Signal Name
1	L/R	TO ENGINE ROOM HARNESS
2	BR	TO ENGINE ROOM HARNESS
3	V	TO ENGINE ROOM HARNESS
4	L/O	TO ENGINE ROOM HARNESS
5	W	TO ENGINE ROOM HARNESS
6	B/R	TO ENGINE ROOM HARNESS
7	Y/R	TO ENGINE ROOM HARNESS
8	BR	TO ENGINE ROOM HARNESS
9	W/L	TO ENGINE ROOM HARNESS
10	L/Y	TO ENGINE ROOM HARNESS
11	SB	TO ENGINE ROOM HARNESS
12	L	TO ENGINE ROOM HARNESS
13	W/R	TO ENGINE ROOM HARNESS
14	Y	TO ENGINE ROOM HARNESS
15	B	TO ENGINE ROOM HARNESS
16	B	TO ENGINE ROOM HARNESS
17	R	TO ENGINE ROOM HARNESS
18	B	TO ENGINE ROOM HARNESS
19	B/R	TO ENGINE ROOM HARNESS
20	GR	TO ENGINE ROOM HARNESS
21	V/R	TO ENGINE ROOM HARNESS
22	SHIELD	TO ENGINE ROOM HARNESS
23	SHIELD	TO ENGINE ROOM HARNESS
24	P	TO ENGINE ROOM HARNESS

Connector No.	F16
Connector Name	AIR FUEL RATIO (A/F) SENSOR (BANK 2)
Connector Type	RH04FDGY-P
Connector Color	GRAY

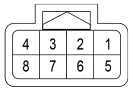
H.S.



Terminal No.	Color of Wire	Signal Name
1	W	IGNITION
2	SB	AFH B2
3	Y/B	AF - B2
4	L/W	AF + B2

Connector No.	F19
Connector Name	WIRE TO WIRE
Connector Type	RH08FB
Connector Color	BLACK

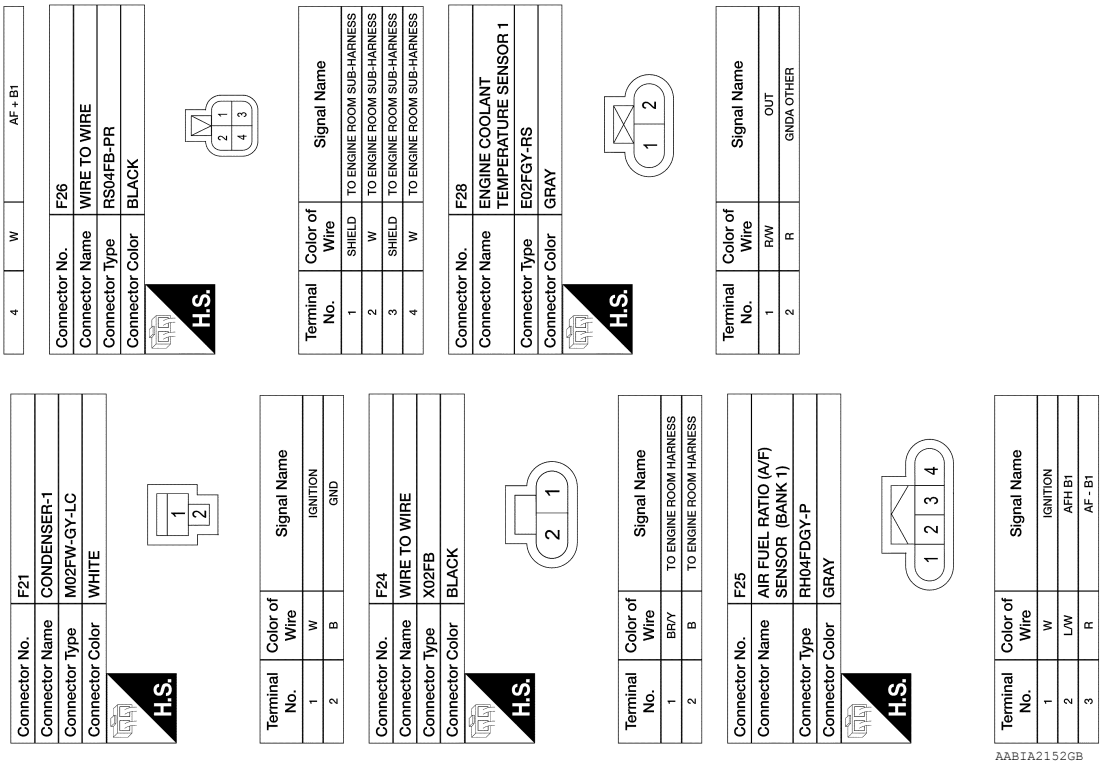
H.S.



Terminal No.	Color of Wire	Signal Name
1	V	TO ENGINE ROOM HARNESS
2	LG	TO ENGINE ROOM HARNESS
3	–	TO ENGINE ROOM HARNESS
4	L	TO ENGINE ROOM HARNESS
5	R	TO ENGINE ROOM HARNESS
6	SB	TO ENGINE ROOM HARNESS
7	L	TO ENGINE ROOM HARNESS
8	P	TO ENGINE ROOM HARNESS

AABIA2151GB

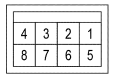
ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD



ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	F34
Connector Name	WIRE TO WIRE
Connector Type	M08FW-GY-LC
Connector Color	GRAY

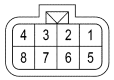
H.S.



Terminal No.	Color of Wire	Signal Name
1	B	TO ENGINE ROOM HARNESS
2	B	TO ENGINE ROOM HARNESS
3	B	TO ENGINE ROOM HARNESS
4	W/R	TO ENGINE ROOM HARNESS
5	P	TO ENGINE ROOM HARNESS
6	O	TO ENGINE ROOM HARNESS
7	SB	TO ENGINE ROOM HARNESS
8	R	TO ENGINE ROOM HARNESS

Connector No.	F35
Connector Name	WIRE TO WIRE
Connector Type	RS08FB-PR
Connector Color	BLACK

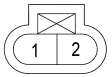
H.S.



Terminal No.	Color of Wire	Signal Name
1	G	TO INJECTOR SUB HARNESS RH
2	V/B	TO INJECTOR SUB HARNESS RH
3	BR	TO INJECTOR SUB HARNESS RH
4	W	TO INJECTOR SUB HARNESS RH
5	R/W	TO INJECTOR SUB HARNESS RH
6	B/R	TO INJECTOR SUB HARNESS RH
7	R	TO INJECTOR SUB HARNESS RH
8	L	TO INJECTOR SUB HARNESS RH

Connector No.	F36
Connector Name	INTAKE VALVE TIMING CONTROL SOLENOID VALVE (BANK 1)
Connector Type	E02FG-RS
Connector Color	GREEN

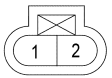
H.S.



Terminal No.	Color of Wire	Signal Name
1	LG/B	CVTC B1
2	V	IGNITION

Connector No.	F37
Connector Name	INTAKE VALVE TIMING CONTROL SOLENOID VALVE (BANK 2)
Connector Type	E02FG-RS
Connector Color	GREEN

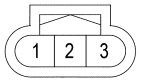
H.S.



Terminal No.	Color of Wire	Signal Name
1	LG/R	IN CVTC B2
2	V	IGNITION

Connector No.	F38
Connector Name	CRANKSHAFT POSITION SENSOR (POS)
Connector Type	RH03FB
Connector Color	BLACK

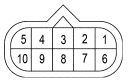
H.S.



Terminal No.	Color of Wire	Signal Name
1	W/G	POWER SUPPLY
2	G/W	GND
3	R/W	POS

Connector No.	F46
Connector Name	A/T ASSEMBLY (WITH VK56VD)
Connector Type	RK10FG
Connector Color	GREEN

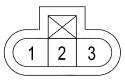
H.S.



Terminal No.	Color of Wire	Signal Name
1	Y/R	VIGN
2	P	BATT
3	L	CAN-H
4	BR	K-LINE
5	B	GND
6	Y/R	VIGN
7	R	REV LAMP RELAY
8	P	CAN-L
9	B/R	STARTER RELAY
10	B	GND

Connector No.	F47
Connector Name	IGNITION COIL NO. 1 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

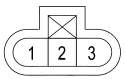
H.S.



Terminal No.	Color of Wire	Signal Name
1	Y	IGN 1
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F48
Connector Name	IGNITION COIL NO. 3 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1	BR/Y	IGN 3
2	B	GND
3	W	IGNITION (POWER)

AABIA2153GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	F49
Connector Name	IGNITION COIL NO. 5 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

H.S.

1 2 3

Terminal No.	Color of Wire	Signal Name
1	P/L	IGN 5
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F50
Connector Name	ELECTRIC THROTTLE CONTROL ACTUATOR
Connector Type	HS06FB
Connector Color	BLACK

H.S.

1 2 3 4 5 6

Terminal No.	Color of Wire	Signal Name
1	R/L	TPS 1 B1
2	V/G	AVCC1 TPS1
3	B/W	TPS2 B1
4	L	GND
5	R	MOTOR + B1
6	W	MOTOR - B1

Connector No.	F51
Connector Name	IGNITION COIL NO. 7 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

H.S.

1 2 3

Terminal No.	Color of Wire	Signal Name
1	G/Y	IGN 7
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F52
Connector Name	IGNITION COIL NO. 8 (WITH POWER TRANSISTOR)
Connector Type	E03FGY-RS
Connector Color	GRAY

H.S.

1 2 3

Terminal No.	Color of Wire	Signal Name
1	O	IGN 8
2	B	GND
3	W	IGNITION (POWER)

Connector No.	F54
Connector Name	HEATED OXYGEN SENSOR 2 (BANK 2) (WITH VK56VD)
Connector Type	RH04FLGY-P
Connector Color	GRAY

H.S.

4 3 2 1

Terminal No.	Color of Wire	Signal Name
1	R	O2 SENSOR B2 -
2	L/W	O2 SENSOR B2 +
3	L/R	O2 HEATER B2
4	V	IGNITION

Connector No.	F56
Connector Name	ENGINE OIL TEMPERATURE SENSOR
Connector Type	E02FGY-RS
Connector Color	GRAY

H.S.

1 2

Terminal No.	Color of Wire	Signal Name
1	L/Y	OUT
2	R	GND A - OTHER

Connector No.	F57
Connector Name	HEATED OXYGEN SENSOR 2 (BANK 1) (WITH VK56VD)
Connector Type	RH04FLGY-P
Connector Color	GRAY

H.S.

4 3 2 1

Terminal No.	Color of Wire	Signal Name
1	R	O2 SENSOR B1 -
2	W/R	O2 SENSOR B1 +
3	LG	O2 HEATER B1
4	V	IGNITION

Connector No.	F66
Connector Name	CAMSHAFT POSITION SENSOR (PHASE) (BANK 1)
Connector Type	RH03FB
Connector Color	BLACK

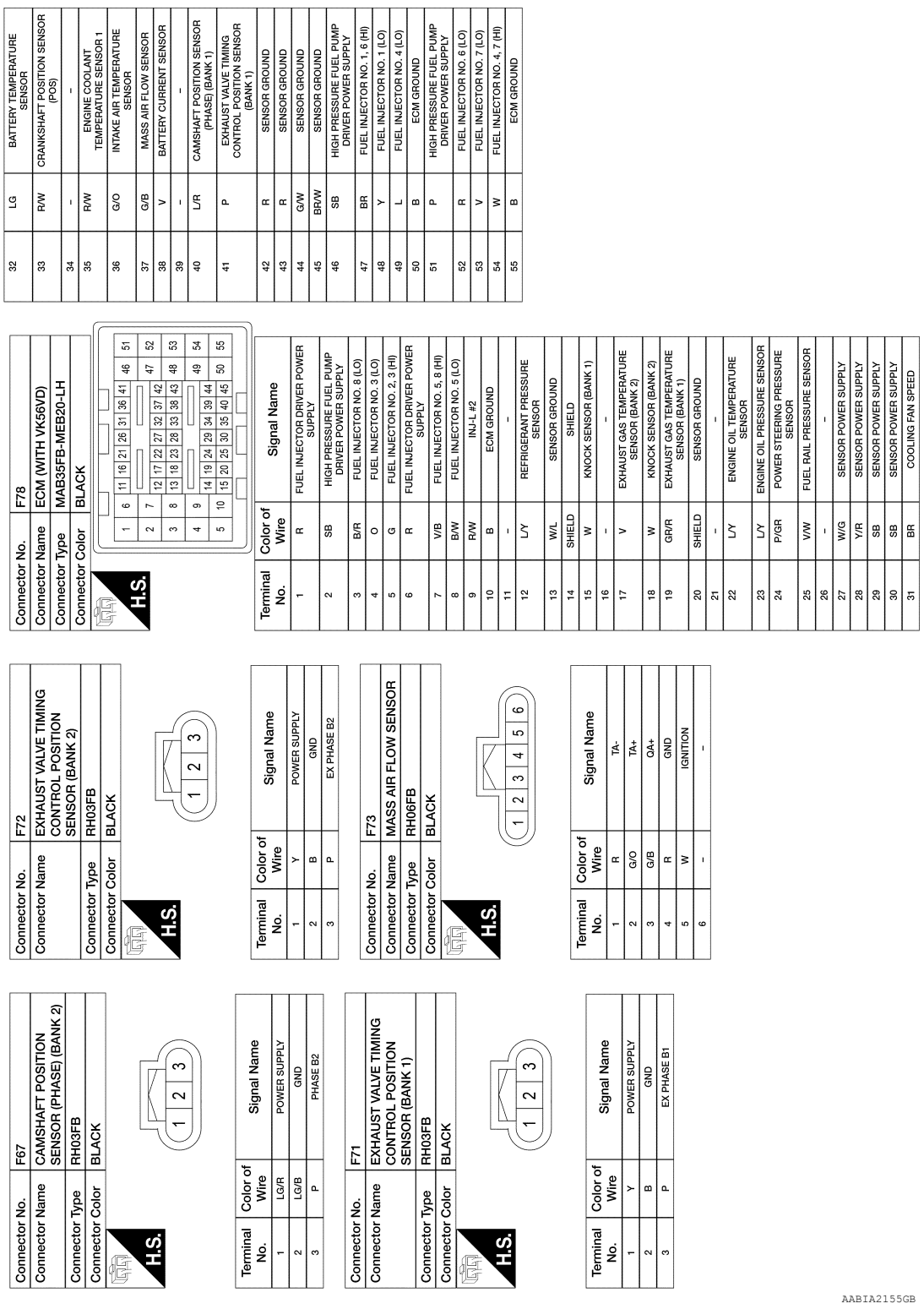
H.S.

1 2 3

Terminal No.	Color of Wire	Signal Name
1	Y/R	POWER SUPPLY
2	BR/W	GND
3	L/R	PHASE B1

AABIA2154GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD



AABIA2155GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	F79
Connector Name	ECM (WITH VK56VD)
Connector Type	MAB55FB-MEB10-LH
Connector Color	BLACK

H.S.

56	61	66	71	76	81	86	91	96	101	106	111	116
57	62	67	72	77	82	87	92	97	102	107	112	117
58	63	68	73	78	83	88	93	98	103	108	113	118
59	64	69	74	79	84	89	94	99	104	109	114	119
60	65	70	75	80	85	90	95	100	105	110	115	120

Terminal No.	Color of Wire	Signal Name
56	V	MULTI-WAY CONTROL VALVE POWER SUPPLY
57	R	MULTI-WAY CONTROL VALVE MOTOR (-)
58	B	MULTI-WAY CONTROL VALVE MOTOR (+)
59	B	HIGH PRESSURE FUEL PUMP (HI)
60	W	HIGH PRESSURE FUEL PUMP (LO)
61	BR	MULTI-WAY CONTROL VALVE POSITION SENSOR
62	B/R	PNP SIGNAL
63	LG/B	SENSOR GROUND
64	SHIELD	SHIELD
65	W	ENGINE COOLANT TEMPERATURE SENSOR 2
66	P	CAMSHAFT POSITION SENSOR (PHASE) (BANK 2)
67	–	–
68	P	EXHAUST VALVE TIMING CONTROL POSITION SENSOR (BANK 2)
69	L/W	A/F SENSOR 1 (BANK 2)
70	Y/B	A/F SENSOR 1 (BANK 2)
71	–	–
72	–	–
73	LG/R	SENSOR POWER SUPPLY
74	R	A/F SENSOR 1 (BANK 1)
75	–	–
76	–	–
77	L/W	HEATED OXYGEN SENSOR 2 (BANK 2)
78	R/L	THROTTLE POSITION SENSOR 1
79	W	A/F SENSOR 1 (BANK 1)
80	B/W	THROTTLE POSITION SENSOR 2
81	–	–
82	–	–
83	V/G	SENSOR POWER SUPPLY
84	W/R	HEATED OXYGEN SENSOR 2 (BANK 1)
85	L	SENSOR GROUND
86	L/G	LIN -(WITH ACTIVE GRILLE SHUTTER)
87	–	–
88	L/LG	ECM RELAY (SELF SHUT-OFF)
89	–	–
90	BR/W	VVEL ACTUATOR MOTOR RELAY ABORT SIGNAL (VVEL CONTROL MODULE)
91	L/B	IGNITION SIGNAL NO. 2
92	BR/Y	IGNITION SIGNAL NO. 3
93	GR	FUEL PUMP RELAY
94	Y/R	IGNITION SIGNAL NO. 6
95	Y	IGNITION SIGNAL NO. 1
96	–	–
97	–	–
98	–	–
99	V/R	THROTTLE CONTROL MOTOR RELAY
100	–	–
101	O	IGNITION SIGNAL NO. 8
102	P/L	IGNITION SIGNAL NO. 5
103	–	–
104	LG/R	IGNITION SIGNAL NO. 4
105	G/Y	IGNITION SIGNAL NO. 7
106	V/W	EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE
107	W	THROTTLE CONTROL MOTOR (OPEN)
108	R	THROTTLE CONTROL MOTOR (CLOSE)
109	–	–
110	–	–
111	O	THROTTLE CONTROL MOTOR POWER SUPPLY
112	LG/B	INTAKE VALVE TIMING CONTROL SOLENOID VALVE (BANK 1)
113	LG/R	INTAKE VALVE TIMING CONTROL SOLENOID VALVE (BANK 2)
114	LG/B	EXHAUST VALVE TIMING CONTROL SOLENOID VALVE (BANK 1)
115	LG/R	EXHAUST VALVE TIMING CONTROL SOLENOID VALVE (BANK 2)
116	L/W	A/F SENSOR 1 HEATER (BANK 1)
117	SB	A/F SENSOR 1 HEATER (BANK 2)
118	LG	HEATED OXYGEN SENSOR 2 HEATER (BANK 1)
119	L/R	HEATED OXYGEN SENSOR 2 HEATER (BANK 2)
120	L	POWER SUPPLY FOR ECM (BACK-UP)

Connector No.	F80
Connector Name	EXHAUST VALVE TIMING CONTROL SOLENOID VALVE (BANK 1)
Connector Type	E02FG-RS
Connector Color	GREEN

H.S.

1 2

Terminal No.	Color of Wire	Signal Name
1	LG/B	EX CVTC B1
2	V	IGNITION

Connector No.	F81
Connector Name	EXHAUST VALVE TIMING CONTROL SOLENOID VALVE (BANK 2)
Connector Type	E02FG-RS
Connector Color	GREEN

H.S.

1 2

Terminal No.	Color of Wire	Signal Name
1	LG/R	EX CVTC B2
2	V	IGNITION

Connector No.	F82
Connector Name	POWER STEERING PRESSURE SENSOR
Connector Type	RK03FB
Connector Color	BLACK

H.S.

1 2 3

Terminal No.	Color of Wire	Signal Name
1	W/L	GND A PRESS
2	P/GR	PS PRES
3	SB	AVCC2 PRESS

Connector No.	F83
Connector Name	VVEL CONTROL SHAFT POSITION SENSOR (BANK 1)
Connector Type	RH06FB
Connector Color	BLACK

H.S.

1 2 3 4 5 6

Terminal No.	Color of Wire	Signal Name
1	W	VEL S1/B1
2	R	A GND 3
3	B	AVCC 3
4	L/G	VEL S2/B2
5	L	A GND 4
6	W/G	AVCC 4

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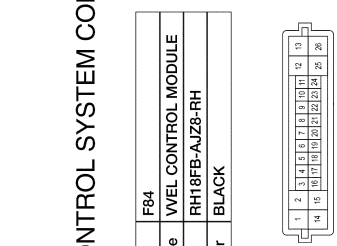
ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	F84
Connector Name	VVEL CONTROL MODULE
Connector Type	RH18FB-AJZ8-RH
Connector Color	BLACK

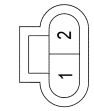
H.S.



Terminal No.	Color of Wire	Signal Name
1	R	VVEL ACTUATOR MOTOR POWER SUPPLY (BANK 2)
2	B	VVEL ACTUATOR MOTOR (HIGH LIFT) (BANK2)
3	W	VVEL CONTROL SHAFT POSITON SENSOR 1 (BANK 1)
4	W/G	SENSOR GROUND
5	L/G	VVEL CONTROL SHAFT POSITON SENSOR 1 (BANK 2)
6	R	SENSOR GROUND
7	B	SENSOR POWER SUPPLY
8	W	POWER SUPPLY FOR VVEL CONTROL MODULE
9	L	SENSOR POWER SUPPLY
10	–	–
11	W	ENG COMMUNICATION LINE
12	B	VVEL ACTUATOR MOTOR (HIGH LIFT) (BANK 1)
13	R	VVEL ACTUATOR MOTOR POWER SUPPLY (BANK 1)
14	B	VVEL CONTROL MODULE GROUND
15	W	VVEL ACTUATOR MOTOR (LOW LIFT) (BANK 2)
16	L/G	VVEL CONTROL SHAFT POSITON SENSOR 2 (BANK 1)
17	O	SENSOR GROUND
18	O/L	VVEL CONTROL SHAFT POSITON SENSOR 2 (BANK 2)
19	L	SENSOR GROUND
20	W/G	SENSOR POWER SUPPLY
21	BR/W	VVEL ACTUATOR MOTOR RELAY ABORT SIGNAL (ECM)
22	L/G	SENSOR POWER SUPPLY
23	BR/Y	VVEL CONTROL MOTOR RELAY
24	R/W	ENG COMMUNICATION LINE
25	W	VVEL ACTUATOR MOTOR (LOW LIFT) (BANK 1)
26	–	–

Connector No.	F85
Connector Name	VVEL ACTUATOR MOTOR (BANK 2)
Connector Type	X02FB
Connector Color	BLACK

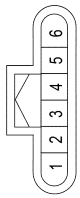
H.S.



Terminal No.	Color of Wire	Signal Name
1	B	MOTOR 1 B2
2	W	MOTOR 2 B2

Connector No.	F86
Connector Name	VVEL CONTROL SHAFT POSITION SENSOR (BANK 2)
Connector Type	RH06FB
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	L/G	VEL S1/B2
2	W/G	A GND 1
3	L	AVCC 1
4	O/L	VEL S2/B2
5	O	A GND 2
6	L/G	AVCC 2

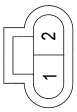
Connector No.	F87
Connector Name	HIGH PRESSURE FUEL PUMP
Connector Type	HS02FLGY-VR
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	H PUMP HI
2	W	H PUMP LO

Connector No.	F88
Connector Name	VVEL ACTUATOR MOTOR (BANK 1)
Connector Type	X02FB
Connector Color	BLACK

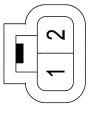
H.S.



Terminal No.	Color of Wire	Signal Name
1	B	MOTOR 1 B1
2	W	MOTOR 2 B1

Connector No.	F89
Connector Name	EXHAUST GAS TEMPERATURE SENSOR (BANK 2)
Connector Type	HS02MW-1V
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
1	V	T EX B2
2	R	GND A OTHER

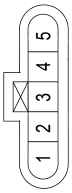
Connector No.	F91
Connector Name	FUEL RAIL PRESSURE SENSOR
Connector Type	AFZ03FB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	SB	AVCC2 PRESS
2	V/W	F PRES
3	W/L	GNDA PRESS

Connector No.	F92
Connector Name	MULTI-WAY CONTROL VALVE
Connector Type	E05FGY-RS
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1	B	MCV VALVE +
2	R	MCV VALVE -
3	R	GND A OTHER
4	BR	MCV POS
5	SB	AVCC2 OTHER

Terminal No.	Color of Wire	Signal Name

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ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	F93
Connector Name	ENGINE COOLANT TEMPERATURE SENSOR 2
Connector Type	E02FGY-RS
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	W	MCV TW
2	R	GND A OTHER

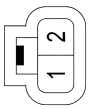
Connector No.	F97
Connector Name	FAN CLUTCH ASSEMBLY (WITH VK56VD)
Connector Type	AAC06FB-WP
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	L	BATTERY
2	SB	AVCC2-OTHER
3	W	E-CPLG
4	R	GNDA-OTHER
5	BR	EFANREV
6	B	GROUND

Connector No.	F100
Connector Name	EXHAUST GAS TEMPERATURE SENSOR (BANK 1)
Connector Type	HS02MW-1V
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
1	GR/R	T EX B1
2	R	GND A OTHER

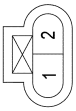
Connector No.	F206
Connector Name	WIRE TO WIRE
Connector Type	RS04MB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	SHIELD	TO ENGINE CONTROL HARNESS
2	W	TO ENGINE CONTROL HARNESS
3	SHIELD	TO ENGINE CONTROL HARNESS
4	W	TO ENGINE CONTROL HARNESS

Connector No.	F207
Connector Name	KNOCK SENSOR (BANK 1)
Connector Type	E02FGY-RS
Connector Color	GRAY

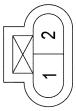
H.S.



Terminal No.	Color of Wire	Signal Name
1	W	OUTPUT SIGNAL
2	SHIELD	GROUND

Connector No.	F208
Connector Name	KNOCK SENSOR (BANK 2)
Connector Type	E02FGY-RS
Connector Color	GRAY

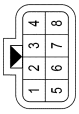
H.S.



Terminal No.	Color of Wire	Signal Name
1	W	OUTPUT SIGNAL
2	SHIELD	GROUND

Connector No.	F220
Connector Name	WIRE TO WIRE
Connector Type	RS08FB-PR
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	P	TO ENGINE CONTROL HARNESS
2	BR	TO ENGINE CONTROL HARNESS
3	G	TO ENGINE CONTROL HARNESS
4	W	TO ENGINE CONTROL HARNESS
5	O	TO ENGINE CONTROL HARNESS
6	LG	TO ENGINE CONTROL HARNESS
7	Y	TO ENGINE CONTROL HARNESS
8	R	TO ENGINE CONTROL HARNESS

Connector No.	F222
Connector Name	WIRE TO WIRE
Connector Type	RS08FB-PR
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	BR	TO ENGINE CONTROL HARNESS
2	P	TO ENGINE CONTROL HARNESS
3	W	TO ENGINE CONTROL HARNESS
4	G	TO ENGINE CONTROL HARNESS
5	L	TO ENGINE CONTROL HARNESS
6	G	TO ENGINE CONTROL HARNESS
7	W	TO ENGINE CONTROL HARNESS
8	SB	TO ENGINE CONTROL HARNESS

Connector No.	F223
Connector Name	WIRE TO WIRE
Connector Type	RS06FGY-PR
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	BR	TO ENGINE ROOM HARNESS
2	Y	TO ENGINE ROOM HARNESS
3	SB	TO ENGINE ROOM HARNESS
4	W/L	TO ENGINE ROOM HARNESS
5	Y/B	TO ENGINE ROOM HARNESS
6	L/Y	TO ENGINE ROOM HARNESS

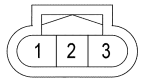
Terminal No.	Color of Wire	Signal Name

AABIA2158GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	F229
Connector Name	ENGINE OIL PRESSURE SENSOR
Connector Type	RH03FB
Connector Color	BLACK

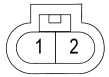
H.S.



Terminal No.	Color of Wire	Signal Name
1	W/L	GND
2	L/Y	VOUT
3	SB	VCC

Connector No.	F230
Connector Name	FUEL INJECTOR NO. 1
Connector Type	HS02FGY
Connector Color	GRAY

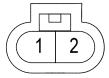
H.S.



Terminal No.	Color of Wire	Signal Name
1	W	POWER
2	R	SIGNAL

Connector No.	F231
Connector Name	FUEL INJECTOR NO. 3
Connector Type	HS02FGY
Connector Color	GRAY

H.S.

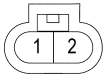


Terminal No.	Color of Wire	Signal Name
1	BR	POWER

2	LG	SIGNAL

Connector No.	F232
Connector Name	FUEL INJECTOR NO. 5
Connector Type	HS02FGY
Connector Color	GRAY

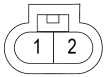
H.S.



Terminal No.	Color of Wire	Signal Name
1	P	POWER
2	O	SIGNAL

Connector No.	F233
Connector Name	FUEL INJECTOR NO. 7
Connector Type	HS02FGY
Connector Color	GRAY

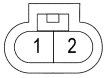
H.S.



Terminal No.	Color of Wire	Signal Name
1	G	POWER
2	Y	SIGNAL

Connector No.	F234
Connector Name	FUEL INJECTOR NO. 2
Connector Type	HS02FGY
Connector Color	GRAY

H.S.

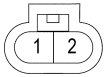


Terminal No.	Color of Wire	Signal Name
1	BR	POWER

2	L	SIGNAL

Connector No.	F235
Connector Name	FUEL INJECTOR NO. 4
Connector Type	HS02FGY
Connector Color	GRAY

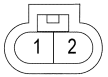
H.S.



Terminal No.	Color of Wire	Signal Name
1	G	POWER
2	SB	SIGNAL

Connector No.	F236
Connector Name	FUEL INJECTOR NO. 6
Connector Type	HS02FGY
Connector Color	GRAY

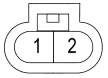
H.S.



Terminal No.	Color of Wire	Signal Name
1	W	POWER
2	W	SIGNAL

Connector No.	F237
Connector Name	FUEL INJECTOR NO. 8
Connector Type	HS02FGY
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1	P	POWER

2	G	SIGNAL

Connector No.	M4
Connector Name	FUSE BLOCK (J/B)
Connector Type	NS16FW-CS
Connector Color	WHITE

H.S.

7P	6P	5P	4P		3P	2P	1P	
16P	15P	14P	13P	12P	11P	10P	9P	8P

Terminal No.	Color of Wire	Signal Name
1P	R	IGNITION
2P	Y	IGNITION
3P	G	IGNITION RELAY OUT
4P	B/W	RR DEF RLY
5P	B/W	RR DEF RLY
6P	O	RR DEF RLY OUT
7P	G	IGNITION
8P	W	IGNITION
9P	L	BATTERY
10P	–	–
11P	–	–
12P	–	–
13P	R	BATTERY
14P	Y	BATTERY
15P	Y/LG	BATTERY
16P	W	BLOWER FAN RELAY OUT

AABIA2159GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	M22
Connector Name	DATA LINK CONNECTOR
Connector Type	BD16FW
Connector Color	WHITE

H.S.

9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8

Terminal No.	Color of Wire	Signal Name
1	–	–
2	–	–
3	LG	M-CAN-L
4	B	BODY GND
5	B	ENG GND
6	L	CAN-H
7	BR	K-LINE
8	G/R	IGN SW
9	–	–
10	–	–
11	SB	M-CAN-H
12	R	CAN-L
13	L	CAN-H
14	P	CAN-L
15	–	–
16	Y	BATTERY

Connector No.	M24
Connector Name	COMBINATION METER (WITH TYPE A)
Connector Type	TH40FW-NH
Connector Color	WHITE

H.S.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Terminal No.	Color of Wire	Signal Name
1	B	GND(STRG/SATELLITE SW GND)
2	–	–
3	–	–
4	–	–
5	–	–
6	–	–
7	–	–
8	–	–
9	BG	AS BELT SW (W/O ODS)
10	LG	TOW MODE SW
11	BR	CHG
12	BR	LED HEAD LAMP (R)
13	W	LED HEAD LAMP (L)
14	R	ACC SW
15	W	OUTSIDE TEMP SENSOR (WITH VK56VD)
16	O	AIR BAG
17	–	–
18	P	TRIP RESET SW
19	–	–
20	R	OUTSIDE TEMP GND (WITH VK56VD)
21	–	–
22	P	STRG SW A
23	R	STRG SW B
24	W	WASHER SW
25	–	–
26	G	PKB SW
27	P/L	AS BELT SW (WITH ODS)
28	O/B	DR BELT SW
29	–	–
30	–	–
31	–	–
32	BR	AT SHIFT UP
33	V/W	AT SHIFT DOWN
34	–	–
35	–	–
36	W	ILL UP SW
37	R	ILL DOWN SW
38	G	8P/R OUTPUT
39	–	–
40	–	–
42	R	BAT
43	Y/W	FUEL SENSOR GND
44	GR	ILL CONT OUTPUT
45	P	CAN-L
46	L	CAN-H
47	B	G1
48	BR/Y	FUEL SENSOR
49	–	–
50	–	–
51	LG	M CAN-L
52	SB	M CAN-H

Connector No.	M25
Connector Name	COMBINATION METER (WITH TYPE A)
Connector Type	TH12FW-NH
Connector Color	WHITE

H.S.

46 45 44 43 42 41
52 51 50 49 48 47

Terminal No.	Color of Wire	Signal Name
41	W	IGN

AABIA2160GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	M31
Connector Name	WIRE TO WIRE
Connector Type	TH80FW-CS16-TM4
Connector Color	WHITE

H.S.

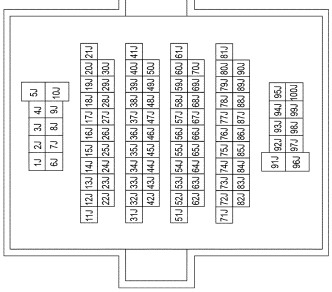
Terminal No.	Color of Wire	Signal Name
1G	G	TO ENGINE ROOM HARNESS
2G	B/R	TO ENGINE ROOM HARNESS
3G	W	TO ENGINE ROOM HARNESS
4G	BR/W	TO ENGINE ROOM HARNESS
5G	–	TO ENGINE ROOM HARNESS
6G	R/W	TO ENGINE ROOM HARNESS
7G	Y	TO ENGINE ROOM HARNESS
8G	G	TO ENGINE ROOM HARNESS
9G	R	TO ENGINE ROOM HARNESS
10G	W	TO ENGINE ROOM HARNESS
11G	R/G	TO ENGINE ROOM HARNESS
12G	W/B	TO ENGINE ROOM HARNESS
13G	BR	TO ENGINE ROOM HARNESS
14G	Y/B	TO ENGINE ROOM HARNESS
15G	G/W	TO ENGINE ROOM HARNESS
16G	G	TO ENGINE ROOM HARNESS
17G	O	TO ENGINE ROOM HARNESS
18G	G/Y	TO ENGINE ROOM HARNESS
19G	Y/V	TO ENGINE ROOM HARNESS
20G	G/Y	TO ENGINE ROOM HARNESS
21G	B/Y	TO ENGINE ROOM HARNESS
22G	G/R	TO ENGINE ROOM HARNESS
23G	Y/R	TO ENGINE ROOM HARNESS
24G	G/B	TO ENGINE ROOM HARNESS
25G	R/W	TO ENGINE ROOM HARNESS
26G	R	TO ENGINE ROOM HARNESS
27G	LG	TO ENGINE ROOM HARNESS
28G	G/B	TO ENGINE ROOM HARNESS
29G	G/B	TO ENGINE ROOM HARNESS
30G	BR/Y	TO ENGINE ROOM HARNESS
31G	R	TO ENGINE ROOM HARNESS
32G	R	TO ENGINE ROOM HARNESS
33G	Y/L	TO ENGINE ROOM HARNESS
34G	GR	TO ENGINE ROOM HARNESS
35G	G/R	TO ENGINE ROOM HARNESS
36G	SB	TO ENGINE ROOM HARNESS
37G	R/W	TO ENGINE ROOM HARNESS
38G	BR	TO ENGINE ROOM HARNESS
39G	BR	TO ENGINE ROOM HARNESS
40G	–	TO ENGINE ROOM HARNESS
41G	R/G	TO ENGINE ROOM HARNESS
42G	O	TO ENGINE ROOM HARNESS
43G	G	TO ENGINE ROOM HARNESS
44G	R/Y	TO ENGINE ROOM HARNESS
45G	G	TO ENGINE ROOM HARNESS
46G	LG	TO ENGINE ROOM HARNESS
47G	R	TO ENGINE ROOM HARNESS
48G	W	TO ENGINE ROOM HARNESS
49G	–	TO ENGINE ROOM HARNESS
50G	BR	TO ENGINE ROOM HARNESS
51G	R	TO ENGINE ROOM HARNESS
52G	L	TO ENGINE ROOM HARNESS
53G	W	TO ENGINE ROOM HARNESS
54G	W	TO ENGINE ROOM HARNESS
55G	G	TO ENGINE ROOM HARNESS
56G	W	TO ENGINE ROOM HARNESS
57G	Y	TO ENGINE ROOM HARNESS
58G	BG	TO ENGINE ROOM HARNESS
59G	BG	TO ENGINE ROOM HARNESS
60G	BG	TO ENGINE ROOM HARNESS
61G	O	TO ENGINE ROOM HARNESS
62G	W	TO ENGINE ROOM HARNESS
63G	O	TO ENGINE ROOM HARNESS
64G	W/L	TO ENGINE ROOM HARNESS
65G	W/R	TO ENGINE ROOM HARNESS
66G	BG	TO ENGINE ROOM HARNESS
67G	O	TO ENGINE ROOM HARNESS
68G	B	TO ENGINE ROOM HARNESS
69G	Y	TO ENGINE ROOM HARNESS
70G	L	TO ENGINE ROOM HARNESS
71G	R/W	TO ENGINE ROOM HARNESS
72G	L/W	TO ENGINE ROOM HARNESS
73G	SHIELD	TO ENGINE ROOM HARNESS
74G	W	TO ENGINE ROOM HARNESS
75G	R	TO ENGINE ROOM HARNESS
76G	R/G	TO ENGINE ROOM HARNESS
77G	BG	TO ENGINE ROOM HARNESS
78G	P	TO ENGINE ROOM HARNESS
79G	–	TO ENGINE ROOM HARNESS
80G	R	TO ENGINE ROOM HARNESS
81G	L	TO ENGINE ROOM HARNESS
82G	R	TO ENGINE ROOM HARNESS
83G	L	TO ENGINE ROOM HARNESS
84G	L	TO ENGINE ROOM HARNESS
85G	W	TO ENGINE ROOM HARNESS
86G	B/R	TO ENGINE ROOM HARNESS
87G	W	TO ENGINE ROOM HARNESS
88G	G	TO ENGINE ROOM HARNESS
89G	P	TO ENGINE ROOM HARNESS
90G	G	TO ENGINE ROOM HARNESS
91G	P	TO ENGINE ROOM HARNESS
92G	V/W	TO ENGINE ROOM HARNESS
93G	BR	TO ENGINE ROOM HARNESS
94G	B	TO ENGINE ROOM HARNESS
95G	G	TO ENGINE ROOM HARNESS
96G	R	TO ENGINE ROOM HARNESS
97G	R	TO ENGINE ROOM HARNESS
98G	W/B	TO ENGINE ROOM HARNESS
99G	R	TO ENGINE ROOM HARNESS
100G	GR/W	TO ENGINE ROOM HARNESS

AABIA2161GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

Connector No.	M40
Connector Name	WIRE TO WIRE
Connector Type	TH80FW-CS16-TM4
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
1J	G	TO BODY HARNESS
2J	R/Y	TO BODY HARNESS
3J	L	TO BODY HARNESS
4J	L/B	TO BODY HARNESS
5J	B	TO BODY HARNESS
6J	BR	TO BODY HARNESS
7J	BG	TO BODY HARNESS
8J	SB	TO BODY HARNESS
9J	BR	TO BODY HARNESS
10J	R	TO BODY HARNESS
11J	O/B	TO BODY HARNESS
12J	L	TO BODY HARNESS
13J	W	TO BODY HARNESS
14J	Y	TO BODY HARNESS
15J	-	TO BODY HARNESS
16J	R	TO BODY HARNESS
17J	G	TO BODY HARNESS
18J	SB	TO BODY HARNESS
19J	O	TO BODY HARNESS
20J	O/B	TO BODY HARNESS
21J	Y	TO BODY HARNESS
22J	P	TO BODY HARNESS
23J	W	TO BODY HARNESS
24J	W/R	TO BODY HARNESS
25J	P	TO BODY HARNESS
26J	L	TO BODY HARNESS
27J	R	TO BODY HARNESS
28J	L	TO BODY HARNESS
29J	G/O	TO BODY HARNESS
30J	SB	TO BODY HARNESS
31J	L/G	TO BODY HARNESS
32J	R	TO BODY HARNESS
33J	BG	TO BODY HARNESS
34J	Y	TO BODY HARNESS
35J	P	TO BODY HARNESS
36J	G/R	TO BODY HARNESS
37J	LG	TO BODY HARNESS
38J	SB	TO BODY HARNESS
39J	Y	TO BODY HARNESS
40J	SB	TO BODY HARNESS
41J	L	TO BODY HARNESS
42J	L	TO BODY HARNESS
43J	W	TO BODY HARNESS
44J	BR	TO BODY HARNESS
45J	BG	TO BODY HARNESS
46J	P	TO BODY HARNESS
47J	O	TO BODY HARNESS
48J	V	TO BODY HARNESS
49J	BR	TO BODY HARNESS
50J	G/W	TO BODY HARNESS
51J	-	TO BODY HARNESS
52J	SHIELD	TO BODY HARNESS
53J	R	TO BODY HARNESS
54J	L	TO BODY HARNESS
55J	R	TO BODY HARNESS
56J	W	TO BODY HARNESS
57J	R	TO BODY HARNESS
58J	B	TO BODY HARNESS
59J	-	TO BODY HARNESS
60J	SHIELD	TO BODY HARNESS
61J	G	TO BODY HARNESS
62J	-	TO BODY HARNESS
63J	R/W	TO BODY HARNESS
64J	L/W	TO BODY HARNESS
65J	SHIELD	TO BODY HARNESS
66J	B	TO BODY HARNESS
67J	SHIELD	TO BODY HARNESS
68J	W	TO BODY HARNESS
69J	SHIELD	TO BODY HARNESS
70J	B/R	TO BODY HARNESS
71J	L/W	TO BODY HARNESS
72J	-	TO BODY HARNESS
73J	-	TO BODY HARNESS
74J	SHIELD	TO BODY HARNESS
75J	R	TO BODY HARNESS
76J	O	TO BODY HARNESS
77J	SHIELD	TO BODY HARNESS
78J	W	TO BODY HARNESS
79J	B	TO BODY HARNESS
80J	W	TO BODY HARNESS
81J	SHIELD	TO BODY HARNESS
82J	L/R	TO BODY HARNESS
83J	-	TO BODY HARNESS
84J	-	TO BODY HARNESS
85J	W	TO BODY HARNESS
86J	G	TO BODY HARNESS
87J	W	TO BODY HARNESS
88J	SHIELD	TO BODY HARNESS
89J	R	TO BODY HARNESS
90J	L	TO BODY HARNESS
91J	L/B	TO BODY HARNESS
92J	SB	TO BODY HARNESS
93J	B	TO BODY HARNESS
94J	LG	TO BODY HARNESS
95J	L	TO BODY HARNESS
96J	G	TO BODY HARNESS
97J	B/Y	TO BODY HARNESS
98J	L/B	TO BODY HARNESS
99J	W/L	TO BODY HARNESS
100J	Y	TO BODY HARNESS

Connector No.	M69
Connector Name	FUSE BLOCK (J/B)
Connector Type	NS10FW-CS
Connector Color	WHITE

H.S.

4M	3M		2M	1M
10M	9M	8M	7M	6M	5M

Terminal No.	Color of Wire	Signal Name
1M	GR	IGNITION
2M	-	-
3M	-	-
4M	-	-
5M	R/Y	BATTERY
6M	R/W	TAIL LAMP 2
7M	-	-
8M	-	-
9M	-	-
10M	W/R	IGNITION

Connector No.	M70
Connector Name	FUSE BLOCK (J/B)
Connector Type	NS16FBR-CS
Connector Color	BROWN

H.S.

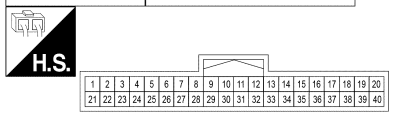
7R	6R	5R	4R		3R	2R	1R
16R	15R	14R	13R	12R	11R	10R	9R	8R

Terminal No.	Color of Wire	Signal Name
1R	L	TAIL LAMP 2
2R	G/R	IGNITION
3R	Y/R	BATTERY
4R	-	-
5R	W	BATTERY
6R	G/W	ACCESSORY
7R	-	-
8R	-	-
9R	-	-
10R	W	BATTERY
11R	-	-
12R	BG	BATTERY
13R	B	ACCESSORY
14R	G/Y	BATTERY
15R	Y	BATTERY
16R	G/R	ACCESSORY

AABIA2162GB

ENGINE CONTROL SYSTEM CONNECTORS - WITH VK56VD

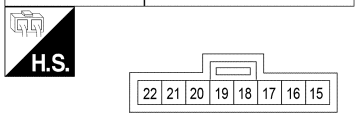
Connector No.	M163
Connector Name	COMBINATION METER (WITH TYPE B)
Connector Type	TH40FW-NH
Connector Color	WHITE



Terminal No.	Color of Wire	Signal Name
1	B	GND (ILL)
2	B	GND (CIRCUIT)
3	B	GND (POWER)
4	–	–
5	–	–
6	R	BAT
7	V	SECURITY
8	W	IGN
9	BG	AS BELT SW (W/O ODS)
10	LG	TOW MODE SW
11	BR	CHG
12	B	SATELLITE SW GND
13	B	STRG SW GND
14	R	ACC
15	W	OUTSIDE TEMP SENSOR
16	O	AIR BAG
17	–	–
18	P	TRIP RESET SW
19	–	–
20	R	OUTSIDE TEMP GND
21	–	–
22	P	STRG SW A
23	R	STRG SW B
24	W	WASHER SW
25	–	–
26	G	PKB SW
27	P/L	AS BELT SW (WITH ODS)
28	O/B	DR BELT SW
29	–	–
30	Y/V	FUEL SENSOR GND
31	BR/Y	FUEL SENSOR
32	BR	AT SHIFT UP
33	V/W	AT SHIFT DOWN
34	L	CAN-H
35	P	CAN-L
36	W	ILL UP SW
37	R	ILL DOWN SW
38	G	8P/R OUTPUT
39	–	–
40	GR	ILL CONT OUT

AABIA2163GB

Connector No.	M199
Connector Name	COMBINATION SWITCH (SPIRAL CABLE)
Connector Type	TK08FGY
Connector Color	GRAY



Terminal No.	Color of Wire	Signal Name
15	R	ASCD SW
16	W	AUDIO STRG SW REMOTE A
17	L	AUDIO STRG SW REMOTE B
18	B	ASCD GND
19	BR	AUDIO STRG SW GND
20	G	HORN SWITCH OUTPUT
21	P	ILL -
22	Y	ILL +

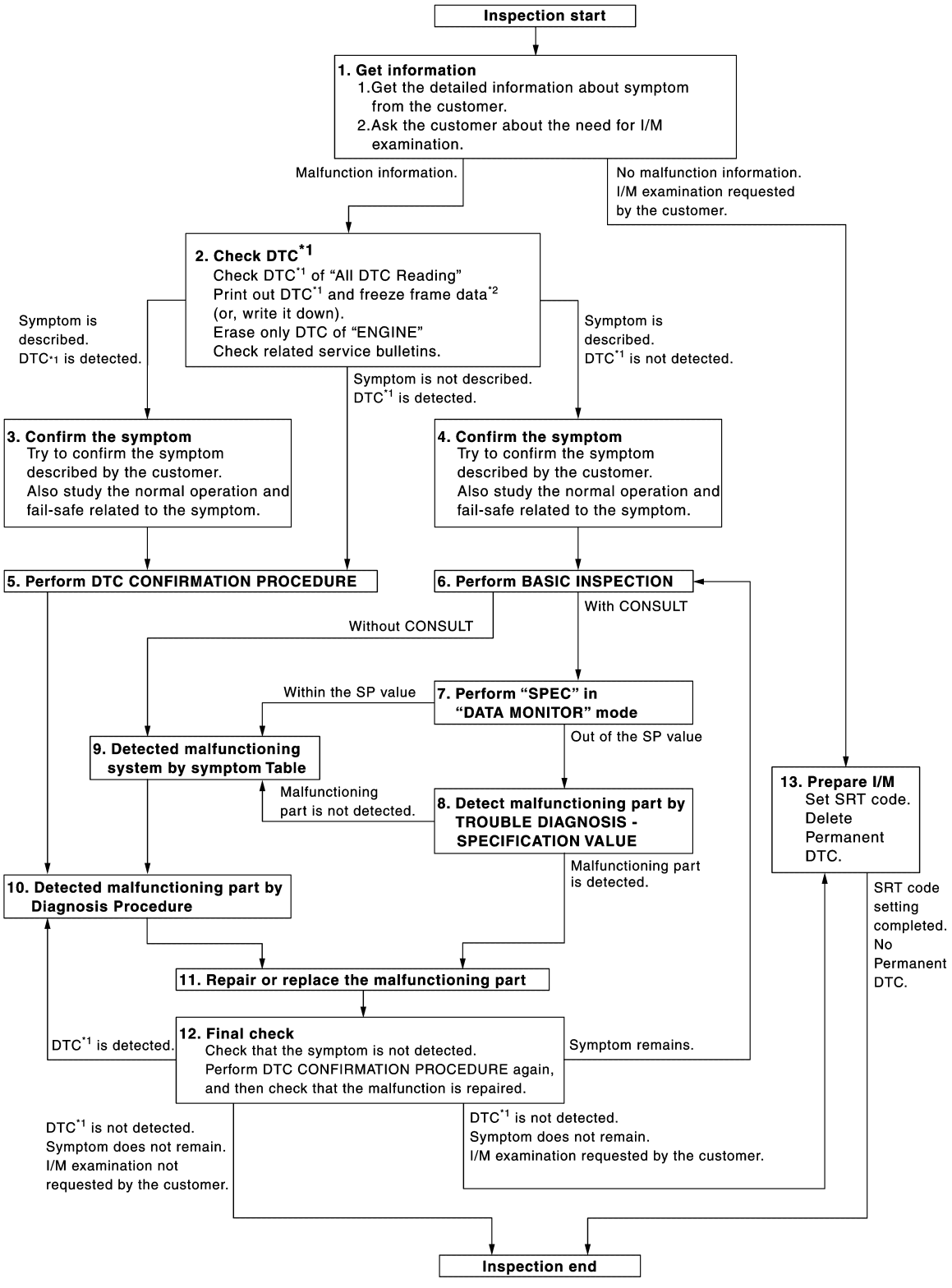
BASIC INSPECTION

DIAGNOSIS AND REPAIR WORKFLOW

Work Flow

INFOID:0000000014419432

OVERALL SEQUENCE



*1: Include 1st trip DTC
*2: Include 1st trip freeze frame data

DETAILED FLOW

1.GET INFORMATION FOR SYMPTOM

1. Get the detailed information from the customer about the symptom (the condition and the environment when the incident/malfunction occurred) using the “Diagnostic Work Sheet”. (Refer to EC-188, "Diagnostic Work Sheet".)
2. Ask if the customer requests I/M examination.

Malfunction information, obtained>>GO TO 2.
No Malfunction information, but a request for I/M examination>>GO TO 13.

2.CHECK DTC

1. Check DTC of “All DTC Reading”.
2. Perform the following procedure if DTC is displayed.

- Record DTC and freeze frame data. (Print them out with CONSULT or GST.)
- Erase only DTC of “ENGINE”.
  - With CONSULT: Refer to “How to Erase DTC and 1st Trip DTC” in EC-94, "CONSULT Function".
  - Without CONSULT: Refer to “How to Erase Self-diagnostic Results” in EC-91, "On Board Diagnosis Function".
- Turn ignition switch OFF.
- Study the relationship between the cause detected by DTC and the symptom described by the customer. (Symptom Table is useful. Refer to EC-716, "Symptom Table".)

3. Check related service bulletins for information.

Are any symptoms described and any DTCs detected?

Symptom is described, DTC is detected>>GO TO 3.
Symptom is described, DTC is not detected>>GO TO 4.
Symptom is not described, DTC is detected>>GO TO 5.

3.CONFIRM THE SYMPTOM

Try to confirm the symptom described by the customer (except MIL ON).
Also study the normal operation and fail-safe related to the symptom. Refer to EC-721, "Description" and EC-131, "Fail-safe".
Diagnosis Work Sheet is useful to verify the incident.
Verify relation between the symptom and the condition when the symptom is detected.

>> GO TO 5.

4.CONFIRM THE SYMPTOM

Try to confirm the symptom described by the customer.
Also study the normal operation and fail-safe related to the symptom. Refer to EC-721, "Description" and EC-131, "Fail-safe".
Diagnosis Work Sheet is useful to verify the incident.
Verify relation between the symptom and the condition when the symptom is detected.

>> GO TO 6.

5.PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE for the displayed DTC, and then make sure that DTC is detected again.
If two or more DTCs are detected, refer to EC-134, "DTC Inspection Priority Chart" and determine trouble diagnosis order.

NOTE:

- Freeze frame data is useful if the DTC is not detected.
- Perform Component Function Check if DTC CONFIRMATION PROCEDURE is not included on Service Manual. This simplified check procedure is an effective alternative though DTC cannot be detected during this check.
  If the result of Component Function Check is NG, it is the same as the detection of DTC by DTC CONFIRMATION PROCEDURE.

Is DTC detected?

YES >> GO TO 10.
NO >> Check according to GI-47, "Intermittent Incident".

6.PERFORM BASIC INSPECTION

Perform EC-190, "Work Procedure".

Do you have CONSULT?

YES >> GO TO 7.
NO >> GO TO 9.

7.PERFORM SPEC IN DATA MONITOR MODE

With CONSULT

Make sure that “MAS A/F SE-B1”, “B/FUEL SCHDL”, “A/F ALPHA-B1” and “A/F ALPHA-B2” are within the SP value using CONSULT “SPEC” in “DATA MONITOR” mode of “ENGINE”. Refer to EC-220, "Component Function Check".

Is the measurement value within the SP value?

YES >> GO TO 9.
NO >> GO TO 8.

8.DETECT MALFUNCTIONING PART BY TROUBLE DIAGNOSIS - SPECIFICATION VALUE

Detect malfunctioning part according to EC-221, "Diagnosis Procedure".

Is a malfunctioning part detected?

YES >> GO TO 11.
NO >> GO TO 9.

9.DETECT MALFUNCTIONING SYSTEM BY SYMPTOM TABLE

Detect malfunctioning system according to EC-716, "Symptom Table" based on the confirmed symptom in step 4, and determine the trouble diagnosis order based on possible causes and symptoms.

>> GO TO 10.

10.DETECT MALFUNCTIONING PART BY DIAGNOSIS PROCEDURE

Inspect according to Diagnosis Procedure of the system.

NOTE:

The Diagnosis Procedure in EC section described based on open circuit inspection. A short circuit inspection is also required for the circuit check in the Diagnosis Procedure. For details, refer to GI-49, "Circuit Inspection".

Is a malfunctioning part detected?

YES >> GO TO 11.
NO >> Monitor input data from related sensors or check voltage of related ECM terminals using CONSULT. Refer to EC-107, "Reference Value".

11.REPAIR OR REPLACE THE MALFUNCTIONING PART

1. Repair or replace the malfunctioning part.
2. Reconnect parts or connectors disconnected during Diagnosis Procedure again after repair and replacement.
3. Check DTC. If DTC is displayed, erase it.
   With CONSULT: Refer to “How to Erase DTC and 1st Trip DTC” in EC-94, "CONSULT Function".
   Without CONSULT: Refer to “How to Erase Self-diagnostic Results” in EC-91, "On Board Diagnosis Function".

>> GO TO 12.

12.FINAL CHECK

When DTC was detected in step 2, perform DTC CONFIRMATION PROCEDURE or Component Function Check again, and then make sure that the malfunction have been completely repaired.
When symptom was described from the customer, refer to confirmed symptom in step 3 or 4, and make sure that the symptom is not detected.

Is DTC detected and does symptom remain?

YES-1 >> DTC is detected: GO TO 10.
YES-2 >> Symptom remains: GO TO 6.
NO-1 >> No request for I/M examination from the customer: Before returning the vehicle to the customer, always erase unnecessary DTC in ECM and TCM (With CONSULT: Refer to “How to Read DTC and 1st Trip DTC” in EC-94, "CONSULT Function", Without CONSULT: Refer to “How to Read Self-diagnostic Results” in EC-91, "On Board Diagnosis Function").
NO-2 >> I/M examination, requested from the customer: GO TO 13.

13. PREPARE FOR I/M EXAMINATION

1. Set SRT codes. Refer to EC-208, "Description".
2. Erase permanent DTCs. Refer to EC-214, "Description".

>> INSPECTION END.

Diagnostic Work Sheet

INFOID:0000000014419433

DESCRIPTION

There are many operating conditions that lead to the malfunction of engine components. A good grasp of such conditions can make troubleshooting faster and more accurate.
In general, each customer feels differently about symptoms. It is important to fully understand the symptoms or conditions for a customer complaint.
Utilize a diagnostic worksheet like the WORKSHEET SAMPLE below in order to organize all the information for troubleshooting.
Some conditions may cause the MIL to illuminate or blink, and DTC to be detected. Examples:

- Vehicle ran out of fuel, which caused the engine to misfire.
- Fuel filler cap was left off or incorrectly screwed on, allowing fuel to evaporate into the atmosphere.

KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

SEF907L

WORKSHEET SAMPLE

Customer name MR/MS		Model & Year	VIN
Engine #		Trans.	Mileage
Incident Date		Manuf. Date	In Service Date
Fuel and fuel filler cap		☐ Vehicle ran out of fuel causing misfire ☐ Fuel filler cap was left off or incorrectly screwed on.	
Symptoms	☐ Startability	☐ Impossible to start ☐ No combustion ☐ Partial combustion ☐ Partial combustion affected by throttle position ☐ Partial combustion NOT affected by throttle position ☐ Possible but hard to start ☐ Others [ ]	
	☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]	
	☐ Driveability	☐ Stumble ☐ Surge ☐ Knock ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]	
	☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading	
Incident occurrence		☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime	
Frequency		☐ All the time ☐ Under certain conditions ☐ Sometimes	
Weather conditions		☐ Not affected	
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH	
Malfunction indicator lamp		☐ Turned on ☐ Not turned on	

MTBL0017

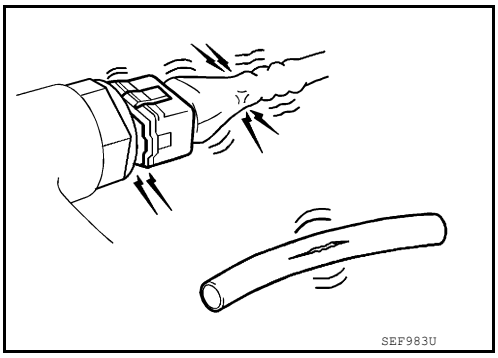
BASIC INSPECTION

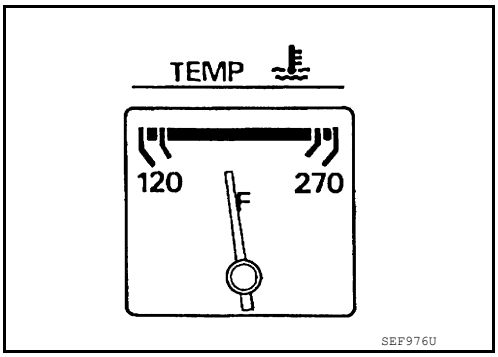
Work Procedure

INFOID:0000000014419434

1.INSPECTION START

1. Check service records for any recent repairs that may indicate a related malfunction, or a current need for scheduled maintenance.
2. Open engine hood and check the following:
- Harness connectors for improper connections
- Wiring harness for improper connections, pinches and cut
- Vacuum hoses for splits, kinks and improper connections
- Hoses and ducts for leakage
- Air cleaner clogging
- Gasket
3. Check that electrical or mechanical loads are not applied.
- Headlamp switch is OFF.
- Air conditioner switch is OFF.
- Rear window defogger switch is OFF.
- Steering wheel is in the straight-ahead position, etc.
4. Start engine and warm it up until engine coolant temperature indicator points to the middle of gauge.
   Check that engine stays below 1,000 rpm.

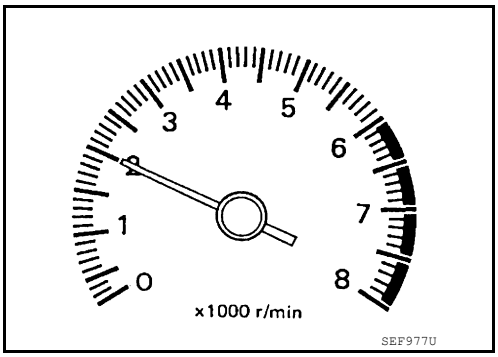




5. Run engine at approximately 2,000 rpm for approximately 2 minutes under no load.
6. Check that no DTC is displayed with CONSULT or GST.

Are any DTCs detected?

YES >> GO TO 2.
NO >> GO TO 3.



2.REPAIR OR REPLACE

Repair or replace components as necessary according to corresponding Diagnosis Procedure.

>> GO TO 3

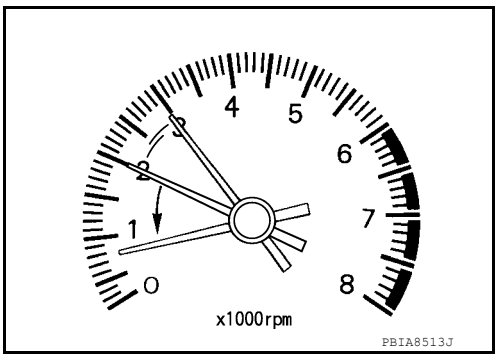
3.CHECK IDLE SPEED

1. Run engine at approximately 2,000 rpm for approximately 2 minutes under no load.

2. Rev engine between 2,000 and 3,000 rpm 2 or 3 times under no load, then run engine at idle speed for approximately 1 minute.
3. Check idle speed.
   For procedure, refer to EC-722, "Inspection".
   For specification, refer to EC-730, "Idle Speed".

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 4.



4. PERFORM ACCELERATOR PEDAL RELEASED POSITION LEARNING

1. Stop engine.
2. Perform EC-198, "Description".

>> GO TO 5.

5. PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Perform EC-199, "Description".

>> GO TO 6.

6. PERFORM IDLE AIR VOLUME LEARNING

Perform EC-200, "Description".

Is Idle Air Volume Learning carried out successfully?

YES >> GO TO 7.
NO >> Follow the instruction of Idle Air Volume Learning. Then GO TO 4.

7. CHECK IDLE SPEED AGAIN

1. Start engine and warm it up to normal operating temperature.
2. Check idle speed.
   For procedure, refer to EC-722, "Inspection".
   For specification, refer to EC-730, "Idle Speed".

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 8.

8. DETECT MALFUNCTIONING PART

Check the Following.
- Check camshaft position sensor and circuit. Refer to EC-420, "DTC Description".
- Check crankshaft position sensor and circuit. Refer to EC-417, "DTC Description".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace malfunctioning part. Then GO TO 4.

9. CHECK ECM FUNCTION

1. Substitute with a non-malfunctioning ECM to check ECM function. (ECM may be the cause of the incident, although this is rare.)
2. Perform initialization of IVIS (NATS) system and registration of all IVIS (NATS) ignition key IDs. Refer to SEC-67, "ECM : Description".

>> GO TO 4.

10. CHECK IGNITION TIMING

1. Run engine at idle.
2. Check ignition timing with a timing light.
   For procedure, refer to EC-723, "Inspection".

For specification, refer to EC-730, "Ignition Timing".

Is the inspection result normal?

YES >> GO TO 19.
NO >> GO TO 11.

11. PERFORM ACCELERATOR PEDAL RELEASED POSITION LEARNING

1. Stop engine.
2. Perform EC-198, "Description".

>> GO TO 12.

12. PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Perform EC-199, "Description".

>> GO TO 13.

13. PERFORM IDLE AIR VOLUME LEARNING

Perform EC-200, "Description".

Is Idle Air Volume Learning carried out successfully?

YES >> GO TO 14.
NO >> Follow the instruction of Idle Air Volume Learning. Then GO TO 4.

14. CHECK IDLE SPEED AGAIN

1. Start engine and warm it up to normal operating temperature.
2. Check idle speed.
   For procedure, refer to EC-722, "Inspection".
   For specification, refer to EC-730, "Idle Speed".

Is the inspection result normal?

YES >> GO TO 15.
NO >> GO TO 17.

15. CHECK IGNITION TIMING AGAIN

1. Run engine at idle.
2. Check ignition timing with a timing light.
   For procedure, refer to EC-723, "Inspection".
   For specification, refer to EC-730, "Ignition Timing".

Is the inspection result normal?

YES >> GO TO 19.
NO >> GO TO 16.

16. CHECK TIMING CHAIN INSTALLATION

Check timing chain installation. Refer to EM-75, "Removal and Installation".

Is the inspection result normal?

YES >> GO TO 17.
NO >> Repair the timing chain installation. Then GO TO 4.

17. DETECT MALFUNCTIONING PART

Check the following.
- Check camshaft position sensor and circuit. Refer to EC-420, "DTC Description".
- Check crankshaft position sensor and circuit. Refer to EC-417, "DTC Description".

Is the inspection result normal?

YES >> GO TO 18.
NO >> Repair or replace malfunctioning part. Then GO TO 4.

18. CHECK ECM FUNCTION

1. Substitute with a non-malfunctioning ECM to check ECM function. (ECM may be the cause of the incident, although this is rare.)

2. Perform initialization of IVIS (NATS) system and registration of all IVIS (NATS) ignition key IDs. Refer to SEC-67, "ECM : Description".

>> GO TO 4.

19. INSPECTION END

If ECM is replaced during this BASIC INSPECTION procedure, perform EC-194, "Description".

>> INSPECTION END

ADDITIONAL SERVICE WHEN REPLACING ECM

Description

INFOID:0000000014419435

When replacing ECM, the following procedure must be performed. (For details, refer to EC-194, "Work Procedure".)

PROGRAMMING OPERATION

NOTE:
After replacing with a blank ECM, programming is required to write ECM information. Be sure to follow the procedure to perform the programming.

BEFORE REPLACEMENT

When replacing ECM, perform “SAVING DATA FOR REPLC CPU” in “WORK SUPPORT” of “ENGINE” by using CONSULT to save current ECM data before replacement.

AFTER REPLACEMENT

After replacing ECM, the following items must be performed:
- Write data after replace CPU
- Accelerator pedal released position learning
- Throttle valve closed position learning
- Idle air volume learning

Work Procedure

INFOID:0000000014419436

1.SAVE ECM DATA

With CONSULT
1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Turn ignition switch ON.
4. Select “SAVING DATA FOR REPLC CPU” in “WORK SUPPORT” mode of “ENGINE” using CONSULT.
5. Follow the instruction of CONSULT display.

NOTE:
- Necessary data in ECM is copied and saved to CONSULT.
- Go to Step 2 regardless of with or without success in saving data.

>> GO TO 2.

2.CHECK ECM PART NUMBER

Check ECM part number to see whether it is blank ECM or not.
NOTE:
- Part number of blank ECM is 23703 - ×××××.
- Check part number when ordering ECM or the one included in the label on the container box.

Is the ECM a blank ECM?

YES >> GO TO 3.
NO >> GO TO 5.

3.SAVE ECM PART NUMBER

Read out the part number from the old ECM and save the number, following the programming instructions. Refer to CONSULT Operation Manual.
NOTE:
- The ECM part number is saved in CONSULT.
- Even when ECM part number is not saved in CONSULT, go to 4.

>> GO TO 4.

4.PERFORM ECM PROGRAMMING

After replacing ECM, perform the ECM programming. Refer to CONSULT Operation Manual.
NOTE:
- Refer to EC-727, "Removal and Installation" for replacement of ECM.

- During programming, maintain the following conditions:
- Ignition switch: ON
- Electric load: OFF
- Brake pedal: Not depressed
- Battery voltage: 12 – 13.5 V (Be sure to check the value of battery voltage by selecting “BATTERY VOLT” in “Data monitor” of CONSULT.)

>> GO TO 6.

5.REPLACE ECM

Replace ECM. Refer to EC-727, "Removal and Installation".

>> GO TO 6.

6.PERFORM INITIALIZATION OF IVIS (NATS) SYSTEM AND REGISTRATION OF ALL IVIS (NATS) IGNITION KEY IDS

Refer to SEC-67, "ECM : Description".

>> GO TO 7.

7.CHECK ECM DATA STATUS

Check if the data is successfully copied from the ECM at Step 1 (before replacement) and saved in CONSULT.

Is the data saved successfully?

YES >> GO TO 8.
NO >> GO TO 9.

8.WRITE ECM DATA

With CONSULT
1. Select “WRITING DATA FOR REPLC CPU” in “WORK SUPPORT” mode of “ENGINE” using CONSULT.
2. Follow the instruction of CONSULT display.

NOTE:
The data saved by “SAVING DATA FOR REPLC CPU” is written to ECM.

>> GO TO 10.

9.PERFORM VIN REGISTRATION

Refer to EC-197, "Description".

>> GO TO 10.

10.PERFORM ACCELERATOR PEDAL RELEASED POSITION LEARNING

Perform Accelerator Pedal Released Position Learning. Refer to EC-198, "Description".

>> GO TO 11.

11.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Perform Throttle Valve Closed Position Learning. Refer to EC-199, "Description".

>> GO TO 12.

12.PERFORM IDLE AIR VOLUME LEARNING

Perform Idle Air Volume Learning. Refer to EC-200, "Description".

>> END

ADDITIONAL SERVICE WHEN REPLACING VVEL CONTROL MODULE

Description

INFOID:0000000014419437

When replacing VVEL control module, the following procedure must be performed. (For details, refer to EC-196, "Work Procedure".)

Work Procedure

INFOID:0000000014419438

1.PERFORM IDLE AIR VOLUME LEARNING

Perform idle air volume learning. Refer to EC-200, "Description".

>> END

VIN REGISTRATION

Description

INFOID:0000000014419439

VIN Registration is an operation to registering VIN in ECM. It must be performed each time ECM is replaced. (For details, refer to EC-197, "Work Procedure".)

NOTE:

Accurate VIN which is registered in ECM may be required for Inspection & Maintenance (I/M).

Work Procedure

INFOID:0000000014419440

1.CHECK VIN

Check the VIN of the vehicle and note it. Refer to GI-36, "Identification Number".

>> GO TO 2.

2.PERFORM VIN REGISTRATION

With CONSULT

1. Turn ignition switch ON and engine stopped.
2. Select “VIN REGISTRATION” in “WORK SUPPORT” mode of “ENGINE”.
3. Follow the instruction of CONSULT display.

>> END

ACCELERATOR PEDAL RELEASED POSITION LEARNING

Description

INFOID:0000000014419441

Accelerator Pedal Released Position Learning is a function of ECM to learn the fully released position of the accelerator pedal by monitoring the accelerator pedal position sensor output signal. It must be performed each time the harness connector of the accelerator pedal position sensor or ECM is disconnected. (For details, refer to EC-198, "Work Procedure".)

Work Procedure

INFOID:0000000014419442

1.START

1. Check that accelerator pedal is fully released.
2. Turn ignition switch ON and wait at least 2 seconds.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON and wait at least 2 seconds.
5. Turn ignition switch OFF and wait at least 10 seconds.

>> END

THROTTLE VALVE CLOSED POSITION LEARNING

Description

INFOID:0000000014419443

Throttle Valve Closed Position Learning is a function of ECM to learn the fully closed position of the throttle valve by monitoring the throttle position sensor output signal. It must be performed each time the harness connector of the electric throttle control actuator or ECM is disconnected or electric throttle control actuator inside is cleaned. (For details, refer to EC-199, "Work Procedure".)

Work Procedure

INFOID:0000000014419444

1.START

WITH CONSULT
1. Turn ignition switch ON.
2. Select “CLSD THL POS LEARN” in “WORK SUPPORT” mode.
3. Follow the instructions on the CONSULT display.
4. Turn ignition switch OFF and wait at least 10 seconds.
   Check that throttle valve moves during the above 10 seconds by confirming the operating sound.

WITHOUT CONSULT
1. Start the engine.
   NOTE:
   Engine coolant temperature is 25°C (77°F) or less before engine starts.
2. Warm up the engine.
   NOTE:
   Raise engine coolant temperature until it reaches 65°C (149°F) or more.
3. Turn ignition switch OFF and wait at least 10 seconds.
   Check that throttle valve moves during the above 10 seconds by confirming the operating sound.

>> END

IDLE AIR VOLUME LEARNING

Description

INFOID:0000000014419445

Idle Air Volume Learning is a function of ECM to learn the idle air volume that keeps engine idle speed within the specific range. (For details, refer to EC-200, "Work Procedure".) It must be performed under the following conditions:

- Each time the electric throttle control actuator or ECM is replaced.
- Idle speed or ignition timing is out of the specification.

Work Procedure

INFOID:0000000014419446

1.PRECONDITIONING

Check that all of the following conditions are satisfied.
Learning will be cancelled if any of the following conditions are missed for even a moment.

- Battery voltage: More than 12.9 V (At idle)
- Engine coolant temperature: 70 - 105°C (158 - 221°F)
- Selector lever position: P or N
- Electric load switch: OFF
  (Air conditioner, headlamp, rear window defogger)
  On vehicles equipped with daytime light systems, if the parking brake is applied before the engine is started the headlamp will not illuminate.
- Steering wheel: Neutral (Straight-ahead position)
- Vehicle speed: Stopped
- Transmission: Warmed-up

- With CONSULT: Drive vehicle until “ATF TEMP 2” in “DATA MONITOR” mode of “A/T” system indicates less than 0.9 V.
- Without CONSULT: Drive vehicle for 10 minutes.

Will CONSULT be used?

YES >> GO TO 2.
NO >> GO TO 3.

2.PERFORM IDLE AIR VOLUME LEARNING

WITH CONSULT

1. Perform Accelerator Pedal Released Position Learning. Refer to EC-198, "Description".
2. Perform Throttle Valve Closed Position Learning. EC-199, "Description".
3. Start engine and warm it up to normal operating temperature.
4. Select “IDLE AIR VOL LEARN” in “WORK SUPPORT” mode.
5. Touch “START” and wait 20 seconds.

Is “CMPLT” displayed on CONSULT screen?

YES >> GO TO 4.
NO >> GO TO 5.

3.PERFORM IDLE AIR VOLUME LEARNING

WITHOUT CONSULT

NOTE:

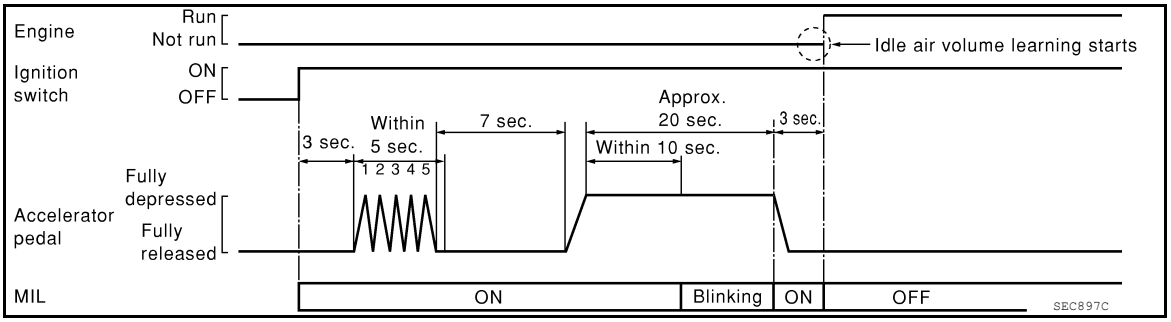
- **It is better to count the time accurately with a clock.**
- **It is impossible to switch the diagnostic mode when an accelerator pedal position sensor circuit has a malfunction.**

1. Perform Accelerator Pedal Released Position Learning. Refer to EC-198, "Description".
2. Perform Throttle Valve Closed Position Learning. EC-199, "Description".
3. Start engine and warm it up to normal operating temperature.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Confirm that accelerator pedal is fully released, turn ignition switch ON and wait 3 seconds.
6. Repeat the following procedure quickly 5 times within 5 seconds.

- Fully depress the accelerator pedal.
- Fully release the accelerator pedal.

7. Wait 7 seconds, fully depress the accelerator pedal for approx. 20 seconds until the MIL stops blinking and turns ON.

8. Fully release the accelerator pedal within 3 seconds after the MIL turns ON.
9. Start engine and let it idle.
10. Wait 20 seconds.



>> GO TO 4.

4. CHECK IDLE SPEED AND IGNITION TIMING

Rev up engine two or three times and check that idle speed and ignition timing are within the specifications.
For procedure, refer to EC-722, "Inspection" and EC-723, "Inspection".
For specifications, refer to EC-730, "Idle Speed" and EC-730, "Ignition Timing".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5. DETECT MALFUNCTIONING PART-I

Check the following
- Check that throttle valve is fully closed.
- Check PCV valve operation.
- Check that downstream of throttle valve is free from air leakage.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace malfunctioning part.

6. DETECT MALFUNCTIONING PART-II

Engine component parts and their installation condition are questionable. Check and eliminate the cause of the incident.
It is useful to perform “TROUBLE DIAGNOSIS - SPECIFICATION VALUE”. Refer to EC-220, "Description".
If any of the following conditions occur after the engine has started, eliminate the cause of the incident and perform Idle Air Volume Learning again:
- Engine stalls.
- Incorrect idle.

>> INSPECTION END

VVEL CONTROL SHAFT POSITION SENSOR ADJUSTMENT

Description

INFOID:0000000014419447

VVEL control shaft position sensor adjustment is an operation to adjust the initial position of the VVEL control shaft position sensor. (For details, refer to EC-202, "Work Procedure".)
It must be performed each time VVEL ladder assembly is replaced.

CAUTION:

- **It must be performed only on the replaced bank side.**
- **It must not be performed except when VVEL ladder assembly is replaced. If by any chance the adjustment is performed, replace VVEL ladder assembly.**

Work Procedure

INFOID:0000000014419448

1.START

Will CONSULT be used?

Will CONSULT be used?

YES >> GO TO 2.
NO >> GO TO 3.

2.PERFORM VVEL CONTROL SHAFT POSITION SENSOR ADJUSTMENT

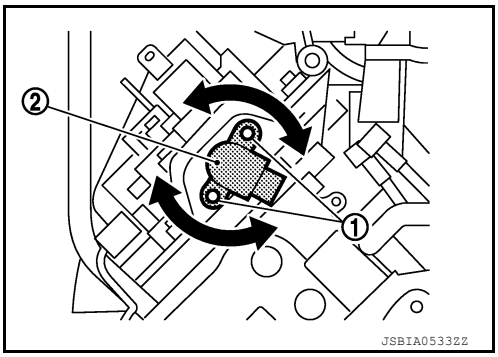
WITH CONSULT

1. Turn ignition switch ON.
2. Select “VVEL POS SEN ADJ PREP” in “WORK SUPPORT” mode with CONSULT.
3. Touch “Start” and wait a few seconds.
4. Check that “CMPLT” is displayed on CONSULT screen.
5. Select “VVEL POSITION SEN-B1” or “VVEL POSITION SEN-B2” in “DATA MONITOR” mode with CONSULT.
6. Loosen the VVEL control shaft position sensor mounting bolts (1).
7. Turn the VVEL control shaft position sensor (2) clockwise and counterclockwise while monitoring the output voltage of “VVEL POSITION SEN-B1” or “VVEL POSITION SEN-B2” and adjust the output voltage to be within the standard value.

   Voltage: 500 ± 48 mV

8. Tighten the VVEL control shaft position sensor mounting bolts.

   : 7.0 N·m (0.71 kg-m, 62 in-lb)



9. Reconfirm that the output voltage of “VVEL POSITION SEN-B1” or “VVEL POSITION SEN-B2” is within the standard value.

   Voltage: 500 ± 48 mV

   NOTE:
   If it varies from the standard value after the mounting bolts are tightened, perform steps 6 to 8 again.
10. Turn ignition switch OFF and wait at least 10 seconds.
11. Start engine and warm it up to normal operating temperature.
12. Turn ignition switch OFF and wait at least 10 seconds.
13. Perform idle air volume learning. Refer to EC-200, "Description".

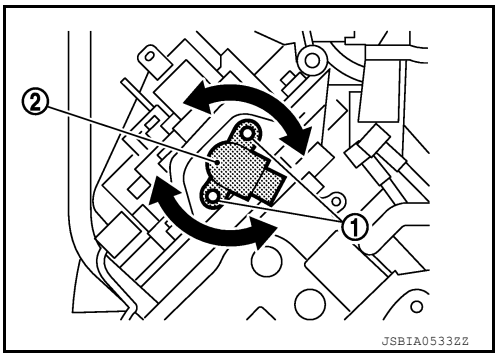
>> INSPECTION END

3.PERFORM VVEL CONTROL SHAFT POSITION SENSOR ADJUSTMENT

WITHOUT CONSULT

1. Disconnect VVEL control shaft position sensor harness connector.
2. Remove VVEL actuator motor relay.
3. Turn ignition switch ON, wait at least 5 seconds and then turn it OFF.

4. Reconnect all harness connectors disconnected.
5. Install VVEL actuator motor relay.
6. Turn ignition switch ON and wait at least 5 seconds.
7. Loosen the VVEL control shaft position sensor mounting bolts (1).
8. Turn the VVEL control shaft position sensor (2) clockwise and counterclockwise while monitoring the output voltage between the VVEL control module terminals with a tester and adjust the output voltage to be within the standard value.



VVEL control module				Voltage
Bank	Connector	+	–	
		Terminal	Terminal	
1	F84	3	6	500 ± 48 mV
2		5	4	

9. Tighten the VVEL control shaft position sensor mounting bolts.

: **7.0 N·m (0.71 kg-m, 62 in-lb)**

10. Reconfirm that the output voltage of VVEL control shaft position sensor is within the standard value.

VVEL control module				Voltage
Bank	Connector	+	–	
		Terminal	Terminal	
1	F84	3	6	500 ± 48 mV
2		5	4	

NOTE:
If it varies from the standard value after the mounting bolts are tightened, perform steps 7 to 9 again.

11. Turn ignition switch OFF and wait at least 10 seconds.
12. Start engine and warm it up to normal operating temperature.
13. Turn ignition switch OFF and wait at least 10 seconds.
14. Perform Idle Air Volume Learning. Refer to EC-200, "Description".

>> INSPECTION END

MIXTURE RATIO SELF-LEARNING VALUE CLEAR

Description

INFOID:0000000014419449

This describes how to erase the mixture ratio self-learning value. For the actual procedure, follow the instructions in “Diagnosis Procedure”. (For details, refer to EC-204, "Work Procedure".)

Work Procedure

INFOID:0000000014419450

1.START

WITH CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Select “SELF-LEARNING CONT” in “WORK SUPPORT” mode with CONSULT.
3. Clear mixture ratio self-learning value by touching “CLEAR”.

WITH GST
1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF.
3. Disconnect mass air flow sensor harness connector.
4. Restart engine and let it idle for at least 5 seconds.
5. Stop engine and reconnect mass air flow sensor harness connector.
6. Select Service $03 with GST. Check DTC P0102 is detected.
7. Select Service $04 with GST to erase the DTC P0102.

>> END

FUEL PRESSURE

Work Procedure

INFOID:0000000014419451

FUEL PRESSURE RELEASE

WITH CONSULT

1. Turn ignition switch ON.
2. Perform “FUEL PRESSURE RELEASE” in “WORK SUPPORT” mode with CONSULT.
3. Start engine.
4. After engine stalls, crank it two or three times to release all fuel pressure.
5. Turn ignition switch OFF.

WITHOUT CONSULT

1. Remove fuel pump fuse in IPDM E/R.
   NOTE:
   - For the fuse number, refer to EC-155, "Wiring Diagram".
   - For the fuse arrangement, refer to PG-174, "IPDM E/R Terminal Arrangement".
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch OFF.
5. Reinstall fuel pump fuse after servicing fuel system.

LOW FUEL PRESSURE CHECK

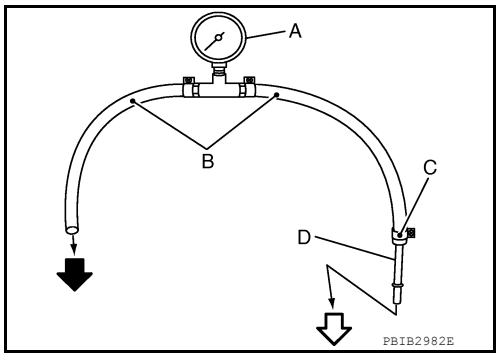
CAUTION:

- **Before disconnecting fuel line, release fuel pressure from fuel line to eliminate danger.**
- **The fuel hose connection method used when taking fuel pressure check must not be used for other purposes.**
- **Do not perform fuel pressure check with electrical systems operating (i.e. lights, rear defogger, A/C, etc.) Fuel pressure gauge may indicate false readings due to varying engine load and changes in manifold vacuum.**

NOTE:

Prepare pans or saucers under the disconnected fuel line because the fuel may spill out.

1. Release fuel pressure to zero.
2. Prepare fuel hose for fuel pressure check (B) and fuel tube adapter [SST (KV10118400)] (D), then connect fuel pressure gauge (A).



⇦ **To quick connector**

⬅ **To fuel tube (engine side)**

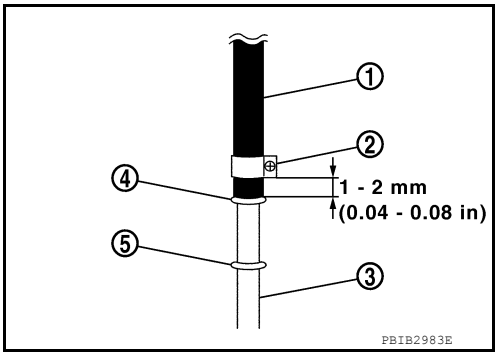
C **: Hose clamp**

CAUTION:

- **Use suitable fuel hose for fuel pressure check (genuine NISSAN fuel hose without quick connector).**
- **To avoid unnecessary force or tension to hose, use moderately long fuel hose for fuel pressure check.**
- **Do not use the fuel hose for checking fuel pressure with damage or cracks on it.**
- **Use Pressure Gauge to check fuel pressure.**

3. Disconnect fuel feed hose from fuel tube. Refer to EM-52, "Exploded View".
   CAUTION:
   Do not twist or kink fuel hose because it is plastic hose.

4. Connect fuel hose for fuel pressure check (1) to fuel tube (engine side) with clamp (2) as shown in the figure.



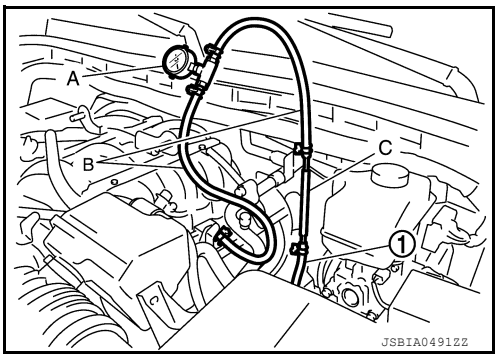
5 : No.2 spool

CAUTION:
- **Wipe off oil or dirt from hose insertion part using cloth moistened with gasoline.**
- **Apply proper amount of gasoline between top of the fuel tube (3) and No.1 spool (4).**
- **Insert fuel hose for fuel pressure check until it touches the No.1 spool on fuel tube.**
- **Use NISSAN genuine hose clamp (part number: 16439 N4710 or 16439 40U00).**
- **When reconnecting fuel line, always use new clamps.**
- **Use a torque driver to tighten clamps.**
- **Install hose clamp to the position within 1 - 2 mm (0.04 - 0.08 in).**

Tightening torque : 1.0 - 1.5 N·m (0.1 - 0.15 kg-m, 9 - 13 in-lb)

- **Make sure that clamp screw does not contact adjacent parts.**

5. Connect fuel tube adapter (C) to fuel feed hose (1) in the same manner as instructed in Step 4.



A : Fuel pressure gauge

B : Fuel hose for fuel pressure check

6. After connecting fuel hose for fuel pressure check, pull the hose with a force of approximately 98 N (10 kg, 22 lb) to confirm fuel tube does not come off.
7. Reinstall the part removed at Step 3.
   NOTE:
   Install the part to allow smooth engine starts.
8. Turn ignition switch ON and check for fuel leakage.
9. Start engine and check for fuel leakage.
10. Read the indication of fuel pressure gauge.
    CAUTION:
    - **Do not perform fuel pressure check with system operating. Fuel pressure gauge may indicate false readings.**
    - **During fuel pressure check, confirm for fuel leakage from fuel connection every 3 minutes.**

At idling : Approximately 450 kPa (4.5 bar, 4.6 kg/cm^2, 65 psi)

HIGH FUEL PRESSURE CHECK

NOTE:
Since the fuel pressure gauge kit cannot be connected, follow the method shown below to check high fuel pressure.

WITH CONSULT

1. Start engine.
2. Check “FUEL PRES SEN V” in “DATA MONITOR” mode with CONSULT.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Idle	980 – 1,200 mV
	Revving engine from idle to 4,000 rpm quickly	1,100 – 2,900 mV

⊗WITHOUT CONSULT
1. Start the engine.
2. Check fuel rail pressure sensor signal voltage.

+		−	Condition	Value (Approx.)
Fuel rail pressure sensor				
Connector	Terminal			
F91	2	Ground	Engine speed: idle	0.98 – 1.2 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	1.1 – 2.9 V

HOW TO SET SRT CODE

Description

INFOID:0000000014419452

OUTLINE

In order to set all SRTs, the self-diagnoses as in the “SRT ITEM” table must have been performed at least once. Each diagnosis may require actual driving for a long period of time under various conditions.

SRT ITEM

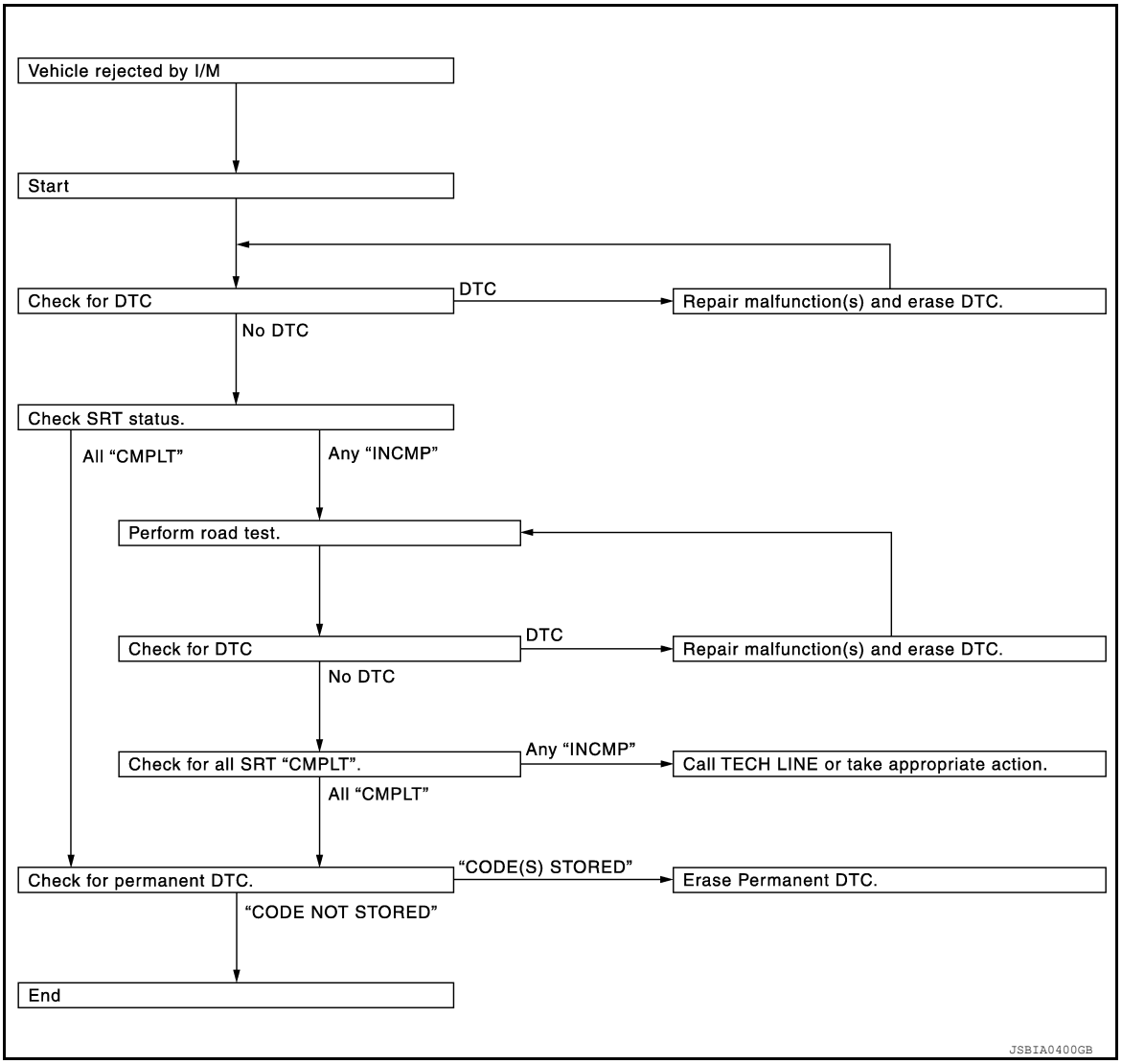
The table below shows required self-diagnostic items to set the SRT to “CMPLT”.

SRT item*1 (CONSULT indication)	Required self-diagnostic items to set the SRT to “CMPLT”	Corresponding DTC No.
CATALYST	Three way catalyst function	P0420, P0430
EVAP SYSTEM	EVAP control system purge flow monitoring	P0441
	EVAP control system	P0456
HO2S	Air fuel ratio (A/F) sensor 1	P0130, P014C, P014D, P014E, P014F, P0150, P015A, P015B, P015C, P015D, P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2, P21A3
	Heated oxygen sensor 2	P0137, P0157
	Heated oxygen sensor 2	P0138, P0158
	Heated oxygen sensor 2	P0139, P0159
EGR/VVT SYSTEM	Intake/Exhaust valve timing control function	P0011, P0012, P0015, P0016, P0017, P0018, P0019, P0021, P0022, P0025

*1: Though displayed on the CONSULT screen, “HO2S HTR” is not SRT item.

SRT SERVICE PROCEDURE

If a vehicle has failed the state emissions inspection due to one or more SRT items indicating “INCMP”, review the flowchart diagnostic sequence, referring to the following flowchart.

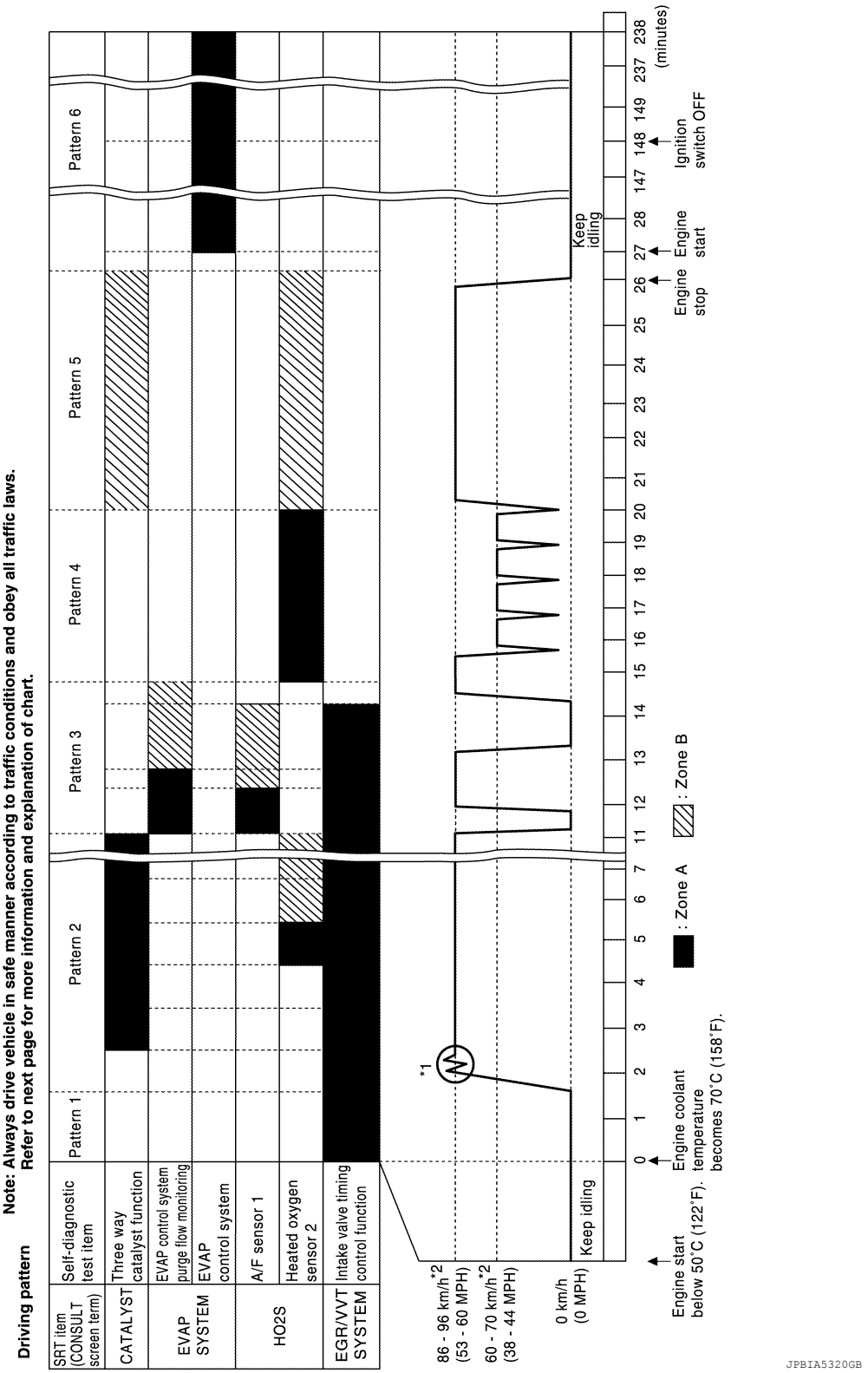


SRT Set Driving Pattern

INFOID:0000000014419453

CAUTION:

Always drive the vehicle in safe manner according to traffic conditions and obey all traffic laws.



*1: Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

*2: Checking the vehicle speed with GST is advised.

- The time required for each diagnosis varies with road surface conditions, weather, altitude, individual driving habits, etc.
  Zone A refers to the range where the time, required for the diagnosis under normal conditions*, is the shortest.

Zone B refers to the range where the diagnosis can still be performed if the diagnosis is not completed within zone A.

*: Normal conditions refer to the following:

- Sea level
- Flat road
- Ambient air temperature: 20 - 30°C (68 - 86°F)
- Diagnosis is performed as quickly as possible under normal conditions.
  Under different conditions [For example: ambient air temperature other than 20 - 30°C (68 - 86°F)], diagnosis may also be performed.

Work Procedure

INFOID:0000000014419454

1.CHECK DTC

Check DTC.

Is any DTC detected?

YES >> Repair malfunction(s) and erase DTC. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK SRT STATUS

WITH CONSULT
Select “SRT STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
WITHOUT CONSULT
Perform “SRT status” mode with EC-91, "On Board Diagnosis Function".
WITH GST
Select Service $01 with GST.

Is SRT code(s) set?

YES >> GO TO 12.
NO-1 >> With CONSULT: GO TO 3.
NO-2 >> Without CONSULT: GO TO 4.

3.DTC CONFIRMATION PROCEDURE

1. Select “SRT WORK SUPPORT” in “DTC & SRT CONFIRMATION” mode with CONSULT.
2. For SRT(s) that is not set, perform the corresponding “DTC CONFIRMATION PROCEDURE” according to the “Performance Priority” in the “SRT ITEM” table. Refer to EC-208, "Description".
3. Check DTC.

Is any DTC detected?

YES >> Repair malfunction(s) and erase DTC. Refer to EC-136, "DTC Index".
NO >> GO TO 11.

4.PERFORM ROAD TEST

- Check the “Performance Priority” in the “SRT ITEM” table. Refer to EC-208, "Description".
- Perform the most efficient SRT set driving pattern to set the SRT properly. Refer to EC-209, "SRT Set Driving Pattern".
  In order to set all SRTs, the SRT set driving pattern must be performed at least once.

>> GO TO 5.

5.PATTERN 1

1. Check the vehicle condition;
- Engine coolant temperature is −10 to 35°C (14 to 95°F).
- Fuel tank temperature is more than 0°C (32°F).
2. Start the engine.
3. Keep engine idling until the engine coolant temperature is greater than 70°C (158°F)

NOTE:
ECM terminal voltage is follows;

- Engine coolant temperature
- −10 to 35°C (14 to 95°F): 3.0 - 4.3 V
- 70°(158°F): Less than 1.4 V

• Fuel tank temperature: Less than 4.1 V
Refer to EC-107, "Reference Value".

>> GO TO 6.

6. PATTERN 2

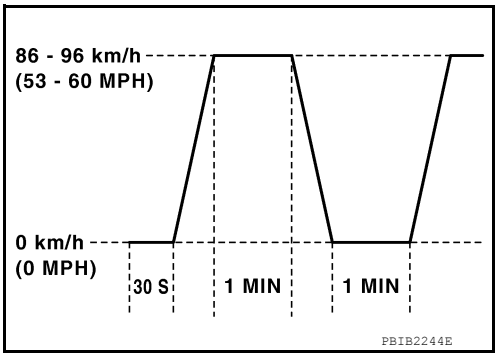
1. Drive the vehicle. And depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again

NOTE:
• Checking the vehicle speed with GST is advised.
• When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

>> GO TO 7.

7. PATTERN 3

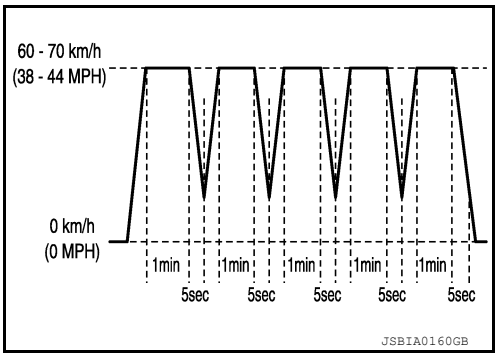
• Operate vehicle following the driving pattern shown in the figure.
• Release the accelerator pedal during deceleration of vehicle speed from 90 km/h (56 MPH) to 0 km/h (0 MPH).



>> GO TO 8.

8. PATTERN 4

• Operate vehicle following the driving pattern shown in the figure.
- Drive the vehicle in a proper gear at 60 km/h (38 MPH) and maintain the speed.
- Release the accelerator pedal fully at least 5 seconds.
- Repeat the above two steps at least 5 times.



>> GO TO 9.

9. PATTERN 5

• The accelerator pedal must be held very steady during steady-state driving.
• If the accelerator pedal is moved, the test must be conducted again.

>> GO TO 10.

10. PATTERN 6

• Cool down the engine so that the engine coolant temperature lowers between 15 - 35°C (59 - 95°F).
CAUTION:
Never turn the ignition switch ON while cooling down the engine.
• Engine coolant temperature at engine start is between 15 – 35°C (59 – 95°F) and has lowered 45°C (113°F) or more since the latest engine stop.

>> GO TO 11.

11. CHECK SRT STATUS

WITH CONSULT
Select “SRT STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
WITHOUT CONSULT
Perform “SRT status” mode with EC-91, "On Board Diagnosis Function".
WITH GST
Select Service $01 with GST.

Is SRT(s) set?

YES >> GO TO 12.
NO >> Call TECH LINE or take appropriate action.

12. CHECK PERMANENT DTC

NOTE:
Permanent DTC cannot be checked with a tool other than CONSULT or GST.

With CONSULT
Select “SRT STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
With GST
Select Service $0A with GST.

Is permanent DTC(s) detected?

YES >> Go to EC-214, "Description".
NO >> END

HOW TO ERASE PERMANENT DTC

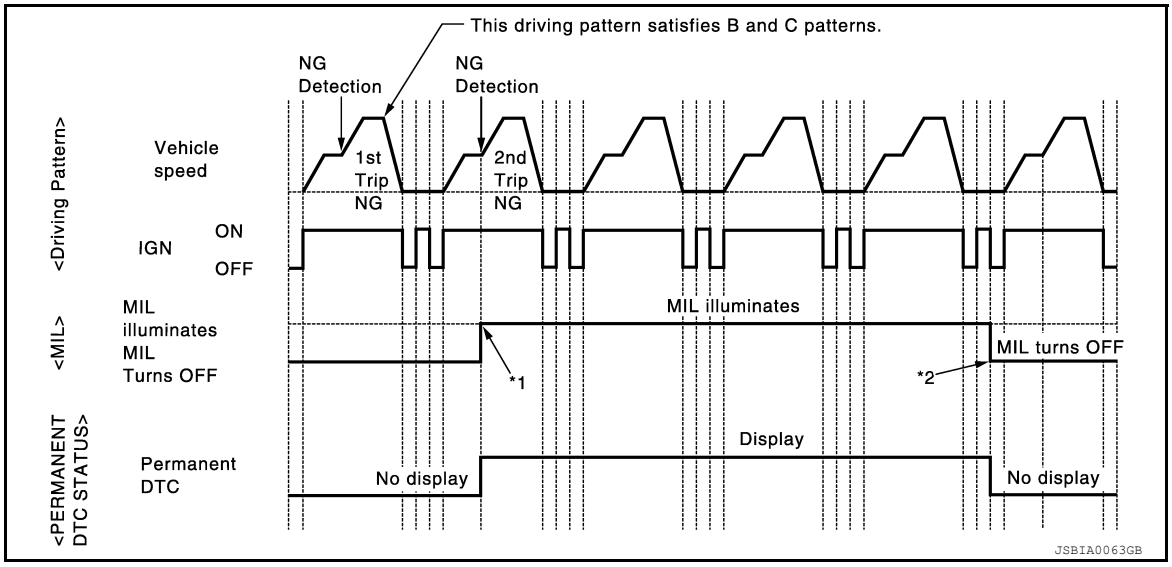
Description

INFOID:0000000014419455

NOTE:
Permanent DTC is not applied for regions where ti is not mandated.

OUTLINE

When a DTC is stored in ECM
When a DTC is stored in ECM and MIL is ON, a permanent DTC is erased with MIL shutoff if the same malfunction is not detected after performing the driving pattern for MIL shutoff three times in a raw.



*1: When the same malfunction is detected in two consecutive trips, MIL will illuminate.

*2: MIL will turn off after vehicle is driven 3 times (driving pattern B) without any malfunctions.

When a DTC is not stored in ECM
The erasing method depends on a permanent DTC stored in ECM. Refer to the following table.
NOTE:
If the applicable permanent DTC includes multiple groups, perform the procedure of Group B first. If the permanent DTC is not erased, perform the procedure of Group A.

×: Applicable —: Not applicable

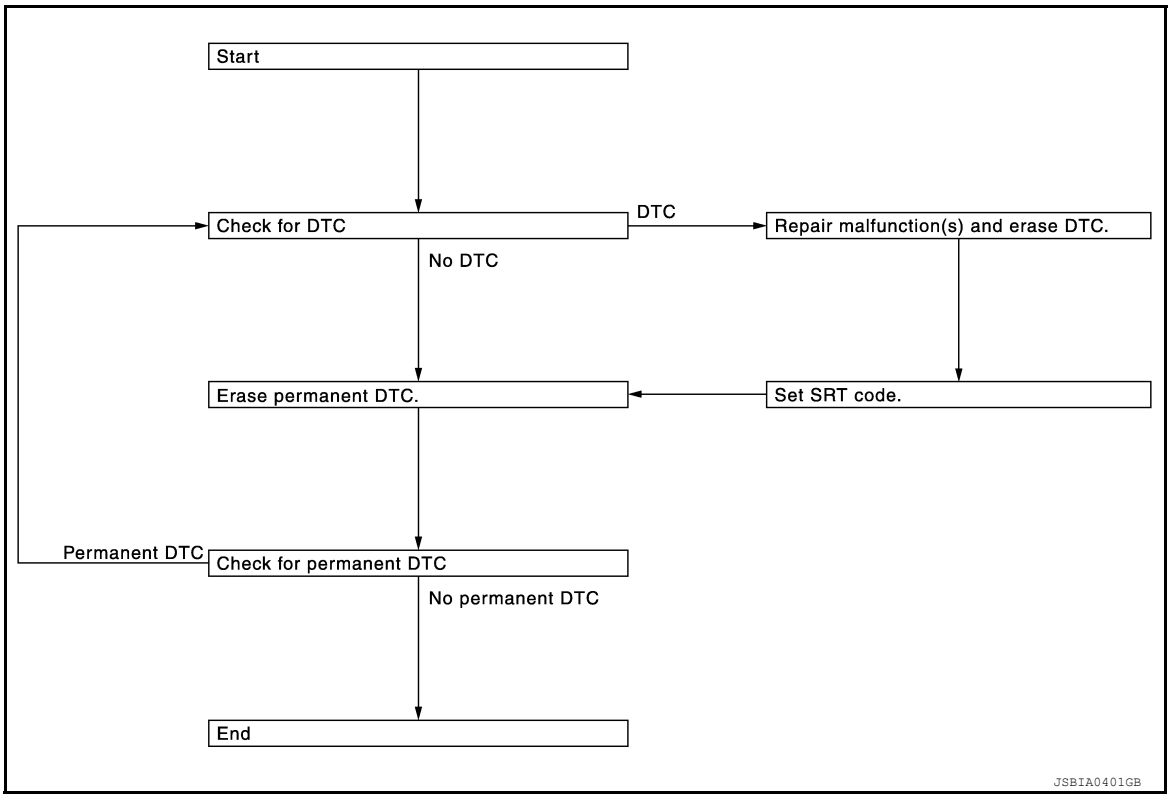
Group*	Perform "DTC CONFIRMATION PROCEDURE" for applicable DTCs.	Driving pattern		Reference
		B	D	
A	×	—	—	EC-215
B	—	×	×	EC-217

*: For group, refer to EC-136, "DTC Index".

PERMANENT DTC ITEM

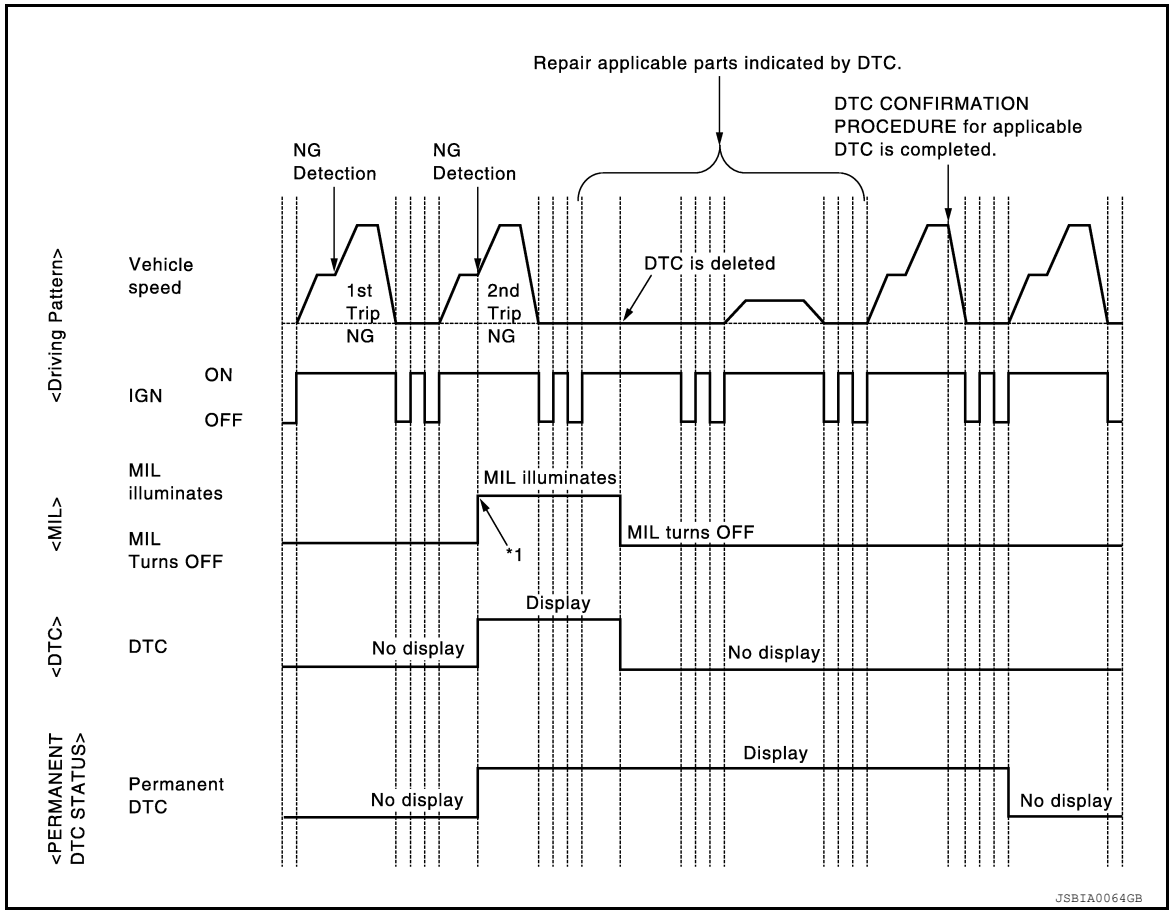
For permanent DTC items, MIL turns ON. Refer to EC-136, "DTC Index".

PERMANENT DTC SERVICE PROCEDURE



Work Procedure (Group A)

INFOID:0000000014419456



*1: When the same malfunction is detected in two consecutive trips, MIL will illuminate.

1.CHECK DTC

Check DTC.

Is any DTC detected?

YES >> Repair malfunction(s) and erase DTC. Refer to EC-94, "CONSULT Function", EC-91, "On Board Diagnosis Function".

NO >> GO TO 2.

2.CHECK PERMANENT DTC

With CONSULT

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select “PERMANENT DTC STATUS” mode with CONSULT.

With GST

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select Service $0A with GST.

Is any permanent DTC detected?

YES >> GO TO 3.

NO >> END

3.PERFORM DTC CONFIRMATION PROCEDURE

Perform “DTC CONFIRMATION PROCEDURE” for DTCs which are the same as permanent DTCs stored in ECM. Refer to EC-94, "CONSULT Function", EC-91, "On Board Diagnosis Function".

>> GO TO 4.

4.CHECK PERMANENT DTC

With CONSULT

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select “PERMANENT DTC STATUS” mode with CONSULT.

With GST

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select Service $0A with GST.

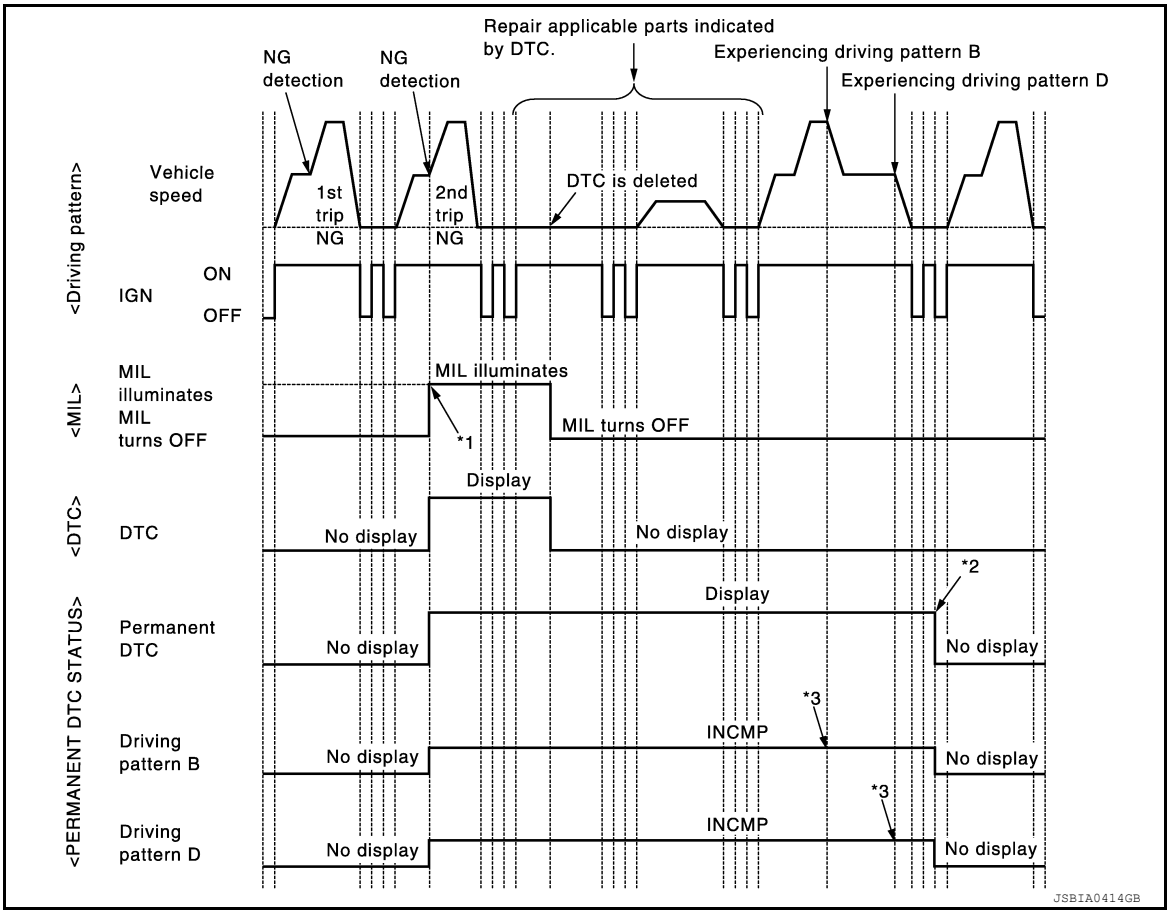
Is any permanent DTC detected?

YES >> GO TO 1.

NO >> END

Work Procedure (Group B)

INFOID:0000000014419457



*1: When the same malfunction is detected in two consecutive trips, MIL will illuminate.

*2: After experiencing driving pattern B and D, permanent DTC is erased.

*3: Indication does not change unless the ignition switch is turned from ON to OFF twice even after experiencing driving pattern B or D.

NOTE:
Drive the vehicle according to only driving patterns indicating “INCMP” in driving patterns B and D on the “PERMANENT DTC STATUS” screen.

1.CHECK DTC

Check DTC.

Is any DTC detected?

YES >> Repair malfunction(s) and erase DTC. Refer to EC-94, "CONSULT Function", EC-91, "On Board Diagnosis Function".

NO >> GO TO 2.

2.CHECK PERMANENT DTC

With CONSULT

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select “PERMANENT DTC STATUS” mode with CONSULT.

With GST

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

4. Turn ignition switch ON.
5. Select Service $0A with GST.

Is any permanent DTC detected?

YES >> GO TO 3.
NO >> END

3. DRIVE DRIVING PATTERN B

CAUTION:
- **Always drive at a safe speed.**
- **Never erase self-diagnosis results.**
- **If self-diagnosis results are erased during the trip of driving pattern B or D, the counter of driving pattern B and D is reset.**

With CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Use “PERMANENT DTC WORK SUPPORT” mode with CONSULT to drive the vehicle according to driving pattern B. Refer to EC-94, "CONSULT Function", EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

With GST
1. Start engine and warm it up to normal operating temperature.
2. Drive the vehicle according to driving pattern B. Refer to EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

>> GO TO 4.

4. CHECK PERMANENT DTC

With CONSULT
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select “PERMANENT DTC STATUS” mode with CONSULT.

With GST
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select Service $0A with GST.

Is any permanent DTC detected?

YES >> GO TO 5.
NO >> END

5. DRIVE DRIVING PATTERN D

CAUTION:
- **Always drive at a safe speed.**
- **Never erase self-diagnosis results.**
- **If self-diagnosis results are erased during the trip of driving pattern B or D, the counter of driving pattern B and D is reset.**

Drive the vehicle according to driving pattern D. Refer to EC-88, "DIAGNOSIS DESCRIPTION : Driving Pattern".

>> GO TO 6.

6. CHECK PERMANENT DTC

With CONSULT
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.

5. Select “PERMANENT DTC STATUS” mode with CONSULT.

With GST

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Select Service $0A with GST.

Is any permanent DTC detected?

YES >> GO TO 1.
NO >> END

DTC/CIRCUIT DIAGNOSIS

TROUBLE DIAGNOSIS - SPECIFICATION VALUE

Description

INFOID:0000000014419458

The specification (SP) value indicates the tolerance of the value that is displayed in “SPEC” in “DATA MONITOR” mode of CONSULT during normal operation of the Engine Control System. When the value in “SPEC” in “DATA MONITOR” mode is within the SP value, the Engine Control System is confirmed OK. When the value in “SPEC” in “DATA MONITOR” mode is NOT within the SP value, the Engine Control System may have one or more malfunctions.
The SP value is used to detect malfunctions that may affect the Engine Control System, but will not illuminate the MIL.
The SP value will be displayed for the following items:
- B/FUEL SCHDL (The fuel injection pulse width programmed into ECM prior to any learned on board correction)
- A/F ALPHA-B1/B2 (The mean value of air-fuel ratio feedback correction factor per cycle)
- MAS A/F SE-B1/B2 (The signal voltage of the mass air flow sensor)
- IDLE FUEL PRES MAX/MIN (the signal voltage of the fuel rail pressure sensor)

Component Function Check

INFOID:0000000014419459

1.PRECONDITIONING

Check that all of the following conditions are satisfied.
TESTING CONDITION
- Vehicle driven distance: More than 5,000 km (3,107 miles)
- Barometric pressure: 98.3 - 104.3 kPa (0.983 - 1.043 bar, 1.003 - 1.064 kg/cm^2, 14.25 - 15.12 psi)
- Atmospheric temperature: 20 - 30°C (68 - 86°F)
- Engine coolant temperature: 75 - 95°C (167 - 203°F)
- Transmission: Warmed-up
- After the engine is warmed up to normal operating temperature, drive vehicle until “ATF TEMP 2” (A/T fluid temperature sensor signal) indicates more than 60°C (140°F).
- Electrical load: Not applied
- Rear window defogger switch, air conditioner switch and lighting switch are OFF. Steering wheel is straight ahead.
- Engine speed: Idle
- Gear position: Neutral (or parking)

>> GO TO 2.

2.PERFORM SPEC IN DATA MONITOR MODE

WITH CONSULT
NOTE:
Perform “SPEC” in “DATA MONITOR” mode in maximum scale display.
1. Perform EC-190, "Work Procedure".
2. Select “B/FUEL SCHDL”, “A/F ALPHA-B1”, “A/F ALPHA-B2”, “MAS A/F SE-B1” in “SPEC” of “DATA MONITOR” mode with CONSULT.
3. Check that monitor items are within the SP value.

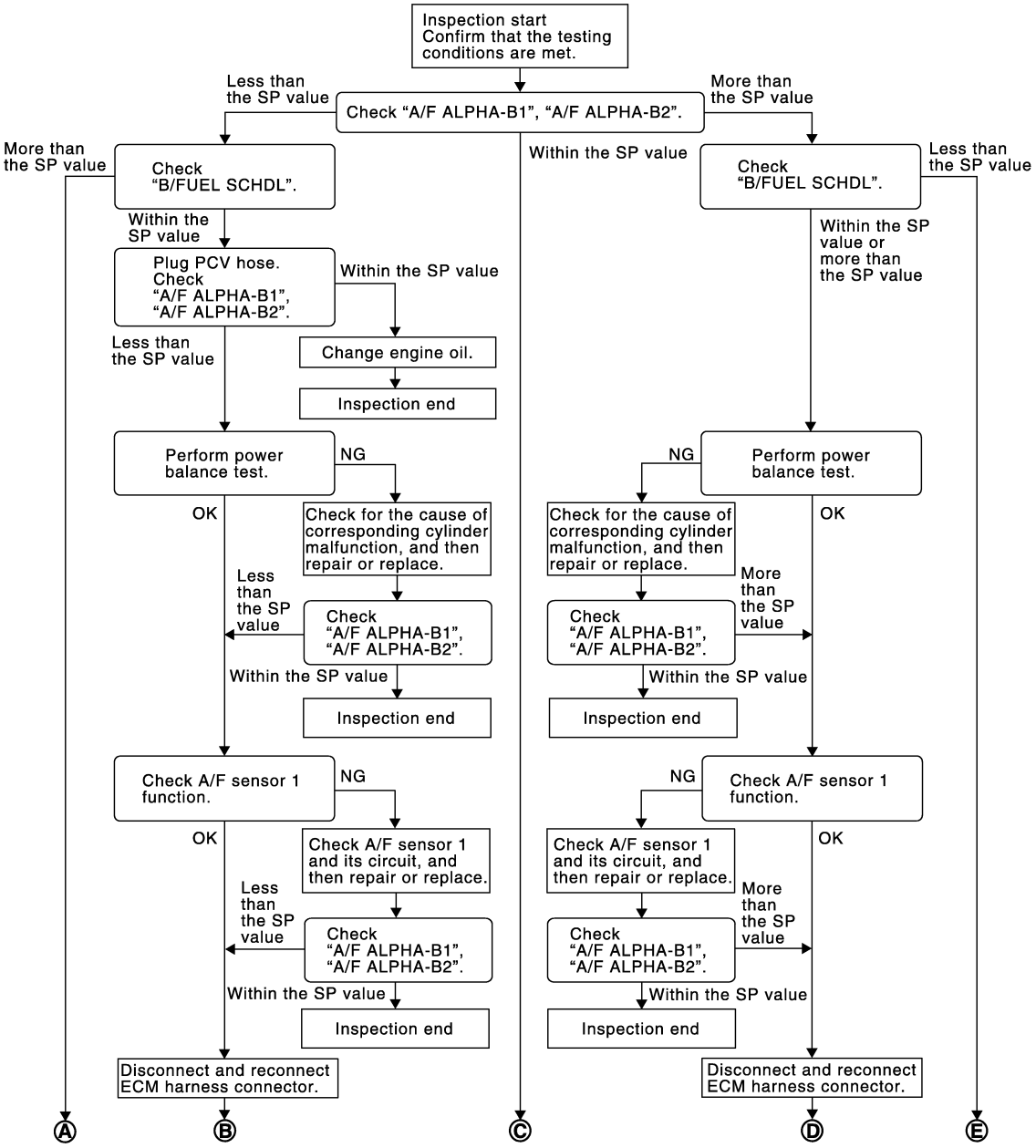
Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> Proceed to EC-221, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419460

OVERALL SEQUENCE



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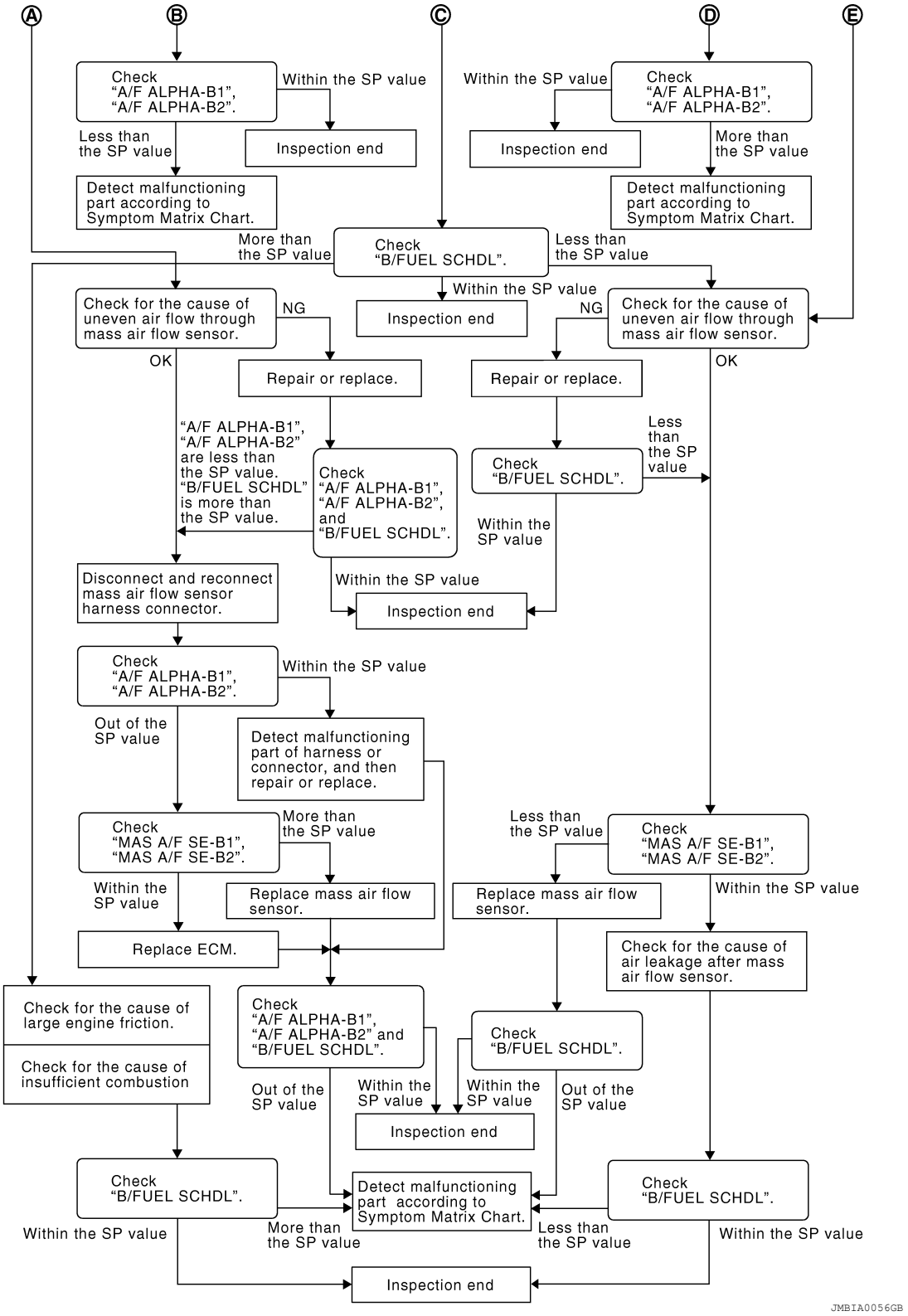


DETAILED PROCEDURE

1. CHECK "A/F ALPHA-B1" AND "A/F ALPHA-B2"

WITH CONSULT

1. Start engine.
2. Check that the testing conditions are met. Refer to EC-220, "Component Function Check".
3. Select "A/F ALPHA-B1" and "A/F ALPHA-B2" in "SPEC" of "DATA MONITOR" mode, and check that each indication is within the SP value.

NOTE:
Check “A/F ALPHA-B1” and “A/F ALPHA-B2” for approximately 1 minute because they may fluctuate. It is NG if the indication is out of the SP value even a little.

Is the measurement value within the SP value?

YES >> GO TO 14.
NO-1 >> Less than the SP value: GO TO 2.
NO-2 >> More than the SP value: GO TO 3.

2. CHECK “B/FUEL SCHDL”

Select “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> GO TO 4.
NO >> More than the SP value: GO TO 16.

3. CHECK “B/FUEL SCHDL”

Select “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> GO TO 6.
NO-1 >> More than the SP value: GO TO 6.
NO-2 >> Less than the SP value: GO TO 22.

4. CHECK “A/F ALPHA-B1”, “A/F ALPHA-B2”

1. Stop the engine.
2. Disconnect PCV hose, and then plug it.
3. Start engine.
4. Select “A/F ALPHA-B1” and “A/F ALPHA-B2” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHANGE ENGINE OIL

1. Stop the engine.
2. Change engine oil.

NOTE:
This symptom may occur when a large amount of gasoline is mixed with engine oil because of driving conditions (such as when engine oil temperature does not rise enough since a journey distance is too short during winter). The symptom will not be detected after changing engine oil or changing driving conditions.

>> INSPECTION END

6. PERFORM POWER BALANCE TEST

1. Perform “POWER BALANCE” in “ACTIVE TEST” mode.
2. Check that each cylinder produces a momentary engine speed drop.

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following below.
- Ignition coil and its circuit (Refer to EC-695, "Component Function Check".)
- Fuel injector and its circuit (Refer to EC-685, "Component Function Check".)
- Intake air leakage
- Low compression pressure (Refer to EM-20, "Inspection".)

Is the inspection result normal?

YES >> Replace fuel injector and then GO TO 8.
NO >> Repair or replace malfunctioning part and then GO TO 8.

8. CHECK “A/F ALPHA-B1” AND “A/F ALPHA-B2”

1. Start engine.
2. Select “A/F ALPHA-B1” and “A/F ALPHA-B2” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> GO TO 9.

9. CHECK A/F SENSOR 1 FUNCTION

Perform all DTC CONFIRMATION PROCEDURE related with A/F sensor 1.
- For DTC P0130, P0150, refer to EC-336, "DTC Description".
- For DTC P0131, P0151, refer to EC-340, "DTC Description".
- For DTC P0132, P0152, refer to EC-343, "DTC Description".
- For DTC P014C, P014D, P014E, P014F, P015A, P015B, P015C, P015D, refer to EC-367, "DTC Description".
- For DTC P2096, P2097, P2098, P2099 refer to EC-621, "DTC Description".

Are any DTCs detected?

YES >> GO TO 10.
NO >> GO TO 12.

10. CHECK A/F SENSOR 1 CIRCUIT

Perform Diagnosis Procedure according to corresponding DTC.

>> GO TO 11.

11. CHECK “A/F ALPHA-B1” AND “A/F ALPHA-B2”

1. Start engine.
2. Select “A/F ALPHA-B1” and “A/F ALPHA-B2” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> GO TO 12.

12. DISCONNECT AND RECONNECT ECM HARNESS CONNECTOR

1. Stop the engine.
2. Disconnect ECM harness connector. Check pin terminal and connector for damage, and then reconnect it.

>> GO TO 13.

13. CHECK “A/F ALPHA-B1” AND “A/F ALPHA-B2”

1. Start engine.
2. Select “A/F ALPHA-B1” and “A/F ALPHA-B2” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> Detect malfunctioning part according to EC-716, "Symptom Table".

14. CHECK “B/FUEL SCHDL”

Select “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO-1 >> More than the SP value: GO TO 15.
NO-2 >> Less than the SP value: GO TO 22.

15. DETECT MALFUNCTIONING PART

1. Check for the cause of large engine friction. Refer to the following.
- Engine oil level is too high
- Engine oil viscosity
- Belt tension of power steering, alternator, A/C compressor, etc. is excessive
- Noise from engine
- Noise from transmission, etc.
2. Check for the cause of insufficient combustion. Refer to the following.
- Valve clearance malfunction
- Intake valve timing control function malfunction
- Camshaft sprocket installation malfunction, etc.

>> Repair or replace malfunctioning part, and then GO TO 27.

16. CHECK INTAKE SYSTEM

Check for the cause of uneven air flow through mass air flow sensor. Refer to the following.
- Crushed air ducts
- Malfunctioning seal of air cleaner element
- Uneven dirt of air cleaner element
- Improper specification of intake air system

Is the inspection result normal?

YES >> GO TO 18.
NO >> Repair or replace malfunctioning part, and then GO TO 17.

17. CHECK “A/F ALPHA-B1”, “A/F ALPHA-B2” AND “B/FUEL SCHDL”

Select “A/F ALPHA-B1”, “A/F ALPHA-B2” and “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> “B/FUEL SCHDL” is more, “A/F ALPHA-B1” and “A/F ALPHA-B2” are less than the SP value: GO TO 18.

18. DISCONNECT AND RECONNECT MASS AIR FLOW SENSOR HARNESS CONNECTOR

1. Stop the engine.
2. Disconnect mass air flow sensor harness connector. Check pin terminal and connector for damage and then reconnect it again.

>> GO TO 19.

19. CHECK “A/F ALPHA-B1” AND “A/F ALPHA-B2”

1. Start engine.
2. Select “A/F ALPHA-B1” and “A/F ALPHA-B2” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> Detect malfunctioning part of mass air flow sensor circuit and repair it. Refer to EC-315, "Diagnosis Procedure". Then GO TO 26.
NO >> GO TO 20.

20. CHECK “MAS A/F SE-B1”

Select “MAS A/F SE-B1” in “SPEC” of “DATA MONITOR” mode, and check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> GO TO 21.
NO >> More than the SP value: Replace malfunctioning mass air flow sensor, and then GO TO 26.

21. REPLACE ECM

1. Replace ECM.

2. Perform EC-194, "Description".

>> GO TO 26.

22. CHECK INTAKE SYSTEM

Check for the cause of uneven air flow through mass air flow sensor. Refer to the following.
- Crushed air ducts
- Malfunctioning seal in air cleaner element
- Uneven dirt in air cleaner element
- Improper specification in intake air system

Is the inspection result normal?

YES >> GO TO 24.
NO >> Repair or replace malfunctioning part, and then GO TO 23.

23. CHECK “B/FUEL SCHDL”

Select “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> Less than the SP value: GO TO 24.

24. CHECK “MAS A/F SE-B1”

Select “MAS A/F SE-B1” in “SPEC” of “DATA MONITOR” mode, and check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> GO TO 25.
NO >> Less than the SP value: Replace malfunctioning mass air flow sensor, and then GO TO 27.

25. CHECK INTAKE SYSTEM

Check for the cause of air leakage after the mass air flow sensor. Refer to the following.
- Disconnection, looseness, and cracks in air duct
- Looseness of oil filler cap
- Disconnection of oil level gauge
- Open stuck, breakage, hose disconnection, or cracks in PCV valve
- Disconnection or cracks in EVAP purge hose, stuck open EVAP canister purge volume control solenoid valve
- Malfunctioning seal in rocker cover gasket
- Disconnection, looseness, or cracks in hoses, such as a vacuum hose, connecting to intake air system parts
- Malfunctioning seal in intake air system, etc.

>> GO TO 27.

26. CHECK “A/F ALPHA-B1”, “A/F ALPHA-B2” AND “B/FUEL SCHDL”

Select “A/F ALPHA-B1”, “A/F ALPHA-B2” and “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and check that each indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> Detect malfunctioning part according to EC-716, "Symptom Table".

27. CHECK “B/FUEL SCHDL”

Select “B/FUEL SCHDL” in “SPEC” of “DATA MONITOR” mode, and then check that the indication is within the SP value.

Is the measurement value within the SP value?

YES >> INSPECTION END
NO >> Detect malfunctioning part according to EC-716, "Symptom Table".

POWER SUPPLY AND GROUND CIRCUIT

Diagnosis Procedure

INFOID:0000000014419461

1.CHECK FUSE

Check that the following fuse is not blowing.

Location	Fuse No.	Capacity
IPDM E/R	#56	20 A
	#40	15 A

Is the fuse blown (open)?

YES >> Replace the fuse after repairing the applicable circuit. (If the replaced fuse is blown again, check IPDM E/R power supply circuit.)
NO >> GO TO 2.

2.CHECK GROUND CONNECTION

1. Turn ignition switch OFF.
2. Check ground connection E24. Refer to GI-49, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace ground connection.

3.CHECK ECM GROUND CIRCUIT

1. Disconnect ECM harness connectors.
2. Check the continuity between ECM harness connector and ground.

+		–	Continuity
ECM			
Connector	Terminal		
F78	10	Ground	Existed
	50		
	55		
E16	147		
	149		
	152		

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK ECM POWER SUPPLY (MAIN)-I

1. Reconnect ECM harness connector.
2. Turn ignition switch ON.
3. Check the voltage between ECM harness connector terminals.

ECM			Voltage
Connector	+	–	
	Terminal		
E16	145	152	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK ECM POWER SUPPLY (MAIN)-II

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Check the voltage between ECM harness connector terminals as per the following.

ECM			Condition	Voltage (Approx.)
Connector	+	–		
	Terminal			
E16	145	152	After turning ignition switch OFF, battery voltage will exist for a few seconds	Drop to 0 V

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 7.

6.CHECK ECM POWER SUPPLY (MAIN) CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connectors.
3. Disconnect IPDM E/R harness connector.
4. Check the continuity between ECM harness connector and IPDM E/R harness connector.

+		–		Continuity
ECM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
E16	145	E121	26	Existed

5. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

7.CHECK ECM RELAY CONTROL SIGNAL

Check the voltage between ECM harness connector terminals as per the following.

ECM				Condition	Voltage (Approx.)
Connector	+	Connector	–		
	Terminal		Terminal		
F79	88	E16	152	Ignition switch ON	0 V
				Turn ignition switch OFF and wait at least 10 seconds.	Battery voltage

Is the inspection result normal?

YES >> Check Intermittent Incident. Refer to GI-47, "Intermittent Incident".
NO >> GO TO 8.

8.CHECK ECM RELAY CONTROL SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect IPDM E/R harness connector.
4. Check the continuity between ECM harness connector and IPDM E/R harness connector.

+		–		Continuity
ECM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
F79	88	E121	31	Existed

5. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> Replace IPDM E/R. Refer to PCS-43, "Removal and Installation of IPDM E/R".
NO >> Repair or replace error-detected parts.

9. CHECK IGNITION SWITCH SIGNAL

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals.

ECM			Condition	Voltage (Approx.)
Connector	+	–		
	Terminal			
E16	133	152	Ignition switch OFF	0 V
			Ignition switch ON	Battery voltage

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10. CHECK IGNITION SWITCH SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect IPDM E/R harness connector.
4. Check the continuity between ECM harness connector and IPDM E/R harness connector.

+		–		Continuity
ECM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
E16	133	E119	17	Existed

5. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

11. CHECK ECM POWER SUPPLY (BACK-UP)

Check the voltage between ECM harness connector terminals.

+		–		Voltage
ECM		ECM		
Connector	Terminal	Connector	Terminal	
F79	120	E16	152	Battery voltage

Is the inspection result normal?

YES >> Check Intermittent Incident. Refer to GI-47, "Intermittent Incident".
NO >> GO TO 12.

12. CHECK ECM POWER SUPPLY (BACK-UP) CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.

3. Disconnect IPDM E/R harness connector.
4. Check the continuity between ECM harness connector and IPDM E/R harness connector.

+		–		Continuity
ECM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
F79	120	E121	32	Existed

5. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

U0101 CAN COMM CIRCUIT

DTC Description

INFOID:0000000014419462

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0101	LOST COMM (TCM) (Lost Communication with TCM)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	CAN communication signal
		Threshold	ECM is not transmitting or receiving CAN communication signal of OBD (emission related diagnosis)
		Diagnosis delay time	TCM for 2 seconds or more

POSSIBLE CAUSE

CAN communication line between TCM and ECM (CAN communication line is open or shorted)

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> EC-231, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419463

Perform the trouble diagnosis for CAN communication system. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

U0113, U1003 CAN COMM CIRCUIT

DTC Description

INFOID:0000000014419464

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0113	CAN COMM CIRCUIT (Lost communication with VVEL control module)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	CAN communication signal
		Threshold	ECM is not transmitting or receiving CAN communication signal of OBD (emission related diagnosis)
		Diagnosis delay time	VVEL control module for 2 seconds or more
U1003		Diagnosis condition	Ignition switch ON
		Signal (terminal)	CAN communication signal
		Threshold	ECM is not transmitting or receiving CAN communication signal other than OBD (emission related diagnosis)
		Diagnosis delay time	VVEL control module for 2 seconds or more

POSSIBLE CAUSE

U0113
- Harness or connectors (VVEL CAN communication line is open or shorted)
- ECM
- VVEL control module

U1003
- Harness or connectors (VVEL CAN communication line is open or shorted)
- ECM
- VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
U0113	Can communication circuit	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
U1003	Can communication circuit	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC U0113 or U1003 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-521, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Proceed to EC-233, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419465

1.CHECK DTC PRIORITY

If DTC U0113 or U1003 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-521, "DTC Description".
NO >> GO TO 2.

2.CHECK VVEL CAN COMMUNICATION CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect VVEL control module harness connector.
4. Check the continuity between ECM harness connector and VVEL control module harness connector.

ECM		VVEL control module		Continuity
Connector	Terminal	Connector	Terminal	
E16	137	F84	24	Existed
	138		11	

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.REPLACE VVEL CONTROL MODULE

Replace VVEL control module. Refer to EC-728, "Removal and Installation".

>> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT
1. Reconnect all harness connectors disconnected.
2. Turn ignition switch ON.
3. Select “SELF DIAGNOSTIC RESULT” mode with CONSULT.
4. Touch “ERASE”.
5. Perform DTC Confirmation Procedure.
   See EC-232, "DTC Description".

WITH GST
1. Reconnect all harness connectors disconnected.
2. Turn ignition switch ON.
3. Select Service $04 with GST.
4. Perform DTC Confirmation Procedure.
   See EC-232, "DTC Description".

Is the DTC U0113 or U1003 displayed again?

YES >> GO TO 6.

NO >> INSPECTION END

6.REPLACE ECM

Replace ECM. Refer to EC-727, "Removal and Installation".

>> INSPECTION END

U0284 ACTIVE GRILLE SHUTTER

DTC Description

INFOID:0000000014681351

When ECM cannot receive the engine communication signal from active grille shutter.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0284	LOST COMM (A/GRLL SHTTR MDL A) (Lost communication with active grille air shutter module A)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Engine communication signal
		Threshold	ECM cannot receive the engine communication signal from active grille shutter
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors (LIN is open or circuit shorted.)
- Active grille shutter

FAIL-SAFE

Engine Control System

DTC No.	Detected items	Engine operating condition in fail-safe mode
U0284	Active grille shutter	ECM operates active grille shutter to fully-open position.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC U0284 is displayed with another DTC UXXXX, first perform the confirmation procedure (trouble diagnosis) for DTC UXXXX.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index"
NO >> GO TO 2.

2.PRECONDITIONING

If another DTC Confirmation Procedure is conducted just before this procedure, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more with ignition switch ON.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is DTC U0284 detected?

YES >> Proceed to EC-235, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014681352

1.CHECK DTC PRIORITY

If DTC U0284 is displayed with another DTC UXXXX, first perform the confirmation procedure (trouble diagnosis) for DTC UXXXX.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index"
NO >> GO TO 2.

2.CHECK ACTIVE GRILLE SHUTTER POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect active grille shutter harness connector.
3. Check the voltage between active grille shutter harness connector and ground as follows.

+		−	Condition	Voltage (Approx.)
Active grille shutter				
Connector	Terminal			
E8	1	Ground	Ignition switch: ON	Battery voltage
			Ignition switch: OFF	0 V

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 3.

3.CHECK FUSE

1. Turn ignition switch OFF.
2. Pull out 20A fuse (No.56) from IPDM E/R.
3. Check that 20A fuse is not blowing.

Is the fuse blown (open)?

YES >> Replace the fuse after repairing the applicable circuit.
NO >> GO TO 4.

4.CHECK ACTIVE GRILLE SHUTTER POWER SUPPLY CIRCUIT

1. Disconnect IPDM E/R harness connector.
2. Check the continuity between IPDM E/R harness connector and active grille shutter harness connector.

IPDM E/R		Active grille shutter		Continuity
Connector	Terminal	Connector	Terminal	
E121	25	E8	1	Existed

3. Also check harness for short to power and short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace the error-detected parts.

5.CHECK ACTIVE GRILLE SHUTTER GROUND CIRCUIT

1. Turn ignition switch OFF
2. Check the continuity between active grille shutter harness connector and ground.

Active grille shutter		—	Continuity
Connector	Terminal		
E8	4	Ground	Existed

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the error-detected parts.

6.CHECK ACTIVE GRILLE SHUTTER INPUT SIGNAL CIRCUIT

1. Disconnect ECM harness connector.
2. Check the continuity between ECM harness connector and active grille shutter harness connector.

ECM		Active grille shutter		Continuity
Connector	Terminal	Connector	Terminal	
F79	86	E8	3	Existed

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the error-detected parts.

7. CHECK ACTIVE GRILLE SHUTTER

Check active grille shutter. Refer to EC-237, "Component Inspection (Active Grille Shutter)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace active grille shutter. Refer to EXT-34, "Removal and Installation".

Component Inspection (Active Grille Shutter)

INFOID:0000000014681353

1. CHECK ACTIVE GRILLE SHUTTER

With CONSULT

1. Start engine.
2. On CONSULT screen, select “ENGINE” >> “Active Test” >> “ACTIVE GRILLE SHUTTER”.
3. Touch “CALIBRTN”.
4. After the calibration completes, check the operation of active grille shutter as follows.

Condition	Active grille shutter
Select “CLOSE”	Close → Open
Select “OPEN”	Open → Close

Without CONSULT

1. Turn ignition switch OFF.
2. Operate shutter by hands to close position.
3. Check the operation of active grille shutter as follows.

Condition	Active grille shutter
Ignition switch: ON	Close → Open

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace active grille shutter. Refer to EXT-34, "Removal and Installation".

U1001 CAN COMM CIRCUIT

DTC Description

INFOID:0000000014419466

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U1001	CAN COMM CIRCUIT (CAN communication line)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	CAN communication signal
		Threshold	ECM is not transmitting or receiving CAN communication signal other than OBD (emission related diagnosis)
		Diagnosis delay time	2 seconds or more

POSSIBLE CAUSE

Harness or connectors (CAN communication line is open or shorted)

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> EC-238, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419467

Perform the trouble diagnosis for CAN communication system. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

U1024 CAN COMM CIRCUIT

DTC Description

INFOID:0000000014419468

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
U1024	VVEL CAN COMM CIRCUIT (VVEL CAN communication)	1	Diagnosis condition	Ignition switch ON
			Signal (terminal)	CAN communication signal
			Threshold	VVEL control module cannot transmitting or receiving CAN communication signal
			Diagnosis delay time	2 seconds or more
		2	Diagnosis condition	Ignition switch ON
			Signal (terminal)	CAN communication signal
			Threshold	Detecting error during the initial diagnosis of CAN controller of VVEL control module
			Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (CAN communication line is open or shorted)
- ECM
- VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
U1024	Can communication circuit	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC U1024 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-521, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 3 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-239, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419469

1.CHECK DTC PRIORITY

If DTC U1024 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-521, "DTC Description".
NO >> GO TO 2.

2.CHECK VVEL CAN COMMUNICATION CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect VVEL control module harness connector.
4. Check the continuity between ECM harness connector and VVEL control module harness connector.

ECM		VVEL control module		Continuity
Connector	Terminal	Connector	Terminal	
E16	137	F84	24	Existed
	138		11	

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.REPLACE VVEL CONTROL MODULE

1. Replace VVEL control module.
2. Perform additional service when replacing VVEL control module. Refer to EC-196, "Description".

>> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT
1. Reconnect all harness connectors disconnected.
2. Turn ignition switch ON.
3. Select “SELF DIAGNOSTIC RESULT” mode with CONSULT.
4. Touch “ERASE”.
5. Perform DTC Confirmation Procedure.
   See EC-239, "DTC Description".

WITH GST
1. Reconnect all harness connectors disconnected.
2. Turn ignition switch ON.
3. Select Service $04 with GST.
4. Perform DTC Confirmation Procedure.
   See EC-239, "DTC Description".

Is the DTC U1024 displayed again?

YES >> GO TO 6.
NO >> INSPECTION END

6.REPLACE ECM

1. Replace ECM.
2. Perform additional service when replacing ECM. Refer to EC-194, "Description".

>> INSPECTION END

U1040 ENG COMM CIRCUIT

DTC Description

INFOID:0000000014681571

DTC DETECTION LOGIC

When ECM unable to transmit engine communication signal.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U1040	Engine communication line	Diagnosis condition	Ignition switch ON
		Signal (terminal)	LIN communication signal
		Threshold	ECM unable to transmit engine communication signal
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors (LIN communication circuit is open or shorted.)
- ECM

FAIL-SAFE

Engine Control System

DTC No.	Detected items	Engine operating condition in fail-safe mode
U1040	Active grille shutter	ECM operates active grille shutter to fully-open position.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If another DTC Confirmation Procedure is conducted just before this procedure, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is DTC U1040 detected?

YES >> Proceed to EC-241, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014681572

1.CHECK ACTIVE GRILLE SHUTTER SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect active grille shutter harness connector.
4. Check the continuity between ECM harness connector and active grille shutter harness connector.

ECM		Active grille shutter		Continuity
Connector	Terminal	Connector	Terminal	
F79	86	E8	3	Existed

5. Also check harness for short to power and short to ground.

Is the inspection result normal?

YES >> INSPECTION END

NO >> Repair or replace error-detected parts.

U1044 ENG COMM CIRCUIT

DTC Description

INFOID:0000000014681573

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U1044	ENG COMM CIRCUIT (Engine communication circuit)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	LIN communication signal
		Threshold	A signal voltage of LIN communication between ECM and active grille shutter is excessively low or excessively high.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (LIN communication circuit is open or shorted.)
- Active grille shutter

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted. always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition ON and wait at least 10 seconds.
2. Check DTC.

Is DTC U1044 detected?

YES >> Proceed to EC-243, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014681574

1.CHECK ACTIVE GRILLE SHUTTER SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect active grille shutter harness connector.
4. Check the continuity between ECM harness connector and active grille shutter harness connector.

ECM		Active grille shutter		Continuity
Connector	Terminal	Connector	Terminal	
F79	86	E8	3	Existed

5. Also check harness for short to power and short to ground.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace error-detected parts.

P0011, P0021 IVT CONTROL

DTC Description

INFOID:0000000014419470

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0011	INT/V TIM CONT-B1 [Intake valve timing control performance (bank 1)]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree
		Diagnosis delay time	—
P0021	INT/V TIM CONT-B2 [Intake valve timing control performance (bank 2)]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree
		Diagnosis delay time	—

POSSIBLE CAUSE

P0011
- Crankshaft position sensor
- Camshaft position sensor
- Intake valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

P0021
- Crankshaft position sensor
- Camshaft position sensor
- Intake valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0011	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.
P0021	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0011 or P0021 is displayed with DTC P0075 or P0081, first perform the trouble diagnosis for DTC P0075 or P0081.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3. PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 25 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-245, "Diagnosis Procedure"
NO >> GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

ENG SPEED	1,000 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-245, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419471

1. CHECK DTC PRIORITY

If DTC P0011 or P0021 is displayed with DTC P0075 or P0081, first perform the trouble diagnosis for DTC P0075 or P0081.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

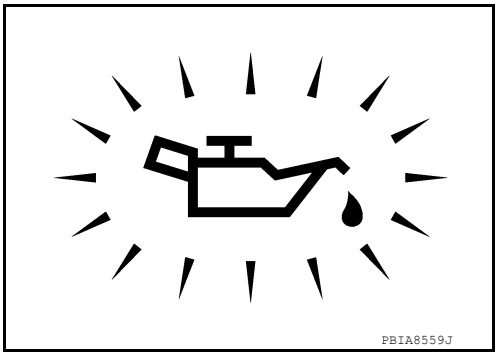
2. CHECK OIL PRESSURE WARNING LAMP

1. Start engine.

2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Go to LU-9, "Inspection".
NO >> GO TO 3.



3. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-247, "Component Inspection (Intake Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

5. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

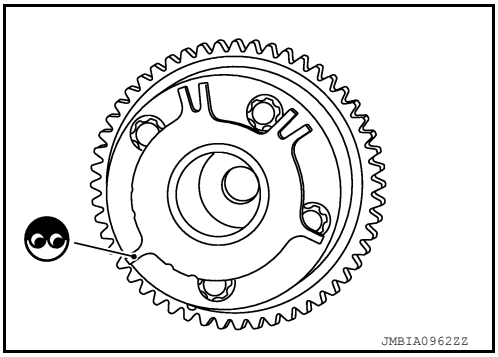
YES >> GO TO 6.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT (INTAKE)

Check the following.
- Accumulation of debris on the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 7.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-74, "Exploded View" or EM-94, "Removal and Installation".



7. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misalignment.

Are there any service records that may cause timing chain misalignment?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 8.

8. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (INT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Intake Valve Timing Control Solenoid Valve)

INFOID:0000000014419472

1. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect intake valve timing control solenoid valve harness connector.
3. Check resistance between intake valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

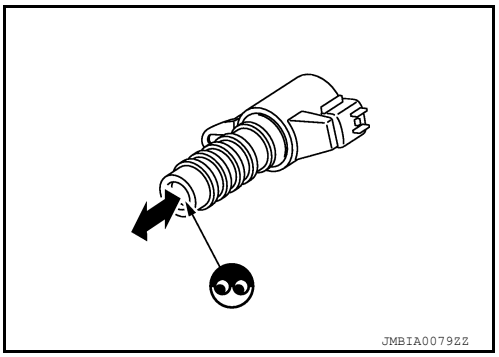
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove intake valve timing control solenoid valve.
2. Provide 12 V DC between intake valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Never apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in intake valve timing control solenoid valve.
NOTE:
Always replace O-ring when intake valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0012 INTAKE VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419473

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis (Trouble diagnosis content)	Detecting condition	Possible cause
P0012	A camshaft position B1 ["A" camshaft position - timing over-retarded bank 1]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree
		Diagnosis delay time	—
		Diagnosis condition	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Intake valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0012	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0012 is displayed with DTC P0075, first perform the trouble diagnosis for DTC P0075.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select "DATA MONITOR" mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)

COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 25 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-249, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

For USA and Canada

ENG SPEED	1,000 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

Except for USA and Canada

ENG SPEED	1,300 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-249, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419474

1.CHECK DTC PRIORITY

If DTC P0012 is displayed with DTC P0075, first perform the trouble diagnosis for DTC P0075.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

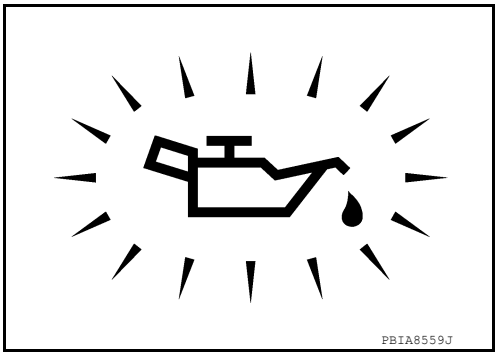
2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.

2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Go to LU-9, "Inspection".
NO >> GO TO 3.



3. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-279, "Component Inspection (Intake Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

5. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

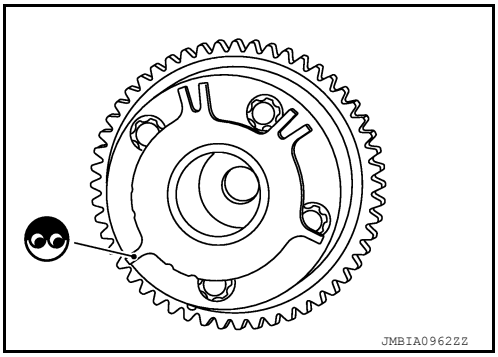
YES >> GO TO 6.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT (INTAKE)

Check the following.
- Accumulation of debris on the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 7.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-74, "Exploded View" or EM-94, "Removal and Installation".



7. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misalignment.

Are there any service records that may cause timing chain misalignment?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 8.

8. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (INT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Intake Valve Timing Control Solenoid Valve)

INFOID:0000000014419475

1. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect intake valve timing control solenoid valve harness connector.
3. Check resistance between intake valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

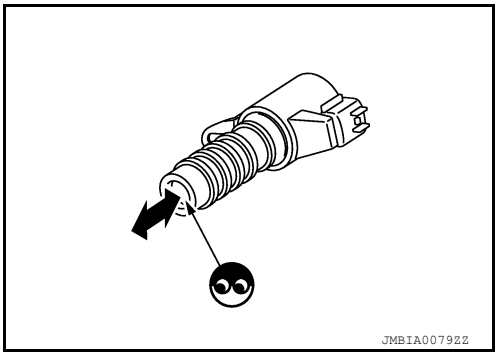
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove intake valve timing control solenoid valve.
2. Provide 12 V DC between intake valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Never apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in intake valve timing control solenoid valve.
NOTE:
Always replace O-ring when intake valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0014, P0024 EVT CONTROL

DTC Description

INFOID:0000000014419476

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0014	EXH/V TIM CONT-B1 [Exhaust valve timing control performance (bank 1)]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree.
		Diagnosis delay time	—
P0024	EXH/V TIM CONT-B2 [Exhaust valve timing control performance (bank 2)]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree.
		Diagnosis delay time	—

POSSIBLE CAUSE

P0014
- Crankshaft position sensor
- Camshaft position sensor
- Exhaust valve timing control position sensor
- Exhaust valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

P0024
- Crankshaft position sensor
- Camshaft position sensor
- Exhaust valve timing control position sensor
- Exhaust valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0014	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.
P0024	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P0014 or P0024 is displayed with DTC P0078, P0084, first perform the trouble diagnosis for DTC P0078, P0084.
- If DTC P0014 or P0024 is displayed with DTC P1078, P1084, first perform the trouble diagnosis for DTC P1078, P1084.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 10 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-253, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

ENG SPEED	1,500 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-253, "Diagnosis Procedure"
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419477

1.CHECK DTC PRIORITY

- If DTC P0014 or P0024 is displayed with DTC P0078, P0084, first perform the trouble diagnosis for DTC P0078, P0084.

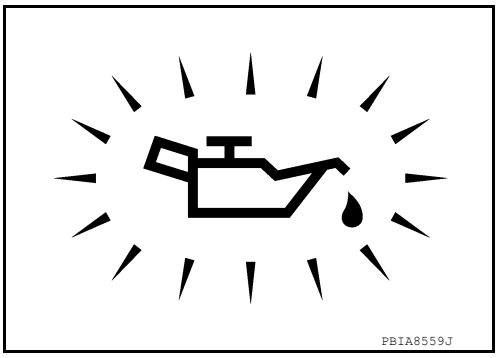
- If DTC P0014 or P0024 is displayed with DTC P1078, P1084, first perform the trouble diagnosis for DTC P1078, P1084.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.
2. Check that oil pressure warning lamp is not illuminated.



Is oil pressure warning lamp illuminated?

YES >> Refer to LU-9, "Inspection".
NO >> GO TO 3.

3.CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-255, "Component Inspection (Echaust Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4.CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR

Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

5.CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

6.CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

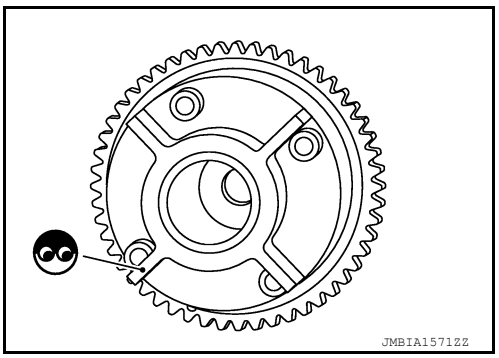
Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

7.CHECK CAMSHAFT (EXH)

Check the following.

- Accumulation of debris to the signal plate of camshaft front end
- Chipping signal plate of camshaft front end



Is the inspection result normal?

YES >> GO TO 8.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-94, "Removal and Installation".

8. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misaligned.

Are there any service records that may cause timing chain misaligned?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 9.

9. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (EXT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Echaust Valve Timing Control Solenoid Valve)

INFOID:0000000014419478

1. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control solenoid valve harness connector.
3. Check resistance between exhaust valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

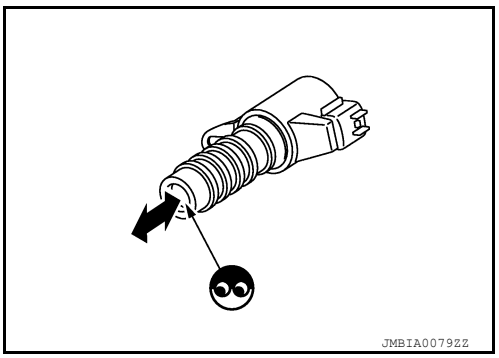
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".
2. Provide 12 V DC between exhaust valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Do not apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in exhaust valve timing control solenoid valve.
NOTE:
Always replace O-ring when exhaust valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0015 EXHAUST VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419479

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0015	B camshaft position B1 (“B” camshaft position - timing over-retarded bank 1)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Exhaust valve timing control position sensor
- Exhaust valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0015	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0015 is displayed with DTC P0078 or P1078, first perform the trouble diagnosis for DTC P0078 or P1078.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 10 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-257, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

ENG SPEED	1,500 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-257, "Diagnosis Procedure"
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419480

1.CHECK DTC PRIORITY

If DTC P0015 is displayed with DTC P0078 or P1078, first perform the trouble diagnosis for DTC P0078 or P1078.

Is applicable DTC detected?

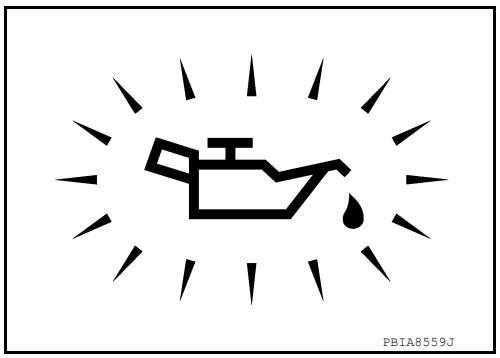
YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.
2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Refer to LU-9, "Inspection".
NO >> GO TO 3.



3.CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-282, "Component Inspection (Echaust Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.

NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR

Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

5. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

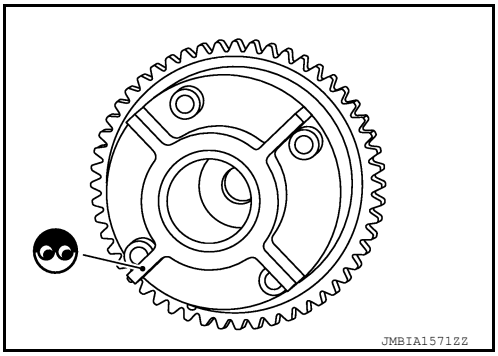
YES >> GO TO 7.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

7. CHECK CAMSHAFT (EXH)

Check the following.
- Accumulation of debris to the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 8.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-94, "Removal and Installation".



8. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misaligned.

Are there any service records that may cause timing chain misaligned?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 9.

9. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (EXT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Echaust Valve Timing Control Solenoid Valve)

INFOID:0000000014419481

1. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control solenoid valve harness connector.
3. Check resistance between exhaust valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

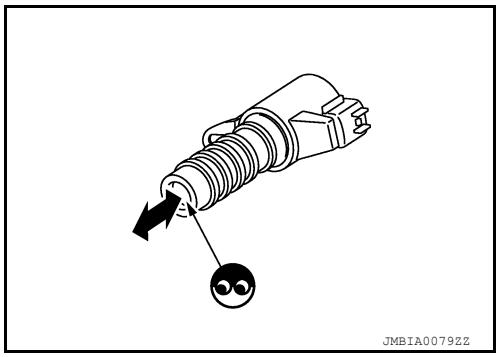
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".
2. Provide 12 V DC between exhaust valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Do not apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in exhaust valve timing control solenoid valve.
NOTE:
Always replace O-ring when exhaust valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0016 INTAKE VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419482

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis (Trouble diagnosis content)	Detecting condition	Possible cause
P0016	Crankshaft position B1 sensor A (Crankshaft position - camshaft position correlation bank 1 sensor A)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree
		Diagnosis delay time	—
		Diagnosis condition	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Intake valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0016	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0016 is displayed with DTC P0075, first perform the trouble diagnosis for DTC P0075.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)

COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 25 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-261, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

For USA and Canada

ENG SPEED	1,000 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

Except for USA and Canada

ENG SPEED	1,300 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-261, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419483

1.CHECK DTC PRIORITY

If DTC P0016 is displayed with DTC P0075, first perform the trouble diagnosis for DTC P0075.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

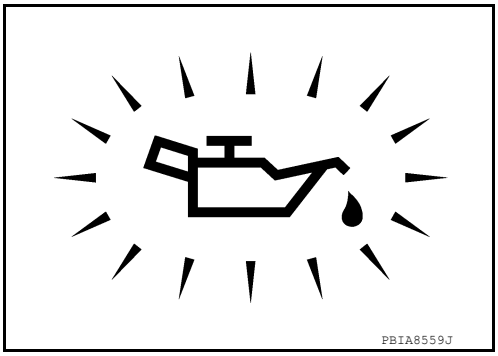
2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.

2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Go to LU-9, "Inspection".
NO >> GO TO 3.



3. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-279, "Component Inspection (Intake Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

5. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

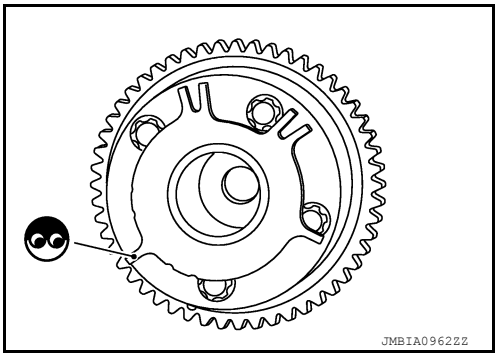
YES >> GO TO 6.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT (INTAKE)

Check the following.
- Accumulation of debris on the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 7.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-74, "Exploded View" or EM-94, "Removal and Installation".



7. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misalignment.

Are there any service records that may cause timing chain misalignment?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 8.

8. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (INT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Intake Valve Timing Control Solenoid Valve)

INFOID:0000000014419484

1. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect intake valve timing control solenoid valve harness connector.
3. Check resistance between intake valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

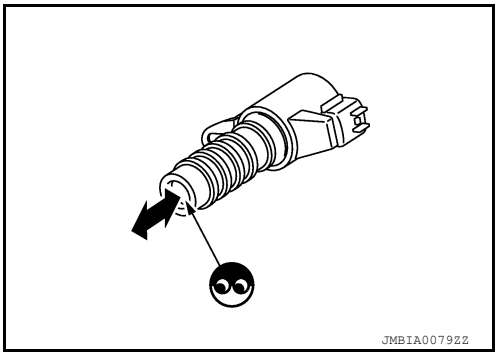
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove intake valve timing control solenoid valve.
2. Provide 12 V DC between intake valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Never apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in intake valve timing control solenoid valve.
NOTE:
Always replace O-ring when intake valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0017 EXHAUST VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419485

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0017	Crankshaft position B1 sensor B (Crankshaft position - camshaft position correlation bank 1 sensor B)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Exhaust valve timing control position sensor
- Exhaust valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0017	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0017 is displayed with DTC P0078 or P1078, first perform the trouble diagnosis for DTC P0078 or P1078.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 10 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-265, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

ENG SPEED	1,500 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-265, "Diagnosis Procedure"
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419486

1.CHECK DTC PRIORITY

If DTC P0017 is displayed with DTC P0078 or P1078, first perform the trouble diagnosis for DTC P0078 or P1078.

Is applicable DTC detected?

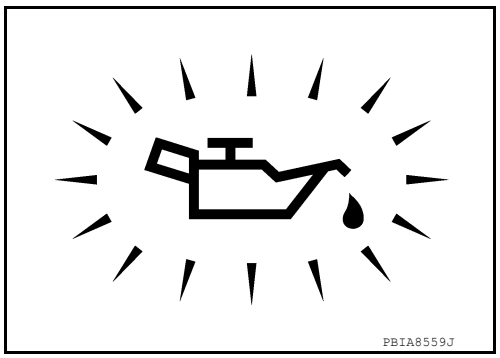
YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.
2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Refer to LU-9, "Inspection".
NO >> GO TO 3.



3.CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-282, "Component Inspection (Echaust Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.

NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR

Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

5. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

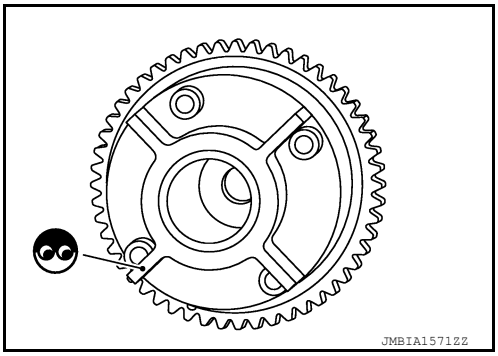
YES >> GO TO 7.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

7. CHECK CAMSHAFT (EXH)

Check the following.
- Accumulation of debris to the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 8.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-94, "Removal and Installation".



8. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misaligned.

Are there any service records that may cause timing chain misaligned?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 9.

9. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (EXT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Echaust Valve Timing Control Solenoid Valve)

INFOID:0000000014419487

1. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control solenoid valve harness connector.
3. Check resistance between exhaust valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

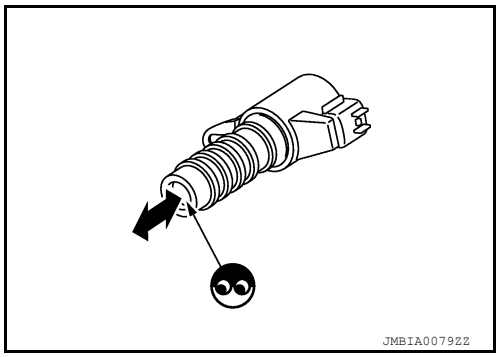
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".
2. Provide 12 V DC between exhaust valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Do not apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in exhaust valve timing control solenoid valve.
NOTE:
Always replace O-ring when exhaust valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0018 INTAKE VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419488

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis (Trouble diagnosis content)	Detecting condition	Possible cause
P0018	Crankshaft position B2 sensor A (Crankshaft position - camshaft position correlation bank 2 sensor A)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree
		Diagnosis delay time	—
		Diagnosis condition	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Intake valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0018	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0018 is displayed with DTC P0081, first perform the trouble diagnosis for DTC P0081.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)

COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 25 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-269, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

For USA and Canada

ENG SPEED	1,000 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

Except for USA and Canada

ENG SPEED	1,300 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-269, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419489

1.CHECK DTC PRIORITY

If DTC P0018 is displayed with DTC P0081, first perform the trouble diagnosis for DTC P0081.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

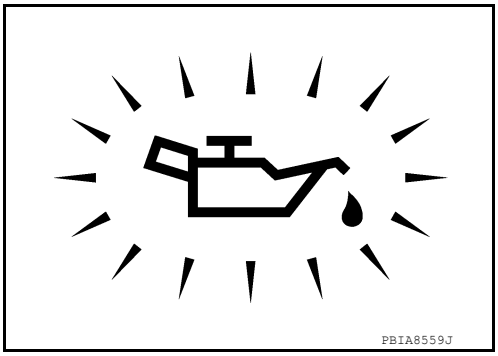
2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.

2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Go to LU-9, "Inspection".
NO >> GO TO 3.



3. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-279, "Component Inspection (Intake Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

5. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

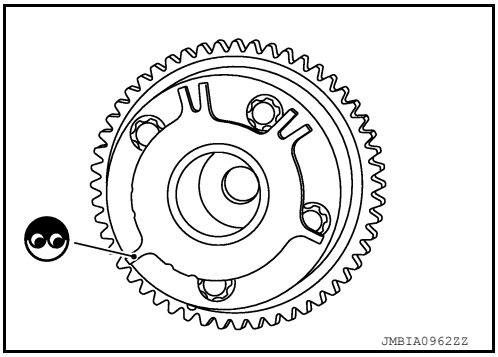
YES >> GO TO 6.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT (INTAKE)

Check the following.
- Accumulation of debris on the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 7.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-74, "Exploded View" or EM-94, "Removal and Installation".



7. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misalignment.

Are there any service records that may cause timing chain misalignment?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 8.

8. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (INT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Intake Valve Timing Control Solenoid Valve)

INFOID:0000000014419490

1. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect intake valve timing control solenoid valve harness connector.
3. Check resistance between intake valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

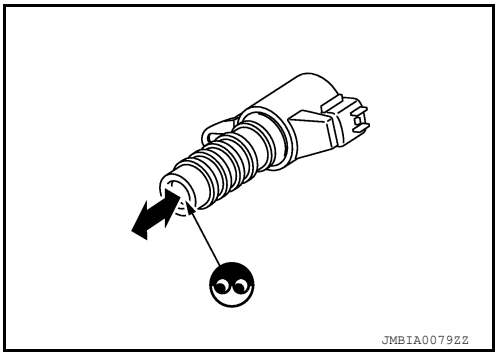
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove intake valve timing control solenoid valve.
2. Provide 12 V DC between intake valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Never apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in intake valve timing control solenoid valve.
NOTE:
Always replace O-ring when intake valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0019 EXHAUST VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419491

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0019	Crankshaft position B2 sensor B (Crankshaft position - camshaft position correlation bank 2 sensor B)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Exhaust valve timing control position sensor
- Exhaust valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0019	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0019 is displayed with DTC P0084 or P1084, first perform the trouble diagnosis for DTC P0084 or P1084.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 10 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-273, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

ENG SPEED	1,500 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-273, "Diagnosis Procedure"
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419492

1.CHECK DTC PRIORITY

If DTC P0019 is displayed with DTC P0084 or P1084, first perform the trouble diagnosis for DTC P0084 or P1084.

Is applicable DTC detected?

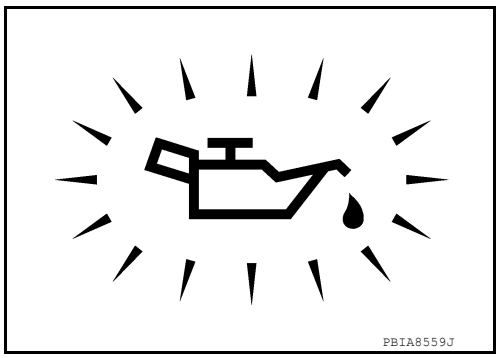
YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.
2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Refer to LU-9, "Inspection".
NO >> GO TO 3.



3.CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-282, "Component Inspection (Echaust Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.

NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR

Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

5. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

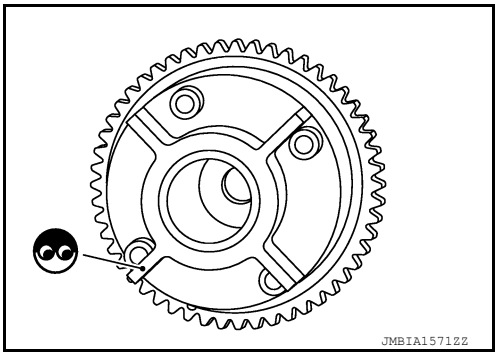
YES >> GO TO 7.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

7. CHECK CAMSHAFT (EXH)

Check the following.
- Accumulation of debris to the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 8.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-94, "Removal and Installation".



8. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misaligned.

Are there any service records that may cause timing chain misaligned?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 9.

9. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (EXT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Echaust Valve Timing Control Solenoid Valve)

INFOID:0000000014419493

1. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control solenoid valve harness connector.
3. Check resistance between exhaust valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

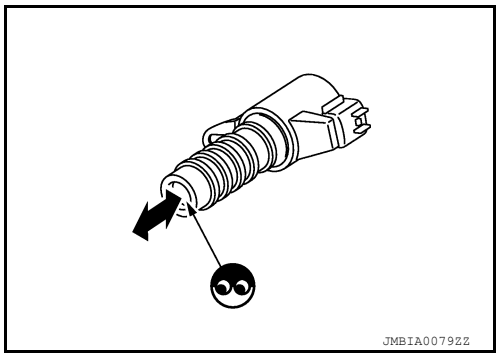
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".
2. Provide 12 V DC between exhaust valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Do not apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in exhaust valve timing control solenoid valve.
NOTE:
Always replace O-ring when exhaust valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0022 INTAKE VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419494

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis (Trouble diagnosis content)	Detecting condition	Possible cause
P0022	A camshaft position B2 (“A” camshaft position - timing over-retarded bank 2)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree
		Diagnosis delay time	—
		Diagnosis condition	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Intake valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0022	Intake valve timing control	The signal is not energized to the intake valve timing control solenoid valve and the valve control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0022 is displayed with DTC P0081, first perform the trouble diagnosis for DTC P0081.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)

COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 25 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-277, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

For USA and Canada

ENG SPEED	1,000 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

Except for USA and Canada

ENG SPEED	1,300 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-277, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419495

1.CHECK DTC PRIORITY

If DTC P0022 is displayed with DTC P0081, first perform the trouble diagnosis for DTC P0081.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

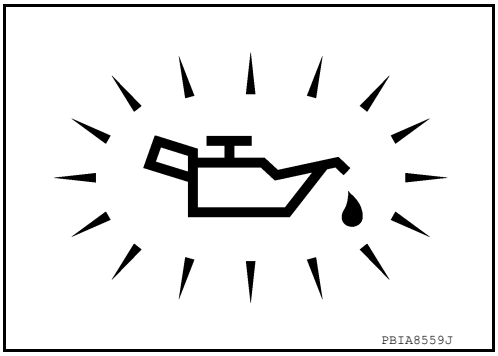
2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.

2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Go to LU-9, "Inspection".
NO >> GO TO 3.



3. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-279, "Component Inspection (Intake Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

5. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

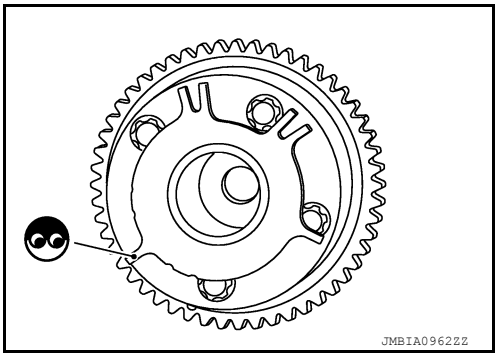
YES >> GO TO 6.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT (INTAKE)

Check the following.
- Accumulation of debris on the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 7.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-74, "Exploded View" or EM-94, "Removal and Installation".



7. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misalignment.

Are there any service records that may cause timing chain misalignment?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 8.

8. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (INT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Intake Valve Timing Control Solenoid Valve)

INFOID:0000000014419496

1. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect intake valve timing control solenoid valve harness connector.
3. Check resistance between intake valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

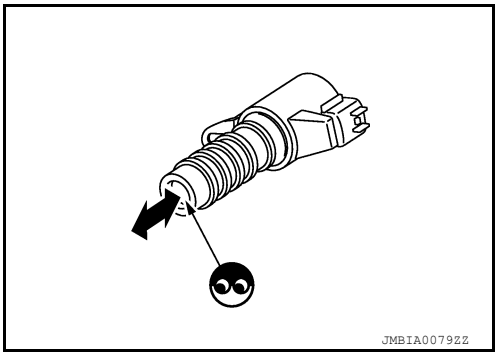
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove intake valve timing control solenoid valve.
2. Provide 12 V DC between intake valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Never apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in intake valve timing control solenoid valve.
NOTE:
Always replace O-ring when intake valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0025 EXHAUST VALVE TIMING CONTROL

DTC Description

INFOID:0000000014419497

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0025	B camshaft position B2 (“B” camshaft position - timing over-retarded bank 2)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	There is a gap between angle of target and phase-control angle degree.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Crankshaft position sensor
- Camshaft position sensor
- Exhaust valve timing control position sensor
- Exhaust valve timing control solenoid valve
- Accumulation of debris to the signal pick-up portion of the camshaft
- Timing chain installation
- Foreign matter caught in the oil groove for intake valve timing control

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0025	Exhaust valve timing control	The signal is not energized to the exhaust valve timing control magnet retarder and the magnet retarder control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0025 is displayed with DTC P0084 or P1084, first perform the trouble diagnosis for DTC P0084 or P1084.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT
1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Maintain the following conditions for at least 6 consecutive seconds.
   Hold the accelerator pedal as steady as possible.

ENG SPEED	Less than 2,000 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	P or N position

4. Let engine idle for 10 seconds.
5. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-281, "Diagnosis Procedure"
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

WITH CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Maintain the following conditions for at least 20 consecutive seconds.

ENG SPEED	1,500 - 3,175 rpm (A constant rotation is maintained.)
COOLAN TEMP/S	More than 70°C (158°F)
Selector lever	1st or 2nd position
Driving location uphill	Driving vehicle uphill (Increased engine load will help maintain the driving conditions required for this test.)

CAUTION:
Always drive at a safe speed.

3. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-281, "Diagnosis Procedure"
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419498

1.CHECK DTC PRIORITY

If DTC P0025 is displayed with DTC P0084 or P1084, first perform the trouble diagnosis for DTC P0084 or P1084.

Is applicable DTC detected?

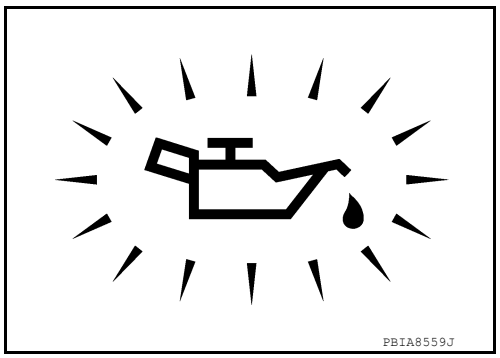
YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK OIL PRESSURE WARNING LAMP

1. Start engine.
2. Check that oil pressure warning lamp is not illuminated.

Is oil pressure warning lamp illuminated?

YES >> Refer to LU-9, "Inspection".
NO >> GO TO 3.



3.CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE

Refer to EC-282, "Component Inspection (Echaust Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 4.

NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

4. CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR

Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

5. CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

6. CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

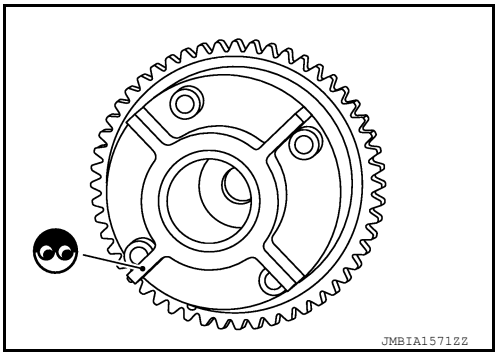
YES >> GO TO 7.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-128, "Exploded View".

7. CHECK CAMSHAFT (EXH)

Check the following.
- Accumulation of debris to the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> GO TO 8.
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft. Refer to EM-94, "Removal and Installation".



8. CHECK TIMING CHAIN INSTALLATION

Check service records for any recent repairs that may cause timing chain misaligned.

Are there any service records that may cause timing chain misaligned?

YES >> Check timing chain installation. Refer to EM-94, "Removal and Installation".
NO >> GO TO 9.

9. CHECK LUBRICATION CIRCUIT

Perform “Inspection of Camshaft Sprocket (EXT) Oil Groove”. Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean lubrication line.

Component Inspection (Echaust Valve Timing Control Solenoid Valve)

INFOID:0000000014419499

1. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control solenoid valve harness connector.
3. Check resistance between exhaust valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

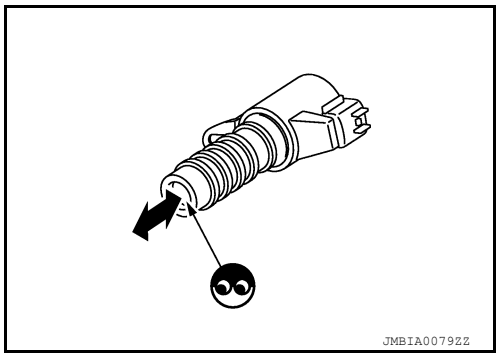
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".
2. Provide 12 V DC between exhaust valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Do not apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in exhaust valve timing control solenoid valve.
NOTE:
Always replace O-ring when exhaust valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0030, P0031, P0032, P0036, P0051, P0052 A/F SENSOR 1 HEATER

DTC Description

INFOID:0000000014419500

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0030	A/F SEN1 HTR (B1) [A/F sensor 1 heater (bank 1) performance]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	A/F sensor 1 heater signal
		Threshold	Voltage signal transmitted from A/F sensor 1 heater to ECM is higher/lower than voltage in the normal range
		Diagnosis delay time	—
P0031	A/F SEN1 HTR (B1) [A/F sensor 1 heater (bank 1) control circuit low]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	A/F sensor 1 heater signal
		Threshold	An excessively low voltage signal is sent to ECM through the A/F sensor 1 heater
		Diagnosis delay time	—
P0032	A/F SEN1 HTR (B1) [A/F sensor 1 heater (bank 1) control circuit high]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	A/F sensor 1 heater signal
		Threshold	An excessively high voltage signal is sent to ECM through the A/F sensor 1 heater
		Diagnosis delay time	—
P0036	A/F SEN1 HTR (B2) [A/F sensor 1 heater (bank 2) performance]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	A/F sensor 1 heater signal
		Threshold	Voltage signal transmitted from A/F sensor 1 heater to ECM is higher/lower than voltage in the normal range
		Diagnosis delay time	—
P0051	A/F SEN1 HTR (B2) [A/F sensor 1 heater (bank 2) control circuit low]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	A/F sensor 1 heater signal
		Threshold	An excessively low voltage signal is sent to ECM through the A/F sensor 1 heater
		Diagnosis delay time	—
P0052	A/F SEN1 HTR (B2) [A/F sensor 1 heater (bank 2) control circuit high]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	A/F sensor 1 heater signal
		Threshold	An excessively high voltage signal is sent to ECM through the A/F sensor 1 heater
		Diagnosis delay time	—

POSSIBLE CAUSE

P0030, P0031, P0036, P0051
- Harness or connectors (The A/F sensor 1 heater circuit is open or shorted)
- The A/F sensor 1 heater

P0032, P0052
- Harness or connectors (The A/F sensor 1 heater circuit is shorted)
- The A/F sensor 1 heater

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-285, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419501

1.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

DTC	A/F sensor 1			Ground	Voltage
	Bank	Connector	Terminal		
P0030, P0031, P0032	1	F25	1	Ground	Battery voltage
P0036, P0051, P0052	2	F16	1		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.

- 20 A fuse (No. 56)
- Harness for open or short between A/F sensor 1 and fuse
- Loose or poor connection for each connector and harness

>> Repair or replace harness or connectors.

3.CHECK A/F SENSOR 1 HEATER OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0030, P0031, P0032	1	F25	2	F79	116	Existed
P0036, P0051, P0052	2	F16	2		117	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK A/F SENSOR 1 HEATER

Refer to EC-286, "Component Inspection (A/F Sensor 1 Heater)".

Is the inspection result normal?

YES >> Repair or replace error-detected parts.
NO >> GO TO 5.

5.REPLACE A/F SENSOR 1

Replace malfunctioning A/F sensor 1. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

Component Inspection (A/F Sensor 1 Heater)

INFOID:0000000014419502

1.CHECK AIR FUEL RATIO (A/F) SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Check resistance between A/F sensor 1 terminals as per the following.

A/F sensor 1		Resistance
+	–	
Terminal		
2	1	1.80 - 2.44 Ω [at 20°C (68°F)]
	3	Not exist
	4	
1	3	
	4	

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE A/F SENSOR 1

Replace malfunctioning A/F sensor 1. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P0037, P0038, P0057, P0058 HO2S2 HEATER

DTC Description

INFOID:0000000014419503

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0037	HO2S2 HTR (B1) [Heated oxygen sensor 2 heater (bank 1) control circuit low]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 heater signal
		Threshold	An excessively low voltage signal is sent to ECM through the heated oxygen sensor 2 heater
		Diagnosis delay time	—
P0038	HO2S2 HTR (B1) [Heated oxygen sensor 2 heater (bank 1) control circuit high]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 heater signal
		Threshold	An excessively high voltage signal is sent to ECM through the heated oxygen sensor 2 heater
		Diagnosis delay time	—
P0057	HO2S2 HTR (B2) [Heated oxygen sensor 2 heater (bank 2) control circuit low]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 heater signal
		Threshold	An excessively low voltage signal is sent to ECM through the heated oxygen sensor 2 heater
		Diagnosis delay time	—
P0058	HO2S2 HTR (B2) [Heated oxygen sensor 2 heater (bank 2) control circuit high]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 heater signal
		Threshold	An excessively high voltage signal is sent to ECM through the heated oxygen sensor 2 heater
		Diagnosis delay time	—

POSSIBLE CAUSE

P0037, P0057
- Harness or connectors (The heated oxygen sensor 2 heater circuit is open or shorted)
- Heated oxygen sensor 2 heater

P0038, P0058
- Harness or connectors (The heated oxygen sensor 2 heater circuit is shorted)
- Heated oxygen sensor 2 heater

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-288, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419504

1.CHECK HEATED OXYGEN SENSOR 2 (HO2S2) POWER SUPPLY CIRCUIT

1. Disconnect heated oxygen sensor 2 (HO2S2) harness connector.
2. Turn ignition switch ON.
3. Check the voltage between HO2S2 harness connector and ground.

DTC	HO2S2			Ground	Voltage
	Bank	Connector	Terminal		
P0037, P0038	1	F57	4	Ground	Battery voltage
P0057, P0058	2	F54	4		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- 20 A fuse (No. 56)
- Harness for open or short between heated oxygen sensor 2 and fuse
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK HO2S2 OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0037, P0038	1	F57	3	F79	118	Existed
P0057, P0058	2	F54	3		119	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK HO2S2 HEATER

Refer to EC-289, "Component Inspection (HO2 Sensor 2 Heater)".

Is the inspection result normal?

YES >> Repair or replace error-detected parts.

NO >> GO TO 5.

5. REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EX-6, "Removal and Installation".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

Component Inspection (HO2 Sensor 2 Heater)

INFOID:0000000014419505

1. CHECK HEATED OXYGEN SENSOR 2 HEATER

1. Turn ignition switch OFF.
2. Disconnect heated oxygen sensor 2 (HO2S2) harness connector.
3. Check resistance between HO2S2 terminals as follows.

Terminal	Resistance
2 and 3	3.4 - 4.4 Ω [at 25°C (77°F)]
1 and 2, 3, 4	∞ Ω (Continuity should not exist)
4 and 1, 2, 3	

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EX-6, "Removal and Installation".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P0075, P0081 IVT CONTROL SOLENOID VALVE

DTC Description

INFOID:0000000014419506

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0075	INT/V TIM V/CIR-B1 [Intake valve timing control solenoid valve (bank 1) circuit]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	—
		Threshold	An improper voltage is sent to the ECM through intake valve timing control solenoid valve
		Diagnosis delay time	—
P0081	INT/V TIM V/CIR-B2 [Intake valve timing control solenoid valve (bank 2) circuit]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	—
		Threshold	An improper voltage is sent to the ECM through intake valve timing control solenoid valve
		Diagnosis delay time	—

POSSIBLE CAUSE

P0075
- Harness or connectors (Intake valve timing control solenoid valve circuit is open or shorted)
- Intake valve timing control solenoid valve

P0081
- Harness or connectors (Intake valve timing control solenoid valve circuit is open or shorted)
- Intake valve timing control solenoid valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-290, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419507

1.CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect intake valve timing (IVT) control solenoid valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between IVT control solenoid valve harness connector and ground.

DTC	IVT control solenoid valve			Ground	Voltage
	Bank	Connector	Terminal		
P0075	1	F36	2	Ground	Battery voltage
P0081	2	F37	2		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between IVT control solenoid valve and IPDM E/R
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK IVT CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between IVT control solenoid valve harness connector and ECM harness connector.

DTC	IVT control solenoid valve			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0075	1	F36	1	F79	112	Existed
P0081	2	F37	1		113	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK IVT CONTROL SOLENOID VALVE

Refer to EC-291, "Component Inspection (Intake Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning IVT control solenoid valve. Refer to EM-74, "Exploded View".

Component Inspection (Intake Valve Timing Control Solenoid Valve)

INFOID:0000000014419508

1.CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect intake valve timing control solenoid valve harness connector.
3. Check resistance between intake valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2.CHECK INTAKE VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove intake valve timing control solenoid valve.

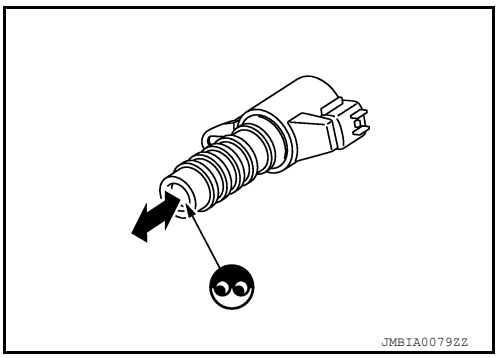
2. Provide 12 V DC between intake valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:

Never apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in intake valve timing control solenoid valve.

NOTE:

Always replace O-ring when intake valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace malfunctioning intake valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0078, P0084 EVT CONTROL SOLENOID VALVE

DTC Description

INFOID:0000000014419509

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0078	EX V/T ACT/CIRC-B1 [Exhaust valve timing control solenoid valve (bank 1) circuit]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Exhaust valve timing control solenoid valve signal
		Threshold	An improper voltage is sent to the ECM through exhaust valve timing control solenoid valve
		Diagnosis delay time	—
P0084	EX V/T ACT/CIRC-B2 [Exhaust valve timing control solenoid valve (bank 2) circuit]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Exhaust valve timing control solenoid valve signal
		Threshold	An improper voltage is sent to the ECM through exhaust valve timing control solenoid valve
		Diagnosis delay time	—

POSSIBLE CAUSE

P0078
- Harness or connectors (Exhaust valve timing control solenoid valve circuit is open or shorted)
- Exhaust valve timing control solenoid valve

P0084
- Harness or connectors (Exhaust valve timing control solenoid valve circuit is open or shorted)
- Exhaust valve timing control solenoid valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-293, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419510

1.CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing (EVT) control solenoid valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between EVT control solenoid valve harness connector and ground.

DTC	EVT control solenoid valve			Ground	Voltage
	Bank	Connector	Terminal		
P0078	1	F80	2	Ground	Battery voltage
P0084	2	F81	2		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVT control solenoid valve and IPDM E/R
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

3. CHECK EVT CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVT control solenoid valve harness connector and ECM harness connector.

DTC	EVT control solenoid valve			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0078	1	F80	1	F79	114	Existed
P0084	2	F81	1		115	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK EVT CONTROL SOLENOID VALVE

Refer to EC-294, "Component Inspection (Echaust Valve Timing Control Solenoid Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning EVT control solenoid valve. Refer to EM-74, "Exploded View".

Component Inspection (Echaust Valve Timing Control Solenoid Valve)

INFOID:0000000014419511

1. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control solenoid valve harness connector.
3. Check resistance between exhaust valve timing control solenoid valve terminals as per the following.

Terminals	Resistance
1 and 2	7.0 - 7.7 Ω [at 20°C (68°F)]
1 or 2 and ground	∞ Ω (Continuity should not exist)

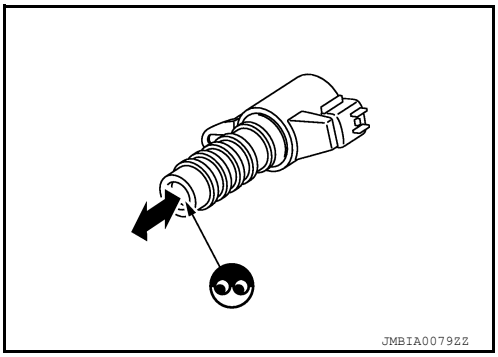
Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

2. CHECK EXHAUST VALVE TIMING CONTROL SOLENOID VALVE-II

1. Remove exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".
2. Provide 12 V DC between exhaust valve timing control solenoid valve terminals 1 and 2, and then interrupt it. Check that the plunger moves as shown in the figure.

CAUTION:
Do not apply 12 V DC continuously for 5 seconds or more. Doing so may result in damage to the coil in exhaust valve timing control solenoid valve.
NOTE:
Always replace O-ring when exhaust valve timing control solenoid valve is removed.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control solenoid valve. Refer to EM-74, "Exploded View".

P0087 FRP CONTROL SYSTEM

DTC Description

INFOID:0000000014419512

DTC DETECTION LOGIC

NOTE:
DTC P0087 may be displayed when running out of gas or air accumulation.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0087	LOW FUEL PRES (High fuel pressure too low)	1	Diagnosis condition	Engine cold start [water temperature 5°C (41°F) – 40°C (104°F)]
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Fuel rail pressure does not reach 1.3 MPa (13 bar, 13.3 kg/cm2, 188.5 psi)
			Diagnosis delay time	—
		2	Diagnosis condition	Engine idle condition after cold start [water temperature 5°C (41°F) – 40°C (104°F)]
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Fuel rail pressure remains at 8.5 MPa (85 bar, 86.7 kg/cm2, 1232.8 psi) or less
			Diagnosis delay time	1 second or more
		3	Diagnosis condition	After engine start (regardless of water temperature)
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Actual fuel pressure − Target fuel pressure ≥ 2.7 MPa (27 bar, 27.5 kg/cm^2, 392 psi)
			Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Fuel system
- Leakage in fuel line
- High pressure fuel pump
- Low pressure fuel pump
- Damage in lifter

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0087	FRP control system	• Engine torque is limited. • VVEL value is maintained at a fixed angle.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0087 is displayed with DTC P0090 and/or P1197, first perform the trouble diagnosis for DTC P0090 and/or P1197.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK FUEL LEAKAGE

1. Turn ignition switch ON.
2. Visually check the piping between low pressure fuel pump and fuel injectors for fuel leakage.

3. Start the engine.
4. Visually check the piping between low pressure fuel pump and fuel injectors for fuel leakage.

Is inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**
- **Before performing the following procedure, check that the fuel tank is 1/8 full of fuel.**

>> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-1

WITH CONSULT

1. Turn ignition switch ON.
2. Select “COOLAN TEMP/S” in “DATA MONITOR” mode of “ENGNE” using CONSULT.
3. Check the following condition;

COOLAN TEMP/S	**: 5 – 40°C (41 – 104°F)**

WITH GST

Follow the above steps for “WITH CONSULT”.

Is the condition satisfied?

YES >> GO TO 5.
NO >> 1. Satisfy the condition.
2. Retry from step 1.

5.PERFORM DTC CONFIRMATION PROCEDURE-2

WITH CONSULT

1. Start the engine and let it idle for 10 seconds.
2. Check 1st trip DTC.

WITH GST

Follow the above steps for “WITH CONSULT”.

Is 1st trip DTC detected?

YES >> Proceed to EC-298, "Diagnosis Procedure".
NO >> GO TO 6.

6.PERFORM DTC CONFIRMATION PROCEDURE-3

WITH CONSULT

1. Select “COOLAN TEMP/S” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
2. Maintain the following condition for 10 seconds or more at idle.

COOLAN TEMP/S	**: 70°C (104°F) or more**

3. Check 1st trip DTC.

WITH GST

Follow the above steps for “WITH CONSULT”.

Is 1st trip DTC detected?

YES >> Proceed to EC-298, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419513

1.CHECK DTC PRIORITY

If DTC P0087 is displayed with DTC P0090 and/or P1197, first perform the trouble diagnosis for DTC P0090 and/or P1197.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.BLEED THE FUEL LINE

1. Start the engine, and let the engine run at idle at least for 10 minutes.
2. Perform DTC confirmation procedure of DTC P0087.

Is 1st trip DTC detected?

YES >> GO TO 3.
NO >> GO TO 7.

3.CHECK LOW FUEL PRESSURE

Check low fuel pressure. Refer to EC-205, "Work Procedure".

Is inspection result normal?

YES >> GO TO 4.
NO >> Check low fuel pressure system. Refer to EC-701, "Diagnosis Procedure".

4.CHECK LOW PRESSURE FUEL LINE FOR INTERNAL LEAKAGE

1. Turn ignition switch OFF.
2. Turn ignition switch ON.
3. Check the following value 30 minutes after turning the ignition switch ON.

Low fuel pressure : 206 kPa (2.1 bar, 2.2 kgf/cm2, 30 psi) or more

Is inspection result normal?

YES >> GO TO 5.
NO >> Replace low pressure fuel pump. Refer to FL-6, "Exploded View".

5.CHECK HIGH PRESSURE FUEL PUMP

Check high pressure fuel pump. Refer to EC-299, "Component Inspection (High Pressure Fuel Pump)".

Is inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the error-detected parts.

6.CHECK LIFTER

Check lifter. Refer to EM-52, "Removal and Installation".

Does the lifter top surface have scratches and/or dents?

YES >> Replace the error-detected parts.
NO >> INSPECTION END

7.CHECK LOW PRESSURE FUEL LINE FOR INTERNAL LEAKAGE

1. Turn ignition switch OFF.
2. Connect fuel pressure gauge. Refer to EC-205, "Work Procedure".
3. Turn ignition switch ON.
4. Check the following value 30 minutes after turning the ignition switch ON.

Low fuel pressure : 206 kPa (2.1 bar, 2.2 kgf/cm2, 30 psi) or more

Is inspection result normal?

YES >> INSPECTION END
NO >> Replace low pressure fuel pump. Refer to FL-6, "Exploded View".

Component Inspection (High Pressure Fuel Pump)

INFOID:0000000014419514

1.CHECK HIGH PRESSURE FUEL PUMP-1

1. Turn ignition switch OFF.
2. Disconnect high pressure fuel pump harness connector.
3. Check the resistance between high pressure fuel pump terminals.

+	–	Condition		Resistance (Approx.)
High pressure fuel pump Terminal				
1	2	Temperature °C (°F)	20 – 30 (68 - 86)	9 - 11 Ω

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace high pressure fuel pump. Refer to EM-52, "Exploded View".

2.CHECK HIGH PRESSURE FUEL PUMP-2

WITH CONSULT
1. Reconnect high pressure fuel pump harness connector.
2. Start the engine.
3. Check “FUEL PRES SEN V” in “DATA MONITOR” mode of “ECM” using CONSULT.

Monitor item	Condition	Voltage (Approx.)
FUEL PRES SEN V	Engine speed: idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

WITHOUT CONSULT
1. Reconnect high pressure fuel pump harness connector.
2. Start the engine.
3. Check FRP sensor signal voltage.

ECM			Condition	Value (Approx.)
Connector	+	–		
	Terminal			
F78	25	13	Engine speed: idle	0.82 – 1.22 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	0.82 – 3.06 V

YES >> INSPECTION END
NO >> Replace high pressure fuel pump. Refer to EM-52, "Exploded View".

P0088 FRP CONTROL SYSTEM

DTC Description

INFOID:0000000014419515

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0088	HIGH FUEL PRES (High fuel pressure too high)	1	Diagnosis condition	Engine idle condition after cold start [water temperature 5°C (41°F) - 40°C (104°F)]
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Fuel rail pressure remains at more than 16.5 MPa (165 bar, 168.3 kg/cm^2, 2392.5 psi)
			Diagnosis delay time	1 second or more
		2	Diagnosis condition	After engine start (regardless of water temperature)
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Actual fuel pressure – Target fuel pressure ≥ 2.7 MPa (27 bar, 27.5 kg/cm^2, 392 psi)
			Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connector (The high pressure fuel pump circuit is open or shorted)
- High pressure fuel pump

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0088	FRP control system	Engine speed is limited.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0088 is displayed with DTC P0090, first perform the trouble diagnosis for DTC P0090.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-303, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**
- **Before performing the following procedure, check that the fuel tank is 1/8 full of fuel.**

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-1

1. Warm up the engine to the normal operating temperature and keep the engine speed at idle for 15 seconds.
   NOTE:

Warm up the engine until “COOLAN TEMP/S” on “DATA MONITOR” mode of “ENGINE” using CONSULT reaches at least 70°C (158°F).
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-304, "Diagnosis Procedure".
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-2

1. Cool the engine until the engine coolant temperature reaches 60°C (140°F) or less.
2. Start the engine and wait at least 40 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-304, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419516

1.CHECK DTC PRIORITY

If DTC P0088 is displayed with DTC P0090, first perform the trouble diagnosis for DTC P0090.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-303, "DTC Description".
NO >> GO TO 2.

2.CHECK LOW FUEL PRESSURE

Check low fuel pressure. Refer to EC-205, "Work Procedure".

Is inspection result normal?

YES >> GO TO 3.
NO >> Check low fuel pressure system. Refer to EC-701, "Diagnosis Procedure".

3.CHECK HIGH PRESSURE FUEL PUMP

Check high pressure fuel pump. Refer to EC-301, "Component Inspection (High Pressure Fuel Pump)".

Is inspection result normal?

YES >> GO TO 4.
NO >> Replace error-detected parts.

4.CHECK FUEL LEAKAGE

1. Start the engine.
2. Visually check that the fuel pump, fuel rail, and fuel piping have no fuel leakage.

Is inspection result normal?

YES >> Check that the fuel system has no breakage, bend, and crush. Refer to FL-5, "Inspection".
NO >> Replace or replace the error-detected parts.

Component Inspection (High Pressure Fuel Pump)

INFOID:0000000014419517

1.CHECK HIGH PRESSURE FUEL PUMP-1

1. Turn ignition switch OFF.
2. Disconnect high pressure fuel pump harness connector.
3. Check the resistance between high pressure fuel pump terminals.

+	–	Condition		Resistance (Approx.)
High pressure fuel pump Terminal				
1	2	Temperature °C (°F)	20 – 30 (68 - 86)	9 - 11 Ω

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace high pressure fuel pump. Refer to EM-52, "Exploded View".

2.CHECK HIGH PRESSURE FUEL PUMP-2

WITH CONSULT
1. Reconnect high pressure fuel pump harness connector.
2. Start the engine.
3. Check “FUEL PRES SEN V” in “DATA MONITOR” mode of “ECM” using CONSULT.

Monitor item	Condition	Value (Approx.)
FUEL PRES SEN V	Engine speed: idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

WITHOUT CONSULT
1. Reconnect high pressure fuel pump harness connector.
2. Start the engine.
3. Check FRP sensor signal voltage.

ECM			Condition	Value (Approx.)
Connector	+	–		
	Terminal			
F78	25	13	Engine speed: idle	0.82 – 1.22 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	0.82 – 3.06 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace high pressure fuel pump. Refer to EM-52, "Exploded View".

P0090 HIGH PRESSURE FUEL PUMP

DTC Description

INFOID:0000000014419518

DTC DETECTION LOGIC

NOTE:
DTC P0090 may be displayed when running out of gas.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0090	FUEL PUMP (High pressure fuel pump circuit)	1	Diagnosis condition	Engine rev
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Fuel rail pressure remains at 1.5 MPa (15 bar, 15.3 kg/ cm^2, 217.5 psi)
			Diagnosis delay time	3 seconds or more
		2	Diagnosis condition	Engine rev
			Signal (terminal)	Fuel rail pressure signal
			Threshold	Fuel rail pressure remains at 18.5 MPa (185 bar, 188.7 kg/ cm^2, 2682.5 psi) or more
			Diagnosis delay time	3 seconds or more

POSSIBLE CAUSE

- Harness or connectors (The fuel pump circuit is open or shorted)
- High pressure fuel pump

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0090	FRP control system	• Engine torque is limited. • VVEL value is maintained at a fixed angle.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0090 is displayed with DTC P1197, first perform the trouble diagnosis for DTC P1197.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-555, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**
- **Before performing the following procedure, check that the fuel tank is 1/8 full of fuel.**

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT

1. Start engine.
2. Select “COOLAN TEMP/S” in “DATA MONITOR” mode of “ENGNE” using CONSULT.
3. Maintain the following condition for 5 seconds or more at idle.

COOLAN TEMP/S	: 70°C (104°F) or more

4. Check 1st trip DTC.

WITH GST
Follow the above steps for “WITH CONSULT”.

Is 1st trip DTC detected?

YES >> Proceed to EC-304, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419519

1.CHECK DTC PRIORITY

If DTC P0090 is displayed with DTC P1197, first perform the trouble diagnosis for DTC P1197.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-555, "DTC Description".
NO >> GO TO 2.

2.CHECK HIGH PRESSURE FUEL PUMP CIRCUIT

1. Turn ignition switch ON.
2. Disconnect ECM harness connector and high pressure fuel pump harness connector.
3. Check the continuity between ECM harness connector and high pressure fuel pump harness connector.

+		–		Value (Approx.)
ECM		High pressure fuel pump		
Connector	Terminal	Connector	Terminal	
F79	59	F87	1	Existed
	60		2	

4. Also check harness for short to ground and to power.

Is inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace the error-detected parts.

3.CHECK HIGH PRESSURE FUEL PUMP

Check high pressure fuel pump. Refer to EC-304, "Component Inspection (High Pressure Fuel Pump)".

Is inspection result normal?

YES >> INSPECTION END
NO >> Replace the error-detected parts.

Component Inspection (High Pressure Fuel Pump)

INFOID:0000000014419520

1.CHECK HIGH PRESSURE FUEL PUMP-1

1. Turn ignition switch OFF.
2. Disconnect high pressure fuel pump harness connector.
3. Check the resistance between high pressure fuel pump terminals.

+	–	Condition		Resistance (Approx.)
High pressure fuel pump				
Terminal				
1	2	Temperature °C (°F)	20 – 30 (68 - 86)	9 - 11 Ω

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace high pressure fuel pump. Refer to EM-52, "Exploded View".

2.CHECK HIGH PRESSURE FUEL PUMP-2

WITH CONSULT
1. Reconnect high pressure fuel pump harness connector.
2. Start the engine.
3. Check “FUEL PRES SEN V” in “DATA MONITOR” mode of “ECM” using CONSULT.

Monitor item	Condition	Value (Approx.)
FUEL PRES SEN V	Engine speed: idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

WITHOUT CONSULT
1. Reconnect high pressure fuel pump harness connector.
2. Start the engine.
3. Check FRP sensor signal voltage.

ECM			Condition	Value (Approx.)
Connector	+	–		
	Terminal			
F78	25	13	Engine speed: idle	0.82 – 1.22 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	0.82 – 3.06 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace high pressure fuel pump. Refer to EM-52, "Exploded View".

P00B3, P00B4 ENGINE COOLANT TEMPERATURE SENSOR 2

DTC Description

INFOID:0000000014419521

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P00B3	RADIATOR COOLANT TEMP SEN (Radiator coolant temperature sensor circuit low)	Diagnosis condition	—
		Signal (terminal)	Engine coolant temperature sensor 2 signal
		Threshold	A voltage signal transmitted from the engine coolant temperature sensor 2 is 0.04 V or less
		Diagnosis delay time	5 seconds or more
P00B4	RADIATOR COOLANT TEMP SEN (Radiator coolant temperature sensor circuit high)	Diagnosis condition	—
		Signal (terminal)	Engine coolant temperature sensor 2 signal
		Threshold	A voltage signal transmitted from the engine coolant temperature sensor 2 is 4.84 V or more.
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

P00B3
- Harness or connectors (Engine coolant temperature sensor 2 circuit is open or shorted)
- Engine coolant temperature sensor 2

P00B4
- Harness or connectors (Engine coolant temperature sensor 2 circuit is open or shorted)
- Engine coolant temperature sensor 2

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P00B3	Engine coolant temperature sensor 2	High coolant temperature control does not function.
P00B4	Engine coolant temperature sensor 2	High coolant temperature control does not function.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 11 V at ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-307, "Diagnosis Procedure".

NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419522

1. CHECK ENGINE COOLANT TEMPERATURE SENSOR 2 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature (ECT) sensor 2 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between ECT sensor 2 harness connector and ground.

+		–	Voltage (Approx.)
ECT sensor 2			
Connector	Terminal		
F93	1	Ground	5 V

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 4.

2. CHECK ENGINE COOLANT TEMPERATURE SENSOR 2 GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between ECT sensor 2 harness connector and ECM harness connector.

+		–		Continuity
ECT sensor 2		ECM		
Connector	Terminal	Connector	Terminal	
F93	2	F78	43	Existed

4. Also check harness for short to ground to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK ENGINE COOLANT TEMPERATURE SENSOR 2

Check the engine coolant temperature sensor 2. Refer to EC-308, "Component Inspection (Engine Coolant Temperature Sensor 2)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace engine coolant temperature sensor 2. Refer to CO-27, "Exploded View".

4. CHECK ENGINE COOLANT TEMPERATURE SENSOR 2 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between ECT sensor 2 harness connector and ECM harness connector.

+		–		Continuity
ECT sensor 2		ECM		
Connector	Terminal	Connector	Terminal	
F93	1	F79	65	Existed

4. Also check harness for short to ground.

Is the inspection result normal?

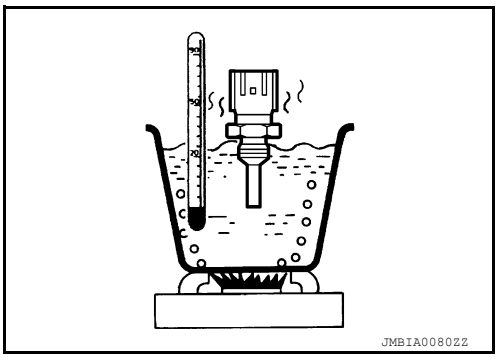
YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

Component Inspection (Engine Coolant Temperature Sensor 2)

INFOID:0000000014419523

1. CHECK ENGINE COOLANT TEMPERATURE SENSOR 2

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor 2 harness connector.
3. Remove engine coolant temperature sensor 2.
4. Check resistance between engine coolant temperature sensor 2 terminals by heating with hot water as shown in the figure.



ECT sensor 2		Condition		Resistance
+	–			
Terminal				
1	2	Temperature [°C (°F)]	20 (68)	2.35 - 2.73 kΩ
			50 (122)	0.68 - 1.00 kΩ
			90 (194)	0.236 - 0.260 kΩ

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace engine coolant temperature sensor 2. Refer to CO-27, "Exploded View".

P0101 MAF SENSOR

DTC Description

INFOID:0000000014419524

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0101	MAF SEN/CIRCUIT-B1 (Mass air flow sensor circuit range/performance)	1	Diagnosis condition	—
			Signal (terminal)	Mass air flow sensor signal
			Threshold	A high voltage from the sensor is sent to ECM under light load driving condition
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	Mass air flow sensor signal
			Threshold	A low voltage from the sensor is sent to ECM under heavy load driving condition
			Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The sensor circuit is open or shorted)
- Mass air flow sensor
- EVAP control system pressure sensor
- Intake air leaks
- Intake air temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0101 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

If engine will not start or stops soon, wait at least 10 seconds with engine stopped (Ignition switch ON) instead of running engine at idle speed.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to normal operating temperature.
2. Drive the vehicle for at least 5 seconds under the following conditions:

CAUTION:
Always drive at a safe speed.

Selector lever	Suitable position
Vehicle speed	40 km/h (25 MPH) or more

NOTE:

- The gear must be fixed while driving the vehicle.
- Keep the accelerator pedal as steady as possible during cruising.

3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-310, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419525

1.CHECK DTC PRIORITY

If DTC P0101 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK INTAKE SYSTEM

Check the following items to see the installation condition and the connection condition of the joint.

- Air duct
- Vacuum hoses
- Intake air passage between air duct and intake manifold

Is the inspection result normal?

YES >> GO TO 3.
NO >> Reconnect or replace error-detected parts.

3.CHECK MASS AIR FLOW SENSOR POWER SUPPLY CIRCUIT

1. Disconnect mass air flow sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between mass air flow sensor harness connector and ground.

+		–	Voltage
Mass air flow sensor			
Connector	Terminal		
F73	5	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.

- Harness for open or short between mass air flow sensor and ECM
- Harness for open or short between mass air flow sensor and IPDM E/R
- Loose or poor connection for each connector and harness

>> Repair or replace error-detected parts.

5.CHECK MASS AIR FLOW SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between mass air flow sensor harness connector and ECM harness connector.

Mass air flow sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F73	4	F78	42	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK MASS AIR FLOW SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between mass air flow sensor harness connector and ECM harness connector.

Mass air flow sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F73	3	F78	37	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK INTAKE AIR TEMPERATURE SENSOR

Check intake air temperature sensor. Refer to EC-320, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace mass air flow sensor (with intake air temperature sensor). Refer to EM-31, "Removal and Installation".

8. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace EVAP control system pressure sensor. Refer to FL-19, "Removal and Installation"

9. CHECK MASS AIR FLOW SENSOR

Check mass air flow sensor. Refer to EC-316, "Component Inspection (MAF Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor. Refer to EM-31, "Removal and Installation".

Component Inspection (MAF sensor)

INFOID:0000000014419526

1. CHECK MASS AIR FLOW SENSOR-I

WITH CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Connect CONSULT and select “DATA MONITOR” mode.
5. Select “MAS A/F SE-B1”, and check the indication.

Monitor item	Condition	Indication (V)
MAS A/F SE-B1	Ignition switch ON (Engine stopped.)	Approx. 0.4
	Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
	2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
	Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

WITHOUT CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.

4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F78	37 [MAF sensor signal]	42	Ignition switch ON (Engine stopped.)	Approx. 0.4
			Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
			2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
			Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK FOR THE CAUSE OF UNEVEN AIR FLOW THROUGH MASS AIR FLOW SENSOR

1. Turn ignition switch OFF.
2. Check for the cause of uneven air flow through mass air flow sensor. Refer to the following.

- Crushed air ducts
- Malfunctioning seal of air cleaner element
- Uneven dirt of air cleaner element
- Intake valve deposits
- Improper specification of intake air system parts

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK MASS AIR FLOW SENSOR-II

WITH CONSULT

1. Repair or replace malfunctioning part.
2. Start engine and warm it up to normal operating temperature.
3. Connect CONSULT and select “DATA MONITOR” mode.
4. Select “MAS A/F SE-B1”, and check the indication.

Monitor item	Condition	Indication (V)
MAS A/F SE-B1	Ignition switch ON (Engine stopped.)	Approx. 0.4
	Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
	2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
	Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

WITHOUT CONSULT

1. Repair or replace malfunctioning part.
2. Start engine and warm it up to normal operating temperature.
3. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F78	37 [MAF sensor signal]	42	Ignition switch ON (Engine stopped.)	Approx. 0.4
			Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
			2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
			Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 4.

4. CHECK MASS AIR FLOW SENSOR-III

WITH CONSULT

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector and reconnect it again.
3. Start engine and warm it up to normal operating temperature.
4. Connect CONSULT and select “DATA MONITOR” mode.
5. Select “MAS A/F SE-B1”, and check the indication.

Monitor item	Condition	Indication (V)
MAS A/F SE-B1	Ignition switch ON (Engine stopped.)	Approx. 0.4
	Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
	2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
	Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

WITHOUT CONSULT

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector and reconnect it again.
3. Start engine and warm it up to normal operating temperature.
4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F78	37 [MAF sensor signal]	42	Ignition switch ON (Engine stopped.)	Approx. 0.4
			Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
			2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
			Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean or replace malfunctioning mass air flow sensor. Refer to EM-31, "Removal and Installation".

P0102, P0103 MAF SENSOR

DTC Description

INFOID:0000000014419527

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0102	MAF SEN/CIRCUIT-B1 (Mass air flow sensor “A” circuit low input)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Mass air flow sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM.
		Diagnosis delay time	—
P0103	MAF SEN/CIRCUIT-B1 (Mass or volume air flow “A” circuit high input)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Mass air flow sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM.
		Diagnosis delay time	—

POSSIBLE CAUSE

P0102
- Harness or connectors (The mass air flow sensor circuit is open or shorted)
- Intake air leakage
- Mass air flow sensor

P0103
- Harness or connectors (The mass air flow sensor circuit is open or shorted)
- Mass air flow sensor

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0102	Mass air flow sensor circuit	Engine speed will not rise more than 2,400 rpm due to the fuel cut.
P0103	Mass air flow sensor circuit	Engine speed will not rise more than 2,400 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

Which DTC is detected?

P0102 >> GO TO 2.
P0103 >> GO TO 3.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR DTC P0102

1. Start engine and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-315, "Diagnosis Procedure".
NO >> INSPECTION END

3.PERFORM DTC CONFIRMATION PROCEDURE FOR DTC P0103-I

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-315, "Diagnosis Procedure".

NO >> GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE FOR DTC P0103-II

1. Start engine and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-315, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419528

1. INSPECTION START

Confirm the detected DTC.

Which DTC is detected?

P0102 >> GO TO 2.
P0103 >> GO TO 3.

2. CHECK INTAKE SYSTEM

Check the following for connection.
- Air duct
- Vacuum hoses
- Intake air passage between air duct to intake manifold

Is the inspection result normal?

YES >> GO TO 3.
NO >> Reconnect the parts.

3. CHECK MAF SENSOR POWER SUPPLY CIRCUIT

1. Disconnect mass air flow (MAF) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between MAF sensor harness connector and ground.

MAF sensor		Ground	Voltage
Connector	Terminal		
F73	5	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between mass air flow sensor and ECM
- Harness for open or short between mass air flow sensor and IPDM E/R
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5. CHECK MAF SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between MAF sensor harness connector and ECM harness connector.

MAF sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F73	4	F78	42	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

6. CHECK MAF SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between MAF sensor harness connector and ECM harness connector.

MAF sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F73	3	F78	37	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

7. CHECK MASS AIR FLOW SENSOR

Refer to EC-316, "Component Inspection (MAF Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor. Refer to EM-31, "Exploded View".

Component Inspection (MAF Sensor)

INFOID:0000000014419529

1. CHECK MASS AIR FLOW SENSOR-I

WITH CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Connect CONSULT and select “DATA MONITOR” mode.
5. Select “MAS A/F SE-B1”, and check the indication.

Monitor item	Condition	Indication (V)
MAS A/F SE-B1	Ignition switch ON (Engine stopped.)	Approx. 0.4
	Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
	2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
	Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

WITHOUT CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F78	37 (MAF sensor signal)	42	Ignition switch ON (Engine stopped.)	Approx. 0.4
			Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
			2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
			Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK FOR THE CAUSE OF UNEVEN AIR FLOW THROUGH MASS AIR FLOW SENSOR

1. Turn ignition switch OFF.
2. Check for the cause of uneven air flow through mass air flow sensor. Refer to the following.

- Crushed air ducts
- Malfunctioning seal of air cleaner element
- Uneven dirt of air cleaner element
- Improper specification of intake air system parts

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK MASS AIR FLOW SENSOR-II

WITH CONSULT

1. Repair or replace malfunctioning part.
2. Start engine and warm it up to normal operating temperature.
3. Connect CONSULT and select “DATA MONITOR” mode.
4. Select “MAS A/F SE-B1””, and check the indication.

Monitor item	Condition	Indication (V)
MAS A/F SE-B1	Ignition switch ON (Engine stopped.)	Approx. 0.4
	Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
	2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
	Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

WITHOUT CONSULT

1. Repair or replace malfunctioning part.
2. Start engine and warm it up to normal operating temperature.
3. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F78	37 (MAF sensor signal)	42	Ignition switch ON (Engine stopped.)	Approx. 0.4
			Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
			2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
			Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 4.

4.CHECK MASS AIR FLOW SENSOR-III

WITH CONSULT

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector and reconnect it again.
3. Start engine and warm it up to normal operating temperature.
4. Connect CONSULT and select “DATA MONITOR” mode.

5. Select “MAS A/F SE-B1”, and check the indication.

Monitor item	Condition	Indication (V)
MAS A/F SE-B1	Ignition switch ON (Engine stopped.)	Approx. 0.4
	Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
	2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
	Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

⊗WITHOUT CONSULT
1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector and reconnect it again.
3. Start engine and warm it up to normal operating temperature.
4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F78	37 (MAF sensor signal)	42	Ignition switch ON (Engine stopped.)	Approx. 0.4
			Idle (Engine is warmed-up to normal operating temperature.)	0.7 - 1.2
			2,500 rpm (Engine is warmed-up to normal operating temperature.)	1.4 - 1.9
			Idle to about 4,000 rpm	0.7 - 1.2 to Approx. 2.4*

*: Check for linear voltage rise in response to engine being increased to about 4,000 rpm.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Clean or replace malfunctioning mass air flow sensor. Refer to EM-31, "Removal and Installation".

P0111 IAT SENSOR

DTC Description

INFOID:0000000014419530

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0111	IAT SENSOR 1 B1 [Intake air temperature (IAT) sensor circuit range/performance]	Diagnosis condition	Engine is started with its cold state
		Signal (terminal)	Intake air temperature sensor signal
		Threshold	The comparison result of signals transmitted to ECM from each temperature sensor (IAT sensor, ECT sensor 1, FTT sensor, and EOT sensor) shows that the voltage signal of the IAT sensor is higher/lower than that of other temperature sensors
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (High or low resistance in the IAT sensor circuit)
- IAT sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

Is it necessary to erase permanent DTC?

YES >> GO TO 3.
NO >> GO TO 2.

2.PERFORM COMPONENT FUNCTION CHECK

Perform component function check. Refer to EC-320, "Component Function Check".

NOTE:

Use the component function check to check the overall function of the IAT sensor circuit. During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-320, "Diagnosis Procedure".

3.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, do not add fuel.**
- **Before performing the following procedure, check that fuel level is between 1/4 and 4/4.**
- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**

>> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE

1. Move the vehicle to a cool place.
   NOTE:
   Cool the vehicle in an environment of ambient air temperature between −10°C (14°F) and 35°C (95°F).

2. Turn ignition switch OFF and soak the vehicle for 12 hours.
   CAUTION:
   Never turn ignition switch ON during soaking.
   NOTE:
   The vehicle must be cooled with the hood open.
3. Start engine and let it idle for 5 minutes or more.
   CAUTION:
   Never turn ignition switch OFF during idling.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-320, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Component Function Check

INFOID:0000000014419531

1.CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector.
3. Check resistance between mass air flow sensor terminals as follows.

Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	25 (77)	1.94 – 2.06

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-320, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419532

1.CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR

Check intake air temperature sensor. Refer to EC-320, "Component Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor (with intake air temperature sensor). Refer to EM-31, "Removal and Installation".

Component Inspection

INFOID:0000000014419533

1.CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector.
3. Check resistance between mass air flow sensor terminals as follows.

Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	25 (77)	1.94 – 2.06

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor (with intake air temperature sensor). Refer to EM-31, "Removal and Installation".

P0112, P0113 IAT SENSOR

DTC Description

INFOID:0000000014419534

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0112	IAT SEN/CIRCUIT-B1 (Intake air temperature sensor circuit low input)	Diagnosis condition	—
		Signal (terminal)	Intake air temperature sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0113	IAT SEN/CIRCUIT-B1 (Intake air temperature sensor circuit high input)	Diagnosis condition	—
		Signal (terminal)	Intake air temperature sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0112
- Harness or connectors (The intake air temperature sensor circuit is open or shorted)
- Intake air temperature sensor

P0113
- Harness or connectors (The intake air temperature sensor circuit is open or shorted)
- Intake air temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-321, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419535

1.CHECK INTAKE AIR TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect mass air flow (MAF) sensor (intake air temperature sensor is built-in) harness connector.
2. Turn ignition switch ON.
3. Check the voltage between MAF sensor harness connector and ground.

MAF sensor		Ground	Voltage (V)
Connector	Terminal		
F73	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

2.CHECK INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between MAF sensor harness connector and ECM harness connector.

MAF sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F73	1	F78	42	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK INTAKE AIR TEMPERATURE SENSOR

Refer to EC-322, "Component Inspection (Intake Air Temperature Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor (with intake air temperature sensor).

Component Inspection (Intake Air Temperature Sensor)

INFOID:0000000014419536

1.CHECK INTAKE AIR TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector.
3. Check resistance between mass air flow sensor terminals as per the following.

Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	25 (77)	1.94 - 2.06

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor (with intake air temperature sensor). Refer to EM-31, "Removal and Installation".

P0116 ENGINE COOLANT TEMPERATURE SENSOR 1

DTC Description

INFOID:0000000014419537

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0116	ECT SEN/CIRC [Engine coolant temperature (ECT) sensor 1 circuit range/performance]	Diagnosis condition	Engine is started with its cold state
		Signal (terminal)	Engine coolant temperature sensor 1 signal
		Threshold	• The comparison result of signals transmitted to ECM from each temperature sensor (IAT sensor, ECT sensor 1, FTT sensor, and EOT sensor) shows that the voltage signal of the ECT sensor 1 is higher/lower than that of other temperature sensors • Engine coolant temperature signal from engine coolant temperature sensor does not fluctuate, even when some time has passed after starting the engine with pre-warming up condition.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (High or low resistance in the ECT sensor 1 circuit)
- ECT sensor 1

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

Is it necessary to erase permanent DTC?

YES >> GO TO 3.
NO >> GO TO 2.

2.PERFORM COMPONENT FUNCTION CHECK

Perform component function check. Refer to EC-324, "Component Function Check".

NOTE:

Use the component function check to check the overall function of the ECT sensor 1 circuit. During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-324, "Diagnosis Procedure".

3.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, do not add fuel.**
- **Before performing the following procedure, check that fuel level is between 1/4 and 4/4.**
- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**

>> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE

1. Move the vehicle to a cool place.
   NOTE:
   Cool the vehicle in an environment of ambient air temperature between −10°C (14°F) and 35°C (95°F).
2. Turn ignition switch OFF and soak the vehicle for 12 hours.
   CAUTION:
   Never turn ignition switch ON during soaking.
   NOTE:
   The vehicle must be cooled with the hood open.
3. Start engine and let it idle for 5 minutes or more.
   CAUTION:
   Never turn ignition switch OFF during idling.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

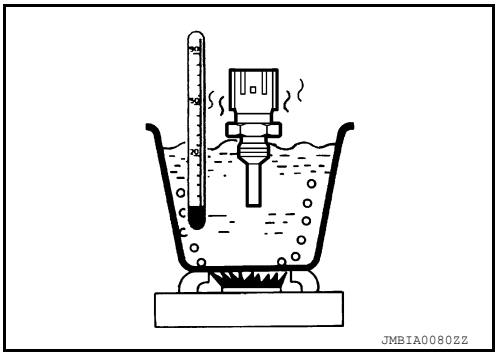
YES >> Proceed to EC-324, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Component Function Check

INFOID:0000000014419538

1.CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect ECT sensor 1 harness connector.
3. Remove ECT sensor 1. Refer to EC-36, "Component Parts Location".
4. Check resistance between ECT sensor 1 terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 – 2.73
		50 (122)	0.68 – 1.00
		90 (194)	0.236 – 0.260

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-324, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419539

1.CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1

Check ECT sensor 1. Refer to EC-324, "Component Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace ECT sensor 1. Refer to EC-36, "Component Parts Location".

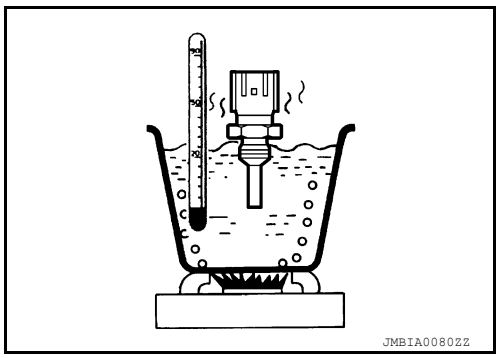
Component Inspection

INFOID:0000000014419540

1.CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect ECT sensor 1 harness connector.
3. Remove ECT sensor 1. Refer to EC-36, "Component Parts Location".

4. Check resistance between ECT sensor 1 terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 – 2.73
		50 (122)	0.68 – 1.00
		90 (194)	0.236 – 0.260

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace ECT sensor 1. Refer to EC-36, "Component Parts Location".

P0117, P0118 ENGINE COOLANT TEMPERATURE SENSOR 1

DTC Description

INFOID:0000000014419541

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0117	ECT SEN/CIRC (Engine coolant temperature sensor 1 circuit low input)	Diagnosis condition	—
		Signal (terminal)	Engine coolant temperature sensor 1 signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0118	ECT SEN/CIRC (Engine coolant temperature sensor 1 circuit high input)	Diagnosis condition	—
		Signal (terminal)	Engine coolant temperature sensor 1 signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0117
- Harness or connectors (The engine coolant temperature sensor 1 circuit is open or shorted)
- Engine coolant temperature sensor 1

P0118
- Harness or connectors (The engine coolant temperature sensor 1 circuit is open or shorted)
- Engine coolant temperature sensor 1

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode	
P0117 P0118	Engine coolant temperature sensor 1 circuit	Engine coolant temperature will be determined by ECM based on the following condition. CONSULT displays the engine coolant temperature decided by ECM.	
		Condition	Engine coolant temperature decided (CONSULT display)
		Just as ignition switch is turned ON or START	40°C (104°F)
		Approx. 4 minutes or more after engine starting	80°C (176°F)
		Except as shown above	40 - 80°C (104 - 176°F) (Depends on the time)
		When the fail-safe system for engine coolant temperature sensor 1 is activated, the cooling fan operates while engine is running.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-327, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419542

1. CHECK ENGINE COOLANT TEMPERATURE SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect engine coolant temperature (ECT) sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between ECT sensor 1 harness connector and ground.

ECT sensor 1		Ground	Voltage (V)
Connector	Terminal		
F28	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

2. CHECK ECT SENSOR 1 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between ECT sensor 1 harness connector and ECM harness connector.

ECT sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F28	2	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3. CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

Refer to EC-327, "Component Inspection (Engine Coolant Temperature Sensor 1)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace engine coolant temperature sensor 1.

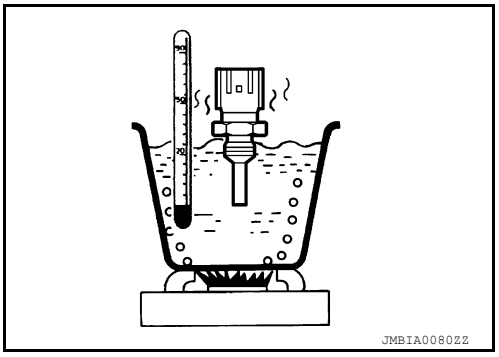
Component Inspection (Engine Coolant Temperature Sensor 1)

INFOID:0000000014419543

1. CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor 1 harness connector.
3. Remove engine coolant temperature sensor 1.
4. Check resistance between engine coolant temperature sensor 1 terminals by heating with hot water as shown in the figure.

Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 - 2.73
		50 (122)	0.68 - 1.00
		90 (194)	0.236 - 0.260



Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace engine coolant temperature sensor 1. Refer to EM-105, "Exploded View".

P0122, P0123 TP SENSOR

DTC Description

INFOID:0000000014419544

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0122	TP SEN 2/CIRC-B1 (Throttle pedal position sensor/switch "A" circuit low)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Throttle position sensor 2 signal
		Threshold	An excessively low voltage from the TP sensor 2 is sent to ECM
		Diagnosis delay time	—
P0123	TP SEN 2/CIRC-B1 (Throttle pedal position sensor/switch "A" circuit high)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Throttle position sensor 2 signal
		Threshold	An excessively high voltage from the TP sensor 2 is sent to ECM.
		Diagnosis delay time	—

POSSIBLE CAUSE

P0122
- Harness or connectors (TP sensor 2 circuit is open or shorted)
- Throttle position sensor 2

P0123
- Harness or connectors (TP sensor 2 circuit is open or shorted)
- Throttle position sensor 2

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0122	Throttle position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.
P0123	Throttle position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0122 or P0123 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-330, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419545

1.CHECK DTC PRIORITY

If DTC P0122 or P0123 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK THROTTLE POSITION SENSOR 2 POWER SUPPLY CIRCUIT

1. Disconnect electric throttle control actuator harness connector.
2. Turn ignition switch ON.
3. Check the voltage between electric throttle control actuator harness connector and ground.

Electric throttle control actuator		Ground	Voltage
Connector	Terminal		
F50	2	Ground	Approx. 5 V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK THROTTLE POSITION SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between electric throttle control actuator harness connector and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	4	F79	85	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK THROTTLE POSITION SENSOR 2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between electric throttle control actuator harness connector and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	3	F79	80	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK THROTTLE POSITION SENSOR

Refer to EC-331, "Component Inspection (Throttle Position Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

Component Inspection (Throttle Position Sensor)

INFOID:0000000014419546

1.CHECK THROTTLE POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Perform EC-199, "Description".
4. Turn ignition switch ON.
5. Set selector lever position to D.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
F79	78 (TP sensor 1 signal)	85 (Sensor ground)	Accelerator pedal	Fully released	More than 0.36
				Fully depressed	Less than 4.75
	80 (TP sensor 2 signal)			Fully released	Less than 4.75
				Fully depressed	More than 0.36

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P0125 ECT SENSOR

DTC Description

INFOID:0000000014419547

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0125	ECT SENSOR (Insufficient engine coolant temperature for closed loop fuel control)	1	Diagnosis condition	After starting the engine
			Signal (terminal)	Mass air flow sensor signal
			Threshold	Voltage sent to ECM from the sensor is not practical
			Diagnosis delay time	Some time has passed
		2	Diagnosis condition	—
			Signal (terminal)	Mass air flow sensor signal
			Threshold	Engine coolant temperature is insufficient for closed loop fuel control
			Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (High resistance in the circuit)
- Engine coolant temperature sensor 1
- Multi-way control valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0125 is displayed with P0117 or P0118, first perform the trouble diagnosis for DTC P0117, P0118.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.CHECK ENGINE COOLANT TEMPERATURE SENSOR 1 FUNCTION

WITH CONSULT
1. Turn ignition switch ON.
2. Select “DATA MONITOR” mode with CONSULT.
3. Check that “COOLAN TEMP/S” is above –10°C (14°F).

WITH GST
Follow the procedure “With CONSULT” above.

Is the temperature above –10°C (14°F)?

YES >> INSPECTION END
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT
1. Start engine and run it for 65 minutes at idle speed.

If "COOLAN TEMP/S" increases to more than –10°C (14°F) within 65 minutes, stop engine because the test result will be OK.

CAUTION:

Never overheat engine.

2. Check 1st trip DTC.

WITH GST

Follow the procedure "With CONSULT" above.

Is 1st trip DTC detected?

YES >> EC-333, "Diagnosis Procedure"
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419548

1.CHECK DTC PRIORITY

If DTC P0125 is displayed with P0117 or P0118, first perform the trouble diagnosis for DTC P0117, P0118.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

Refer to EC-327, "Component Inspection (Engine Coolant Temperature Sensor 1)".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace engine coolant temperature sensor 1.

3.CHECK MULTI-WAY CONTROL VALVE OPERATION

When the engine is cold [lower than 66°C (151°F)] condition, grasp lower radiator hose and confirm that the engine coolant does not flow.

Is the inspection result normal?

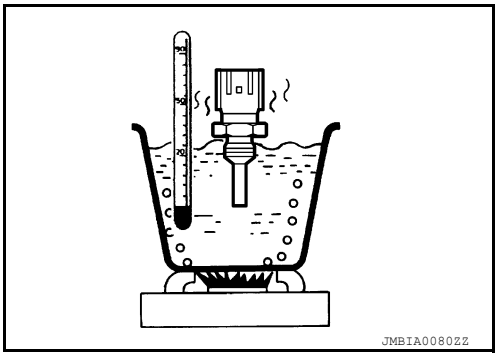
YES >> INSPECTION END
NO >> Repair or replace water outlet (MCV). Refer to CO-27, "Exploded View".

Component Inspection (Engine Coolant Temperature Sensor 1)

INFOID:0000000014419549

1.CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor 1 harness connector.
3. Remove engine coolant temperature sensor 1.
4. Check resistance between engine coolant temperature sensor 1 terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 - 2.73
		50 (122)	0.68 - 1.00
		90 (194)	0.236 - 0.260

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace engine coolant temperature sensor 1. Refer to EM-105, "Exploded View".

P0127 IAT SENSOR

DTC Description

INFOID:0000000014419550

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0127	IAT SENSOR-B1 (Intake air temperature too high)	Diagnosis condition	—
		Signal (terminal)	Intake air temperature sensor signal
		Threshold	Rationally incorrect voltage from the sensor is sent to ECM, compared with the voltage signal from Intake air temperature sensor.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The intake air temperature sensor circuit is open or shorted)
- Intake air temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

This test may be conducted with the drive wheels lifted in the shop or by driving the vehicle. If a road test is expected to be easier, it is unnecessary to lift the vehicle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT

1. Wait until engine coolant temperature is less than 90°C (194°F)

- Turn ignition switch ON.
- Select “DATA MONITOR” mode with CONSULT.
- Check the engine coolant temperature.
- If the engine coolant temperature is not less than 90°C (194°F), turn ignition switch OFF and cool down engine.

NOTE:

Perform the following steps before engine coolant temperature is above 90°C (194°F).

2. Turn ignition switch ON.
3. Select “DATA MONITOR” mode with CONSULT.
4. Start engine.
5. Hold vehicle speed at more than 70 km/h (43 MPH) for 100 consecutive seconds.

CAUTION:

Always drive vehicle at a safe speed.

6. Check 1st trip DTC.

WITH GST

Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-335, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419551

1.CHECK INTAKE AIR TEMPERATURE SENSOR

Refer to EC-335, "Component Inspection (Intake Air Temperature Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor (with intake air temperature sensor).

Component Inspection (Intake Air Temperature Sensor)

INFOID:0000000014419552

1.CHECK INTAKE AIR TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector.
3. Check resistance between mass air flow sensor terminals as per the following.

Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	25 (77)	1.94 - 2.06

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace mass air flow sensor (with intake air temperature sensor). Refer to EM-35, "Removal and Installation".

P0130, P0150 A/F SENSOR 1

DTC Description

INFOID:0000000014419553

DTC DETECTION LOGIC

To judge malfunctions, the diagnosis checks that the A/F signal computed by ECM from the A/F sensor 1 signal fluctuates according to fuel feedback control.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0130	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit]	A)	Diagnosis condition	—
			Signal (terminal)	Air fuel ratio sensor 1 signal
			Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly in a range other than approx. 2.2 V
			Diagnosis delay time	—
		B)	Diagnosis condition	—
			Signal (terminal)	Air fuel ratio sensor 1 signal
			Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly approx. 2.2 V
			Diagnosis delay time	—
P0150	A/F SENSOR1 (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit]	A)	Diagnosis condition	—
			Signal (terminal)	Air fuel ratio sensor 1 signal
			Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly in a range other than approx. 2.2 V
			Diagnosis delay time	—
		B)	Diagnosis condition	—
			Signal (terminal)	Air fuel ratio sensor 1 signal
			Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly approx. 2.2 V
			Diagnosis delay time	—

POSSIBLE CAUSE

P0130
- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

P0150
- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2. PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A

1. Start engine and warm it up to normal operating temperature.
2. Let engine idle for 2 minutes.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-338, "Diagnosis Procedure".
NO-1 >> With CONSULT: GO TO 3.
NO-2 >> With GST: GO TO 7.

3. CHECK AIR FUEL RATIO (A/F) SENSOR 1 FUNCTION

WITH CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Select “A/F SEN1 (B1)” or “A/F SEN1 (B2)” in “DATA MONITOR” mode with CONSULT.
3. Check “A/F SEN1 (B1)” or “A/F SEN1 (B2)” indication.

Does the indication fluctuate around 2.2 V?

YES >> GO TO 4.
NO >> Go to EC-338, "Diagnosis Procedure".

4. PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION B-I

1. Select “A/F SEN1 (B1) P1276” (for DTC P0130) or “A/F SEN1 (B2) P1286” (for DTC P0150) of “A/F SEN1” in “DTC WORK SUPPORT” mode with CONSULT.
2. Touch “START”.
3. When the following conditions are met, “TESTING” will be displayed on the CONSULT screen.

ENG SPEED	1,000 - 3,200 rpm
VHCL SPEED SE	More than 64 km/h (40 mph)
B/FUEL SCHDL	1.0 - 8.0 msec
Selector lever	D position

If “TESTING” is not displayed after 20 seconds, retry from step 2.
CAUTION:
Always drive vehicle at a safe speed.

Is “TESTING” displayed on CONSULT screen?

YES >> GO TO 5.
NO >> Check A/F sensor 1 function again. GO TO 3.

5. PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION B-II

Release accelerator pedal fully.
NOTE:
Never apply brake when releasing the accelerator pedal.

Which does “TESTING” change to?

COMPLETED>>GO TO 6.
OUT OF CONDITION>>Retry DTC CONFIRMATION PROCEDURE. GO TO 4.

6. PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION B-III

Touch “SELF-DIAG RESULT”.

Is “OK” displayed on CONSULT screen?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Go to EC-338, "Diagnosis Procedure".

7. PERFORM COMPONENT FUNCTION CHECK FOR MALFUNCTION B

NOTE:

Use component function check to check the overall function of the A/F sensor 1 circuit. During this check, a 1st trip DTC might not be confirmed.

WITH GST

1. Start engine and warm it up to normal operating temperature.
2. Drive the vehicle at a speed of 80 km/h (50 MPH) for a few minutes in the suitable gear position.
3. Shift the selector lever position to D, then release the accelerator pedal fully until the vehicle speed decreases to 50 km/h (31 MPH).
   CAUTION:
   Always drive vehicle at a safe speed.
   NOTE:
   Never apply brake when releasing the accelerator pedal.
4. Repeat steps 2 and 3 for 5 times.
5. Stop the vehicle and turn ignition switch OFF.
6. Wait at least 10 seconds and turn ignition switch ON.
7. Turn ignition switch OFF and wait at least 10 seconds.
8. Restart engine.
9. Repeat steps 2 and 3 for 5 times.
10. Stop the vehicle.
11. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-338, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419554

1. CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between A/F sensor 1 harness connector and ground.

DTC	A/F sensor 1			Ground	Voltage
	Bank	Connector	Terminal		
P0130	1	F25	1	Ground	Battery voltage
P0150	2	F16	1		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2. CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between A/F sensor 1 harness connector and IPDM E/R harness connector.

DTC	A/F sensor 1			IPDM E/R		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0130	1	F25	1	E121	25	Existed
P0150	2	F16	1			

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform trouble diagnosis for power supply circuit.
NO >> Repair or replace malfunctioning part.

3. CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.

2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0130	1	F25	4	F79	79	Existed
			3		74	
P0150	2	F16	4	F79	69	
			3		70	

4. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P0130	1	F25	4	Ground	Not Existed
			3		
P0150	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P0130	1	F79	74	Ground	Not Existed
			79		
P0150	2	F79	69		
			70		

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace malfunctioning part.

4. REPLACE A/F SENSOR 1

Replace malfunctioning A/F sensor 1. Refer to EM-45, "Removal and Installation - XD Models".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P0131, P0151 A/F SENSOR 1

DTC Description

INFOID:0000000014419555

DTC DETECTION LOGIC

To judge the malfunction, the diagnosis checks that the A/F signal computed by ECM from the A/F sensor 1 signal is not inordinately low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0131	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit low voltage]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly approx. 0 V
		Diagnosis delay time	—
P0151	A/F SENSOR1 (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit low voltage]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly approx. 0 V
		Diagnosis delay time	—

POSSIBLE CAUSE

P0131
- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

P0151
- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 10.5 V or more at idle.

>> GO TO 2.

2.CHECK A/F SENSOR FUNCTION

WITH CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Select “A/F SEN1 (B1)” or “A/F SEN1 (B2)” in “DATA MONITOR” mode with CONSULT.
3. Check “A/F SEN1 (B1)” or “A/F SEN1 (B2)” indication.

WITH GST

Follow the procedure “With CONSULT” above.

Is the indication constantly approx. 0 V?

YES >> Go to EC-341, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Restart engine.
5. Drive and accelerate vehicle to more than 40 km/h (25 MPH) within 20 seconds after restarting engine.
   CAUTION:
   Always drive vehicle at a safe speed.
6. Maintain the following conditions for approximately 20 consecutive seconds.

ENG SPEED	1,000 - 3,200 rpm
VHCL SPEED SE	More than 40 km/h (25 mph)
B/FUEL SCHDL	1.5 - 9.0 msec
Selector lever	Suitable position

NOTE:
- **Keep the accelerator pedal as steady as possible during cruising.**
- **If this procedure is not completed within 1 minute after restarting engine at step 1, return to step 1.**

7. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-341, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419556

1.CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between A/F sensor 1 harness connector and ground.

DTC	A/F sensor 1			Ground	Voltage
	Bank	Connector	Terminal		
P0131	1	F25	1	Ground	Battery voltage
P0151	2	F16	1		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between A/F sensor 1 harness connector and IPDM E/R harness connector.

DTC	A/F sensor 1			IPDM E/R		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0131	1	F25	1	E121	25	Existed
P0151	2	F16	1			

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform trouble diagnosis for power supply circuit.
NO >> Repair or replace malfunctioning part.

3. CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0131	1	F25	4	F79	79	Existed
			3		74	
P0151	2	F16	4	F79	69	
			3		70	

4. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P0131	1	F25	4	Ground	Not Existed
			3		
P0151	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P0131	1	F79	74	Ground	Not Existed
			79		
P0151	2	F79	69		
			70		

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace malfunctioning part.

4. REPLACE A/F SENSOR 1

Replace malfunctioning A/F sensor 1. Refer to EM-45, "Removal and Installation - XD Models".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P0132, P0152 A/F SENSOR 1

DTC Description

INFOID:0000000014419557

DTC DETECTION LOGIC

To judge the malfunction, the diagnosis checks that the A/F signal computed by ECM from the A/F sensor 1 signal is not inordinately low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0132	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit high voltage]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly approx. 5 V
		Diagnosis delay time	—
P0152	A/F SENSOR1 (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit high voltage]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is constantly approx. 5 V
		Diagnosis delay time	—

POSSIBLE CAUSE

P0132
- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

P0152
- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 10.5 V or more at idle.

>> GO TO 2.

2.CHECK A/F SENSOR FUNCTION

WITH CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Select “A/F SEN1 (B1)” or “A/F SEN1 (B2)” in “DATA MONITOR” mode with CONSULT.
3. Check “A/F SEN1 (B1)” or “A/F SEN1 (B2)” indication.

WITH GST

Follow the procedure “With CONSULT” above.

Is the indication constantly approx. 5 V?

YES >> Go to EC-344, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Restart engine.
5. Drive and accelerate vehicle to more than 40 km/h (25 MPH) within 20 seconds after restarting engine.
   CAUTION:
   Always drive vehicle at a safe speed.
6. Maintain the following conditions for approximately 20 consecutive seconds.

ENG SPEED	1,000 - 3,200 rpm
VHCL SPEED SE	More than 40 km/h (25 mph)
B/FUEL SCHDL	1.5 - 9.0 msec
Selector lever	Suitable position

NOTE:
- **Keep the accelerator pedal as steady as possible during cruising.**
- **If this procedure is not completed within 1 minute after restarting engine at step 1, return to step 1.**

7. Check 1st trip DTC.

WITH GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Go to EC-344, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419558

1.CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between A/F sensor 1 harness connector and ground.

DTC	A/F sensor 1			Ground	Voltage
	Bank	Connector	Terminal		
P0132	1	F25	1	Ground	Battery voltage
P0152	2	F16	1		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between A/F sensor 1 harness connector and IPDM E/R harness connector.

DTC	A/F sensor 1			IPDM E/R		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0132	1	F25	1	E121	25	Existed
P0152	2	F16	1			

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform trouble diagnosis for power supply circuit.
NO >> Repair or replace malfunctioning part.

3. CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0132	1	F25	4	F79	79	Existed
			3		74	
P0152	2	F16	4	F79	69	
			3		70	

4. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P0132	1	F25	4	Ground	Not Existed
			3		
P0152	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P0132	1	F79	74	Ground	Not Existed
			79		
P0152	2	F79	69		
			70		

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace malfunctioning part.

4. REPLACE A/F SENSOR 1

Replace malfunctioning A/F sensor 1. Refer to EM-45, "Removal and Installation - XD Models".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

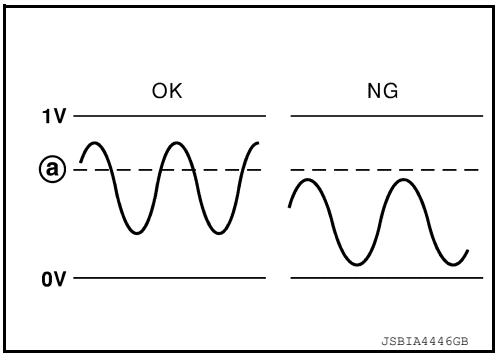
P0137, P0157 HO2S2

DTC Description

INFOID:0000000014419559

DTC DETECTION LOGIC

The heated oxygen sensor 2 has a much longer switching time between rich and lean than the air fuel ratio (A/F) sensor 1. The oxygen storage capacity of the three way catalyst (manifold) causes the longer switching time. To judge the malfunctions of heated oxygen sensor 2, ECM monitors whether the maximum voltage of the sensor is sufficiently high during various driving conditions such as fuel cut.
ⓐ: 0.73 V



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0137	HO2S2 (B1) [Heated oxygen sensor 2 (bank 1) circuit low voltage]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 signal
		Threshold	The maximum voltage from the sensor does not reach the specified voltage
		Diagnosis delay time	—
P0157	HO2S2 (B2) [Heated oxygen sensor 2 (bank 2) circuit low voltage]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 signal
		Threshold	The maximum voltage from the sensor does not reach the specified voltage
		Diagnosis delay time	—

POSSIBLE CAUSE

P0137
- Harness or connectors (The heated oxygen sensor 2 circuit is open or shorted)
- Heated oxygen sensor 2
- Fuel pressure
- Fuel injector
- Intake air leaks

P0157
- Harness or connectors (The heated oxygen sensor 2 circuit is open or shorted)
- Heated oxygen sensor 2
- Fuel pressure
- Fuel injector
- Intake air leaks

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

Will CONSULT be used?

YES >> GO TO 2.

NO >> GO TO 4.

2. PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT

TESTING CONDITION:

For better results, perform "DTC WORK SUPPORT" at a temperature of 0 to 30°C (32 to 86°F).

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Restart engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Select "DATA MONITOR" mode with CONSULT.
8. Check that "COOLAN TEMP/S" indicates more than 70°C (158°F).
   If not, warm up engine and go to next step when "COOLAN TEMP/S" indication reaches 70°C (158°F).
9. Open engine hood.
10. Select "HO2S2 (B1) P1147" (for DTC P0137) or "HO2S2 (B2) P1167" (for DTC P0157) of "HO2S2" in "DTC WORK SUPPORT" mode with CONSULT.
11. Follow the instruction of CONSULT display.
    NOTE:
    It will take at most 10 minutes until "COMPLETED" is displayed.
12. Touch "SELF-DIAG RESULTS".

Is "OK" displayed on CONSULT screen?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO-1 >> "NG" is displayed: Proceed to EC-348, "Diagnosis Procedure".
NO-2 >> "CAN NOT BE DIAGNOSED" is displayed: GO TO 3.

3. PERFORM DTC CONFIRMATION PROCEDURE AGAIN

1. Turn ignition switch OFF and leave the vehicle in a cool place (soak the vehicle).
2. Perform DTC confirmation procedure again.

>> GO TO 2.

4. PERFORM COMPONENT FUNCTION CHECK-I

NOTE:

Use component function check to check the overall function of the heated oxygen sensor 2 circuit. During this check, a 1st trip DTC might not be confirmed.

WITH GST

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Restart engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0137	F79	84	F78	43	Revving up to 4,000 rpm under no load at least 10 times	The voltage should be above 0.73 V at least once during this procedure.
P0157		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END

NO >> GO TO 5.

5.PERFORM COMPONENT FUNCTION CHECK-II

Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0137	F79	84	F78	43	Keeping engine at idle for 10 minutes	The voltage should be above 0.73 V at least once during this procedure.
P0157		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> GO TO 6.

6.PERFORM COMPONENT FUNCTION CHECK-III

Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0137	F79	84	F78	43	Coasting from 80 km/h (50 MPH) with selector lever in the D position	The voltage should be above 0.73 V at least once during this procedure.
P0157		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-348, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419560

1.CLEAR THE MIXTURE RATIO SELF-LEARNING VALUE

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Run engine for at least 10 minutes at idle speed.

Is the 1st trip DTC P0171 or P0174 detected? Is it difficult to start engine?

YES >> Perform trouble diagnosis for DTC P0171 or P0174. Refer to EC-373, "DTC Description".
NO >> GO TO 2.

2.CHECK HEATED OXYGEN SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect heated oxygen sensor 2 (HO2S2) harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0137	1	F57	1	F78	43	Existed
P0157	2	F54	1			

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK HO2S2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0137	1	F57	2	F79	84	Existed
P0157	2	F54	2		77	

2. Check the continuity between HO2S2 harness connector and ground, or ECM harness connector and ground.

DTC	HO2S2			ECM		Ground	Continuity
	Bank	Connector	Terminal	Connector	Terminal		
P0137	1	F57	2	F79	84	Ground	Not existed
P0157	2	F54	2		77		

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK HEATED OXYGEN SENSOR 2

Refer to EC-349, "Component Inspection (HO2 sensor 2)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5.REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

Component Inspection (HO2 sensor 2)

INFOID:0000000014419561

1.INSPECTION START

Will CONSULT be used?

Will CONSULT be used?

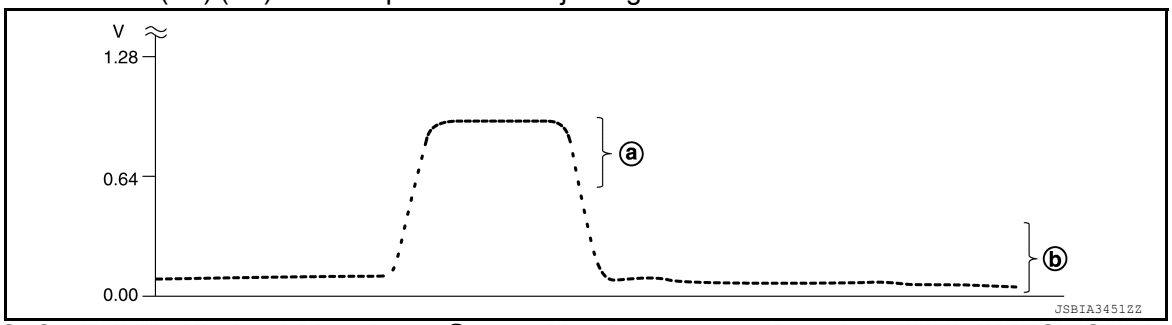
YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK HEATED OXYGEN SENSOR 2

With CONSULT

1. Start engine and warm it up to the normal operating temperature.
2. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
3. Let engine idle for 1 minute.
4. Select “FUEL INJECTION” in “ACTIVE TEST” mode, and select “HO2S2 (B1)/(B2)” as the monitor item with CONSULT.

5. Check “HO2S2 (B1)/(B2)” at idle speed when adjusting “FUEL INJECTION” to ±25%.



“HO2S2 (B1)/(B2)” should be above ⓐ: 0.73 V at least once when the “FUEL INJECTION” is +25%.
“HO2S2 (B1)/(B2)” should be below ⓑ: 0.18 V at least once when the “FUEL INJECTION” is −25%.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

3. CHECK HEATED OXYGEN SENSOR 2-I

Ⓧ Without CONSULT

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
4. Let engine idle for 1 minute.
5. Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Revving up to 4,000 rpm under no load at least 10 times	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 4.

4. CHECK HEATED OXYGEN SENSOR 2-II

Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Keeping engine at idle for 10 minutes	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5. CHECK HEATED OXYGEN SENSOR 2-III

Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Coasting from 80 km/h (50 MPH) with selector lever in the D position	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6. REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P0138, P0158 HO2S2

DTC Description

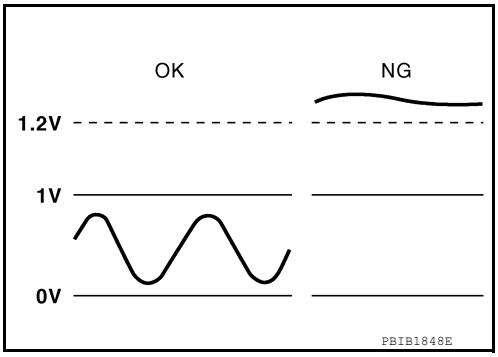
INFOID:0000000014419562

DTC DETECTION LOGIC

The heated oxygen sensor 2 has a much longer switching time between rich and lean than the air fuel ratio (A/F) sensor 1. The oxygen storage capacity of the three way catalyst (manifold) causes the longer switching time.

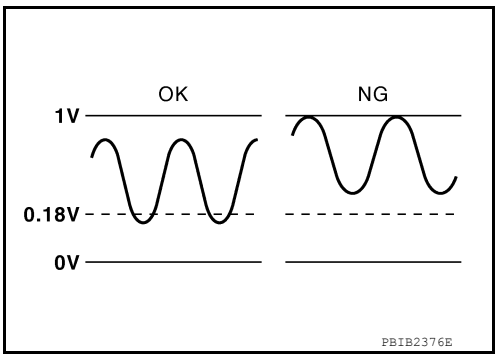
MALFUNCTION A

To judge the malfunctions of heated oxygen sensor 2, ECM monitors whether the voltage is unusually high during various driving conditions such as fuel cut.



MALFUNCTION B

To judge the malfunctions of heated oxygen sensor 2, ECM monitors whether the minimum voltage of sensor is sufficiently low during various driving conditions such as fuel cut.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0138	HO2S2 (B1) [Heated oxygen sensor 2 (bank 1) circuit high voltage]	A)	Diagnosis condition	—
			Signal (terminal)	Heated oxygen sensor 2 signal
			Threshold	An excessively high voltage from the sensor is sent to ECM
			Diagnosis delay time	—
		B)	Diagnosis condition	—
			Signal (terminal)	Heated oxygen sensor 2 signal
			Threshold	The minimum voltage from the sensor is not reached to the specified voltage
			Diagnosis delay time	—

P0158	HO2S2 (B2) [Heated oxygen sensor 2 (bank 2) circuit high voltage]	A)	Diagnosis condition	—
			Signal (terminal)	Heated oxygen sensor 2 signal
			Threshold	An excessively high voltage from the sensor is sent to ECM
			Diagnosis delay time	—
		B)	Diagnosis condition	—
			Signal (terminal)	Heated oxygen sensor 2 signal
			Threshold	The minimum voltage from the sensor is not reached to the specified voltage.
			Diagnosis delay time	—

POSSIBLE CAUSE

P0138-A, P0158-A
- Harness or connectors (The heated oxygen sensor 2 circuit is open or shorted)
- Heated oxygen sensor 2

P0138-B, P0158-B
- Harness or connectors (The heated oxygen sensor 2 circuit is open or shorted)
- Heated oxygen sensor 2
- Fuel pressure
- Fuel injector

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 2 minutes.
7. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-355, "Diagnosis Procedure".
NO-1 >> With CONSULT: GO TO 3.
NO-2 >> With GST: GO TO 5.

3.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION B

WITH CONSULT

NOTE:
For better results, perform “DTC WORK SUPPORT” at a temperature of 0 to 30°C (32 to 86°F).

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Select “DATA MONITOR” mode with CONSULT.

8. Check that “COOLAN TEMP/S” indicates more than 70°C (158°F).
   If not, warm up engine and go to next step when “COOLAN TEMP/S” indication reaches 70°C (158°F).
9. Open engine hood.
10. Select “HO2S2 (B1) P1146” (for DTC P0138) or “HO2S2 (B2) P1166” (for DTC P0158) of “HO2S2” in “DTC WORK SUPPORT” mode with CONSULT.
11. Follow the instruction of CONSULT display.
    NOTE:
    It will take at most 10 minutes until “COMPLETED” is displayed.
12. Touch “SELF-DIAG RESULTS”.

Is “OK” displayed on CONSULT screen?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO-1 >> “NG” is displayed: Proceed to EC-355, "Diagnosis Procedure".
NO-2 >> “CAN NOT BE DIAGNOSED” is displayed: GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION B AGAIN

1. Turn ignition switch OFF and leave the vehicle in a cool place (soak the vehicle).
2. Perform DTC confirmation procedure again.

>> GO TO 3.

5. PERFORM COMPONENT FUNCTION CHECK FOR MALFUNCTION B-I

NOTE:
Use component function check to check the overall function of the heated oxygen sensor 2 circuit. During this check, a 1st trip DTC might not be confirmed.

WITH GST
1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0138	F79	84	F78	43	Revving up to 4,000 rpm under no load at least 10 times	The voltage should be below 0.18 V at least once during this procedure.
P0158		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> GO TO 6.

6. PERFORM COMPONENT FUNCTION CHECK FOR MALFUNCTION B-II

Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0138	F79	84	F78	43	Keeping engine at idle for 10 minutes	The voltage should be below 0.18 V at least once during this procedure.
P0158		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END

NO >> GO TO 7.

7. PERFORM COMPONENT FUNCTION CHECK FOR MALFUNCTION B-III

Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0138	F79	84	F78	43	Coasting from 80 km/h (50 MPH) with selector lever in the D position	The voltage should be below 0.18 V at least once during this procedure.
P0158		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-355, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419563

1. INSPECTION START

Confirm the detected malfunction (A or B). Refer to EC-352, "DTC Description".

Which malfunction is detected?

A >> GO TO 2
B >> GO TO 7.

2. CHECK HEATED OXYGEN SENSOR 2 CONNECTOR

1. Disconnect heated oxygen sensor 2 (HO2S2) harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace harness or connectors.

3. CHECK HO2S2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0138	1	F57	1	F78	43	Existed
P0158	2	F54	1			

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK HO2S2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0138	1	F57	2	F79	84	Existed
P0158	2	F54	2		77	

2. Check the continuity between HO2S2 harness connector and ground, or ECM harness connector and ground.

DTC	HO2S2			ECM		Ground	Continuity
	Bank	Connector	Terminal	Connector	Terminal		
P0138	1	F57	2	F79	84	Ground	Not existed
P0158	2	F54	2		77		

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK HEATED OXYGEN SENSOR 2

Refer to EC-357, "Component Inspection (HO2 sensor 2)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6.REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

7.CLEAR THE MIXTURE RATIO SELF-LEARNING VALUE

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Run engine for at least 10 minutes at idle speed.

Is the 1st trip DTC P0172 or P0175 detected? Is it difficult to start engine?

YES >> Perform trouble diagnosis for DTC P0172, P0175. Refer to EC-377, "DTC Description".
NO >> GO TO 8.

8.CHECK HEATED OXYGEN SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect heated oxygen sensor 2 (HO2S2) harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0138	1	F57	1	F78	43	Existed
P0158	2	F54	1			

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

9.CHECK HO2S2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0138	1	F57	2	F79	84	Existed
P0158	2	F54	2		77	

2. Check the continuity between HO2S2 harness connector and ground, or ECM harness connector and ground.

DTC	HO2S2			ECM		Ground	Continuity
	Bank	Connector	Terminal	Connector	Terminal		
P0138	1	F57	2	F79	84	Ground	Not existed
P0158	2	F54	2		77		

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

10.CHECK HEATED OXYGEN SENSOR 2

Refer to EC-357, "Component Inspection (HO2 sensor 2)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 11.

11.REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

Component Inspection (HO2 sensor 2)

INFOID:0000000014419564

1.INSPECTION START

Will CONSULT be used?

Will CONSULT be used?

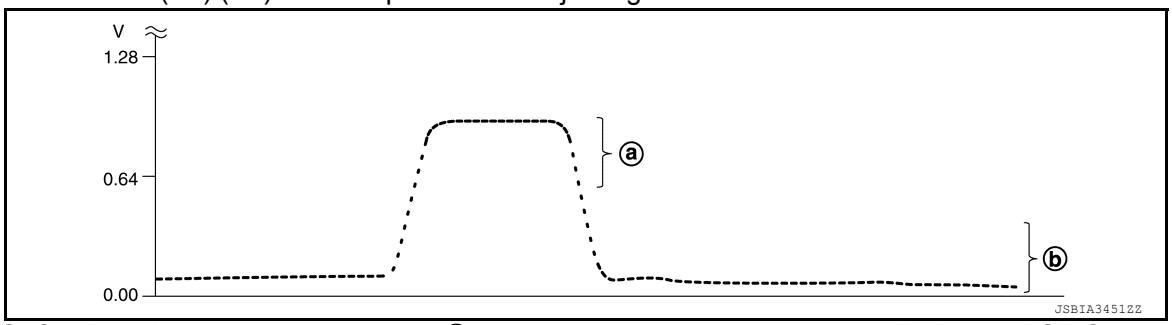
YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK HEATED OXYGEN SENSOR 2

With CONSULT

1. Start engine and warm it up to the normal operating temperature.
2. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
3. Let engine idle for 1 minute.
4. Select “FUEL INJECTION” in “ACTIVE TEST” mode, and select “HO2S2 (B1)/(B2)” as the monitor item with CONSULT.

5. Check “HO2S2 (B1)/(B2)” at idle speed when adjusting “FUEL INJECTION” to ±25%.



“HO2S2 (B1)/(B2)” should be above ⓐ: 0.73 V at least once when the “FUEL INJECTION” is +25%.
“HO2S2 (B1)/(B2)” should be below ⓑ: 0.18 V at least once when the “FUEL INJECTION” is −25%.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

3. CHECK HEATED OXYGEN SENSOR 2-I

Ⓧ Without CONSULT

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
4. Let engine idle for 1 minute.
5. Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Revving up to 4,000 rpm under no load at least 10 times	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 4.

4. CHECK HEATED OXYGEN SENSOR 2-II

Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Keeping engine at idle for 10 minutes	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5. CHECK HEATED OXYGEN SENSOR 2-III

Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Coasting from 80 km/h (50 MPH) with selector lever in the D position	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6. REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

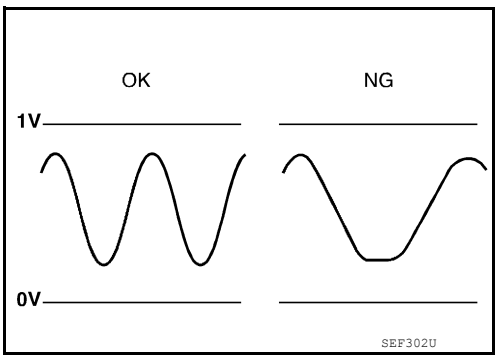
P0139, P0159 HO2S2

DTC Description

INFOID:0000000014419565

DTC DETECTION LOGIC

The heated oxygen sensor 2 has a much longer switching time between rich and lean than the air fuel ratio (A/F) sensor 1. The oxygen storage capacity of the three way catalyst 1 causes the longer switching time. To judge the malfunctions of heated oxygen sensor 2, ECM monitors whether the switching response of the sensor's voltage is faster than specified during various driving conditions such as fuel cut.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0139	HO2S2 (B1) [Heated oxygen sensor 2 (bank 1) circuit slow response]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 signal
		Threshold	The switching time between rich and lean of a heated oxygen sensor 2 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P0159	HO2S2 (B2) [Heated oxygen sensor 2 (bank 2) circuit slow response]	Diagnosis condition	—
		Signal (terminal)	Heated oxygen sensor 2 signal
		Threshold	The switching time between rich and lean of a heated oxygen sensor 2 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0139
- Harness or connectors (The sensor circuit is open or shorted)
- Heated oxygen sensor 2
- Fuel system
- EVAP system
- Intake air system

P0159
- Harness or connectors (The sensor circuit is open or shorted)
- Heated oxygen sensor 2
- Fuel system
- EVAP system
- Intake air system

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

Do you have CONSULT?

Do you have CONSULT?

YES >> GO TO 2.

NO >> GO TO 7.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
For better results, perform "DTC WORK SUPPORT" at a temperature of 0 to 30°C (32 to 86°F).

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

With CONSULT

1. Turn ignition switch ON and select "DATA MONITOR" mode with CONSULT.
2. Start engine and warm it up to the normal operating temperature.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Turn ignition switch OFF and wait at least 10 seconds.
6. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
7. Let engine idle for 1 minute.
8. Make sure that "COOLAN TEMP/S" indicates more than 70°C (158°F).
9. Drive the vehicle in a proper gear at 60 km/h (38MPH) and maintain the speed.
   CAUTION:
   Always drive vehicle at a safe speed.
10. Release the accelerator pedal fully at least 5 seconds.
    CAUTION:
    - **Enable the engine brake.**
    - **Always drive carefully.**
    - **Never apply brake when releasing the accelerator pedal.**
11. Repeat step 9 and 10 at least 8 times.
12. Check the following item of "DATA MONITOR".

DTC	Data monitor item	Status
P0139	HO2 S2 DIAG1 (B1)	CMPLT
	HO2 S2 DIAG2 (B1)	
P0159	HO2 S2 DIAG1 (B2)	
	HO2 S2 DIAG2 (B2)	

Is "CMPLT" displayed on CONSULT screen?

YES >> GO TO 6.
NO-1: "CMPLT" is not displayed on DIAG 1>>Perform DTC confirmation procedure again.
NO-2: "CMPLT" is not displayed on DIAG 2>>GO TO 4.

4.PERFORM DTC WORK SUPPORT

1. Open engine hood.
2. Select "HO2S2 (B1) P0139" or "HO2S2 (B2) P0159" of "HO2S2" in "DTC WORK SUPPORT" mode with CONSULT.
3. Start engine and follow the instruction of CONSULT display.
   NOTE:
   It will take at most 10 minutes until "COMPLETED" is displayed.

Is "COMPLETED" displayed on CONSULT screen?

YES >> GO TO 6.
NO >> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE AGAIN

1. Turn ignition switch OFF and leave the vehicle in a cool place (soak the vehicle).
2. Perform DTC confirmation procedure again.

>> GO TO 3.

6.PERFORM SELF-DIAGNOSIS

With CONSULT

Perform ECM self-diagnosis.

Is DTC “P0139” or “P0159” detected?

YES >> Proceed to EC-363, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

7.PERFORM COMPONENT FUNCTION CHECK-I

NOTE:

Use component function check to check the overall function of the heated oxygen sensor 2 circuit. During this check, a 1st trip DTC might not be confirmed.

WITH GST

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Restart engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0139	F79	84	F78	43	Revving up to 4,000 rpm under no load at least 10 times	A change of voltage should be more than 0.29 V for 1 second during this procedure.
P0159		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> GO TO 8.

8.PERFORM COMPONENT FUNCTION CHECK-II

Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0139	F79	84	F78	43	Keeping engine at idle for 10 minutes	A change of voltage should be more than 0.29 V for 1 second during this procedure.
P0159		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> GO TO 9.

9.PERFORM COMPONENT FUNCTION CHECK-III

Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0139	F79	84	F78	43	Coasting from 80 km/h (50 MPH) with selector lever in the D position	A change of voltage should be more than 0.29 V for 1 second during this procedure.
P0159		77				

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-363, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419566

1. CLEAR THE MIXTURE RATIO SELF-LEARNING VALUE

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Work Procedure".
2. Run engine for at least 10 minutes at idle speed.

Is the 1st trip DTC P0171, P0172, P0174 or P0175 detected? Is it difficult to start engine?

YES >> Perform trouble diagnosis for DTC P0171, P0174 or P0172, P0175. Refer to EC-373, "DTC Description" or EC-377, "DTC Description".
NO >> GO TO 2.

2. CHECK HEATED OXYGEN SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect heated oxygen sensor 2 (HO2S2) harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0139	1	F57	1	F78	43	Existed
P0159	2	F54	1			

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3. CHECK HO2S2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between HO2S2 harness connector and ECM harness connector.

DTC	HO2S2			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0139	1	F57	2	F79	84	Existed
P0159	2	F54	2		77	

2. Check the continuity between HO2S2 harness connector and ground, or ECM harness connector and ground.

DTC	HO2S2			ECM		Ground	Continuity
	Bank	Connector	Terminal	Connector	Terminal		
P0139	1	F57	2	F79	84	Ground	Not existed
P0159	2	F54	2		77		

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK HEATED OXYGEN SENSOR 2

Refer to EC-364, "Component Inspection (HO2 sensor 2)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5. REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

Component Inspection (HO2 sensor 2)

INFOID:0000000014419567

1. INSPECTION START

Will CONSULT be used?

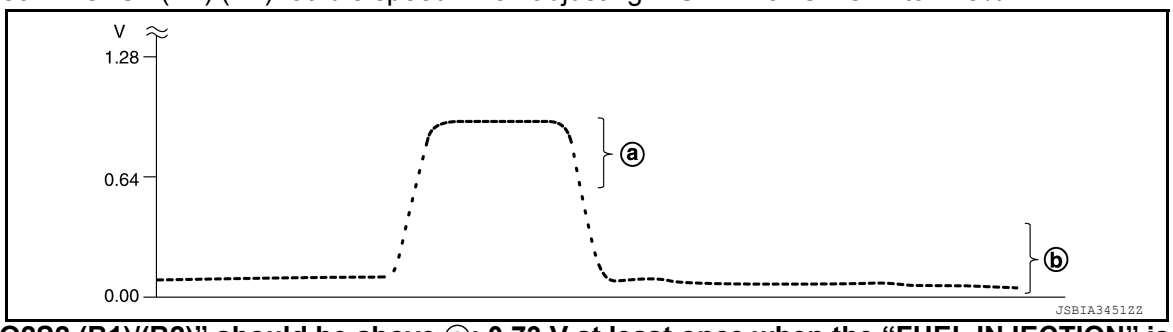
Will CONSULT be used?

YES >> GO TO 2.
NO >> GO TO 3.

2. CHECK HEATED OXYGEN SENSOR 2

With CONSULT

1. Start engine and warm it up to the normal operating temperature.
2. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
3. Let engine idle for 1 minute.
4. Select “FUEL INJECTION” in “ACTIVE TEST” mode, and select “HO2S2 (B1)/(B2)” as the monitor item with CONSULT.
5. Check “HO2S2 (B1)/(B2)” at idle speed when adjusting “FUEL INJECTION” to ±25%.



“HO2S2 (B1)/(B2)” should be above ⓐ: 0.73 V at least once when the “FUEL INJECTION” is +25%.
“HO2S2 (B1)/(B2)” should be below ⓑ: 0.18 V at least once when the “FUEL INJECTION” is −25%.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

3. CHECK HEATED OXYGEN SENSOR 2-I

Without CONSULT

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.

4. Let engine idle for 1 minute.
5. Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Revving up to 4,000 rpm under no load at least 10 times	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 4.

4. CHECK HEATED OXYGEN SENSOR 2-II

Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Keeping engine at idle for 10 minutes	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5. CHECK HEATED OXYGEN SENSOR 2-III

Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	84 [HO2S2 (bank 1)]	F78	43	Coasting from 80 km/h (50 MPH) with selector lever in the D position	The voltage should be above 0.73 V at least once during this procedure. The voltage should be below 0.18 V at least once during this procedure.
	77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6. REPLACE HEATED OXYGEN SENSOR 2

Replace malfunctioning heated oxygen sensor 2. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any heated oxygen sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**

- **Before installing new oxygen sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P014C, P014D, P014E, P014F, P015A, P015B, P015C, P015D A/F SENSOR 1

DTC Description

INFOID:0000000014419568

DTC DETECTION LOGIC

To judge malfunctions, this diagnosis measures response time of the A/F signal computed by ECM from the A/F sensor 1 signal. The time is compensated by engine operating (speed and load), fuel feedback control constant, and the A/F sensor 1 temperature index. Judgment is based on whether the compensated time (the A/F signal cycling time index) is inordinately long or not.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P014C	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit slow response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P014D	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit slow response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P015A	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit delayed response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P015B	A/F SENSOR1 (B1) [Air fuel ratio (A/F) sensor 1 (bank 1) circuit delayed response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P014E	A/F SENSOR1 (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit slow response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P014F	A/F SENSOR1 (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit slow response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—

P015C	A/F SENSOR (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit delayed response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—
P015D	A/F SENSOR (B2) [Air fuel ratio (A/F) sensor 1 (bank 2) circuit delayed response]	Diagnosis condition	—
		Signal (terminal)	Air fuel ratio sensor 1 signal
		Threshold	The response time of a A/F sensor 1 signal delays more than the specified time computed by ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The A/F sensor 1 circuit is open or shorted)
- A/F sensor 1

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is more than 11 V at idle.

Do you have CONSULT?

YES >> GO TO 2.
NO >> GO TO 6.

2.PERFORM DTC CONFIRMATION PROCEDURE-1

With CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1minute under no load.
6. Let engine idle for 1 minute.
7. Increase the engine speed up to about 3,600 rpm and keep it for 10 seconds.
8. Fully release accelerator pedal and then let engine idle for about 1 minute.
9. Check the items status of “DATA MONITOR” as follows.
   NOTE:
   If “PRSNT” changed to “ABSNT”, proceed to EC-220, "Component Function Check".

DTC	Data monitor item	Status
• P014C • P014D • P015A • P015B	A/F SEN1 DIAG3 (B1)	PRSNT
• P014E • P014F • P015C • P015D	A/F SEN1 DIAG3 (B2)	

Is “PRSNT” displayed on CONSULT screen?

YES >> GO TO 4.
NO >> GO TO 3.

3. PERFORM DTC CONFIRMATION PROCEDURE-2

With CONSULT

Perform DTC confirmation procedure-1 again.

Is “PRSNT” displayed on CONSULT screen?

YES >> GO TO 4.
NO >> Proceed to EC-370, "Diagnosis Procedure".

4. PERFORM DTC CONFIRMATION PROCEDURE-2

With CONSULT

1. Wait for about 20 seconds at idle.
2. Check the items status of “DATA MONITOR” as follows.
   NOTE:
   If “CMPLT” changed to “INCMP”, proceed to EC-220, "Component Function Check".

DTC	Data monitor item	Status
• P014C • P014D • P015A • P015B	A/F SEN1 DIAG1 (B1)	CMPLT
	A/F SEN1 DIAG2 (B1)	
• P014E • P014F • P015C • P015D	A/F SEN1 DIAG1 (B2)	
	A/F SEN1 DIAG2 (B2)	

Is “CMPLT” displayed on CONSULT screen?

YES >> GO TO 5.
NO >> Proceed to EC-370, "Diagnosis Procedure".

5. PERFORM SELF-DIAGNOSIS

With CONSULT

Check the “SELF-DIAG RESULT”.

Is any DTC detected?

YES >> Proceed to EC-370, "Diagnosis Procedure".
NO >> INSPECTION END

6. CHECK AIR-FUEL RATIO SELF-LEARNING VALUE

With GST

1. Start engine and warm it up to normal operating temperature.
2. Select Service $01 with GST.
3. Calculate the total value of “Short term fuel trim” and “Long term fuel trim” indications.

Is the total percentage within ±15%?

YES >> GO TO 8.
NO >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following.
- Intake air leaks
- Exhaust gas leaks
- Incorrect fuel pressure
- Lack of fuel
- Fuel injector
- Incorrect PCV hose connection
- PCV valve
- Mass air flow sensor

>> Repair or replace malfunctioning part.

8.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
5. Let engine idle for 1 minute.
6. Increase the engine speed up to about 3,600 rpm and keep it for 10 seconds.
7. Fully release accelerator pedal and then let engine idle for about 1 minute.
8. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-370, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419569

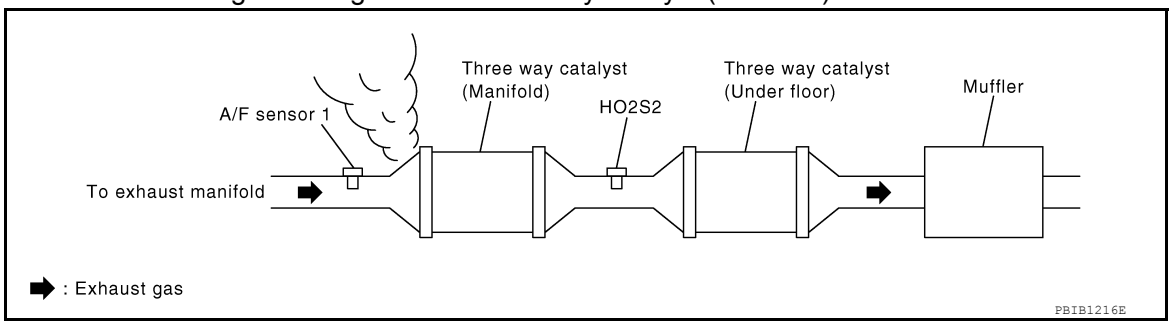
1.RETIGHTEN AIR FUEL RATIO SENSOR 1

Loosen and retighten the air fuel ratio (A/F) sensor 1. Refer to EM-45, "Exploded View".

>> GO TO 2.

2.CHECK EXHAUST GAS LEAKAGE

1. Start engine and run it at idle.
2. Listen for an exhaust gas leakage before three way catalyst (manifold).



Is exhaust gas leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 3.

3.CHECK FOR INTAKE AIR LEAKAGE

Listen for an intake air leakage after the mass air flow sensor.

Is intake air leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 4.

4.CLEAR THE MIXTURE RATIO SELF-LEARNING VALUE

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Run engine for at least 10 minutes at idle speed.

Is the 1st trip DTC P0171, P172, P0174 or P0175 detected? Is it difficult to start engine?

YES >> Perform trouble diagnosis for DTC P0171, P0174 or P0172, P0175. Refer to EC-373, "DTC Description" or EC-377, "DTC Description".
NO >> GO TO 5.

5.CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between A/F sensor 1 harness connector and ground.

DTC	A/F sensor 1			Ground	Voltage
	Bank	Connector	Terminal		
P014C P014D P015A P015B	1	F25	1	Ground	Battery voltage
P014E P014F P015C P015D	2	F16	1		

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6. CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between A/F sensor 1 harness connector and IPDM E/R harness connector.

DTC	A/F sensor 1			IPDM E/R		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P014C P014D P015A P015B	1	F25	1	E121	25	Existed
P014E P014F P015C P015D	2	F16	1			

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform trouble diagnosis for power supply circuit.
NO >> Repair or replace malfunctioning part.

7. CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P014C P014D P015A P015B	1	F25	4	F79	79	Existed
			3		74	
P014E P014F P015C P015D	2	F16	4	F79	69	
			3		70	

4. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P014C P014D P015A P015B	1	F25	4	Ground	Not Existed
			3		
P014E P014F P015C P015D	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P014C P014D P015A P015B	1	F79	79	Ground	Not Existed
			74		
P014E P014F P015C P015D	2	F79	69		
			70		

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace malfunctioning part.

8.CHECK A/F SENSOR 1 HEATER

Refer to EC-286, "Component Inspection (A/F Sensor 1 Heater)".

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 11.

9.CHECK MASS AIR FLOW SENSOR

Check mass air flow sensor.
Refer to EC-316, "Component Inspection (MAF Sensor)".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace malfunctioning mass air flow sensor. Refer to EM-35, "Removal and Installation".

10.CHECK PCV VALVE

Refer to EC-726, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace PCV valve.

11.REPLACE A/F SENSOR 1

Replace malfunctioning A/F sensor 1. Refer to EM-45, "Exploded View".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

>> INSPECTION END

P0171, P0174 FUEL INJECTION SYSTEM FUNCTION

DTC Description

INFOID:0000000014419570

DTC DETECTION LOGIC

With the Air/Fuel Mixture Ratio Self-Learning Control, the actual mixture ratio can be brought closely to the theoretical mixture ratio based on the mixture ratio feedback signal from A/F sensor 1. The ECM calculates the necessary compensation to correct the offset between the actual and the theoretical ratios.
In case the amount of the compensation value is extremely large (the actual mixture ratio is too lean), the ECM judges the condition as the fuel injection system malfunction and illuminates the MIL (2 trip detection logic).

Sensor	Input signal to ECM	ECM function	Actuator
A/F sensor 1	Density of oxygen in exhaust gas (Mixture ratio feedback signal)	Fuel injection control	Fuel injector

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0171	FUEL SYS-LEAN-B1 [Fuel injection system too lean (bank 1)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Fuel injection system does not operate properly
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	The amount of mixture ratio compensation is too large (The mixture ratio is too lean)
			Diagnosis delay time	—
P0174	FUEL SYS-LEAN-B2 [Fuel injection system too lean (bank 2)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Fuel injection system does not operate properly
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	The amount of mixture ratio compensation is too large (The mixture ratio is too lean)
			Diagnosis delay time	—

POSSIBLE CAUSE

P0171
- Intake air leakage
- A/F sensor 1
- Fuel injector
- Exhaust gas leakage
- Incorrect fuel pressure
- Lack of fuel
- Mass air flow sensor
- Incorrect PCV hose connection

P0174
- Intake air leakage
- A/F sensor 1

- Fuel injector
- Exhaust gas leakage
- Incorrect fuel pressure
- Lack of fuel
- Mass air flow sensor
- Incorrect PCV hose connection

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Start engine.

Is it difficult to start engine?

YES >> GO TO 3.
NO >> GO TO 4.

3.RESTART ENGINE

If it is difficult to start engine, the fuel injection system has a malfunction, too.
Crank engine while depressing accelerator pedal.

NOTE:
When depressing accelerator pedal three fourths (3/4) or more, the control system does not start the engine. Do not depress accelerator pedal too much.

Does engine start?

YES >> Proceed to EC-375, "Diagnosis Procedure".
NO >> Check exhaust and intake air leakage visually.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Keep engine idle for at least 5 minutes.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-375, "Diagnosis Procedure".
NO >> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE-III

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Start engine.
5. Maintain the following conditions for at least 10 consecutive minutes.
   Hold the accelerator pedal as steady as possible.

Vehicle speed	50 - 120 km/h (31 - 75 MPH)

CAUTION:
Always drive vehicle at a safe speed.

6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-375, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".

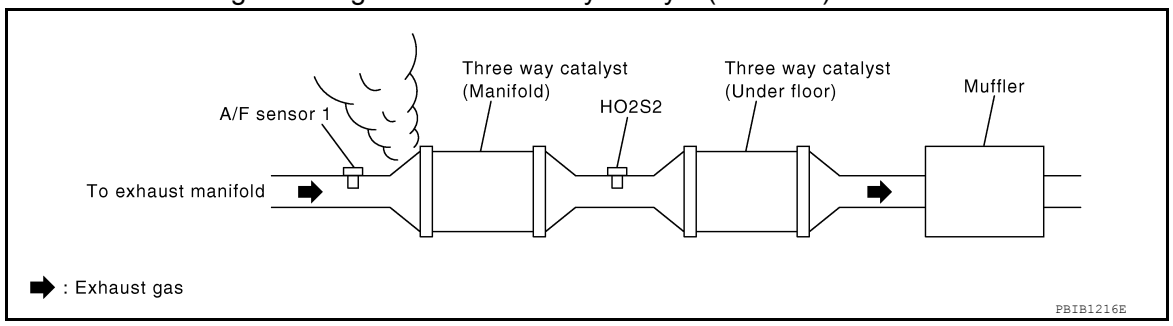
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419571

1.CHECK EXHAUST GAS LEAKAGE

1. Start engine and run it at idle.
2. Listen for an exhaust gas leakage before three way catalyst (manifold).



Is exhaust gas leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 2.

2.CHECK FOR INTAKE AIR LEAKAGE

1. Listen for an intake air leakage after the mass air flow sensor.
2. Check PCV hose connection.

Is intake air leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 3.

3.CHECK A/F SENSOR 1 CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect corresponding A/F sensor 1 harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0171	1	F25	4	F79	79	Existed
			3		74	
P0174	2	F16	4	F79	69	
			3		70	

5. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P0171	1	F25	4	Ground	Not Existed
			3		
P0174	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P0171	1	F79	79	Ground	Not Existed
			74		
P0174	2	F79	69		
			70		

6. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK FUEL PRESSURE

Check fuel pressure. Refer to EC-205, "Work Procedure".

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. DETECT MALFUNCTIONING PART

Check fuel hoses and fuel tubes for clogging.

Is the inspection result normal?

YES >> Replace “fuel filter and fuel pump assembly”. Refer to FL-6, "Removal and Installation".
NO >> Repair or replace malfunctioning part.

6. CHECK MASS AIR FLOW SENSOR

WITH CONSULT
1. Install all removed parts.
2. Check “MASS AIR FLOW” in “DATA MONITOR” mode with CONSULT.
   For specification, refer to EC-730, "Mass Air Flow Sensor".

WITH GST
1. Install all removed parts.
2. Check mass air flow sensor signal in Service $01 with GST.
   For specification, refer to EC-730, "Mass Air Flow Sensor".

Is the measurement value within the specification?

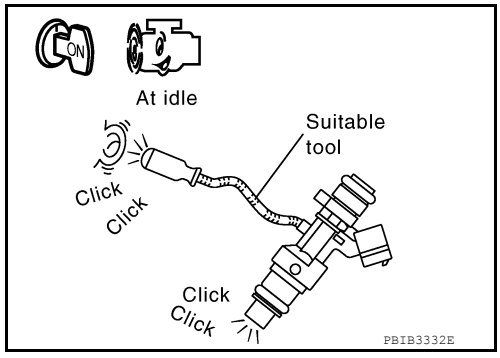
YES >> GO TO 7.
NO >> Check connectors for rusted terminals or loose connections in the mass air flow sensor circuit or grounds. Refer to EC-315, "Diagnosis Procedure".

7. CHECK FUNCTION OF FUEL INJECTOR

WITH CONSULT
1. Start engine.
2. Perform “POWER BALANCE” in “ACTIVE TEST” mode with CONSULT.
3. Check that each circuit produces a momentary engine speed drop.

WITHOUT CONSULT
1. Start engine and let it idle.
2. Listen to each fuel injector operating sound.

Clicking sound should be heard.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Perform trouble diagnosis for fuel injector, refer to EC-685, "Diagnosis Procedure".

P0172, P0175 FUEL INJECTION SYSTEM FUNCTION

DTC Description

INFOID:0000000014419572

DTC DETECTION LOGIC

With the Air/Fuel Mixture Ratio Self-Learning Control, the actual mixture ratio can be brought closely to the theoretical mixture ratio based on the mixture ratio feedback signal from A/F sensor 1. The ECM calculates the necessary compensation to correct the offset between the actual and the theoretical ratios.
In case the amount of the compensation value is extremely large (the actual mixture ratio is too rich), the ECM judges the condition as the fuel injection system malfunction and illuminates the MIL (2 trip detection logic).

Sensor	Input signal to ECM	ECM function	Actuator
A/F sensor 1	Density of oxygen in exhaust gas (Mixture ratio feedback signal)	Fuel injection control	Fuel injector

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0172	FUEL SYS-RICH-B1 [Fuel injection system too rich (bank 1)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Fuel injection system does not operate properly
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	The amount of mixture ratio compensation is too large (The mixture ratio is too rich)
			Diagnosis delay time	—
P0175	FUEL SYS-RICH-B2 [Fuel injection system too rich (bank 2)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Fuel injection system does not operate properly
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	The amount of mixture ratio compensation is too large (The mixture ratio is too rich)
			Diagnosis delay time	—

POSSIBLE CAUSE

P0172
- A/F sensor 1
- Fuel injector
- Exhaust gas leakage
- Incorrect fuel pressure
- Mass air flow sensor

P0175
- A/F sensor 1
- Fuel injector
- Exhaust gas leakage
- Incorrect fuel pressure
- Mass air flow sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Start engine.

Is it difficult to start engine?

YES >> GO TO 3.
NO >> GO TO 4.

3.RESTART ENGINE

If it is difficult to start engine, the fuel injection system has a malfunction, too.
Crank engine while depressing accelerator pedal.

NOTE:
When depressing accelerator pedal three fourths (3/4) or more, the control system does not start the engine. Do not depress accelerator pedal too much.

Does engine start?

YES >> Proceed to EC-378, "Diagnosis Procedure".
NO >> Remove spark plugs and check for fouling, etc.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Keep engine idle for at least 5 minutes.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-378, "Diagnosis Procedure".
NO >> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE-III

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Start engine.
5. Maintain the following conditions for at least 10 consecutive minutes.
   Hold the accelerator pedal as steady as possible.

Vehicle speed	50 - 120 km/h (31 - 75 MPH)

CAUTION:
Always drive vehicle at a safe speed.

6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-378, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

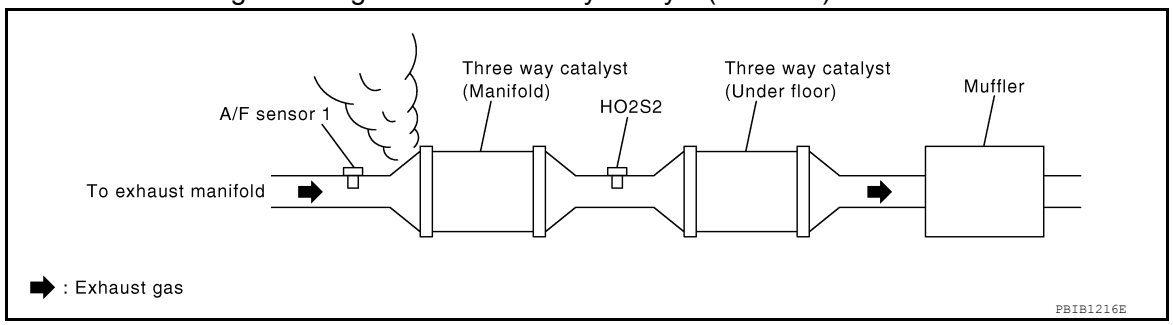
Diagnosis Procedure

INFOID:0000000014419573

1.CHECK EXHAUST GAS LEAKAGE

1. Start engine and run it at idle.

2. Listen for an exhaust gas leakage before three way catalyst (manifold).



Is exhaust gas leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 2.

2. CHECK FOR INTAKE AIR LEAKAGE

Listen for an intake air leakage after the mass air flow sensor.

Is intake air leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 3.

3. CHECK A/F SENSOR 1 CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect corresponding A/F sensor 1 harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0172	1	F25	4	F79	79	Existed
			3		74	
P0175	2	F16	4	F79	69	
			3		70	

5. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P0172	1	F25	4	Ground	Not Existed
			3		
P0175	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P0172	1	F79	79	Ground	Not Existed
			74		
P0175	2	F79	69		
			70		

6. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 4.

NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK FUEL PRESSURE

Check fuel pressure. Refer to EC-205, "Work Procedure".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace fuel filter and fuel pump assembly". Refer to FL-6, "Removal and Installation".

5. CHECK MASS AIR FLOW SENSOR

WITH CONSULT
1. Install all removed parts.
2. Check "MASS AIR FLOW" in "DATA MONITOR" mode with CONSULT.
   For specification, refer to EC-730, "Mass Air Flow Sensor".

WITH GST
1. Install all removed parts.
2. Check mass air flow sensor signal in "Service $01" with GST.
   For specification, refer to EC-730, "Mass Air Flow Sensor".

Is the measurement value within the specification?

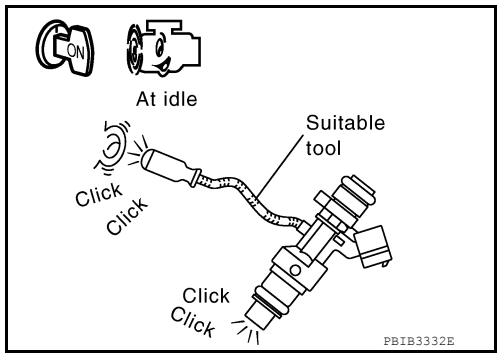
YES >> GO TO 6.
NO >> Check connectors for rusted terminals or loose connections in the mass air flow sensor circuit or grounds. Refer to EC-315, "Diagnosis Procedure".

6. CHECK FUNCTION OF FUEL INJECTOR

WITH CONSULT
1. Start engine.
2. Perform "POWER BALANCE" in "ACTIVE TEST" mode with CONSULT.
3. Check that each circuit produces a momentary engine speed drop.

WITHOUT CONSULT
1. Start engine and let it idle.
2. Listen to each fuel injector operating sound.

Clicking sound should be heard.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Perform trouble diagnosis for fuel injector, refer to EC-685, "Diagnosis Procedure".

P0181 FTT SENSOR

DTC Description

INFOID:0000000014419574

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0181	FTT SENSOR [Fuel tank temperature (FTT) sensor circuit range/performance]	A)	Diagnosis condition	—
			Signal (terminal)	FTT sensor signal
			Threshold	Rationally incorrect voltage from the sensor is sent to ECM, compared with the voltage signals from ECT sensor 1 and intake air temperature sensor
			Diagnosis delay time	—
		B)	Diagnosis condition	Engine is started with its cold state
			Signal (terminal)	FTT sensor signal
			Threshold	The comparison result of signals transmitted to ECM from each temperature sensor (IAT sensor, ECT sensor 1, EOT sensor, and FTT sensor) shows that the voltage signal of the FTT sensor is higher/lower than that of other temperature sensors
			Diagnosis delay time	—

POSSIBLE CAUSE

P0181-A
- Harness or connectors (The FTT sensor circuit is open or shorted)
- FTT sensor
- Combination meter

P0181-B
- Harness or connectors (High or low resistance in the FTT sensor circuit)
- FTT sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

Is it necessary to erase permanent DTC?

YES >> GO TO 7.
NO >> GO TO 2.

2.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A-I

1. Turn ignition switch ON and wait at least 10 seconds.

2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-383, "Diagnosis Procedure".
NO >> GO TO 4.

4. CHECK ENGINE COOLANT TEMPERATURE

With CONSULT
1. Select “COOLAN TEMP/S” in “DATA MONITOR” with CONSULT.
2. Check “COOLAN TEMP/S” value.

With GST
Follow the procedure “With CONSULT” above.

“COOLAN TEMP/S” less than 60°C (140°F)?

YES >> INSPECTION END
NO >> GO TO 5.

5. PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A-II

With CONSULT
1. Cool engine down until “COOLAN TEMP/S” is less than 60°C (140°F).
2. Wait at least 10 seconds.
3. Check 1st trip DTC.

With GST
Follow the procedure “With CONSULT” above.

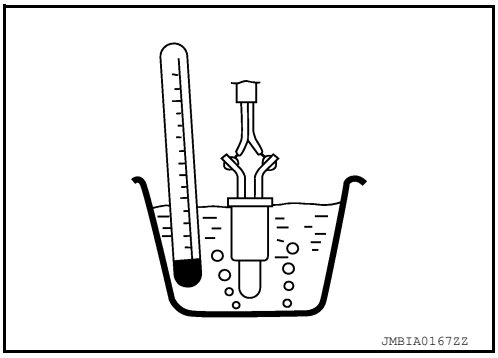
Is 1st trip DTC detected?

YES >> Proceed to EC-383, "Diagnosis Procedure".
NO >> GO TO 6.

6. PERFORM COMPONENT FUNCTION CHECK (FOR MALFUNCTION B)

NOTE:
Use the component function check to check the overall function of the FTT sensor circuit. During this check, a 1st trip DTC might not be confirmed.

1. Turn ignition switch OFF.
2. Disconnect fuel level sensor unit and fuel pump harness connector.
3. Remove fuel level sensor unit. Refer to FL-6, "Removal and Installation".
4. Check resistance between fuel level sensor unit and fuel pump terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
3 and 4	Temperature [°C (°F)]	20 (68)	2.3 – 2.7
		50 (122)	0.79 – 0.90

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-383, "Diagnosis Procedure".

7. PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
- **Before performing the following procedure, do not add fuel.**
- **Before performing the following procedure, check that fuel level is between 1/4 and 4/4.**
- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**

>> GO TO 8.

8. PERFORM DTC CONFIRMATION PROCEDURE B

1. Move the vehicle to a cool place.
   NOTE:
   Cool the vehicle in an environment of ambient air temperature between −10°C (14°F) and 35°C (95°F).
2. Turn ignition switch OFF and leave the vehicle for 12 hours.
   CAUTION:
   Never turn ignition switch ON during this procedure.
   NOTE:
   The vehicle must be cooled with the hood open.
3. Start engine and let it idle for 5 minutes or more.
   CAUTION:
   Never turn ignition switch OFF during idling.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-383, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419575

1. INSPECTION START

Confirm the detected malfunction (A or B). Refer to EC-381, "DTC Description".

Which malfunction is detected?

A >> GO TO 2.
B >> GO TO 7.

2. CHECK FUEL TANK TEMPERATURE (FTT) SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect fuel level sensor unit and fuel pump harness connector.
3. Turn ignition switch ON.
4. Check the voltage between fuel level sensor unit and fuel pump harness connector and ground.

Fuel level sensor unit and fuel pump		Ground	Voltage (V)
Connector	Terminal		
C37	3	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and fuel level sensor unit and fuel pump
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connector.

4. CHECK FUEL TANK TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel tank temperature sensor harness connector and ECM harness connector.

Fuel level sensor unit and fuel pump		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C37	3	E16	128	Existed

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FUEL TANK TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel level sensor unit and fuel pump harness connector and ECM harness connector.

Fuel level sensor unit and fuel pump		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C37	4	E16	148	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit, short to ground or short to power in harness or connector.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between fuel level sensor unit and fuel pump and combination meter
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connector.

7.CHECK FTT SENSOR

Check FTT sensor. Refer to EC-384, "Component Inspection".

Is the inspection result normal?

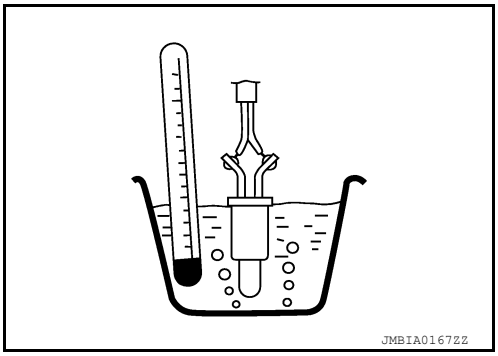
YES >> INSPECTION END
NO >> Replace fuel level sensor unit and fuel pump. Refer to FL-6, "Removal and Installation".

Component Inspection

INFOID:0000000014419576

1.CHECK FUEL TANK TEMPERATURE (FTT) SENSOR

1. Turn ignition switch OFF.
2. Disconnect fuel level sensor unit and fuel pump harness connector.
3. Remove fuel level sensor unit. Refer to FL-6, "Removal and Installation".
4. Check resistance between fuel level sensor unit and fuel pump terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
3 and 4	Temperature [°C (°F)]	20 (68)	2.3 – 2.7
		50 (122)	0.79 – 0.90

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel level sensor unit and fuel pump. Refer to FL-6, "Removal and Installation".

P0182, P0183 FTT SENSOR

DTC Description

INFOID:0000000014419577

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0182	FTT SEN/CIRCUIT (Fuel temperature sensor “A” circuit low)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Fuel tank temperature sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0183	FTT SEN/CIRCUIT (Fuel temperature sensor “A” circuit high)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Fuel tank temperature sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0182
- Harness or connectors (The FTT sensor circuit is open or shorted)
- Fuel tank temperature sensor
- Combination meter

P0183
- Harness or connectors (The FTT sensor circuit is open or shorted)
- Fuel tank temperature sensor
- Combination meter

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-385, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419578

1.CHECK FUEL TANK TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect “fuel level sensor unit and fuel pump” harness connector.
3. Turn ignition switch ON.
4. Check the voltage between “fuel level sensor unit and fuel pump” harness connector and ground.

Fuel level sensor unit and fuel pump		Ground	Voltage (V)
Connector	Terminal		
C37	3	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and “fuel level sensor unit and fuel pump”
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connector.

3.CHECK FUEL TANK TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel tank temperature sensor harness connector and ECM harness connector.

Fuel level sensor unit and fuel pump		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C37	3	E16	128	Existed

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FUEL TANK TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel level sensor unit and fuel pump harness connector and ECM harness connector.

Fuel level sensor unit and fuel pump		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C37	4	E16	148	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between “fuel level sensor unit and fuel pump” and “combination meter”
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connector.

6.CHECK FUEL TANK TEMPERATURE SENSOR

Refer to EC-387, "Component Inspection (Fuel Tank Temperature Sensor)".

Is the inspection result normal?

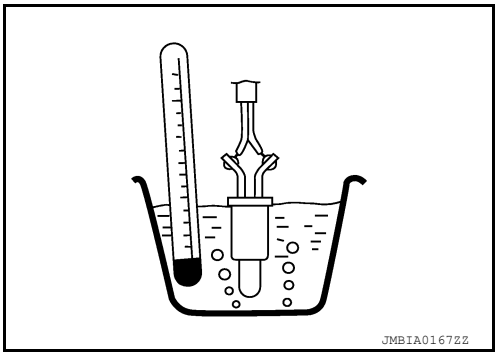
YES >> INSPECTION END
NO >> Replace “fuel level sensor unit and fuel pump”. Refer to FL-6, "Removal and Installation".

Component Inspection (Fuel Tank Temperature Sensor)

INFOID:0000000014419579

1. CHECK FUEL TANK TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect “fuel level sensor unit and fuel pump” harness connector.
3. Remove fuel level sensor unit.
4. Check resistance between “fuel level sensor unit and fuel pump ” terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
3 and 4	Temperature [°C (°F)]	20 (68)	2.3 - 2.7
		50 (122)	0.79 - 0.90

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace “fuel level sensor unit and fuel pump”.

P0190, P0192, P0193 FRP SENSOR

DTC Description

INFOID:0000000014419580

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0190	FUEL PRES SEN/CIRCUIT (Fuel rail pressure sensor “A” circuit)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Signal voltage from the fuel rail pressure sensor remains at more than 4.84 V / less than 0.2 V
		Diagnosis delay time	5 seconds or more
P0192	FRP SEN/CIRC (Fuel rail pressure sensor “A” circuit low)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Signal voltage from the fuel rail pressure sensor remains at less than 0.37 V
		Diagnosis delay time	5 seconds or more
P0193	FRP SEN/CIRC (Fuel rail pressure sensor “A” circuit high)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Signal voltage from the fuel rail pressure sensor remains at more than 3.46 V
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

P0190
- Harness or connectors (Fuel rail pressure sensor circuit is open or shorted)
- Fuel rail pressure sensor
- Sensor power supply 3

P0192
- Harness or connectors (Fuel rail pressure sensor circuit is open or shorted)
- Fuel rail pressure sensor
- Sensor power supply 3

P0193
- Harness or connectors (Fuel rail pressure sensor circuit is open or shorted)
- Fuel rail pressure sensor
- Sensor power supply 3

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0190	FRP sensor	• Engine speed is limited. • High pressure fuel pump is activated at maximum discharge pressure.

P0192 and P0193
Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine ON and wait at least 60 seconds.
2. Check DTC or 1st trip DTC.

Is DTC or 1st trip DTC detected?

YES >> Proceed to EC-389, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419581

NOTE:
Turning the ignition switch ON with FRP sensor harness connector disconnected causes ECM to detect DTC P0190. Be sure to erase the DTC when the diagnosis procedure.

1.CHECK FRP SENSOR POWER SUPPLY-I

1. Turn ignition switch OFF.
2. Disconnect FRP sensor connector.
3. Turn ignition switch ON.
4. Check the voltage between FRP sensor harness connector terminals.

FRP sensor			Voltage (Approx.)
Connector	+ terminal	–	
F91	1	3	5 V

Inspection result normal?

YES >> GO TO 4.
NO >> GO TO 2.

2.CHECK FRP SENSOR POWER SUPPLY-II

Check the voltage between FRP sensor harness connector and the ground.

+ FRP sensor		–	Voltage (Approx.)
Connector	Terminal		
F91	1	Ground	5 V

Is inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

4.CHECK FRP SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

+		–		Continuity
FRP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F91	3	F78	13	Existed

Is inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK ECM GROUND CIRCUIT

Check the continuity between ECM harness connector and the ground.

ECM		Ground	Continuity
Connector	Terminal		
E16	147	Ground	Existed
	149		
	152		

Is inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FRP SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

+		–		Continuity
FRP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F91	2	F78	25	Existed

4. Also check harness for short to ground and to power.

Is inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK FRP SENSOR

Refer to EC-390, "Component Inspection (Fuel Rail Pressure Sensor)".

Is inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace error-detected parts.

Component Inspection (Fuel Rail Pressure Sensor)

INFOID:0000000014419582

1.CHECK FRP SENSOR

WITH CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start the engine.
4. Select “DATA MONITOR” mode with CONSULT.
5. Check that the “FUEL PRES SEN V” indication.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Engine speed: Idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

WITHOUT CONSULT
1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start the engine.
4. Check FRP sensor signal voltage.

+		–		Condition	Value (Approx.)
ECM					
Connector	Terminal	Connector	Terminal		
F78	25	F78	13	[Engine is running] • Warm-up condition • Idle speed	0.82 – 1.22 V
				[Engine is running] • Warm-up condition • Revving engine from idle to 4,000 rpm quickly	0.82 – 3.06 V

Is the inspection result normal?

YES >> INSPECTION END.
NO >> Replace FRP sensor. Refer to EM-57, "Exploded View".

P0191 FRP SENSOR

DTC Description

INFOID:0000000014419583

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0191	FRP SENSOR A (Fuel rail pressure sensor “A” circuit range/performance)	Diagnosis condition	—
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Fuel rail pressure remains at more than 14.5 MPa (147.9 kg/cm^2, 2102.5 psi)
		Diagnosis delay time	0.2 seconds or more

POSSIBLE CAUSE

- Harness or connectors (Fuel rail pressure sensor circuit is open or shorted)
- Fuel rail pressure sensor
- Sensor power supply 3

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and warm it up to the normal operating temperature.
   NOTE:
   Warm up the engine until “COOLAN TEMP/S” on “DATA MONITOR” of CONSULT reaches at least 70°C (158°F).
2. Turn the ignition switch OFF and cool the engine until the engine coolant temperature reaches 35°C (95°F) or less.
   CAUTION:
   - **The difference between air temperature and engine coolant temperature must be 5°C (9°F) or less.**
   - **Do not turn ignition switch ON.**
3. Turn ignition switch ON and wait at least 60 seconds.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-392, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419584

NOTE:
Turning the ignition switch ON with FRP sensor harness connector disconnected causes ECM to detect DTC P0190. Be sure to erase the DTC when the diagnosis procedure.

1.CHECK FRP SENSOR POWER SUPPLY-I

1. Turn ignition switch OFF.

2. Disconnect FRP sensor connector.
3. Turn ignition switch ON.
4. Check the voltage between FRP sensor harness connector terminals.

FRP sensor			Voltage (Approx.)
Connector	+	–	
	terminal		
F91	1	3	5 V

Inspection result normal?

YES >> GO TO 4.
NO >> GO TO 2.

2.CHECK FRP SENSOR POWER SUPPLY-II

Check the voltage between FRP sensor harness connector and the ground.

+		–	Voltage (Approx.)
FRP sensor			
Connector	Terminal		
F91	1	Ground	5 V

Is inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

4.CHECK FRP SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

+		–		Continuity
FRP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F91	3	F78	13	Existed

Is inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK ECM GROUND CIRCUIT

Check the continuity between ECM harness connector and the ground.

ECM		Ground	Continuity
Connector	Terminal		
E16	147	Ground	Existed
	149		
	152		

Is inspection result normal?

YES >> GO TO 6.

NO >> Repair or replace error-detected parts.

6.CHECK FRP SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

+		–		Continuity
FRP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F91	2	F78	25	Existed

4. Also check harness for short to ground and to power.

Is inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK FRP SENSOR

Refer to EC-390, "Component Inspection (Fuel Rail Pressure Sensor)".

Is inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace error-detected parts.

Component Inspection (Fuel Rail Pressure Sensor)

INFOID:0000000014419585

1.CHECK FRP SENSOR

WITH CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start the engine.
4. Select “DATA MONITOR” mode with CONSULT.
5. Check that the “FUEL PRES SEN V” indication.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Engine speed: Idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

WITHOUT CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start the engine.
4. Check FRP sensor signal voltage.

+		–		Condition	Value (Approx.)
ECM					
Connector	Terminal	Connector	Terminal		
F78	25	F78	13	[Engine is running] • Warm-up condition • Idle speed	0.82 – 1.22 V
				[Engine is running] • Warm-up condition • Revving engine from idle to 4,000 rpm quickly	0.82 – 3.06 V

Is the inspection result normal?

YES >> INSPECTION END.
NO >> Replace FRP sensor. Refer to EM-57, "Exploded View".

P0196 EOT SENSOR

DTC Description

INFOID:0000000014419586

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0196	EOT SENSOR [Engine oil temperature (EOT) sensor circuit range/performance]	A)	Diagnosis condition	—
			Signal (terminal)	Engine oil temperature sensor signal
			Threshold	Rationally incorrect voltage from the sensor is sent to ECM, compared with the voltage signals from EOT sensor and intake air temperature sensor
			Diagnosis delay time	—
		B)	Diagnosis condition	Engine is started with its cold state
			Signal (terminal)	Engine oil temperature sensor signal
			Threshold	The comparison result of signals transmitted to ECM from each temperature sensor (IAT sensor, ECT sensor 1, FTT sensor, and EOT sensor) shows that the signal voltage of the EOT sensor is higher/lower than that of other temperature sensors
			Diagnosis delay time	—

POSSIBLE CAUSE

P0196-A
- Harness or connectors (The EOT sensor circuit is open or shorted)
- EOT sensor

P0196-B
- Harness or connectors (High or low resistance in the EOT sensor circuit)
- EOT sensor

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0196	Engine oil temperature sensor	Exhaust valve timing control does not function.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0196 is displayed with DTC P0197 or P0198, first perform the confirmation procedure for DTC P0197 or P0198.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-399, "DTC Description".
NO >> GO TO 2.

2.INSPECTION START

Is it necessary to erase permanent DTC?

YES >> GO TO 7.
NO >> GO TO 3.

3.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE FOR MULFUNCTION A-I

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and let it idle for 5 minutes and 10 seconds.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-397, "Diagnosis Procedure".
NO >> GO TO 5.

5. PERFORM DTC CONFIRMATION PROCEDURE FOR MULFUNCTION A-II

With CONSULT
1. Select “DATA MONITOR” mode with CONSULT.
2. Check that “COOLAN TEMP/S” indicates above 60°C (140°F).
   If it is above 80°C (176°F), go to the following steps.
   If it is below 60°C (140°F), warm engine up until “COOLAN TEMP/S” indicates more than 60°C (140°F). Then perform the following steps.
3. Turn ignition switch OFF and soak the vehicle in a cool place.
4. Turn ignition switch ON.
   NOTE:
   Do not turn ignition switch OFF until step 8.
5. Select “DATA MONITOR” mode with CONSULT.
6. Check the following.

COOLAN TEMP/S	Below 40°C (104°F)
INT/A TEMP SE	Below 40°C (104°F)
Difference between “COOLAN TEMP/S” and “INT/A TEMP SE”	Within 6°C (11°F)

   If they are within the specified range, perform the following steps.
   If they are out of the specified range, soak the vehicle to meet the above conditions. Then perform the following steps.
   NOTE:
   - **Do not turn ignition switch OFF.**
   - **If it is supposed to need a long period of time, do not deplete the battery.**
7. Start engine and let it idle for 5 minutes.
8. Check 1st trip DTC.

With GST
Follow the procedure “With CONSULT” above.

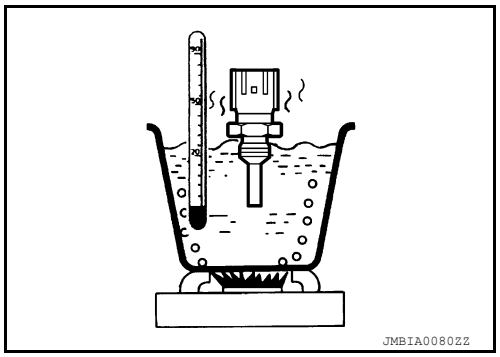
Is 1st trip DTC detected?

YES >> Proceed to EC-397, "Diagnosis Procedure".
NO >> GO TO 6.

6. PERFORM COMPONENT FUNCTION CHECK (FOR MULFUNCTION B)

NOTE:
Use the component function check to check the overall function of the EOT sensor circuit. During this check, a 1st trip DTC might not be confirmed.
1. Turn ignition switch OFF.
2. Disconnect EOT sensor harness connector.

3. Remove EOT sensor. Refer to EM-64, "Exploded View".
4. Check resistance between EOT sensor terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 – 2.73
		50 (122)	0.68 – 1.00
		90 (194)	0.236 – 0.260

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-397, "Diagnosis Procedure".

7. PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, do not add fuel.**
- **Before performing the following procedure, check that fuel level is between 1/4 and 4/4.**
- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**

>> GO TO 8.

8. PERFORM DTC CONFIRMATION PROCEDURE B

1. Move the vehicle to a cool place.
   NOTE:
   Cool the vehicle in an environment of ambient air temperature between −10°C (14°F) and 35°C (95°F).
2. Turn ignition switch OFF and soak the vehicle for 12 hours.
   CAUTION:
   Never turn ignition switch ON during soaking.
   NOTE:
   The vehicle must be cooled with the hood open.
3. Start engine and let it idle for 5 minutes or more.
   CAUTION:
   Never turn ignition switch OFF during idling.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-397, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419587

1. CHECK DTC PRIORITY

If DTC P0196 is displayed with DTC P0197 or P0198, first perform the confirmation procedure for DTC P0197 or P0198.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-399, "DTC Description".
NO >> GO TO 2.

2. CHECK ENGINE OIL TEMPERATURE (EOT) SENSOR

Check EOT sensor. Refer to EC-398, "Component Inspection".

Is the inspection result normal?

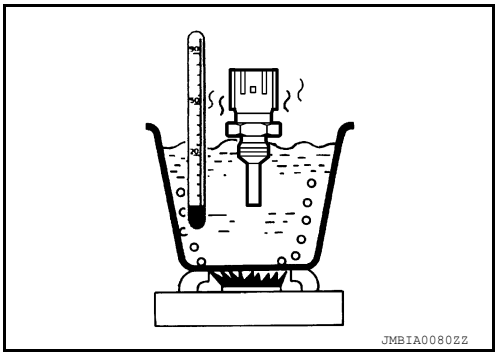
YES >> INSPECTION END
NO >> Replace EOT sensor. Refer to EM-64, "Exploded View".

Component Inspection

INFOID:0000000014419588

1. CHECK ENGINE OIL TEMPERATURE (EOT) SENSOR

1. Turn ignition switch OFF.
2. Disconnect EOT sensor harness connector.
3. Remove EOT sensor. Refer to EM-64, "Exploded View".
4. Check resistance between EOT sensor terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 – 2.73
		50 (122)	0.68 – 1.00
		90 (194)	0.236 – 0.260

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EOT sensor. Refer to EM-64, "Exploded View".

P0197, P0198 EOT SENSOR

DTC Description

INFOID:0000000014419589

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0197	EOT SEN/CIRC (Engine oil temperature sensor circuit low input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Engine oil temperature sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0198	EOT SEN/CIRC (Engine oil temperature sensor circuit high input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Engine oil temperature sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0197
- Harness or connectors (The engine oil temperature sensor circuit is open or shorted)
- Engine oil temperature sensor

P0198
- Harness or connectors (The engine oil temperature sensor circuit is open or shorted)
- Engine oil temperature sensor

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0197	Engine oil temperature sensor	Exhaust valve timing control does not function.
P0198	Engine oil temperature sensor	Exhaust valve timing control does not function.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-399, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419590

1.CHECK ENGINE OIL TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect engine oil temperature (EOT) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between EOT sensor harness connector and ground.

EOT sensor		Ground	Voltage (V)
Connector	Terminal		
F56	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

2.CHECK EOT SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EOT sensor harness connector and ECM harness connector.

EOT sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F56	2	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK ENGINE OIL TEMPERATURE SENSOR

Refer to EC-400, "Component Inspection (Engine Oil Temperature Sensor)".

Is the inspection result normal?

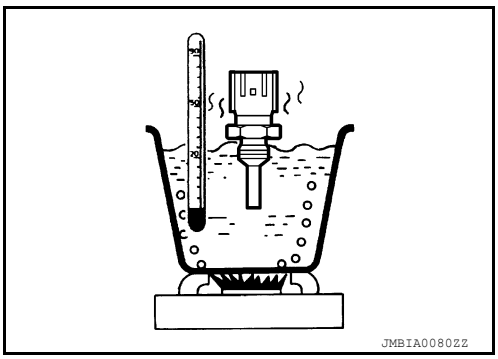
YES >> INSPECTION END
NO >> Replace engine oil temperature sensor. Refer to EM-64, "Exploded View".

Component Inspection (Engine Oil Temperature Sensor)

INFOID:0000000014419591

1.CHECK ENGINE OIL TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect engine oil temperature sensor harness connector.
3. Remove engine oil temperature sensor.
4. Check resistance between engine oil temperature sensor terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.35 - 2.73
		50 (122)	0.68 - 1.00
		90 (194)	0.236 - 0.260

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace engine oil temperature sensor. Refer to EM-64, "Exploded View".

P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208 INJECTOR

DTC Description

INFOID:0000000014419592

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0201	EOT SEN/CIRC (Engine oil temperature sensor circuit low input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 1 fuel injector signal
		Threshold	ECM detects No. 1 injector circuit is open or shorted
		Diagnosis delay time	—
P0202	EOT SEN/CIRC (Engine oil temperature sensor circuit high input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 2 fuel injector signal
		Threshold	ECM detects No. 2 injector circuit is open or shorted
		Diagnosis delay time	—
P0203	EOT SEN/CIRC (Engine oil temperature sensor circuit low input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 3 fuel injector signal
		Threshold	ECM detects No. 3 injector circuit is open or shorted
		Diagnosis delay time	—
P0204	EOT SEN/CIRC (Engine oil temperature sensor circuit high input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 4 fuel injector signal
		Threshold	ECM detects No. 4 injector circuit is open or shorted
		Diagnosis delay time	—
P0205	EOT SEN/CIRC (Engine oil temperature sensor circuit low input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 5 fuel injector signal
		Threshold	ECM detects No. 5 injector circuit is open or shorted
		Diagnosis delay time	—
P0206	EOT SEN/CIRC (Engine oil temperature sensor circuit high input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 6 fuel injector signal
		Threshold	ECM detects No. 6 injector circuit is open or shorted
		Diagnosis delay time	—
P0207	EOT SEN/CIRC (Engine oil temperature sensor circuit low input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 7 fuel injector signal
		Threshold	ECM detects No. 7 injector circuit is open or shorted
		Diagnosis delay time	—
P0208	EOT SEN/CIRC (Engine oil temperature sensor circuit high input)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	No. 8 fuel injector signal
		Threshold	ECM detects No. 8 injector circuit is open or shorted
		Diagnosis delay time	—

POSSIBLE CAUSE

- The fuel injector circuit is open or shorted
- Fuel injector
- ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0201	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0202	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0203	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0204	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0205	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0206	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0207	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.
P0208	Injector	• Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Start the engine and let it idle at least 30 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-403, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419593

1.PERFORM TROUBLE DIAGNOSIS FOR INJECTOR

Refer to EC-685, "Component Function Check".

Is inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace error-detected parts.

P0222, P0223 TP SENSOR

DTC Description

INFOID:0000000014419594

DTC DETECTION LOGIC

NOTE:
If DTC P0222 or P0223 is displayed with DTC P0643, perform the trouble diagnosis for DTC P0643. Refer to EC-530, "DTC Description".

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0222	TP SEN 1/CIRC-B1 (Throttle pedal position sensor/switch “B” circuit low)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	TP sensor 1 signal
		Threshold	An excessively low voltage from the TP sensor 1 is sent to ECM
		Diagnosis delay time	—
P0223	TP SEN 1/CIRC-B1 (Throttle pedal position sensor/switch “B” circuit high)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	TP sensor 1 signal
		Threshold	An excessively high voltage from the TP sensor 1 is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0222
- Harness or connectors (TP sensor 1 circuit is open or shorted)
- Electric throttle control actuator (TP sensor 1)

P0223
- Harness or connectors (TP sensor 1 circuit is open or shorted)
- Electric throttle control actuator (TP sensor 1)

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0222	Throttle position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.
P0223	Throttle position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.
TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-405, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419595

1.CHECK THROTTLE POSITION SENSOR 1 POWER SUPPLY CIRCUIT-I

1. Disconnect electric throttle control actuator harness connector.
2. Turn ignition switch ON.
3. Check the voltage between electric throttle control actuator harness connector and ground.

Electric throttle control actuator		Ground	Voltage (V)
Connector	Terminal		
F50	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

2.CHECK THROTTLE POSITION SENSOR 1 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between electric throttle control actuator and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	4	F79	85	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK THROTTLE POSITION SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between electric throttle control actuator and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	1	F79	78	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK THROTTLE POSITION SENSOR

Refer to EC-406, "Component Inspection (Throttle Position Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 5.

5.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

Component Inspection (Throttle Position Sensor)

INFOID:0000000014419596

1.CHECK THROTTLE POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Perform EC-199, "Description".
4. Turn ignition switch ON.
5. Set selector lever position to D.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
F79	78 (TP sensor 1 signal)	85 (Sensor ground)	Accelerator pedal	Fully released	More than 0.36
				Fully depressed	Less than 4.75
	80 (TP sensor 2 signal)			Fully released	Less than 4.75
				Fully depressed	More than 0.36

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308 MISFIRE

DTC Description

INFOID:0000000014419597

DTC DETECTION LOGIC

When a misfire occurs, engine speed will fluctuate. If the engine speed fluctuates enough to cause the crankshaft position (CKP) sensor signal to vary, ECM can determine that a misfire is occurring.

Sensor	Input signal to ECM	ECM function
Crankshaft position sensor	Engine speed	On board diagnosis of misfire

The misfire detection logic consists of the following two conditions.

1. One Trip Detection Logic (Three Way Catalyst Damage)
   On the 1st trip that a misfire condition occurs that can damage the three way catalyst (TWC) due to overheating, the MIL will blink.
   When a misfire condition occurs, the ECM monitors the CKP sensor signal every 200 engine revolutions for a change.
   When the misfire condition decreases to a level that will not damage the TWC, the MIL will turn off.
   If another misfire condition occurs that can damage the TWC on a second trip, the MIL will blink.
   When the misfire condition decreases to a level that will not damage the TWC, the MIL will remain on.
   If another misfire condition occurs that can damage the TWC, the MIL will begin to blink again.
2. Two Trip Detection Logic (Exhaust quality deterioration)
   For misfire conditions that will not damage the TWC (but will affect vehicle emissions), the MIL will only light when the misfire is detected on a second trip. During this condition, the ECM monitors the CKP sensor signal every 1,000 engine revolutions.
   A misfire malfunction can be detected in any one cylinder or in multiple cylinders.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0300	MULTI CYL MISFIRE (Random/Multiple cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	Multiple cylinders misfires
		Diagnosis delay time	—
P0301	CYL 1 MISFIRE (No.1 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.1 cylinder misfires
		Diagnosis delay time	—
P0302	CYL 2 MISFIRE (No.2 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.2 cylinder misfires
		Diagnosis delay time	—
P0303	CYL 3 MISFIRE (No.3 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.3 cylinder misfires
		Diagnosis delay time	—
P0304	CYL 4 MISFIRE (No.4 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.4 cylinder misfires
		Diagnosis delay time	—

P0305	CYL 5 MISFIRE (No.5 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.5 cylinder misfires
		Diagnosis delay time	—
P0306	CYL 6 MISFIRE (No.6 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.6 cylinder misfires
		Diagnosis delay time	—
P0307	CYL 7 MISFIRE (No.7 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.7 cylinder misfires
		Diagnosis delay time	—
P0308	CYL 8 MISFIRE (No.8 cylinder misfire detected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	No.8 cylinder misfires
		Diagnosis delay time	—

POSSIBLE CAUSE

- Improper spark plug
- Insufficient compression
- Incorrect fuel pressure
- The fuel injector circuit is open or shorted
- Fuel injector
- Intake air leakage
- The ignition signal circuit is open or shorted
- Lack of fuel
- Signal plate
- A/F sensor 1
- Incorrect PCV hose connection

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Restart engine and let it idle for about 15 minutes.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-409, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Turn ignition switch OFF and wait at least 10 seconds.

2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Start engine and drive the vehicle under similar conditions to (1st trip) Freeze Frame Data for a certain time. Refer to the table below.
   Hold the accelerator pedal as steady as possible.
   Similar conditions to (1st trip) Freeze Frame Data mean that the following conditions should be satisfied at the same time.
   CAUTION:
   Always drive vehicle in safe manner according to traffic conditions and obey all traffic laws when driving.

Engine speed	Engine speed in the freeze frame data ± 400 rpm
Vehicle speed	Vehicle speed in the freeze frame data ± 10 km/h (6 MPH)
Base fuel schedule	Base fuel schedule in the freeze frame data × (1 ± 0.1)
Engine coolant temperature (T) condition	When the freeze frame data shows lower than 70°C (158°F), T should be lower than 70°C (158°F).
	When the freeze frame data shows higher than or equal to 70°C (158°F), T should be higher than or equal to 70°C (158°F).

Driving time varies according to the engine speed in the freeze frame data.

Engine speed	Time
Around 1,000 rpm	Approximately 10 minutes
Around 2,000 rpm	Approximately 5 minutes
More than 3,000 rpm	Approximately 3.5 minutes

5. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-409, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419598

1. CHECK GROUND CONNECTION

Check the following.
- Connection condition of the ground F94 and F95.
- Connection condition of the ground harness between engine assembly and vehicle body (If equipped).

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace error-detected parts.

2. CHECK FOR INTAKE AIR LEAKAGE AND PCV HOSE

1. Start engine and run it at idle speed.
2. Listen for the sound of the intake air leakage.
3. Check PCV hose connection.

Is intake air leakage detected?

YES >> Discover air leakage location and repair.
NO >> GO TO 3.

3. CHECK FOR EXHAUST SYSTEM CLOGGING

Stop engine and visually check exhaust tube, three way catalyst and muffler for dents.

Is the inspection result normal?

YES-1 >> With CONSULT: GO TO 4.
YES-2 >> Without CONSULT: GO TO 5.
NO >> Repair or replace malfunctioning part.

4. PERFORM POWER BALANCE TEST

WITH CONSULT
1. Start engine.
2. Perform “POWER BALANCE” in “ACTIVE TEST” mode with CONSULT.
3. Check that each circuit produces a momentary engine speed drop.

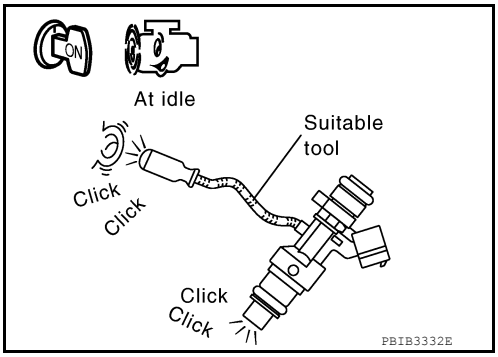
Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 5.

5. CHECK FUNCTION OF FUEL INJECTOR-I

1. Start engine and let it idle.
2. Listen to each fuel injector operation.

Clicking sound should be heard.



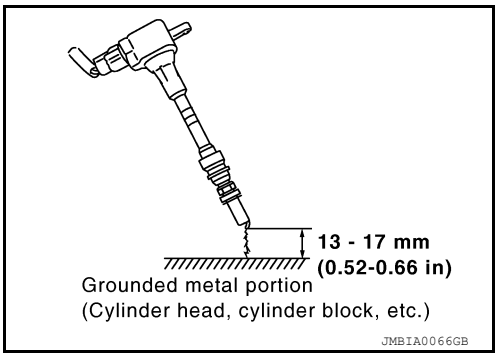
Is the inspection result normal?

YES >> GO TO 6.
NO >> Perform trouble diagnosis for FUEL INJECTOR, refer to EC-685, "Diagnosis Procedure".

6. CHECK FUNCTION OF IGNITION COIL-I

CAUTION:
Perform the following procedure in a place with no combustible objects and good ventilation.

1. Turn ignition switch OFF.
2. Remove fuel pump fuse No. in IPDM E/R to release fuel pressure.
   NOTE:
   Do not use CONSULT to release fuel pressure, or fuel pressure applies again during the following procedure.
3. Start engine.
4. After engine stalls, crank it 2 or 3 times to release all fuel pressure.
5. Turn ignition switch OFF.
6. Remove all ignition coil harness connectors to avoid the electrical discharge from the ignition coils.
7. Remove ignition coil and spark plug of the cylinder to be checked.
8. Crank engine for 5 seconds or more to remove combustion gas in the cylinder.
9. Connect spark plug and harness connector to ignition coil.
10. Fix ignition coil using a rope etc. with gap of 13 - 17 mm (0.52 - 0.66 in) between the edge of the spark plug and grounded metal portion as shown in the figure.
11. Crank engine for approximately 3 seconds, and check whether spark is generated between the spark plug and the grounded metal portion.



Spark should be generated.

CAUTION:
- **Never place the spark plug and the ignition coil within 50 cm (19.7 in) each other. Be careful not to get an electrical shock while checking, because the electrical discharge voltage becomes 20 kV or more.**
- **It might damage the ignition coil if the gap of more than 17 mm (0.66 in) is made.**

NOTE:
When the gap is less than 13 mm (0.52 in), a spark might be generated even if the coil is malfunctioning.

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 7.

7. CHECK FUNCTION OF IGNITION COIL-II

1. Turn ignition switch OFF.
2. Disconnect spark plug and connect a non-malfunctioning spark plug.
3. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded metal portion.

Spark should be generated.

Is the inspection result normal?

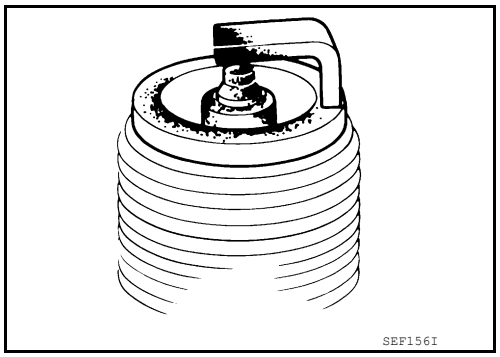
YES >> GO TO 8.
NO >> Check ignition coil, power transistor and their circuits. Refer to EC-695, "Diagnosis Procedure".

8. CHECK SPARK PLUG

Check the initial spark plug for fouling, etc.

Is the inspection result normal?

YES >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".
NO >> Repair or clean spark plug. Then GO TO 9.



9. CHECK FUNCTION OF IGNITION COIL-III

1. Reconnect the initial spark plugs.
2. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded portion.

Spark should be generated.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".

10. CHECK COMPRESSION PRESSURE

Check compression pressure. Refer to EM-20, "Inspection".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

11. CHECK FUEL PRESSURE

1. Install all removed parts.
2. Check fuel pressure. Refer to EC-205, "Work Procedure".

Is the inspection result normal?

YES >> GO TO 13.
NO >> GO TO 12.

12. DETECT MALFUNCTIONING PART

Check fuel hoses and fuel tubes for clogging.

Is the inspection result normal?

YES >> Replace “fuel filter and fuel pump assembly”.
NO >> Repair or replace malfunctioning part.

13. CHECK IDLE SPEED AND IGNITION TIMING

Check idle speed and ignition timing.

For procedure, refer to EC-722, "Inspection" and EC-723, "Inspection".
For specification, refer to EC-730, "Idle Speed" and EC-730, "Ignition Timing".

Is the inspection result normal?

YES >> GO TO 14.
NO >> Follow the EC-190, "Work Procedure".

14. CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1			Ground	Voltage
Bank	Connector	Terminal		
1	F25	1	Ground	Battery voltage
2	F16	1		

Is the inspection result normal?

YES >> GO TO 16.
NO >> GO TO 15.

15. CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between A/F sensor 1 harness connector and IPDM E/R harness connector.

A/F sensor 1			IPDM E/R		Continuity
Bank	Connector	Terminal	Connector	Terminal	
1	F25	1	E121	25	Existed
2	F16	1			

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform trouble diagnosis for power supply circuit.
NO >> Repair or replace malfunctioning part.

16. CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

Bank	A/F sensor 1		ECM		Continuity
	Connector	Terminal	Connector	Terminal	
1	F25	4	F79	79	Existed
		3		74	
2	F16	4	F79	69	
		3		70	

4. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

Bank	A/F sensor 1		Ground	Continuity
	Connector	Terminal		
1	F25	4	Ground	Not Existed
		3		
2	F16	4		
		3		

Bank	ECM		Ground	Continuity
	Connector	Terminal		
1	F79	79	Ground	Not Existed
		74		
2	F79	69		
		70		

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 17.
NO >> Repair or replace malfunctioning part.

17. CHECK A/F SENSOR 1 HEATER

Refer to EC-286, "Component Inspection (A/F Sensor 1 Heater)".

Is the inspection result normal?

YES >> GO TO 18.
NO >> Replace malfunctioning A/F sensor 1. Refer to EX-6, "Exploded View".

18. CHECK MASS AIR FLOW SENSOR

WITH CONSULT
Check mass air flow sensor signal in “DATA MONITOR” mode with CONSULT.
For specification, refer to EC-730, "Mass Air Flow Sensor".

WITH GST
Check mass air flow sensor signal in Service $01 with GST.
For specification, refer to EC-730, "Mass Air Flow Sensor".

Is the measurement value within the specification?

YES >> GO TO 19.
NO >> Check connectors for rusted terminals or loose connections in the mass air flow sensor circuit or ground. Refer to EC-315, "Diagnosis Procedure".

19. CHECK SYMPTOM MATRIX CHART

Check items on the rough idle symptom in EC-716, "Symptom Table".

Is the inspection result normal?

YES >> GO TO 20.
NO >> Repair or replace malfunctioning part.

20. ERASE THE 1ST TRIP DTC

Some tests may cause a 1st trip DTC to be set.
Erase the 1st trip DTC from the ECM memory after performing the tests. Refer to EC-94, "CONSULT Function" or EC-91, "On Board Diagnosis Function".

>> INSPECTION END

P0327, P0328, P0332, P0333 KS

DTC Description

INFOID:0000000014419599

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0327	KNOCK SEN/CIRC-B1 [Knock sensor (bank 1) circuit low input]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Knock sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0328	KNOCK SEN/CIRC-B1 [Knock sensor (bank 1) circuit high input]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Knock sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0332	KNOCK SEN/CIRC-B2 [Knock sensor (bank 2) circuit low input]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Knock sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0333	KNOCK SEN/CIRC-B2 [Knock sensor (bank 2) circuit high input]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Knock sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0327
- Harness or connectors (The knock sensor circuit is open or shorted)
- Knock sensor

P0328
- Harness or connectors (The knock sensor circuit is open or shorted)
- Knock sensor

P0332
- Harness or connectors (The knock sensor circuit is open or shorted)
- Knock sensor

P0333
- Harness or connectors (The knock sensor circuit is open or shorted)
- Knock sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and run it for at least 5 seconds at idle speed.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-415, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419600

1.CHECK KNOCK SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Disconnect knock sensor harness connector and ECM harness connector.
2. Check the continuity between knock sensor harness connector and ECM harness connector.

DTC	Knock sensor			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0327, P0328	1	F207	2	F78	20	Existed
P0332, P0333	2	F208	2			

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between knock sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit or short to power in harness or connectors.

3.CHECK KNOCK SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between knock sensor harness connector and ECM harness connector.

DTC	Knock sensor			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0327, P0328	1	F207	1	F78	15	Existed
P0332, P0333	2	F208	1		18	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and knock sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK KNOCK SENSOR

Refer to EC-416, "Component Inspection (Knock Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning knock sensor. Refer to EM-128, "Exploded View".

Component Inspection (Knock Sensor)

INFOID:0000000014419601

1. CHECK KNOCK SENSOR

1. Turn ignition switch OFF.
2. Disconnect knock sensor harness connector.
3. Check resistance between knock sensor terminals as per the following.
   NOTE:
   It is necessary to use an ohmmeter which can measure more than 10 MΩ.

Terminals	Resistance
1 and 2	Approx. 532 - 588 kΩ [at 20°C (68°F)]

CAUTION:
Never use any knock sensors that have been dropped or physically damaged. Use only new ones.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning knock sensor. Refer to EM-128, "Exploded View".

P0335 CKP SENSOR

DTC Description

INFOID:0000000014419602

DTC DETECTION LOGIC

Sensor	Input signal to ECM	ECM function	Actuator
A/F sensor 1	Density of oxygen in exhaust gas (Mixture ratio feedback signal)	Fuel injection control	Fuel injector

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0335	CKP SEN/CIRCUIT (Crankshaft position sensor “A” circuit)	1	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Crankshaft position sensor signal
			Threshold	The crankshaft position sensor signal is not detected by the ECM during the first few seconds of engine cranking
			Diagnosis delay time	—
		2	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Crankshaft position sensor signal
			Threshold	The proper pulse signal from the crankshaft position sensor is not sent to ECM while the engine is running
			Diagnosis delay time	—
		3	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Crankshaft position sensor signal
			Threshold	The crankshaft position sensor signal is not in the normal pattern during engine running
			Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Crankshaft position sensor circuit is open or shorted)
- Crankshaft position sensor
- Signal plate

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0335 is displayed with DTC P0643, first perform the confirmation procedure for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10.5 V or more with ignition switch ON.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 5 seconds.
   If engine does not start, crank engine for at least 2 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-418, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419603

1.CHECK DTC PRIORITY

If DTC P0335 is displayed with DTC P0643, first perform the confirmation procedure for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK CRANKSHAFT POSITION SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect crankshaft position (CKP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between CKP sensor harness connector and ground.

CKP sensor		Ground	Voltage (V)
Connector	Terminal		
F38	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK CKP SENSOR POWER SUPPLY CIRCUIT-II

1. Turn ignition switch ON.
2. Disconnect ECM harness connector.
3. Check the continuity between CKP sensor harness connector and ECM harness connector.

CKP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F38	1	F78	27	Existed

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair open circuit.

4.CHECK CKP SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between CKP sensor harness connector and ECM harness connector.

CKP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F38	2	F78	44	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK CKP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between CKP sensor harness connector and ECM harness connector.

CKP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F38	3	F78	33	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

6.CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace crankshaft position sensor.

7.CHECK GEAR TOOTH

Visually check for chipping signal plate gear tooth.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace the signal plate.

Component Inspection (Crankshaft Position Sensor)

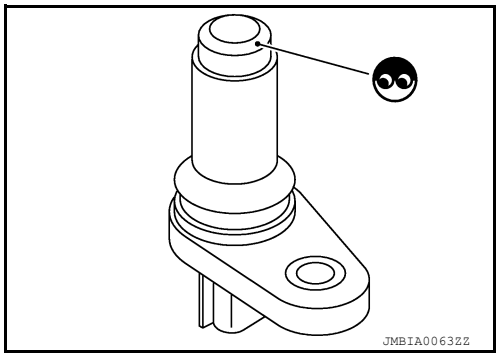
INFOID:0000000014419604

1.CHECK CRANKSHAFT POSITION SENSOR-I

1. Turn ignition switch OFF.
2. Loosen the fixing bolt of the sensor.
3. Disconnect crankshaft position sensor harness connector.
4. Remove the sensor.
5. Visually check the sensor for chipping.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace crankshaft position sensor. Refer to EM-70, "Exploded View".



2.CHECK CRANKSHAFT POSITION SENSOR-II

Check resistance between crankshaft position sensor terminals as per the following.

Terminals (Polarity)	Resistance
1 (+) - 2 (-)	Except 0 or ∞ Ω [at 25°C (77°F)]
1 (+) - 3 (-)	
2 (+) - 3 (-)	

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace crankshaft position sensor. Refer to EM-70, "Exploded View".

P0340, P0345 CMP SENSOR

DTC Description

INFOID:0000000014419605

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0340	CMP SEN/CIRC-B1 [Camshaft position sensor “A” circuit bank 1]	1	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Camshaft position sensor signal
			Threshold	The cylinder No. signal is not sent to ECM for the first few seconds during engine cranking
			Diagnosis delay time	—
		2	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Camshaft position sensor signal
			Threshold	The cylinder No. signal is not sent to ECM during engine running
			Diagnosis delay time	—
		3	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Camshaft position sensor signal
			Threshold	The cylinder No. signal is not in the normal pattern during engine running
			Diagnosis delay time	—
P0345	CMP SEN/CIRC-B1 [Camshaft position sensor “A” circuit bank 2]	1	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Camshaft position sensor signal
			Threshold	The cylinder No. signal is not sent to ECM for the first few seconds during engine cranking
			Diagnosis delay time	—
		2	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Camshaft position sensor signal
			Threshold	The cylinder No. signal is not sent to ECM during engine running
			Diagnosis delay time	—
		3	Diagnosis condition	Start engine and let it idle
			Signal (terminal)	Camshaft position sensor signal
			Threshold	The cylinder No. signal is not in the normal pattern during engine running
			Diagnosis delay time	—

POSSIBLE CAUSE

P0340
- Harness or connectors [Camshaft position sensor (bank 1) circuit is open or shorted]
- Camshaft position sensor (bank 1)
- Camshaft (INT)
- Starter motor
- Starting system circuit
- Dead (Weak) battery

P0345
- Harness or connectors [Camshaft position sensor (bank 2) circuit is open or shorted]
- Camshaft position sensor (bank 2)

- Camshaft (INT)
- Starter motor
- Starting system circuit
- Dead (Weak) battery
- Sensor power supply 2

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0340 is displayed with DTC P0643, first perform the confirmation procedure for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10.5 V or more with ignition switch ON.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Start engine and let it idle for at least 5 seconds.
   If engine does not start, crank engine for at least 2 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-421, "Diagnosis Procedure".
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Maintain engine speed at more than 800 rpm for at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-421, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419606

1.CHECK DTC PRIORITY

If DTC P0340 is displayed with DTC P0643, first perform the confirmation procedure for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK STARTING SYSTEM

Turn ignition switch to START position.

Does the engine turn over? Does the starter motor operate?

YES >> GO TO 3.
NO >> Check starting system. (Refer to STR-23, "Work Flow (With GR8-1200 NI)", or STR-27, "Work Flow (Without GR8-1200 NI)". For the details of the GR8-1200 NI, refer to EX-4, "Special Service Tool".)

3.CHECK CAMSHAFT POSITION SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect camshaft position (CMP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between CMP sensor harness connector and ground.

DTC	CMP sensor			Ground	Voltage (V)
	Bank	Connector	Terminal		
P0340	1	F66	1	Ground	Approx. 5
P0345	2	F67	1		

Is the inspection result normal?

YES >> GO TO 6.
NO-1 >> P0340: GO TO 4.
NO-2 >> P0345: GO TO 5.

4.CHECK CMP SENSOR POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between CMP sensor harness connector and ECM harness connector.

CMP sensor			ECM		Continuity
Bank	Connector	Terminal	Connector	Terminal	
1	F66	1	F78	28	Existed

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair open circuit.

5.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

6.CHECK CMP SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between CMP sensor harness connector and ECM harness connector.

DTC	CMP sensor			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0340	1	F66	2	F78	45	Existed
P0345	2	F67	2	F79	63	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK CMP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between CMP sensor harness connector and ECM harness connector.

DTC	CMP sensor			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P0340	1	F66	3	F78	40	Existed
P0345	2	F67	3	F79	66	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

8.CHECK CAMSHAFT POSITION SENSOR

Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

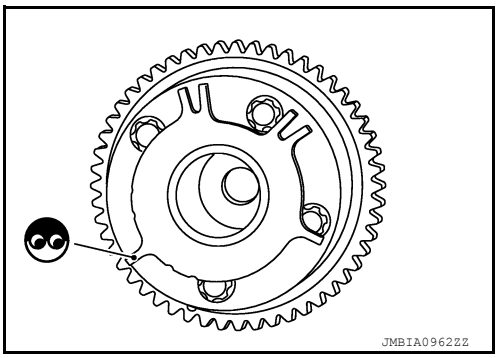
YES >> GO TO 9.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-74, "Exploded View".

9.CHECK CAMSHAFT (INT)

Check the following.
- Accumulation of debris to the signal plate of camshaft front end
- Chipping signal plate of camshaft front end

Is the inspection result normal?

YES >> INSPECTION END
NO >> Remove debris and clean the signal plate of camshaft front end or replace camshaft.



Component Inspection (Camshaft Position Sensor)

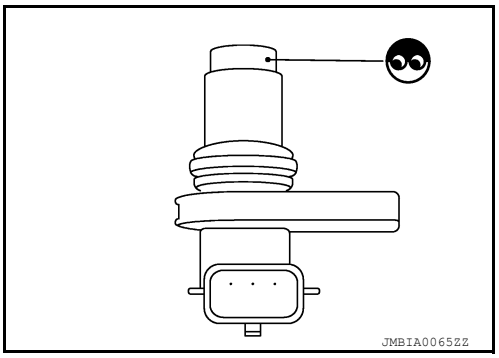
INFOID:0000000014419607

1.CHECK CAMSHAFT POSITION SENSOR-I

1. Turn ignition switch OFF.
2. Loosen the fixing bolt of the sensor.
3. Disconnect camshaft position sensor harness connector.
4. Remove the sensor.
5. Visually check the sensor for chipping.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning camshaft position sensor.



2.CHECK CAMSHAFT POSITION SENSOR-II

Check resistance camshaft position sensor terminals as per the following.

Terminals (Polarity)	Resistance
1 (+) - 2 (-)	Except 0 or ∞ Ω [at 25°C (77°F)]
1 (+) - 3 (-)	
2 (+) - 3 (-)	

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-74, "Exploded View".

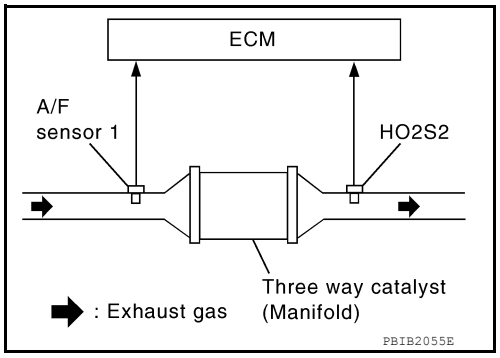
P0420, P0430 THREE WAY CATALYST FUNCTION

DTC Description

INFOID:0000000014419608

DTC DETECTION LOGIC

The ECM monitors the switching frequency ratio of air fuel ratio (A/F) sensor 1 and heated oxygen sensor 2.
A three way catalyst (manifold) with high oxygen storage capacity will indicate a low switching frequency of heated oxygen sensor 2. As oxygen storage capacity decreases, the heated oxygen sensor 2 switching frequency will increase.
When the frequency ratio of A/F sensor 1 and heated oxygen sensor 2 approaches a specified limit value, the three way catalyst (manifold) malfunction is diagnosed.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0420	TW CATALYST SYS-B1 [Catalyst system efficiency below threshold (bank 1)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Three way catalyst (manifold) does not operate properly
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Three way catalyst (manifold) does not have enough oxygen storage capacity
			Diagnosis delay time	—
P0430	TW CATALYST SYS-B2 [Catalyst system efficiency below threshold (bank 2)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Three way catalyst (manifold) does not operate properly
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Three way catalyst (manifold) does not have enough oxygen storage capacity
			Diagnosis delay time	—

POSSIBLE CAUSE

P0420
- Three way catalyst (manifold)
- Exhaust tube
- Intake air leakage
- Fuel injector
- Fuel injector leakage
- Spark plug
- Improper ignition timing

P0430
- Three way catalyst (manifold)
- Exhaust tube
- Intake air leakage

- Fuel injector
- Fuel injector leakage
- Spark plug
- Improper ignition timing

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

Will CONSULT be used?

YES >> GO TO 2.
NO >> GO TO 6.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT

TESTING CONDITION:

Do not maintain engine speed for more than the specified minutes below.

1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
6. Let engine idle for 1 minute.
7. Select “DATA MONITOR” mode with CONSULT.
8. Check that “COOLAN TEMP/S” indicates more than 70°C (158°F).
   If not, warm up engine and go to next step when “COOLAN TEMP/S” indication reaches to 70°C (158°F).
9. Open engine hood.
10. Select “DTC & SRT CONFIRMATION” then “SRT WORK SUPPORT” mode with CONSULT.
11. Rev engine between 2,000 and 3,000 rpm and hold it for 3 consecutive minutes then release the accelerator pedal completely.
12. Check the indication of “CATALYST”.

Which is displayed on CONSULT screen?

CMPLT >> GO TO 5.
INCMP >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Wait 5 seconds at idle.
2. Rev engine between 2,000 and 3,000 rpm and maintain it until “INCMP” of “CATALYST” changes to “CMPLT” (It will take approximately 5 minutes).

Does the indication change to “CMPLT”?

YES >> GO TO 5.
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE AGAIN

1. Stop engine and cool it down to less than 70°C (158°F).
2. Perform DTC CONFIRMATION PROCEDURE again.

>> GO TO 2.

5.PERFORM DTC CONFIRMATION PROCEDURE-III

Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-427, "Diagnosis Procedure".
NO >> INSPECTION END

6. PERFORM COMPONENT FUNCTION CHECK

WITH GST
Perform component function check. Refer to EC-427, "Component Function Check".
NOTE:
Use component function check to check the overall function of the three way catalyst (manifold). During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-427, "Diagnosis Procedure"

Component Function Check

INFOID:0000000014419609

1. PERFORM COMPONENT FUNCTION CHECK

WITH GST
1. Start engine and warm it up to the normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Start engine and keep the engine speed between 3,500 and 4,000 rpm for at least 1 minute under no load.
4. Let engine idle for 1 minute.
5. Open engine hood.
6. Check the voltage between ECM harness connector terminals under the following conditions.

DTC	ECM				Condition	Voltage
	+		–			
	Connector	Terminal	Connector	Terminal		
P0420	F79	84 [HO2S2 (bank 1)]	F78	43	Keeping engine speed at 2,500 rpm constant under no load	The voltage fluctuation cycle takes more than 5 seconds. • 1 cycle: 0.6 - 1.0 → 0 - 0.3 → 0.6 - 1.0
P0430		77 [HO2S2 (bank 2)]				

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-427, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419610

1. CHECK EXHAUST SYSTEM

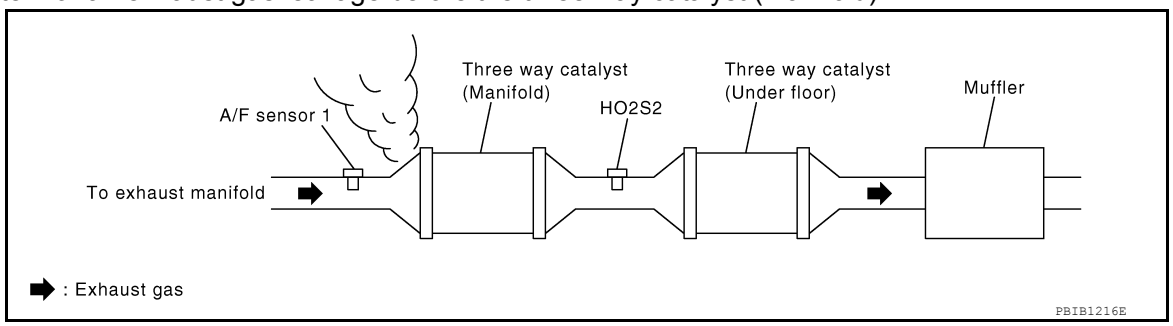
Visually check exhaust tubes and muffler for dents.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace malfunctioning part.

2. CHECK EXHAUST GAS LEAKAGE

1. Start engine and run it at idle.
2. Listen for an exhaust gas leakage before the three way catalyst (manifold).



Is exhaust gas leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 3.

3. CHECK INTAKE AIR LEAKAGE

Listen for an intake air leakage after the mass air flow sensor.

Is intake air leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 4.

4. CHECK IDLE SPEED AND IGNITION TIMING

Check idle speed and ignition timing.
For procedure, refer to EC-722, "Inspection" and EC-723, "Inspection".
For specification, refer to EC-730, "Idle Speed" and EC-730, "Ignition Timing".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Follow the EC-190, "Work Procedure".

5. CHECK FUEL INJECTORS

Refer to EC-685, "Component Function Check".

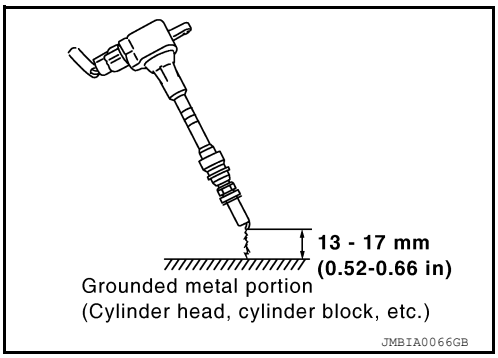
Is the inspection result normal?

YES >> GO TO 6.
NO >> Perform EC-685, "Diagnosis Procedure".

6. CHECK FUNCTION OF IGNITION COIL-I

CAUTION:
Perform the following procedure in a place with no combustible objects and good ventilation.

1. Turn ignition switch OFF.
2. Remove fuel pump fuse in IPDM E/R to release fuel pressure.
   NOTE:
   - For the fuse number, refer to EC-155, "Wiring Diagram".
   - For the fuse arrangement, refer to PG-164, "Terminal Arrangement".
   - Do not use CONSULT to release fuel pressure, or fuel pressure applies again during the following procedure.
3. Start engine.
4. After engine stalls, crank it 2 or 3 times to release all fuel pressure.
5. Turn ignition switch OFF.
6. Remove all ignition coil harness connectors to avoid the electrical discharge from the ignition coils.
7. Remove ignition coil and spark plug of the cylinder to be checked.
8. Crank engine for 5 seconds or more to remove combustion gas in the cylinder.
9. Connect spark plug and harness connector to ignition coil.
10. Fix ignition coil using a rope etc. with gap of 13 - 17 mm (0.52 - 0.66 in) between the edge of the spark plug and grounded metal portion as shown in the figure.
11. Crank engine for approximately 3 seconds, and check whether spark is generated between the spark plug and the grounded metal portion.



Spark should be generated.

CAUTION:
- **Never place the spark plug and the ignition coil within 50 cm (19.7 in) each other. Be careful not to get an electrical shock while checking, because the electrical discharge voltage becomes 20 kV or more.**
- **It might damage the ignition coil if the gap of more than 17 mm (0.66 in) is made.**

NOTE:
When the gap is less than 13 mm (0.52 in), a spark might be generated even if the coil is malfunctioning.

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 7.

7. CHECK FUNCTION OF IGNITION COIL-II

1. Turn ignition switch OFF.
2. Disconnect spark plug and connect a non-malfunctioning spark plug.
3. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded metal portion.

Spark should be generated.

Is the inspection result normal?

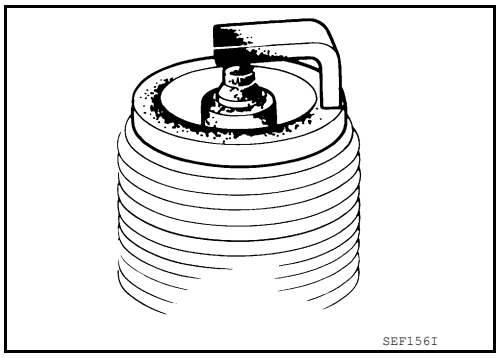
YES >> GO TO 8.
NO >> Check ignition coil, power transistor and their circuits. Refer to EC-695, "Diagnosis Procedure".

8. CHECK SPARK PLUG

Check the initial spark plug for fouling, etc.

Is the inspection result normal?

YES >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".
NO >> Repair or clean spark plug. Then GO TO 9.



9. CHECK FUNCTION OF IGNITION COIL-III

1. Reconnect the initial spark plugs.
2. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded portion.

Spark should be generated.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".

10. PERFORM DTC CONFIRMATION PROCEDURE

1. Replace three way catalyst assembly. Refer to EM-45, "Removal and Installation - XD Models".
2. Perform DTC confirmation procedure. Refer to EC-425, "DTC Description".

Is DTC detected?

YES >> Replace fuel injecor. Refer to EM-57, "Removal and Installation".
NO >> INSPECTION END

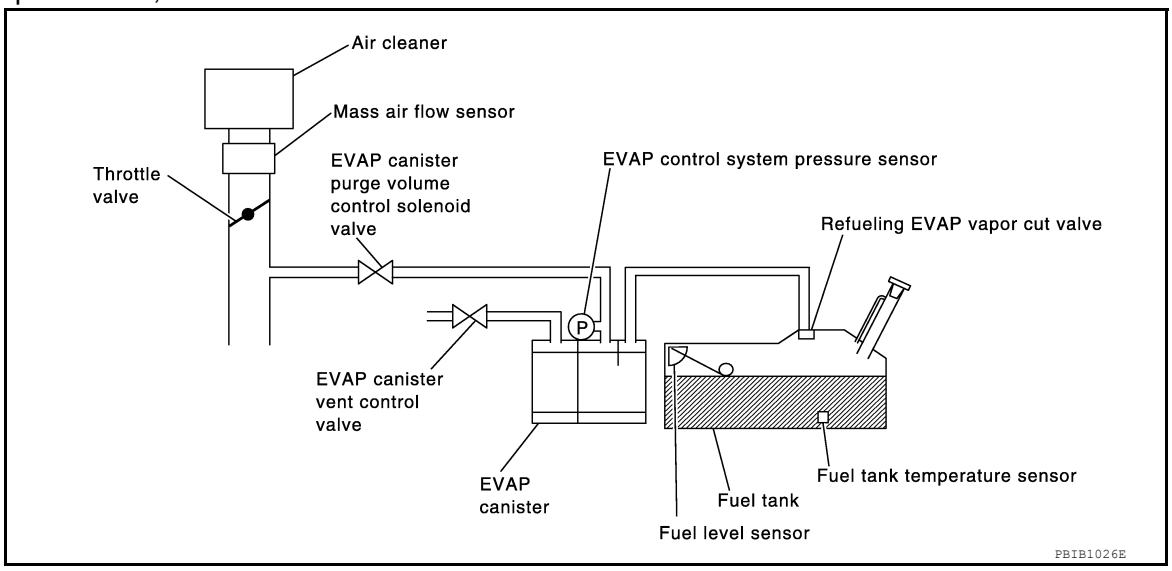
P0441 EVAP CONTROL SYSTEM

DTC Description

INFOID:0000000014419611

DTC DETECTION LOGIC

In this evaporative emission (EVAP) control system, purge flow occurs during non-closed throttle conditions. Purge volume is related to air intake volume. Under normal purge conditions (non-closed throttle), the EVAP canister purge volume control solenoid valve is open to admit purge flow. Purge flow exposes the EVAP control system pressure sensor to intake manifold vacuum.
Under normal conditions (non-closed throttle), sensor output voltage indicates if pressure drop and purge flow are adequate. If not, a malfunction is determined.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0441	EVAP PURG FLOW/MON (EVAP control system incorrect purge flow)	Diagnosis condition	—
		Signal (terminal)	Intake air temperature sensor signal
		Threshold	EVAP control system does not operate properly, EVAP control system has a leak between intake manifold and EVAP control system pressure sensor
		Diagnosis delay time	—

POSSIBLE CAUSE

- EVAP canister purge volume control solenoid valve stuck closed
- EVAP control system pressure sensor and the circuit
- Loose, disconnected or improper connection of rubber tube
- Blocked rubber tube
- Cracked EVAP canister
- EVAP canister purge volume control solenoid valve circuit
- Accelerator pedal position sensor
- Blocked purge port
- EVAP canister vent control valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0441 is displayed with other DTC such as P2122, P2123, P2127, P2128 or P2138, first perform trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

Will CONSULT be used?

YES >> GO TO 3.
NO >> GO TO 6.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT

TESTING CONDITION:
Always perform test at a temperature of 5°C (41°F) or more.

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and let it idle for at least 70 seconds.
6. Select “PURG FLOW P0441” of “EVAPORATIVE SYSTEM” in “DTC WORK SUPPORT” mode with CONSULT.
7. Touch “START”.

Is “COMPLETED” displayed on CONSULT screen?

YES >> GO TO 5.
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-II

When the following conditions are met, “TESTING” will be displayed on the CONSULT screen. Maintain the conditions continuously until “TESTING” changes to “COMPLETED”. (It will take at least 35 seconds.)

Selector lever	Suitable position
VHCL SPEED SE	32 - 120 km/h (20 - 75 MPH)
ENG SPEED	500 - 3,000 rpm
B/FUEL SCHDL	1.3 - 17.0 msec
COOLAN TEMP/S	More than 0°C (32°F)

CAUTION:
Always drive vehicle at a safe speed.
NOTE:
If “TESTING” does not change for a long time, retry from step 2.

Is “COMPLETED” displayed on CONSULT screen?

YES >> GO TO 5.
NO >> Perform DTC CONFIRMATION PROCEDURE again. GO TO 2.

5.PERFORM DTC CONFIRMATION PROCEDURE-III

Touch “SELF-DIAG RESULTS”.

Which is displayed on CONSULT screen?

OK >> INSPECTION END
NG >> Proceed to EC-433, "Diagnosis Procedure".

6.PERFORM COMPONENT FUNCTION CHECK

WITH GST

Perform component function check. Refer to EC-433, "Component Function Check".

NOTE:
Use component function check to check the overall monitoring function of the EVAP control system purge flow monitoring. During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-433, "Diagnosis Procedure".

Component Function Check

INFOID:0000000014419612

1.PERFORM COMPONENT FUNCTION CHECK

WITH GST

1. Lift up drive wheels.
2. Start engine (VDC switch OFF) and warm it up to normal operating temperature.
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Start engine and wait at least 70 seconds.
5. Set voltmeter probes to ECM harness connector terminals under the following conditions.

ECM		
Connector	+	–
	Terminal	Terminal
E16	121 (EVAP control system pressure sensor signal)	148

6. Check EVAP control system pressure sensor value at idle speed and note it.
7. Establish and maintain the following conditions for at least 1 minute.

Air conditioner switch	ON
Headlamp switch	ON
Rear window defogger switch	ON
Engine speed	Approx. 3,000 rpm
Gear position	Any position other than P, N or R

8. Verify that EVAP control system pressure sensor value stays 0.1 V less than the value at idle speed (measured at step 6) for at least 1 second.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-433, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419613

1.CHECK DTC PRIORITY

If DTC P0441 is displayed with other DTC such as P2122, P2123, P2127, P2128 or P2138, first perform trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK EVAP CANISTER

1. Turn ignition switch OFF.
2. Check EVAP canister for cracks.

Is the inspection result normal?

YES-1 >> With CONSULT: GO TO 3.
YES-2 >> Without CONSULT: GO TO 4.
NO >> Replace EVAP canister. Refer to FL-14, "Removal and Installation".

3.CHECK PURGE FLOW

WITH CONSULT

1. Disconnect vacuum hose connected to EVAP canister purge volume control solenoid valve at EVAP service port.

2. Start engine and let it idle.
3. Select “PURG VOL CONT/V” in “ACTIVE TEST” mode with CONSULT.
4. Touch “Qd” and “Qu” on CONSULT screen to adjust “PURG VOL CONT/V” opening and check vacuum existence.

PURG VOL CONT/V	Vacuum
100%	Existed
0%	Not existed

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 5.

4.CHECK PURGE FLOW

WITHOUT CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Stop engine.
3. Disconnect vacuum hose connected to EVAP canister purge volume control solenoid valve at EVAP service port and install vacuum gauge. For the location of EVAP service port, refer to EC-70, "EVAPORATIVE EMISSION SYSTEM : System Description".
4. Start engine and let it idle.
   Never depress accelerator pedal even slightly.
5. Check vacuum gauge indication before 60 seconds pass after starting engine.

Vacuum should not exist.

6. Rev engine up to 2,000 rpm after 100 seconds pass after starting engine.

Vacuum should exist.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 5.

5.CHECK EVAP PURGE LINE

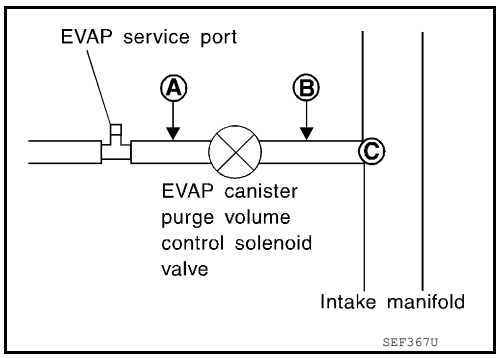
1. Turn ignition switch OFF.
2. Check EVAP purge line for improper connection or disconnection.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair EVAP purge line.

6.CHECK EVAP PURGE HOSE AND PURGE PORT

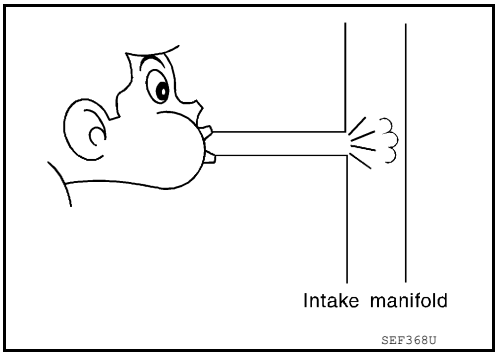
1. Disconnect purge hoses connected to EVAP service port (**A**) and EVAP canister purge volume control solenoid valve (**B**).
2. Blow air into each hose and EVAP purge port (**C**).



3. Check that air flows freely.

Is the inspection result normal?

YES-1 >> With CONSULT: GO TO 7.
YES-2 >> Without CONSULT: GO TO 8.
NO >> Repair or clean hoses and/or purge port.



7. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

WITH CONSULT
1. Start engine.
2. Perform “PURG VOL CONT/V” in “ACTIVE TEST” mode with CONSULT. Check that engine speed varies according to the valve opening.

Does engine speed vary according to the valve opening?

YES >> GO TO 9.
NO >> GO TO 8.

8. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

Refer to EC-440, "Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace EVAP canister purge volume control solenoid valve. Refer to FL-14, "Exploded View".

9. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR CONNECTOR

1. Disconnect EVAP control system pressure sensor harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace EVAP control system pressure sensor. Refer to EM-35, "Exploded View".

10. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR FUNCTION

Refer to EC-455, "DTC Description" for DTC P0452, EC-459, "DTC Description" for DTC P0453.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Replace EVAP control system pressure sensor.

11. CHECK RUBBER TUBE FOR CLOGGING

1. Disconnect rubber tube connected to EVAP canister vent control valve.
2. Check the rubber tube for clogging.

Is the inspection result normal?

YES >> GO TO 12.
NO >> Clean the rubber tube using an air blower.

12. CHECK EVAP CANISTER VENT CONTROL VALVE

Refer to EC-446, "Component Inspection (EVAP Canister Vent Control Valve)".

Is the inspection result normal?

YES >> GO TO 13.
NO >> Replace EVAP canister vent control valve.

13. CHECK EVAP PURGE LINE

Inspect EVAP purge line (pipe and rubber tube). Check for evidence of leaks.

Is the inspection result normal?

YES >> GO TO 14.

NO >> Repair or replace malfunctioning part.

14. CLEAN EVAP PURGE LINE

Clean EVAP purge line (pipe and rubber tube) using air blower.

>> INSPECTION END

P0443 EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

DTC Description

INFOID:0000000014419614

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0443	PURG VOLUME CONT/V (EVAP canister purge volume control solenoid valve)	Diagnosis condition	—
		Signal (terminal)	EVAP canister purge volume control solenoid valve signal
		Threshold	The canister purge flow is detected during the specified driving conditions, even when EVAP canister purge volume control solenoid valve is completely closed
		Diagnosis delay time	—

POSSIBLE CAUSE

- EVAP control system pressure sensor
- EVAP canister purge volume control solenoid valve (The valve is stuck open)
- EVAP canister vent control valve
- EVAP canister
- Hoses (Hoses are connected incorrectly or clogged)

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Always perform test at a temperature of 5°C (41°F) or more.

Do you have CONSULT

YES >> GO TO 2.
NO >> GO TO 3.

2.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON.
6. Select “PURG VOL CN/V P1444” of “EVAPORATIVE SYSTEM” in “DTC WORK SUPPORT” mode with CONSULT.
7. Touch “START”.
8. Start engine and let it idle until “TESTING” on CONSULT changes to “COMPLETED”. (It will take approximately 10 seconds.)
   If “TESTING” is not displayed after 5 minutes, retry from step 2.
9. Touch “SELF-DIAG RESULTS”.

Which is displayed on CONSULT screen?

OK >> INSPECTION END
NG >> Proceed to EC-438, "Diagnosis Procedure".

3.PERFORM DTC CONFIRMATION PROCEDURE

WITH GST

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and let it idle for at least 20 seconds.
6. Check 1st trip DTC.

Is 1st trip DTC displayed?

YES >> Proceed to EC-438, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419615

1. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect EVAP canister purge volume control solenoid valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between EVAP canister purge volume control solenoid valve harness connector and ground.

EVAP canister purge volume control solenoid valve		Ground	Voltage
Connector	Terminal		
F30	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVAP canister purge volume control solenoid valve and IPDM E/R
- Harness for open or short between EVAP canister purge volume control solenoid valve and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

3. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP canister purge volume control solenoid valve harness connector and ECM harness connector.

EVAP canister purge volume control solenoid valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F30	2	F78	106	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR CONNECTOR

1. Disconnect EVAP control system pressure sensor harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 5.

NO >> Replace EVAP control system pressure sensor.

5. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

YES-1 >> With CONSULT: GO TO 6.
YES-2 >> Without CONSULT: GO TO 7.
NO >> Replace EVAP control system pressure sensor.

6. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

WITH CONSULT
1. Turn ignition switch OFF.
2. Reconnect harness connectors disconnected.
3. Start engine.
4. Perform “PURG VOL CONT/V” in “ACTIVE TEST” mode with CONSULT. Check that engine speed varies according to the valve opening.

Does engine speed vary according to the valve opening?

YES >> GO TO 8.
NO >> GO TO 7.

7. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

Refer to EC-440, "Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace EVAP canister purge volume control solenoid valve. Refer to EM-35, "Exploded View".

8. CHECK RUBBER TUBE FOR CLOGGING

1. Disconnect rubber tube connected to EVAP canister vent control valve.
2. Check the rubber tube for clogging.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Clean the rubber tube using an air blower.

9. CHECK EVAP CANISTER VENT CONTROL VALVE

Refer to EC-446, "Component Inspection (EVAP Canister Vent Control Valve)".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

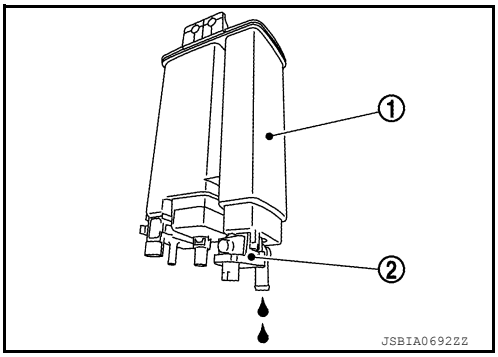
10. CHECK IF EVAP CANISTER IS SATURATED WITH WATER

1. Remove EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
2. Check if water will drain from EVAP canister (1).

- EVAP canister vent control valve (2)

Does water drain from the EVAP canister?

YES >> GO TO 11.
NO >> INSPECTION END



11. CHECK EVAP CANISTER

Weigh the EVAP canister with the EVAP canister vent control valve and EVAP control system pressure sensor attached.

The weight should be less than 2.5 kg (5.5 lb).

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 12.

12. DETECT MALFUNCTIONING PART

Check the following.
- EVAP canister for damage
- EVAP hose between EVAP canister and vehicle frame for clogging or poor connection

>> Repair hose or replace EVAP canister. Refer to FL-14, "Exploded View".

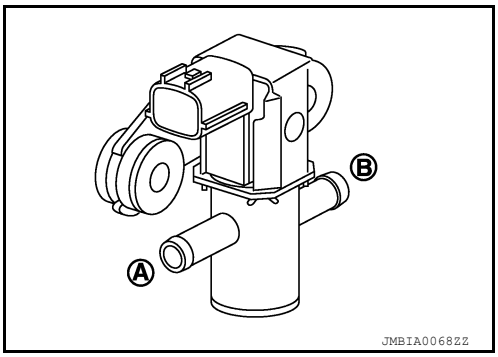
Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve)

INFOID:0000000014419616

1. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

WITH CONSULT

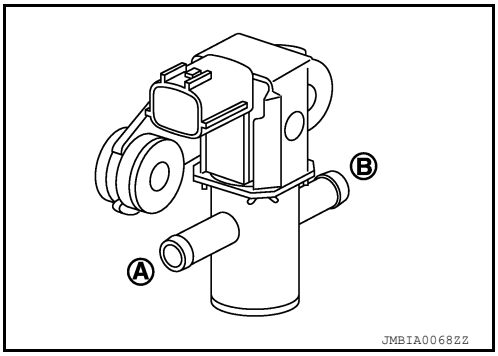
1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Disconnect EVAP purge hoses connected to EVAP canister purge volume control solenoid valve.
4. Start engine.
5. Select “PURG VOL CONT/V” in “ACTIVE TEST” mode with CONSULT.
6. Touch “Qd” and “Qu” on CONSULT screen to adjust “PURG VOL C/V” opening and check air passage continuity of EVAP canister purge volume control solenoid valve under the following conditions.



Condition (PURG VOL C/V value)	Air passage continuity between (A) and (B)
100%	Existed
0%	Not existed

WITHOUT CONSULT

1. Turn ignition switch OFF.
2. Disconnect EVAP canister purge volume control solenoid valve harness connector.
3. Disconnect EVAP purge hoses connected to EVAP canister purge volume control solenoid valve.
4. Check air passage continuity of EVAP canister purge volume control solenoid valve under the following conditions.



Condition	Air passage continuity between (A) and (B)
12 V direct current supply between terminals 1 and 2	Existed
No supply	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP canister purge volume control solenoid valve. Refer to EM-35, "Exploded View".

P0444, P0445 EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

DTC Description

INFOID:0000000014419617

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0444	PURG VOLUME CONT/V (EVAP canister purge volume control solenoid valve circuit open)	Diagnosis condition	—
		Signal (terminal)	EVAP canister purge volume control solenoid valve signal
		Threshold	An excessively low voltage signal is sent to ECM through the valv
		Diagnosis delay time	—
P0445	PURG VOLUME CONT/V (EVAP canister purge volume control solenoid valve circuit shorted)	Diagnosis condition	—
		Signal (terminal)	EVAP canister purge volume control solenoid valve signal
		Threshold	An excessively high voltage signal is sent to ECM through the valve
		Diagnosis delay time	—

POSSIBLE CAUSE

P0444
- Harness or connectors (The solenoid valve circuit is open or shorted)
- EVAP canister purge volume control solenoid valve

P0445
- Harness or connectors (The solenoid valve circuit is shorted)
- EVAP canister purge volume control solenoid valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 13 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-441, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419618

1.CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect EVAP canister purge volume control solenoid valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between EVAP canister purge volume control solenoid valve harness connector and ground.

EVAP canister purge volume control solenoid valve		Ground	Voltage
Connector	Terminal		
F30	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2. DETECT MALFUNCTIONING PART

Check the following.
- Loose or poor connection for each connector and harness
- Harness for open or short between EVAP canister purge volume control solenoid valve and IPDM E/R
- Harness for open or short between EVAP canister purge volume control solenoid valve and ECM

>> Repair open circuit, short to ground or short to power in harness or connectors.

3. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP canister purge volume control solenoid valve harness connector and ECM harness connector.

EVAP canister purge volume control solenoid valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F30	2	F79	106	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES-1 >> With CONSULT: GO TO 4.
YES-2 >> Without CONSULT: GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE OPERATION

WITH CONSULT
1. Reconnect all harness connectors disconnected.
2. Start engine.
3. Perform “PURG VOL CONT/V” in “ACTIVE TEST” mode with CONSULT. Check that engine speed varies according to the valve opening.

Does engine speed vary according to the valve opening?

YES >> INSPECTION END
NO >> GO TO 5.

5. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

Refer to EC-440, "Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP canister purge volume control solenoid valve.

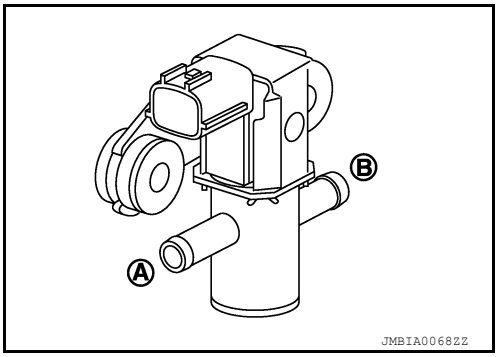
Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve)

INFOID:0000000014419619

1. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

WITH CONSULT

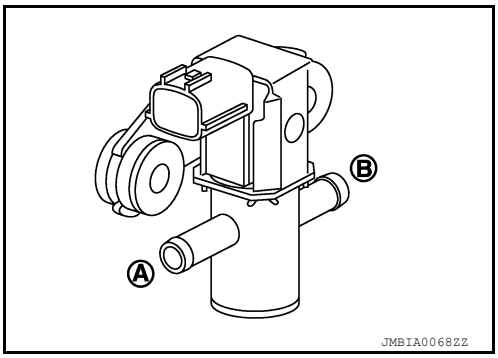
1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Disconnect EVAP purge hoses connected to EVAP canister purge volume control solenoid valve.
4. Start engine.
5. Select “PURG VOL CONT/V” in “ACTIVE TEST” mode with CONSULT.
6. Touch “Qd” and “Qu” on CONSULT screen to adjust “PURG VOL C/V” opening and check air passage continuity of EVAP canister purge volume control solenoid valve under the following conditions.



Condition (PURG VOL C/V value)	Air passage continuity between (A) and (B)
100%	Existed
0%	Not existed

WITHOUT CONSULT

1. Turn ignition switch OFF.
2. Disconnect EVAP canister purge volume control solenoid valve harness connector.
3. Disconnect EVAP purge hoses connected to EVAP canister purge volume control solenoid valve.
4. Check air passage continuity of EVAP canister purge volume control solenoid valve under the following conditions.



Condition	Air passage continuity between (A) and (B)
12 V direct current supply between terminals 1 and 2	Existed
No supply	Not existed

Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace EVAP canister purge volume control solenoid valve. Refer to EM-35, "Exploded View".

P0447 EVAP CANISTER VENT CONTROL VALVE

DTC Description

INFOID:0000000014419620

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0447	VENT CONTROL VALVE (EVAP canister vent control valve circuit open)	Diagnosis condition	—
		Signal (terminal)	EVAP canister vent control valve signal
		Threshold	An improper voltage signal is sent to ECM through EVAP canister vent control valve
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The valve circuit is open or shorted)
- EVAP canister vent control valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and wait at least 8 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-444, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419621

1.INSPECTION START

Will CONSULT be used?

Will CONSULT be used?

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK EVAP CANISTER VENT CONTROL VALVE CIRCUIT

WITH CONSULT
1. Turn ignition switch OFF and then ON.
2. Select “VENT CONTROL/V” in “ACTIVE TEST” mode with CONSULT.
3. Touch “ON/OFF” on CONSULT screen.
4. Check for operating sound of the valve.

Clicking sound should be heard.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 3.

3. CHECK EVAP CANISTER VENT CONTROL VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect EVAP canister vent control valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between EVAP canister vent control valve harness connector and ground.

EVAP canister vent control valve		Ground	Voltage
Connector	Terminal		
C38	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVAP canister vent control valve and IPDM E/R
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5. CHECK EVAP CANISTER VENT CONTROL VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP canister vent control valve harness connector and ECM harness connector.

EVAP canister vent control valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C38	2	E16	141	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6. DETECT MALFUNCTIONING PART

Check the following.
- Loose or poor connection for each connector and harness
- Harness for open or short between EVAP canister vent control valve and ECM

>> Repair open circuit, short to ground or short to power in harness or connectors.

7. CHECK RUBBER TUBE FOR CLOGGING

1. Disconnect rubber tube connected to EVAP canister vent control valve.
2. Check the rubber tube for clogging.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Clean the rubber tube using an air blower.

8. CHECK EVAP CANISTER VENT CONTROL VALVE

Refer to EC-446, "Component Inspection (EVAP Canister Vent Control Valve)".

Is the inspection result normal?

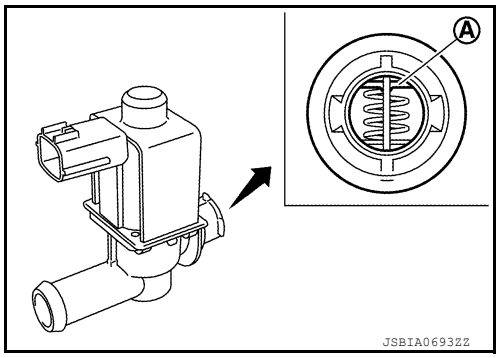
YES >> INSPECTION END
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

Component Inspection (EVAP Canister Vent Control Valve)

INFOID:0000000014419622

1. CHECK EVAP CANISTER VENT CONTROL VALVE-I

1. Turn ignition switch OFF.
2. Remove EVAP canister vent control valve from EVAP canister.
3. Check portion (A) of EVAP canister vent control valve for rust.



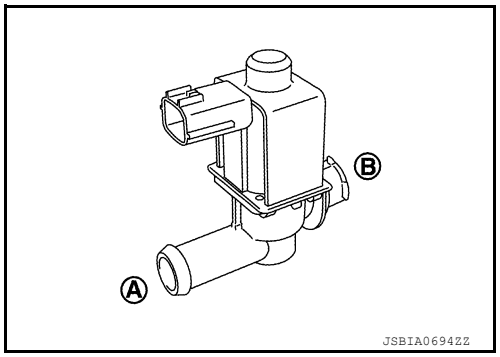
Is it rusted?

YES >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".
NO >> GO TO 2.

2. CHECK EVAP CANISTER VENT CONTROL VALVE-II

WITH CONSULT

1. Reconnect harness connectors disconnected.
2. Turn ignition switch ON.
3. Perform “VENT CONTROL/V” in “ACTIVE TEST” mode.
4. Check air passage continuity and operation delay time.
   Check that new O-ring is installed properly.



VENT CONTROL/V Condition	Air passage continuity between (A) and (B)
ON	Not existed
OFF	Existed

Operation takes less than 1 second.

WITHOUT CONSULT

1. Disconnect EVAP canister vent control valve harness connector.
2. Check air passage continuity and operation delay time under the following conditions.
   Check that new O-ring is installed properly.

Condition	Air passage continuity between (A) and (B)
12 V direct current supply between terminals 1 and 2	Not existed
OFF	Existed

Operation takes less than 1 second.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

3. CHECK EVAP CANISTER VENT CONTROL VALVE-III

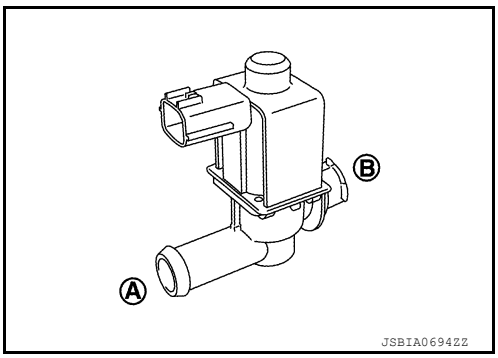
WITH CONSULT

1. Clean the air passage [portion (A) to (B)] of EVAP canister vent control valve using an air blower.
2. Perform “VENT CONTROL/V” in “ACTIVE TEST” mode.

3. Check air passage continuity and operation delay time.
Check that new O-ring is installed properly.

VENT CONTROL/V Condition	Air passage continuity between (A) and (B)
ON	Not existed
OFF	Existed

Operation takes less than 1 second.



⊗ WITHOUT CONSULT
1. Clean the air passage [portion (A) to (B)] of EVAP canister vent control valve using an air blower.
2. Check air passage continuity and operation delay time under the following conditions.
Check that new O-ring is installed properly.

Condition	Air passage continuity between (A) and (B)
12 V direct current supply between terminals 1 and 2	Not existed
OFF	Existed

Operation takes less than 1 second.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

P0448 EVAP CANISTER VENT CONTROL VALVE

DTC Description

INFOID:0000000014419623

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0448	VENT CONTROL VALVE (EVAP canister vent control valve close)	Diagnosis condition	—
		Signal (terminal)	EVAP canister vent control valve signal
		Threshold	EVAP canister vent control valve remains closed under specified driving conditions
		Diagnosis delay time	—

POSSIBLE CAUSE

- EVAP canister vent control valve
- EVAP control system pressure sensor and the circuit
- Blocked rubber tube to EVAP canister vent control valve
- EVAP canister is saturated with water

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Start engine and let it idle for at least 1 minute.
4. Repeat next procedures 3 times.

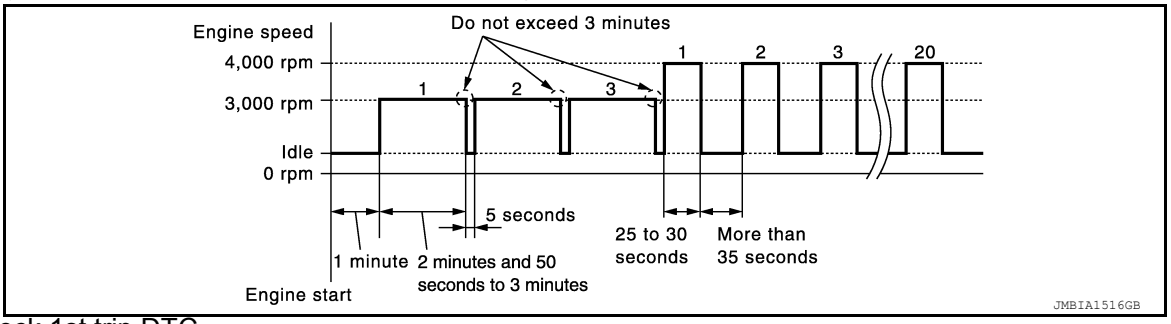
- Increase the engine speed up to between 3,000 and 3,500 rpm and maintain that speed for 2 minutes and 50 seconds to 3 minutes.

Do not exceed 3 minutes.

- Fully released accelerator pedal and keep engine idle for approximately 5 seconds.

5. Repeat next procedure 20 times.

- Quickly increase the engine speed up to between 4,000 and 4,500 rpm and maintain that speed for 25 to 30 seconds.
- Fully released accelerator pedal and keep engine idle for at least 35 seconds.



6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-449, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".

NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419624

1.CHECK RUBBER TUBE

1. Turn ignition switch OFF.
2. Disconnect rubber tube connected to EVAP canister vent control valve.
3. Check the rubber tube for clogging.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Clean rubber tube using an air blower.

2.CHECK EVAP CANISTER VENT CONTROL VALVE

Refer to EC-446, "Component Inspection (EVAP Canister Vent Control Valve)".

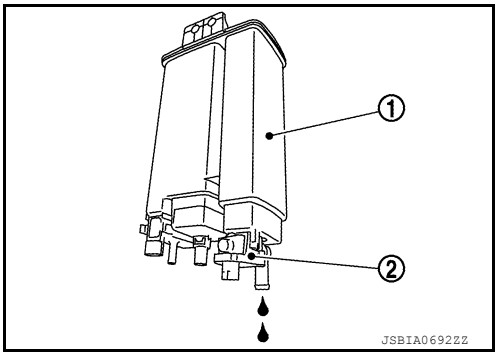
Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

3.CHECK IF EVAP CANISTER IS SATURATED WITH WATER

1. Remove EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
2. Check if water will drain from the EVAP canister (1).

2 : EVAP canister vent control valve



Does water drain from EVAP canister?

YES >> GO TO 4.
NO >> GO TO 6.

4.CHECK EVAP CANISTER

Weigh the EVAP canister with the EVAP canister vent control valve and EVAP control system pressure sensor attached.

The weight should be less than 2.5 kg (5.5 lb).

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the following.

- EVAP canister for damage
- EVAP hose between EVAP canister and vehicle frame for clogging or poor connection

>> Repair hose or replace EVAP canister. Refer to FL-14, "Exploded View".

6.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR CONNECTOR

1. Disconnect EVAP control system pressure sensor harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace EVAP control system pressure sensor. Refer to FL-19, "Exploded View".

7.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

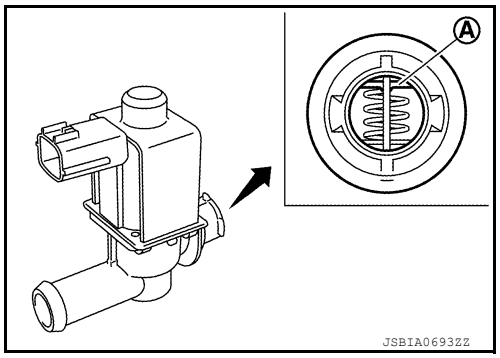
YES >> INSPECTION END
NO >> Replace EVAP control system pressure sensor. Refer to FL-19, "Exploded View".

Component Inspection (EVAP Canister Vent Control Valve)

INFOID:0000000014419625

1. CHECK EVAP CANISTER VENT CONTROL VALVE-I

1. Turn ignition switch OFF.
2. Remove EVAP canister vent control valve from EVAP canister.
3. Check portion (A) of EVAP canister vent control valve for rust.



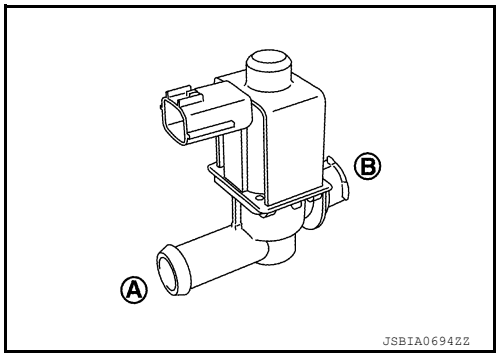
Is it rusted?

YES >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".
NO >> GO TO 2.

2. CHECK EVAP CANISTER VENT CONTROL VALVE-II

WITH CONSULT

1. Reconnect harness connectors disconnected.
2. Turn ignition switch ON.
3. Perform “VENT CONTROL/V” in “ACTIVE TEST” mode.
4. Check air passage continuity and operation delay time.
   Check that new O-ring is installed properly.



VENT CONTROL/V Condition	Air passage continuity between (A) and (B)
ON	Not existed
OFF	Existed

Operation takes less than 1 second.

WITHOUT CONSULT

1. Disconnect EVAP canister vent control valve harness connector.
2. Check air passage continuity and operation delay time under the following conditions.
   Check that new O-ring is installed properly.

Condition	Air passage continuity between (A) and (B)
12 V direct current supply between terminals 1 and 2	Not existed
OFF	Existed

Operation takes less than 1 second.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

3. CHECK EVAP CANISTER VENT CONTROL VALVE-III

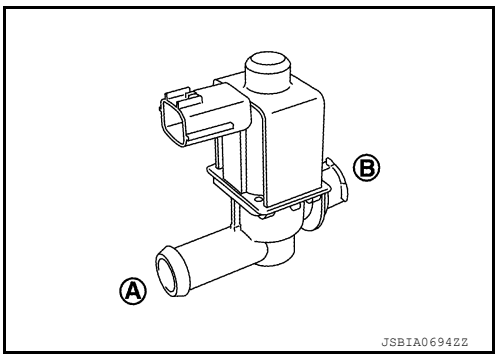
WITH CONSULT

1. Clean the air passage [portion (A) to (B)] of EVAP canister vent control valve using an air blower.
2. Perform “VENT CONTROL/V” in “ACTIVE TEST” mode.

3. Check air passage continuity and operation delay time.
Check that new O-ring is installed properly.

VENT CONTROL/V Condition	Air passage continuity between (A) and (B)
ON	Not existed
OFF	Existed

Operation takes less than 1 second.



WITHOUT CONSULT
1. Clean the air passage [portion (A) to (B)] of EVAP canister vent control valve using an air blower.
2. Check air passage continuity and operation delay time under the following conditions.
Check that new O-ring is installed properly.

Condition	Air passage continuity between (A) and (B)
12 V direct current supply between terminals 1 and 2	Not existed
OFF	Existed

Operation takes less than 1 second.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

P0451 EVAP CONTROL SYSTEM PRESSURE SENSOR

DTC Description

INFOID:0000000014419626

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0451	EVAP SYS PRES SEN (EVAP control system pressure sensor performance)	Diagnosis condition	—
		Signal (terminal)	EVAP control system pressure sensor signal
		Threshold	ECM detects a sloshing signal from the EVAP control system pressure sensor
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (EVAP control system pressure sensor circuit is shorted)
- EVAP control system pressure sensor
- Sensor power supply 3

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

NOTE:
Never remove fuel filler cap during DTC confirmation procedure.

1. PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

With CONSULT>>GO TO 2.
Without CONSULT>>GO TO 5.

2. PERFORM DTC CONFIRMATION PROCEDURE-1

With CONSULT

1. Start engine and let it idle for least 40 seconds.
   NOTE:
   Do not depress accelerator pedal even slightly.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-453, "Diagnosis Procedure".
NO >> GO TO 3.

3. PERFORM DTC CONFIRMATION PROCEDURE-2

With CONSULT

1. Select “EVAP DIAG READY” in “DATA MONITOR” mode of “ENGINE”.
2. Let it idle until “OFF” of “EVAP DIAG READY” changes to “ON”.
   NOTE:
   It will take at most 2 hours until “OFF” of “EVAP DIAG READY” changes to “ON”.
3. Turn ignition switch OFF and wait at least 90 minutes.
   NOTE:
   Never turn ignition switch ON during 90 minutes.
4. Turn ignition switch ON.
5. Select “EVAP LEAK DIAG” in “DATA MONITOR” mode of “ENGINE”.
6. Check that “EVAP LEAK DIAG” indication.

Which is displayed on CONSULT?

CMPLT >> GO TO 4.
YET >> 1. Perform DTC CONFIRMATION PROCEDURE again.
2. GO TO 1.

4.PERFORM DTC CONFIRMATION PROCEDURE-3

With CONSULT
Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-453, "Diagnosis Procedure".
NO >> INSPECTION END

5.PERFORM DTC CONFIRMATION PROCEDURE-4

With GST
1. Start engine and let it idle for least 40 seconds.
NOTE:
Do not depress accelerator pedal even slightly.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-453, "Diagnosis Procedure".
NO >> GO TO 6.

6.PERFORM DTC CONFIRMATION PROCEDURE-5

With GST
1. Let it idle for at least 2 hours.
2. Turn ignition switch OFF and wait at least 90 minutes.
NOTE:
Never turn ignition switch ON during 90 minutes.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-453, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419627

1.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR CONNECTOR

1. Disconnect EVAP control system pressure sensor harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace harness connector.

2.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between EVAP control system pressure sensor harness connector and ground.

EVAP control system pressure sensor		Ground	Voltage (V)
Connector	Terminal		
C32	3	Ground	Approx. 5 V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

4. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP control system pressure sensor.

Component Inspection (EVAP Control System Pressure Sensor)

INFOID:0000000014419628

1. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

1. Turn ignition switch OFF.
2. Remove EVAP control system pressure sensor with its harness connector.
   Always replace O-ring with a new one.
3. Install a vacuum pump to EVAP control system pressure sensor.
4. Turn ignition switch ON and check output voltage between ECM harness connector terminals under the following conditions.

ECM			Condition [Applied vacuum kPa (kg/cm^2, psi)]	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
E16	121	148	Not applied	1.8 - 4.8
			-26.7 (-0.272, -3.87)	2.1 to 2.5 lower than above value

CAUTION:

- **Always calibrate the vacuum pump gauge when using it.**
- **Never apply below -93.3 kPa (-0.952 kg/cm^2, -13.53 psi) or pressure over 101.3 kPa (1.033 kg/cm^2, 14.69 psi).**

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP control system pressure sensor.

P0452 EVAP CONTROL SYSTEM PRESSURE SENSOR

DTC Description

INFOID:0000000014419629

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0452	EVAP SYS PRES SEN (EVAP control system pressure sensor low input)	Diagnosis condition	—
		Signal (terminal)	EVAP control system pressure sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (EVAP control system pressure sensor circuit is shorted)
- EVAP control system pressure sensor
- Sensor power supply 3

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Always perform test at a temperature of 5°C (41°F) or more.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON.
6. Select “DATA MONITOR” mode with CONSULT.
7. Check that “FUEL T/TMP SE” is more than 0°C (32°F).
8. Start engine and wait at least 20 seconds.
9. Check 1st trip DTC.

WITH GST

1. Start engine and warm it up to normal operating temperature.
2. Set voltmeter probes to ECM harness connector terminals under the following conditions.

ECM		
Connector	+	–
	Terminal	Terminal
E16	128 (Fuel tank temperature sensor signal)	152

3. Check that the voltage is less than 4.2 V.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON.
6. Turn ignition switch OFF and wait at least 10 seconds.

7. Start engine and wait at least 20 seconds.
8. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-456, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419630

1. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR CONNECTOR

1. Disconnect EVAP control system pressure sensor harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace harness connector.

2. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT-I

1. Turn ignition switch ON.
2. Check the voltage between EVAP control system pressure sensor harness connector and ground.

EVAP control system pressure sensor		Ground	Voltage (V)
Connector	Terminal		
C32	3	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 3.

3. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	3	E16	125	Existed

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open between ECM and EVAP control system pressure sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit.

5. CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

6.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	1	E16	148	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVAP control system pressure sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	2	E16	121	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 9.

9.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVAP control system pressure sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

10.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP control system pressure sensor. Refer to FL-19, "Exploded View".

Component Inspection (EVAP Control System Pressure Sensor)

INFOID:0000000014419631

1.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

1. Turn ignition switch OFF.
2. Remove EVAP control system pressure sensor with its harness connector.

Always replace O-ring with a new one.

3. Install a vacuum pump to EVAP control system pressure sensor.
4. Turn ignition switch ON and check output voltage between ECM harness connector terminals under the following conditions.

ECM			Condition [Applied vacuum kPa (kg/cm^2, psi)]	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
E16	121	148	Not applied	1.8 - 4.8
			-26.7 (-0.272, -3.87)	2.1 to 2.5 lower than above value

CAUTION:

- **Always calibrate the vacuum pump gauge when using it.**
- **Never apply below -93.3 kPa (-0.952 kg/cm^2, -13.53 psi) or pressure over 101.3 kPa (1.033 kg/cm^2, 14.69 psi).**

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP control system pressure sensor.

P0453 EVAP CONTROL SYSTEM PRESSURE SENSOR

DTC Description

INFOID:0000000014419632

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0453	EVAP SYS PRES SEN (EVAP control system pressure sensor high input)	Diagnosis condition	—
		Signal (terminal)	EVAP control system pressure sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (EVAP control system pressure sensor circuit is shorted)
- EVAP control system pressure sensor
- EVAP canister vent control valve
- EVAP canister
- Rubber hose from EVAP canister vent control valve to vehicle frame
- Sensor power supply 3

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Always perform test at a temperature of 5°C (41°F) or more.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON.
6. Select “DATA MONITOR” mode with CONSULT.
7. Check that “FUEL T/TMP SE” is more than 0°C (32°F).
8. Start engine and wait at least 20 seconds.
9. Check 1st trip DTC.

WITH GST

1. Start engine and warm it up to normal operating temperature.
2. Set voltmeter probes to ECM harness connector terminals under the following conditions.

ECM		
Connector	+	–
	Terminal	Terminal
E16	128 (Fuel tank temperature sensor signal)	152

3. Check that the voltage is less than 4.2 V.

4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON.
6. Turn ignition switch OFF and wait at least 10 seconds.
7. Start engine and wait at least 20 seconds.
8. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-460, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419633

1.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR CONNECTOR

1. Disconnect EVAP control system pressure sensor harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace harness connector.

2.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between EVAP control system pressure sensor harness connector and ground.

EVAP control system pressure sensor		Ground	Voltage (V)
Connector	Terminal		
C32	3	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 3.

3.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	3	E16	125	Existed

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open between ECM and EVAP control system pressure sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit.

5.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

6. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	1	E16	148	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVAP control system pressure sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	2	E16	121	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 9.

9. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between EVAP control system pressure sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

10. CHECK RUBBER TUBE

1. Disconnect rubber tube connected to EVAP canister vent control valve. Refer to FL-17, "Exploded View".
2. Check the rubber tube for clogging.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Clean the rubber tube using an air blower, repair or replace rubber tube.

11. CHECK EVAP CANISTER VENT CONTROL VALVE

Refer to EC-446, "Component Inspection (EVAP Canister Vent Control Valve)".

Is the inspection result normal?

YES >> GO TO 12.

NO >> Replace EVAP canister vent control valve. Refer to FL-17, "Exploded View".

12. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

YES >> GO TO 13.
NO >> Replace EVAP control system pressure sensor. Refer to FL-19, "Exploded View".

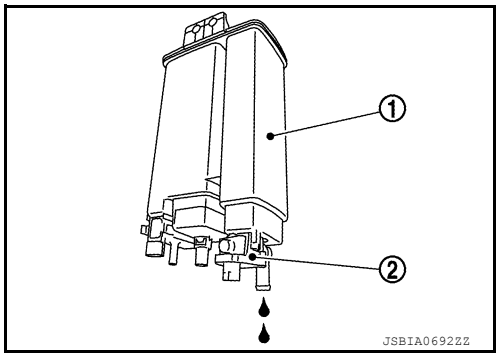
13. CHECK IF EVAP CANISTER IS SATURATED WITH WATER

1. Remove EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
2. Check if water will drain from the EVAP canister (1).

- EVAP canister vent control valve (2)

Does water drain from EVAP canister?

YES >> GO TO 14.
NO >> INSPECTION END



14. CHECK EVAP CANISTER

Weigh the EVAP canister with the EVAP canister vent control valve and EVAP control system pressure sensor attached.

The weight should be less than 2.5 kg (5.5 lb).

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 15.

15. DETECT MALFUNCTIONING PART

Check the following.

- EVAP canister for damage
- EVAP hose between EVAP canister and vehicle frame for clogging or poor connection

>> Repair hose or replace EVAP canister. Refer to FL-14, "Exploded View".

Component Inspection (EVAP Control System Pressure Sensor)

INFOID:0000000014419634

1. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

1. Turn ignition switch OFF.
2. Remove EVAP control system pressure sensor with its harness connector.
   Always replace O-ring with a new one.
3. Install a vacuum pump to EVAP control system pressure sensor.
4. Turn ignition switch ON and check output voltage between ECM harness connector terminals under the following conditions.

ECM			Condition [Applied vacuum kPa (kg/cm^2, psi)]	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
E16	121	148	Not applied	1.8 - 4.8
			-26.7 (-0.272, -3.87)	2.1 to 2.5 lower than above value

CAUTION:

- **Always calibrate the vacuum pump gauge when using it.**

- **Never apply below -93.3 kPa (-0.952 kg/cm^2, -13.53 psi) or pressure over 101.3 kPa (1.033 kg/cm^2, 14.69 psi).**

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EVAP control system pressure sensor.

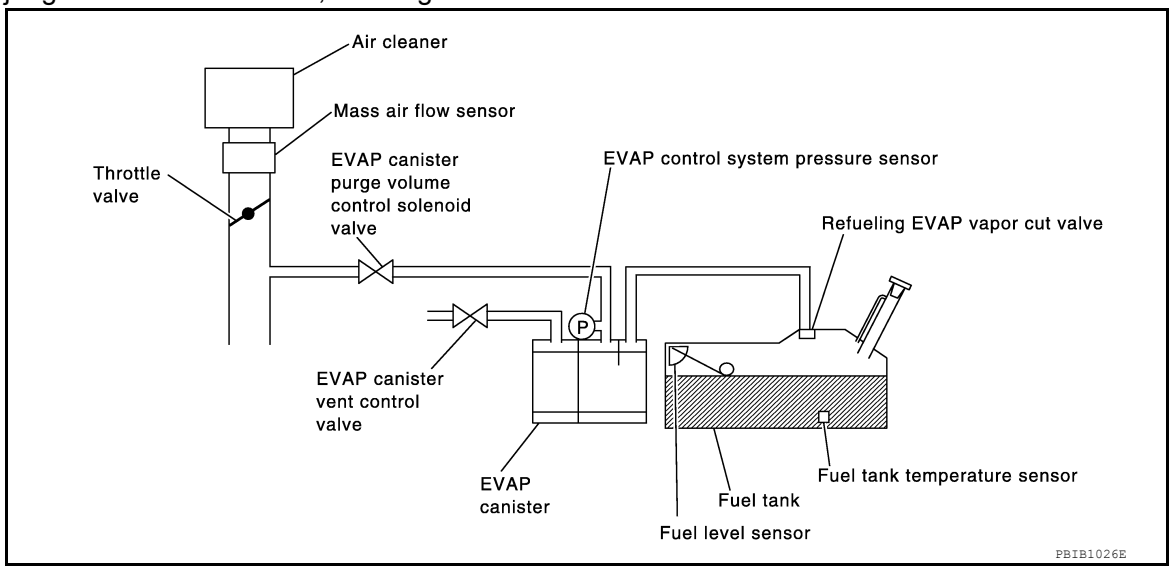
P0456 EVAP CONTROL SYSTEM

DTC Description

INFOID:0000000014419635

DTC DETECTION LOGIC

This diagnosis detects leaks in the EVAP line between fuel tank and EVAP canister purge volume control solenoid valve, using the negative pressure caused by decrease of fuel temperature in the fuel tank after turning ignition switch OFF.
If ECM judges there are no leaks, the diagnosis will be OK.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0456	EVAP VERY SML LEAK [Evaporative emission control system leak detected (very small leak)]	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	EVAP system has a leak
			Diagnosis delay time	—
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	EVAP system does not operate properly
			Diagnosis delay time	—

CAUTION:

- **Use only a genuine NISSAN fuel filler cap as a replacement. If an incorrect fuel filler cap is used, the MIL may illuminate.**
- **If the fuel filler cap is not tightened properly, the MIL may illuminate.**
- **Use only a genuine NISSAN rubber tube as a replacement.**

POSSIBLE CAUSE

- Incorrect fuel tank vacuum relief valve
- Incorrect fuel filler cap used
- Fuel filler cap remains open or does not close
- Foreign matter caught in fuel filler cap
- Leak is in line between intake manifold and EVAP canister purge volume control solenoid valve
- Foreign matter caught in EVAP canister vent control valve
- EVAP canister or fuel tank leaks
- EVAP purge line (pipe and rubber tube) leaks
- EVAP purge line rubber tube bent
- Loose or disconnected rubber tube
- EVAP canister vent control valve and the circuit
- EVAP canister purge volume control solenoid valve and the circuit

- Fuel tank temperature sensor
- O-ring of EVAP canister vent control valve is missing or damaged
- EVAP canister is saturated with water
- EVAP control system pressure sensor
- Refueling EVAP vapor cut valve
- ORVR system leaks
- Fuel level sensor and the circuit
- Foreign matter caught in EVAP canister purge volume control solenoid valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

Do you have CONSULT?

YES >> GO TO 2.
NO >> GO TO 4.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

WITH CONSULT

1. Turn ignition switch ON and select “EVAP DIAG READY” in “DATA MONITOR” mode with CONSULT.
2. Start engine and wait at idle until “OFF” of “EVAP DIAG READY” changes to “ON”.
   NOTE:
   It will take at most 2 hours until “OFF” of “EVAP DIAG READY” changes to “ON”.
3. Turn ignition switch OFF and wait at least 90 minutes.
   NOTE:
   Never turn ignition switch ON during 90 minutes.
4. Turn ignition switch ON and select “EVAP LEAK DIAG” in “DATA MONITOR” mode with CONSULT.
5. Check that “EVAP LEAK DIAG” indication.

Which is displayed on CONSULT?

CMPLT >> GO TO 3.
YET >> Perform DTC CONFIRMATION PROCEDURE again. GO TO 1.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed toEC-465, "Diagnosis Procedure".
NO >> INSPECTION END.

4.PERFORM DTC CONFIRMATION PROCEDURE

WITH GST

1. Start engine and wait engine idle for at least 2 hours.
2. Turn ignition switch OFF and wait at least 90 minutes.
   NOTE:
   Never turn ignition switch ON during 90 minutes.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-465, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

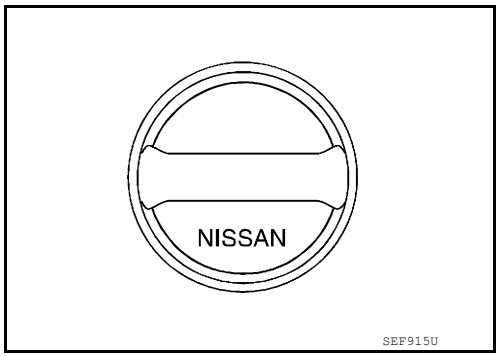
INFOID:0000000014419636

1.CHECK FUEL FILLER CAP DESIGN

1. Turn ignition switch OFF.
2. Check for genuine NISSAN fuel filler cap design.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace with genuine NISSAN fuel filler cap.



2.CHECK FUEL FILLER CAP INSTALLATION

Check that the cap is tightened properly by rotating the cap clockwise.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Open fuel filler cap, then clean cap and fuel filler neck threads using air blower. Then retighten until reteaching sound is heard.

3.CHECK FUEL FILLER CAP FUNCTION

Check for air releasing sound while opening the fuel filler cap.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.CHECK FUEL TANK VACUUM RELIEF VALVE

Refer to EC-469, "Component Inspection (Fuel Filler Cap)".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace fuel filler cap with a genuine one.

5.CHECK FOR EVAP LEAK

Refer to FL-15, "Inspection".

Is there any leak in EVAP line?

YES >> Repair or replace.
NO >> GO TO 6.

6.CHECK EVAP CANISTER VENT CONTROL VALVE

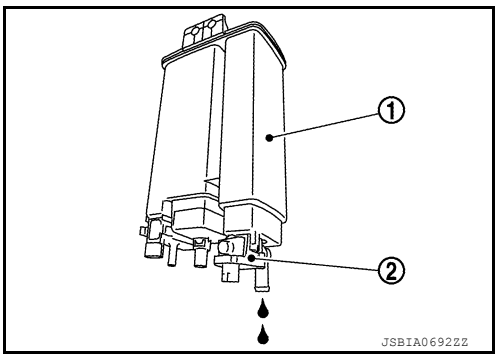
Check the following.
- EVAP canister vent control valve is installed properly.
  Refer to FL-17, "Exploded View".
- EVAP canister vent control valve.
  Refer to EC-446, "Component Inspection (EVAP Canister Vent Control Valve)".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace EVAP canister vent control valve and O-ring. Refer to FL-17, "Exploded View".

7.CHECK IF EVAP CANISTER SATURATED WITH WATER

1. Remove EVAP canister (1) with EVAP canister vent control valve (2) and EVAP control system pressure sensor attached.
2. Check if water will drain from the EVAP canister.



Does water drain from EVAP canister?

YES >> GO TO 8.
NO-1 >> With CONSULT: GO TO 10.
NO-2 >> Without CONSULT: GO TO 11.

8. CHECK EVAP CANISTER

Weigh the EVAP canister assembly with the EVAP canister vent control valve and EVAP control system pressure sensor attached. Refer to FL-17, "Exploded View" (EVAP canister vent control valve), FL-19, "Exploded View" (EVAP control system pressure sensor).

The weight should be less than 2.5 kg (5.5 lb).

Is the inspection result normal?

YES-1 >> With CONSULT: GO TO 10.
YES-2 >> Without CONSULT: GO TO 11.
NO >> GO TO 9.

9. DETECT MALFUNCTIONING PART

Check the following.

- EVAP canister for damage
- EVAP hose between EVAP canister and vehicle frame for clogging or poor connection

>> Repair hose or replace EVAP canister. Refer to FL-14, "Exploded View".

10. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE OPERATION

WITH CONSULT

1. Disconnect vacuum hose to EVAP canister purge volume control solenoid valve at EVAP service port.
2. Start engine and let it idle.
3. Select “PURG VOL CONT/V” in “ACTIVE TEST” mode.
4. Touch “Qu” on CONSULT screen to increase “PURG VOL CONT/V” opening to 100%.
5. Check vacuum hose for vacuum.

Vacuum should exist.

Is the inspection result normal?

YES >> GO TO 13.
NO >> GO TO 12.

11. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE OPERATION

WITHOUT CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Stop engine.
3. Disconnect vacuum hose to EVAP canister purge volume control solenoid valve at EVAP service port.
4. Start engine and let it idle for at least 80 seconds.
5. Check vacuum hose for vacuum when revving engine up to 2,000 rpm.

Vacuum should exist.

Is the inspection result normal?

YES >> GO TO 13.
NO >> GO TO 12.

12. CHECK VACUUM HOSE

Check vacuum hoses for clogging or disconnection.

Is the inspection result normal?

YES >> GO TO 13.
NO >> Repair or reconnect the hose.

13. CHECK EVAP CANISTER PURGE VOLUME CONTROL SOLENOID VALVE

Refer to EC-440, "Component Inspection (EVAP Canister Purge Volume Control Solenoid Valve)".

Is the inspection result normal?

YES >> GO TO 14.
NO >> Replace EVAP canister purge volume control solenoid valve. Refer to EM-35, "Exploded View".

14. CHECK FUEL TANK TEMPERATURE SENSOR

Refer to EC-384, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 15.
NO >> Replace fuel level sensor unit. Refer to FL-6, "Removal and Installation".

15. CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR

Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

Is the inspection result normal?

YES >> GO TO 16.
NO >> Replace EVAP control system pressure sensor. Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".

16. CHECK EVAP PURGE LINE

Check EVAP purge line (pipe, rubber tube, fuel tank and EVAP canister) for cracks or improper connection. Refer to FL-14, "Exploded View".

Is the inspection result normal?

YES >> GO TO 17.
NO >> Repair or reconnect the hose.

17. CLEAN EVAP PURGE LINE

Clean EVAP purge line (pipe and rubber tube) using air blower.

>> GO TO 18.

18. CHECK EVAP/ORVR LINE

Check EVAP/ORVR line between EVAP canister and fuel tank for clogging, kink, looseness and improper connection.

Is the inspection result normal?

YES >> GO TO 19.
NO >> Repair or replace hoses and tubes.

19. CHECK RECIRCULATION LINE

Check recirculation line between fuel filler tube and fuel tank for clogging, kink, cracks, looseness and improper connection.

Is the inspection result normal?

YES >> GO TO 20.
NO >> Repair or replace hose, tube or fuel filler tube. Refer to FL-9, "Exploded View".

20. CHECK REFUELING EVAP VAPOR CUT VALVE

Refer to EC-708, "Component Inspection (EVAP Vapor Cut Valve)".

Is the inspection result normal?

YES >> GO TO 21.
NO >> Replace refueling EVAP vapor cut valve with fuel tank. Refer to FL-14, "Exploded View".

21. CHECK FUEL LEVEL SENSOR

Refer to MWI-94, "Component Inspection (Cummins 5.0L)" (TYPE A), MWI-173, "Component Inspection" (TYPE B).

Is the inspection result normal?

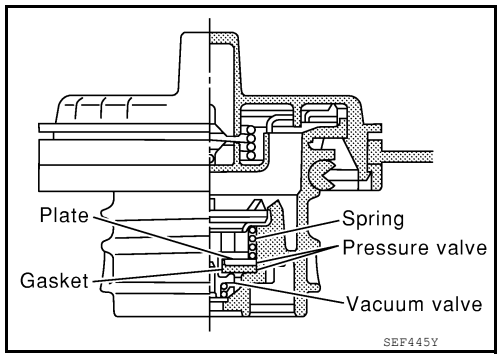
YES >> INSPECTION END
NO >> Replace fuel level sensor unit. Refer to FL-6, "Removal and Installation".

Component Inspection (Fuel Filler Cap)

INFOID:0000000014419637

1.CHECK FUEL FILLER CAP

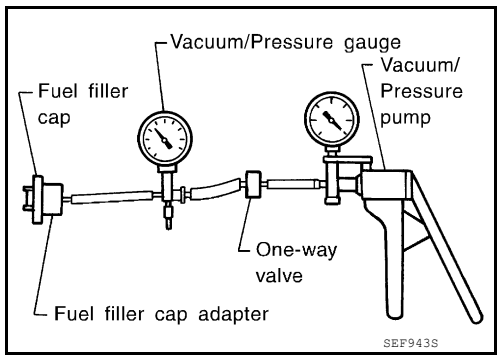
1. Turn ignition switch OFF.
2. Remove fuel filler cap.
3. Wipe clean valve housing.



4. Install fuel filler cap adapter (commercial service tool) to fuel filler cap.
5. Check valve opening pressure and vacuum.

Pressure: **15.3 - 20.0 kPa (0.156 - 0.204 kg/cm^2, 2.22 - 2.90 psi)**

Vacuum: **−6.0 to −3.3 kPa (−0.061 to −0.034 kg/cm^2, −0.87 to −0.48 psi)**



Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE FUEL FILLER CAP

Replace fuel filler cap.

CAUTION:

Use only a genuine fuel filler cap as a replacement. If an incorrect fuel filler cap is used, the MIL may illuminate.

>> INSPECTION END

P0460 FUEL LEVEL SENSOR

DTC Description

INFOID:0000000014419638

DTC DETECTION LOGIC

When the vehicle is parked, the fuel level in the fuel tank is naturally stable. It means that output signal of the fuel level sensor does not change. If ECM senses sloshing signal from the sensor, fuel level sensor malfunction is detected.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0460	FUEL LEV SEN SLOSH (Fuel level sensor “A” circuit)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	Fuel level sensor signal
		Threshold	Even though the vehicle is parked, a signal being varied is sent from the fuel level sensor to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The CAN communication line is open or shorted)
- Harness or connectors (The sensor circuit is open or shorted)
- Combination meter
- Fuel level sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P0460 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0460 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and wait maximum of 2 consecutive minutes.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-470, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419639

1.CHECK DTC PRIORITY

- If DTC P0460 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0460 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".

NO >> GO TO 2.

2.CHECK DTC WITH “COMBINATION METER”

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is any DTC detected?

YES >> Perform trouble diagnosis of detected DTC.
NO >> GO TO 3.

3.CHECK FUEL LEVEL SENSOR SIGNAL CIRCUIT

Check fuel level sensor signal circuit. Refer to MWI-91, "Component Function Check (Cummins 5.0L)" (TYPE A), MWI-172, "Component Function Check" (TYPE B).

Is the inspection result normal?

YES >> INSPECTION END
NO >> Perform trouble diagnosis of fuel level sensor signal circuit. Refer to MWI-91, "Diagnosis Procedure (Cummins 5.0L)" (TYPE A), MWI-172, "Diagnosis Procedure" (TYPE B).

P0461 FUEL LEVEL SENSOR

DTC Description

INFOID:0000000014419640

DTC DETECTION LOGIC

Driving long distances naturally affect fuel gauge level.
This diagnosis detects the fuel gauge malfunction of the gauge not moving even after a long distance has been driven.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0461	FUEL LEVEL SENSOR (Fuel level sensor “A” circuit range/performance)	Diagnosis condition	—
		Signal (terminal)	Fuel level sensor signal
		Threshold	The output signal of the fuel level sensor does not change within the specified range even though the vehicle has been driven a long distance
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The CAN communication line is open or shorted)
- Harness or connectors (The sensor circuit is open or shorted)
- Combination meter
- Fuel level sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P0461 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0461 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PERFORM COMPONENT FUNCTION CHECK

Perform Component Function Check. Refer to EC-472, "Component Function Check".
Use component function check to check the overall function of the fuel level sensor. During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-473, "Diagnosis Procedure".

Component Function Check

INFOID:0000000014419641

1.CHECK DTC PRIORITY

- If DTC P0461 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0461 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

WARNING:

When performing the following procedure, always observe the handling of the fuel. Refer to FL-3, "General Precautions".
TESTING CONDITION:
Before starting component function check, preparation of draining fuel and refilling fuel is required.

>> GO TO 3.

3.PERFORM COMPONENT FUNCTION CHECK

NOTE:
Start from step 8, if it is possible to confirm that the fuel cannot be drained by 30 ℓ (7-7/8 US gal, 6-5/8 Imp gal) in advance.
1. Prepare a fuel container and a spare hose.
2. Release fuel pressure from fuel line. Refer to EC-205, "Work Procedure".
3. Remove the fuel feed hose on the fuel level sensor unit. Refer to FL-6, "Removal and Installation".
4. Connect a spare fuel hose where the fuel feed hose was removed.
5. Turn ignition switch ON.
6. Drain fuel by 30 ℓ (7-7/8 US gal, 6-5/8 Imp gal) from the fuel tank using proper equipment.
7. Confirm that the fuel gauge indication varies.
8. Fill fuel into the fuel tank for 30 ℓ (7-7/8 US gal, 6-5/8 Imp gal).
9. Confirm that the fuel gauge indication varies.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-473, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419642

1.CHECK DTC PRIORITY

- If DTC P0461 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0461 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC WITH “COMBINATION METER”

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is any DTC detected?

YES >> Perform trouble diagnosis of detected DTC.
NO >> GO TO 3.

3.CHECK FUEL LEVEL SENSOR SIGNAL CIRCUIT

Check fuel level sensor signal circuit. Refer to MWI-91, "Component Function Check (Cummins 5.0L)" (TYPE A), MWI-172, "Component Function Check" (TYPE B).

Is the inspection result normal?

YES >> INSPECTION END
NO >> Perform trouble diagnosis of fuel level sensor signal circuit. Refer to MWI-91, "Diagnosis Procedure (Cummins 5.0L)" (TYPE A), MWI-172, "Diagnosis Procedure" (TYPE B).

P0462, P0463 FUEL LEVEL SENSOR

DTC Description

INFOID:0000000014419643

DTC DETECTION LOGIC

This diagnosis indicates the former, to detect open or short circuit malfunction.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0462	FUEL LEVL SEN/CIRC (Fuel level sensor “A” circuit low)	Diagnosis condition	—
		Signal (terminal)	Fuel level sensor signal
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P0463	FUEL LEVL SEN/CIRC (Fuel level sensor circuit “A” high)	Diagnosis condition	—
		Signal (terminal)	Fuel level sensor signal
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0462
- Harness or connectors (The CAN communication line is open or shorted)
- Harness or connectors (The sensor circuit is open or shorted)
- Combination meter
- Fuel level sensor

P0463
- Harness or connectors (The CAN communication line is open or shorted)
- Harness or connectors (The sensor circuit is open or shorted)
- Combination meter
- Fuel level sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P0462 or P0463 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0462 or P0463 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at ignition switch ON.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.

2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-475, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419644

1.CHECK DTC PRIORITY

- If DTC P0462 or P0463 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0462 or P0463 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform the diagnosis of the applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC WITH “COMBINATION METER”

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is any DTC detected?

YES >> Perform trouble diagnosis of detected DTC.
NO >> GO TO 3.

3.CHECK FUEL LEVEL SENSOR SIGNAL CIRCUIT

Check fuel level sensor signal circuit. Refer to MWI-91, "Component Function Check (Cummins 5.0L)" (TYPE A), MWI-172, "Component Function Check" (TYPE B).

Is the inspection result normal?

YES >> INSPECTION END
NO >> Perform trouble diagnosis of fuel level sensor signal circuit. Refer to MWI-91, "Diagnosis Procedure (Cummins 5.0L)" (TYPE A), MWI-172, "Diagnosis Procedure" (TYPE B).

P0500 VSS

DTC Description

INFOID:0000000014419645

DTC DETECTION LOGIC

ECM receives vehicle speed signals from two different paths via CAN communication line: One is from the ABS actuator and electric unit (control unit) via the combination unit and the other is from TCM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0500	VEH SPEED SEN/CIRC (Vehicle speed sensor)	Diagnosis condition	• Selector lever: D position • Vehicle speed: 20 km/h (13 MPH) or more
		Signal (terminal)	—
		Threshold	At 20 km/h (13 MPH), ECM detects the following status continuouse: The difference between vehicle speed calculated by output speed sensor transmitted from TCM to ECM via CAN communication and vehicle speed indicated on the combination meter exceeds 15km/h (10 MPH).
		Diagnosis delay time	5 seconds or mor

POSSIBLE CAUSE

- Harness or connector
  (The CAN communication line is open or shorted.)
- Combination meter
- ABS actuator and electric unit (control unit)
- Wheel sensor
- TCM
- Output speed sensor

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0500	Vehicle speed sensor	The cooling fan operates (Highest) while engine is running.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P0500 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0500 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine.
2. Shift the selector lever to D range and wait at least for 2 seconds.

3. Drive the vehicle at least 5 seconds at 20 km/h (13 MPH) or more.
CAUTION:
Always drive vehicle at a safe speed.
NOTE:
This procedure may be conducted with the drive wheels lifted in the shop or by driving the vehicle. If a road test is expected to be easier, it is unnecessary to lift the vehicle.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-477, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419646

1.CHECK DTC PRIORITY

- If DTC P0500 is displayed with DTC UXXXX, first perform the trouble diagnosis for DTC UXXXX.
- If DTC P0500 is displayed with DTC P0607, first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC WITH TCM

Check DTC with TCM. Refer to TM-317, "CONSULT Function".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Perform trouble shooting relevant to DTC indicated.

3.CHECK DTC WITH ABS ACTUATOR AND ELECTRIC UNIT (CONTROL UNIT)

Check DTC with ABS actuator and electric unit (control unit). Refer to BRC-55, "DTC Index".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Perform trouble shooting relevant to DTC indicated.

4.CHECK DTC WITH COMBINATION METER

Check DTC with combination meter. Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is the inspection result normal?

YES >> GO TO 5.
NO >> Perform trouble shooting relevant to DTC indicated.

5.CHECK OUTPUT SPEED SENSOR

Check output speed sensor. Refer to TM-380, "Diagnosis Procedure".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace or replace error-detected parts.

6.CHECK WHEEL SENSOR

Check wheel sensor. Refer to BRC-91, "DTC Description".

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Replace or replace error-detected parts.

P0506 ISC SYSTEM

DTC Description

INFOID:0000000014419647

DTC DETECTION LOGIC

The ECM controls the engine idle speed to a specified level through the fine adjustment of the air, which is let into the intake manifold, by operating the electric throttle control actuator. The operating of the throttle valve is varied to allow for optimum control of the engine idling speed. The crankshaft position sensor detects the actual engine speed and sends a signal to the ECM.
The ECM controls the electric throttle control actuator so that the engine speed coincides with the target value memorized in the ECM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ECM is determined by taking into consideration various engine conditions, such as during warming up, deceleration and engine load (air conditioner, power steering and cooling fan operation, etc.).

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0506	ISC SYSTEM (Idle speed control system RPM lower than expected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The idle speed is less than the target idle speed by 100 rpm or more.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Electric throttle control actuator
- Intake air leakage

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0506 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

If the target idle speed is out of the specified value, perform EC-200, "Description", before conducting DTC Confirmation Procedure.
TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**
- **Always perform the test at a temperature above −10°C (14°F).**

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Restart engine and run it for at least 1 minute at idle speed.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-479, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419648

1.CHECK DTC PRIORITY

If DTC P0506 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK INTAKE AIR LEAKAGE

1. Start engine and let it idle.
2. Listen for an intake air leakage after the mass air flow sensor.

Is intake air leakage detected?

YES >> Discover air leakage location and repair.
NO >> GO TO 3.

3.REPLACE ECM

1. Stop engine.
2. Replace ECM.
3. Perform additional service when replacing ECM. Refer to EC-194, "Description".

>> INSPECTION END

P0507 ISC SYSTEM

DTC Description

INFOID:0000000014419649

DTC DETECTION LOGIC

The ECM controls the engine idle speed to a specified level through the fine adjustment of the air, which is let into the intake manifold, by operating the electric throttle control actuator. The operating of the throttle valve is varied to allow for optimum control of the engine idling speed. The crankshaft position sensor detects the actual engine speed and sends a signal to the ECM.
The ECM controls the electric throttle control actuator so that the engine speed coincides with the target value memorized in the ECM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ECM is determined by taking into consideration various engine conditions, such as during warming up, deceleration and engine load (air conditioner, power steering and cooling fan operation, etc.).

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0507	ISC SYSTEM (Idle speed control system RPM higher than expected)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The idle speed is more than the target idle speed by 200 rpm or more.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Electric throttle control actuator
- Intake air leakage
- PCV system

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P0507 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

If the target idle speed is out of the specified value, perform EC-200, "Description", before conducting DTC Confirmation Procedure.

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.**
- **Always perform the test at a temperature above −10°C (14°F).**

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start engine and run it for at least 1 minute at idle speed.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-481, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419650

1.CHECK DTC PRIORITY

If DTC P0507 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK PCV HOSE CONNECTION

Confirm that PCV hose is connected correctly.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace malfunctioning part.

3.CHECK INTAKE AIR LEAKAGE

1. Start engine and let it idle.
2. Listen for an intake air leakage after the mass air flow sensor.

Is intake air leakage detected?

YES >> Discover air leakage location and repair.
NO >> GO TO 4.

4.REPLACE ECM

1. Stop engine.
2. Replace ECM.
3. Perform additional service when replacing ECM. Refer to EC-194, "Description".

>> INSPECTION END

P050A, P050B, P050E COLD START CONTROL

DTC Description

INFOID:0000000014419651

DTC DETECTION LOGIC

ECM controls ignition timing and engine idle speed when engine is started with pre-warming up condition. This control promotes the activation of three way catalyst by heating the catalyst and reduces emissions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P050A	Cold start idle air control system performance	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM does not control engine idle speed properly when engine is started with pre-warming up condition.
		Diagnosis delay time	—
P050B	Cold start ignition timing performance	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM does not control ignition timing properly when engine is started with pre-warming up condition.
		Diagnosis delay time	—
P050E	Cold start engine exhaust temperature too low	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The temperature of the catalyst inlet does not rise to the proper temperature when the engine is started with pre-warming up condition.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Lack of intake air volume
- Fuel injection system
- ECM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P050A, P050B or P050E is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is more than 11 V at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

With CONSULT
1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Select “DATA MONITOR” mode with CONSULT.
4. Check the indication of “COOLAN TEMP/S”.

With GST
Follow the procedure “With CONSULT” above.

Is the value of “COOLAN TEMP/S” between 4°C (39°F) and 36°C (97°F)?

YES >> GO TO 4.
NO-1 [If it is below 4°C (39°F)]>>Warm up the engine until the value of “COOLAN TEMP/S” reaches 15°C (59°F) or more. Retry from step 1.
NO-2 [If it is above 36°C (97°F)]>>Cool engine down to less than 36°C (97°F). Retry from step 1.

4. PERFORM DTC CONFIRMATION PROCEDURE-II

With CONSULT
1. Set the select lever in N range.
2. Start the engine and warm up in idle with the value of “COOLAN TEMP/S” between 4°C (39°F) and 40°C (104°F) for more than 15 seconds.
3. Check 1st trip DTC.

With GST
Follow the procedure “With CONSULT” above.

Is 1st trip DTC detected?

YES >> Proceed to EC-483, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419652

1. CHECK DTC PRIORITY

If DTC P050A, P050B or P050E is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2. PERFORM IDLE AIR VOLUME LEARNING

Perform EC-200, "Description".

Is Idle Air Volume Learning carried out successfully?

YES >> GO TO 3.
NO >> Follow the instruction of Idle Air Volume Learning.

3. CHECK INTAKE SYSTEM

Check for the cause of intake air volume lacking. Refer to the following.
- Crushed intake air passage
- Intake air passage clogging
- Clogging of throttle body

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace malfunctioning part

4. CHECK FUEL INJECTION SYSTEM FUNCTION

Perform DTC Confirmation Procedure for DTC P0171, P0174. Refer to EC-373, "DTC Description".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Go to EC-375, "Diagnosis Procedure" for DTC P0171, P0174.

5. PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.

2. Erase DTC.
3. Perform DTC Confirmation Procedure.
   See EC-482, "DTC Description".

Is the 1st trip DTC P050A, P050B or P050E displayed again?

YES >> GO TO 6.
NO >> INSPECTION END

6. REPLACE ECM

1. Replace ECM.
2. Go to EC-727, "Removal and Installation".

>> INSPECTION END

P0520 EOP SENSOR

DTC Description

INFOID:0000000014419653

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0520	EOP sensor circuit	Diagnosis condition	Ignition switch ON
		Signal (terminal)	EOP sensor signal
		Threshold	Signal voltage from the EOP sensor remains at more than 4.9 V / less than 0.26 V.
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors
  (EOP sensor circuit is open or shorted.)
- Engine oil level abnormality
- EOP sensor
- Power steering pressure sensor
- FRP sensor
- Sensor power suplly 3

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-485, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419654

1.CHECK ENGINE OIL

1. Turn ignition switch OFF.
2. Check engine oil level and pressure. Refer to LU-9, "Inspection".

Is inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace error-detected parts.

2.CHECK EOP SENSOR POWER SUPPLY-I

1. Disconnect EOP sensor connector.
2. Turn ignition switch ON.
3. Check the voltage between EOP sensor harness connector terminals.

EOP sensor			Voltage (Approx.)
Connector	+ terminal	–	
F229	3	1	5 V

Inspection result normal?

YES >> GO TO 7.
NO >> GO TO 3.

3.CHECK EOP SENSOR POWER SUPPLY-II

Check the voltage between EOP sensor harness connector and the ground.

+		–	Voltage (Approx.)
EOP sensor			
Connector	Terminal		
F229	3	Ground	5 V

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

5.CHECK EOP SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EOP sensor harness connector and ECM harness connector.

+		–		Continuity
EOP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F229	1	F78	13	Existed

Is inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK ECM GROUND CIRCUIT

Check the continuity between ECM harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
E16	147	Ground	Existed
	149		
	152		

Is inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

7.CHECK EOP SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EOP sensor harness connector and ECM harness connector.

+		–		Continuity
EOP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F229	2	F78	23	Existed

4. Also check harness for short to ground and to power.

Is inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK EOP SENSOR

Refer to EC-487, "Component Inspection (EOP sensor)".

Is inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

Component Inspection (EOP sensor)

INFOID:0000000014419655

1.CHECK EOP SENSOR

1. Turn ignition switch OFF.
2. Disconnect EOP sensor harness connector.
3. Check resistance between EOP sensor connector terminals.

+	–	Condition	Resistance (kΩ)
EOP sensor			
Terminal			
1	2	None	4 kΩ – 10 kΩ
	3		2 kΩ – 8 kΩ
2	1		4 kΩ – 10 kΩ
	3		1 kΩ – 3 kΩ
3	1		2 kΩ – 8 kΩ
	2		1 kΩ – 3 kΩ

Is the inspection result normal?

YES >> INSPECTION END.
NO >> Replace EOP sensor. Refer to EM-70, "Exploded View".

P0524 ENGINE OIL PRESSURE

DTC Description

INFOID:0000000014681575

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0524	ENGINE OIL PRESSURE (Engine oil pressure too low)	Diagnosis condition	Engine speed: 1,000 rpm or more
		Signal (terminal)	Engine oil pressure sensor signal
		Threshold	An EOP sensor signal voltage applied to ECM remains lower than the specified value
		Diagnosis delay time	10 seconds or more

POSSIBLE CAUSE

- Decrease in engine oil pressure
- Decrease in engine oil level
- Engine oil condition
- EOP sensor
- Engine body

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0524	Engine oil pressure	• ECM illuminates oil pressure warning lamp on the combination meter. • Engine speed will not rise more than 4,000 rpm due to the fuel cut. • Fail-safe is canceled when ignition switch OFF → ON.

DTC CONFIRMATION PROCEDURE

CAUTION:

If "EC-489, "Diagnosis Procedure"" is unfinished, be sure to perform Step 3 and 4.

1.PRECONDITIONING-1

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PRECONDITIONING-2

Is "Diagnosis Procedure" of DTC P0524 finished?

YES >> GO TO 3.
NO >> GO TO 4.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to normal operating temperature.
2. Maintain the following conditions for about 10 consecutive seconds.

Selector lever	P or N position
Engine coolant temperature	70°C (158°F) or more
Engine speed	1,000 rpm or more

NOTE:

With engine speed set around 4,000 rpm, the phenomenon can be reproduced more easily.
3. Check DTC.

Is DTC P0524 detected?

YES >> Proceed to EC-489, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

4.CHECK ENGINE OIL LEVEL

Check engine oil level. Refer to LU-9, "Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Proceed to EC-489, "Diagnosis Procedure".

5.CHECK ENGINE OIL PRESSURE

With CONSULT
1. Turn ignition switch ON.
2. On CONSULT screen, select “ENGINE” >> “Data Monitor”.
3. Start the engine and check that “EOP SENSOR” changes, according to engine speeds.

Monitor item	Condition		Value
EOP SENSOR	• Engine: After warming up • Selector lever: P or N • Air conditioner switch: OFF • No load	Idle	Approx. 1,200 mV
		2,000 rpm	Approx. 2,800 mV

Without CONSULT
Check engine oil pressure. Refer to LU-9, "Inspection".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Proceed to EC-489, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014681576

1.CHECK ENGINE OIL LEVEL

1. Turn ignition switch OFF.
2. Check engine oil level. Refer to LU-9, "Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 4.

2.CHECK ENGINE OIL PRESSURE

With CONSULT
1. Turn ignition switch ON.
2. On CONSULT screen, select “ENGINE” >> “Data Monitor”.
3. Start the engine and check that “EOP SENSOR” changes, according to engine speeds.

Monitor item	Condition		Value
EOP SENSOR	• Engine: After warming up • Selector lever: P or N • Air conditioner switch: OFF • No load	Idle	Approx. 1,200 mV
		2,000 rpm	Approx. 2,800 mV

Without CONSULT
Check engine oil pressure. Refer to LU-9, "Inspection".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Check oil pump. Refer to LU-17, "Removal and Installation".

3.CHECK EOP SENSOR

Check EOP sensor. Refer to EC-490, "Component Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace error-detected parts.

4.CHECK ENGINE OIL LEAKAGE

Check engine oil leakage. Refer to LU-9, "Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK CAUSE OF ENGINE OIL CONSUMPTION

Check the following item.

Step	Inspection item	Equipment	Standard	Reference
1	PCV valve	EC-726, "Inspection"		
2	Exhaust front tube	Visual	• No blocking • No abnormal sounds	—
3	Oil pump	LU-18, "Inspection"		
4	• Piston • Piston pin • Piston ring	• Piston to piston pin oil clearance • Piston ring side clearance • Piston ring end gap		EM-137
5	Cylinder block	• Cylinder block top surface distortion • Piston to cylinder bore clearance		EM-137

>> Repair or replace error-detected parts.

Component Inspection

INFOID:0000000014681577

1.CHECK EOP SENSOR

1. Turn ignition switch OFF.
2. Disconnect EOP sensor harness connector.
3. Check resistance between EOP sensor connector terminals.

EOP sensor Terminal		Condition	Resistance
1	2	None	4 – 10 kΩ
	3		2 – 8 kΩ
2	3		1 – 3 kΩ

Is the inspection result normal?

YES >> INSPECTION END.
NO >> Replace EOP sensor. Refer to EM-70, "Exploded View".

P0527 COOLING FAN SPEED SENSOR

DTC Description

INFOID:0000000014419656

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0527	Coofan clutch assemblyling fan speed sensor circuit range/performance	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Cooling fan speed sensor signal
		Threshold	The number of fan speed signals is 16 rpm or less during engine rev.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  (The fan clutch assembly circuit is open or shorted)
- Fan clutch assembly
- Cooling fan
- IPDM E/R
- Sensor power supply 2

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to the normal operating temperature.
2. Keep the engine speed approximately 1,000 rpm at no load.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-491, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419657

1.CHECK COOLING FAN SPEED SENSOR POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF.
2. Disconnect the fan clutch assembly harness connector.
3. Turn ignition switch ON.
4. Check the voltage between the fan clutch assembly harness connector terminals.

Fan clutch assembly			Voltage (Approx.)
Connector	+	–	
	terminal		
F152	2	4	5 V

Is inspection result normal?

YES >> GO TO 6.
NO >> GO TO 2.

2.CHECK COOLING FAN SPEED SENSOR POWER SUPPLY CIRCUIT-II

1. Check the voltage between the fan clutch assembly harness connector and the ground.

+		–	Voltage (Approx.)
Fan clutch assembly			
Connector	terminal		
F152	2	Ground	5 V

Is inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

4.CHECK COOLING FAN SPEED SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between the fan clutch assembly harness connector and ECM harness connector.

+		–		Continuity
Fan clutch assembly		ECM		
Connector	Terminal	Connector	Terminal	
F152	4	F78	43	Existed

Is inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK ECM GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between ECM harness connector and the ground.

+		–	Continuity
ECM			
Connector	Terminal		
E16	147	Ground	Existed
	149		
	152		

Is inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

6.CHECK COOLING FAN SPEED SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between fan clutch assembly harness connector and ECM harness connector.

+		–		Continuity
Fan clutch assembly		ECM		
Connector	Terminal	Connector	Terminal	
F152	5	F78	31	Existed

4. Also check harness for short to ground and to power.

Is inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK COOLING FAN SPEED SENSOR

1. Reconnect all harness connectors disconnected.
2. Perform cooling fan speed sensor component inspection. Refer to EC-493, "Component Inspection (Cooling Fan Speed Sensor)".

Is inspection result normal?

YES >> GO TO 8.
NO >> Replace the fan clutch assembly.

8.CHECK COOLING FAN ROTATIONAL CONDITION

Rotate the cooling fan by hand.

Dose the cooling fan rotates smoothly?

YES >> GO TO 9.
NO >> Check that the cooling fan is not interfered with other parts.

9.CHECK FAN CLUTCH ASSEMBLY CLUTCH ASSEMBLY SYSTEM

Refer to EC-680, "Diagnosis Procedure".

Is inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

Component Inspection (Cooling Fan Speed Sensor)

INFOID:0000000014419658

1.CHECK COOLING FAN SPEED SENSOR

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector.
3. Rotate the fan clutch assembly slowly with hand and check the voltage between fan clutch assembly connector terminals under the following conditions.

+	–	Condition	Voltage (V) (Approx.)
Fan clutch assembly			
Terminal			
5	4	• 5V direct current supply to terminal 2 • Terminal 4 connect to ground	0 ⇔ 5 **NOTE:** The voltage is in waveform

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace the fan clutch assembly.

P0544, P0545 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419659

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0544	EXHAUST GAS TEMP SENSOR 1 B1 (Exhaust gas temperature sensor circuit bank 1 sensor 1)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is less than 0.025 V.
		Diagnosis delay time	5 seconds or more
P0545	EXHAUST GAS TEMP SENSOR 1 B1 (Exhaust gas temperature sensor circuit low bank 1 sensor 1)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is less than 0.209 V.
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors
  (Exhaust gas temperature sensor circuit is shorted.)
- Exhaust gas temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 11 V.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-494, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419660

1.CHECK EXHAUST GAS TEMPERATURE SENSOR

With CONSULT
1. Turn ignition switch ON.
2. Select “EXHAUST GAS TEMP SEN 1 B1” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine and warm it up to normal operating temperature.

4. Check that “EXHAUST GAS TEMP SEN 1 B1” indication as follows.

Monitor item	Condition	Value
EXHAUST GAS TEMP SEN 1 B1	• Warm-up condition • Idle speed	1,290 – 2,940 mV

Without CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Check that voltage between ECM harness connector terminals as follows.

ECM			Condition	Voltage
Connector	+	–		
	Terminal			
F78	19	43	• Warm-up condition • Idle speed	1.29 – 2.94 V

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace exhaust gas temperature sensor. Refer to EM-45, "Exploded View".

2.CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect exhaust gas temperature sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between exhaust gas temperature sensor harness connector terminal and ground.

+		–	Voltage (Approx.)
Exhaust gas temperature sensor			
Connector	Terminal		
F100	1	Ground	5 V

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 4.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		Continuity
Exhaust gas temperature sensor		ECM		
Connector	Terminal	Connector	Terminal	
F100	2	F78	43	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

4.CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		
Exhaust gas temperature sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F100	1	F78	19	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for ECM power supply circuit. Refer to EC-227, "Diagnosis Procedure".

NO >> Repair or replace error-detected parts.

P0546, P2081 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419661

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0546	EXHAUST GAS TEMP SENSOR 1 B1 (Exhaust gas temperature sensor circuit high bank 1 sensor 1)	Diagnosis condition	—
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is more than 4.84 V.
		Diagnosis delay time	5 seconds or more
P2081	EXHAUST GAS TEMP SENSOR 1 B1 (Exhaust gas temperature sensor circuit intermittent bank 1 sensor 1)	Diagnosis condition	—
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is 4.84 V or more.
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors
  (Exhaust gas temperature sensor circuit is open.)
- Exhaust gas temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING-1

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:

Before performing the following procedure, confirm that battery voltage is more than 11 V at idle.

>> GO TO 2.

2.PRECONDITIONING-2

With CONSULT

1. Turn ignition switch ON.
2. Select “COOLANT TEMP/S” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Check the following conditions:

COOLANT TEMP/S	More than −30°C (−22°F)

With GST

Follow the procedure “With CONSULT” above.

Is the condition satisfied?

YES >> GO TO 4.
NO >> GO TO 3.

3.PRECONDITIONING-3

With CONSULT
1. Start the engine until the following condition is satisfied.

COOLANT TEMP/S	More than −30°C (−22°F)

2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.

With GST
Follow the procedure “With CONSULT” above.

>> GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE

1. Shift the selector lever to P range.
2. Start engine and let it idle for at least 20 seconds.
3. Depress the accelerator pedal for 5 seconds or more.
   NOTE:
   Do not release the accelerator pedal during DTC confirmation procedure.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-498, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419662

1. CHECK EXHAUST GAS TEMPERATURE SENSOR

With CONSULT
1. Turn ignition switch ON.
2. Select “EXHAUST GAS TEMP SEN 1 B1” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine and warm it up to normal operating temperature.
4. Check that “EXHAUST GAS TEMP SEN 1 B1” indication as follows.

Monitor item	Condition	Value
EXHAUST GAS TEMP SEN 1 B1	• Warm-up condition • Idle speed	1,290 – 2,940 mV

Without CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Check that voltage between ECM harness connector terminals as follows.

ECM			Condition	Voltage
Connector	+	–		
	Terminal			
F78	19	43	• Warm-up condition • Idle speed	1.29 – 2.94 V

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace exhaust gas temperature sensor. Refer to EM-45, "Exploded View".

2. CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect exhaust gas temperature sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between exhaust gas temperature sensor harness connector terminal and ground.

+		–	Voltage (Approx.)
Exhaust gas temperature sensor			
Connector	Terminal		
F100	1	Ground	5 V

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 4.

3. CHECK EXHAUST GAS TEMPERATURE SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		Continuity
Exhaust gas temperature sensor		ECM		
Connector	Terminal	Connector	Terminal	
F100	2	F78	43	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

4. CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		Continuity
Exhaust gas temperature sensor		ECM		
Connector	Terminal	Connector	Terminal	
F100	1	F78	19	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for ECM power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

P0547, P0548 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419663

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0547	EXHAUST GAS TEMP SENSOR 1 B2 (Exhaust gas temperature sensor circuit bank 2 sensor 1)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is less than 0.025 V.
		Diagnosis delay time	5 seconds or more
P0548	EXHAUST GAS TEMP SENSOR 1 B2 (Exhaust gas temperature sensor circuit low bank 2 sensor 1)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is less than 0.209 V.
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors
  (Exhaust gas temperature sensor circuit is shorted.)
- Exhaust gas temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 11 V.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-500, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419664

1.CHECK EXHAUST GAS TEMPERATURE SENSOR

With CONSULT
1. Turn ignition switch ON.
2. Select “EXHAUST GAS TEMP SEN 1 B2” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine and warm it up to normal operating temperature.

4. Check that “EXHAUST GAS TEMP SEN 1 B2” indication as follows.

Monitor item	Condition	Value
EXHAUST GAS TEMP SEN 1 B2	• Warm-up condition • Idle speed	1,290 – 2,940 mV

⊗Without CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Check that voltage between ECM harness connector terminals as follows.

ECM			Condition	Voltage
Connector	+	–		
	Terminal			
F78	17	43	• Warm-up condition • Idle speed	1.29 – 2.94 V

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace exhaust gas temperature sensor. Refer to EM-45, "Exploded View".

2.CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect exhaust gas temperature sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between exhaust gas temperature sensor harness connector terminal and ground.

+		–	Voltage (Approx.)
Exhaust gas temperature sensor			
Connector	Terminal		
F89	1	Ground	5 V

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 4.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		Continuity
Exhaust gas temperature sensor		ECM		
Connector	Terminal	Connector	Terminal	
F89	2	F78	43	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

4.CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		
Exhaust gas temperature sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F89	1	F78	17	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for ECM power supply circuit. Refer to EC-227, "Diagnosis Procedure".

NO >> Repair or replace error-detected parts.

P0549, P2083 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419665

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0549	EXHAUST GAS TEMP SENSOR 1 B2 (Exhaust gas temperature sensor circuit high bank 2 sensor 1)	Diagnosis condition	—
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is more than 4.84 V.
		Diagnosis delay time	5 seconds or more
P2083	EXHAUST GAS TEMP SENSOR 1 B2 (Exhaust gas temperature sensor circuit intermittent bank 2 sensor 1)	Diagnosis condition	—
		Signal (terminal)	Exhaust gas temperature sensor signal
		Threshold	ECM detects that a voltage signal from exhaust gas temperature sensor is 4.84 V or more.
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors
  (Exhaust gas temperature sensor circuit is open.)
- Exhaust gas temperature sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING-1

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 11 V at idle.

>> GO TO 2.

2.PRECONDITIONING-2

With CONSULT

1. Turn ignition switch ON.
2. Select “COOLANT TEMP/S” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Check the following conditions:

COOLANT TEMP/S	More than −30°C (−22°F)

With GST

Follow the procedure “With CONSULT” above.

Is the condition satisfied?

YES >> GO TO 4.
NO >> GO TO 3.

3.PRECONDITIONING-3

With CONSULT
1. Start the engine until the following condition is satisfied.

COOLANT TEMP/S	More than −30°C (−22°F)

2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.

With GST
Follow the procedure “With CONSULT” above.

>> GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE

1. Shift the selector lever to P range.
2. Start engine and let it idle for at least 20 seconds.
3. Depress the accelerator pedal for 5 seconds or more.
   NOTE:
   Do not release the accelerator pedal during DTC confirmation procedure.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-504, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419666

1. CHECK EXHAUST GAS TEMPERATURE SENSOR

With CONSULT
1. Turn ignition switch ON.
2. Select “EXHAUST GAS TEMP SEN 1 B2” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine and warm it up to normal operating temperature.
4. Check that “EXHAUST GAS TEMP SEN 1 B2” indication as follows.

Monitor item	Condition	Value
EXHAUST GAS TEMP SEN 1 B2	• Warm-up condition • Idle speed	1,290 – 2,940 mV

Without CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Check that voltage between ECM harness connector terminals as follows.

ECM			Condition	Voltage
Connector	+	–		
	Terminal			
F78	17	43	• Warm-up condition • Idle speed	1.29 – 2.94 V

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace exhaust gas temperature sensor. Refer to EM-45, "Exploded View".

2. CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect exhaust gas temperature sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between exhaust gas temperature sensor harness connector terminal and ground.

+		–	Voltage (Approx.)
Exhaust gas temperature sensor			
Connector	Terminal		
F89	1	Ground	5 V

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 4.

3. CHECK EXHAUST GAS TEMPERATURE SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		Continuity
Exhaust gas temperature sensor		ECM		
Connector	Terminal	Connector	Terminal	
F89	2	F78	43	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

4. CHECK EXHAUST GAS TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between exhaust gas temperature sensor harness connector and ECM harness connector.

+		–		Continuity
Exhaust gas temperature sensor		ECM		
Connector	Terminal	Connector	Terminal	
F89	1	F78	17	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for ECM power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

P0550 PSP SENSOR

DTC Description

INFOID:0000000014419667

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0550	PW ST P SEN/CIRC (Power steering pressure sensor circuit)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Power steering pressure sensor signal
		Threshold	An excessively low or high voltage from the sensor is sent to ECM.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  (The Power steering pressure sensor circuit is open or shorted)
- Power steering pressure sensor
- Sensor power supply 3

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and let it idle for at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-506, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419668

1.CHECK POWER STEERING PRESSURE SENSOR POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF.
2. Disconnect power steering pressure (PSP) sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between PSP sensor harness connector terminals.

PSP sensor			Voltage (Approx.)
Connector	+	–	
	terminal		
F82	3	1	5 V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 2.

2.CHECK POWER STEERING PRESSURE SENSOR POWER SUPPLY CIRCUIT-II

1. Check the voltage between PSP sensor harness connector and the ground.

+		–	Voltage (Approx.)
PSP sensor			
Connector	terminal		
F82	3	Ground	5 V

Is inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

4.CHECK PSP SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between PSP sensor harness connector and ECM harness connector.

+		–		Continuity
PSP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F82	1	F78	13	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK ECM GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between ECM harness connector and the ground.

+		–	Continuity
ECM			
Connector	Terminal		
E16	147	Ground	Existed
	149		
	152		

Is inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

6.CHECK PSP SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between PSP sensor harness connector and ECM harness connector.

+		–		Continuity
PSP sensor		ECM		
Connector	Terminal	Connector	Terminal	
F82	2	F78	24	Existed

4. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK PSP SENSOR

Refer to EC-508, "Component Inspection (Power Steering Pressure Sensor)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace PSP sensor.

8.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

>> INSPECTION END

Component Inspection (Power Steering Pressure Sensor)

INFOID:0000000014419669

1.CHECK POWER STEERING PRESSURE SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and let it idle.
4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
F78	24	13	Steering wheel	Being turned	0.5 - 4.5
				Not being turned	0.4 - 0.8

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace power steering pressure sensor.

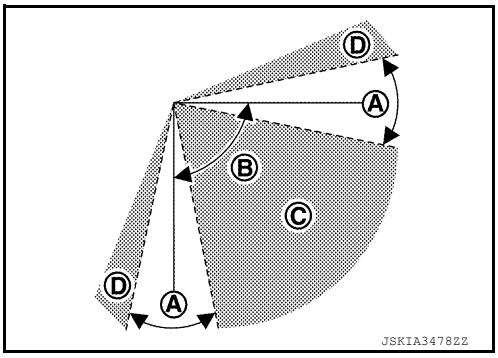
P059F ACTIVE GRILLE SHUTTER

DTC Description

INFOID:0000000014681578

DTC DETECTION LOGIC

Active grille shutter normally stops within zone Ⓐ which is defined by zone Ⓑ (90°±20°).
If the active grille shutter stops within zone Ⓒ stuck error is detected, and if the active grille shutter stops at position beyond zone Ⓓ over-run error is detected.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P059F	ACTIVE GRILLE AIR SHUTTER A (Active grille air shutter A performance/ stuck off)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	Detects the malfunction of initial position learning or operational malfunctions for specified times
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Active grille shutter circuit is open or shorted.)
- Active grille shutter
- Foreign objects interferes with active grille shutter

FAIL-SAFE

Engine Control System

DTC No.	Detected items	Engine operating condition in fail-safe mode
P059F	Active grille shutter	• When a voltage and temperature related malfunction is detected, the active grille shutter stops at the position of detection. • Except for the above case, operates the active grille shutter to fully opened position.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P059F displayed with DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500, P0607 or P159F first perform the confirmation procedure (trouble diagnosis) for DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500, P0607 or P159F.

Is DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500, P0607or P159F detected?

YES >> Perform diagnosis of applicable.
- DTC UXXXX: Refer toEC-136, "DTC Index".
- DTC P0116: Refer to EC-323, "DTC Description".
- DTC P0117, P0118: Refer to EC-326, "DTC Description".
- DTC P0125: Refer to EC-332, "DTC Description".
- DTC P0196: Refer to EC-395, "DTC Description".
- DTC P0197, P0198: Refer to EC-399, "DTC Description".
- DTC P0500: Refer to EC-476, "DTC Description".
- DTC P0607: Refer to EC-521, "DTC Description".
- DTC P159F: Refer to EC-606, "DTC Description".

NO >> GO TO 2.

2.PERFORM DIAGNOSIS PROCEDURE

NOTE:
Since this DTC is difficult to be confirmed, perform diagnosis procedure to judge the normality.

>> Proceed to EC-510, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014681579

1.CHECK DTC PRIORITY

If DTC P059F displayed with DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500, P0607 or P159F first perform the confirmation procedure (trouble diagnosis) for DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500, P0607 or P159F.

Is DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500, P0607or P159F detected?

YES >> Perform diagnosis of applicable.
- DTC UXXXX: Refer to EC-136, "DTC Index".
- DTC P0116: Refer to EC-323, "DTC Description".
- DTC P0117, P0118: Refer to EC-326, "DTC Description".
- DTC P0125: Refer to EC-332, "DTC Description".
- DTC P0196: Refer to EC-395, "DTC Description".
- DTC P0197, P0198: Refer to EC-399, "DTC Description".
- DTC P0500: Refer to EC-476, "DTC Description".
- DTC P0607: Refer to EC-521, "DTC Description".
- DTC P159F: Refer to EC-606, "DTC Description".

NO >> GO TO 2.

2.CHECK ACTIVE GRILL SHUTTER

1. Turn ignition switch OFF.
2. Check if any foreign objects interferes with active grille shutter.
3. Check the installation condition of active grille shutter.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace the error-detected parts.

3.CHECK ACTIVE GRILLE SHUTTER POWER SUPPLY

1. Disconnect active grille shutter harness connector.
2. Check the voltage between active grille shutter harness connector and ground as follows.

+		–	Condition	Voltage (Approx.)
Active grille shutter				
Connector	Terminal			
E8	1	Ground	Ignition switch: ON	Battery voltage
			Ignition switch: OFF	0 V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 4.

4.CHECK FUSE

1. Turn ignition switch OFF.
2. Pull out 20A fuse (No.56) from IPDM E/R.
3. Check that 20A fuse is not blowing.

Is the fuse blown (open)?

YES >> Replace the fuse after repairing the applicable circuit.
NO >> GO TO 5.

5.CHECK ACTIVE GRILLE SHUTTER POWER SUPPLY CIRCUIT

1. Disconnect IPDM E/R harness connector.
2. Check the continuity between IPDM E/R harness connector and active grille shutter harness connector.

IPDM E/R		Active grille shutter		Continuity
Connector	Terminal	Connector	Terminal	
E121	25	E8	1	Existed

3. Also check harness for short to power and short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace the error-detected parts.

6.CHECK ACTIVE GRILLE SHUTTER GROUND CIRCUIT

1. Turn ignition switch OFF
2. Check the continuity between active grille shutter harness connector and ground.

Active grille shutter		—	Continuity
Connector	Terminal		
E8	4	Ground	Existed

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the error-detected parts.

7.CHECK ACTIVE GRILLE SHUTTER INPUT SIGNAL CIRCUIT

1. Disconnect ECM harness connector.
2. Check the continuity between ECM harness connector and active grille shutter harness connector.

ECM		Active grille shutter		Continuity
Connector	Terminal	Connector	Terminal	
F79	86	E8	3	Existed

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the error-detected parts.

8.CHECK ACTIVE GRILLE SHUTTER

Check active grille shutter. Refer to EC-511, "Component Inspection (Active Grille Shutter)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace active grille shutter. Refer to EXT-34, "Removal and Installation".

Component Inspection (Active Grille Shutter)

INFOID:0000000014681580

1.CHECK ACTIVE GRILLE SHUTTER

With CONSULT

1. Start engine.
2. On CONSULT screen, select “ENGINE” >> “Active Test” >> “ACTIVE GRILLE SHUTTER”.
3. Touch “CALIBRTN”.
4. After the calibration completes, check the operation of active grille shutter as follows.

Condition	Active grille shutter
Select “CLOSE”	Close → Open
Select “OPEN”	Open → Close

Without CONSULT

1. Turn ignition switch OFF.
2. Operate shutter by hands to close position.
3. Check the operation of active grille shutter as follows.

Condition	Active grille shutter
Ignition switch: ON	Close → Open

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace active grille shutter. Refer to EXT-34, "Removal and Installation".

P0603 ECM

DTC Description

INFOID:0000000014419670

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0603	ECM BACK UP CIRCUIT [Internal control module keep alive memory (KAM) error]	1	Diagnosis condition	Ignition switch ON
			Signal (terminal)	—
			Threshold	Malfunction in the internal back up RAM of ECM
			Diagnosis delay time	—
		2	Diagnosis condition	Ignition switch ON
			Signal (terminal)	—
			Threshold	Malfunction in the internal EEP-ROM system of ECM
			Diagnosis delay time	—

POSSIBLE CAUSE

- ECM power supply
- ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0603	ECM	Engine torque may be limited.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 1 second.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Repeat step 1 and 2 for 10 times.
4. Turn ignition switch ON.
5. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-513, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419671

1.CHECK ECM POWER SUPPLY AND GROUND CIRCUIT

Perform trouble diagnosis for ECM power supply and ground circuit. Refer to EC-227, "Diagnosis Procedure".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace error-detected parts.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-513, "DTC Description".

Is the 1st trip DTC P0603 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P0604 ECM

DTC Description

INFOID:0000000014419672

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0604	ECM [Internal control module random access memory (RAM) error]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	Malfunction in the internal RAM of ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0604	ECM	• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • ASCD operation may be deactivated.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON (engine stopped) and wait least 20 minutes.
   CAUTION:
   Never start engine during this procedure.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-515, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419673

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-515, "DTC Description".

Is the 1st trip DTC P0604 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".

NO >> INSPECTION END

P0605 ECM

DTC Description

INFOID:0000000014419674

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0605	ECM [Internal control module read only memory (ROM) error]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	Malfunction in the internal ROM of ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0605	ECM	**NOTE:** Fail-safe may not occur depending on malfunction type. • ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • ASCD operation may be deactivated.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON (engine stopped) and wait least 20 minutes.
   CAUTION:
   Never start engine during this procedure.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-517, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419675

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-517, "DTC Description".

Is the 1st trip DTC P0605 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P0606 ECM

DTC Description

INFOID:0000000014419676

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0606	CONTROL MODULE (Control module processor)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	Malfunction in ECM processor
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0606	ECM	**NOTE:** Fail-safe may not occur depending on malfunction type. • ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • ASCD operation may be deactivated.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON (engine stopped) and wait at least 10 seconds.
   CAUTION:
   Never start engine during this procedure.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-520, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Start engine.
2. Rev up the engine quickly to approximately 3,000 rpm under unloaded condition and completely release the accelerator pedal.
3. Let the engine idle and wait at least 10 seconds.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-520, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419677

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure for 3 times. Refer to EC-519, "DTC Description".

Is the 1st trip DTC P0606 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P0607 ECM

DTC Description

INFOID:0000000014419678

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0607	ECM (Control module performance)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	ECM internal communication system is malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0607	ECM	Engine torque may be limited.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON (engine stopped) and wait least 10 seconds.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-521, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419679

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-521, "DTC Description".

Is the 1st trip DTC P0607 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P060A ECM

DTC Description

INFOID:0000000014419680

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P060A	CONTROL MODULE (Internal control module monitoring processor performance)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	ECM internal monitoring processor is malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P060A	ECM	**NOTE:** Fail-safe may not occur depending on malfunction type. • ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • Engine torque may be limited. • ASCD operation may be deactivated.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and wait at least 10 seconds.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Repeat step 1 and 2 for 5 times.
4. Turn ignition switch ON.
5. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-522, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419681

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-522, "DTC Description".

Is the 1st trip DTC P060A displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P060B ECM

DTC Description

INFOID:0000000014419682

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P060B	CONTROL MODULE (Internal control module A/D processing performance)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	ECM internal analog/digital conversion processing system is malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P060B	ECM	**NOTE:** Fail-safe may not occur depending on malfunction type. • ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve • ASCD operation may be deactivated.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON (engine stopped) and wait least 10 seconds.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-524, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419683

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-524, "DTC Description".

Is the 1st trip DTC P060B displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P0611 ECM PROTECTION

DTC Description

INFOID:0000000014419684

DTC DETECTION LOGIC

This DTC is detected when the ECM protective function is activated due to an extreme temperature increase in ECM, resulting from severe conditions such as heavy load driving.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0611	FIC MODULE (ECM protection)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM overheat protection control is activated
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM overheated

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

This DTC is displayed as protection function history. If no malfunction is detected after the diagnosis, the customer must be informed of the activation of the protection function.

>> Proceed to EC-526, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419685

1.INSPECTION START

1. Perform DTC confirmation procedure. Refer to EC-526, "DTC Description".
2. Check 1st trip DTC.

Is DTC P0605 detected?

YES >> Proceed to EC-517, "Diagnosis Procedure".
NO >> Explain the customer about the activation of the protection function.

P062B ECM

DTC Description

INFOID:0000000014419686

DTC DETECTION LOGIC

This DTC is detected when the ECM-integrated injector driver unit has a malfunction. For injector driver unit, refer to EC-43, "ECM".

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P062B	ECM (Internal control module fuel injector control performance)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	Injector driver unit is malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors (Injector circuit is open or shorted)
- Battery power supply
- ECM (injector driver unit)

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P062B	ECM	Type1 • Engine torque is limited. • Idle engine speed is increased. • Fuel injector power supply shut-off. • High fuel pressure limitation.
		Type2 • Engine torque is limited. • Fuel injection shut-off of malfunction cylinder. • Mixture ratio feedback control does not function. • Idle engine speed is increased.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and keep the engine speed at idle for 30 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-527, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419687

1.CHECK FUEL INJECTOR

Perform fuel injector. Refer to EC-685, "Component Function Check".

Is inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace error-detected parts.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure again. Refer to EC-527, "DTC Description".
4. Check 1st trip DTC.

Is the DTC P062B displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P062F CONTROL MODULE

DTC Description

INFOID:0000000014419688

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P062F	CONTROL MODULE (Internal control module EEPROM error)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	ECM calculation is function malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure is previously conducted, always turn ignition switch OFF and wait at least 30 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check the DTC.

Is the DTC detected?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-529, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419689

1.INSPECTION START

1. Perform DTC Confirmation Procedure. Refer to EC-529, "DTC Description".
2. Erase DTC.

Is DTC erased?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ECM

1. Replace ECM. Refer to EC-727, "Removal and Installation".
2. Perform EC-194, "Description".

>> INSPECTION END

P0643 SENSOR POWER SUPPLY

DTC Description

INFOID:0000000014419690

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0643	SENSOR POWER/CIRC (Sensor power supply circuit short)	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	—
		Threshold	ECM detects that the voltage of power source for sensor is excessively low or high
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  (Accelerator pedal position sensor 1 circuit is shorted)
  [Camshaft position sensor (bank 1) circuit is shorted]
  [Exhaust valve timing control position sensor (bank 1) circuit is shorted]
  (Throttle position sensor circuit is shorted)
  (Crankshaft position sensor circuit is shorted)
- Accelerator pedal position sensor 1
- Camshaft position sensor (bank 1)
- Exhaust valve timing control position sensor (bank 1)
- Throttle position sensor
- Crankshaft position sensor

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P0643	Sensor power supply	• ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (Approx. 5 decrees) by the return spring. • The position of the following components is fixed. - Intake valve timing control solenoid valve - Exhaust valve timing control solenoid valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-530, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419691

1.CHECK ACCELERATOR PEDAL POSITION SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect accelerator pedal position (APP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between APP sensor harness connector and ground.

APP sensor		Ground	Voltage (V)
Connector	Terminal		
E20	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY CIRCUIT

Check harness for short to power and short to ground, between the following terminals.

ECM		Sensor		
Connector	Terminal	Name	Connector	Terminal
F78	27	Crankshaft position sensor	F38	1
	28	Camshaft position sensor (bank 1)	F66	1
		Exhaust valve timing control position sensor (bank 1)	F71	1
F79	83	Electric throttle control actuator	F50	2
E16	146	APP sensor 1	E20	2

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair short to ground or short to power in harness or connectors.

3.CHECK COMPONENTS

Check the following.
- Crankshaft position sensor (Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".)
- Camshaft position sensor (bank 1) (Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".)
- Exhaust valve timing control position sensor (bank 1) (Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".)
- Throttle position sensor (Refer to EC-644, "Component Inspection (Throttle Position Sensor)".)
- APP sensor 1 (Refer to EC-647, "Component Inspection (Accelerator Pedal Position Sensor)".)

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace malfunctioning component.

4.CHECK THROTTLE POSITION SENSOR

Refer to EC-331, "Component Inspection (Throttle Position Sensor)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 5.

5.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

6.CHECK ACCELERATOR PEDAL POSITION SENSOR

Refer to EC-638, "Component Inspection (Accelerator Pedal Position Sensor)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

8.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

>> INSPECTION END

P0850 PNP SWITCH

DTC Description

INFOID:0000000014419692

DTC DETECTION LOGIC

When the selector lever position is P or N, park/neutral position (PNP) signal is sent to ECM from TCM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0850	P-N POS SW/CIRCUIT (Park/neutral position switch)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The signal of the park/neutral position (PNP) signal does not change during driving after the engine is started.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  [The park/neutral position (PNP) signal circuit is open or shorted]
- TCM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

Will CONSULT be used?

Will CONSULT be used?

YES >> GO TO 2.
NO >> GO TO 5.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.CHECK PNP SIGNAL

WITH CONSULT

1. Turn ignition switch ON.
2. Select “P/N POSI SW” in “DATA MONITOR” mode with CONSULT. Then check the “P/N POSI SW” signal under the following conditions.

Position (Selector lever)	Known-good signal
N or P position	ON
Except above position	OFF

Is the inspection result normal?

YES >> GO TO 4.
NO >> Go to EC-534, "Diagnosis Procedure".

4.PERFORM DTC CONFIRMATION PROCEDURE

1. Select “DATA MONITOR” mode with CONSULT.
2. Start engine and warm it up to normal operating temperature.
3. Maintain the following conditions for at least 50 consecutive seconds.

CAUTION:

Always drive vehicle at a safe speed.

ENG SPEED	1,000 - 6,375 rpm
COOLAN TEMP/S	More than 70°C (158°F)
B/FUEL SCHDL	2.0 - 31.8 msec
VHCL SPEED SE	More than 64 km/h (40 mph)
Selector lever	Suitable position

4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-534, "Diagnosis Procedure".
NO >> INSPECTION END

5.PERFORM COMPONENT FUNCTION CHECK

WITH GST
Perform Component Function Check. Refer to EC-534, "Component Function Check".
NOTE:
Use Component Function Check to check the overall function of the park/neutral position (PNP) signal circuit. During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Go to EC-534, "Diagnosis Procedure".

Component Function Check

INFOID:0000000014419693

1.PERFORM COMPONENT FUNCTION CHECK

WITH GST
1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals under the following conditions.

ECM				Condition		Voltage (V)
+		–				
Connector	Terminal	Connector	Terminal			
F79	62	E16	152	Selector lever	P or N position	Battery voltage
					Except above position	Approx. 0

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-534, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419694

1.CHECK DTC WITH TCM

Refer to TM-317, "CONSULT Function".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace malfunctioning part.

2.CHECK STARTING SYSTEM

Turn ignition switch OFF, then turn it to START.

Does starter motor operate?

YES >> GO TO 3.
NO >> Check DTC with BCM. Refer to BCS-52, "DTC Index".

3.CHECK PNP SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect A/T assembly harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between A/T assembly harness connector and ECM harness connector.

A/T assembly		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F46	9	F79	62	Existed

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between A/T assembly and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

P100A, P100B VVEL SYSTEM

DTC Description

INFOID:0000000014419695

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P100A	VVEL SYSTEM-B1 [VVEL response malfunction (bank 1)]	Diagnosis condition	—
		Signal (terminal)	—
P100B	VVEL SYSTEM-B1 [VVEL response malfunction (bank 1)]	Threshold	Actual event response to target is poor
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (VVEL actuator motor assembly circuit is open or shorted)
- VVEL actuator motor assembly
- VVEL actuator housing assembly
- VVEL ladder assembly
- VVEL control module

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P100A or P100B is displayed with DTC P1090 or P1093 first perform the trouble diagnosis for DTC P1090 or P1093.
- If DTC P100A or P100B is displayed with DTC P0101, first perform the trouble diagnosis for DTC P0101.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine.
2. Depress the accelerator pedal rapidly half or more under no load conditions, and then release it.
3. Wait at idle for 5 seconds or more.
4. Repeat steps 2 to 3 for three times.
5. Check 1st trip DTC.

Is DTC detected?

YES >> Proceed to EC-536, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419696

1.CHECK DTC PRIORITY

- If DTC P100A or P100B is displayed with DTC P1090 or P1093 first perform the trouble diagnosis for DTC P1090 or P1093.
- If DTC P100A or P100B is displayed with DTC P0101, first perform the trouble diagnosis for DTC P0101.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.VVEL ACTUATOR MOTOR OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect VVEL control module harness connector.
2. Disconnect VVEL actuator motor harness connector.
3. Check the continuity between VVEL control module harness connector and VVEL actuator motor harness connector.

DTC No.	VVEL control module			VVEL actuator motor		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P100A	1	F84	12	F88	1	Existed
					2	Not existed
			25		1	Not existed
					2	Existed
P100B	2		2	F85	1	Existed
					2	Not existed
			15		1	Not existed
					2	Existed

4. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between VVEL actuator motor and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK VVEL ACTUATOR MOTOR

Refer to EC-538, "Component Inspection (VVEL ACTUATOR MOTOR)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.REPLACE VVEL ACTUATOR MOTOR ASSEMBLY

Replace VVEL actuator motor assembly. Refer to EM-41, "Removal and Installation".

>> INSPECTION END

6.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace.

7.REPLACE VVEL CONTROL MODULE

Replace VVEL control module. Refer to EC-728, "Removal and Installation".

>> GO TO 8.

8.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase 1st trip DTC.
3. Perform DTC Confirmation Procedure.
   See EC-536, "DTC Description".

Is the DTC P100A or P100B displayed again?

YES >> GO TO 9.
NO >> INSPECTION END

9.CHECK VVEL ACTUATOR HOUSING ASSEMBLY

Refer to EC-539, "Component Inspection (VVEL ACTUATOR HOUSING ASSEMBLY)".

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10.REPLACE VVEL ACTUATOR HOUSING ASSEMBLY

Replace VVEL actuator housing assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

11.CHECK VVEL LADDER ASSEMBLY

Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> GO TO 13.
NO >> GO TO 12.

12.REPLACE CYLINDER HEAD AND VVEL LADDER ASSEMBLY

Replace cylinder head and VVEL ladder assembly.
Refer to EM-106, "Removal and Installation" (Cylinder head).
Refer to EM-94, "Removal and Installation" (VVEL ladder assembly)

>> INSPECTION END

13.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

>> INSPECTION END

Component Inspection (VVEL ACTUATOR MOTOR)

INFOID:0000000014419697

1.CHECK VVEL ACTUATOR MOTOR

1. Turn ignition switch OFF.
2. Disconnect VVEL actuator motor harness connector.
3. Check resistance between VVEL actuator motor terminals as per the following.

VVEL actuator motor	Resistance
Terminal	
1 and 2	16 Ω or less

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE VVEL ACTUATOR MOTOR ASSEMBLY

Replace VVEL actuator motor assembly. Refer to EM-41, "Removal and Installation".

>> INSPECTION END

Component Inspection (VVEL ACTUATOR HOUSING ASSEMBLY)

INFOID:0000000014419698

1.CHECK VVEL ACTUATOR HOUSING ASSEMBLY

1. Turn ignition switch OFF.
2. Remove VVEL actuator housing assembly. Refer to EM-94, "Removal and Installation".
3. Turn the ball screw shaft to check that it works smoothly.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE VVEL ACTUATOR HOUSING ASSEMBLY

Replace VVEL actuator housing assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

P1078, P1084 EVT CONTROL POSITION SENSOR

DTC Description

INFOID:0000000014419699

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1078	EXH TIM SEN/CIRC-B1 [Exhaust valve timing (EVT) control position sensor (bank 1) circuit]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	EVT control position sensor signal
P1084	EXH TIM SEN/CIRC-B2 [Exhaust valve timing control position sensor (bank 2) circuit]	Threshold	An excessively high or low voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  [Exhaust valve timing control position sensor (bank 1/ bank 2) circuit is open or shorted)
- Exhaust valve timing control position sensor (bank 1/ bank 2)
- Crankshaft position sensor
- Camshaft position sensor (bank 1/ bank 2)
- Accumulation of debris to the signal pick-up portion of the camshaft

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1078 or P1084 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and let it idle for 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-540, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419700

1.CHECK DTC PRIORITY

If DTC P1078 or P1084 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect exhaust valve timing (EVT) control position sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between exhaust valve timing control position sensor harness connector and ground.

DTC	EVT control position sensor			Ground	Voltage (V)
	Bank	Connector	Terminal		
P1078	1	F71	1	Ground	Approx. 5
P1084	2	F72	1		

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground in harness or connectors.

3.CHECK EVT CONTROL POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVT control position sensor harness connector and ECM harness connector.

DTC	EVT control position sensor			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P1078	1	F71	2	F78	45	Existed
P1084	2	F72	2	F79	63	

4. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to power in harness or connectors.

4.CHECK EVT CONTROL POSITION SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between EVT control position sensor harness connector and ECM harness connector.

DTC	EVT control position sensor			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P1078	1	F71	3	F78	41	Existed
P1084	2	F72	3	F79	68	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK EXHAUST VALVE TIMING CONTROL POSITION SENSOR

Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

6.CHECK CRANKSHAFT POSITION SENSOR

Refer to EC-419, "Component Inspection (Crankshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 7.

NO >> Replace crankshaft position sensor. Refer to EM-128, "Exploded View".

7. CHECK CAMSHAFT POSITION SENSOR

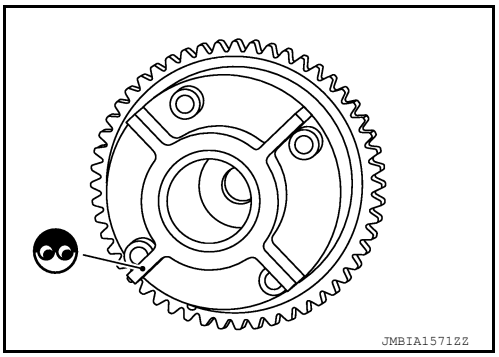
Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace malfunctioning camshaft position sensor. Refer to EM-74, "Exploded View".

8. CHECK CAMSHAFT SPROCKET (SIGNAL PLATE)

Check the following.
- Accumulation of debris to the signal plate of ccamshaft sprocket (EXH)
- Chipping signal plate of camshaft sprocket (EXH)



Is the inspection result normal?

YES >> GO TO 9.
NO >> Remove debris and clean the signal plate of camshaft sprocket (EXH) or replace camshaft sprocket (EXH). Refer to EM-74, "Exploded View".

9. CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

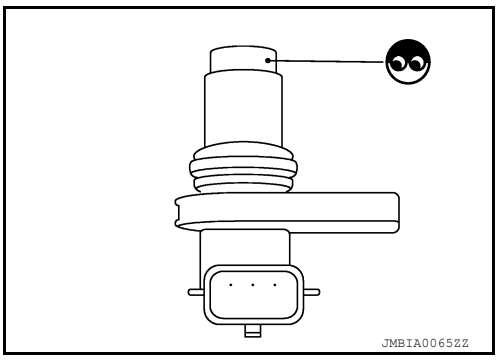
>> INSPECTION END

Component Inspection (Exhaust Valve Timing Control Position Sensor)

INFOID:0000000014419701

1. EXHAUST VALVE TIMING CONTROL POSITION SENSOR-I

1. Turn ignition switch OFF.
2. Disconnect exhaust valve timing control position sensor harness connector.
3. Loosen the fixing bolt of the sensor.
4. Remove the sensor. Refer to EM-74, "Exploded View".
5. Visually check the sensor for chipping.



Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

2. EXHAUST VALVE TIMING CONTROL POSITION SENSOR-II

Check resistance exhaust valve timing control position sensor terminals as shown below.

Terminals	Resistance
1 (+) - 2 (-)	Except 0 or ∞ Ω [at 25°C (77°F)]
1 (+) - 3 (-)	
2 (+) - 3 (-)	

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning exhaust valve timing control position sensor. Refer to EM-74, "Exploded View".

P1087, P1088 VVEL SYSTEM

DTC Description

INFOID:0000000014419702

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1087	VVEL SYSTEM-B1 [VVEL small event angle malfunction (bank 1)]	Diagnosis condition	Start engine and let it idle
		Signal (terminal)	EVT control position sensor signal
P1088	VVEL SYSTEM-B2 [VVEL small event angle malfunction (bank 2)]	Threshold	The event angle of VVEL control shaft is always small
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (VVEL actuator motor assembly circuit is open or shorted)
- VVEL actuator motor assembly
- VVEL actuator housing assembly
- VVEL ladder assembly
- VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1087 P1088	VVEL control function	VVEL of normal bank is controlled at VVEL angle of abnormal bank. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1087 or P1088 is displayed with DTC P1090 or P1093, first perform the trouble diagnosis for DTC P1090 or P1093.

Is applicable DTC detected?

>> Perform diagnosis of applicable. Refer to EC-547, "DTC Description".

Diagnosis Procedure

INFOID:0000000014419703

1.CHECK DTC PRIORITY

If P1087 or P1088 is displayed with DTC P1090 or P1093, first perform the trouble diagnosis for DTC P1090 or P1093.

Is applicable DTC detected?

>> Perform diagnosis of applicable. Refer to EC-547, "DTC Description".

P1089, P1092 VVEL CONTROL SHAFT POSITION SENSOR

DTC Description

INFOID:0000000014419704

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1089	VVEL POS SEN/CIRC-B1 [VVEL control shaft position sensor (bank 1) circuit]	Diagnosis condition	—
		Signal (terminal)	—
P1092	VVEL POS SEN/CIRC-B2 [VVEL control shaft position sensor (bank 2) circuit]	Threshold	• An excessively low voltage from the sensor is sent to VVEL control module. • An excessively high voltage from the sensor is sent to VVEL control module. • Rationally incorrect voltage is sent to VVEL control module compared with the signals from VVEL control shaft position sensor 1 and VVEL control shaft position sensor 2
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (VVEL control shaft position sensor circuit is open or shorted)
- VVEL control shaft position sensor
- VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1089 P1092	VVEL control shaft position sensor	VVEL value is maintained at a fixed angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1089 or P1092 is displayed with DTC P1608 first perform the trouble diagnosis for DTC P1608.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-610, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Proceed to EC-545, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419705

1.CHECK DTC PRIORITY

If DTC P1089 or P1092 is displayed with DTC P1608 first perform the trouble diagnosis for DTC P1608.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-610, "DTC Description".
NO >> GO TO 2.

2.VVEL CONTROL SHAFT POSITION SENSOR POWER SUPPLY CIRCUIT

1. Disconnect VVEL control shaft position sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between VVEL control shaft position sensor harness connector and ground.

DTC No.	VVEL control shaft position sensor			Ground	Voltage (V)
	Bank	Connector	Terminal		
P1089	1	F83	3	Ground	Approx. 5
			6		
P1092	2	F86	3		
			6		

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between VVEL control shaft position sensor and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK VVEL CONTROL SHAFT POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect VVEL control module harness connector.
3. Check the continuity between VVEL control shaft position sensor harness connector and VVEL control module harness connector.

DTC No.	VVEL control shaft position sensor			VVEL control module		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P1089	1	F83	2	F84	6	Existed
			5		19	
P1092	2	F86	2		4	
			5		17	

4. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between VVEL control shaft position sensor and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

6. VVEL CONTROL SHAFT POSITION SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between VVEL control shaft position sensor harness connector and VVEL control module harness connector.

DTC No.	VVEL control shaft position sensor			VVEL control module		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P1089	1	F83	1	F84	3	Existed
			4		16	
P1092	2	F86	1		5	
			4		18	

2. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between VVEL control shaft position sensor and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8. REPLACE VVEL CONTROL MODULE

1. Replace VVEL control module.
2. Perform additional service when replacing VVEL control module. Refer to EC-196, "Description".

>> GO TO 9.

9. PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC Confirmation Procedure.
   See EC-544, "DTC Description".

Is the DTC P1089 or P1092 displayed again?

YES >> GO TO 10.
NO >> INSPECTION END

10. REPLACE VVEL ACTUATOR LADDER ASSEMBLY

Replace VVEL actuator ladder assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

P1090, P1093 VVEL ACTUATOR MOTOR

DTC Description

INFOID:0000000014419706

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1090	VVEL ACTR MOT-B1 [VVEL system performance (bank 1)]	Diagnosis condition	—
		Signal (terminal)	—
P1093	VVEL ACTR MOT-B2 [VVEL system performance (bank 2)]	Threshold	• Event angle difference between the actual and the target is detected. • Abnormal current is sent to VVEL actuator motor assembly
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (VVEL actuator motor assembly circuit is open or shorted)
- VVEL actuator motor assembly
- VVEL actuator housing assembly
- VVEL ladder assembly
- VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1090 P1093	VVEL actuator motor	VVEL of normal bank is controlled at VVEL angle of abnormal bank. Engine speed will not rise more than 3,500 rpm due to the fuel cut.
		VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1090 or P1093 is displayed with DTC P1091 first perform the trouble diagnosis for DTC P1091.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-610, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 10 second.
2. Keep the engine speed at approximately 3,500 rpm for at least 10 seconds under no load.
3. Check DTC.

Is DTC detected?

YES >> Proceed to EC-548, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".

NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419707

1.CHECK DTC PRIORITY

If DTC P1090 or P1093 is displayed with DTC P1091 first perform the trouble diagnosis for DTC P1091.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-610, "DTC Description".
NO >> GO TO 2.

2.VVEL ACTUATOR MOTOR ASSEMBLY OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect VVEL control module harness connector.
2. Disconnect VVEL actuator motor assembly harness connector.
3. Check the continuity between VVEL control module harness connector and VVEL actuator motor assembly harness connector.

DTC No.	VVEL control module			VVEL actuator motor assembly		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P1090	1	F84	12	F88	1	Existed
					2	Not existed
			25		1	Not existed
					2	Existed
P1093	2		2	F85	1	Existed
					2	Not existed
			15		1	Not existed
					2	Existed

4. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between VVEL actuator motor assembly and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK VVEL ACTUATOR MOTOR ASSEMBLY

Refer to EC-549, "Component Inspection (VVEL ACTUATOR MOTOR ASSEMBLY)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.REPLACE VVEL ACTUATOR MOTOR ASSEMBLY

Replace VVEL actuator motor assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

6.REPLACE VVEL CONTROL MODULE

1. Replace VVEL control module.
2. Perform additional service when replacing VVEL control module. Refer to EC-196, "Description".

>> GO TO 7.

7.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC Confirmation Procedure.
   See EC-547, "DTC Description".

Is the DTC P1090 or P1093 displayed again?

YES >> GO TO 8.
NO >> INSPECTION END

8.CHECK VVEL ACTUATOR HOUSING ASSEMBLY

Refer to EC-549, "Component Inspection (VVEL ACTUATOR MOTOR ASSEMBLY)".

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 9.

9.REPLACE VVEL ACTUATOR HOUSING ASSEMBLY

Replace VVEL actuator housing assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

10.CHECK VVEL LADDER ASSEMBLY

Refer to EM-96, "Inspection".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 11.

11.REPLACE VVEL LADDER ASSEMBLY

Replace VVEL ladder assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

Component Inspection (VVEL ACTUATOR MOTOR ASSEMBLY)

INFOID:0000000014419708

1.CHECK VVEL ACTUATOR MOTOR

1. Turn ignition switch OFF.
2. Disconnect VVEL actuator motor harness connector.
3. Check resistance between VVEL actuator motor terminals as per the following.

VVEL actuator motor	Resistance
Terminal	
1 and 2	16Ω or less

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE VVEL ACTUATOR SUB ASSEMBLY

Replace VVEL actuator sub assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

Component Inspection (VVEL ACTUATOR HOUSING ASSEMBLY)

INFOID:0000000014419709

1.CHECK VVEL ACTUATOR HOUSING ASSEMBLY

1. Turn ignition switch OFF.
2. Remove VVEL actuator housing assembly. Refer to EM-94, "Removal and Installation".

3. Turn the ball screw shaft to check that it works smoothly.

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE VVEL ACTUATOR HOUSING ASSEMBLY

Replace VVEL actuator housing assembly. Refer to EM-94, "Removal and Installation".

>> INSPECTION END

P1091 VVEL ACTUATOR MOTOR RELAY

DTC Description

INFOID:0000000014419710

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1091	VVEL ACTR MOT PWR [VVEL actuator motor relay circuit]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	• VVEL control module detects the VVEL actuator motor relay is stuck OFF • VVEL control module detects the VVEL actuator motor relay is stuck ON
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  (VVEL actuator motor relay circuit is open or shorted)
  (Abort circuit is open or shorted)
- VVEL actuator motor relay
- VVEL control module
- ECM

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1091	VVEL actuator motor relay	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 1 second.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON and wait at least 1 second.
4. Check 1st trip DTC.

Is DTC detected?

YES >> Proceed to EC-551, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419711

1.VVEL ACTUATOR MOTOR RELAY POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF.

2. Disconnect VVEL actuator motor relay.
3. Check the voltage between VVEL actuator motor relay harness connector and ground.

VVEL actuator motor relay		Ground	Voltage
Connector	Terminal		
E100	1	Ground	Battery voltage
	3		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- 50A fusible link (letter Z)
- Harness for open or short between VVEL actuator motor relay and battery

>> Repair open circuit, short to ground or short to power in harness or connectors.

3.VVEL ACTUATOR MOTOR RELAY POWER SUPPLY CIRCUIT-II

1. Disconnect VVEL control module harness connector.
2. Check the continuity between VVEL actuator motor relay harness connector and VVEL control module harness connector.

VVEL control module		VVEL actuator motor relay		Continuity
Connector	Terminal	Connector	Terminal	
F84	23	E100	2	Existed

3. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

4.VVEL ACTUATOR MOTOR RELAY INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between VVEL actuator motor relay harness connector and VVEL control module harness connector.

VVEL control module			VVEL actuator motor relay		Continuity
Bank	Connector	Terminal	Connector	Terminal	
1	F84	13	E100	5	Existed
2		1			

2. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK VVEL ACTUATOR MOTOR RELAY

Refer to EC-553, "Component Inspection (VVEL Actuator Motor Relay)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace VVEL actuator motor relay.

6.CHECK ABORT CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check the continuity between VVEL control module harness connector and ECM harness connector.

VVEL control module		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F84	21	F79	90	Existed

3. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open and short between ECM and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8.REPLACE VVEL CONTROL MODULE

1. Replace VVEL control module.
2. Perform additional service when replacing VVEL control module. Refer to EC-196, "Description".

>> GO TO 9.

9.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC Confirmation Procedure.
   See EC-551, "DTC Description".

Is the DTC P1091 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

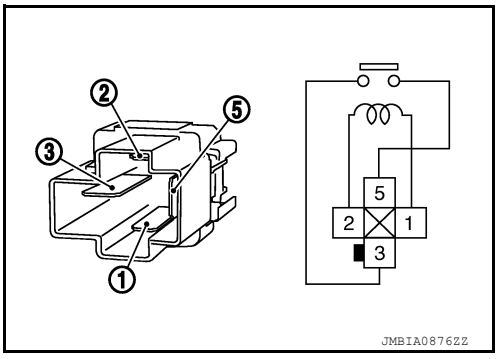
Component Inspection (VVEL Actuator Motor Relay)

INFOID:0000000014419712

1.CHECK VVEL ACTUATOR MOTOR RELAY

1. Turn ignition switch OFF.
2. Remove VVEL actuator motor relay.
3. Check the continuity between VVEL actuator motor relay terminals under the following conditions.

Terminal	Condition	Continuity
3 and 5	12V direct current supply between terminals 1 and 2	Existed
	No current supply	Not existed



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace VVEL actuator motor relay.

P1148, P1168 CLOSED LOOP CONTROL

DTC Description

INFOID:0000000014419713

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1148	CLOSED LOOP-B1 [Closed loop control function (bank 1)]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The closed loop control function for bank 1 does not operate even when vehicle is being driven in the specified condition.
		Diagnosis delay time	—
P1168	CLOSED LOOP-B2 [Closed loop control function (bank 2)]	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The closed loop control function for bank 2 does not operate even when vehicle is being driven in the specified condition.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  (The A/F sensor 1 circuit is open or shorted.)
- A/F sensor 1
- A/F sensor 1 heater

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1148 or P1168 is displayed with DTC for A/F sensor 1 first perform the trouble diagnosis for DTC for A/F sensor 1.

Is applicable DTC detected?

>> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".

Diagnosis Procedure

INFOID:0000000014419714

1.CHECK DTC PRIORITY

If DTC P1148 or P1168 is displayed with DTC for A/F sensor 1 first perform the trouble diagnosis for DTC for A/F sensor 1.

Is applicable DTC detected?

>> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".

P1197 OUT OF GAS

DTC Description

INFOID:0000000014419715

DTC DETECTION LOGIC

This diagnosis result is detected when the fuel level of the fuel tank is extremely low and the engine does not run normally.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1197	FUEL RUN OUT (Out of gas)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	• Fuel rail pressure remains at 1.5 MPa (15 bar, 15.3 kg/cm^2, 217.5 psi) or less for 3 seconds or more with the fuel level too low • Fuel rail pressure remains 2.7 MPa (27 bar, 27.5 kg/cm^2, 392 psi) lower than a target fuel pressure for 5 seconds or more with the fuel level too low • Fuel rail pressure remains at 0.23 MPa (2.3 bar, 2.346 kg/cm^2, 33.35 psi) or less for 5 seconds or more with the fuel level too low **NOTE:** Allow engine coolant temperature to reach 70°C (158°F) or more once.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Out of gas
- Harness or connectors (The low pressure fuel pump circuit is open or shorted.)
- Low pressure fuel pump
- Fuel pressure regulator
- Low pressure fuel system
- Harness or connectors (The high pressure fuel pump circuit is shorted.)
- High pressure fuel pump
- High pressure fuel system
- Fuel rail pressure sensor
- Disconnection of the fuel hose

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1197	Out of gas	• Engine torque is limited. • VVEL value is maintained at a fixed angle.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

Start the engine.

Does the engine start?

YES >> GO TO 3.
NO >> Proceed to EC-556, "Diagnosis Procedure".

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Warm up the engine to the normal operating temperature.
   NOTE:
   For best results, warm up the engine until “COOLAN TEMP/S” on “DATA MONITOR” of CONSULT reaches at least 70°C (158°F).
2. Keep the engine speed at 3,500 rpm for 5 seconds and let it idle at least 60 seconds.
3. Check the 1st trip DTC.
   NOTE:
   If the fuel tank has sufficient fuel, this diagnosis result may not be detected.

Is 1st trip DTC detected?

YES >> Proceed to EC-556, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419716

1.REFUEL THE VEHICLE

1. Refuel 10 liter (10 US qt, 8 imp qt).
   CAUTION:
   Never refuel more than 10 liter.
2. Start the engine and keep the engine speed at 3,000 rpm for 30 seconds.
   NOTE:
   For best results, warm up the engine until “COOLAN TEMP/S” on “DATA MONITOR” of CONSULT reaches at least 70°C (158°F).
3. Turn ignition switch OFF and wait at least 10 seconds.
4. Turn ignition switch ON.
5. Turn ignition switch OFF and wait at least 10 seconds.
6. Turn ignition switch ON.
7. Erase the DTC.
8. Start the engine and let it idle at least 60 seconds.
9. Perform the confirmation procedure again. Refer to EC-555, "DTC Description".

Is 1st trip DTC detected?

YES >> GO TO 2.
NO >> INSPECTION END

2.CHECK LOW PRESSURE FUEL PUMP

Refer to EC-701, "Component Function Check".

Is inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK HIGH PRESSURE FUEL PUMP

Refer to EC-691, "Component Function Check".

Is inspection result normal?

YES >> Check the fuel hose for disconnection and looseness.
NO >> Repair or replace error-detected parts.

P119A, P119B FUEL RAIL PRESSURE SENSOR

DTC Description

INFOID:0000000014681581

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P119A	FUEL PRESSURE SENSOR (Fuel pressure sensor)	Diagnosis condition	• Battery voltage: 8 V or more • Under engine start condition • Engine coolant temperature at previous ignition switch OFF: 65°C (149°F) or more • Engine coolant temperature: 35°C (65°F) or less • Temperature difference between engine coolant and intake air: Less than 6°C (42°F) • Fuel system monitor: Excessively RICH
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Fuel rail pressure is less than 1.0 MPa (10.2 kg/cm^2, 145 psi) (calculated by ECM)
		Diagnosis delay time	—
P119B	FUEL PRESSURE SENSOR (Fuel pressure sensor)	Diagnosis condition	• Battery voltage: 8 V or more • Ignition switch: ON (engine stopped) • Engine coolant temperature at previous ignition switch OFF: 65°C (149°F) or more • Engine coolant temperature: 35°C (65°F) or less • Temperature difference between engine coolant and intake air: Less than 6°C (42°F) • Fuel system monitor: Excessively LEAN
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Fuel rail pressure is more than 1.5 MPa (15.3 kg/cm^2, 217 psi) (calculated by ECM)
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
- The fuel rail pressure sensor circuit is open or shorted.
- Sensor power supply 3 is shorted.
- Fuel rail pressure sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING-I

If DTC Confirmation Procedure is previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, check that battery voltage is 9 V or more with ignition switch ON.

>> GO TO 2.

2.PRECONDITIONING-II

NOTE:
- When it is certain that the previous driving is performed with the engine warmed up, the next steps can be performed.
- When it is difficult to satisfy the conditions, performing Component Function Check can identify the presence or absence of malfunction in the part/system that may result in a possible cause of this DTC. (Perform DTC Confirmation Procedure as much as possible.)

1. Start the engine and warm it up until engine coolant temperature reaches 70°C (158°F) or more.
2. Stop the engine and leave the vehicle in a cool place (soak the engine) until the engine coolant temperature reaches 35°C (95°F) or less.

CAUTION:
- **The difference between air temperature and engine coolant temperature must be 5°C (9°F) or less.**
- **Never turn ignition switch ON during soak the engine.**

Are the conditions satisfied?

YES >> GO TO 4.
NO >> GO TO 3.

3.COMPONENT FUNCTION CHECK

With CONSULT
1. Turn ignition switch OFF.
2. Start the engine.
3. On CONSULT screen, select “ENGINE” >> “Data Monitor”.
4. Check the value of “FUEL PRES SEN V” under the following conditions.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Engine speed: Idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

Without CONSULT
1. Turn ignition switch OFF.
2. Start the engine.
3. Check fuel rail pressure sensor signal voltage.

ECM			Condition	Value
Connector	+	–		
	Terminal			
F91	25	13	Engine speed: Idle	0.82 – 1.2 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	0.8 – 3.0 V

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Proceed to EC-559, "Diagnosis Procedure".

4.PERFORM DTC CONFIRMATION PROCEDURE-I

With CONSULT
1. Turn ignition switch ON (engine stopped).
2. On CONSULT screen, select “ENGINE” >> “Data Monitor” >> “COOLAN TEMP/S” and “INT/A TEMP SE”.
3. Check that the indicated value of “COOLAN TEMP/S” is less than 35°C (95°F).
4. Check that the difference between “INT/A TEMP SE” and “COOLAN TEMP/S” is 5°C (41°F) or less.
5. Check “Self-diagnostic result” of “ENGINE”.

Is DTC P119A or P119B detected?

YES >> Proceed to EC-559, "Diagnosis Procedure".
NO-1 >> Conditions satisfied: GO TO 5.
NO-2 >> Conditions not satisfied: GO TO 2.

5.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Start the engine (or cranking) at least 1 second.
2. Check “Self-diagnostic result” of “ENGINE”.

Is DTC P119A or P119B detected?

YES >> Proceed to EC-559, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014681582

NOTE:
Turning the ignition switch ON with FRP sensor harness connector disconnected causes ECM to detect DTC P0190. Be sure to erase the DTC when the diagnosis procedure.

1.CHECK FUEL RAIL PRESSURE (FRP) SENSOR POWER SUPPLY-I

1. Turn ignition switch OFF.
2. Disconnect FRP sensor connector.
3. Turn ignition switch ON.
4. Check the voltage between FRP sensor harness connector terminals.

FRP sensor			Voltage (Approx.)
Connector	+	–	
	terminal		
F91	3	1	5 V

Inspection result normal?

YES >> GO TO 7.
NO >> GO TO 2.

2.CHECK FRP SENSOR POWER SUPPLY-II

Check the voltage between FRP sensor harness connector and the ground.

+		–	Voltage (Approx.)
FRP sensor			
Connector	Terminal		
F91	3	Ground	5 V

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 3.

3.CHECK FRP SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

FRP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	3	F78	13	Existed

4. Also check harness for short to power and short to ground.

Is inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for ECM power supply circuit. Refer to EC-227, "Diagnosis Procedure".

NO >> Repair or replace error-detected parts.

5. CHECK FRP SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

FRP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F78	29	Existed

4. Also check harness for short to power.

Is inspection result normal?

YES >> GO TO 6.

NO >> Repair or replace error-detected parts.

6. CHECK ECM GROUND CIRCUIT

1. Check the continuity between ECM harness connector and ground.

ECM		—	Continuity
Connector	Terminal		
F78	10	Ground	Existed
	50		
	55		
E16	147		
	149		
	152		

2. Also check harness for short to power.

Is the inspection result normal?

YES >> INSPECTION END

NO >> Repair or replace error-detected parts.

7. CHECK FRP SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

FRP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	2	F78	25	Existed

4. Also check harness for short to power and short to ground.

Is inspection result normal?

YES >> GO TO 8.

NO >> Repair or replace error-detected parts.

8. CHECK FRP SENSOR

Check the FRP sensor. Refer to EC-561, "Component Inspection (Fuel Rail Pressure Sensor)".

Is inspection result normal?

YES >> INSPECTION END

NO >> Repair or replace error-detected parts.

Component Inspection (Fuel Rail Pressure Sensor)

INFOID:0000000014681583

1. CHECK FRP SENSOR

With CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start engine.
4. On CONSULT screen, select “ENGINE” >> “Data Monitor”.
5. Check that the “FUEL PRES SEN V” indication.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Engine speed: Idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

Without CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start the engine.
4. Check FRP sensor signal voltage.

ECM			Condition	Value
Connector	+	–		
	Terminal			
F91	25	13	Engine speed: Idle	0.82 – 1.2 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	0.8 – 3.0 V

Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace FRP sensor. Refer to EM-57, "Exploded View".

P119C FUEL RAIL PRESSURE SENSOR

DTC Description

INFOID:0000000014681584

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P119C	FUEL PRESSURE SENSOR (Fuel pressure sensor)	Diagnosis condition	• Battery voltage: 8 V or more • Engine speed: 600 rpm or more • Engine coolant temperature: With a background of 65°C (149°F) or more during the trip • Remaining fuel amount: 15% or more • Fuel cut: No
		Signal (terminal)	Fuel rail pressure sensor signal
		Threshold	Fuel rail pressure between MAX and MIN differs more than 0.075 MPa (0.765 kg/cm^2, 10.875 psi)
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
- Fuel rail pressure sensor circuit is open or shorted.
- Sensor power supply 3 is shorted.
- Fuel rail pressure sensor

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P119C is displayed with DTC P0190, first perform the confirmation procedure (trouble diagnosis) for DTC P0190.

Is DTC P0190 detected?

YES >> Perform diagnosis for P0190. Refer to EC-388, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING-1

If DTC Confirmation Procedure is previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, check that battery voltage is 9 V or more with ignition switch ON.**
- **Remaining fuel amount must be 15% or more.**

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or more.
2. Drive the vehicle and accelerate 10 consecutive seconds or more with the engine speed 1,500 rpm or more.
3. Check 1st trip DTC.

Is DTC P119C detected?

YES >> Proceed to EC-563, "Diagnosis Procedure".

NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014681585

NOTE:
Turning the ignition switch ON with FRP sensor harness connector disconnected causes ECM to detect DTC P119C. Be sure to erase the DTC when the diagnosis procedure.

1.CHECK DTC PRIORITY

If DTC P119C is displayed with DTC P0190, first perform the confirmation procedure (trouble diagnosis) for DTC P0190.

Is DTC P0190 detected?

YES >> Perform diagnosis for P0190. Refer to EC-388, "DTC Description".
NO >> GO TO 2.

2.CHECK FUEL RAIL PRESSURE (FRP) SENSOR POWER SUPPLY-1

1. Turn ignition switch OFF.
2. Disconnect FRP sensor connector.
3. Turn ignition switch ON.
4. Check the voltage between FRP sensor harness connector terminals.

FRP sensor			Voltage (Approx.)
Connector	+	–	
	terminal		
F91	3	1	5 V

Inspection result normal?

YES >> GO TO 8.
NO >> GO TO 3.

3.CHECK FRP SENSOR POWER SUPPLY-2

Check the voltage between FRP sensor harness connector and the ground.

+		–	Voltage (Approx.)
FRP sensor			
Connector	Terminal		
F91	3	Ground	5 V

Is inspection result normal?

YES >> GO TO 6.
NO >> GO TO 4.

4.CHECK FRP SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

FRP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	3	F78	13	Existed

4. Also check harness for short to power and short to ground.

Is inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

Perform EC-714, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for ECM power supply circuit. Refer to EC-227, "Diagnosis Procedure".

NO >> Repair or replace error-detected parts.

6. CHECK FRP SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

FRP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F78	29	Existed

4. Also check harness for short to power.

Is inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7. CHECK ECM GROUND CIRCUIT

1. Check the continuity between ECM harness connector and ground.

ECM		—	Continuity
Connector	Terminal		
F78	10	Ground	Existed
	50		
	55		
E16	147		
	149		
	152		

2. Also check harness for short to power.

Is the inspection result normal?

YES >> INSPECTION END

NO >> Repair or replace error-detected parts.

8. CHECK FRP SENSOR SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between FRP sensor harness connector and ECM harness connector.

FRP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	2	F78	25	Existed

4. Also check harness for short to power and short to ground.

Is inspection result normal?

YES >> GO TO 9.

NO >> Repair or replace error-detected parts.

9. CHECK FRP SENSOR

Check the FRP sensor. Refer to EC-565, "Component Inspection (Fuel Rail Pressure Sensor)".

Is inspection result normal?

YES >> INSPECTION END

NO >> Repair or replace error-detected parts.

Component Inspection (Fuel Rail Pressure Sensor)

INFOID:0000000014711648

1.CHECK FRP SENSOR

With CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start engine.
4. On CONSULT screen, select “ENGINE” >> “Data Monitor”.
5. Check that the “FUEL PRES SEN V” indication.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Engine speed: Idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

Without CONSULT

1. Turn ignition switch OFF.
2. Reconnect harness connector disconnected.
3. Start the engine.
4. Check FRP sensor signal voltage.

ECM			Condition	Value
Connector	+	–		
	Terminal			
F91	25	13	Engine speed: Idle	0.82 – 1.2 V
			Engine speed: Revving engine from idle to 4,000 rpm quickly	0.8 – 3.0 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace FRP sensor. Refer to EM-57, "Exploded View".

P1212 TCS COMMUNICATION LINE

DTC Description

INFOID:0000000014419717

DTC DETECTION LOGIC

This CAN communication line is used to control the smooth engine operation during the TCS operation. Pulse signals are exchanged between ECM and “ABS actuator and electric unit (control unit)”.

Be sure to erase the malfunction information such as DTC not only for “ABS actuator and electric unit (control unit)” but also for ECM after TCS related repair.

NOTE:

Freeze frame data is not stored in the ECM for this self-diagnosis.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1212	TCS/CIRC (TCS communication line)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM cannot receive the information from “ABS actuator and electric unit (control unit)” continuously
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The CAN communication line is open or shorted)
- ABS actuator and electric unit (control unit)
- Dead (Weak) battery

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P1212 is displayed with DTC UXXXX first perform the trouble diagnosis for DTC UXXXX.
- If DTC P1212 is displayed with DTC P0607 first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 10.5 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-566, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419718

1.CHECK DTC PRIORITY

- If DTC P1212 is displayed with DTC UXXXX first perform the trouble diagnosis for DTC UXXXX.
- If DTC P1212 is displayed with DTC P0607 first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> Perform the trouble diagnosis for TCS. Refer to TM-353, "Work Flow".

P1217 ENGINE OVER TEMPERATURE

DTC Description

INFOID:0000000014419719

DTC DETECTION LOGIC

NOTE:

If the cooling fan or any of other components in the cooling system has a malfunction, engine coolant temperature increases.

When the engine coolant temperature reaches an abnormally high temperature condition, a malfunction is indicated.

CAUTION:

When a malfunction is indicated, always replace the coolant. Refer to CO-11, "Changing Engine Coolant". Also, replace the engine oil. Refer to LU-10, "Draining" and LU-10, "Refilling".

1. **Fill radiator with coolant up to specified level with a filling speed of 2 liters per minute. Always use coolant with the proper mixture ratio. Refer to MA-14, "Anti-Freeze Coolant Mixture Ratio".**
2. **After refilling coolant, run engine to ensure that no water-flow noise is emitted.**

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1217	Engine over temperature (Overheat)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	• Cooling fan does not operate properly (Overheat) • Cooling fan system does not operate properly (Overheat) • Engine coolant is not within the specified quantity.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The cooling fan circuit is open or shorted)
- IPDM E/R
- Fan clutch assembly
- Cooling fan speed sensor
- Radiator hose
- Radiator
- Reservoir tank cap
- Water pump
- Multi-way control valve

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P1217 is displayed with DTC DTC UXXXX first perform the trouble diagnosis for DTC UXXXX.
- If DTC P1217 is displayed with DTC P0607 first perform the trouble diagnosis for DTC P0607.
- If DTC P1217 is displayed with DTC P0527 first perform the trouble diagnosis for DTC P0527.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PERFORM COMPONENT FUNCTION CHECK

Perform component function check. Refer to EC-569, "Component Function Check".

NOTE:

Use component function check to check the overall function of the cooling fan. During this check, a DTC might not be confirmed.

Is the inspection result normal?

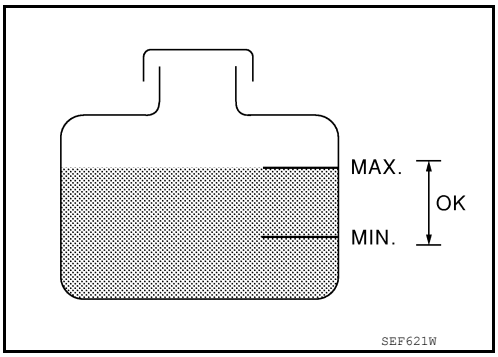
YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Go to EC-569, "Diagnosis Procedure".

Component Function Check

INFOID:0000000014419720

1.PERFORM COMPONENT FUNCTION CHECK-I

WARNING:
Never remove the reservoir tank cap when the engine is hot. Serious burns could be caused by high pressure fluid escaping from the radiator.
Wrap a thick cloth around cap. Carefully remove the cap by turning it a quarter turn to allow built-up pressure to escape. Then turn the cap all the way off.
Check the coolant level in the reservoir tank and radiator.
Allow engine to cool before checking coolant level.



Is the coolant level in the reservoir tank and/or radiator below the proper range?

YES >> Proceed to EC-569, "Diagnosis Procedure".
NO >> GO TO 2.

2.PERFORM COMPONENT FUNCTION CHECK-II

Confirm whether customer filled the coolant or not.

Did customer fill the coolant?

YES >> Proceed to EC-569, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM COMPONENT FUNCTION CHECK-III

WITH CONSULT
1. Start the engine.
2. Perform “FAN DUTY CONTROL” in “ACTIVE TEST” mode with CONSULT.
3. Check that cooling fan speed varies according to the percentage.
   NOTE:
   Fan speed changes as the percentage changes.

WITHOUT CONSULT
1. Start the engine.
2. Perform IPDM E/R auto active test. Refer to PCS-10, "Diagnosis Description".
3. Check that cooling fan speed increase.
   NOTE:
   Speed changes gradually when performing the auto active test.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-569, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419721

1.CHECK DTC PRIORITY

- If DTC P1217 is displayed with DTC DTC UXXXX first perform the trouble diagnosis for DTC UXXXX.
- If DTC P1217 is displayed with DTC P0607 first perform the trouble diagnosis for DTC P0607.
- If DTC P1217 is displayed with DTC P0527 first perform the trouble diagnosis for DTC P0527.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK COOLING FAN OPERATION

WITH CONSULT
1. Start the engine.
2. Perform “FAN DUTY CONTROL” in “ACTIVE TEST” mode with CONSULT.
3. Check that cooling fan speed varies according to the percentage.
   NOTE:
   Speed changes gradually as the percentage changes.

WITHOUT CONSULT
1. Start the engine.
2. Perform IPDM E/R auto active test and check cooling fan operation, refer to PCS-10, "Diagnosis Description".
3. Check that cooling fan speed increase.
   NOTE:
   Speed changes gradually when performing the auto active test.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Proceed to EC-680, "Diagnosis Procedure".

3.CHECK ENGINE COOLANT LEAKAGE-I

Check cooling system for leakage. Refer to CO-9, "System Inspection".

Is leakage detected?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK ENGINE COOLANT LEAKAGE-II

Check the following for leakage.
- Hose
- Radiator
- Water pump

>> Repair or replace malfunctioning part.

5.CHECK RESERVOIR TANK CAP

Check reservoir tank cap. Refer to CO-9, "System Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace reservoir tank cap.

6.CHECK MULTI-WAY CONTROL VALVE

Check multi-way control valve. Refer to EC-664, "Component Inspection (Multi-way Control Valve)".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

7.CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

Refer to EC-327, "Component Inspection (Engine Coolant Temperature Sensor 1)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace engine coolant temperature sensor 1. Refer to EM-105, "Exploded View".

8.CHECK MAIN 12 CAUSES

If the cause cannot be isolated, check the CO-5, "Troubleshooting Chart".

>> INSPECTION END

P1220 FUEL PUMP CONTROL MODULE (FPCM)

DTC Description

INFOID:0000000014419722

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1220	FPCM (Fuel pump control module)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	During engine cranking, the signal voltage of the FPCM to the ECM is too low
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  (FPCM circuit is open or shorted)
  (Fuel pump circuit is open or shorted)
- FPCM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is between 12 - 15 V at idle.**
- **Before performing the following procedure, check that the engine coolant temperature is −10°C (14°F) or more.**

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 5 seconds.
   If engine does not start, crank engine for at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-571, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419723

1.CHECK FUEL PUMP RELAY POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Turn ignition switch ON.
4. Check the voltage between ECM harness connector terminals.

ECM				Voltage
Connector	+	Connector	-	
	Terminal		Terminal	
F79	93	E16	152	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK FUEL PUMP RELAY POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

+		–		Continuity
ECM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
F79	93	E122	45	Existed

4. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

3.CHECK FPCM POWER SUPPLY

1. Turn ignition switch OFF.
2. Reconnect ECM harness connector.
3. Disconnect FPCM harness connector.
4. Turn ignition switch ON.
5. Check the voltage between FPCM harness connector and ground.

FPCM		Ground	Voltage
Connector	Terminal		
C12	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.CHECK FPCM POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between FPCM harness connector and IPDM E/R harness connector.

+		–		Continuity
FPCM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
C12	1	E124	58	Existed

4. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

5.CHECK FPCM GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Check the continuity between FPCM harness connector and ground.

FPCM		Ground	Continuity
Connector	Terminal		
C12	4	Ground	Existed

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit or short to power in harness or connectors.

6.CHECK FPCM INPUT AND OUTPUT CIRCUITS FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check the continuity between FPCM harness connector and ECM harness connector.

FPCM		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C12	3	E16	130	Existed
	2		136	

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between FPCM and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8.CHECK FUEL PUMP CONTROL CIRCUIT FOR OPEN AND SHORT

1. Disconnect fuel level sensor unit and fuel pump harness connector.
2. Check the continuity between FPCM harness connector and fuel level sensor unit and fuel pump harness connector.

FPCM		Fuel level sensor unit and fuel pump		Continuity
Connector	Terminal	Connector	Terminal	
C12	6	C37	1	Existed
	5		2	

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

9.CHECK FPCM

Refer to EC-573, "Component Inspection (FPCM)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace FPCM.

Component Inspection (FPCM)

INFOID:0000000014419724

1.CHECK FUEL PUMP CONTROL MODULE (FPCM)

1. Check the voltage between FPCM terminals under the following conditions.

FPCM			Condition	Voltage
Connector	+	–		
	Terminal	Terminal		
C12	6	5	For 1 second after turning ignition switch ON	Approx. 8.5 V
			More than 1 second after turning ignition switch ON	Approx. 0 V
			Idle speed	Approx. 8.5 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace FPCM.

P1225 TP SENSOR

DTC Description

INFOID:0000000014419725

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1225	CTP LEARNING-B1 (Closed throttle position learning performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	Closed throttle position learning value is excessively low
		Diagnosis delay time	—

POSSIBLE CAUSE

Electric throttle control actuator (TP sensor 1 and 2)

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Check 1st trip DTC.

Is DTC detected?

YES >> Proceed to EC-575, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419726

1.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR VISUALLY

1. Turn ignition switch OFF.
2. Remove the intake air duct.
3. Check if foreign matter is caught between the throttle valve and the housing.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Remove the foreign matter and clean the electric throttle control actuator inside, then perform throttle valve closed position learning. Refer to EC-199, "Description".

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P1226 TP SENSOR

DTC Description

INFOID:0000000014419727

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1226	CTP LEARNING-B1 (Closed throttle position learning performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	Closed throttle position learning is not performed successfully, repeatedly
		Diagnosis delay time	—

POSSIBLE CAUSE

Electric throttle control actuator (TP sensor 1 and 2)

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Repeat steps 2 and 3 for 32 times.
5. Check 1st trip DTC.

Is DTC detected?

YES >> Proceed to EC-576, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419728

1.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR VISUALLY

1. Turn ignition switch OFF.
2. Remove the intake air duct.
3. Check if foreign matter is caught between the throttle valve and the housing.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Remove the foreign matter and clean the electric throttle control actuator inside, then perform throttle valve closed position learning. Refer to EC-199, "Description".

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P1423, P1424 COLD START CONTROL

DTC Description

INFOID:0000000014419729

DTC DETECTION LOGIC

ECM controls fuel injection timing and fuel injection quantity when engine is started with the engine cold. This control promotes the activation of three way catalyst by heating the catalyst and reduces emissions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1423	COLD START CONTROL (Cold start emission reduction strategy monitoring)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM does not control fuel injection timing properly when engine is started with the engine cold
		Diagnosis delay time	—
P1424	COLD START CONTROL (Cold start emission reduction strategy monitoring)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM does not control fuel injection quantity properly when engine is started with with the engine cold
		Diagnosis delay time	—

POSSIBLE CAUSE

ECM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1423 or P1424 is displayed with other DTC first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

WITH CONSULT

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Select “DATA MONITOR” mode with CONSULT.
4. Check that “COOLAN TEMP/S”.

- If it is between 5°C (41°F) and 40°C (104°F) go to the following steps.
- If it is below 5°C (41°F) warm engine up to more than 5°C (41°F) and retry from step 1.
- If it is above 40°C (104°F) cool engine down to less than 40°C (104°F) and retry from step 1.

5. Start engine and let it idle for 5 minutes.
6. Check 1st trip DTC.

WITH GST

Follow the procedure “With CONSULT” above.

Is DTC detected?

YES >> Proceed to EC-578, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419730

1.CHECK DTC PRIORITY

If DTC P1423 or P1424 is displayed with other DTC first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.INSPECTION START

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-577, "DTC Description".
4. Check 1st trip DTC.

Is the 1st trip DTC P1423 or P1424 displayed again?

YES >> GO TO 3.
NO >> INSPECTION END

3.REPLACE ECM

Replace ECM. Refer to EC-727, "Removal and Installation".

>> INSPECTION END

P1550 BATTERY CURRENT SENSOR

DTC Description

INFOID:0000000014419731

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1550	BAT CURRENT SENSOR (Battery current sensor circuit range/ performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The output voltage of the battery current sensor remains within the specified range while engine is running
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Battery current sensor circuit is open or shorted)
- Battery current sensor
- Sensor power supply 2

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-579, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419732

1.CHECK BATTERY CURRENT SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect battery current sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between battery current sensor harness connector and ground.

Battery current sensor		Ground	Voltage (V)
Connector	Terminal		
E161	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

3.CHECK BATTERY CURRENT SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	3	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK BATTERY CURRENT SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	4	F78	38	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK BATTERY CURRENT SENSOR

Refer to EC-580, "Component Inspection (Battery Current Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

Component Inspection (Battery Current Sensor)

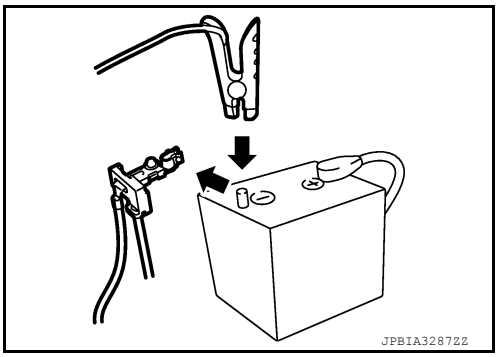
INFOID:0000000014419733

1.CHECK BATTERY CURRENT SENSOR

1. Turn ignition switch OFF.

2. Reconnect harness connectors disconnected.
3. Disconnect battery negative cable.

⬅: To body ground



4. Install jumper cable between battery negative terminal and body ground.
5. Turn ignition switch ON.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Voltage (V)
Connector	+	–	
	Terminal	Terminal	
F78	38 (Battery current sensor signal)	43	Approx. 2.5

Before measuring the terminal voltage, confirm that the battery is fully charged. Refer to PG-175, "How to Handle Battery".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

P1551, P1552 BATTERY CURRENT SENSOR

DTC Description

INFOID:0000000014419734

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1551	BAT CURRENT SENSOR (Battery current sensor circuit low input)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	An excessively low voltage from the sensor is sent to ECM
		Diagnosis delay time	—
P1552	Battery current sensor circuit high input (BAT CURRENT SENSOR)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	An excessively high voltage from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Battery current sensor circuit is open or shorted)
- Battery current sensor
- Sensor power supply 2

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-582, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419735

1.CHECK BATTERY CURRENT SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect battery current sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between battery current sensor harness connector and ground.

Battery current sensor		Ground	Voltage (V)
Connector	Terminal		
E161	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

3.CHECK BATTERY CURRENT SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	3	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK BATTERY CURRENT SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	4	F78	38	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK BATTERY CURRENT SENSOR

Refer to EC-584, "Component Inspection (Battery Current Sensor)".

Is the inspection result normal?

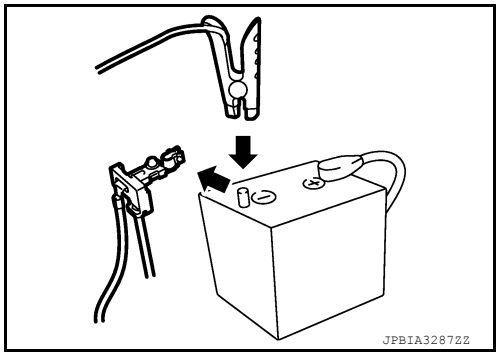
YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

Component Inspection (Battery Current Sensor)

INFOID:0000000014419736

1. CHECK BATTERY CURRENT SENSOR

1. Turn ignition switch OFF.
2. Reconnect harness connectors disconnected.
3. Disconnect battery negative cable.



⬅: To body ground

4. Install jumper cable between battery negative terminal and body ground.
5. Turn ignition switch ON.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Voltage (V)
Connector	+	–	
	Terminal	Terminal	
F78	38 (Battery current sensor signal)	43	Approx. 2.5

Before measuring the terminal voltage, confirm that the battery is fully charged. Refer to PG-175, "How to Handle Battery".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

P1553 BATTERY CURRENT SENSOR

DTC Description

INFOID:0000000014419737

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1553	BAT CURRENT SENSOR (Battery current sensor performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The signal voltage transmitted from the sensor to ECM is higher than the amount of the maximum power generation
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Battery current sensor circuit is open or shorted)
- Battery current sensor
- Sensor power supply 2

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-585, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419738

1.CHECK BATTERY CURRENT SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect battery current sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between battery current sensor harness connector and ground.

Battery current sensor		Ground	Voltage (V)
Connector	Terminal		
E161	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

3.CHECK BATTERY CURRENT SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	3	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK BATTERY CURRENT SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	4	F78	38	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK BATTERY CURRENT SENSOR

Refer to EC-586, "Component Inspection (Battery Current Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

Component Inspection (Battery Current Sensor)

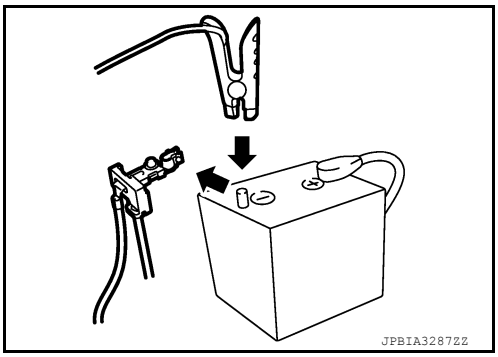
INFOID:0000000014419739

1.CHECK BATTERY CURRENT SENSOR

1. Turn ignition switch OFF.

2. Reconnect harness connectors disconnected.
3. Disconnect battery negative cable.

⬅: To body ground



4. Install jumper cable between battery negative terminal and body ground.
5. Turn ignition switch ON.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Voltage (V)
Connector	+	–	
	Terminal	Terminal	
F78	38 (Battery current sensor signal)	43	Approx. 2.5

Before measuring the terminal voltage, confirm that the battery is fully charged. Refer to PG-175, "How to Handle Battery".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

P1554 BATTERY CURRENT SENSOR

DTC Description

INFOID:0000000014419740

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1554	BAT CURRENT SENSOR (Battery current sensor performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The output voltage of the battery current sensor is lower than the specified value while the battery voltage is high enough
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Battery current sensor circuit is open or shorted)
- Battery current sensor
- Sensor power supply 2

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PERFORM COMPONENT FUNCTION CHECK

Perform Component Function Check. Refer to EC-588, "Component Function Check".

NOTE:

Use Component Function Check to check the overall function of the battery current sensor circuit. During this check, a 1st trip DTC might not be confirmed.

Is the inspection result normal?

YES-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
YES-2 >> Confirmation after repair: INSPECTION END
NO >> Go to EC-589, "Diagnosis Procedure".

Component Function Check

INFOID:0000000014419741

1.PRECONDITIONING

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 12.8 V or more at idle.**
- **Before performing the following procedure, confirm that all load switches and A/C switch are turned OFF.**

>> GO TO 2.

2.PERFORM COMPONENT FUNCTION CHECK

WITH CONSULT

1. Start engine and let it idle.
2. Select “BAT CUR SEN” in “DATA MONITOR” mode with CONSULT.
3. Check “BAT CUR SEN” indication for 10 seconds.
   “BAT CUR SEN” should be above 2,300 mV at least once.

WITHOUT CONSULT

1. Start engine and let it idle.
2. Check the voltage between ECM harness connector terminals as per the following.

ECM			Voltage (V)
Connector	+	–	
	Terminal	Terminal	
F78	38 (Battery current sensor signal)	43	Approx. 2.5

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-589, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419742

1.CHECK BATTERY CURRENT SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect battery current sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between battery current sensor harness connector and ground.

Battery current sensor		Ground	Voltage (V)
Connector	Terminal		
E161	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

3.CHECK BATTERY CURRENT SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	3	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK BATTERY CURRENT SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	4	F78	38	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between battery current sensor and ECM
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

7. CHECK BATTERY CURRENT SENSOR

Refer to EC-590, "Component Inspection (Battery Current Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

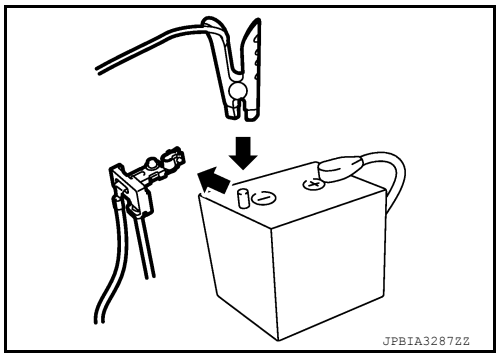
Component Inspection (Battery Current Sensor)

INFOID:0000000014419743

1. CHECK BATTERY CURRENT SENSOR

1. Turn ignition switch OFF.
2. Reconnect harness connectors disconnected.
3. Disconnect battery negative cable.

⬅: To body ground



4. Install jumper cable between battery negative terminal and body ground.
5. Turn ignition switch ON.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Voltage (V)
Connector	+	–	
	Terminal	Terminal	
F78	38 (Battery current sensor signal)	43	Approx. 2.5

Before measuring the terminal voltage, confirm that the battery is fully charged. Refer to PG-175, "How to Handle Battery".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

P1556, P1557 BATTERY TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419744

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1556	BAT TMP SEN/CIRC (Battery temperature sensor circuit low input)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Voltage signal transmitted from battery temperature sensor
		Threshold	Signal voltage from Battery temperature sensor remains 0.16V or less
		Diagnosis delay time	5 seconds or more
P1557	BAT TMP SEN/CIRC (Battery temperature sensor circuit high input)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Voltage signal transmitted from battery temperature sensor
		Threshold	Signal voltage from Battery temperature sensor remains 4.84V or more
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors
  [Battery current sensor (Battery temperature sensor) circuit is shorted.]
- Battery current sensor (Battery temperature sensor)

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1556 or P1557 is displayed with DTC P0643 first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and let it idle at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-592, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419745

1.CHECK DTC PRIORITY

If DTC P1556 or P1557 is displayed with DTC P0643 first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK BATTERY TEMPERATURE SENSOR INPUT SIGNAL CIRCUIT-I

1. Disconnect battery current sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between battery current sensor harness connector and ground.

Battery current sensor		Ground	Voltage (V)
Connector	Terminal		
E161	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK BATTERY TEMPERATURE SENSOR INPUT SIGNAL CIRCUIT-II

1. Turn ignition switch ON.
2. Disconnect ECM harness connector.
3. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	2	F78	32	Existed

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair open circuit.

4.CHECK BATTERY TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between battery current sensor harness connector and ECM harness connector.

Battery current sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E161	3	F78	43	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK BATTERY TEMPERATURE SENSOR

Refer to EC-593, "Component Inspection (Battery Temperature Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

Component Inspection (Battery Temperature Sensor)

INFOID:0000000014419746

1. CHECK BATTERY TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect battery current sensor.
3. Check the resistance between battery current sensor connector terminals.

Battery current sensor		Resistance
+	–	
Terminal		
2	3	continuity with the resistance value 100 Ω or more

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace battery negative cable assembly.

P1564 ASCD STEERING SWITCH

DTC Description

INFOID:0000000014419747

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1564	ASCD SW (ASCD steering switch)	Diagnosis condition	—
		Signal (terminal)	ASCD steering switch signal
		Threshold	• An excessively high voltage signal from the ASCD steering switch is sent to ECM • ECM detects that input signal from the ASCD steering switch is out of the specified range • ECM detects that the ASCD steering switch is stuck ON
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The switch circuit is open or shorted)
- ASCD steering switch
- ECM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1564 is displayed with DTC P0605 first perform the trouble diagnosis for DTC P0605.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-517, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 seconds.
2. Press MAIN switch for at least 10 seconds, then release it and wait at least 10 seconds.
3. Press CANCEL switch for at least 10 seconds, then release it and wait at least 10 seconds.
4. Press ACCELERATE/RESUME switch for at least 10 seconds, then release it and wait at least 10 seconds.
5. Press COAST/SET switch for at least 10 seconds, then release it and wait at least 10 seconds.
6. Check DTC.

Is DTC detected?

YES >> Proceed to EC-595, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419748

1.CHECK DTC PRIORITY

If DTC P1564 is displayed with DTC P0605 first perform the trouble diagnosis for DTC P0605.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-517, "DTC Description".
NO >> GO TO 2.

2.CHECK ASCD STEERING SWITCH CIRCUIT

WITH CONSULT

1. Turn ignition switch ON.
2. Select “MAIN SW”, “CANCEL SW”, “RESUME/ACC SW” and “SET SW” in “DATA MONITOR” mode with CONSULT.
3. Check each item indication under the following conditions.

Monitor item	Condition		Indication
MAIN SW	MAIN switch	Pressed	ON
		Released	OFF
CANCEL SW	CANCEL switch	Pressed	ON
		Released	OFF
RESUME/ACC SW	ACCELERATE/RESUME switch	Pressed	ON
		Released	OFF
SET SW	COAST/SET switch	Pressed	ON
		Released	OFF

WITHOUT CONSULT

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
E16	134 (ASCD steering switch signal)	135	MAIN switch: Pressed	Approx. 0
			CANCEL switch: Pressed	Approx. 1
			COAST/SET switch: Pressed	Approx. 2
			ACCELERATE/RESUME switch: Pressed	Approx. 3
			All ASCD steering switches: Released	Approx. 4

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 3.

3.CHECK ASCD STEERING SWITCH GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect combination switch harness connector.
4. Check the continuity between combination switch and ECM harness connector.

Combination switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
—	7*1 13*2	E16	135	Existed

*1: With heated steering wheel
*2: Without heated steering wheel

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Combination switch (spiral cable)
- Harness for open and short between ECM and combination switch

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK ASCD STEERING SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between combination switch and ECM harness connector.

Combination switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
—	10*1 9*2	E16	134	Existed

*1: With heated steering wheel
*2: Without heated steering wheel

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Combination switch (spiral cable)
- Harness for open and short between ECM and combination switch

>> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK ASCD STEERING SWITCH

Refer to EC-596, "Component Inspection (ASCD Steering Switch)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace ASCD steering switch. Refer to ST-36, "Removal and Installation".

Component Inspection (ASCD Steering Switch)

INFOID:0000000014419749

1.CHECK ASCD STEERING SWITCH

1. Turn ignition switch OFF.
2. Disconnect combination switch (spiral cable) harness connector M199.
3. Check resistance between combination switch harness connector terminals under the following conditions.

Combination switch		Condition	Resistance (Ω)
Connector	Terminals		
M199	15 and 18	MAIN switch: Pressed	Approx. 0
		CANCEL switch: Pressed	Approx. 250
		COAST/SET switch: Pressed	Approx. 660
		ACCELERATE/RESUME switch: Pressed	Approx. 1,480
		All ASCD steering switches: Released	Approx. 4,000

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace ASCD steering switch. Refer to ST-36, "Removal and Installation".

P1572 BRAKE PEDAL POSITION SWITCH

DTC Description

INFOID:0000000014419750

DTC DETECTION LOGIC

NOTE:

This self-diagnosis has the one trip detection logic. When malfunction A is detected, DTC is not stored in ECM memory. And in that case, 1st trip DTC and 1st trip freeze frame data are displayed. 1st trip DTC is erased when ignition switch is turned OFF. And even when malfunction A is detected in two consecutive trips, DTC is not stored in ECM memory.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1572	ASCD BRAKE SW (ASCD brake switch)	A	Diagnosis condition	—
			Signal (terminal)	• Brake pedal position switch signal • Stop lamp switch signal
			Threshold	When the vehicle speed is above 30 km/h (19 MPH), ON signals from the stop lamp switch and the brake pedal position switch are sent to the ECM at the same time
			Diagnosis delay time	—
		B	Diagnosis condition	—
			Signal (terminal)	Brake pedal position switch signal
			Threshold	Brake pedal position switch signal is not sent to ECM for extremely long time while the vehicle is being driven
			Diagnosis delay time	Extremely long time

POSSIBLE CAUSE

- Harness or connectors (The stop lamp switch circuit is shorted)
- Harness or connectors (The brake pedal position switch circuit is shorted)
- Stop lamp switch
- Brake pedal position switch
- Incorrect stop lamp switch installation
- Incorrect brake pedal position switch installation
- ECM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P1572 is displayed with DTC P0605 first perform the trouble diagnosis for DTC P0605.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-517, "DTC Description".

NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

NOTE:

The procedure for malfunction B is not described. It takes an extremely long time to complete the procedure for malfunction B. By performing the procedure for malfunction A, the condition that causes malfunction B can be detected.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A

1. Start engine (VDC switch OFF).
2. Press MAIN switch and check that CRUISE indicator is displayed in combination meter.
3. Drive the vehicle for at least 5 consecutive seconds under the following conditions.
   CAUTION:
   Always drive vehicle at a safe speed.
   NOTE:
   This procedure may be conducted with the drive wheels lifted in the shop or by driving the vehicle. If a road test is expected to be easier, it is unnecessary to lift the vehicle.

Vehicle speed	More than 30 km/h (19 mph)
Selector lever	Suitable position

4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-599, "Diagnosis Procedure".
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE

1. Drive the vehicle for at least 5 consecutive seconds under the following conditions.
   CAUTION:
   Always drive vehicle at a safe speed.
   NOTE:
   This procedure may be conducted with the drive wheels lifted in the shop or by driving the vehicle. If a road test is expected to be easier, it is unnecessary to lift the vehicle.

Vehicle speed	More than 30 km/h (19 mph)
Selector lever	Suitable position
Driving location	Depress the brake pedal for more than 5 seconds so as not to come off from the above-mentioned vehicle speed.

2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-599, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419751

1.CHECK DTC PRIORITY

If DTC P1572 is displayed with DTC P0605 first perform the trouble diagnosis for DTC P0605.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-517, "DTC Description".
NO >> GO TO 2.

2.CHECK OVERALL FUNCTION-I

WITH CONSULT

1. Turn ignition switch ON.
2. Select “BRAKE SW1” in “DATA MONITOR” mode with CONSULT.
3. Check “BRAKE SW1” indication under the following conditions.

Monitor item	Condition		Indication
BRAKE SW1 (Brake pedal position switch)	Brake pedal	Slightly depressed	OFF
		Fully released	ON

WITHOUT CONSULT

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals as per the following.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
E16	140 (Brake pedal position switch signal)	152	Brake pedal	Slightly depressed	Approx. 0
				Fully released	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 4.

3.CHECK OVERALL FUNCTION-II

WITH CONSULT
Select “BRAKE SW2” and check indication under the following conditions.

Monitor item	Condition		Indication
BRAKE SW2 (Stop lamp switch)	Brake pedal	Slightly depressed	ON
		Fully released	OFF

WITHOUT CONSULT
Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
E16	139 (Stop lamp switch signal)	152	Brake pedal	Slightly depressed	Battery voltage
				Fully released	Approx. 0

Is the inspection result normal?

YES >> GO TO 13.
NO >> GO TO 9.

4.CHECK BRAKE PEDAL POSITION SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect brake pedal position switch harness connector.
3. Turn ignition switch ON.
4. Check the voltage between brake pedal position switch harness connector and ground.

Brake pedal position switch		Ground	Voltage
Connector	Terminal		
E170	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the following.
- 10 A fuse (No. 30)
- Harness for open or short between brake pedal position switch and fuse
- Loose or poor connection for each connector and harness

>> Repair open circuit or short to ground in harness or connectors.

6. CHECK BRAKE PEDAL POSITION SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between brake pedal position switch harness connector and ECM harness connector.

Brake pedal position switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E170	2	E16	140	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and brake pedal position switch
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8. CHECK BRAKE PEDAL POSITION SWITCH

Refer to EC-602, "Component Inspection (Brake Pedal Position Switch)"

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace brake pedal position switch.

9. CHECK STOP LAMP SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Check the voltage between stop lamp switch harness connector and ground.

Stop lamp switch		Ground	Voltage
Connector	Terminal		
E38	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10. DETECT MALFUNCTIONING PART

Check the following.
- 10 A fuse (No. 10)
- Harness for open or short between stop lamp switch and battery
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

11. CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check the continuity between stop lamp switch harness connector and ECM harness connector.

Stop lamp switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E38	2	E16	139	Existed

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 13.
NO >> GO TO 12.

12. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and stop lamp switch
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

13. CHECK STOP LAMP SWITCH

Refer to EC-602, "Component Inspection (Stop Lamp Switch)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace stop lamp switch.

Component Inspection (Brake Pedal Position Switch)

INFOID:0000000014419752

1. CHECK BRAKE PEDAL POSITION SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect brake pedal position switch harness connector.
3. Check the continuity between brake pedal position switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. CHECK BRAKE PEDAL POSITION SWITCH-II

1. Adjust brake pedal position switch installation. Refer to BR-10, "Inspection".
2. Check the continuity between brake pedal position switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace brake pedal position switch. Refer to BR-21, "Removal and Installation".

Component Inspection (Stop Lamp Switch)

INFOID:0000000014419753

1. CHECK STOP LAMP SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Check the continuity between stop lamp switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK STOP LAMP SWITCH-II

1. Adjust stop lamp switch installation. Refer to BR-10, "Inspection".
2. Check the continuity between stop lamp switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace stop lamp switch. Refer to BR-21, "Removal and Installation".

P1574 ASCD VEHICLE SPEED SENSOR

DTC Description

INFOID:0000000014419754

DTC DETECTION LOGIC

The ECM receives two vehicle speed signals by the CAN communication line. One is sent from “combination meter”, and the other is from TCM (Transmission control module). The ECM uses these signals for ASCD control. Refer to EC-76, "AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description" for ASCD functions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1574	ASCD VHL SPD SEN (ASCD vehicle speed sensor)	Diagnosis condition	—
		Signal (terminal)	ASCD steering switch signal
		Threshold	ECM detects a difference between two vehicle speed signals is out of the specified range
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (The CAN communication line is open or shorted)
- Combination meter
- ABS actuator and electric unit (control unit)
- Wheel sensor
- TCM
- ECM

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine (VDC switch OFF).
2. Drive the vehicle at more than 40 km/h (25 MPH).
   CAUTION:
   Always drive vehicle at a safe speed.
   NOTE:
   This procedure may be conducted with the drive wheels lifted in the shop or by driving the vehicle. If a road test is expected to be easier, it is unnecessary to lift the vehicle.
3. Check DTC.

Is DTC detected?

YES >> Proceed to EC-605, "Diagnosis Procedure".
NO >> INSPECTION END

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P1574 is displayed with DTC UXXXX first perform the trouble diagnosis for DTC UXXXX.
- If DTC P1574 is displayed with DTC P0500 first perform the trouble diagnosis for DTC P0500.
- If DTC P1574 is displayed with DTC P0605 first perform the trouble diagnosis for DTC P0605.
- If DTC P1574 is displayed with DTC P0607 first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.

2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine (VDC switch OFF).
2. Drive the vehicle at more than 40 km/h (25 MPH).
   CAUTION:
   Always drive vehicle at a safe speed.
   NOTE:
   This procedure may be conducted with the drive wheels lifted in the shop or by driving the vehicle. If a road test is expected to be easier, it is unnecessary to lift the vehicle.
3. Check DTC.

Is DTC detected?

YES >> Proceed to EC-599, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419755

1.CHECK DTC PRIORITY

- If DTC P1574 is displayed with DTC UXXXX first perform the trouble diagnosis for DTC UXXXX.
- If DTC P1574 is displayed with DTC P0500 first perform the trouble diagnosis for DTC P0500.
- If DTC P1574 is displayed with DTC P0605 first perform the trouble diagnosis for DTC P0605.
- If DTC P1574 is displayed with DTC P0607 first perform the trouble diagnosis for DTC P0607.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC WITH TCM

Check DTC with TCM. Refer to TM-317, "CONSULT Function".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Perform Diagnosis Procedure corresponding to the DTC indicated.

3.CHECK DTC WITH “ABS ACTUATOR AND ELECTRIC UNIT (CONTROL UNIT)”

Refer to BRC-43, "CONSULT Function (ABS)".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Perform Diagnosis Procedure corresponding to the DTC indicated.

4.CHECK DTC WITH “COMBINATION METER”

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

>> INSPECTION END

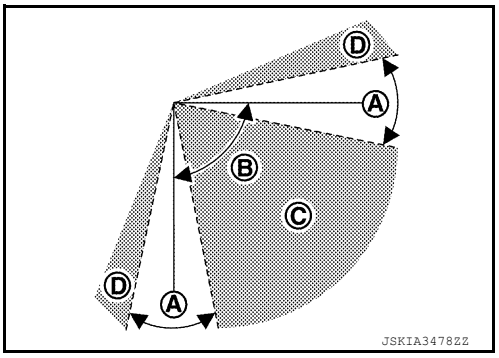
P159F ACTIVE GRILLE SHUTTER

DTC Description

INFOID:0000000014681587

DTC DETECTION LOGIC

Active grille shutter normally stops within zone Ⓐ which is defined by zone Ⓑ (90°±20°).
If the active grille shutter stops within zone Ⓒ stuck error is detected, and if the active grille shutter stops at position beyond zone Ⓓ over-run error is detected.



DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P159F	ACTIVE GRILLE AIR SHUTTER A (Active grille air shutter A)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	Detects the malfunction of initial position learning or operational malfunctions for specified times
		Diagnosis delay time	—

POSSIBLE CAUSE

- Foreign objects interferes with active grille shutter

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P159F displayed with DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500 or P0607 first perform the confirmation procedure (trouble diagnosis) for DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500 or P0607.

Is DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500 or P0607 detected?

YES >> Perform diagnosis of applicable.
- DTC UXXXX: Refer to EC-136, "DTC Index".
- DTC P0116: Refer to EC-323, "DTC Description".
- DTC P0117, P0118: Refer to EC-326, "DTC Description".
- DTC P0125: Refer to EC-332, "DTC Description".
- DTC P0196: Refer to EC-395, "DTC Description".
- DTC P0197, P0198: Refer to EC-399, "DTC Description".
- DTC P0500: Refer to EC-476, "DTC Description".
- DTC P0607: Refer to EC-521, "DTC Description".

NO >> GO TO 2.

2.PRECONDITIONING

If another DTC Confirmation Procedure is conducted just before this procedure, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is between 11V and 16V with ignition switch ON.

With CONSULT >>GO TO 3.
Without CONSULT>>GO TO 4.

3.DTC CONFIRMATION PROCEDURE

With CONSULT

1. Turn ignition switch OFF and wait 10 seconds or more.
2. Turn ignition switch ON.
3. On CONSULT screen, select “ENGINE” >> “Active Test” >> “ACTIVE GRILLE SHUTTER”.
4. Touch “CALIBRTN”at least 30 seconds.
5. Check 1st trip DTC.

Is DTC P159F is detected?

YES >> Proceed to EC-607, "Diagnosis Procedure".
NO >> INSPECTION END

4.DTC CONFIRMATION PROCEDURE

1. Drive the vehicle at 30 km/h (19 MPH) or more for at least 30 seconds.
2. Check DTC.

Is DTC P159F detected?

YES >> Proceed to EC-607, "Diagnosis Procedure"
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014681588

1.CHECK DTC PRIORITY

If DTC P159F displayed with DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500 or P0607 first perform the confirmation procedure (trouble diagnosis) for DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500 or P0607.

Is DTC UXXXX, P0116, P0117, P0118, P0125, P0196, P0197, P0198, P0500 or P0607 detected?

YES >> Perform diagnosis of applicable.
- DTC UXXXX: Refer to EC-136, "DTC Index".
- DTC P0116: Refer to EC-323, "DTC Description".
- DTC P0117, P0118: Refer to EC-326, "DTC Description".
- DTC P0125: Refer to EC-332, "DTC Description".
- DTC P0196: Refer to EC-395, "DTC Description".
- DTC P0197, P0198: Refer to EC-399, "DTC Description".
- DTC P0500: Refer to EC-476, "DTC Description".
- DTC P0607: Refer to EC-521, "DTC Description".

NO >> GO TO 2.

2.CHECK ACTIVE GRILL SHUTTER

1. Turn ignition switch OFF.
2. Check if any foreign objects interferes with active grille shutter.
3. Check the installation condition of active grille shutter.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Repair or replace the error-detected parts.

P1606 VVEL CONTROL MODULE

DTC Description

INFOID:0000000014419756

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1606	VVEL CONTROL MODULE	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	• VVEL control module calculation function is malfunctioning • VVEL EEP-ROM system is malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1606	VVEL control module	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-608, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419757

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC Confirmation Procedure.
   See EC-608, "DTC Description".

Is the DTC P1606 displayed again?

YES >> Replace VVEL control module. Refer to EC-728, "Removal and Installation".
NO >> INSPECTION END

P1607 VVEL CONTROL MODULE

DTC Description

INFOID:0000000014419758

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1607	VVEL CONTROL MODULE (VVEL control module circuit)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The internal circuit of the VVEL control module is malfunctioning
		Diagnosis delay time	—

POSSIBLE CAUSE

VVEL control module

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-609, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419759

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC Confirmation Procedure.
   See EC-609, "DTC Description".

Is the DTC P1607 displayed again?

YES >> Replace VVEL control module. Refer to EC-728, "Removal and Installation".
NO >> INSPECTION END

P1608 VVEL SENSOR POWER SUPPLY

DTC Description

INFOID:0000000014419760

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1608	VVEL SENSOR POWER/CIRC (VVEL sensor power supply circuit)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	VVEL control module detects a voltage of power source for sensor is excessively low or high
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (VVEL control shaft position sensor power supply circuit is open or shorted)
- VVEL control shaft position sensor
- VVEL control module

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P1608	VVEL control shaft position sensor	VVEL actuator motor relay is turned off, and VVEL value is become at a minimum angle. Engine speed will not rise more than 3,500 rpm due to the fuel cut.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 10 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-610, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419761

1.CHECK VVEL CONTROL SHAFT POSITION SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect VVEL control shaft position sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between VVEL control shaft position sensor harness connector and ground.

VVEL control shaft position sensor			Ground	Voltage
Bank	Connector	Terminal		
1	F83	3	Ground	Approx. 5V
		6		
2	F86	3		
		6		

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 2.

2.CHECK VVEL CONTROL SHAFT POSITION SENSOR POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF.
2. Disconnect VVEL control module harness connector.
3. Check the continuity between VVEL control shaft position sensor harness connector and VVEL control module harness connector.

VVEL control shaft position sensor			VVEL control module		Continuity
Bank	Connector	Terminal	Connector	Terminal	
1	F83	3	F84	7	Existed
		6		20	
2	F86	3		9	
		6		22	

4. Also check harness for short to ground and power.

Is the inspection result normal?

YES >> Replace VVEL control module. Refer to EC-728, "Removal and Installation".
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between VVEL control shaft position sensor and VVEL control module
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.REPLACE VVEL LADDER ASSEMBLY

Replace VVEL ladder assembly. Refer to EM-94, "Removal and Installation".

>> NSPECTION END

P1805 BRAKE SWITCH

DTC Description

INFOID:0000000014419762

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1805	BRAKE SW/CIRCUIT (Brake switch)	Diagnosis condition	—
		Signal (terminal)	Stop lamp switch signal
		Threshold	A brake switch signal is not sent to ECM for extremely long time while the vehicle is being driven
		Diagnosis delay time	Extremely long time

POSSIBLE CAUSE

- Harness or connectors (Stop lamp switch circuit is open or shorted)
- Stop lamp switch

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode	
P1805	Brake switch	ECM controls the electric throttle control actuator by regulating the throttle opening to a small range. Therefore, acceleration will be poor.	
		Vehicle condition	Driving condition
		When engine is idling	Normal
		When accelerating	Poor acceleration

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Fully depress the brake pedal for at least 5 seconds.
3. Erase the DTC.
4. Check 1st trip DTC.

Is DTC detected?

YES >> Go to EC-612, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419763

1.CHECK STOP LAMP SWITCH CIRCUIT

1. Turn ignition switch OFF.
2. Check for stop lamp illumination under the following conditions.

Condition		Stop lamp
Brake pedal	Fully released	Not illuminated
	Slightly depressed	Illuminated

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 2.

2.CHECK STOP LAMP SWITCH POWER SUPPLY CIRCUIT

1. Disconnect stop lamp switch harness connector.
2. Check the voltage between stop lamp switch harness connector and ground.

Stop lamp switch		Ground	Voltage
Connector	Terminal		
E38	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- 10 A fuse (No. 10)
- Harness for open or short between stop lamp switch and battery
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK STOP LAMP SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect stop lamp switch harness connector.
2. Disconnect ECM harness connector.
3. Check the continuity between stop lamp switch harness connector and ECM harness connector.

Stop lamp switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E38	2	E16	139	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and stop lamp switch
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

6.CHECK STOP LAMP SWITCH

Refer to EC-613, "Component Inspection (Stop Lamp Switch)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace stop lamp switch. Refer to BR-21, "Removal and Installation".

Component Inspection (Stop Lamp Switch)

INFOID:0000000014419764

1.CHECK STOP LAMP SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch harness connector.
3. Check the continuity between stop lamp switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. CHECK STOP LAMP SWITCH-II

1. Adjust stop lamp switch installation. Refer to BR-21, "Removal and Installation".
2. Check the continuity between stop lamp switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Not existed
		Slightly depressed	Existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace stop lamp switch. Refer to BR-21, "Removal and Installation".

P2080 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419765

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P2080	EXHAUST GAS TEMP SENSOR 1 B1 (Exhaust gas temperature sensor circuit range/performance bank 1 sensor 1)	1	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	The difference between estimated exhaust gas temperature calculated by ECM and temperature sent from exhaust gas temperature sensor is approx. 200°C (392°F) or more
			Diagnosis delay time	20 seconds or more
		2	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	The difference between exhaust gas temperature sent from exhaust gas temperature sensor and estimated exhaust gas temperature calculated by ECM is 300°C (572°F) or more
			Diagnosis delay time	20 seconds or more

POSSIBLE CAUSE

- Exhaust gas temperature sensor
- Exhaust gas leaks

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- DTC P2080 is displayed with DTCs related to following items, first perform the trouble diagnosis of DTCs.
- Crankshaft position sensor
- Misfire
- Fuel system
- A/F sensor 1
- A/F sensor 1 heater
- Mass air flow sensor
- Engine coolant temperature sensor 1
- Intake air temperature sensor
- Vehicle speed sensor
- DTC P2080 is displayed with DTC P0544, P0545, P0546, or P2081, first perform the trouble diagnosis for DTC P0544, P0545, P0546, or P2081.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 11 V at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

With CONSULT
1. Turn ignition switch ON.
2. Select “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine and warm it up to normal operating temperature.
4. Maintain the following conditions for at least 20 consecutive seconds.

CAUTION:
Always drive vehicle at a safe speed.

INT/A TEMP SE	• More than 0°C (32°F) • Less than 50°C (122°F)
COOLANT TEMP/S	More than 65°C (149°F)
VHCL SPEED SE	More than 80 km/h (50 MPH)

NOTE:
Keep the accelerator pedal as steady as possible during cruising.

5. Check 1st trip DTC.

With GST
Follow the procedure “With CONSULT” above.

Is DTC detected?

YES >> Go to EC-616, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419766

1.CHECK DTC PRIORITY

- DTC P2080 is displayed with DTCs related to following items, first perform the trouble diagnosis of DTCs.
- Crankshaft position sensor
- Misfire
- Fuel system
- A/F sensor 1
- A/F sensor 1 heater
- Mass air flow sensor
- Engine coolant temperature sensor 1
- Intake air temperature sensor
- Vehicle speed sensor
- DTC P2080 is displayed with DTC P0544, P0545, P0546, or P2081, first perform the trouble diagnosis for DTC P0544, P0545, P0546, or P2081.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR EXHAUST GAS LEAKS

1. Start the engine and let it idle.
2. Listen for an exhaust gas leak upstream the three way catalyst.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR

With CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Select “EXHAUST GAS TEMP SEN 1 B1” in “DATA MONITOR” mode of “ENGINE” using CONSULT.

3. Check that “EXHAUST GAS TEMP SEN 1 B1” indication as follows.

Monitor item	Condition	Value
EXHAUST GAS TEMP SEN 1 B1	• Warm-up condition • Idle speed	1,290 – 2,940 mV

Without CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Check that voltage between ECM harness connector terminals as follows.

ECM			Condition	Voltage
Connector	+	–		
	Terminal			
F78	19	43	• Warm-up condition • Idle speed	1.29 – 2.94 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace exhaust gas temperature sensor. Refer to EM-45, "Exploded View".

P2082 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014419767

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2082	EXHAUST GAS TEMP SENSOR 1 B2 (Exhaust gas temperature sensor circuit range/performance bank 2 sensor 1)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The difference between estimated exhaust gas temperature calculated by ECM and temperature sent from exhaust gas temperature sensor is approx. 200°C (392°F) or more
		Diagnosis delay time	20 seconds or more
P2082	EXHAUST GAS TEMP SENSOR 1 B2 (Exhaust gas temperature sensor circuit range/performance bank 2 sensor 1)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The difference between exhaust gas temperature sent from exhaust gas temperature sensor and estimated exhaust gas temperature calculated by ECM is 300°C (572°F) or more
		Diagnosis delay time	20 seconds or more

POSSIBLE CAUSE

- Exhaust gas temperature sensor
- Exhaust gas leaks

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- DTC P2082 is displayed with DTCs related to following items, first perform the trouble diagnosis of DTCs.
- Crankshaft position sensor
- Misfire
- Fuel system
- A/F sensor 1
- A/F sensor 1 heater
- Mass air flow sensor
- Engine coolant temperature sensor 1
- Intake air temperature sensor
- Vehicle speed sensor
- DTC P2082 is displayed with DTC P0547, P0548, P0549, or P2083, first perform the trouble diagnosis for DTC P0547, P0548, P0549, or P2083.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 11 V at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

With CONSULT
1. Turn ignition switch ON.
2. Select “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine and warm it up to normal operating temperature.
4. Maintain the following conditions for at least 20 consecutive seconds.
   CAUTION:
   Always drive vehicle at a safe speed.

INT/A TEMP SE	• More than 0°C (32°F) • Less than 50°C (122°F)
COOLANT TEMP/S	More than 65°C (149°F)
VHCL SPEED SE	More than 80 km/h (50 MPH)

   NOTE:
   Keep the accelerator pedal as steady as possible during cruising.
5. Check 1st trip DTC.

With GST
Follow the procedure “With CONSULT” above.

Is DTC detected?

YES >> Go to EC-619, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419768

1.CHECK DTC PRIORITY

- DTC P2082 is displayed with DTCs related to following items, first perform the trouble diagnosis of DTCs.
- Crankshaft position sensor
- Misfire
- Fuel system
- A/F sensor 1
- A/F sensor 1 heater
- Mass air flow sensor
- Engine coolant temperature sensor 1
- Intake air temperature sensor
- Vehicle speed sensor
- DTC P2082 is displayed with DTC P0547, P0548, P0549, or P2083, first perform the trouble diagnosis for DTC P0547, P0548, P0549, or P2083.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR EXHAUST GAS LEAKS

1. Start the engine and let it idle.
2. Listen for an exhaust gas leak upstream the three way catalyst.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR

With CONSULT
1. Start engine and warm it up to normal operating temperature.
2. Select “EXHAUST GAS TEMP SEN 1 B2” in “DATA MONITOR” mode of “ENGINE” using CONSULT.

3. Check that “EXHAUST GAS TEMP SEN 1 B2” indication as follows.

Monitor item	Condition	Value
EXHAUST GAS TEMP SEN 1 B2	• Warm-up condition • Idle speed	1,290 – 2,940 mV

Without CONSULT

1. Start engine and warm it up to normal operating temperature.
2. Check that voltage between ECM harness connector terminals as follows.

ECM			Condition	Voltage
Connector	+	–		
	Terminal			
F78	17	43	• Warm-up condition • Idle speed	1.29 – 2.94 V

Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace exhaust gas temperature sensor. Refer to EM-45, "Exploded View".

P2096, P2097, P2098, P2099 A/F SENSOR 1

DTC Description

INFOID:0000000014419769

DTC DETECTION LOGIC

To judge the malfunction, the A/F signal computed by ECM from the A/F sensor 1 signal is monitored so it will not shift to LEAN side or RICH side.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2096	POST CAT FUEL TRIM SYS B1 (Post catalyst fuel trim system too lean bank 1)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The output voltage computed by ECM from the A/F sensor 1 signal is shifts to the lean side for a specified period
		Diagnosis delay time	—
P2097	POST CAT FUEL TRIM SYS B1 (Post catalyst fuel trim system too rich bank 1)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is shifts to the rich side for a specified period
		Diagnosis delay time	—
P2098	POST CAT FUEL TRIM SYS B2 (Post catalyst fuel trim system too lean bank 2)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The output voltage computed by ECM from the A/F sensor 1 signal is shifts to the lean side for a specified period
		Diagnosis delay time	—
P2099	POST CAT FUEL TRIM SYS B2 (Post catalyst fuel trim system too rich bank 2)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The A/F signal computed by ECM from the A/F sensor 1 signal is shifts to the rich side for a specified period
		Diagnosis delay time	—

POSSIBLE CAUSE

- A/F sensor 1 (bank 1/ bank 2)
- A/F sensor 1 heater
- Heated oxygen sensor 2 (bank 1/ bank 2)
- Fuel pressure
- Fuel injector
- Intake air leaks
- Exhaust gas leaks

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Turn ignition switch OFF and wait at least 10 seconds.
3. Turn ignition switch ON.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start the engine and keep the engine speed between 3,500 and 4,000 rpm for 1 minute under no load.
6. Let engine idle for 1 minute.
7. Keep engine speed between 2,500 and 3,000 rpm for 20 minutes.
8. Check 1st trip DTC.

Is DTC detected?

YES >> Go to EC-622, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419770

1.RETIGHTEN A/F SENSOR 1 AND HEATED OXYGEN SENSOR 2

Loosen and retighten the A/F sensor 1 and heated oxygen sensor 2. Refer to EX-6, "Exploded View".

>> GO TO 2.

2.CHECK FOR EXHAUST GAS LEAK

1. Start engine and run it at idle.
2. Listen for an exhaust gas leak before the three way catalyst 2.

Is exhaust gas leak detected?

YES >> Repair or replace.
NO >> GO TO 3.

3.CHECK A/F SENSOR 1 CONNECTOR

1. Disconnect A/F sensor 1 harness connector.
2. Check that water is not inside connectors.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace harness connector.

4.CHECK FOR INTAKE AIR LEAKAGE

1. Reconnect A/F sensor 1 harness connector.
2. Start engine and run it at idle.
3. Listen for an intake air leakage after the mass air flow sensor.

Is intake air leakage detected?

YES >> Repair or replace malfunctioning part.
NO >> GO TO 5.

5.CLEAR THE MIXTURE RATIO SELF-LEARNING VALUE

1. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".
2. Run engine for at least 10 minutes at idle speed.

Is the 1st trip DTC P0171, P0172, P0174 or P0175 detected? Is it difficult to start engine?

YES >> Perform trouble diagnosis for DTC P0171, P0174 or P0172, P0175. Refer to EC-375, "Diagnosis Procedure" or EC-378, "Diagnosis Procedure".
NO >> GO TO 6.

6.CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect air fuel ratio (A/F) sensor 1 harness connector.
3. Turn ignition switch ON.

4. Check the voltage between A/F sensor 1 harness connector and ground.

DTC	A/F sensor 1			Ground	Voltage
	Bank	Connector	Terminal		
P2096 P2097	1	F25	1	Ground	Battery voltage
P2098 P2099	2	F16	1		

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7. CHECK AIR FUEL RATIO SENSOR 1 POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between A/F sensor 1 harness connector and IPDM E/R harness connector.

DTC	A/F sensor 1			IPDM E/R		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P2096 P2097	1	F25	1	E121	25	Existed
P2098 P2099	2	F16	1			

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform trouble diagnosis for power supply circuit.
NO >> Repair or replace malfunctioning part.

8. CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

DTC	A/F sensor 1			ECM		Continuity
	Bank	Connector	Terminal	Connector	Terminal	
P2096 P2097	1	F25	4	F79	79	Existed
			3		74	
P2098 P2099	2	F16	4	F79	69	
			3		70	

4. Check the continuity between A/F sensor 1 harness connector and ground, or ECM harness connector and ground.

DTC	A/F sensor 1			Ground	Continuity
	Bank	Connector	Terminal		
P2096 P2097	1	F25	4	Ground	Not Existed
			3		
P2098 P2099	2	F16	4		
			3		

DTC	ECM			Ground	Continuity
	Bank	Connector	Terminal		
P2096 P2097	1	F79	79	Ground	Not Existed
			74		
P2098 P2099	2	F79	69		
			70		

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace malfunctioning part.

9.CHECK A/F SENSOR 1 HEATER

Refer to EC-286, "Component Inspection (A/F Sensor 1 Heater)".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair or replace malfunctioning part.

10.CHECK HEATED OXYGEN SENSOR 2

Check heated oxygen sensor 2. Refer to EC-364, "Component Inspection (HO2 sensor 2)".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace malfunctioning part.

11.REPLACE AIR FUEL RATIO (A/F) SENSOR 1

Replace air fuel ratio (A/F) sensor 1. Refer to EX-6, "Exploded View".

CAUTION:

- **Discard any A/F sensor which has been dropped from a height of more than 0.5 m (19.7 in) onto a hard surface such as a concrete floor; use a new one.**
- **Before installing new A/F sensor, clean exhaust system threads using Oxygen Sensor Thread Cleaner [commercial service tool (J-43897-18 or J-43897-12)] and approved anti-seize lubricant (commercial service tool).**

Will CONSULT be used?

YES >> GO TO 12.
NO >> GO TO 13.

12.CONFIRM A/F ADJUSTMENT DATA

WITH CONSULT

1. Turn ignition switch ON.
2. Select “A/F ADJ-B1” and “A/F ADJ-B2” in “DATA MONITOR” mode with CONSULT.
3. Check that “0.000” is displayed on CONSULT screen.

Is “0.000” displayed?

YES >> INSPECTION END
NO >> GO TO 13.

13.CLEAR THE MIXTURE RATIO SELF-LEARNING VALUE

Clear the mixture ratio self-learning value. Refer to EC-204, "Description".

Will CONSULT be used?

YES >> GO TO 14.
NO >> INSPECTION END

14.CONFIRM A/F ADJUSTMENT DATA

WITH CONSULT

1. Turn ignition switch ON.
2. Select “A/F ADJ-B1” and “A/F ADJ-B2” in “DATA MONITOR” mode with CONSULT.

3. Check that “0.000” is displayed on CONSULT screen.

>> INSPECTION END

P2100, P2103 THROTTLE CONTROL MOTOR RELAY

DTC Description

INFOID:0000000014419771

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2100	ETC MOT PWR-B1 [Throttle control motor relay circuit open (bank 1)]	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Throttle control motor relay signal
		Threshold	ECM detects that the voltage of power source for throttle control motor is excessively low
		Diagnosis delay time	—
P2103	ETC MOT PWR (Throttle control motor relay circuit short)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Throttle control motor relay signal
		Threshold	ECM detects that the throttle control motor relay is stuck ON
		Diagnosis delay time	—

POSSIBLE CAUSE

P2100
- Harness or connectors (Throttle control motor relay circuit is open)
- Throttle control motor relay

P2103
- Harness or connectors (Throttle control motor relay circuit is shorted)
- Throttle control motor relay

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2100 P2103	Throttle control motor relay	ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

Which DTC is detected?

P2100 >> GO TO 2.
P2103 >> GO TO 3.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR DTC P2100

1. Turn ignition switch ON and wait at least 2 seconds.
2. Start engine and let it idle for 5 seconds.
3. Check DTC.

Is DTC detected?

YES >> Go to EC-627, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

3.PERFORM DTC CONFIRMATION PROCEDURE FOR DTC P2103

1. Turn ignition switch ON and wait at least 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-627, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419772

1.CHECK THROTTLE CONTROL MOTOR RELAY POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect IPDM E/R harness connector E119.
4. Check the continuity between IPDM E/R harness connector and ECM harness connector.

IPDM E/R		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E119	16	F79	99	Existed

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace error-detected parts.

2.CHECK THROTTLE CONTROL MOTOR RELAY INPUT SIGNAL CIRCUIT

1. Check the continuity between IPDM E/R sensor harness connector and ECM harness connector.

IPDM E/R		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E119	11	F79	111	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for IPDM E/R power supply circuit.
NO >> Repair or replace error-detected parts.

P2101 ELECTRIC THROTTLE CONTROL FUNCTION

DTC Description

INFOID:0000000014419773

DTC DETECTION LOGIC

Electric throttle control actuator consists of throttle control motor, throttle position sensor, etc.
The throttle control motor is operated by the ECM and it opens and closes the throttle valve.
The current opening angle of the throttle valve is detected by the throttle position sensor and it provides feedback to the ECM. ECM controls the throttle valve opening angle in response to driving condition via the throttle control motor.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2101	ETC FNCTN/CIRC-B1 (Throttle actuator “A” control motor circuit range/performance)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	—
		Threshold	Electric throttle control function does not operate properly
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Throttle control motor circuit is open or shorted)
- Electric throttle control actuator

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2101	Electric throttle control function	ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P2101 is displayed with DTC P2100, first perform the trouble diagnosis for DTC P2100.
- If DTC P2101 is displayed with DTC P2119, first perform the trouble diagnosis for DTC P2119.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 2 seconds.
2. Start engine and let it idle for 5 seconds.
3. Check DTC.

Is DTC detected?

YES >> Proceed to EC-629, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419774

1.CHECK DTC PRIORITY

- If DTC P2101 is displayed with DTC P2100, first perform the trouble diagnosis for DTC P2100.
- If DTC P2101 is displayed with DTC P2119, first perform the trouble diagnosis for DTC P2119.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK THROTTLE CONTROL MOTOR RELAY INPUT SIGNAL CIRCUIT-I

1. Check the voltage between ECM harness connector and ground under the following conditions.

ECM		Ground	Condition	Voltage
Connector	Terminal			
F79	111	Ground	Ignition switch: OFF	Approx. 0 V
			Ignition switch: ON	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK THROTTLE CONTROL MOTOR RELAY POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect IPDM E/R harness connector.
4. Check the continuity between ECM harness connector and IPDM E/R harness connector.

IPDM E/R		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E119	16	F79	99	Existed

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THROTTLE CONTROL MOTOR RELAY INPUT SIGNAL CIRCUIT-II

1. Check the continuity between ECM harness connector and IPDM E/R harness connector.

IPDM E/R		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E119	11	F79	111	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Perform the trouble diagnosis for IPDM E/R power supply circuit.

5.CHECK THROTTLE CONTROL MOTOR OUTPUT SIGNAL CIRCUIT FOR OPEN OR SHORT

1. Turn ignition switch OFF.
2. Disconnect electric throttle control actuator harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between electric throttle control actuator harness connector and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	5	F79	107	Not existed
			108	Existed
	6		107	Existed
			108	Not existed

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR VISUALLY

1. Remove the intake air duct.
2. Check if foreign matter is caught between the throttle valve and the housing.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Remove the foreign matter and clean the electric throttle control actuator inside, then perform throttle valve closed position learning. Refer to EC-199, "Description".

7.CHECK THROTTLE CONTROL MOTOR

Refer to EC-630, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 8.
NO >> INSPECTION END

8.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

1. Replace malfunction electric throttle control actuator. Refer to EM-35, "Removal and Installation".
2. Perform EC-630, "Special Repair Requirement".

>> INSPECTION END

Component Inspection

INFOID:0000000014419775

1.CHECK THROTTLE CONTROL MOTOR

1. Turn ignition switch OFF.
2. Disconnect electric throttle control actuator harness connector.
3. Check the resistance between electric throttle control actuator terminals as per the following.

Terminals	Resistance
5 and 6	Approx. 1 - 15 Ω [at 25°C (77°F)]

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

1. Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".
2. Perform EC-630, "Special Repair Requirement".

>> INSPECTION END

Special Repair Requirement

INFOID:0000000014419776

1.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Refer to EC-199, "Description".

>> GO TO 2.

2. PERFORM IDLE AIR VOLUME LEARNING

Refer to EC-200, "Description".

>> END

P2118 THROTTLE CONTROL MOTOR

DTC Description

INFOID:0000000014419777

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2118	ETC MOT-B1 (Throttle control motor circuit short)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	—
		Threshold	ECM detects short in both circuits between ECM and throttle control motor
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Throttle control motor circuit is shorted)
- Electric throttle control actuator (Throttle control motor)

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2118	Throttle control motor	ECM stops the electric throttle control actuator control, throttle valve is maintained at a fixed opening (approx. 5 degrees) by the return spring.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 2 seconds.
2. Start engine and let it idle for 5 seconds.
3. Check DTC.

Is DTC detected?

YES >> Proceed to EC-632, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419778

1.CHECK THROTTLE CONTROL MOTOR OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect electric throttle control actuator harness connector.
2. Disconnect ECM harness connector.
3. Check the continuity between electric throttle control actuator harness connector and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	5	F79	107	Not existed
			108	Existed
	6		107	Existed
			108	Not existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace malfunctioning part.

2.CHECK THROTTLE CONTROL MOTOR

Refer to EC-633, "Component Inspection (Electric Throttle Control Motor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

Component Inspection (Electric Throttle Control Motor)

INFOID:0000000014419779

1.CHECK THROTTLE CONTROL MOTOR

1. Turn ignition switch OFF.
2. Disconnect electric throttle control actuator harness connector.
3. Check resistance between electric throttle control actuator terminals as per the following.

Terminals	Resistance
5 and 6	Approx. 1 - 15 Ω [at 25°C (77°F)]

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P2119 ELECTRIC THROTTLE CONTROL ACTUATOR

DTC Description

INFOID:0000000014419780

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P2119	ETC ACTR-B1 (Electric throttle control actuator)	A)	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Electric throttle control actuator does not function properly due to the return spring malfunction
			Diagnosis delay time	—
		B)	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	Throttle valve opening angle in fail-safe mode is not in specified range
			Diagnosis delay time	—
		C)	Diagnosis condition	—
			Signal (terminal)	—
			Threshold	ECM detects that the throttle valve is stuck open
			Diagnosis delay time	—

POSSIBLE CAUSE

Electric throttle control actuator

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2119	Electric throttle control actuator	(When electric throttle control actuator does not function properly due to the return spring malfunction:) ECM controls the electric throttle actuator by regulating the throttle opening around the idle position. The engine speed will not rise more than 2,000 rpm.
		(When throttle valve opening angle in fail-safe mode is not in specified range:) ECM controls the electric throttle control actuator because of regulating the throttle opening to 20 degrees or less.
		(When ECM detects the throttle valve is stuck open:) While the vehicle is being driven, it slows down gradually by fuel cut. After the vehicle stops, the engine stalls. The engine can restart in the N or P position, and engine speed will not exceed 1,000 rpm or more.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 10 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A AND B

1. Turn ignition switch ON and wait at least 1 second.
2. Selector lever position is D and wait at least 3 seconds.

3. Selector lever position is P.
4. Turn ignition switch OFF and wait at least 10 seconds.
5. Turn ignition switch ON and wait at least 1 second.
6. Selector lever position is D and wait at least 3 seconds.
7. Selector lever position is P.
8. Turn ignition switch OFF, wait at least 10 seconds, and then turn ON.
9. Check DTC.

Is DTC detected?

YES >> Go to EC-635, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION C

1. Turn ignition switch ON and wait at least 1 second.
2. Selector lever position is D and wait at least 3 seconds.
3. Selector lever position is N or P.
4. Start engine and let it idle for 3 seconds.
5. Check DTC.

Is DTC detected?

YES >> Proceed to EC-635, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419781

1.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR VISUALLY

1. Turn ignition switch OFF.
2. Remove the intake air duct.
3. Check if foreign matter is caught between the throttle valve and the housing.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Remove the foreign matter and clean the electric throttle control actuator inside, then perform throttle valve closed position learning. Refer to EC-199, "Description".

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P2122, P2123 APP SENSOR

DTC Description

INFOID:0000000014419782

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2122	APP SEN 1/CIRC (Accelerator pedal position sensor 1 circuit low input)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Accelerator pedal position sensor 1 signal
		Threshold	An excessively low voltage from the APP sensor 1 is sent to ECM
		Diagnosis delay time	—
P2123	APP SEN 1/CIRC (Accelerator pedal position sensor 1 circuit high input)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Accelerator pedal position sensor 1 signal
		Threshold	An excessively high voltage from the APP sensor 1 is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (APP sensor 1 circuit is open or shorted)
- Accelerator pedal position sensor (APP sensor 1)

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2122 P2123	Accelerator pedal position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P2122 or P2123 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-637, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419783

1.CHECK DTC PRIORITY

If DTC P2122 or P2123 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK ACCELERATOR PEDAL POSITION SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect accelerator pedal position (APP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between APP sensor harness connector and ground.

APP sensor		Ground	Voltage (V)
Connector	Terminal		
E20	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and APP sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK APP SENSOR 1 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between APP sensor harness connector and ECM harness connector.

APP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	4	E16	151	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and APP sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

6.CHECK APP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between APP sensor harness connector and ECM harness connector.

APP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	3	E16	150	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7. DETECT MALFUNCTIONING PART

Check the following.
- Loose or poor connection for each connector and harness
- Harness for open or short between ECM and APP sensor

>> Repair open circuit, short to ground or short to power in harness or connectors.

8. CHECK APP SENSOR

Refer to EC-638, "Component Inspection (Accelerator Pedal Position Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 9.

9. REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

Component Inspection (Accelerator Pedal Position Sensor)

INFOID:0000000014419784

1. CHECK ACCELERATOR PEDAL POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Turn ignition switch ON.
4. Check the voltage ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
E16	150 (APP sensor 1)	151	Accelerator pedal	Fully released	0.5 - 1.0
				Fully depressed	4.2 - 4.8
	143 (APP sensor 2)	144		Fully released	0.25 - 0.5
				Fully depressed	2.0 - 2.5

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

P2127, P2128 APP SENSOR

DTC Description

INFOID:0000000014419785

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2127	APP SEN 2/CIRC (Accelerator pedal position sensor 2 circuit low input)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	APP sensor 2 signal
		Threshold	An excessively low voltage from the APP sensor 2 is sent to ECM
		Diagnosis delay time	—
P2128	APP SEN 2/CIRC (Accelerator pedal position sensor 2 circuit high input)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	APP sensor 2 signal
		Threshold	An excessively high voltage from the APP sensor 2 is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (Accelerator pedal position sensor 2 circuit is open or shorted)
- Accelerator pedal position sensor (APP sensor 2)
- Sensor power supply 2

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2127 P2128	Accelerator pedal position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-639, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419786

1.CHECK ACCELERATOR PEDAL POSITION SENSOR 2 POWER SUPPLY CIRCUIT-I

1. Disconnect accelerator pedal position (APP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between APP sensor harness connector and ground.

APP sensor		Ground	Voltage (V)
Connector	Terminal		
E20	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

3.CHECK APP SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between APP sensor harness connector and ECM harness connector.

APP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	5	E16	144	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Loose or poor connection for each connector and harness
- Harness for open or short between ECM and APP sensor

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK APP SENSOR 2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between APP sensor harness connector and ECM harness connector.

APP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	6	E16	143	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and APP sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK APP SENSOR

Refer to EC-641, "Component Inspection (Accelerator Pedal Position Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 8.

8.REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

Component Inspection (Accelerator Pedal Position Sensor)

INFOID:0000000014419787

1.CHECK ACCELERATOR PEDAL POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Turn ignition switch ON.
4. Check the voltage ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
E16	150 (APP sensor 1)	151	Accelerator pedal	Fully released	0.5 - 1.0
				Fully depressed	4.2 - 4.8
	143 (APP sensor 2)	144		Fully released	0.25 - 0.5
				Fully depressed	2.0 - 2.5

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

P2135 TP SENSOR

DTC Description

INFOID:0000000014419788

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2135	TP SENSOR-B1 (Throttle position sensor circuit range/ performance)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Throttle position sensor signal
		Threshold	Rationally incorrect voltage is sent to ECM compared with the signals from TP sensor 1 and TP sensor 2
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connector (TP sensor 1 or 2 circuit is open or shorted)
- Electric throttle control actuator (TP sensor 1 or 2)

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2135	Throttle position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P2135 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-642, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419789

1.CHECK DTC PRIORITY

If DTC P2135 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.CHECK THROTTLE POSITION SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect electric throttle control actuator harness connector.
2. Turn ignition switch ON.
3. Check the voltage between electric throttle control actuator harness connector and ground.

Electric throttle control actuator		Ground	Voltage (V)
Connector	Terminal		
F50	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK THROTTLE POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between electric throttle control actuator harness connector and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	4	F79	85	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

4.CHECK THROTTLE POSITION SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between electric throttle control actuator harness connector and ECM harness connector.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F50	1	F79	78	Existed
	3		80	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK THROTTLE POSITION SENSOR

Refer to EC-644, "Component Inspection (Throttle Position Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

Component Inspection (Throttle Position Sensor)

INFOID:0000000014419790

1. CHECK THROTTLE POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Perform EC-199, "Description".
4. Turn ignition switch ON.
5. Set selector lever position to D.
6. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
F79	78 (TP sensor 1 signal)	85 (Sensor ground)	Accelerator pedal	Fully released	More than 0.36
				Fully depressed	Less than 4.75
	80 (TP sensor 2 signal)			Fully released	Less than 4.75
				Fully depressed	More than 0.36

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

Replace electric throttle control actuator. Refer to EM-35, "Removal and Installation".

>> INSPECTION END

P2138 APP SENSOR

DTC Description

INFOID:0000000014419791

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2138	APP SENSOR (Accelerator pedal position sensor circuit range/performance)	Diagnosis condition	Start the engine and let it idle
		Signal (terminal)	Accelerator pedal position sensor signal
		Threshold	Rationally incorrect voltage is sent to ECM compared with the signals from APP sensor 1 and APP sensor 2
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors (APP sensor 1 or 2 circuit is open or shorted)
- Accelerator pedal position sensor (APP sensor 1 or 2)
- Sensor power supply 1 and 2

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2138	Accelerator pedal position sensor	The ECM controls the electric throttle control actuator in regulating the throttle opening in order for the idle position to be within +10 degrees. The ECM regulates the opening speed of the throttle valve to be slower than the normal condition. Therefore, the acceleration will be poor.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P2138 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 8 V or more at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for 1 second.
2. Check DTC.

Is DTC detected?

YES >> Go to EC-645, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419792

1.CHECK DTC PRIORITY

If DTC P2138 is displayed with DTC P0643, first perform the trouble diagnosis for DTC P0643.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-530, "DTC Description".
NO >> GO TO 2.

2. CHECK ACCELERATOR PEDAL POSITION SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect accelerator pedal position (APP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between APP sensor harness connector and ground.

APP sensor		Ground	Voltage (V)
Connector	Terminal		
E20	2	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Loose or poor connection for each connector and harness
- Harness for open or short between ECM and APP sensor

>> Repair open circuit, short to ground or short to power in harness or connectors.

4. CHECK APP SENSOR 2 POWER SUPPLY CIRCUIT-I

1. Turn ignition switch ON.
2. Check the voltage between APP sensor harness connector and ground.

APP sensor		Ground	Voltage (V)
Connector	Terminal		
E20	1	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

6. CHECK APP SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between APP sensor harness connector and ECM harness connector.

APP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	4	E16	151	Existed
	5		144	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and accelerator pedal position sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

8.CHECK APP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between APP sensor harness connector and ECM harness connector.

APP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	3	E16	150	Existed
	6		143	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 9.

9.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and accelerator pedal position sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

10.CHECK APP SENSOR

Refer to EC-647, "Component Inspection (Accelerator Pedal Position Sensor)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 11.

11.REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

Component Inspection (Accelerator Pedal Position Sensor)

INFOID:0000000014419793

1.CHECK ACCELERATOR PEDAL POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Turn ignition switch ON.
4. Check the voltage ECM harness connector terminals under the following conditions.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
E16	150 (APP sensor 1)	151	Accelerator pedal	Fully released	0.5 - 1.0
				Fully depressed	4.2 - 4.8
	143 (APP sensor 2)	144		Fully released	0.25 - 0.5
				Fully depressed	2.0 - 2.5

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. REPLACE ACCELERATOR PEDAL ASSEMBLY

Replace accelerator pedal assembly. Refer to ACC-3, "Removal and Installation".

>> INSPECTION END

P219A, P219B AIR FUEL RATIO

DTC Description

INFOID:0000000014419794

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P219A	AIR FUEL RATIO IMBALANCE B1 (Air-fuel ratio imbalance bank 1)	Diagnosis condition	—
		Signal (terminal)	—
P219B	AIR FUEL RATIO IMBALANCE B2 (Air-fuel ratio imbalance bank 2)	Threshold	ECM detects a lean/rich air fuel ratio state in any cylinder for a specified length of time
		Diagnosis delay time	—

POSSIBLE CAUSE

- Fuel injector
- Exhaust gas leaks
- Incorrect fuel pressure
- Mass air flow sensor
- Intake air leaks
- Lack of fuel
- Incorrect PCV hose connection
- Improper spark plug
- Insufficient compression
- The fuel injector circuit is open or shorted
- Ignition coil
- The ignition signal circuit is open or shorted

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P219A or P219B is displayed with other DTC, first perform the trouble diagnosis for other DTC.
- If DTC P219A or P219B is displayed with P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2 or P21A3, first perform the trouble diagnosis for P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2 or P21A3.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

NOTE:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PRECONDITIONING-2

1. Turn ignition switch ON.
2. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".

Will CONSULT be used?

YES >> GO TO 4.
NO >> GO TO 7.

4. PERFORM DTC CONFIRMATION PROCEDURE-1

1. Turn ignition switch ON.
2. Select “COOLAN TEMP/S” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Start engine.
4. Make sure that “COOLAN TEMP/S” indicates more than 80°C (176°F).

>> GO TO 5.

5. PERFORM DTC CONFIRMATION PROCEDURE-2

With CONSULT

1. Select “SYSTEM 1 DIAGNOSIS B B1” and “SYSTEM 1 DIAGNOSIS A B1” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
2. Drive vehicle under the following conditions for at least 5 consecutive seconds.

CAUTION:

- **Always drive vehicle at a safe speed.**

ENG SPEED	1,200 – 1,600rpm
COOLAN TEMP/S	More than 80°C (176°F)
B/FUEL SCHDL	8 – 12 msec
Selector lever	D position
SYSTEM 1 DIAGNOSIS B B1	PRSENT

NOTE:

- Drive the vehicle at approximately 88 km/h (55MPH) allows easy diagnosis.
- Keep the accelerator pedal as possible during crusing.

3. Check “SYSTEM 1 DIAGNOSIS A B1” indication.

Is “CMPLT” displayed?

YES >> GO TO 6.
NO >> GO TO 3.

6. PERFORM DTC CONFIRMATION PROCEDURE-3

Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-651, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

7. PERFORM DTC CONFIRMATION PROCEDURE-4

Without CONSULT

1. Start the engine and warm it up to normal operating temperature.
2. Drive vehicle under the following conditions for at least 5 consecutive seconds.

CAUTION:

- **Always drive vehicle at a safe speed.**

Engine speed	1,200 – 1,600 rpm
Calculated load value	34 – 68 %
Selector lever	D position

NOTE:

- Drive the vehicle at approximately 88 km/h (55MPH) allows easy diagnosis.
- Keep the accelerator pedal as possible during crusing.

3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-651, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".

NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419795

1.CHECK DTC PRIORITY

- If DTC P219A or P219B is displayed with other DTC, first perform the trouble diagnosis for other DTC.
- If DTC P219A or P219B is displayed with P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2 or P21A3, first perform the trouble diagnosis for P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2 or P21A3.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR INTAKE AIR LEAK

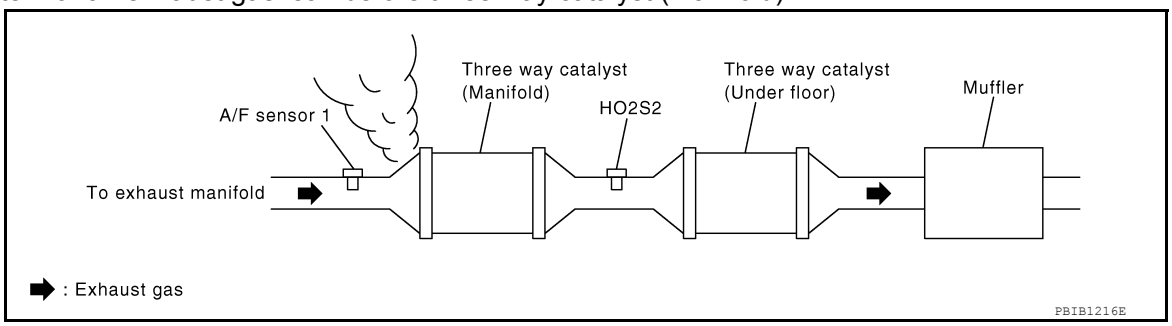
1. Stop engine and check the following for connection.
- Air duct
- Vacuum hoses
- PCV hose
- Intake air passage between air duct to intake manifold
2. Start engine and let it idle.
3. Listen for an intake air leak after the mass air flow sensor.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK EXHAUST GAS LEAK

1. Stop engine and visually check exhaust tube, three way catalyst and muffler for dents connection.
2. Start engine and let it idle.
3. Listen for an exhaust gas leak before three way catalyst (manifold).



Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FUEL PRESSURE

1. Release fuel pressure to zero. Refer to EC-205, "Work Procedure".
2. Check fuel pressure. Refer to EC-205, "Work Procedure".

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 9.

5.CHECK MASS AIR FLOW SENSOR

With CONSULT
Check “MASS AIR FLOW” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
For specification, refer to EC-730, "Mass Air Flow Sensor".

With GST
Check mass air flow sensor signal in Service $01 using GST.
For specification, refer to EC-730, "Mass Air Flow Sensor".

Is the inspection result normal?

YES >> GO TO 6.

NO >> Check connectors for rusted terminals or loose connections in the mass air flow sensor circuit or grounds. Refer to EC-310, "Diagnosis Procedure".

6. CHECK FUNCTION OF FUEL INJECTOR-1

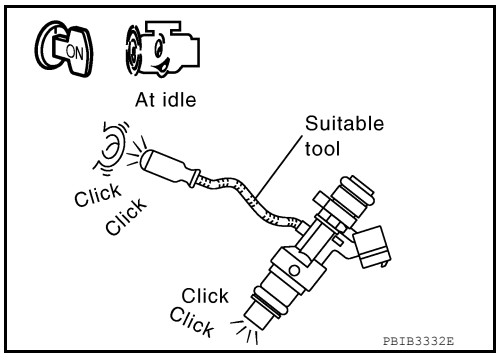
With CONSULT

1. Start engine.
2. Perform “POWER BALANCE” in “ACTIVE TEST” mode of “ENGINE” using CONSULT.
3. Check that each circuit produces a momentary engine speed drop.

Without CONSULT

1. Let engine idle.
2. Listen to each fuel injector operating sound.

Clicking noise should be heard.



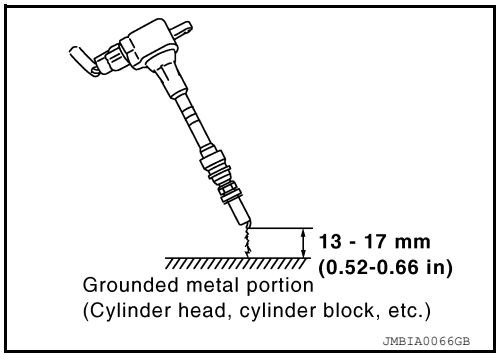
Is the inspection result normal?

YES >> GO TO 7.
NO >> Perform trouble diagnosis for fuel injector, refer to EC-685, "Component Function Check".

7. CHECK FUNCTION OF IGNITION COIL-1

CAUTION:
Perform the following steps in a well-ventilated area with no combustibles.

1. Turn ignition switch OFF.
2. Remove fuel pump fuse from IPDM E/R to release fuel pressure.
   NOTE:
   CONSULT must not be used to release fuel pressure. It develops again during the following steps, if released by using CONSULT.
3. Start the engine.
4. After an engine stall, crank the engine two or three times to release all the fuel pressure.
5. Turn ignition switch OFF.
6. Disconnect all the harness connectors of ignition coil to prevent electric discharge from occurring in ignition coil.
7. Remove ignition coil assembly and spark plug of cylinder. Refer to EM-34, "Removal and Installation".
8. Crank engine for 5 seconds or more to remove combustion gas in the cylinder.
9. Connect spark plug and harness connector to ignition coil.
10. Allow a 13-17mm (0.52-0.66 in) spacing between spark plug and grounded metal portion as shown in the figure to fix the ignition coil with a rope or an equivalent.
11. Crank the engine for approximately 3 seconds to see if sparking occurs between spark plug and the grounded metal portion.



Spark should be generated.

CAUTION:

- **The discharge voltage becomes 20 kV or higher. Therefore, always stay away from the spark plug and ignition coil at least 50 cm (19.7 in) during the inspection.**
- **Leaving a space of more than 17mm (0.66 in) may damage the ignition coil.**

NOTE:
When the gap is less than 13 mm (0.52 in), a the spark might be generated even if the coil is malfunctioning.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 10.

8.CHECK COMPRESSION PRESSURE

Check compression pressure. Refer to EM-20, "Inspection".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

9.DETECT MALFUNCTIONING PART

Check fuel hoses and fuel tubes for clogging.

Is the inspection result normal?

YES >> Replace fuel filter and fuel pump assembly. Refer to FL-6, "Removal and Installation".
NO >> Repair or replace error-detected parts.

10.CHECK FUNCTION OF IGNITION COIL-2

1. Turn ignition switch OFF.
2. Disconnect spark plug and connect a non-malfunctioning spark plug.
3. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded metal portion.

Spark should be generated.

Is the inspection result normal?

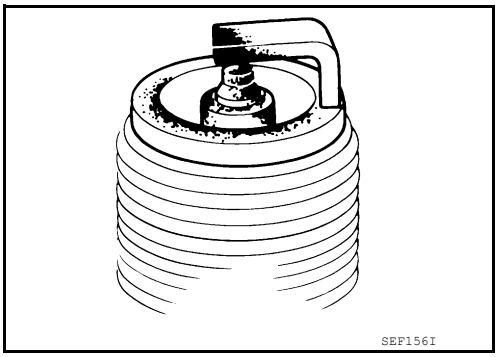
YES >> GO TO 11.
NO >> Check ignition coil, power transistor and their circuits. Refer to EC-695, "Component Function Check".

11.CHECK SPARK PLUG

Check the initial spark plug for fouling, etc.

Is the inspection result normal?

YES >> 1. Repair or clean spark plug. Refer to EM-34, "Removal and Installation".
2. GO TO 12.
NO >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".



12.CHECK FUNCTION OF IGNITION COIL-3

1. Reconnect the initial spark plugs.
2. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded portion.

Spark should be generated.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".

P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2, P21A3 AIR FUEL RATIO

DTC Description

INFOID:0000000014419796

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P219C	CYLINDER 1 AIR-FUEL RATIO (Cylinder 1 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 1 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—
P219D	CYLINDER 2 AIR-FUEL RATIO (Cylinder 2 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 2 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—
P219E	CYLINDER 3 AIR-FUEL RATIO (Cylinder 3 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 3 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—
P219F	CYLINDER 4 AIR-FUEL RATIO (Cylinder 4 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 4 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—
P21A0	CYLINDER 5 AIR-FUEL RATIO (Cylinder 5 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 5 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P21A1	CYLINDER 6 AIR-FUEL RATIO (Cylinder 6 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 6 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—
P21A2	CYLINDER 7 AIR-FUEL RATIO (Cylinder 7 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 7 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—
P21A3	CYLINDER 8 AIR-FUEL RATIO (Cylinder 8 Air-Fuel Ratio Imbalance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The cylinder 8 combustion condition calculated by ECM based on a crankshaft position sensor signal is continuously imbalanced compared with other cylinders (Abnormal air-fuel ratio)
		Diagnosis delay time	—

POSSIBLE CAUSE

- Fuel injector
- Exhaust gas leaks
- Incorrect fuel pressure
- Mass air flow sensor
- Intake air leaks
- Lack of fuel
- Incorrect PCV hose connection
- Improper spark plug
- Insufficient compression
- The fuel injector circuit is open or shorted
- Ignition coil
- The ignition signal circuit is open or shorted

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2 or P21A3 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING-1

If DTC Confirmation Procedure has been previously conducted, always perform the following before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.

3. Turn ignition switch OFF and wait at least 10 seconds.

NOTE:
Before performing the following procedure, confirm that battery voltage is 11 V or more at idle.

>> GO TO 3.

3.PRECONDITIONING-2

1. Turn ignition switch ON.
2. Clear the mixture ratio self-learning value. Refer to EC-204, "Description".

Will CONSULT be used?

YES >> GO TO 4.
NO >> GO TO 7.

4.PERFORM DTC CONFIRMATION PROCEDURE-1

With CONSULT

1. Turn ignition switch ON.
2. On CONSULT screen, select “ENGINE” >> “DATA MONITOR” >> “COOLAN TEMP/S”.
3. Start engine.
4. Check that “COOLAN TEMP/S” indicates more than 80°C (176°F).

>> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE-2

With CONSULT

1. On CONSULT screen, select the following items in “DATA MONITOR”.

- ENG SPEED
- COOLAN TEMP/S
- B/FUEL SCHDL
- A/F IMBALNC DIAG-CPS STAT
- A/F IMBLNC DIAG-CPS CMPLT

2. Drive vehicle under the following conditions for at least 20 consecutive seconds.

CAUTION:
- **Always drive vehicle at a safe speed.**
- **This procedure must be performed by two or more persons.**

ENG SPEED	1,000 – 1,400 rpm
COOLAN TEMP/S	More than 80°C (176°F)
B/FUEL SCHDL	3 – 6 msec
Selector lever	D position (A/T)
A/F IMBALNC DIAG-CPS STAT	PRSNT

NOTE:
- **Keep the accelerator pedal as possible during cruising.**
- Drive the vehicle at approximately 88 km/h (55MPH) allows easy diagnosis.

3. Check “A/F IMBLNC DIAG-CPS CMPLT” indication.

Is “CMPLT” displayed?

YES >> GO TO 6.
NO >> GO TO 3.

6.PERFORM DTC CONFIRMATION PROCEDURE-3

Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-657, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

7.PERFORM DTC CONFIRMATION PROCEDURE-4

With GST

1. Start the engine and warm it up to normal operating temperature.
2. Drive vehicle under the following conditions for at least 20 consecutive seconds.
   CAUTION:
   - **Always drive vehicle at a safe speed.**

Engine speed	1,000 – 1,400 rpm
Calculated load value	13 – 30%
Selector lever	D position (A/T)

   NOTE:
   - **Keep the accelerator pedal as possible during crusing.**
   - Drive the vehicle at approximately 88 km/h (55MPH) allows easy diagnosis.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-657, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419797

1.CHECK DTC PRIORITY

If DTC P219C, P219D, P219E, P219F, P21A0, P21A1, P21A2 or P21A3 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR INTAKE AIR LEAK

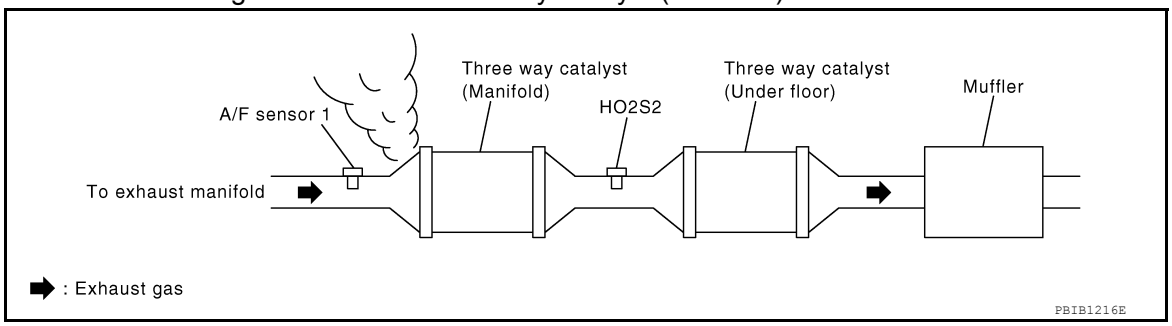
1. Stop engine and check the following for connection.
- Air duct
- Vacuum hoses
- PCV hose
- Intake air passage between air duct to intake manifold
2. Start engine and let it idle.
3. Listen for an intake air leak after the mass air flow sensor.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK EXHAUST GAS LEAK

1. Stop engine and visually check exhaust tube, three way catalyst and muffler for dents connection.
2. Start engine and let it idle.
3. Listen for an exhaust gas leak before three way catalyst (manifold).



Is the inspection result normal?

YES >> GO TO 4.

NO >> Repair or replace error-detected parts.

4. CHECK FUEL PRESSURE

1. Release fuel pressure to zero. Refer to EC-205, "Work Procedure".
2. Check fuel pressure. Refer to EC-205, "Work Procedure".

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 9.

5. CHECK MASS AIR FLOW SENSOR

With CONSULT
Check “MASS AIR FLOW” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
For specification, refer to EC-730, "Mass Air Flow Sensor".

With GST
Check mass air flow sensor signal in Service $01 using GST.
For specification, refer to EC-730, "Mass Air Flow Sensor".

Is the inspection result normal?

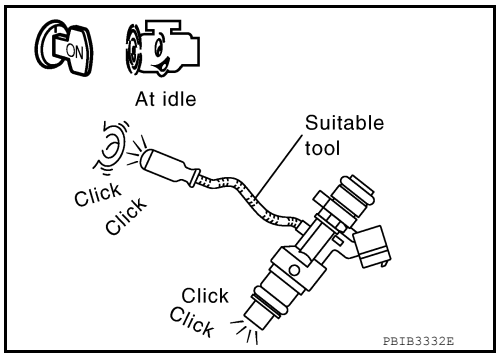
YES >> GO TO 6.
NO >> Check connectors for rusted terminals or loose connections in the mass air flow sensor circuit or grounds. Refer to EC-310, "Diagnosis Procedure".

6. CHECK FUNCTION OF FUEL INJECTOR-1

With CONSULT
1. Start engine.
2. Perform “POWER BALANCE” in “ACTIVE TEST” mode of “ENGINE” using CONSULT.
3. Check that each circuit produces a momentary engine speed drop.

Without CONSULT
1. Let engine idle.
2. Listen to each fuel injector operating sound.

Clicking noise should be heard.



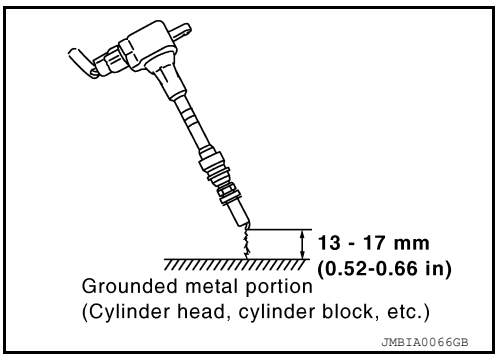
Is the inspection result normal?

YES >> GO TO 7.
NO >> Perform trouble diagnosis for fuel injector, refer to EC-685, "Component Function Check".

7. CHECK FUNCTION OF IGNITION COIL-1

CAUTION:
Perform the following steps in a well-ventilated area with no combustibles.
1. Turn ignition switch OFF.
2. Remove fuel pump fuse from IPDM E/R to release fuel pressure.
   NOTE:
   CONSULT must not be used to release fuel pressure. It develops again during the following steps, if released by using CONSULT.
3. Start the engine.
4. After an engine stall, crank the engine two or three times to release all the fuel pressure.
5. Turn ignition switch OFF.
6. Disconnect all the harness connectors of ignition coil to prevent electric discharge from occurring in ignition coil.
7. Remove ignition coil assembly and spark plug of cylinder. Refer to EM-34, "Removal and Installation".
8. Crank engine for 5 seconds or more to remove combustion gas in the cylinder.
9. Connect spark plug and harness connector to ignition coil.

10. Allow a 13-17mm (0.52-0.66 in) spacing between spark plug and grounded metal portion as shown in the figure to fix the ignition coil with a rope or an equivalent.
11. Crank the engine for approximately 3 seconds to see if sparking occurs between spark plug and the grounded metal portion.



Spark should be generated.

CAUTION:

- **The discharge voltage becomes 20 kV or higher. Therefore, always stay away from the spark plug and ignition coil at least 50 cm (19.7 in) during the inspection.**
- **Leaving a space of more than 17mm (0.66 in) may damage the ignition coil.**

NOTE:

When the gap is less than 13 mm (0.52 in), a the spark might be generated even if the coil is malfunctioning.

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 10.

8. CHECK COMPRESSION PRESSURE

Check compression pressure. Refer to EM-20, "Inspection".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

9. DETECT MALFUNCTIONING PART

Check fuel hoses and fuel tubes for clogging.

Is the inspection result normal?

YES >> Replace fuel filter and fuel pump assembly. Refer to FL-6, "Removal and Installation".
NO >> Repair or replace error-detected parts.

10. CHECK FUNCTION OF IGNITION COIL-2

1. Turn ignition switch OFF.
2. Disconnect spark plug and connect a non-malfunctioning spark plug.
3. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded metal portion.

Spark should be generated.

Is the inspection result normal?

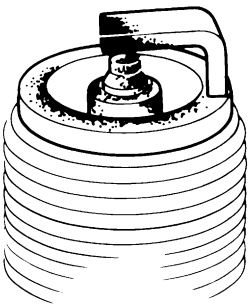
YES >> GO TO 11.
NO >> Check ignition coil, power transistor and their circuits. Refer to EC-695, "Component Function Check".

11. CHECK SPARK PLUG

Check the initial spark plug for fouling, etc.

Is the inspection result normal?

YES >> 1. Repair or clean spark plug. Refer to EM-34, "Removal and Installation".
2. GO TO 12.
NO >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".



12. CHECK FUNCTION OF IGNITION COIL-3

1. Reconnect the initial spark plugs.
2. Crank engine for approximately 3 seconds, and recheck whether spark is generated between the spark plug and the grounded portion.

Spark should be generated.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace spark plug(s) with standard type one(s). For spark plug type, refer to EM-154, "Spark Plug".

P2610 ECM INTERNAL TIMER

DTC Description

INFOID:0000000014419798

DTC DETECTION LOGIC

This ECM contains a timer and measures time between an ignition switch OFF and the next ignition switch ON. This enables the judging of the state of engine cooling at an engine start.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2610	ECM/PCM INTERNAL ENG OFF TIMER (ECM/PCM internal engine off timer performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	• ECM internal engine off timer is malfunctioning • The time calculated by ECM based on a descent allowance of engine coolant temperatures during ignition switch OFF is extremely shorter than the time counted by the Engine internal OFF timer
		Diagnosis delay time	—

POSSIBLE CAUSE

- ECM
- ECM power supply

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.INSPECTION START

It is necessary to erase permanent DTC?

YES >> GO TO 4.
NO >> GO TO 2.

2.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:
Before performing the following procedure, confirm that battery voltage is 12 V or more under ignition switch OFF condition.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 190 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-662, "Diagnosis Procedure".
NO >> INSPECTION END

4.PRECONDITIONING

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TESTING CONDITION:

- **Before performing the following procedure, confirm that battery voltage is 12 V or more under ignition switch OFF condition.**
- **Before performing the following procedure, check that fuel level is between 2/8 and 7/8.**

>> GO TO 5.

5.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 190 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-662, "Diagnosis Procedure".
NO >> GO TO 6.

6.PERFORM DTC CONFIRMATION PROCEDURE-II

CAUTION:
To start this self-diagnosis, the conditions listed bellow are required to be satisfied. Perform the following steps to satisfy the conditions.
- **Engine coolant temperature decrease by 55°C (131°F) or more during the time between an ignition switch OFF (after engine warm-up) and the second ignition switch ON.**
- **A fuel temperature at the second ignition switch ON is −5°C (23°F) or more and less than 35°C (95°F).**
- **The temperature difference between engine coolant and fuel is 5°C (41°F) or more.**

NOTE:
This self-diagnosis is not performed if the distance traveled is extremely short.
1. Turn ignition switch ON.
2. Start engine and warm it up to normal operating temperature.
3. Turn ignition switch OFF and soak the vehicle for at least 14 hours.
   CAUTION:
   - **Never turn ON the ignition switch during soaking.**
   - **Never open the fuel filler cap and perform refueling during soaking.**
4. Turn ignition switch ON and wait at least 190 seconds.
5. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-662, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419799

1.CHECK ECM POWER SUPPLY AND GROUND CIRCUIT

Check ECM power supply and ground circuit. Refer to EC-227, "Diagnosis Procedure".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace error-detected parts.

2.CHECK SELF-DIAGNOSTIC RESULT

Check that DTCs related to the fuel system and the cooling system are not detected.

Is the inspection result normal?

YES >> Check the DTC. Refer to EC-136, "DTC Index".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Erase DTC. Refer to EC-94, "CONSULT Function".
2. Perform DTC Confirmation Procedure again. Refer to EC-661, "DTC Description".

Is the 1st trip DTC P2610 displayed again?

YES >> Replace ECM. Refer to EC-727, "Removal and Installation".
NO >> INSPECTION END

P26A3 MULTI-WAY CONTROL VALVE MOTOR

DTC Description

INFOID:0000000014419800

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P26A3	ENGINE COOLANT BYPASS VALVE (Engine coolant bypass valve A range/ performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM detects the following status continuously : Target valve angle - actual valve angle ≥ ± 5°
		Diagnosis delay time	10 seconds or more

POSSIBLE CAUSE

- Harness or connectors (Multi-way control valve motor circuit is open or shorted)
- Multi-way control valve

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P26A3	Multi-way control valve	• When detecting a malfunction with the valve closed, ECM fully opens the valve. • When detecting a malfunction with the valve opened, ECM maintains valve angle. • When detecting a malfunction in sensor, ECM fully opens the valve. • ECM limits the engine output depending on malfunctions.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

If DTC P26A3 is displayed with DTC P26A5, P26A6, and/or P26A7 first perform the trouble diagnosis for DTC P26A5, P26A6, and/or P26A7.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is between more than 10 V and less than 16 V at idle.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 seconds.
2. Start the engine and let it idle for 60 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-664, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419801

1.CHECK DTC PRIORITY

If DTC P26A3 is displayed with DTC P26A5, P26A6, and/or P26A7 first perform the trouble diagnosis for DTC P26A5, P26A6, and/or P26A7.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK MULTI-WAY CONTROL VALVE MOTOR OUTPUT SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect multi-way control valve harness connector and ECM harness connector.
3. Check the continuity between multi-way control valve harness connector and ECM harness connector.

+		–		Continuity
Multi-way control valve		ECM		
Connector	Terminal	Connector	Terminal	
F92	1	F79	58	Existed
	2		57	

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK MULTI-WAY CONTROL VALVE MOTOR

Check the multi-way control valve motor. Refer to EC-664, "Component Inspection (Multi-way Control Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

Component Inspection (Multi-way Control Valve)

INFOID:0000000014419802

1.CHECK MULTI-WAY CONTROL VALVE-1

With CONSULT

1. Turn ignition switch ON and engine stopped.
2. On the CONSULT screen, select “ENGINE” >> “WORK SUPPORT” >> “ENGINE COOLANT BYPASS VALVE”.
3. Check that indication of “ENGINE COOLANT B/V POSI”.

Is “205 deg” or more displayed on CONSULT screen?

YES >> GO TO 2.
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

2.CHECK MULTI-WAY CONTROL VALVE-2

With CONSULT

1. Start the engine.
2. Warm engine up to the normal operating temperature.
3. Check the following condition.

COOLANT TEMP/S	10 - 100°C (50 - 212°F)
ENG OIL TEMP	120°C (248°F) or less
A/C switch	OFF

4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start the engine.
6. Check “ENGINE COOLANT B/V POSI” approximately 2 seconds after engine start.

Is “40°” or less displayed on CONSULT screen?

YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

P26A5 MULTI-WAY CONTROL VALVE POSITION SENSOR

DTC Description

INFOID:0000000014419803

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P26A5	ENGINE COOLANT B/V A POSI SEN (Engine coolant bypass valve A position sensor circuit range/performance)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM detects the following status: • A voltage signal transmitted from the multi-way control valve position sensor is 4.76 V or more/4.3 V or less. Outside the above threshold when the valve is moved to the upper side stopper after ignition OFF • A voltage signal transmitted from the multi-way control valve position sensor is 0.8 V or more/0.34 or less. Outside the threshold when the valve is moved to the lower side stopper after engine start
		Diagnosis delay time	10 seconds or more

POSSIBLE CAUSE

- Harness or connectors (Multi-way control valve position sensor circuit is open or shorted)
- Multi-way control valve position sensor
- Sensor power supply 2

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P26A5	Multi-way control valve	• When detecting a malfunction with the valve closed, ECM fully opens the valve. • When detecting a malfunction with the valve opened, ECM maintains valve angle. • When detecting a malfunction in sensor, ECM fully opens the valve. • ECM limits the engine output depending on malfunctions.

DTC CONFIRMATION PROCEDURE

1.CHECK DTC PRIORITY

- If DTC P26A5 is displayed with DTC P0117 or P0118 first perform the trouble diagnosis for DTC P0117 or P0118.
- If DTC P26A5 is displayed with DTC P26A3 first perform the trouble diagnosis for DTC P26A3.
- If DTC P26A5 is displayed with DTC P26A6, or P26A7 first perform the trouble diagnosis for DTC P26A6, or P26A7.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:
Before performing the following procedure, confirm that battery voltage is more than 10 V at ignition switch ON.

>> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-1

1. Start the engine and let it idle.
2. Maintain the following conditions for at least 10 consecutive seconds.

Engine outlet coolant temperature (engine coolant temperature sensor 1)	10°C (50°F) or more
Engine oil temperature	135°C (275°F) or less
Engine speed	4,500 rpm or less
Accelerator pedal	Fully released

3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-667, "Diagnosis Procedure".
NO >> GO TO 4.

4.PERFORM DTC CONFIRMATION PROCEDURE-2

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Start the engine and let it idle.
3. Maintain the following conditions for at least 10 consecutive seconds.

Engine outlet coolant temperature (engine coolant temperature sensor 1)	10°C (50°F) or more
Engine oil temperature	135°C (275°F) or less
Engine speed	4,500 rpm or less

4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-667, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419804

1.CHECK DTC PRIORITY

- If DTC P26A5 is displayed with DTC P0117 or P0118 first perform the trouble diagnosis for DTC P0117 or P0118.
- If DTC P26A5 is displayed with DTC P26A3 first perform the trouble diagnosis for DTC P26A3.
- If DTC P26A5 is displayed with DTC P26A6, or P26A7 first perform the trouble diagnosis for DTC P26A6, or P26A7.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect multi-way control valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between multi-way control valve harness connector and ground.

+		−	Voltage (Approx.)
Multi-way control valve			
Connector	Terminal		
F92	5	Ground	5 V

Is the inspection result normal?

YES >> GO TO 4.

NO >> GO TO 3.

3.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

4.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between multi-way control valve harness connector and ECM harness connector.

+		–		Continuity
Multi-way control valve		ECM		
Connector	Terminal	Connector	Terminal	
F92	3	F78	43	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR INPUT SIGNAL CIRCUIT

1. Check the continuity between multi-way control valve harness connector and ECM harness connector.

+		–		Continuity
Multi-way control valve		ECM		
Connector	Terminal	Connector	Terminal	
F92	4	F79	61	Existed

2. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR

Check the multi-way control valve position sensor. Refer to EC-668, "Component Inspection (Multi-way Control Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

Component Inspection (Multi-way Control Valve)

INFOID:0000000014419805

1.CHECK MULTI-WAY CONTROL VALVE-1

With CONSULT

1. Turn ignition switch ON and engine stopped.
2. On the CONSULT screen, select “ENGINE” >> “WORK SUPPORT” >> “ENGINE COOLANT BYPASS VALVE”.
3. Check that indication of “ENGINE COOLANT B/V POSI”.

Is “205 deg” or more displayed on CONSULT screen?

YES >> GO TO 2.
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

2.CHECK MULTI-WAY CONTROL VALVE-2

With CONSULT
1. Start the engine.
2. Warm engine up to the normal operating temperature.
3. Check the following condition.

COOLANT TEMP/S	10 - 100°C (50 - 212°F)
ENG OIL TEMP	120°C (248°F) or less
A/C switch	OFF

4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start the engine.
6. Check “ENGINE COOLANT B/V POSI” approximately 2 seconds after engine start.

Is “40°” or less displayed on CONSULT screen?

YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

P26A6 P26A7 MULTI-WAY CONTROL VALVE POSITION SENSOR

DTC Description

INFOID:0000000014419806

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P26A6	ENGINE COOLANT B/V A POSI SEN (Engine coolant bypass valve A position sensor circuit low)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM detects the following status continuously: A voltage signal transmitted from the multi-way control valve position sensor is 0.34 V or less
		Diagnosis delay time	5 seconds or more
P26A7	ENGINE COOLANT B/V A POSI SEN (Engine coolant bypass valve A position sensor circuit high)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	ECM detects the following status continuously: A voltage signal transmitted from the multi-way control valve position sensor is 4.76 V or more
		Diagnosis delay time	5 seconds or more

POSSIBLE CAUSE

- Harness or connectors (Multi-way control valve position sensor circuit is open or shorted)
- Multi-way control valve position sensor
- Sensor power supply 2

FAIL-SAFE

DTC No.	Detected items	Engine operating condition in fail-safe mode
P26A6 P26A7	Multi-way control valve	• When detecting a malfunction with the valve closed, ECM fully opens the valve. • When detecting a malfunction with the valve opened, ECM maintains valve angle. • When detecting a malfunction in sensor, ECM fully opens the valve. • ECM limits the engine output depending on malfunctions.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

TEST CONDITION:

Before performing the following procedure, confirm that battery voltage is more than 11 V at ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 seconds.
2. Start the engine and let it idle for 20 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-671, "Diagnosis Procedure".

NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419807

1.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect multi-way control valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between multi-way control valve harness connector and ground.

+		–	Voltage (Approx.)
Multi-way control valve			
Connector	Terminal		
F92	5	Ground	5 V

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK SENSOR POWER SUPPLY 2 CIRCUIT

Perform EC-712, "Diagnosis Procedure".

Is inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

3.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between multi-way control valve harness connector and ECM harness connector.

+		–		Continuity
Multi-way control valve		ECM		
Connector	Terminal	Connector	Terminal	
F92	3	F78	43	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR INPUT SIGNAL CIRCUIT

1. Check the continuity between multi-way control valve harness connector and ECM harness connector.

+		–		Continuity
Multi-way control valve		ECM		
Connector	Terminal	Connector	Terminal	
F92	4	F79	61	Existed

2. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK MULTI-WAY CONTROL VALVE POSITION SENSOR

Check the multi-way control valve position sensor. Refer to EC-668, "Component Inspection (Multi-way Control Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

Component Inspection (Multi-way Control Valve)

INFOID:0000000014419808

1. CHECK MULTI-WAY CONTROL VALVE-1

With CONSULT

1. Turn ignition switch ON and engine stopped.
2. On the CONSULT screen, select “ENGINE” >> “WORK SUPPORT” >> “ENGINE COOLANT BYPASS VALVE”.
3. Check that indication of “ENGINE COOLANT B/V POSI”.

Is “205°” or more displayed on CONSULT screen?

YES >> GO TO 2.
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

2. CHECK MULTI-WAY CONTROL VALVE-2

With CONSULT

1. Start the engine.
2. Warm engine up to the normal operating temperature.
3. Check the following condition.

COOLANT TEMP/S	10 - 100°C (50 - 212°F)
ENG OIL TEMP	120°C (248°F) or less
A/C switch	OFF

4. Turn ignition switch OFF and wait at least 10 seconds.
5. Start the engine.
6. Check “ENGINE COOLANT B/V POSI” approximately 2 seconds after engine start.

Is “40 deg” or less displayed on CONSULT screen?

YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

P26AB MULTI-WAY CONTROL VALVE

DTC Description

INFOID:0000000014419809

DTC DETECTION LOGIC

Engine coolant temperature has not risen enough to open the multi-way control valve even though the engine has run long enough.
This is due to a leak in the seal or the multi-way control valve being stuck open.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P26AB	ENGINE COOLANT B/V POSI SEN (Engine coolant bypass valve “A” stuck/ open)	Diagnosis condition	—
		Signal (terminal)	—
		Threshold	The engine coolant temperature does not reach to specified temperature even though the engine has run long enough
		Diagnosis delay time	—

POSSIBLE CAUSE

- Multi-way control valve
- Leakage from multi-way control valve
- Engine coolant temperature sensor 1

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

NOTE:
Never refuel before and during the following procedure.

1.CHECK DTC PRIORITY

If DTC P26AB is displayed with DTC P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 or P0308, first perform the trouble diagnosis for DTC P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 or P0308.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.PRECONDITIONING-1

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

>> GO TO 3.

3.PRECONDITIONING-2

With CONSULT
1. Turn ignition switch ON.
2. Check the following conditions:

Ambient temperature	−10°C (14°F) or more
A/C switch	OFF
Blower fan switch	OFF

3. Select “DATA MONITOR” mode of “ENGINE” using CONSULT.
4. Check the following conditions:

COOLAN TEMP/S	[(−10°C) – (+52°C) (14 – 126°F)]

Is the condition satisfied?

YES >> GO TO 4.
NO >> 1. Satisfy the condition.
2. GO TO 4.

4. PERFORM DTC CONFIRMATION PROCEDURE-1

With CONSULT
1. Start engine.
2. Drive the vehicle until the following condition is satisfied.

CAUTION:
Always drive vehicle at safe speed.

- **STEP 1**

Drive the vehicle under the conditions instructed below until the difference between “COOLAN TEMP/S” and “FUEL T/TMP SE” becomes at least 23°C (73°F).

COOLAN TEMP/S	68°C (154°F) or less
FUEL T/TMP SE	Less than the value calculated by subtracting 28°C (82°F) from “COOLAN TEMP/S”.*

*: Example

COOLAN TEMP/S	FUEL T/TMP SE
65°C (149°F)	37°C (99°F) or less
60°C (140°F)	32°C (89°F) or less

- **STEP 2**

Drive the vehicle at 60 km/h (37 MPH) or more with the difference between “COOLAN TEMP/S” and “FUEL T/TMP SE” maintained at 28°C (82°F) or more.

NOTE:
Keep the accelerator pedal as steady as possible during cruising.

- **STEP 3**

Drive the vehicle at 60 km/h (37 MPH) or more until “COOLAN TEMP/S” increases by 6°C (43°F).

NOTE:
Keep the accelerator pedal as steady as possible during cruising.

Is the condition satisfied?

YES >> GO TO 5.
NO >> GO TO 2.

5. PERFORM DTC CONFIRMATION PROCEDURE-2

With CONSULT
1. Drive the vehicle until the following condition is satisfied.

COOLAN TEMP/S	68°C (154°F) or more

CAUTION:
Always drive vehicle at safe speed.

2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-674, "Diagnosis Procedure".
NO-1 >> To check malfunction symptom before repair: Refer to GI-47, "Intermittent Incident".
NO-2 >> Confirmation after repair: INSPECTION END

Diagnosis Procedure

INFOID:0000000014419810

1. CHECK DTC PRIORITY

If DTC P26AB is displayed with DTC P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 or P0308, first perform the trouble diagnosis for DTC P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 or P0308.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable. Refer to EC-136, "DTC Index".
NO >> GO TO 2.

2.CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

Check the engine coolant temperature sensor 1. Refer to EC-675, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace engine coolant temperature sensor 1. Refer to EM-105, "Exploded View".

3.CHECK MULTI-WAY CONTROL VALVE

Check the multi-way control valve. Refer to EC-668, "Component Inspection (Multi-way Control Valve)".

Is the inspection result normal?

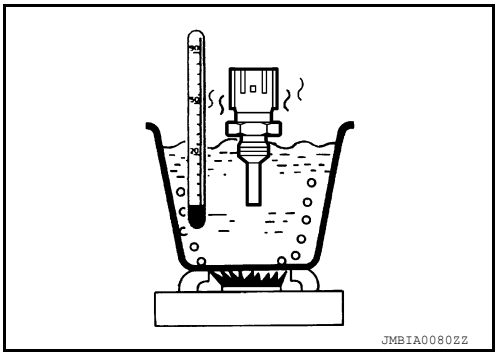
YES >> INSPECTION END
NO >> Replace multi-way control valve. Refer to CO-29, "Removal and Installation".

Component Inspection

INFOID:0000000014419811

1.CHECK ENGINE COOLANT TEMPERATURE SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor 1 harness connector.
3. Remove engine coolant temperature sensor 1.
4. Check resistance between engine coolant temperature sensor 1 terminals by heating with hot water as shown in the figure.



Engine coolant temperature sensor 1		Condition		Resistance (kΩ)
+	–			
Terminal				
1	2	Temperature [°C (°F)]	20 (68)	2.35 - 2.73
			50 (122)	0.68 - 1.00
			90 (194)	0.236 - 0.260

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace engine coolant temperature sensor 1. Refer to EM-105, "Exploded View".

ASCD INDICATOR

Component Function Check

INFOID:0000000014419812

1.CHECK ASCD INDICATOR FUNCTION

Check ASCD indicator under the following conditions.

ASCD INDICATOR	CONDITION		SPECIFICATION
CRUISE LAMP	• Ignition switch: ON	• MAIN switch: Pressed at the 1st time → at the 2nd time	ON → OFF

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-676, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419813

1.CHECK DTC

Check that DTC UXXXX is not displayed.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Perform trouble diagnosis for DTC UXXXX.

2.CHECK DTC WITH COMBINATION METER

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace malfunctioning part.

3.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace combination meter. Refer to MWI-108, "Removal and Installation" (TYPE A), MWI-187, "Removal and Installation" (TYPE B).
NO >> Repair or replace malfunctioning part.

BRAKE PEDAL POSITION SWITCH

Component Function Check

INFOID:0000000014419814

1.CHECK BRAKE PEDAL POSITION SWITCH FUNCTION

WITH CONSULT
1. Turn ignition switch ON.
2. Select “BRAKE SW1” in “DATA MONITOR” mode with CONSULT.
3. Check “BRAKE SW1” indication under the following conditions.

Monitor item	Condition		Indication
BRAKE SW1 (Brake pedal position switch)	Brake pedal	Slightly depressed	OFF
		Fully released	ON

WITHOUT CONSULT
1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals as per the following.

ECM			Condition		Voltage (V)
Connector	+	–			
	Terminal	Terminal			
E16	140 (Brake pedal position switch signal)	152	Brake pedal	Slightly depressed	Approx. 0
				Fully released	Battery voltage

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-677, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419815

1.CHECK BRAKE PEDAL POSITION SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect brake pedal position switch harness connector.
3. Turn ignition switch ON.
4. Check the voltage between brake pedal position switch harness connector and ground.

Brake pedal position switch		Ground	Voltage
Connector	Terminal		
E170	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- 10 A fuse (No. 30)
- Harness for open or short between brake pedal position switch and fuse
- Loose or poor connection for each connector and harness

>> Repair open circuit or short to ground in harness or connectors.

3.CHECK BRAKE PEDAL POSITION SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.

2. Disconnect ECM harness connector.
3. Check the continuity between brake pedal position switch harness connector and ECM harness connector.

Brake pedal position switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E170	2	E16	140	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and brake pedal position switch
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5. CHECK BRAKE PEDAL POSITION SWITCH

Refer to EC-678, "Component Inspection (Brake Pedal Position Switch)".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace brake pedal position switch. Refer to BR-21, "Removal and Installation".

6. CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

>> INSPECTION END

Component Inspection (Brake Pedal Position Switch)

INFOID:0000000014419816

1. CHECK BRAKE PEDAL POSITION SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect brake pedal position switch harness connector.
3. Check the continuity between brake pedal position switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2. CHECK BRAKE PEDAL POSITION SWITCH-II

1. Adjust brake pedal position switch installation. Refer to BR-21, "Removal and Installation".
2. Check the continuity between brake pedal position switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Brake pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END

NO >> Replace brake pedal position switch. Refer to BR-21, "Removal and Installation".

COOLING FAN

Component Function Check

INFOID:0000000014419817

1.CHECK COOLING FAN FUNCTION

WITH CONSULT
1. Start the engine.
2. Perform “FAN DUTY CONTROL” in “ACTIVE TEST” mode with CONSULT.
3. Check that cooling fan speed varies according to the percentage.

NOTE:
Speed changes gradually as the percentage changes.

WITHOUT CONSULT
1. Start the engine and warm up the engine until engine coolant temperature reaches at least 98°C (209°F).
2. Check that cooling fan speed increase.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-680, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419818

1.CHECK DRIVE BELT

1. Turn ignition switch OFF.
2. Check that the drive belt is not broken.

Is inspection result normal?

YES >> GO TO 2.
NO >> Replace drive belt.

2.CHECK FAN CLUTCH ASSEMBLY POWER SUPPLY

1. Disconnect the fan clutch assembly harness connector.
2. Turn ignition switch ON.
3. Check the voltage between the fan clutch assembly harness connector and ground.

+		–	Voltage (Approx.)
Fan clutch assembly			
Connector	Terminal		
F152	1	Ground	Battery voltage

Is inspection result normal?

YES >> GO TO 3.
NO >> Perform trouble diagnosis for power supply circuit.

3.CHECK FAN CLUTCH ASSEMBLY GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Check the continuity between the fan clutch assembly harness connector and ground.

+		–	Continuity
Fan clutch assembly			
Connector	Terminal		
F152	6	Ground	Existed

Is inspection result normal?

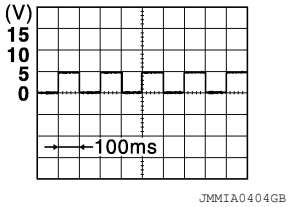
YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FAN CLUTCH ASSEMBLY CONTROL SIGNAL

WITH CONSULT

1. Start the engine.
2. Perform “FAN DUTY CONTROL” in “ACTIVE TEST” mode of “ECM” with CONSULT.
3. Set the Duty value to 100%.
4. Check the voltage between the fan clutch assembly harness connector and ground.

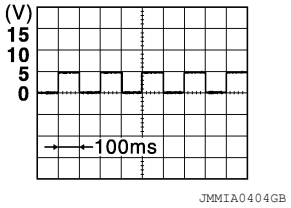
CAUTION:
Wait for 1 minute or more to measure.

+		–	Voltage (Approx.)
Fan clutch assembly			
Connector	Terminal		
F152	3	Ground	 2. 5 V

WITHOUT CONSULT

1. Start the engine and warm up the engine until engine coolant temperature reaches at least 98°C (209°F).
2. Check the voltage between the fan clutch assembly harness connector and ground.

CAUTION:
Wait for 1 minute or more to measure.

+		–	Voltage (Approx.)
Fan clutch assembly			
Connector	Terminal		
F152	3	Ground	 2. 5 V

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 5.

5. CHECK FAN CLUTCH ASSEMBLY CONTROL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between the fan clutch assembly harness connector and IPDM E/R harness connector.

+		–		Continuity
Fan clutch assembly		IPDM E/R		
Connector	Terminal	Connector	Terminal	
F152	3	E130	72	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK CAN COMMUNICATION

Refer to LAN-53, "Trouble Diagnosis Flow Chart".

Is inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Repair or Replace error-detected parts.

7.CHECK COOLING FAN SPEED SENSOR

Refer to EC-491, "Diagnosis Procedure".

Is inspection result normal?

YES >> Replace the fan clutch assembly. Refer to CO-22, "Removal and Installation".
NO >> Repair or replace error-detected parts.

ELECTRICAL LOAD SIGNAL

Description

INFOID:0000000014419819

The electrical load signal (Rear window defogger switch signal, headlamp switch signal, heater fan switch signal, etc.) is transferred via the CAN communication line.

Component Function Check

INFOID:0000000014419820

1.CHECK REAR WINDOW DEFOGGER SWITCH FUNCTION

1. Turn ignition switch ON.
2. Select “DATA MONITOR” mode with CONSULT.
3. Select “LOAD SIGNAL” and check indication under the following conditions.

Monitor item	Condition		Indication
LOAD SIGNAL	Rear window defogger switch	ON	ON
		OFF	OFF

Is the inspection result normal?

YES >> GO TO 2.
NO >> Go to EC-683, "Diagnosis Procedure".

2.CHECK LIGHTING SWITCH FUNCTION

Check “LOAD SIGNAL” indication under the following conditions.

Monitor item	Condition		Indication
LOAD SIGNAL	Lighting switch	ON at 2nd position	ON
		OFF	OFF

Is the inspection result normal?

YES >> GO TO 3.
NO >> Go to EC-683, "Diagnosis Procedure".

3.CHECK HEATER FAN CONTROL SWITCH FUNCTION

Select “HEATER FAN SW” and check indication under the following conditions.

Monitor item	Condition		Indication
HEATER FAN SW	Heater fan control switch	ON	ON
		OFF	OFF

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-683, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419821

1.INSPECTION START

Confirm the malfunctioning circuit (rear window defogger, headlamp or heater fan). Refer to EC-683, "Component Function Check".

Which circuit is related to the incident?

Rear window defogger>>GO TO 2.
Headlamp>>GO TO 3.
Heater fan>>GO TO 4.

2.CHECK REAR WINDOW DEFOGGER SYSTEM

Refer to DEF-30, "Work Flow".

>> INSPECTION END

3. CHECK HEADLAMP SYSTEM

Refer to EXL-94, "Work Flow".

>> INSPECTION END

4. CHECK HEATER FAN CONTROL SYSTEM

Refer to HAC-61, "Work Flow".

>> INSPECTION END

FUEL INJECTOR

Component Function Check

INFOID:0000000014419822

1.INSPECTION START

Turn ignition switch to START.

Are any cylinders ignited?

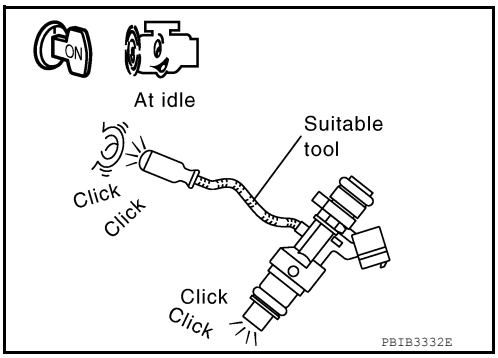
YES >> GO TO 2.
NO >> Proceed to EC-685, "Diagnosis Procedure".

2.CHECK FUEL INJECTOR FUNCTION

WITH CONSULT
1. Start engine.
2. Perform “POWER BALANCE” in “ACTIVE TEST” mode with CONSULT.
3. Check that each circuit produces a momentary engine speed drop.

WITHOUT CONSULT
1. Start engine.
2. Listen to each fuel injector operating sound.

Clicking sound should be heard.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-685, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419823

1.CHECK FUEL INJECTOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect fuel injector harness connector.
3. Turn ignition switch ON.
4. Check the voltage between fuel injector harness connector and ground.

+			–	Voltage
Fuel injector				
Cylinder	Connector	Terminal		
1	F230	1	Ground	Battery voltage
2	F234	1		
3	F231	1		
4	F235	1		
5	F232	1		
6	F236	1		
7	F233	1		
8	F237	1		

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 2.

2.CHECK FUEL INJECTOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.

2. Disconnect ECM harness connector.
3. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F230	1	F78	47	Existed
2	F234	1		5	
3	F231	1			
4	F235	1		54	
5	F232	1		7	
6	F236	1		47	
7	F233	1		54	
8	F237	1		7	

4. Also check harness for short to ground.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK FUEL INJECTOR DRIVER POWER SUPPLY

1. Reconnect ECM harness connector.
2. Turn ignition switch ON.
3. Check the voltage between ECM harness connector and ground.

+		–	Voltage
ECM			
Connector	Terminal		
F78	1	Ground	Battery voltage
	2		
	6		
	46		

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident"
NO >> GO TO 4.

4. CHECK FUEL INJECTOR DRIVER POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect fuel injector relay harness connector.
4. Check the continuity between ECM harness connector and fuel injector relay harness connector.

ECM		Fuel injector relay		Continuity
Connector	Terminal	Connector	Terminal	
F78	1	E171	3	Existed
	6		3	

5. Check the continuity between ECM harness connector and high pressure fuel pump and fuel injector relay harness connector.

ECM		High pressure fuel pump and Fuel injector relay		Continuity
Connector	Terminal	Connector	Terminal	
F78	2	E172	6	Existed
	46		6	

6. Also check harness for short to ground.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts

5.CHECK FUEL INJECTOR RELAY POWER SUPPLY (CONTACT SIDE)

1. Turn ignition switch ON.
2. Check the voltage between fuel injector relay harness connector and ground.

+		−	Voltage
Fuel injector relay			
Connector	Terminal		
E171	5	Ground	Battery voltage

3. Check the voltage between high pressure fuel pump and fuel injector relay harness connector and ground.

+		−	Voltage
High pressure fuel pump and Fuel injector relay			
Connector	Terminal		
E172	7	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 6.
NO >> Perform the trouble diagnosis for power supply circuit.

6.CHECK FUEL INJECTOR RELAY POWER SUPPLY (EXCITATION COIL SIDE)

1. Reconnect all harness connectors disconnected.
2. Check the voltage between fuel injector relay harness connector and ground.

+		−	Voltage
Fuel injector relay			
Connector	Terminal		
E171	2	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.CHECK FUEL INJECTOR RELAY POWER SUPPLY CIRCUIT (EXCITATION COIL SIDE)

1. Turn ignition switch OFF.
2. Disconnect fuel injector relay harness connector.
3. Disconnect IPDM E/R harness connector.
4. Check the continuity between IPDM E/R harness connector and fuel injector harness connector.

IPDM E/R		Fuel injector relay		Continuity
Connector	Terminal	Connector	Terminal	
E121	26	E171	2	Existed

5. Check the continuity between IPDM E/R harness connector and high pressure fuel pump and fuel injector harness connector.

IPDM E/R		High pressure fuel pump and Fuel injector relay		Continuity
Connector	Terminal	Connector	Terminal	
E121	26	E172	2	Existed

6. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit.
NO >> Repair or replace error-detected parts.

8. CHECK FUEL INJECTOR RELAY GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect fuel injector relay harness connector.
3. Check the continuity between fuel injector relay harness connector and ground.

Fuel injector relay		–	Continuity
Connector	Terminal		
E171	1	Ground	Existed

4. Check the continuity between high pressure fuel pump and fuel injector relay harness connector and ground.

High pressure fuel pump and Fuel injector relay		–	Continuity
Connector	Terminal		
E172	1	Ground	Existed

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair or replace error-detected parts.

9. CHECK FUEL INJECTOR GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F230	2	F78	48	Existed
2	F234	2		9	
3	F231	2		4	
4	F235	2		49	
5	F232	2		8	
6	F236	2		52	
7	F233	2		53	
8	F237	2		3	

4. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

10.CHECK FUEL INJECTOR RELAY

Check the fuel injector relay. Refer to EC-689, "Component Inspection (Fuel Injector Relay)".

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident"
NO >> Replace fuel injector relay.

11.CHECK FUEL INJECTOR

Check the fuel injector. Refer to EC-689, "Component Inspection (Fuel Injector)".

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident"
NO >> Replace malfunctioning fuel injector. Refer to EM-57, "Exploded View".

Component Inspection (Fuel Injector)

INFOID:0000000014419824

1.CHECK FUEL INJECTOR

1. Turn ignition switch OFF.
2. Disconnect fuel injector harness connector.
3. Check the resistance between fuel injector terminals as per the following.

Injector		Condition		Resistance
+	–			
Terminal				
1	2	Temperature	10 - 60°C (50 - 140°F)	1.44 - 1.73 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning fuel injector. Refer to EM-57, "Removal and Installation".

Component Inspection (Fuel Injector Relay)

INFOID:0000000014419825

1.CHECK FUEL INJECTOR RELAY

1. Turn ignition switch OFF.
2. Remove fuel injector relay.
3. Check the continuity between fuel injector relay terminals as per the following conditions.

+	–	Conditions	Continuity
Fuel injector relay			
Terminal			
3	5	12 V direct current supply between terminals 1 and 2	Existed
		No current supply	Not existed

4. Check the continuity between high pressure fuel pump and fuel injector relay terminals as per the following conditions.

+	–	Conditions	Continuity
High pressure fuel pump and Fuel injector relay			
Terminal			
6	7	12 V direct current supply between terminals 1 and 2	Existed
		No current supply	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel injector relay.

HIGH PRESSURE FUEL PUMP

Component Function Check

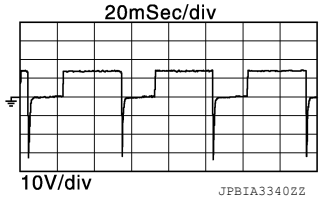
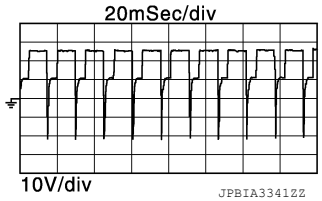
INFOID:0000000014419826

1.CHECK HIGH PRESSURE FUEL PUMP FUNCTION

WITH CONSULT
1. Start engine.
2. Check “FUEL PRES SEN V” in “DATA MONITOR” mode with CONSULT.

Monitor Item	Condition	Values/Status
FUEL PRES SEN V	Engine speed: Idle	820 – 1,220 mV
	Engine speed: Revving engine from idle to 4,000 rpm quickly	820 – 3,060 mV

WITHOUT CONSULT
1. Start engine.
2. Check the voltage between ECM harness connector and ground.

ECM				Condition	Voltage
+		–			
Connector	Terminal	Connector	Terminal		
F79	59	E16	152	[Engine is running] • Warm-up condition • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle	BATTERY VOLTAGE (11 - 14 V)★ 
				[Engine is running] • Warm-up condition • Engine speed: 2,000 rpm	BATTERY VOLTAGE (11 - 14 V)★ 

Is the inspection result normal?

YES >> INSPECTION END
NO >> Proceed to EC-691, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419827

1.CHECK HIGH PRESSURE FUEL PUMP POWER SUPPLY

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector and ground.

+		–	Voltage
ECM			
Connector	Terminal		
F78	51	Ground	Battery voltage

Is inspection result normal?

YES >> GO TO 8.

NO >> GO TO 2.

2.CHECK HIGH PRESSURE FUEL PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Disconnect fuel injector relay harness connector.
4. Check the continuity between ECM harness connector and high pressure fuel pump and injector relay harness connector.

+		–		Continuity
ECM		High pressure fuel pump and injector relay		
Connector	Terminal	Connector	Terminal	
F78	51	E172	3	Existed

5. Also check harness for short to ground.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts

3.CHECK HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY POWER SUPPLY (CONTACT SIDE)

Check the voltage between high pressure fuel pump and injector relay harness connector and ground.

+		–	Voltage
High pressure fuel pump and injector relay			
Connector	Terminal		
E172	5	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.
NO >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".

4.CHECK HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY POWER SUPPLY (EXCITATION COIL SIDE)

1. Reconnect all harness connectors disconnected.
2. Turn ignition switch ON.
3. Check the voltage between high pressure fuel pump and injector relay harness connector and ground.

+		–	Voltage
High pressure fuel pump and injector relay			
Connector	Terminal		
E172	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5

5.CHECK HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY POWER SUPPLY CIRCUIT (EXCITATION COIL SIDE)

1. Turn ignition switch OFF.
2. Disconnect high pressure fuel pump and injector relay harness connector.
3. Disconnect IPDM E/R harness connector.
4. check the continuity between IPDM E/R harness connector and high pressure fuel pump harness connector.

+		–		Continuity
IPDM E/R		High pressure fuel pump and injector relay		
Connector	Terminal	Connector	Terminal	
E121	26	E172	2	Existed

5. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure".
NO >> Repair or replace error-detected parts.

6.CHECK HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect high pressure fuel pump and injector relay harness connector.
3. Check the continuity between high pressure fuel pump and injector relay harness connector and ground.

+		–	Continuity
High pressure fuel pump and injector relay			
Connector	Terminal		
E172	1	Ground	Existed

4. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY

Check the high pressure fuel pump and injector relay. Refer to EC-694, "Component Inspection (High Pressure Fuel Pump And Injector Relay)".

Is inspection result normal?

YES >> GO TO 8.
NO >> Replace high pressure fuel pump and injector relay.

8.CHECK HIGH PRESSURE FUEL PUMP SOLENOID CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector and high pressure fuel pump harness connector.
3. Check the continuity between ECM harness connector and high pressure fuel pump harness connector.

+		–		Continuity
ECM		High pressure fuel pump		
Connector	Terminal	Connector	Terminal	
E79	59	F87	1	Existed
	60		2	

4. Also check harness for short to ground and to power.

Is inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.CHECK HIGH PRESSURE FUEL PUMP SOLENOID

Refer to EC-694, "Component Inspection (High Pressure Fuel Pump Solenoid)".

Is inspection result normal?

YES >> GO TO 10.
NO >> Replace high pressure fuel pump. Refer to EM-52, "Removal and Installation".

10.CHECK HIGH PRESSURE FUEL PUMP INSTALLATION CONDITION

1. Turn ignition switch OFF.
2. Check that the high pressure fuel pump is installed with no backlash and looseness.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11.CHECK CAMSHAFT

1. Remove camshaft. Refer to EM-94, "Removal and Installation".
2. Check camshaft. Refer to EM-96, "Inspection".

Is inspection result normal?

YES >> INSPECTION END
NO >> Replace camshaft. Refer to EM-94, "Removal and Installation".

Component Inspection (High Pressure Fuel Pump Solenoid)

INFOID:0000000014419828

1.CHECK HIGH PRESSURE FUEL PUMP SOLENOID

1. Turn ignition switch OFF.
2. Disconnect high pressure fuel pump harness connector.
3. Check the resistance between high pressure fuel pump connector terminals as per the following.

+	–	Condition		Resistance
High pressure fuel pump Terminal				
1	2	Temperature	20 – 30°C (68 – 86°F)	9 – 11 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace high pressure fuel pump. Refer to EM-52, "Removal and Installation".

Component Inspection (High Pressure Fuel Pump And Injector Relay)

INFOID:0000000014419829

1.CHECK HIGH PRESSURE FUEL PUMP AND INJECTOR RELAY

1. Turn ignition switch OFF.
2. Remove high pressure fuel pump and injector relay.
3. Check the continuity between high pressure fuel pump and injector relay terminals as per the following conditions.

+	–	Conditions	Continuity
High pressure fuel pump and injector relay Terminal			
5	3	12 V direct current supply between terminals 1 and 2	Existed
		No current supply	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace high pressure fuel pump and injector relay.

IGNITION SIGNAL

Component Function Check

INFOID:0000000014419830

1.INSPECTION START

Turn ignition switch OFF, and restart engine.

Does the engine start?

YES-1 >> With CONSULT: GO TO 2.
YES-2 >> Without CONSULT: GO TO 3.
NO >> Go to EC-695, "Diagnosis Procedure".

2.CHECK IGNITION SIGNAL FUNCTION

WITH CONSULT

1. Perform “POWER BALANCE” in “ACTIVE TEST” mode with CONSULT.
2. Check that each circuit produces a momentary engine speed drop.

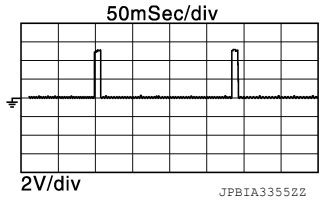
Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-695, "Diagnosis Procedure".

3.CHECK IGNITION SIGNAL FUNCTION

WITHOUT CONSULT

1. Let engine idle.
2. Read the voltage signal between ECM harness connector terminals under the following conditions with an oscilloscope.

ECM					Voltage signal
Cylinder	+		–		
	Connector	Terminal	Connector	Terminal	
1	F79	95	E16	152	
2		91			
3		92			
4		104			
5		102			
6		94			
7		105			
8		101			

NOTE:

The pulse cycle changes depending on rpm at idle.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-695, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419831

1.CHECK IGNITION COIL POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF, wait at least 10 seconds and then turn it ON.
2. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Voltage
Connector	+	–	
	Terminal	Terminal	
E16	145	152	Battery voltage

Is the inspection result normal?

YES >> GO TO 2.
NO >> Go to EC-227, "Diagnosis Procedure".

2. CHECK IGNITION COIL POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF.
2. Disconnect condenser harness connector.
3. Turn ignition switch ON.
4. Check the voltage between condenser harness connector and ground.

Condenser		Ground	Voltage
Connector	Terminal		
F21	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 3.

3. CHECK IGNITION COIL POWER SUPPLY CIRCUIT-III

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between IPDM E/R harness connector and condenser harness connector.

IPDM E/R		Condenser		Continuity
Connector	Terminal	Connector	Terminal	
E119	17	F21	1	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> Go to EC-227, "Diagnosis Procedure".
NO >> GO TO 4.

4. DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between IPDM E/R and condenser
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5. CHECK CONDENSER GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Check the continuity between condenser harness connector and ground.

Condenser		Ground	Continuity
Connector	Terminal		
F21	2	Ground	Existed

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit or short to power in harness or connectors.

6. CHECK CONDENSER

Refer to EC-699, "Component Inspection (Condenser)"

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace condenser.

7. CHECK IGNITION COIL POWER SUPPLY CIRCUIT-IV

1. Reconnect all harness connectors disconnected.
2. Disconnect ignition coil harness connector.
3. Turn ignition switch ON.
4. Check the voltage between ignition coil harness connector and ground.

Ignition coil			Ground	Voltage
Cylinder	Connector	Terminal		
1	F47	3	Ground	Battery voltage
2	F6	3		
3	F48	3		
4	F7	3		
5	F49	3		
6	F8	3		
7	F51	3		
8	F52	3		

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 8.

8. DETECT MALFUNCTIONING PART

Check the following.
- Harness connector F10 and E22
- Harness for open or short between ignition coil and harness connector F10

>> Repair or replace harness or connectors.

9. CHECK IGNITION COIL GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Check the continuity between ignition coil harness connector and ground.

Ignition coil			Ground	Continuity
Cylinder	Connector	Terminal		
1	F47	2	Ground	Existed
2	F6	2		
3	F48	2		
4	F7	2		
5	F49	2		
6	F8	2		
7	F51	2		
8	F52	2		

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair open circuit or short to power in harness or connectors.

10. CHECK IGNITION COIL OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connector.
2. Check the continuity between ignition coil harness connector and ECM harness connector.

Ignition coil			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F47	1	F49	95	Existed
2	F6	1		91	
3	F48	1		92	
4	F7	1		104	
5	F49	1		102	
6	F8	1		94	
7	F51	1		105	
8	F52	1		101	

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair open circuit, short to ground or short to power in harness or connectors.

11.CHECK IGNITION COIL WITH POWER TRANSISTOR

Refer to EC-698, "Component Inspection (Ignition Coil with Power Transistor)".

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace malfunctioning ignition coil with power transistor.

12.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

>> INSPECTION END

Component Inspection (Ignition Coil with Power Transistor)

INFOID:0000000014419832

1.CHECK IGNITION COIL WITH POWER TRANSISTOR-I

1. Turn ignition switch OFF.
2. Disconnect ignition coil harness connector.
3. Check resistance between ignition coil terminals as per the following.

Terminals	Resistance [at 25°C (77°F)]
1 and 2	Except 0 or ∞ Ω
1 and 3	Except 0 Ω
2 and 3	

Is the inspection result normal?

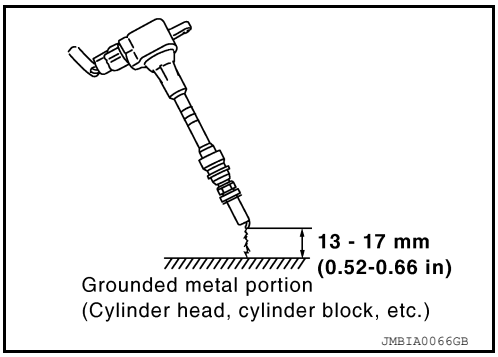
YES >> GO TO 2.
NO >> Replace malfunctioning ignition coil with power transistor.

2.CHECK IGNITION COIL WITH POWER TRANSISTOR-II

CAUTION:
Perform the following procedure in a place with no combustible objects and good ventilation.

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Remove fuel pump fuse in IPDM E/R to release fuel pressure.
   NOTE:
   - For the fuse number, refer to EC-155, "Wiring Diagram".
   - For the fuse arrangement, refer to PG-174, "IPDM E/R Terminal Arrangement".
   - Do not use CONSULT to release fuel pressure, or fuel pressure applies again during the following procedure.

4. Start engine.
5. After engine stalls, crank it 2 or 3 times to release all fuel pressure.
6. Turn ignition switch OFF.
7. Remove all ignition coil harness connectors to avoid the electrical discharge from the ignition coils.
8. Remove ignition coil and spark plug of the cylinder to be checked.
9. Crank engine for 5 seconds or more to remove combustion gas in the cylinder.
10. Connect spark plug and harness connector to ignition coil.
11. Fix ignition coil using a rope etc. with gap of 13 - 17 mm (0.52 - 0.66 in) between the edge of the spark plug and grounded metal portion as shown in the figure.
12. Crank engine for approximately 3 seconds, and check whether spark is generated between the spark plug and the grounded metal portion.



Spark should be generated.

CAUTION:

- **Never place the spark plug and the ignition coil within 50 cm (19.7 in) each other. Be careful not to get an electrical shock while checking, because the electrical discharge voltage becomes 20 kV or more.**
- **It might damage the ignition coil if the gap of more than 17 mm (0.66 in) is made.**

NOTE:

When the gap is less than 13 mm (0.52 in), a spark might be generated even if the coil is malfunctioning.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace malfunctioning ignition coil with power transistor.

Component Inspection (Condenser)

INFOID:0000000014419833

1. CHECK CONDENSER

1. Turn ignition switch OFF.
2. Disconnect condenser harness connector.
3. Check resistance between condenser terminals as per the following.

Terminals	Resistance
1 and 2	Above 1 MΩ [at 25°C (77°F)]

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace condenser.

INFORMATION DISPLAY (ASCD)

Component Function Check

INFOID:0000000014419834

1.CHECK INFORMATION DISPLAY

1. Start engine.
2. Press MAIN switch on ASCD steering switch.
3. Drive the vehicle at more than 40 km/h (25 MPH).
   CAUTION:
   Always drive vehicle at a safe speed.
4. Press SET/COAST switch.
5. Check that the reading of the speedometer shows the same value as the set speed indicated in the information display while driving the vehicle on a flat road.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-700, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419835

1.CHECK DTC

Check that DTC UXXXX or P0500 is not displayed.

Is the inspection result normal?

YES >> GO TO 2.
NO-1 >> Perform trouble diagnosis for DTC UXXXX.
NO-2 >> Perform trouble diagnosis for DTC P0500. Refer to EC-476, "DTC Description".

2.CHECK DTC WITH “COMBINATION METER”

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is the inspection result normal?

YES >> GO TO 3.
NO >> Perform trouble diagnosis for DTC indicated.

3.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace combination meter.
NO >> Repair or replace.

LOW PRESSURE FUEL PUMP

Component Function Check

INFOID:0000000014419836

1.CHECK FUEL PUMP FUNCTION

1. Turn ignition switch ON.
2. Pinch fuel feed hose with two fingers.

NOTE:
Fuel pressure pulsation should be felt on the fuel feed hose for 1 second after ignition switch is turned ON.

Is the inspection result normal?

YES >> INSPECTION END
NO >> EC-701, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419837

1.CHECK FUEL PUMP RELAY POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Turn ignition switch ON.
4. Check the voltage between ECM harness connector terminals.

ECM				Voltage
Connector	+	Connector	-	
	Terminal		Terminal	
F79	93	E16	152	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.CHECK FUEL PUMP RELAY POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

+		–		Continuity
ECM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
F79	93	E122	45	Existed

4. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure"
NO >> Repair or replace error-detected parts.

3.CHECK FPCM POWER SUPPLY

1. Turn ignition switch OFF.
2. Disconnect FPCM harness connector.
3. Turn ignition switch ON.
4. Check the voltage between FPCM harness connector and ground.

+		–	Voltage
FPCM			
Connector	Terminal		
C12	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4. CHECK FPCM POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector.
3. Check the continuity between FPCM harness connector and IPDM E/R harness connector.

+		–		Continuity
FPCM		IPDM E/R		
Connector	Terminal	Connector	Terminal	
C12	1	E124	58	Existed

4. Also check harness for short to ground.

Is the inspection result normal?

YES >> Perform the trouble diagnosis for power supply circuit. Refer to EC-227, "Diagnosis Procedure"
NO >> Repair or replace error-detected parts.

5. CHECK FPCM GROUND CIRCUIT

1. Turn ignition switch OFF.
2. Check the continuity between FPCM harness connector and ground.

+		–	Continuity
FPCM			
Connector	Terminal		
C12	4	Ground	Existed

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit or short to power in harness or connectors.

6. CHECK FPCM INPUT AND OUTPUT CIRCUIT

1. Disconnect ECM harness connector.
2. Check the continuity between FPCM harness connector and ECM harness connector.

+		–		Continuity
FPCM		ECM		
Connector	Terminal	Connector	Terminal	
C12	3	E16	130	Existed
	2		136	

3. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK FUEL PUMP CONTROL CIRCUIT

1. Disconnect fuel level sensor unit and fuel pump harness connector.
2. Check the continuity between FPCM harness connector and fuel level sensor unit and fuel pump harness connector.

+		–		Continuity
FPCM		Fuel level sensor unit and fuel pump		
Connector	Terminal	Connector	Terminal	
C12	6	C37	1	Existed
	5		2	

3. Also check harness for short to ground and to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK LOW PRESSURE FUEL PUMP

Refer to EC-703, "Component Inspection (Low Pressure Fuel Pump)".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace fuel level sensor unit and fuel pump. Refer to FL-6, "Removal and Installation".

9.CHECK FPCM

Refer to EC-703, "Component Inspection (FPCM)".

Is the inspection result normal?

YES >> Check intermittent incident. Refer to GI-47, "Intermittent Incident".
NO >> Replace FPCM. Refer to EC-729, "Removal and Installation".

Component Inspection (Low Pressure Fuel Pump)

INFOID:0000000014419838

1.CHECK FUEL PRESSURE REGULATOR

1. Turn ignition switch OFF.
2. Check low fuel pressure. Refer to EC-205, "Work Procedure".

Is inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK LOW PRESSURE FUEL PUMP

1. Turn ignition switch OFF.
2. Disconnect fuel level sensor unit and fuel pump.
3. Check resistance between fuel level sensor unit and fuel pump terminals as follows.

+	–	Condition	Resistance
Fuel level sensor unit and fuel pump			
Terminals			
1	2	Temperature: 25°C (77°F)	0.2 - 5.0 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel level sensor unit and fuel pump. Refer to FL-6, "Removal and Installation".

Component Inspection (FPCM)

INFOID:0000000014419839

1.CHECK FUEL PUMP CONTROL MODULE (FPCM)

1. Check the voltage between FPCM terminals under the following conditions.

FPCM		Condition	Voltage
+	–		
Terminal	Terminal		
6	5	For 1 second after turning ignition switch ON	Approx. 8.5 V
		More than 1 second after turning ignition switch ON	Approx. 0 V
		Idle speed	Approx. 8.5 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace FPCM. Refer to EC-729, "Removal and Installation".

MALFUNCTION INDICATOR LAMP

Component Function Check

INFOID:0000000014419840

1.CHECK MIL FUNCTION

1. Turn ignition switch ON.
2. Check that MIL illuminates.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-705, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419841

1.CHECK DTC

Check that DTC UXXXX is not displayed.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Perform trouble diagnosis for DTC UXXXX.

2.CHECK DTC WITH COMBINATION METER

Refer to MWI-27, "CONSULT Function (METER/M&A)" (TYPE A), MWI-131, "CONSULT Function (METER/M&A)" (TYPE B).

Is the inspection result normal?

YES >> GO TO 3.
NO >> Perform trouble diagnosis for DTC indicated.

3.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace combination meter.
NO >> Repair or replace malfunctioning part.

ON BOARD REFUELING VAPOR RECOVERY (ORVR)

Component Function Check

INFOID:0000000014419842

1.CHECK ORVR FUNCTION

Check whether the following symptoms are present.
- Fuel odor from EVAP canister is strong.
- Cannot refuel/Fuel odor from the fuel filler opening is strong while refueling.

Are any symptoms present?

YES >> Proceed to EC-706, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000014419843

1.INSPECTION START

Check whether the following symptoms are present.
A: Fuel odor from EVAP canister is strong.
B: Cannot refuel/Fuel odor from the fuel filler opening is strong while refueling.

Which symptom is present?

A >> GO TO 2.
B >> GO TO 7.

2.CHECK EVAP CANISTER

1. Remove EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
2. Weigh the EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
   The weight should be less than 2.5 kg (5.5 lb).

Is the inspection result normal?

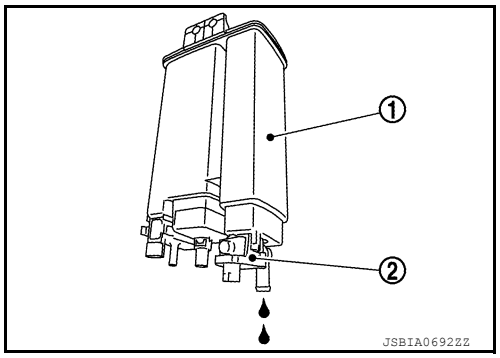
YES >> GO TO 3.
NO >> GO TO 4.

3.CHECK IF EVAP CANISTER IS SATURATED WITH WATER

Check if water will drain from EVAP canister (1).
- EVAP canister vent control valve (2)

Does water drain from the EVAP canister?

YES >> GO TO 4.
NO >> GO TO 6.



4.REPLACE EVAP CANISTER

Replace EVAP canister with a new one.

>> GO TO 5.

5.DETECT MALFUNCTIONING PART

Check the EVAP hose between EVAP canister and vehicle frame for clogging or poor connection.

>> Repair or replace EVAP hose.

6.CHECK REFUELING EVAP VAPOR CUT VALVE

Refer to EC-708, "Component Inspection (EVAP Vapor Cut Valve)".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace refueling EVAP vapor cut valve with fuel tank.

7. CHECK EVAP CANISTER

1. Remove EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
2. Weigh the EVAP canister with EVAP canister vent control valve and EVAP control system pressure sensor attached.
   The weight should be less than 2.5 kg (5.5 lb).

Is the inspection result normal?

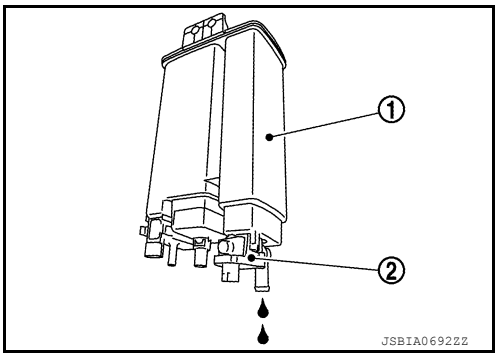
YES >> GO TO 8.
NO >> GO TO 9.

8. CHECK IF EVAP CANISTER IS SATURATED WITH WATER

Check if water will drain from EVAP canister (1).
- EVAP canister vent control valve (2)

Does water drain from the EVAP canister?

YES >> GO TO 9.
NO >> GO TO 11.



9. REPLACE EVAP CANISTER

Replace EVAP canister with a new one.

>> GO TO 10.

10. DETECT MALFUNCTIONING PART

Check the EVAP hose between EVAP canister and vehicle frame for clogging or poor connection.

>> Repair or replace EVAP hose.

11. CHECK VENT HOSES AND VENT TUBES

Check hoses and tubes between EVAP canister and refueling control valve for clogging, kinks, looseness and improper connection.

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair or replace hoses and tubes.

12. CHECK FILLER NECK TUBE

Check recirculation line for clogging, dents and cracks.

Is the inspection result normal?

YES >> GO TO 13.
NO >> Replace filler neck tube.

13. CHECK REFUELING EVAP VAPOR CUT VALVE

Refer to EC-708, "Component Inspection (EVAP Vapor Cut Valve)".

Is the inspection result normal?

YES >> GO TO 14.
NO >> Replace refueling EVAP vapor cut valve with fuel tank.

14. CHECK FUEL FILLER TUBE

Check filler neck tube and hose connected to the fuel tank for clogging, dents and cracks.

Is the inspection result normal?

YES >> GO TO 15.
NO >> Replace fuel filler tube.

15. CHECK ONE-WAY FUEL VALVE-I

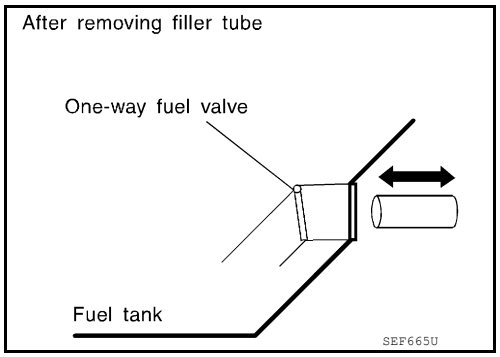
Check one-way fuel valve for clogging.

Is the inspection result normal?

YES >> GO TO 16.
NO >> Repair or replace one-way fuel valve with fuel tank.

16. CHECK ONE-WAY FUEL VALVE-II

1. Check that fuel is drained from the tank.
2. Remove fuel filler tube and hose.
3. Check one-way fuel valve for operation as per the following.
   When a stick is inserted, the valve should open, when removing stick it should close.
   Do not drop any material into the tank.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel filler tube or replace one-way fuel valve with fuel tank.

Component Inspection (EVAP Vapor Cut Valve)

INFOID:0000000014419844

1. CHECK REFUELING EVAP VAPOR CUT VALVE

1. Turn ignition switch OFF.
2. Remove fuel tank. Refer to FL-9, "Removal and Installation".
3. Drain fuel from the tank as per the following:

- Remove fuel gauge retainer.
- Drain fuel from the tank using a handy pump into a fuel container.

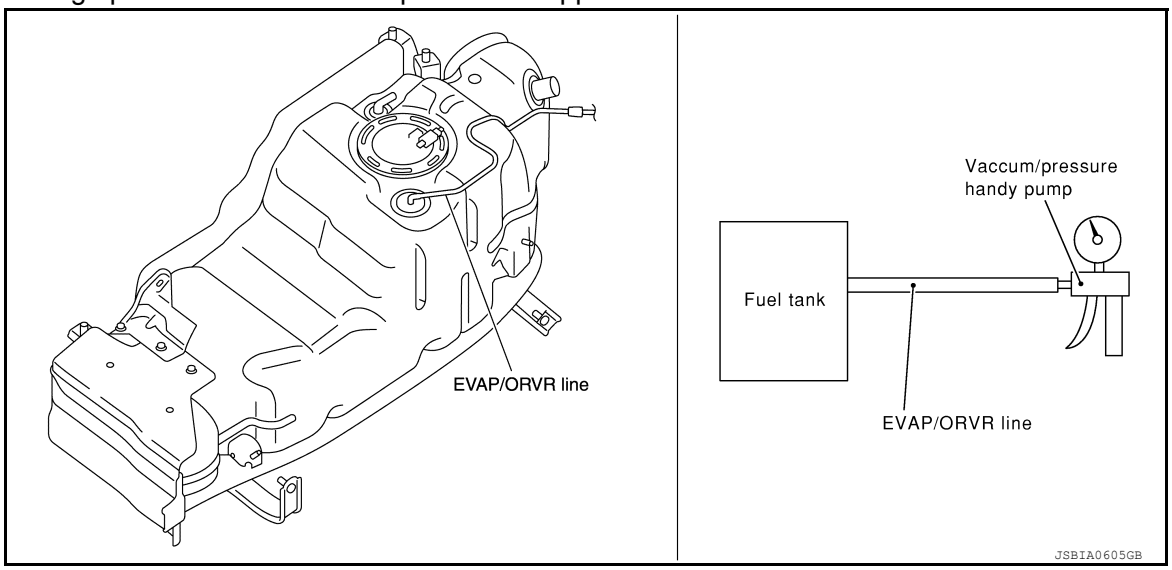
4. Check refueling EVAP vapor cut valve for being stuck to close as per the following.
   Blow air into the refueling EVAP vapor cut valve (from the end of EVAP/ORVR line hose), and check that the air flows freely into the tank.
5. Check refueling EVAP vapor cut valve for being stuck to open as per the following.

- Connect vacuum pump to hose end.
- Remove fuel gauge retainer with fuel gauge unit.

Always replace O-ring with new one.

- Turn fuel tank upside down.

- Apply vacuum pressure to hose end [−13.3 kPa (−0.136 kg/cm^3, −1.93 psi)] with fuel gauge retainer remaining open and check that the pressure is applicable.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace refueling EVAP vapor cut valve with fuel tank.

REFRIGERANT PRESSURE SENSOR

Component Function Check

INFOID:0000000014419845

1.CHECK REFRIGERANT PRESSURE SENSOR FUNCTION

1. Start engine and warm it up to normal operating temperature.
2. Turn A/C switch and blower fan switch ON.
3. Check the voltage between ECM harness connector terminals as per the following.

ECM			Voltage (V)
Connector	+	–	
	Terminal	Terminal	
F78	12 (Refrigerant pressure sensor signal)	13	1.0 - 4.0

Is the inspection result normal?

YES >> INSPECTION END
NO >> Go to EC-710, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000014419846

1.CHECK REFRIGERANT PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect refrigerant pressure sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between refrigerant pressure sensor harness connector and ground.

Refrigerant pressure sensor		Ground	Voltage (V)
Connector	Terminal		
E40	3	Ground	Approx. 5

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and refrigerant pressure sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

3.CHECK REFRIGERANT PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between refrigerant pressure sensor harness connector and ECM harness connector.

Refrigerant pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E40	1	F78	13	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and refrigerant pressure sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

5.CHECK REFRIGERANT PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between refrigerant pressure sensor harness connector and ECM harness connector.

Refrigerant pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E40	2	F78	12	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness for open or short between ECM and refrigerant pressure sensor
- Loose or poor connection for each connector and harness

>> Repair open circuit, short to ground or short to power in harness or connectors.

7.CHECK INTERMITTENT INCIDENT

Refer to GI-47, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace refrigerant pressure sensor. Refer to HA-31, "Removal and Installation".
NO >> Repair or replace malfunctioning part.

SENSOR POWER SUPPLY 2 CIRCUIT

Description

INFOID:0000000014419847

ECM supplies a voltage of 5 V to some of the sensors systematically divided into 3 groups, respectively. Accordingly, when a short circuit develops in a sensor power source, a malfunction may occur simultaneously in the sensors belonging to the same group as the short-circuited sensor.

Sensor power supply 1

- Accelerator pedal position sensor 1
- Crankshaft position sensor
- Camshaft position sensor (Bank 1)
- Exhaust valve timing control position sensor (Bank 1)
- Throttle position sensor

NOTE:
If sensor power supply 1 circuit is malfunctioning, DTC P0643 is displayed.

Sensor power supply 2

- Accelerator pedal position sensor 2
- Battery current sensor
- Multi-way control valve
- Fan clutch assembly
- Camshaft position sensor (Bank 2)
- Exhaust valve timing control position sensor (Bank 2)

Sensor power supply 3

- EVAP control system pressure sensor
- Fuel rail pressure sensor
- Engine oil pressure sensor
- Refrigerant pressure sensor
- Power steering pressure sensor

Diagnosis Procedure

INFOID:0000000014419848

1.CHECK APP SENSOR 2 POWER SUPPLY CIRCUIT-1

1. Turn ignition switch OFF.
2. Disconnect accelerator pedal position (APP) sensor 2 harness connector.
3. Turn ignition switch ON.
4. Check the voltage between APP sensor 2 harness connector and ground.

+		−	Voltage (Approx.)
APP sensor 2			
Connector	Terminal		
E20	1	Ground	5 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK APP SENSOR 1 POWER SUPPLY CIRCUIT-2

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between APP sensor 2 harness connector and ECM harness connector.

+		−		Continuity
APP sensor 2		ECM		
Connector	Terminal	Connector	Terminal	
E20	1	E16	142	Existed

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit.

3. CHECK SENSOR POWER SUPPLY 2 CIRCUIT

1. Disconnect following sensors harness connector.
2. Check harness for short to power and short to ground, between the following terminals.

ECM		Sensor		
Connector	Terminal	Name	Connector	Terminal
E16	142	APP sensor 2	E20	1
F78	30	Battery current sensor	E161	1
		Multi-way control valve	F92	5
		Fan clutch assembly	F152	2
F79	73	Camshaft position sensor (Bank 2)	F67	1
		Exhaust valve timing control position sensor (Bank 2)	F72	1

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair short to ground or short to power in harness or connectors.

4. CHECK COMPONENTS

Check the following.
- APP sensor 2 (Refer to EC-638, "Component Inspection (Accelerator Pedal Position Sensor)".)
- Battery current sensor (Refer to EC-580, "Component Inspection (Battery Current Sensor)".)
- Multi-way control valve (Refer to EC-664, "Component Inspection (Multi-way Control Valve)".)
- Fan clutch assembly (Refer to EC-493, "Component Inspection (Cooling Fan Speed Sensor)".)
- Camshaft position sensor (Bank 2) (Refer to EC-423, "Component Inspection (Camshaft Position Sensor)".)
- Exhaust valve timing control position sensor (Bank 2) (Refer to EC-542, "Component Inspection (Exhaust Valve Timing Control Position Sensor)".)

Is the inspection result normal?

YES >> Perform GI-47, "Intermittent Incident".
NO >> Replace malfunctioning component.

SENSOR POWER SUPPLY 3 CIRCUIT

Description

INFOID:0000000014419849

ECM supplies a voltage of 5 V to some of the sensors systematically divided into 3 groups, respectively. Accordingly, when a short circuit develops in a sensor power source, a malfunction may occur simultaneously in the sensors belonging to the same group as the short-circuited sensor.

Sensor power supply 1

- Accelerator pedal position sensor 1
- Crankshaft position sensor
- Camshaft position sensor (Bank 1)
- Exhaust valve timing control position sensor (Bank 1)
- Throttle position sensor

NOTE:
If sensor power supply 1 circuit is malfunctioning, DTC P0643 is displayed.

Sensor power supply 2

- Accelerator pedal position sensor 2
- Battery current sensor
- Multi-way control valve
- Fan clutch assembly
- Camshaft position sensor (Bank 2)
- Exhaust valve timing control position sensor (Bank 2)

Sensor power supply 3

- EVAP control system pressure sensor
- Fuel rail pressure sensor
- Engine oil pressure sensor
- Refrigerant pressure sensor
- Power steering pressure sensor

Diagnosis Procedure

INFOID:0000000014419850

1.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT-1

1. Turn ignition switch OFF.
2. Disconnect EVAP control system pressure sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between EVAP control system pressure sensor harness connector and ground.

+		−	Voltage (Approx.)
EVAP control system pressure sensor			
Connector	Terminal		
C32	3	Ground	5 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK EVAP CONTROL SYSTEM PRESSURE SENSOR POWER SUPPLY CIRCUIT-2

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector.
3. Check the continuity between EVAP control system pressure sensor harness connector and ECM harness connector.

+		–		
EVAP control system pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
C32	3	E16	125	Existed

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit.

3.CHECK SENSOR POWER SUPPLY 3 CIRCUIT

1. Disconnect following sensors harness connector.
2. Check harness for short to power and short to ground, between the following terminals.

ECM		Sensor		
Connector	Terminal	Name	Connector	Terminal
E16	125	EVAP control system pressure sensor	C32	3
F78	29	Fuel rail pressure sensor	F91	1
		Engine oil pressure sensor	F229	3
		Refrigerant pressure sensor	E40	3
		Power steering pressure sensor	F82	3

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair short to ground or short to power in harness or connectors.

4.CHECK COMPONENTS

Check the following.
- EVAP control system pressure sensor (Refer to EC-454, "Component Inspection (EVAP Control System Pressure Sensor)".)
- Fuel rail pressure sensor (Refer to EC-390, "Component Inspection (Fuel Rail Pressure Sensor)".)
- Engine oil pressure sensor (Refer to EC-487, "Component Inspection (EOP sensor)".)
- Refrigerant pressure sensor (Refer to EC-710, "Component Function Check".)
- Power steering pressure sensor (Refer to EC-508, "Component Inspection (Power Steering Pressure Sensor)".)

Is the inspection result normal?

YES >> Perform GI-47, "Intermittent Incident".
NO >> Replace malfunctioning component.

SYMPTOM DIAGNOSIS

ENGINE CONTROL SYSTEM SYMPTOMS

Symptom Table

INFOID:0000000014419851

SYSTEM — BASIC ENGINE CONTROL SYSTEM

		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
Warranty symptom code		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Fuel	Low pressure fuel pump circuit	1	1	2	3	2		2	2			3		2	EC-701
	Fuel pressure regulator system	3	3	4	4	4	4	4	4	4		4			EC-205
	Fuel injector circuit	1	1	2	3	2		2	2			2			EC-685
	Evaporative emission system	3	3	4	4	4	4	4	4	4		4			EC-724
	FRP sensor circuit	1	1	2	2	2		2	2			2			EC-388 EC-392
	High pressure fuel pump circuit			4		3									EC-691
Air	Positive crankcase ventilation system	3	3	4	4	4	4	4	4	4		4	1		EC-726
	Incorrect idle speed adjustment						1	1	1	1		1			EC-190
	Electric throttle control actuator	1	1	2	3	3	2	2	2	2		2		2	EC-628 EC-634
Ignition	Incorrect ignition timing adjustment	3	3	1	1	1		1	1			1			EC-190
	Ignition circuit	1	1	2	2	2		2	2			2			EC-695
Main power supply and ground circuit		2	2	3	3	3		3	3		2	3			EC-227

	SYMPTOM													Reference page
	HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
Warranty symptom code	AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Mass air flow sensor circuit	1			2										EC-314
Engine coolant temperature sensor 1 circuit						3			3					EC-326
Air fuel ratio (A/F) sensor 1 circuit		1	2	3	2		2	2			2			EC-284 EC-336 EC-340 EC-343 EC-367
Throttle position sensor circuit						2			2					EC-329 EC-404 EC-575 EC-576 EC-642
Accelerator pedal position sensor circuit			3	2	1									EC-636 EC-639 EC-645
Knock sensor circuit			2								3			EC-414
Engine oil temperature sensor			4		2						3			EC-399
Engine oil pressure sensor			4		4	3	3	3			3			EC-485
Crankshaft position sensor circuit	2	2												EC-417
Camshaft position sensor circuit	3	2												EC-420
Vehicle speed signal circuit		2	3		3						3			EC-476
Power steering pressure sensor circuit		2					3	3						EC-506
ECM	2	2	3	3	3	3	3	3	3	3	3			—
Intake valve timing control solenoid valve circuit		3	2		1	3	2	2	3		3			EC-290
Exhaust valve timing control solenoid valve circuit		3	2		1	3	2	2	3		3			EC-252 EC-293
Exhaust valve timing control position sensor	5	5	5	5	5		5	5			5			EC-540
Exhaust gas temperature sensor											5			EC-494 EC-497
VVEL control module	3		4	4	3									EC-608 EC-609
VVEL actuator motor	3		4	4	3									EC-547
VVEL actuator motor relay	3		4	4	3									EC-551
VVEL control shaft position sensor	3		4	4	3									EC-544
PNP signal circuit			3		3		3	3			3			EC-533

	SYMPTOM													Reference page
	HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
Warranty symptom code	AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Refrigerant pressure sensor circuit		2				3			3		4			EC-710
Electrical load signal circuit							3							EC-683
Air conditioner circuit	2	2	3	3	3	3	3	3	3		3		2	HAC-113
ABS actuator and electric unit (control unit)			4											BRC-66
Battery current sensor						4	5	5					3	EC-579 EC-585 EC-588
Heated oxygen sensor 2			6		6		6	6			5			EC-346 EC-352 EC-364

1 - 6: The numbers refer to the order of inspection.

(continued on next page)

SYSTEM — ENGINE MECHANICAL & OTHER

		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
Warranty symptom code		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Fuel	Fuel tank	5													FL-5
	Fuel piping			5	5	5		5	5			5			FL-5
	Vapor lock		5												—
	Valve deposit														—
	Poor fuel (Heavy weight gasoline, Low octane)	5		5	5	5		5	5			5			—

		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
Warranty symptom code		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Air	Air duct		5	5		5		5	5			5			EM-33
	Air cleaner														EM-31
	Air leakage from air duct (Mass air flow sensor — electric throttle control actuator)	5			5		5			5					EM-33
	Electric throttle control actuator														EC-628
	Air leakage from intake manifold/ Collector/Gasket														EM-35
Cranking	Battery	1	1	1		1		1	1			1		1	PG-175
	Generator circuit														CHG-28 (With EXP-800 NI or GR8-1200 NI)*, CHG-33 (Without EXP-800 NI or GR8-1200 NI)*.
	Starter circuit	3													STR-23 (With GR8-1200 NI)*, STR-27 (Without GR8-1200 NI)*.
	Signal plate	6													EM-128
	PNP signal	4													EC-533
Engine	Cylinder head	5	5	5	5	5		5	5			5			EM-112
	Cylinder head gasket										4		3		
	Cylinder block	6	6	6	6	6		6	6			6	4		EM-137
	Piston														
	Piston ring														
	Connecting rod														
	Bearing														
	Crankshaft														

		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)	ENGINE STALL	HESITATION/SURGING/FLAT SPOT	SPARK KNOCK/DETONATION	LACK OF POWER/POOR ACCELERATION	HIGH IDLE/LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEATS/WATER TEMPERATURE HIGH	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BATTERY DEAD (UNDER CHARGE)	
Warranty symptom code		AA	AB	AC	AD	AE	AF	AG	AH	AJ	AK	AL	AM	HA	
Valve mechanism	Timing chain	5	5	5	5	5		5	5			5			EM-91
	Camshaft														EM-96
	Intake valve timing control														EM-74
	Intake valve												3		EM-112
	Exhaust valve														
Exhaust	Exhaust manifold/Tube/Muffler/Gasket	5	5	5	5	5		5	5			5			EM-51 EX-5
	Three way catalyst														
Lubrication	Oil pan/Oil strainer/Oil pump/Oil filter/Oil gallery/Oil cooler	5	5	5	5	5		5	5			5			EM-68 EM-73 LU-11 LU-15 LU-18
	Oil level (Low)/Filthy oil														LU-9
Cooling	Radiator/Hose/Radiator filler cap	5	5	5	5	5		5	5		4	5			CO-9
	Water pump														CO-26
	Water gallery														EM-137
	Cooling fan									5					CO-23
	Coolant level (Low)/Contaminated coolant														CO-9
	Multi-way control valve											4			CO-30
IVIS (INFINITI Vehicle Immobilizer System — NATS)		1	1												SEC-64

1 - 6: The numbers refer to the order of inspection.

*: For the details of the EXP-800 NI or GR8-1200 NI, refer to CHG-4, "Special Service Tool".

NORMAL OPERATING CONDITION

Description

INFOID:0000000014419852

FUEL CUT CONTROL (AT NO LOAD AND HIGH ENGINE SPEED)

If the engine speed is above 1,800 rpm under no load (for example, the selector lever position is neutral and engine speed is over 1,800 rpm) fuel will be cut off after some time. The exact time when the fuel is cut off varies based on engine speed.

Fuel cut will be operated until the engine speed reaches 1,500 rpm, then fuel cut will be cancelled.

NOTE:

This function is different from deceleration control listed under direct injection gasoline System, EC-61, "DIRECT INJECTION GASOLINE SYSTEM : System Description".

PERIODIC MAINTENANCE

IDLE SPEED

Inspection

INFOID:0000000014419853

1.CHECK IDLE SPEED

WITH CONSULT
Check idle speed in “DATA MONITOR” mode with CONSULT.
WITH GST
Check idle speed with Service $01 of GST.

>> INSPECTION END

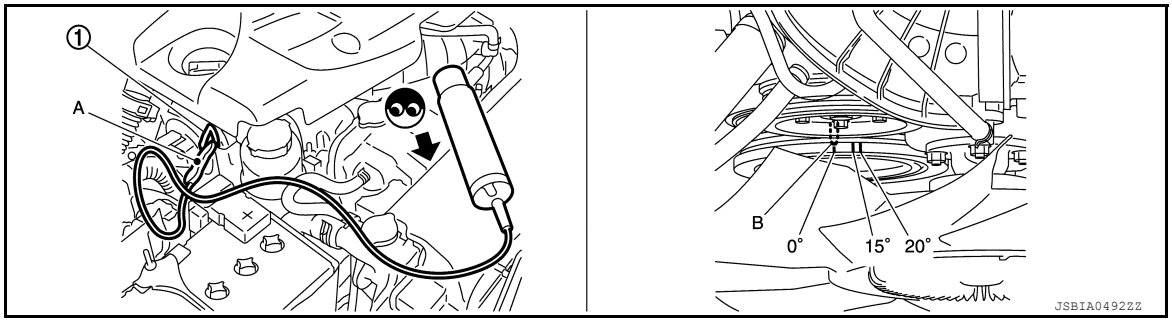
IGNITION TIMING

Inspection

INFOID:0000000014419854

1.CHECK IGNITION TIMING

1. Attach timing light to loop wire as shown.



1. Loop wire
A. Timing light
B. Timing indicator

2. Check ignition timing.

>> INSPECTION END

EVAP LEAK CHECK

Inspection

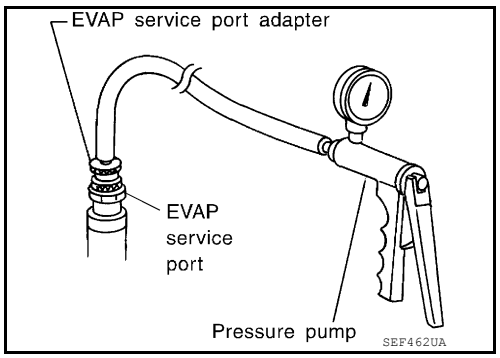
INFOID:0000000014419855

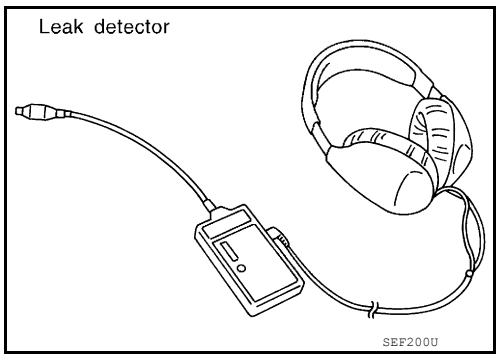
CAUTION:
- **Do not use compressed air or a high pressure pump.**
- **Do not exceed 4.12 kPa (0.042 kg/cm^2, 0.6 psi) of pressure in EVAP system.**

NOTE:
- Do not start engine.
- Improper installation of EVAP service port adapter (commercial service tool) to the EVAP service port may cause a leak.

WITH CONSULT

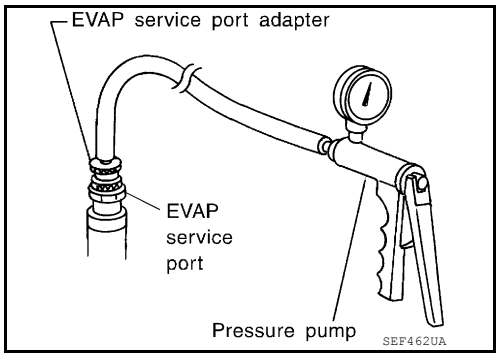
1. To locate the EVAP leak, install EVAP service port adapter (commercial service tool) and pressure pump to EVAP service port.
2. Turn ignition switch ON.
3. Select the “EVAP SYSTEM CLOSE” of “WORK SUPPORT” mode with CONSULT.
4. Touch “START”. A bar graph (Pressure indicating display) will appear on the screen.
5. Apply positive pressure to the EVAP system until the pressure indicator reaches the middle of the bar graph.
6. Remove EVAP service port adapter (commercial service tool) and hose with pressure pump.
7. Locate the leak using a leak detector (commercial service tool). Refer to EC-70, "EVAPORATIVE EMISSION SYSTEM : System Diagram".



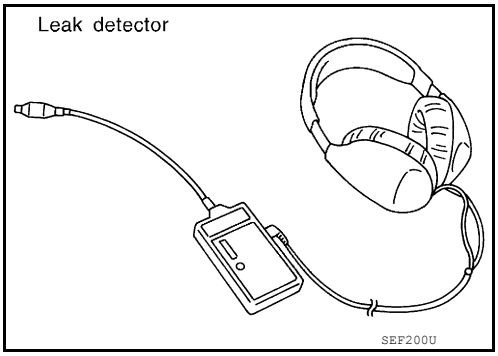


WITHOUT CONSULT

1. To locate the EVAP leak, install EVAP service port adapter (commercial service tool) and pressure pump to EVAP service port.
2. Apply battery voltage between the terminals of EVAP canister vent control valve to make a closed EVAP system.
3. To locate the leak, deliver positive pressure to the EVAP system until pressure gauge points reach 1.38 to 2.76 kPa (0.014 to 0.028 kg/cm^2, 0.2 to 0.4 psi).
4. Remove EVAP service port adapter (commercial service tool) and hose with pressure pump.



5. Locate the leak using a leak detector (commercial service tool). Refer to EC-70, "EVAPORATIVE EMISSION SYSTEM : System Diagram".



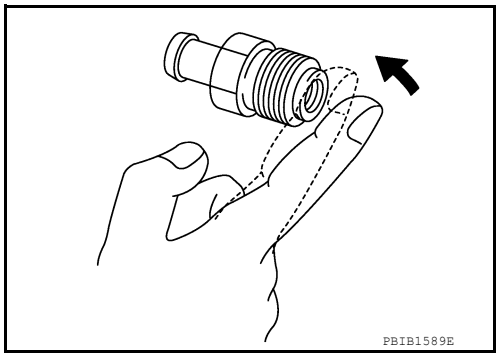
POSITIVE CRANKCASE VENTILATION

Inspection

INFOID:0000000014419856

1. CHECK PCV VALVE

With engine running at idle, remove PCV valve from rocker cover. A properly working valve makes a hissing noise as air passes through it. A strong vacuum should be felt immediately when a finger is placed over valve inlet.



Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace PCV valve. Refer to EM-38, "Exploded View".

REMOVAL AND INSTALLATION

ECM

Removal and Installation

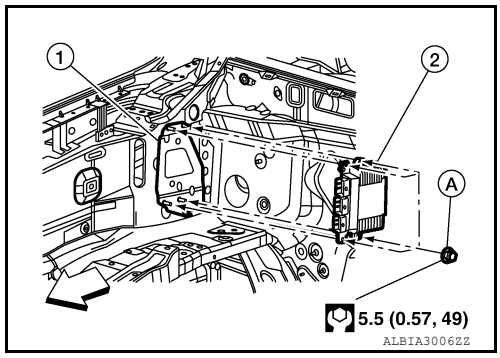
INFOID:0000000014419857

REMOVAL

CAUTION:

Perform ADDITIONAL SERVICE WHEN REPLACING ECM. Refer to EC-194, "Description".

1. Disconnect the battery or batteries negative terminal(s).Refer to PG-185, "Battery Disconnect".
2. Remove the cowl top extension. Refer to EXT-36, "Removal and Installation - Cowl Top Extension".
3. Remove the front wheel and tire (RH) using power tool. Refer to WT-69, "Removal and Installation".
4. Remove the front fender protector (RH). Refer to EXT-41, "Removal and Installation - Front Fender Protector".
5. Position the relay box and IDPM/ER aside.
6. Disconnect harness connector from the ECM.
7. Remove nuts (A) and ECM (2) from ECM bracket (1).
8. Remove bolts and ECM bracket (1) from vehicle (if necessary).



INSTALLATION

Installation is in the reverse order of removal.

CAUTION:

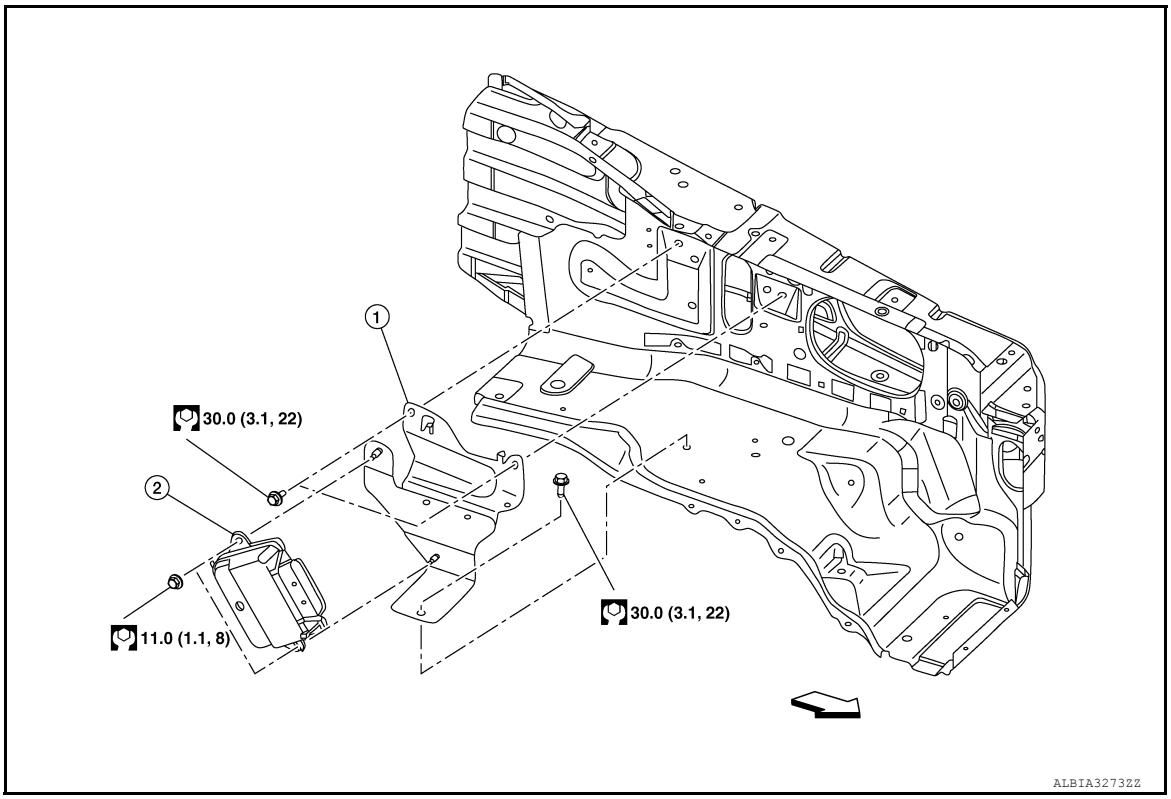
Perform ADDITIONAL SERVICE WHEN REPLACING ECM. Refer to EC-194, "Description".

VVEL CONTROL MODULE

Removal and Installation

INFOID:0000000014419858

Exploded View



1. VVEL control module bracket
2. VVEL control module
⇦ Front

REMOVAL

CAUTION:

Additional service must be preformed when replacing VVEL control module. Refer to EC-196, "Description".

1. Remove the cowl top extension. refer to EXT-36, "Removal and Installation - Cowl Top Extension".
2. Disconnect the harness connector from the VVEL control module.
3. Remove nuts and VVEL control module.
4. Remove bolts and VVEL control module bracket (if necessary).

INSTALLATION

Installation is in reverse order of removal.

CAUTION:

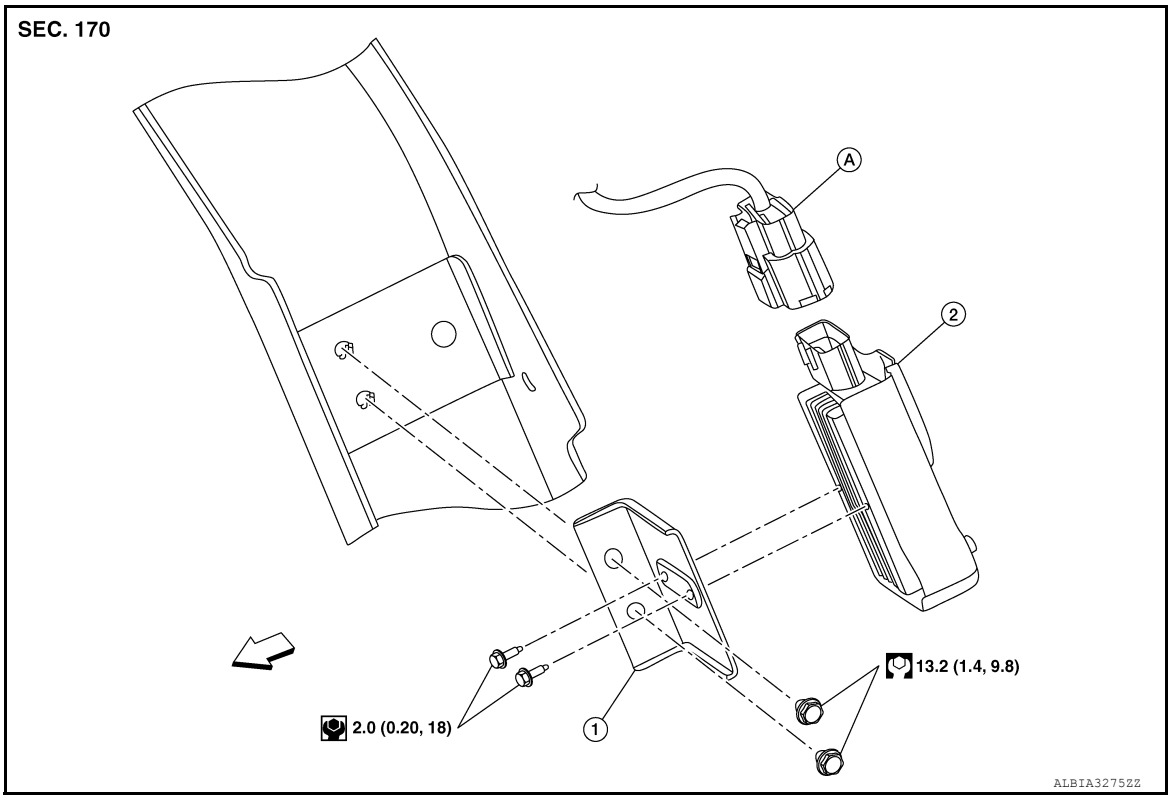
Perform additional service when replacing VVEL control module. Refer to EC-196, "Description".

FUEL PUMP CONTROL MODULE (FPCM)

Removal and Installation

INFOID:0000000014419859

Exploded View



1. Fuel pump control module bracket
2. Fuel pump control module
A. Harness connector

⇦ Front

REMOVAL

CAUTION:

Additional service must be performed when replacing fuel pump control module. Refer to EC-64, "FUEL PRESSURE CONTROL : System Description".

1. Remove the rear wheel and tire (LH) using power tool. Refer to WT-69, "Removal and Installation".
2. Remove the rear fender protector (LH). Refer to EXT-42, "Removal and Installation - Rear Fender Protector".
3. Disconnect the harness connector from fuel pump control module.
4. Remove bolts, and fuel pump control module and bracket assembly from vehicle.
5. Remove screws, and fuel pump control module from fuel pump control module bracket (if necessary).

INSTALLATION

Installation is in the reverse order of removal.

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Idle Speed

INFOID:0000000014419860

Condition	Specification
No load* (in P or N position)	600 ± 50 rpm

*: Under the following conditions

- A/C switch: OFF
- Electric load: OFF (Lights, heater fan & rear window defogger)
- Steering wheel: Kept in straight-ahead position

Ignition Timing

INFOID:0000000014419861

Condition	Specification
No load* (in P or N position)	12 ± 2°BTDC

*: Under the following conditions

- A/C switch: OFF
- Electric load: OFF (Lights, heater fan & rear window defogger)
- Steering wheel: Kept in straight-ahead position

Calculated Load Value

INFOID:0000000014419862

Condition	Specification (Using CONSULT or GST)
At idle	5 – 35%
At 2,500 rpm	5 – 35%

Mass Air Flow Sensor

INFOID:0000000014419863

Supply voltage	Battery voltage (11 – 14 V)
Output voltage at idle	0.7 – 1.2 V*
Mass air flow (Using CONSULT or GST)	1.0 – 5.0 g/s at idle* 7.0 – 20.0 g/s at 2,500 rpm*

*: Engine is warmed up to normal operating temperature and running under no load.

PRECAUTION

PRECAUTIONS

Precaution for Supplemental Restraint System (SRS) "AIR BAG" and "SEAT BELT PRE-TENSIONER"

INFOID:0000000014419864

The Supplemental Restraint System such as “AIR BAG” and “SEAT BELT PRE-TENSIONER”, used along with a front seat belt, helps to reduce the risk or severity of injury to the driver and front passenger for certain types of collision. Information necessary to service the system safely is included in the SR and SB section of this Service Manual.

WARNING:

- **To avoid rendering the SRS inoperative, which could increase the risk of personal injury or death in the event of a collision which would result in air bag inflation, it is recommended that all maintenance and repair be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper repair, including incorrect removal and installation of the SRS, can lead to personal injury caused by unintentional activation of the system. For removal of Spiral Cable and Air Bag Module, see the SR section.**
- **Do not use electrical test equipment on any circuit related to the SRS unless instructed to in this Service Manual. SRS wiring harnesses can be identified by yellow and/or orange harnesses or harness connectors.**

PRECAUTIONS WHEN USING POWER TOOLS (AIR OR ELECTRIC) AND HAMMERS

WARNING:

- **When working near the Airbag Diagnosis Sensor Unit or other Airbag System sensors with the Ignition ON or engine running, DO NOT use air or electric power tools or strike near the sensor(s) with a hammer. Heavy vibration could activate the sensor(s) and deploy the air bag(s), possibly causing serious injury.**
- **When using air or electric power tools or hammers, always switch the Ignition OFF, disconnect the battery or batteries, and wait at least three minutes before performing any service.**

On Board Diagnosis (OBD) System of Engine and A/T

INFOID:0000000014419865

The ECM has an on board diagnostic system. It will light up the malfunction indicator lamp (MIL) to warn the driver of a malfunction causing emission deterioration.

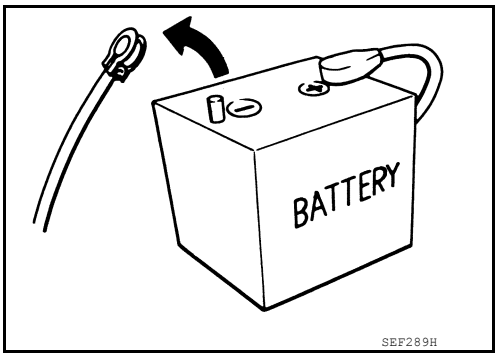
CAUTION:

- **Be sure to turn the ignition switch OFF and disconnect the negative battery cable before any repair or inspection work. The open/short circuit of related switches, sensors, solenoid valves, etc. will cause the MIL to light up.**
- **Be sure to connect and lock the connectors securely after work. A loose (unlocked) connector will cause the MIL to light up due to the open circuit. (Be sure the connector is free from water, grease, dirt, bent terminals, etc.)**
- **Certain systems and components, especially those related to OBD, may use a new style slide-locking type harness connector. For description and how to disconnect, refer to PG-7, "Harness Connector".**
- **Be sure to route and secure the harnesses properly after work. The interference of the harness with a bracket, etc. may cause the MIL to light up due to the short circuit.**
- **Be sure to connect rubber tubes properly after work. A misconnected or disconnected rubber tube may cause the MIL to light up due to the malfunction of the EVAP system or fuel injection system, etc.**
- **Be sure to erase the unnecessary malfunction information (repairs completed) from the ECM and TCM (Transmission control module) before returning the vehicle to the customer.**

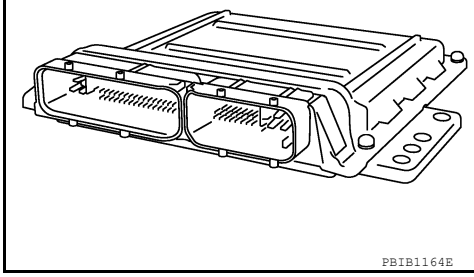
Precaution

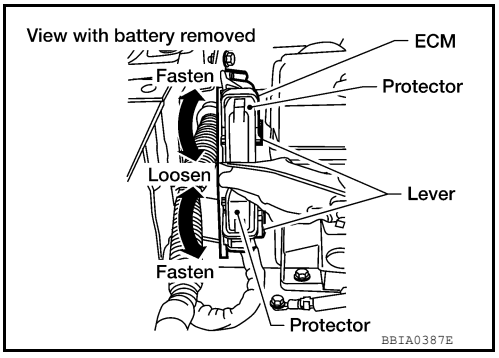
INFOID:0000000014419866

- **Always use a 12 volt battery as power source.**
- **Do not attempt to disconnect battery cables while engine is running.**
- **Before connecting or disconnecting the ECM harness connector, turn ignition switch OFF and disconnect negative battery cable. Failure to do so may damage the ECM because battery voltage is applied to ECM even if ignition switch is turned OFF.**
- **Before removing parts, turn ignition switch OFF and then disconnect negative battery cable.**

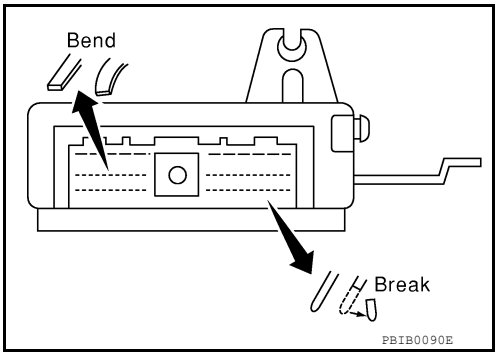


- **Do not disassemble ECM.**
- **If a battery cable is disconnected, the memory will return to the ECM value.**
  The ECM will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a malfunction. Do not replace parts because of a slight variation.
- **If the battery is disconnected, the following emission-related diagnostic information will be lost within 24 hours.**
  - **Diagnostic trouble codes**
  - **1st trip diagnostic trouble codes**
  - **Freeze frame data**
  - **1st trip freeze frame data**
  - **System readiness test (SRT) codes**
  - **Test values**
  - **<Flexible Fuel Vehicle>**
    Presumed ethanol mixture ratio
- **When connecting ECM harness connector, fasten it securely with a lever as far as it will go as shown in the figure.**

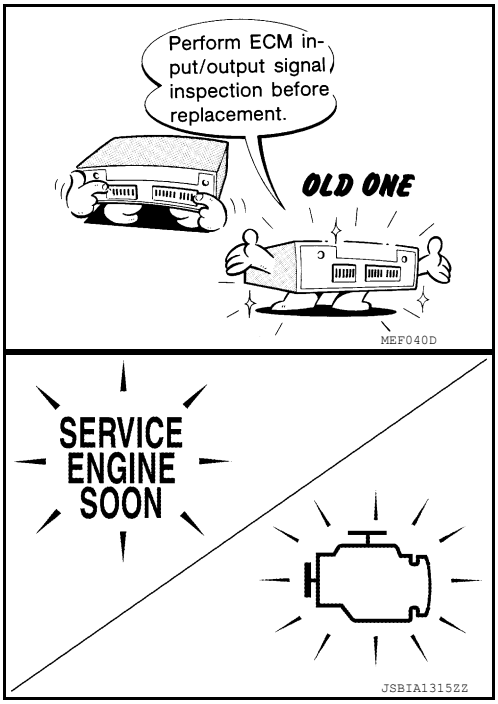




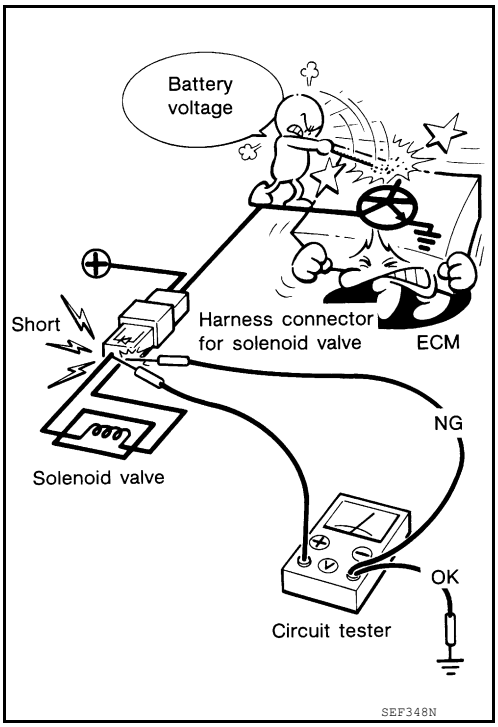
- **When connecting or disconnecting pin connectors into or from ECM, take care not to damage pin terminals (bend or break).**
  Make sure that there are not any bends or breaks on ECM pin terminal, when connecting pin connectors.
- **Securely connect ECM harness connectors.**
  A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- **Keep engine control system harness at least 10 cm (4 in) away from adjacent harness, to prevent engine control system malfunctions due to receiving external noise, degraded operation of ICs, etc.**
- **Keep engine control system parts and harness dry.**



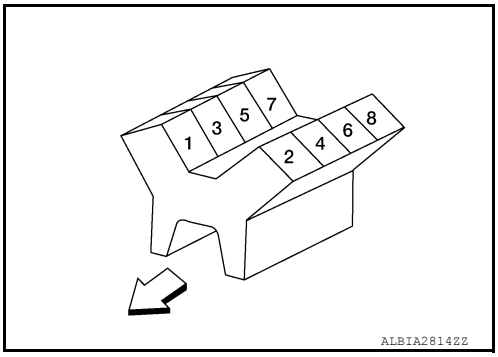
- **Before replacing ECM, perform ECM Terminals and Reference Value inspection and make sure ECM functions properly. Refer to EC-817, "Reference Value".**
- **Handle mass air flow sensor carefully to avoid damage.**
- **Do not disassemble mass air flow sensor.**
- **Do not clean mass air flow sensor with any type of detergent.**
- **Do not disassemble electric throttle control actuator.**
- **Even a slight leak in the air intake system can cause serious incidents.**
- **Do not shock or jar the camshaft position sensor (PHASE), crankshaft position sensor (POS).**
- **After performing each TROUBLE DIAGNOSIS, perform DTC Confirmation Procedure or Overall Function Check.**
  The DTC should not be displayed in the DTC Confirmation Procedure if the repair is completed. The Overall Function Check should be a good result if the repair is completed.



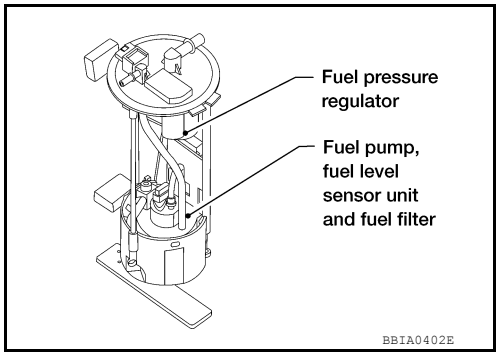
- **When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.
- **Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.**



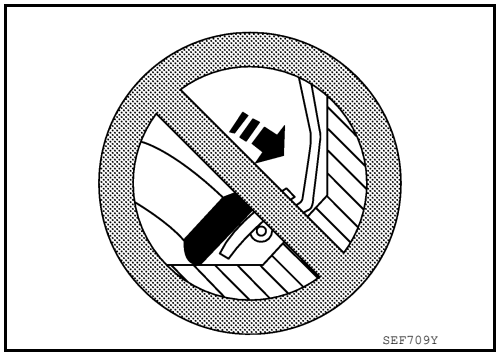
- Cylinder number and bank layout:
- Bank 1: 1, 3, 5, 7
- Bank 2: 2, 4, 6, 8
- ⇦: Front



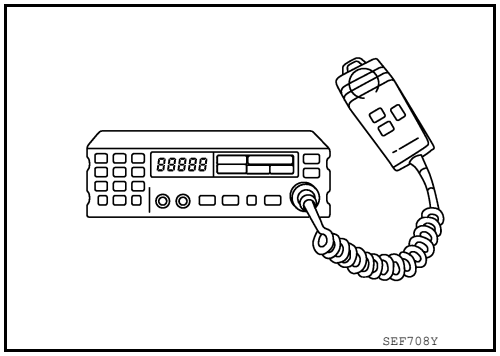
- **Do not operate fuel pump when there is no fuel in lines.**
- **Tighten fuel hose clamps to the specified torque.**



- **Do not depress accelerator pedal when starting.**
- **Immediately after starting, do not rev up engine unnecessarily.**
- **Do not rev up engine just prior to shutdown.**



- **When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on installation location.**
  - **Keep the antenna as far as possible from the electronic control units.**
  - **Keep the antenna feeder line more than 20 cm (8 in) away from the harness of electronic controls. Do not let them run parallel for a long distance.**
  - **Adjust the antenna and feeder line so that the standing-wave radio can be kept smaller.**
  - **Be sure to ground the radio to vehicle body.**



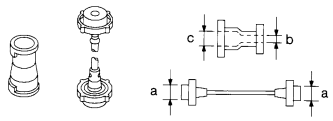
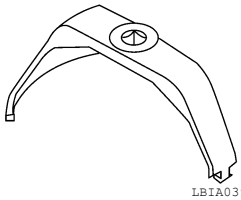
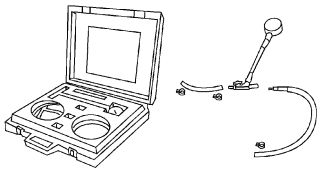
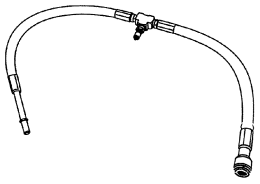
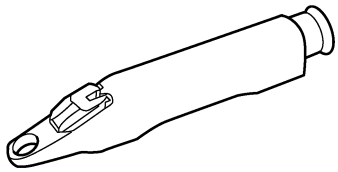
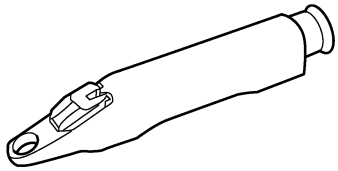
PREPARATION

PREPARATION

Special Service Tool

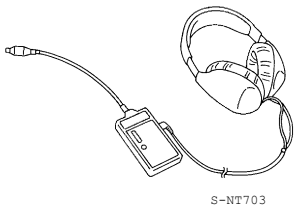
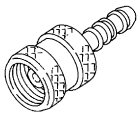
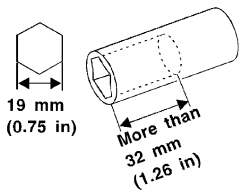
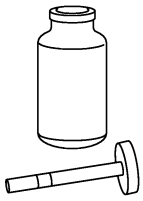
INFOID:0000000014419867

The actual shapes of TechMate tools may differ from those of special service tools illustrated here.

Tool number (TechMate No.) Tool name	Description	
EG17650301 (J-33984-A) Radiator cap tester adapter	 S-NT564	Adapting radiator cap tester to radiator cap and radiator filler neck **a: 28 (1.10) dia.** **b: 31.4 (1.236) dia.** **c: 41.3 (1.626) dia.** Unit: mm (in)
— (J-45722) 130 mm lock ring tool	 LBIA0398E	Removing and installing DEF pump
(J-44321) Fuel pressure gauge kit	 LEC642	Checking fuel pressure
(J-44321-6) Fuel pressure adapter	 LBIA0376E	Connecting fuel pressure gauge to quick connector type fuel lines.
(J-23688) Engine coolant refractometer	 WBIA0539E	Checking concentration of ethylene glycol in engine coolant
— (J-54466) 5025 DEF Refractometer	 WBIA0539E	Checking concentration of urea in DEF

Commercial Service Tool

INFOID:0000000014419868

Tool name (TechMate No.)	Description	
Leak detector i.e.: (J-41416)	 S-NT703	Locating the EVAP leak
EVAP service port adapter i.e.: (J-41413-OBD)	 S-NT704	Applying positive pressure through EVAP service port
Fuel filler cap adapter i.e.: (MLR-8382)	S-NT815	Checking fuel tank vacuum relief valve opening pressure
Socket wrench	 S-NT705	Removing and installing engine coolant temperature sensor
Anti-seize lubricant i.e.: (Permatex™ 133AR or equivalent meeting MIL specification MIL-A-907)	 S-NT779	Lubricating sensor threads and bolts for exhaust system.

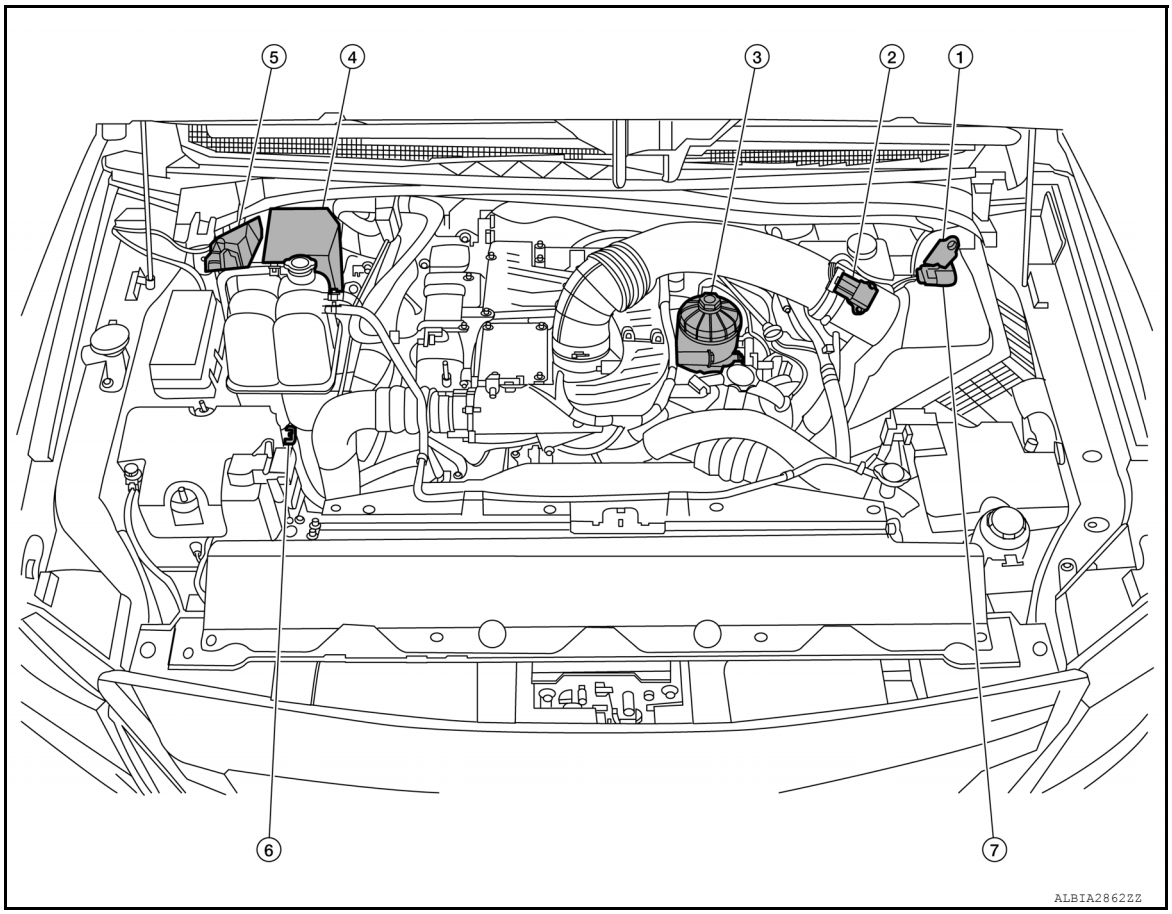
SYSTEM DESCRIPTION

COMPONENT PARTS

Component Parts Location

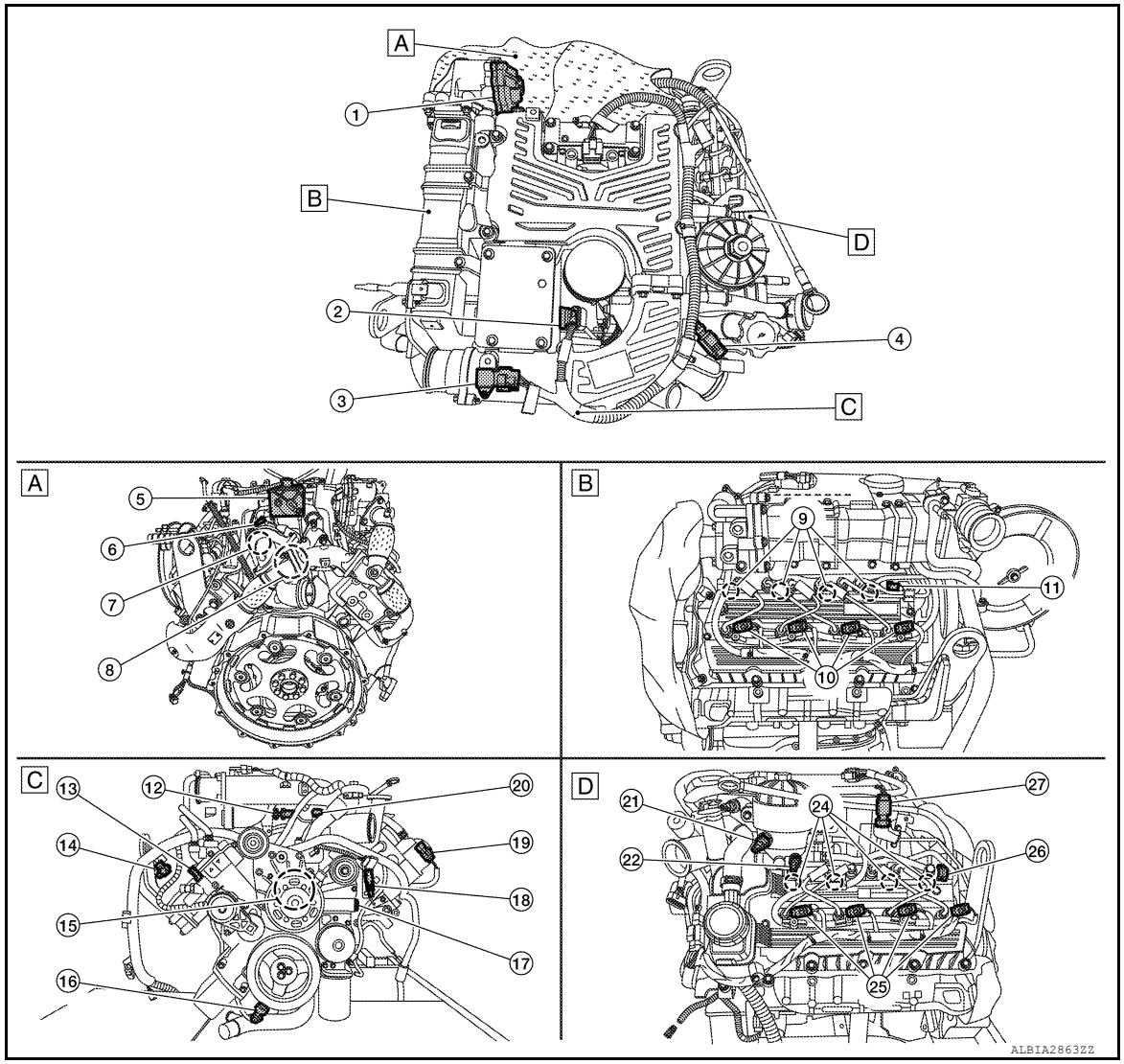
INFOID:0000000014419869

ENGINE ROOM COMPARTMENT



No.	Component parts	Function
①	Glow plug control module	EC-749, "Glow Plug Control Module"
②	Mass air flow (MAF) sensor	EC-751, "Mass Air Flow Sensor"
③	Fuel filter (stage 2)	• EC-745, "DEF Line Heater" • EC-753, "Water In Fuel Sensor"
④	IPDM E/R	IPDM E/R activates the internal control circuit to perform the relay ON/OFF control according to the input signals from various sensors and the request signals received from control units via CAN communication. Refer to PCS-43, "Removal and Installation of IPDM E/R" for detailed installation location.
⑤	ECM	EC-746, "ECM"
⑥	Coolant level sensor	EC-743, "Coolant Level Sensor"
⑦	Turbocharger compressor intake pressure/temperature sensor (with intake air temperature sensor)	EC-753, "Turbocharger Compressor Intake Pressure/Temperature Sensor"

ENGINE COMPARTMENT

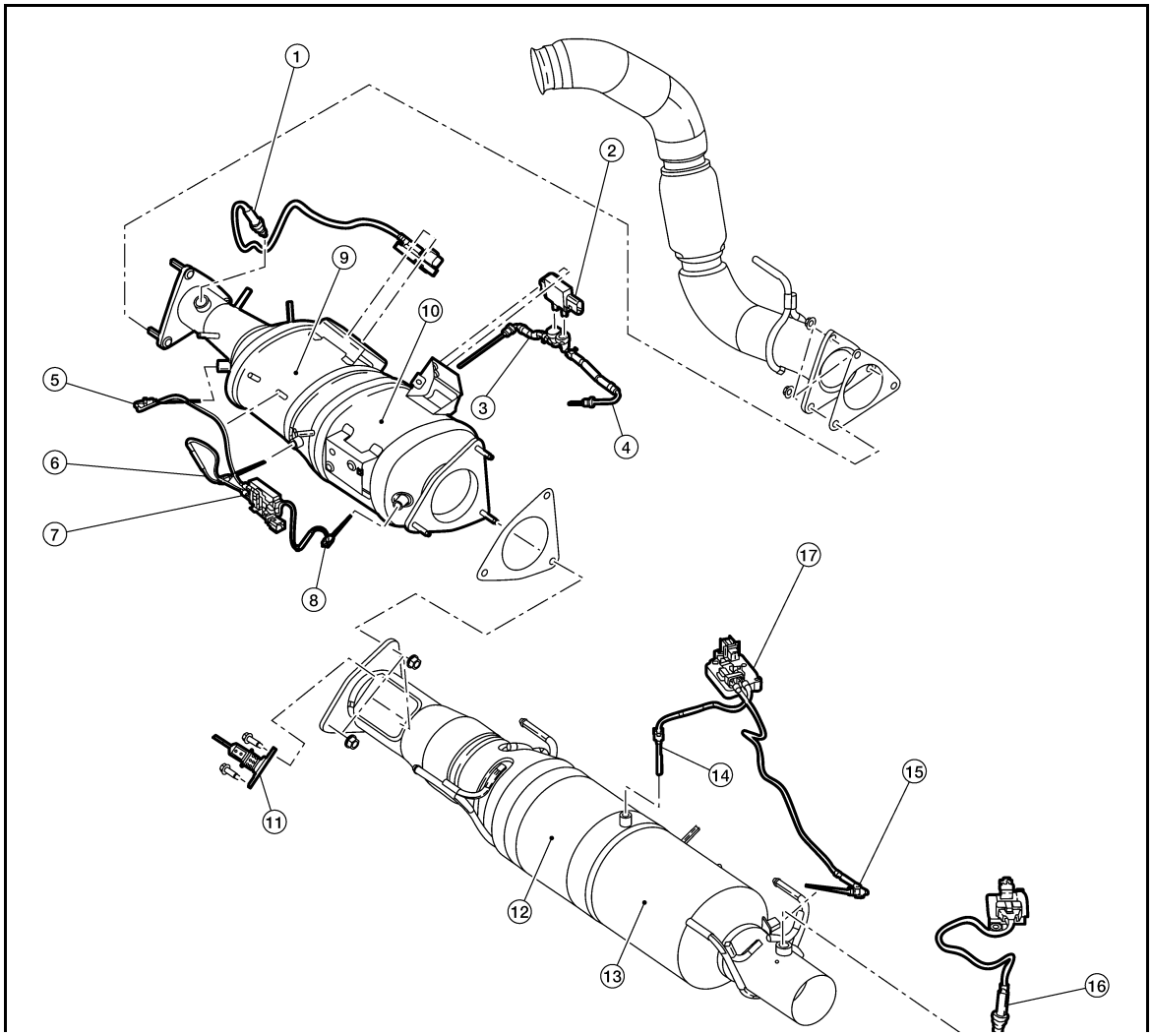


A Back side of engine
B Right side of engine
C Front side of engine
D Left side of engine

No.	Component parts	Function
①	EGR valve	EC-747, "EGR Valve"
②	EGR bypass valve	EC-746, "EGR Bypass Valve"
③	Engine charge air cooler outlet pressure/temperature sensor	EC-747, "Engine Charge Air Cooler Outlet Pressure/Temperature Sensor"
④	Intake manifold temperature sensor	EC-750, "Intake Manifold Temperature Sensor"
⑤	Rotary turbine control valve actuator	EC-752, "Rotary Turbine Control Valve Actuator"
⑥	Turbocharger speed sensor	EC-753, "Turbocharger Speed Sensor"
⑦	High pressure turbo compressor	EM-398, "Exploded View"
⑧	Low pressure turbo compressor	
⑨	Glow plugs RH	EC-749, "Glow Plug"
⑩	Fuel injectors RH	EC-748, "Fuel Injector"
⑪	Fuel rail pressure sensor	EC-749, "Fuel Rail Pressure Sensor"

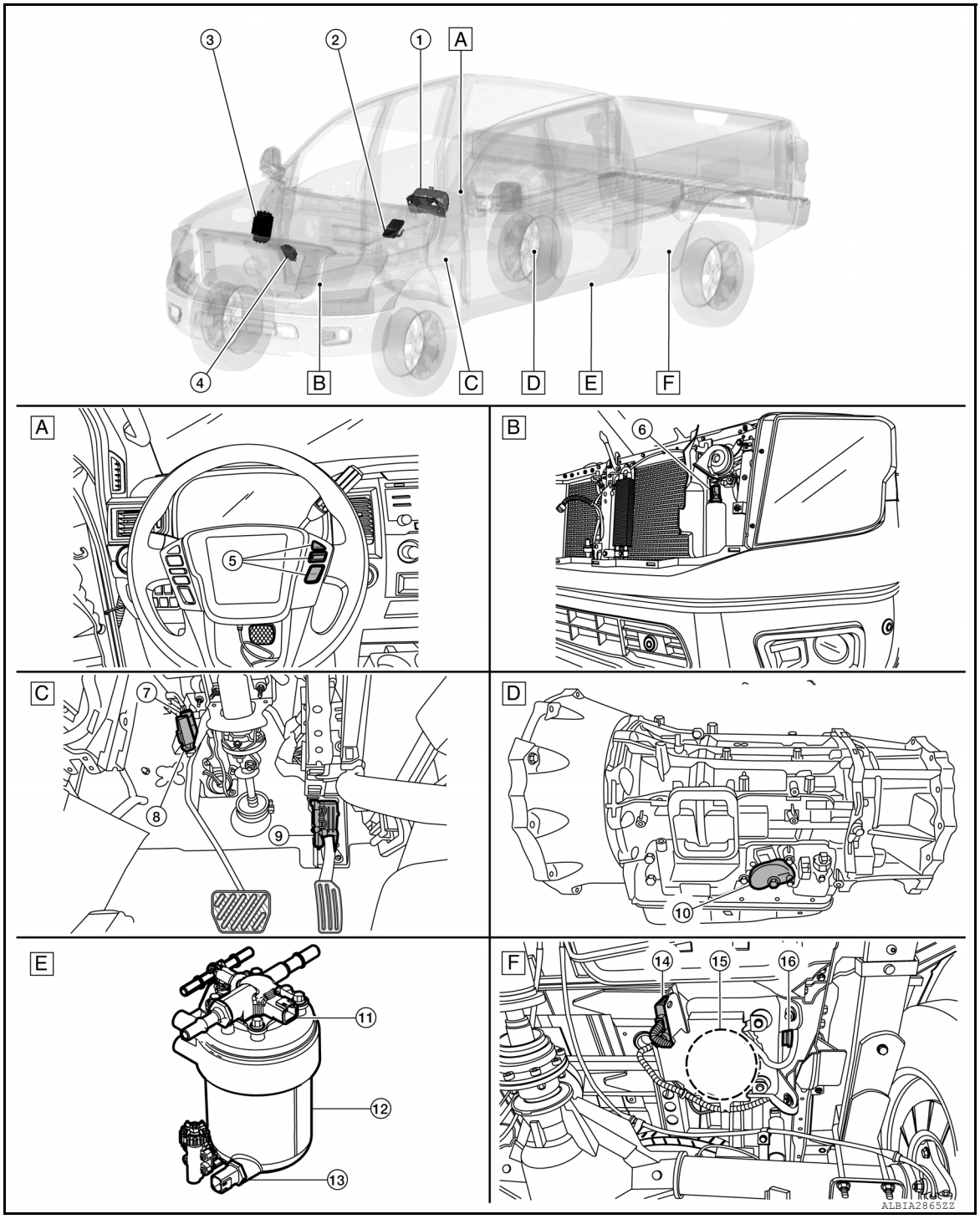
No.	Component parts	Function
⑫	EGR temperature sensor	EC-746, "EGR Temperature Sensor"
⑬	Camshaft position sensor	EC-743, "Camshaft Position Sensor"
⑭	Coolant temperature sensor	EC-747, "Engine Coolant Temperature Sensor"
⑮	Fuel pump actuator	EC-748, "Fuel Pump Actuator"
⑯	Crankshaft position sensor	EC-744, "Crankshaft Position Sensor"
⑰	Compressor bypass valve solenoid	EC-743, "Compressor Bypass Valve Solenoid"
⑱	Coolant heater (if equipped)	CO-38, "System Description"
⑲	Crankcase pressure sensor	EC-744, "Crankcase Pressure Sensor"
⑳	Low pressure turbocharger boost pressure sensor	EC-750, "Low Pressure Turbocharger Boost Pressure Sensor"
㉑	Fuel temperature sensor	EC-749, "Fuel Temperature Sensor"
㉒	Fuel pressure sensor	EC-748, "Fuel Pressure Sensor"
㉓	Oil pressure switch	EC-751, "Oil Pressure Switch"
㉔	Glow plugs LH	EC-749, "Glow Plug"
㉕	Fuel injectors LH	EC-748, "Fuel Injector"
㉖	Fuel pressure relief valve	EC-748, "Fuel Pressure Relief Valve"
㉗	Exhaust gas pressure sensor	EC-746, "Exhaust Gas Pressure Sensor"

EXHAUST COMPARTMENT



No.	Component parts	Function
①	Intake NOx sensor	EC-750, "Intake NOx Sensor"
②	DPF (diesel particulate filter) differential pressure sensor	EC-745, "DPF (Diesel Particulate Filter) Differential Pressure Sensor"
③	DPF (diesel particulate filter) differential pressure sensor upstream tube	
④	DPF (diesel particulate filter) differential pressure sensor downstream tube	
⑤	DOC (diesel oxidation catalyst) inlet temperature sensor	EC-745, "DPF Temperature Sensor"
⑥	DPF (diesel particulate filter) inlet temperature sensor	
⑦	DPF (diesel particulate filter) temperature sensor module	
⑧	DPF (diesel particulate filter) outlet temperature sensor	
⑨	DOC (diesel oxidation catalyst) assembly	EX-41, "Exploded View"
⑩	DPF (diesel particulate filter) assembly	
⑪	DEF (diesel exhaust fluid) dosing valve	EC-744, "DEF Dosing Valve"
⑫	SCR (selective catalyst reduction) assembly	EX-35, "Exploded View"
⑬	AOC (ammonia oxidation catalyst) assembly	
⑭	SCR (selective catalyst reduction) temperature sensor	EC-752, "SCR Temperature Sensor Module"
⑮	AOC (ammonia oxidation catalyst) temperature sensor	
⑯	Outlet NOx sensor	EC-751, "Outlet NOx Sensor"
⑰	SCR (selective catalyst reduction) temperature sensor module	EC-752, "SCR Temperature Sensor Module"

BODY COMPARTMENT



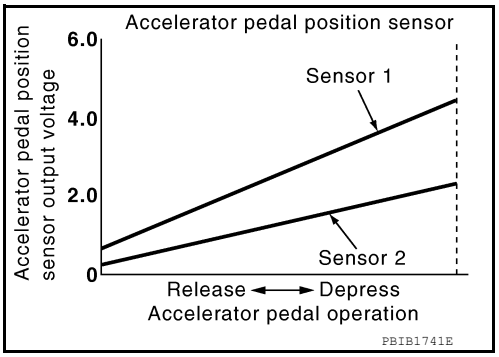
A Steering wheel
B Behind front grille
C Pedal periphery
D Transmission
E Behind fuel tank
F Left rear side under carriage

No.	Component	Function
①	Combination meter	Mainly transmits the following signals to ECM via CAN communication. • Vehicle speed • A/C ON signal • Blower fan ON signal Refer to MWI-12, "METER SYSTEM : Combination Meter" for detailed installation location.
②	BCM	Mainly transmits the following signals to ECM via CAN communication. • A/C ON signal • Blower fan ON signal Refer to BCS-79, "Removal and Installation".
③	ECM	EC-746, "ECM"
④	TCM	Mainly transmits the following signal to ECM via electrical signal. • Park/neutral signal Mainly transmits the following signal to ECM via CAN communication: • Powertrain revolution Refer to TM-17, "A/T CONTROL SYSTEM : TCM" for detailed installation location.
⑤	ASCD steering switch	EC-743, "ASCD Steering Switch"
⑥	Refrigerant pressure sensor	EC-751, "Refrigerant Pressure Sensor"
⑦	Stop lamp switch	EC-752, "Stop Lamp Switch/ASCD Cancel Switch"
⑧	Brake pedal position switch	
⑨	Accelerator pedal position switch	EC-742, "Accelerator Pedal Position Sensor"
⑩	Transmission range switch	TM-17, "A/T CONTROL SYSTEM : Transmission Range Switch"
⑪	Fuel pump	EC-748, "Fuel Pump Actuator"
⑫	Stage 1 filter assembly	FL-39, "Removal and Installation"
⑬	Water in fuel sensor	EC-753, "Water In Fuel Sensor"
⑭	DEF (diesel exhaust fluid) control module	EC-744, "DEF Control Module"
⑮	DEF (diesel exhaust fluid) dosing control module	EC-745, "DEF Supply Pump Assembly"
⑯	DEF (diesel exhaust fluid) quality sensor	EC-745, "DEF Quality Sensor"

Accelerator Pedal Position Sensor

INFOID:0000000014419870

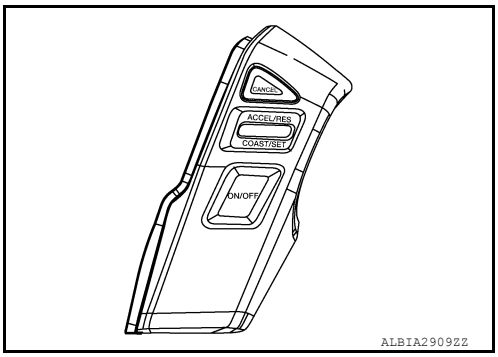
The accelerator pedal position (APP) sensor is installed on the upper end of the accelerator pedal assembly. The sensors detect the accelerator pedal position and send a signal to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.



ASCD Steering Switch

INFOID:0000000014419871

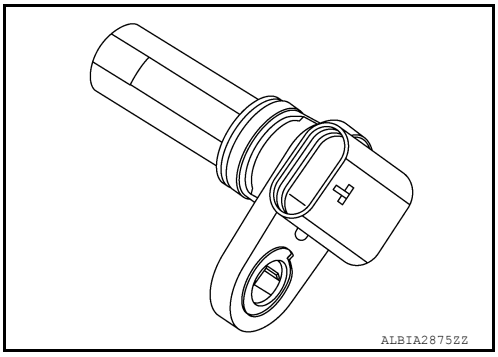
ASCD steering switch has variant values of electrical resistance for each button. ECM reads voltage variation of switch and determines which button is operated.



Camshaft Position Sensor

INFOID:0000000014419872

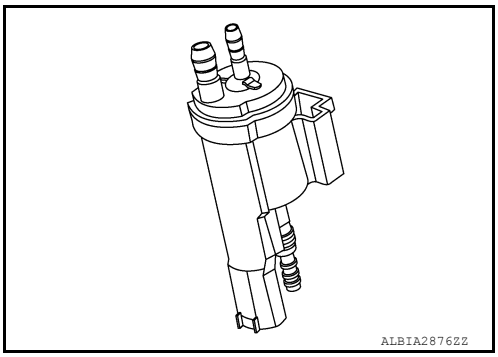
After the ECM determines top dead center of cylinder number 1 on the compression stroke at startup (using the camshaft position sensor), the ECM then relies on the crankshaft position sensor to control the timing of the injections.



Compressor Bypass Valve Solenoid

INFOID:0000000014419873

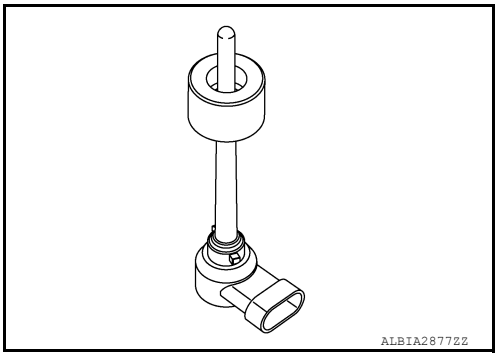
Located on the front left side of the engine. It is an ON/OFF solenoid that is controlled by the ECM. When energized by the ECM, the compressor bypass solenoid directs vacuum to the compressor bypass actuator to open the compressor bypass valve.



Coolant Level Sensor

INFOID:0000000014419874

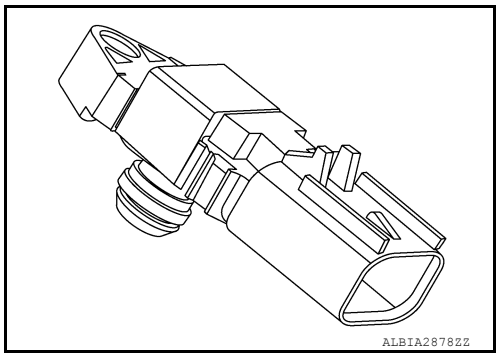
Detects that coolant level is low and transmits coolant level signal to ECM.



Crankcase Pressure Sensor

INFOID:0000000014419875

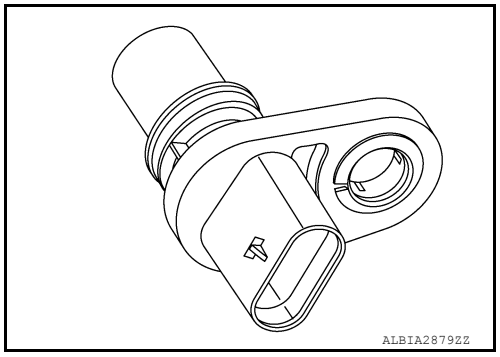
- Crankcase pressure sensor measures pressure in the crankcase, converts it to voltage signal and transmits it to ECM.



Crankshaft Position Sensor

INFOID:0000000014419876

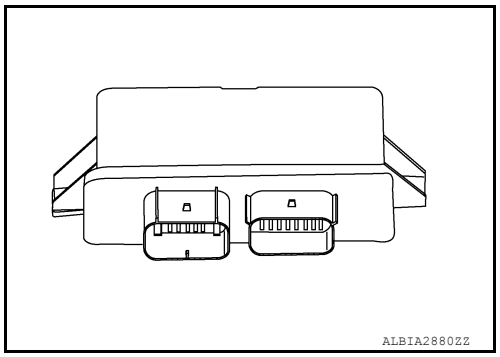
Crankshaft Position Sensor (CKP) detects engine speed and crankshaft position. The size difference of gear tooth placed on signal plate changes the gap between signal plate and sensor, and magnetic field change around the sensor induces sensor output voltage change. ECM detects engine speed and crankshaft position based on this voltage change.



DEF Control Module

INFOID:0000000014419877

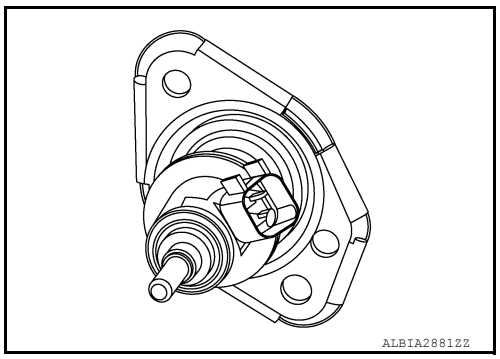
The DEF control module communicates and shares information with the ECM. Using input from the ECM and other sensors, the control module controls the operation of the DEF pump assembly, including the DEF heating systems.



DEF Dosing Valve

INFOID:0000000014419878

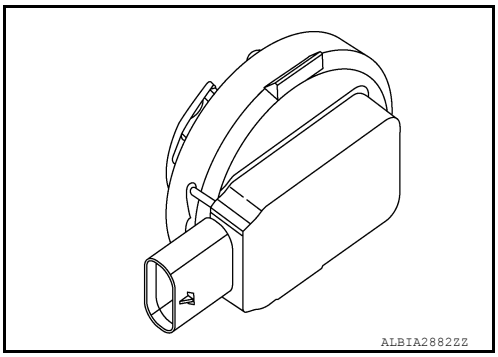
- The DEF dosing valve is located on the decomposition tube. It is a PWM valve that sprays a fine mist of DEF into the exhaust stream when commanded by the ECM. This spray of DEF is sometimes called SCR dosing because the SCR catalyst uses DEF to chemically convert NOx to nitrogen and water.



DEF Quality Sensor

INFOID:0000000014419879

- A DEF quality sensor is mounted on the side of the DEF tank. This sensor detects the urea concentration in the DEF to confirm it is acceptable for effective dosing (approximately 32.5% urea). If the DEF quality sensor detects an incorrect DEF concentration, the DEF warning lamp in the combination meter will illuminate. In some cases, the MIL may also illuminate.
- If the DEF tank is filled with anything other than DEF or has diluted DEF, the aftertreatment system will not operate correctly. A DTC will be set and engine power reductions will follow.



DEF Line Heater

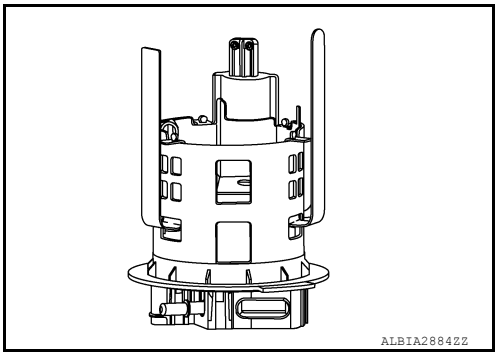
INFOID:0000000014419880

A DEF line heater is located at the end of the DEF dosing line where it meets the DEF pump. This heater is used to heat the dosing line between the DEF pump and the DEF dosing valve to prevent freezing during vehicle operation.

DEF Supply Pump Assembly

INFOID:0000000014419881

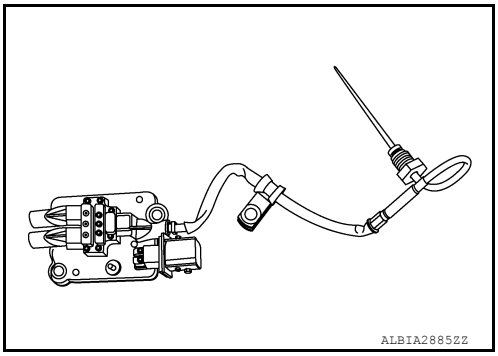
- The DEF pump assembly is mounted to the bottom of the DEF tank with most of the assembly inside the tank submerged in DEF.
- The pump assembly includes:
- DEF pump
- DEF tank heater
- DEF temperature sensor
- DEF level sensor
- DEF pressure sensor
- DEF dosing line heater



DPF Temperature Sensor

INFOID:0000000014419882

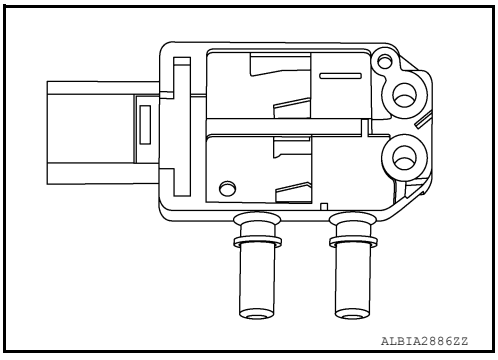
The DPF temperature sensor is located between the DOC and the DPF. This sensor measures exhaust gas temperature after it has passed through the DOC and also helps determine the amount of fuel dosing for aftertreatment thermal management.



DPF (Diesel Particulate Filter) Differential Pressure Sensor

INFOID:0000000014419883

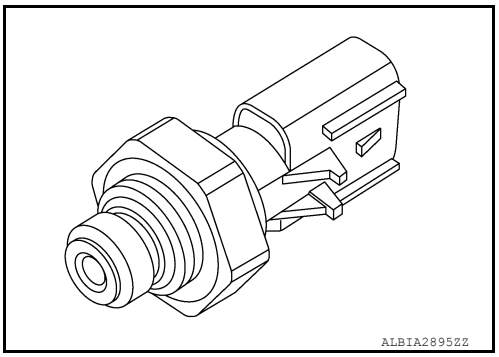
The Diesel Particulate Filter (DPF) differential pressure sensor is connected to the DPF with tubes (upstream and downstream). The DPF pressure sensor measures the difference between the exhaust pressure before and after the DPF. The DPF differential pressure sensor converts the pressure difference into a voltage signal. The ECM receives the signal and estimates the amount of particulate matter in the DPF.



Exhaust Gas Pressure Sensor

INFOID:0000000014419884

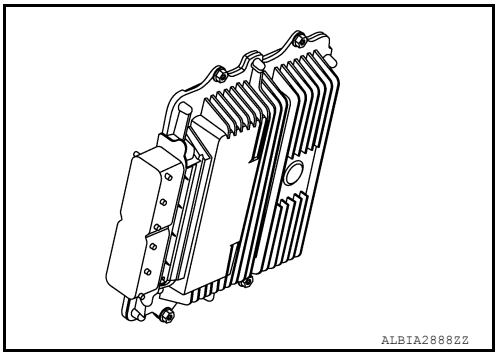
The exhaust gas pressure sensor is remotely located at the back left corner of the air intake manifold. The sensor is mounted in a tube that reads exhaust gas pressure from the left exhaust manifold. The exhaust gas pressure sensor is used as an input for rotary turbine control valve positioning during cold start and is also used to assist in thermal management for the aftertreatment system. In addition, the exhaust gas pressure sensor is used by the ECM as one of the inputs to determine the quantity of EGR flow.



ECM

INFOID:0000000014419885

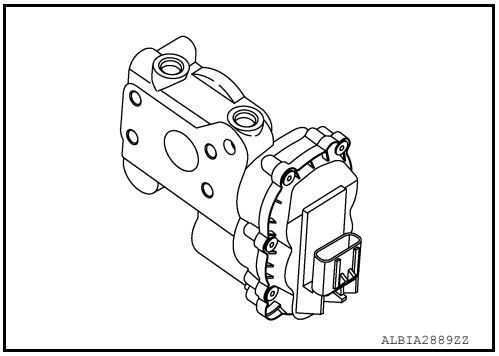
The ECM controls all aspects of engine performance, including the operation of fuel, EGR, and aftertreatment components for reducing emissions.



EGR Bypass Valve

INFOID:0000000014419886

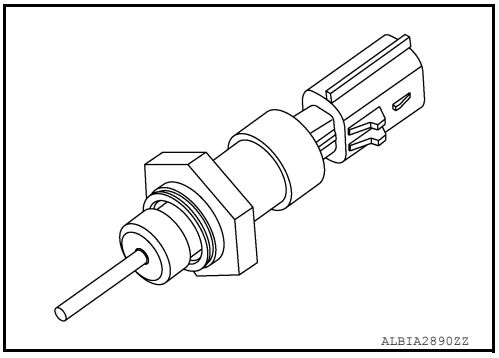
The ECM uses this valve to allow exhaust gas into the engine without going through the EGR cooler (EGR cooler bypass). Some operating conditions require EGR that does not go through the EGR cooler, such as at start up (aids in warming a cold engine) or during regeneration of the Diesel Particulate Filter (DPF),



EGR Temperature Sensor

INFOID:0000000014419887

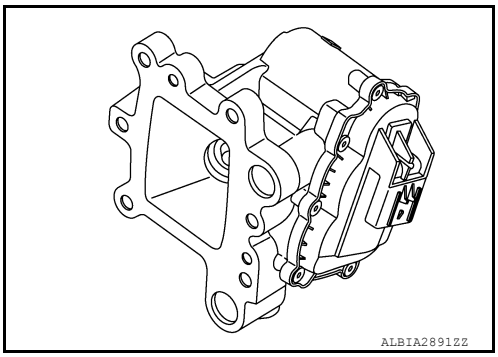
The ECM uses the EGR temperature sensor, as well as other sensors, to precisely calculate the appropriate flow and density of exhaust gas passing through either valve.



EGR Valve

INFOID:0000000014419888

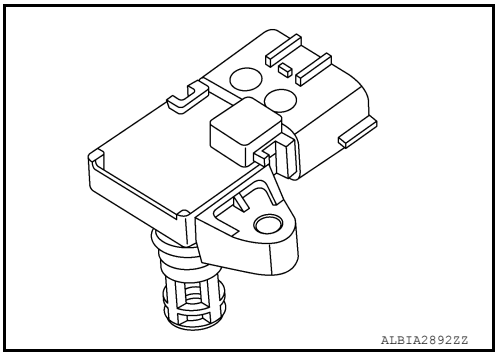
The EGR valve is used by the ECM to control the amount of exhaust gas that flows through the EGR cooler before it enters the intake. Since the engine does not always need EGR, the EGR flow may be disabled during cold ambient conditions, low speed/load, or if certain DTCs related to the EGR components are current.



Engine Charge Air Cooler Outlet Pressure/Temperature Sensor

INFOID:0000000014419889

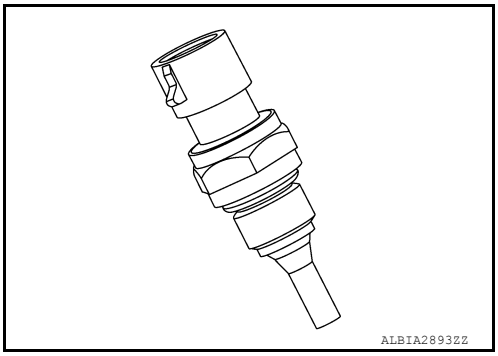
The engine charge air cooler outlet pressure/temperature sensor monitors the temperature and pressure of air in the intake air duct. The sensor information is used by the ECM to determine air filter restriction, changes in altitude, help determine air volume entering the engine and manage engine operation.



Engine Coolant Temperature Sensor

INFOID:0000000014419890

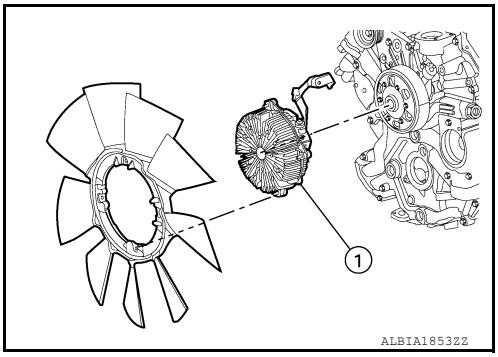
The Engine Coolant Temperature (ECT) sensor is used to detect the engine coolant temperature.



Fan Clutch Assembly

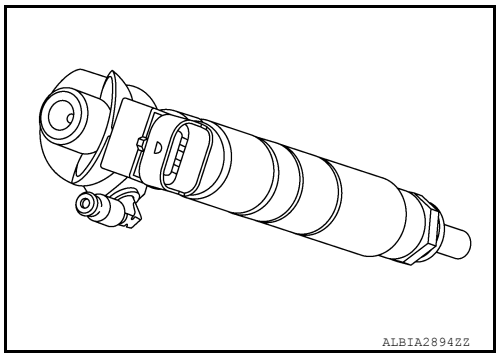
INFOID:0000000014419891

- A cooling fan clutch (1) is utilized to control cooling fan operation. This fan clutch is controlled by the ECM. The ECM monitors coolant temperature and intake manifold temperature to determine when to engage the cooling fan. There are also additional sensors monitored by the ECM for fan control (for example, air conditioner pressure and transmission temperature). The fan clutch is an electro-viscous fan clutch.



Fuel Injector

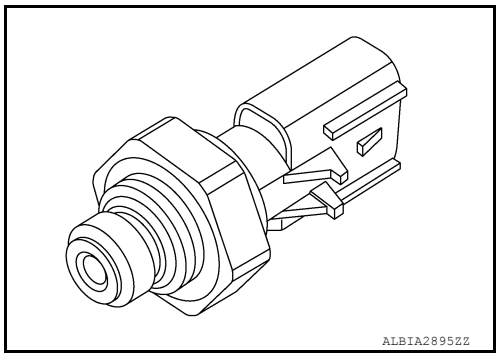
INFOID:0000000014419892



Piezoelectric injectors require electrical current, high pressure fuel, low pressure fuel, and reversed electrical current to inject fuel and close the injector after injection. Piezoelectric injectors use high and low fuel pressure within the injector and piezo crystals within a stack of ceramic discs. High pressure fuel near the top of the high pressure control chamber holds the injector needle in place until it is time to inject. When the ECM sends current through the piezo stack, the piezo crystals expand. This expansion is amplified by the hydraulic pressure of the fuel in the low pressure chamber to move the control valve. High pressure fuel in the control chamber exits to the low pressure chamber when the control valve opens. This action unseats the injector needle and fuel is injected. To close the injector, current must flow in the opposite direction (reverse polarity) to retract the piezo crystals and allow fuel pressure in the injector to seat the injector needle.

Fuel Pressure Sensor

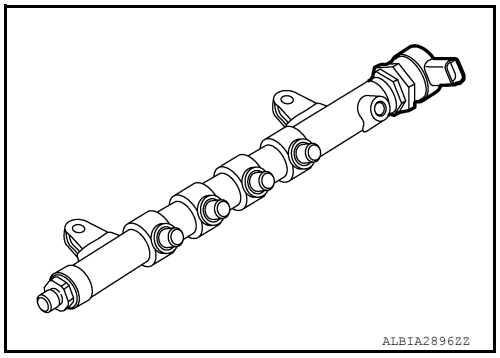
INFOID:0000000014419893



The right bank fuel rail contains a fuel rail pressure sensor that monitors the pressure provided to the fuel rails from the high-pressure fuel pump.

Fuel Pressure Relief Valve

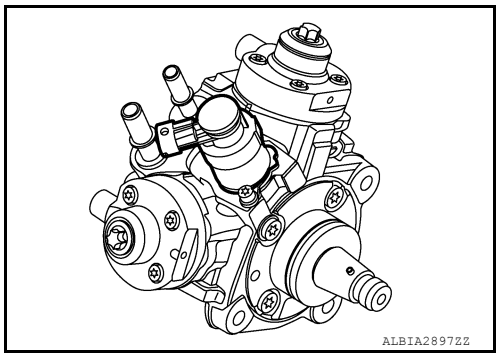
INFOID:0000000014419894



- The left bank fuel rail contains a fuel rail pressure relief valve. The fuel rail pressure relief valve is controlled by a Pulse Width Modulation (PWM) signal from the ECM. Using the fuel rail pressure relief valve to regulate the fuel pressure in the high pressure system is one of the controls the ECM uses to regulate fuel delivered (injected) into the engine. Bled off fuel from the fuel rail pressure relief valve is routed to the return manifold in the bottom of the stage 2 fuel filter. When the engine shuts down and the ignition switch is turned OFF, the fuel pressure relief valve will open, allowing the fuel pressure inside the rails to depressurize. Before opening any high pressure components, make sure to wait a minimum of 10 minutes for fuel pressure and temperature to decrease.

Fuel Pump Actuator

INFOID:0000000014419895

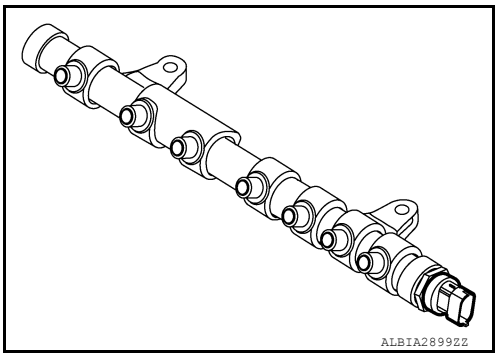


The fuel pump actuator is a normally open, Pulse-Width Modulated (PWM) valve used to control fuel volume into the high pressure fuel pump. The ECM controls operation of the fuel pump actuator and fuel pressure relief valve to regulate fuel rail volume and pressure. The fuel pump actuator and O-rings are the only serviceable components on the high pressure fuel pump.

Fuel Rail Pressure Sensor

INFOID:0000000014419896

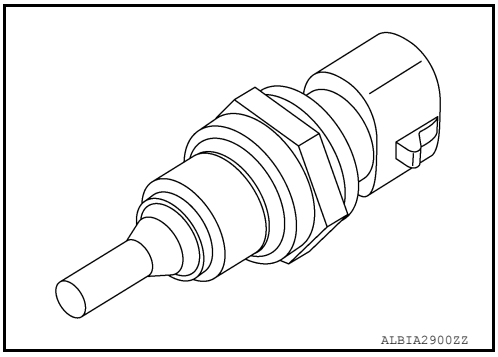
The fuel rail pressure sensor monitors the fuel pressure within the fuel rails and communicates this data to the ECM. The ECM uses fuel pressure data to adjust the PWM signal to the fuel pump actuator and fuel pressure relief valve to achieve the desired fuel pressure for optimum fuel injection.



Fuel Temperature Sensor

INFOID:0000000014419897

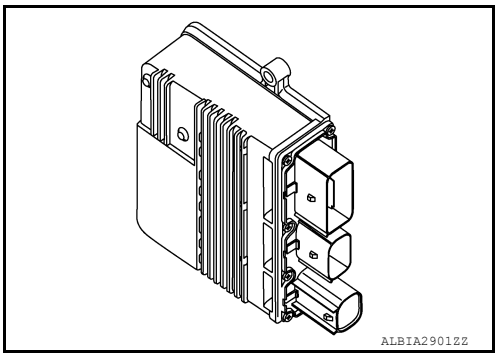
The fuel temperature sensor measures fuel temperature before it passes through the stage 2 fuel filter housing. This sensor is critical for determining if fuel temperature is within specifications. If fuel temperature is above specifications, a DTC could be set and engine power may be reduced to protect the engine.



Glow Plug Control Module

INFOID:0000000014419898

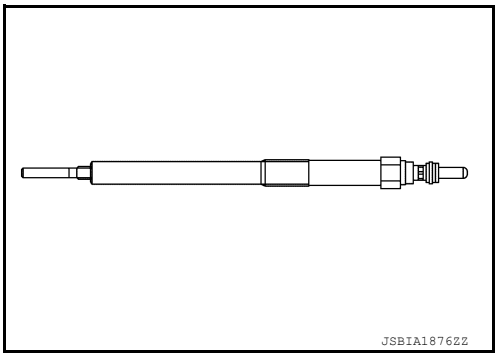
The glow plug control module receives fused power directly from the batteries. The ECM communicates with the glow plug control module over the CAN. The glow plugs are grounded through the cylinder head. The ECM calculates an average temperature based on inputs from the engine coolant temperature sensor, the air intake manifold temperature sensor, and an internal temperature sensor in the glow plug control module. After the required conditions are met, the glow plug control module sends an output to each of the eight glow plugs individually. The glow plug control module monitors the operation of individual glow plugs and reports malfunctions back to the ECM. The glow plugs begin activating with the ignition switch on during the wait-to-start sequence and will continue to operate after cranking if the ECM determines the glow plugs are needed.



Glow Plug

INFOID:0000000014419899

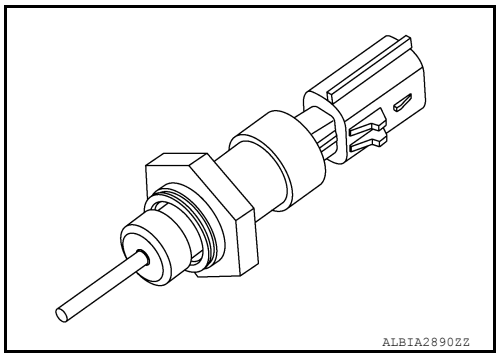
The glow plugs are threaded into the tops of the cylinder heads above each of the eight cylinders. A tapered area on the lower portion of the glow plug mates with the taper in the cylinder head to seal the glow plug opening. When energized by the glow plug control module, the glow plugs can reach temperatures over 816° C (1,500° F) within two seconds. This extra heat within the cylinder helps promote combustion of fuel when ambient temperatures are low.



Intake Manifold Temperature Sensor

INFOID:0000000014419900

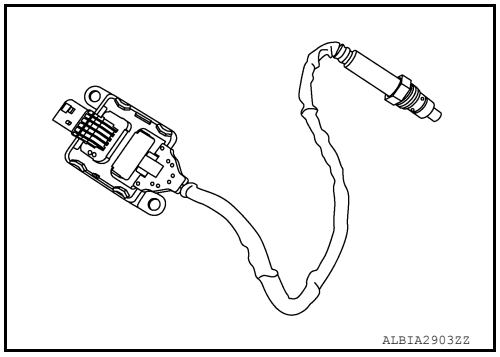
The intake manifold temperature sensor measures the temperature of the combined charge air and EGR before it enters the intake manifold. This is the last air temperature reading the ECM receives before air enters the combustion chambers.



Intake NOx Sensor

INFOID:0000000014419901

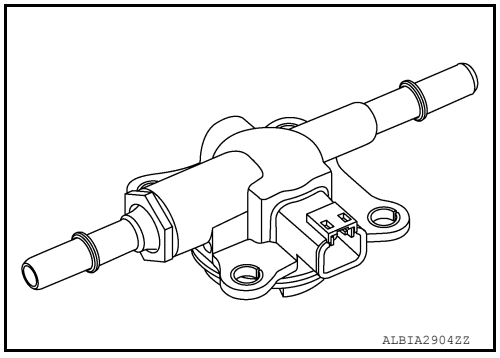
The intake NOx sensor is the first sensor mounted on the aftertreatment tubing, just in front of the DOC. This sensor measures the quantity of NOx in the exhaust gas before it enters the aftertreatment system. The intake NOx sensor includes a unique processor that is mounted externally from the sensor, and also includes a heater to bring the sensor to operating temperature quickly. The intake NOx sensor also detects the oxygen level in the exhaust.
The ECM compares the intake and outlet NOx sensor readings to determine the amount of NOx reduction that is achieved in the aftertreatment system, and to determine how much DEF to inject into the exhaust stream.



Lift Pump

INFOID:0000000014419902

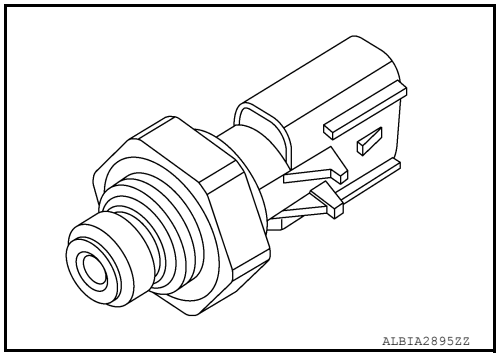
Whenever the ignition is cycled ON, the lift pump operates for approximately 1 minute to prime the fuel system. Normal lift pump supply pressure is approximately 350 to 600 kPa absolute (3.5 to 6 bar) (51 to 87 psi) with the engine cranking or running.



Low Pressure Turbocharger Boost Pressure Sensor

INFOID:0000000014419903

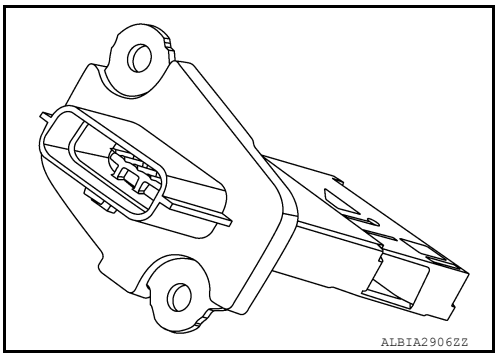
The low pressure turbocharger boost pressure sensor is located on the compressor outlet side of the low pressure turbocharger. This sensor monitors charge air pressure in the compressor outlet tubing.



Mass Air Flow Sensor

INFOID:0000000014419904

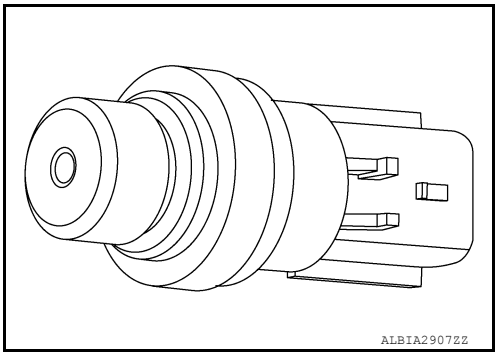
The MAF sensor is located on the intake air duct just after the air filter housing. The ECM uses data from the MAF sensor and other air intake sensors to determine the quantity of air entering the engine. In addition, the MAF sensor has a major impact on EGR calculations and Selective Catalytic Reduction (SCR) dosing.



Oil Pressure Switch

INFOID:0000000014419905

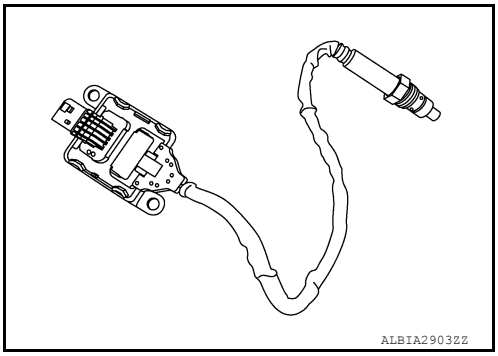
The oil pressure switch detects engine oil pressure and transmits a voltage signal to the ECM.



Outlet NOx Sensor

INFOID:0000000014419906

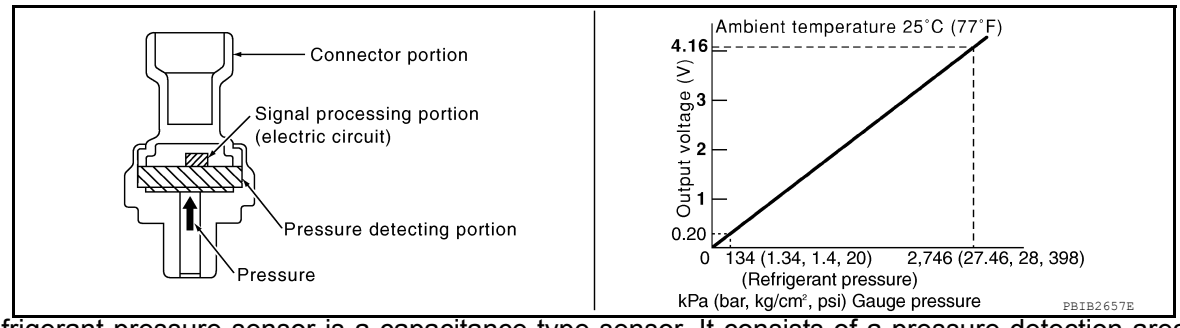
The outlet NOx sensor is located at the back of the aftertreatment system, downstream of the ASC. The outlet NOx sensor measures the NOx quantity that remains after all aftertreatment has occurred. This sensor also includes a heater to bring the sensor up to operating temperature quickly. The ECM compares the inlet and outlet NOx sensor values to determine if the aftertreatment system is efficiently removing NOx. If NOx levels remain too high at the outlet NOx sensor, the ECM may command additional EGR or additional DEF dosing to lower these levels.



Refrigerant Pressure Sensor

INFOID:0000000014419907

The refrigerant pressure sensor converts high-pressure side refrigerant pressure into voltage and outputs it to ECM. The ECM operates cooling system protection and idle speed control according to the voltage value that is inputted.



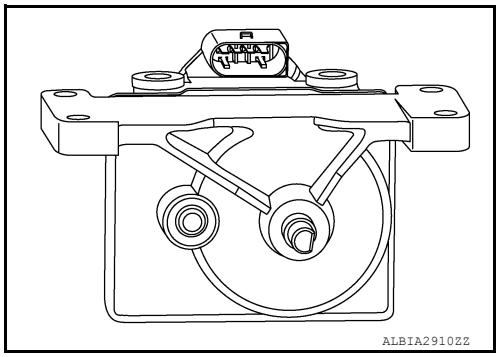
The refrigerant pressure sensor is a capacitance type sensor. It consists of a pressure detection area and a signal processing area. The pressure detection area, which is a variable capacity condenser, changes internal static capacitance according to pressure force. The signal processing area detects the static capacitance of

the pressure detection area, converts the static capacitance into a voltage value, and transmits the voltage value to the ECM.

Rotary Turbine Control Valve Actuator

INFOID:0000000014419908

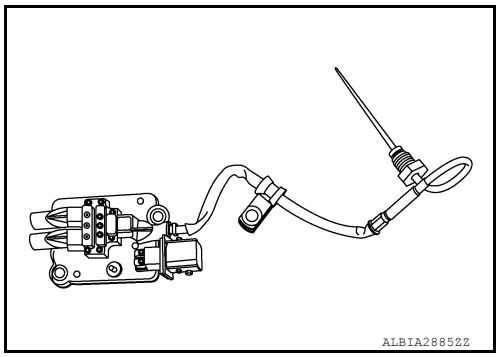
The rotary turbine control valve actuator is located at the top rear portion of the air intake manifold. The rotary turbine control valve actuator controls the position of the rotary turbine control valve based on commands from the ECM. The actuator assembly also includes a sensor that monitors the position of the rotary turbine control valve actuator. This position information is used by the ECM for control of the rotary turbine control valve.



SCR Temperature Sensor Module

INFOID:0000000014419909

- The SCR temperature sensor module is located on the SCR catalyst and consists of a module and two temperature sensor probes.
- The SCR temperature sensor module is used to measure the temperature of exhaust gas.

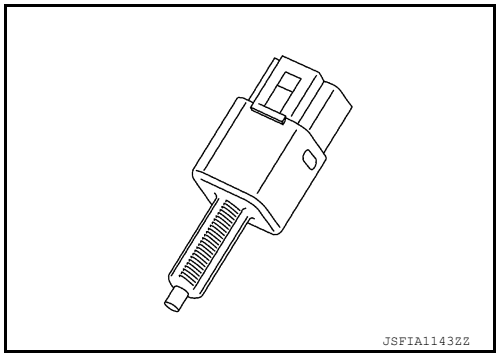


Stop Lamp Switch/ASCD Cancel Switch

INFOID:0000000014419910

STOP LAMP SWITCH

Stop lamp switch signal is sent to ECM via CAN communication line from the combination meter or BCM. This signal is used mainly to decrease the engine speed when the vehicle is driven.



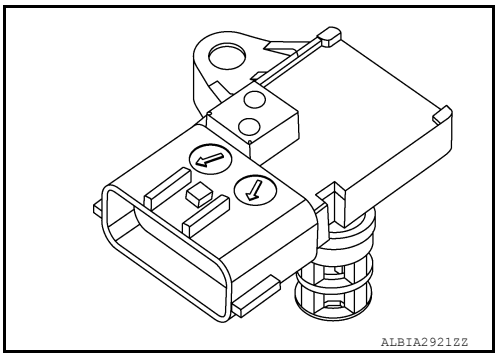
BRAKE PEDAL POSITION SWITCH

Brake pedal position switch is installed to brake pedal bracket.
ECM detects the state of the brake pedal according to the input signal sent from brake pedal position switch.

Turbocharger Compressor Intake Pressure/Temperature Sensor

INFOID:0000000014419911

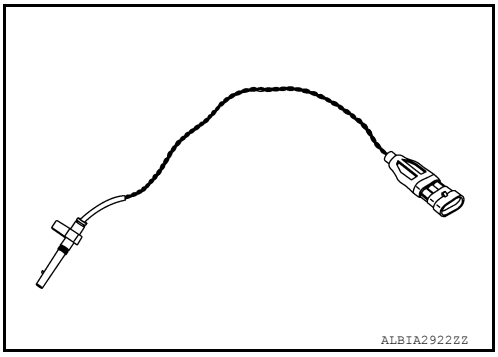
The turbocharger compressor intake pressure/temperature sensor is located on top of the air filter housing. This sensor monitors the temperature and pressure of air in the intake air duct, and can help the ECM determine air filter restriction and changes in altitude.



Turbocharger Speed Sensor

INFOID:0000000014419912

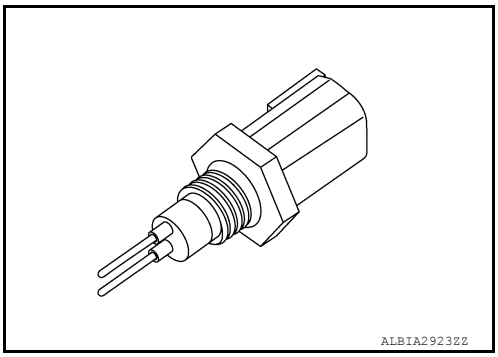
The turbocharger speed sensor is located on the top of the high pressure turbocharger compressor housing. This sensor monitors the rotational speed of the high pressure turbocharger to protect against over-speed conditions.



Water In Fuel Sensor

INFOID:0000000014419913

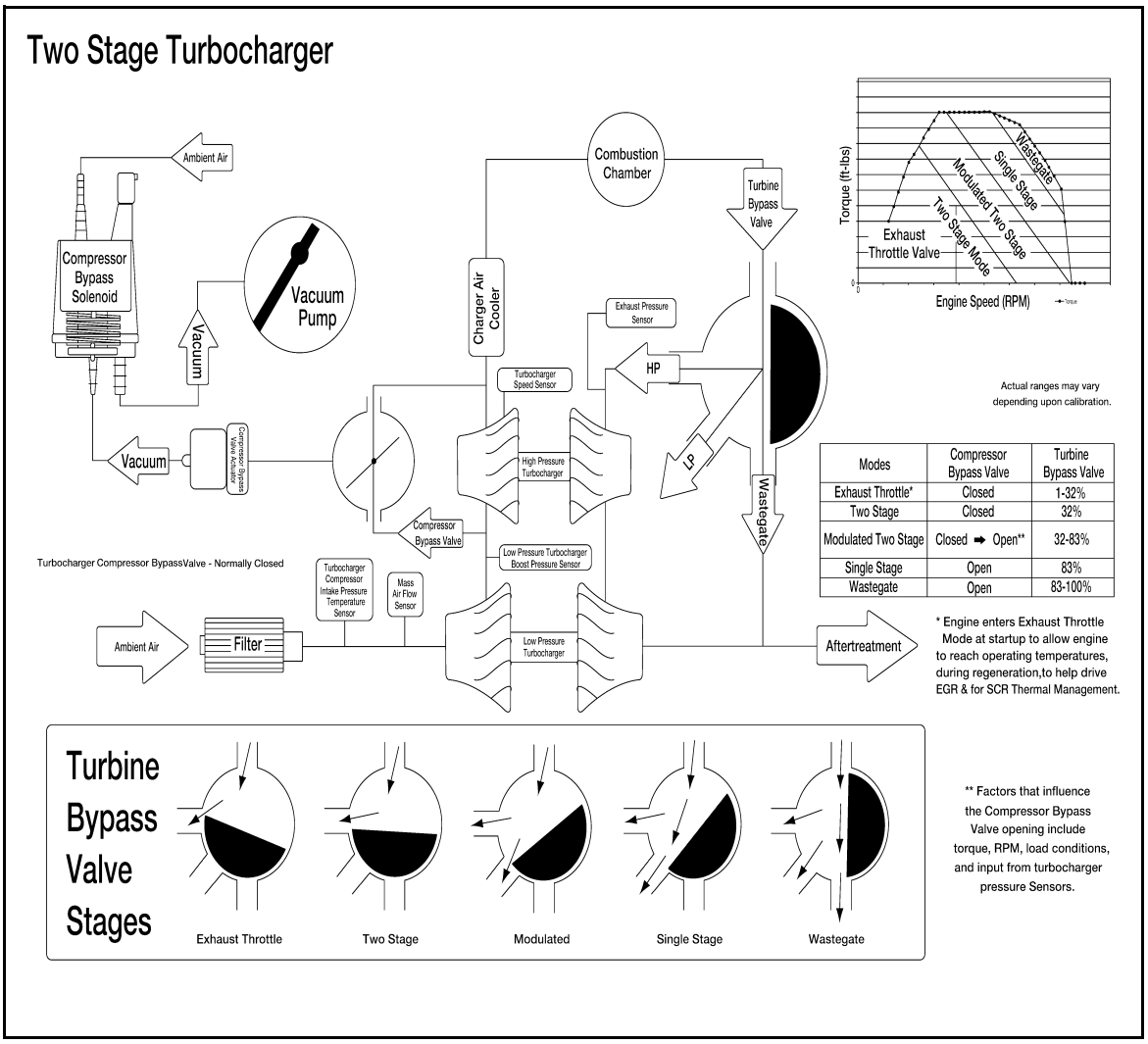
Water in Fuel (WIF) sensor detects the presence of water in the bottom of the stage 1 fuel filter housing and illuminates an icon in the combination meter.



STRUCTURE AND OPERATION
TURBOCHARGER BOOST CONTROL

TURBOCHARGER BOOST CONTROL : System Diagram

INFOID:0000000014419914



TURBOCHARGER BOOST CONTROL : System Description

INFOID:0000000014419915

DESCRIPTION

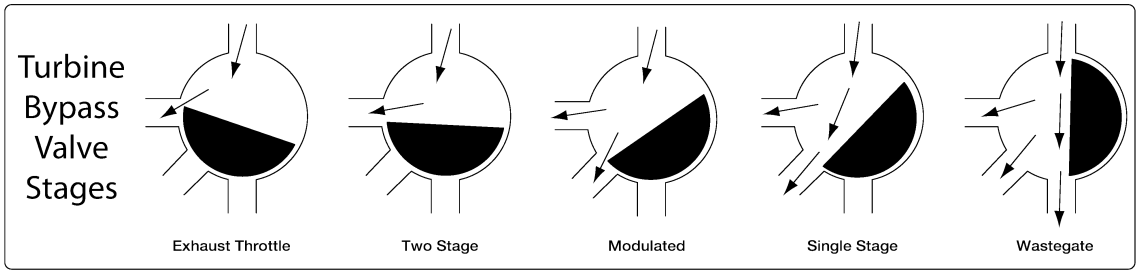
The turbocharger uses exhaust gas energy from the engine to turn the turbine wheel. The turbine wheel drives the compressor wheel through a common shaft. The impeller on the low-pressure compressor wheel in turn draws intake air through the air filter and inlet plumbing into the compressor housing of the turbocharger. The low pressure turbocharger pressurizes the air and feeds into the high-pressure turbocharger to further pressurize the intake flow. The air is then delivered to the charge-air cooler.

The turbine, compressor wheel, and shaft are supported by two rotating bearings in the bearing housing. Passages in the bearing housing direct filtered, pressurized engine oil to the shaft bearings and thrust bearings. The oil is used to lubricate and cool the rotating components. Oil then drains from the bearing housing to the engine sump through the oil drain connection. An adequate supply of good, filtered oil is very important to the life of the turbocharger.

The compressor bypass valve controls the amount of air that goes into the high-pressure turbocharger. The compressor bypass valve actuator is mounted on the compressor outlet connection, vacuum driven, and controlled by the Engine Control Module (ECM) via the compressor bypass valve solenoid.

TURBOCHARGER BOOST CONTROL OF EACH CONDITION

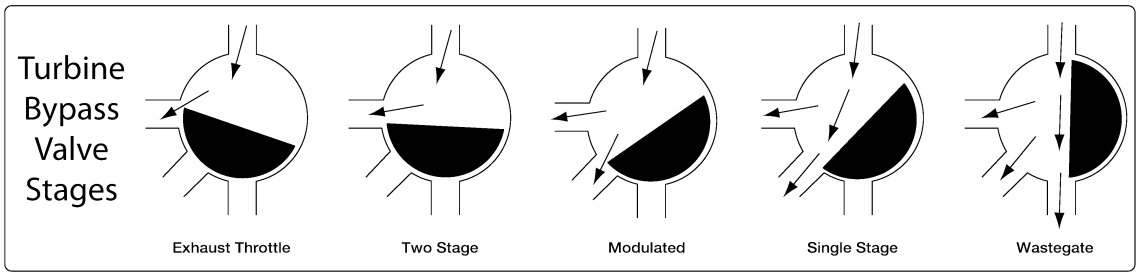
Exhaust Throttle



ALBIA2924GB

Name	Mode	Compressor bypass valve	Rotary turbine control valve
Condition	EXHAUST THROTTLE	CLOSED	1 — 32 %

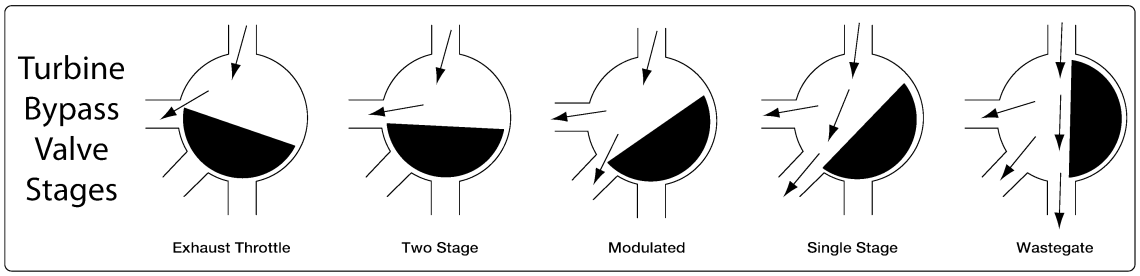
Two Stage



ALBIA2924GB

Name	Mode	Compressor bypass valve	Rotary turbine control valve
Condition	TWO STAGE	CLOSED	32 %

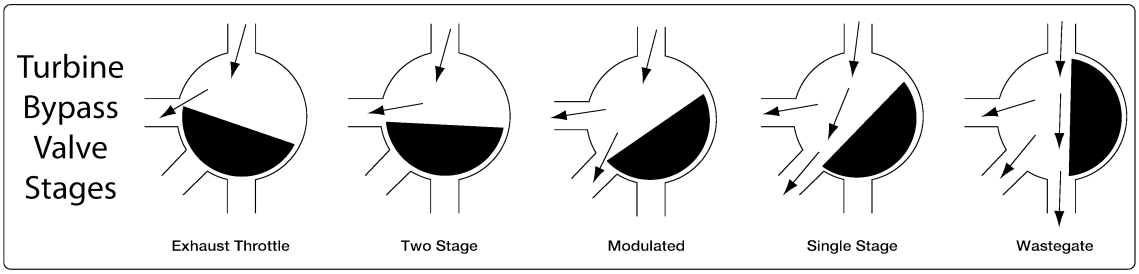
Two Stage Modulated



ALBIA2924GB

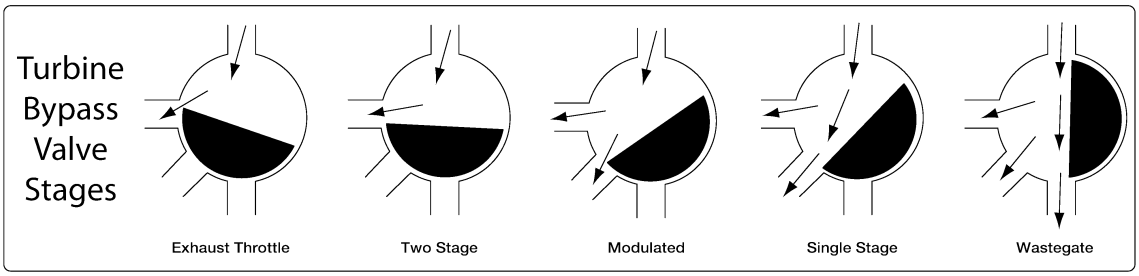
Name	Mode	Compressor bypass valve	Rotary turbine control valve
Condition	TWO STAGE MODULATED	CLOSED ⇒ OPEN	32 — 83 %

Single Stage



Name	Mode	Compressor bypass valve	Rotary turbine control valve
Condition	SINGLE STAGE	OPEN	83 %

Wastegate

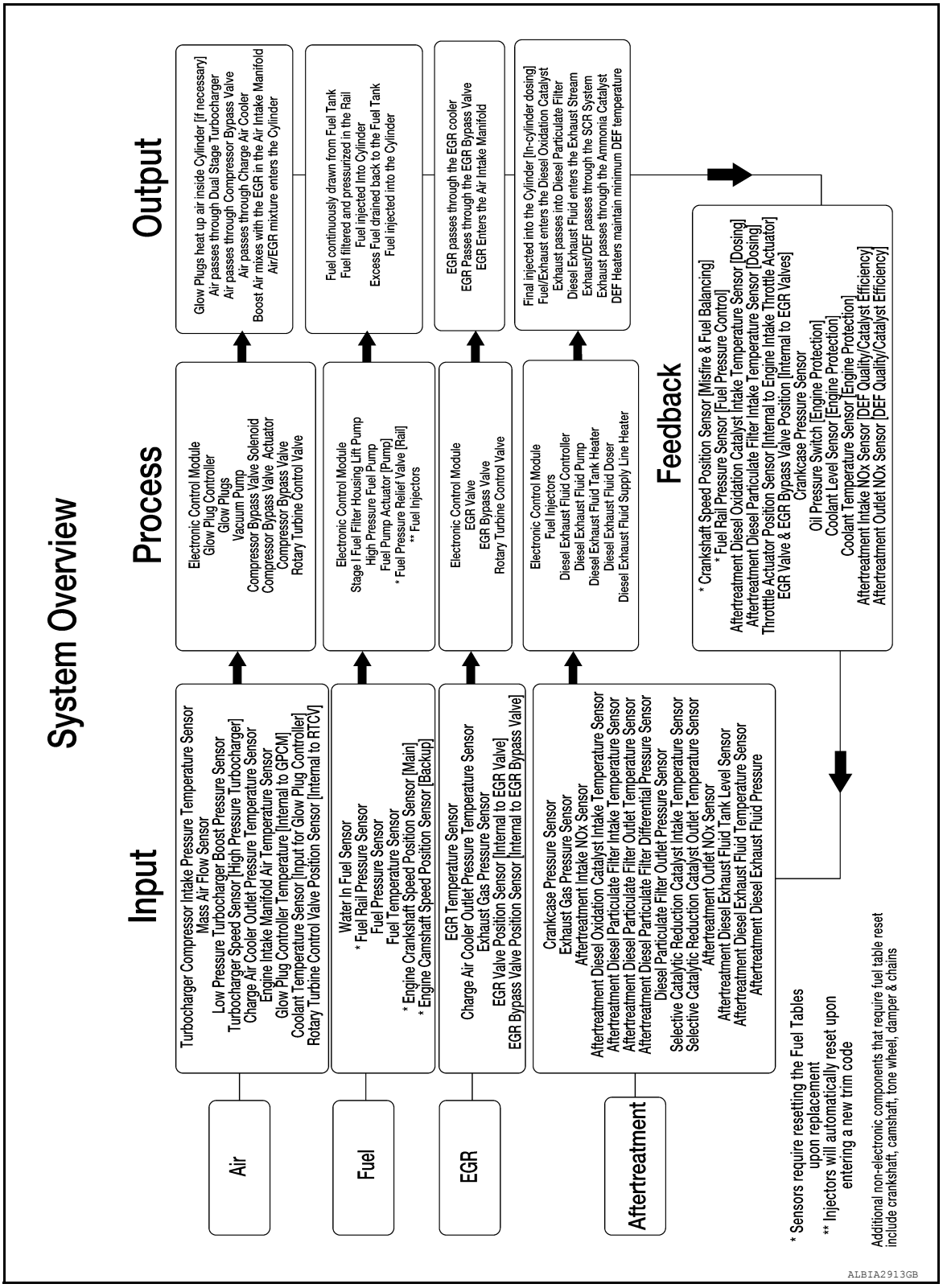


Name	Mode	Compressor bypass valve	Rotary turbine control valve
Condition	WASTEGATE	OPEN	83 — 100 %

SYSTEM
ENGINE CONTROL SYSTEM
ENGINE CONTROL SYSTEM : System Description

INFOID:0000000014419916

SYSTEM DIAGRAM



SYSTEM DESCRIPTION

The air intake system and exhaust system components work together to provide the correct amount of intake charge flow into the engine.

- Turbocharger assembly
- Turbocharger compressor bypass valve
- Charge-air cooler
- Air intake connection
- Air intake manifold
- Glow plugs
- Glow plug controller

The high-pressure and low-pressure turbochargers are serviceable as an assembly or can be replaced separately. The high-pressure turbocharger has a speed sensor mounted on its compressor housing.

The turbocharger uses exhaust gas energy from the engine to turn the turbine wheel. The turbine wheel drives the compressor wheel through a common shaft. The impeller on the low-pressure compressor wheel in turn draws intake air through the air filter and inlet plumbing into the compressor housing of the turbocharger. The low pressure turbocharger pressurizes the air and feeds into the high-pressure turbocharger to further pressurize the intake flow. The air is then delivered to the charge-air cooler.

Engine lubricating oil is used to lubricate the bearings and provide cooling for the turbochargers. The lubricating oil is supplied to the turbocharger through the supply line at engine operating pressure. The supply line feeds separately and feeds both turbochargers. A return line for the high-pressure turbocharger drains into the back of the engine block. The low-pressure turbocharger drains through its mount on the engine block.

The turbine, compressor wheel, and shaft are supported by two rotating bearings in the bearing housing. Passages in the bearing housing direct filtered, pressurized engine oil to the shaft bearings and thrust bearings. The oil is used to lubricate and cool the rotating components. Oil then drains from the bearing housing to the engine sump through the oil drain connection. An adequate supply of good, filtered oil is very important to the life of the turbocharger. Make sure a high quality oil is used and the oil and the oil filter are changed in accordance with the maintenance recommendations.

The compressor bypass valve controls the amount of air that goes into the high-pressure turbocharger. The compressor bypass valve actuator is mounted on the compressor outlet connection, vacuum driven, and controlled by the Engine Control Module (ECM) via the compressor bypass valve solenoid.

This engine uses a chassis-mounted charge-air cooler to improve engine performance. This system also uses large diameter piping to transfer the air from the engine turbocharger to the charge-air cooler, then returns the air from the charge-air cooler to the engine intake manifold. As the intake air is compressed by the turbocharger, the air temperature increases. This heated air is then passed through the charge-air cooler, which cools the air. Cool air is more dense, which allows more air to be compressed into the cylinder, yielding higher combustion efficiency. The charge-air cooler outlet pressure/temperature sensor is located first on the air intake connection. Then, the EGR mixes in from the EGR bypass valve and EGR cooler. Further upstream, the engine intake manifold air temperature sensor measures the intake charge temperature before entering the air intake manifold.

The air intake manifold separates the intake flow to feed the right and left bank cylinders. The glow plugs are threaded into the cylinder head and heat the intake charge to facilitate engine starting in cold weather.

Intake Air Flow Description

Air Cleaner

Air first flows through the air cleaner, where foreign material and debris are removed.

Air Inlet Piping and Low-Pressure Turbocharger

Air then flows through the air inlet piping to the low-pressure turbocharger compressor inlet. Air is compressed and goes to the high-pressure turbocharger for more pressure or bypasses the high-pressure turbocharger via the turbocharger compressor bypass valve. The intake charge is compressed to a level of pressure deter-

mined by the Engine Control Module (ECM). The ECM regulates the level of pressure in the intake system via the rotary turbine control valve and the turbocharger compressor bypass valve.

Charge-Air Cooler

After the air flows out of the turbocharger compressor outlet connection, it gets passed through a charge-air cooler to remove some of the heat generated by compressing the air. By lowering the temperature of the air, its density is increased. The increased density of the air allows the engine to meet emissions levels while maintaining a higher level of performance.

Air Intake Connection Adapter, Air Intake Connection, and Air Intake Manifold

From the outlet of the charge-air cooler, air flows into the air intake connection. From here, the intake air mixes with the EGR before flowing into the air intake manifold, where the EGR and fresh air mixture is distributed to the cylinders.

Fuel System Priming

NOTE:
If the starting motor is engaged for 30 or more seconds without the engine starting, the starting motor will be locked out from operating to allow for proper cooling of the starting motor. During this time, the WAIT TO START lamp, if equipped, will flash for 2 minutes. Once the lamp stops flashing, the starting motor will be allowed to function.

It is not necessary to vent air from the high pressure fuel system before starting the engine. After a filter change or running the fuel tank dry, complete the following:

- Key ON vehicle for 60 seconds to prime the fuel system. After 60 seconds, crank the engine for a maximum of 30 seconds or until the engine fires. If it does not fire, repeat this step.
- When the engine does start, it may operate erratically and with increased noise levels for a few minutes. This is a normal condition as air is being removed from the system.

EGR Valve

The Exhaust Gas Recirculation (EGR) cooler is best serviced as an assembly of the EGR cooler and the bracket.

The Exhaust Gas Recirculation (EGR) system recirculates exhaust gas to the intake manifold. This system makes a major contribution to the reduction of diesel engine NOx emissions. A gas-coolant liquid exchanger cools the EGR gas flow.

Aftertreatment Diesel Particulate Filter

The aftertreatment Diesel Particulate Filter (DPF) differential pressure sensor tubes connect the aftertreatment DPF differential pressure sensor to the ports on the aftertreatment system. There are two aftertreatment DPF differential pressure sensor tubes. One tube connects to the aftertreatment system upstream of the aftertreatment DPF and the other connects downstream of the aftertreatment DPF.

To make sure of proper function of the drain holes and condensate drainage in the pressure sensor and related tubing, the DPF device must be mounted such that the tubes integral to the pressure sensor are oriented downward. Horizontally-mounted devices must be installed such that the axis of the housing and the pressure sensor are within ±10° of vertical.

ENGINE CONTROL SYSTEM : Fail safe

INFOID:0000000014419917

DTC RELATED ITEM

DTC No.	Detected condition	Action taken when DTC is CRNT
U0106 U0307 U0407	ECM communication with glow plug control module (CAN2).	Glow plug operation disabled.
P0383	Glow plug control module supply voltage less than 6V.	
P0384	Glow plug control module supply voltage greater than 16V.	
P064C	Glow plug control module internal error.	
P06E5		
P263E	Glow plug control module internal temperature greater than 125° C (257° F).	
U010E U11C1	ECM communication with DEF control module (CAN2).	• DEF fluid injection disabled. • Engine torque reduced. • Vehicle speed limited to 8 km/h (5 mph).
U029D	ECM communication with intake NOx sensor (CAN2).	
P1C54	ECM detects NOx conversion efficiency of intake NOx sensor critically low.	
P2048	ECM detects DEF dosing valve circuit open, short high or short low.	
P20B7	ECM detects DEF dosing heater temperature not rising when commanded ON.	
P2201	ECM detects intake NOx sensor not reading 0 while in motoring (non fueling) condition.	
U029E	ECM communication with outlet NOx sensor (CAN2).	• Engine torque reduced. • Vehicle speed limited to 8 km/h (5 mph).
P1C70	ECM detects engine operated for extended period with critical faults.	
P203F	DEF tank level critically low.	
P20E8	• DEF supply pump assembly unable to successfully prime. • DEF control unit detects DEF supply pressure does not reach 460 kPa during priming, or less than 400 kPa during dosing.	
P20E9	DEF control unit detects diesel exhaust fluid pressure greater than 600 kPa (87 psi).	
P2BA7	DEF tank level critically low.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U02A2	ECM communication with DEF quality sensor (CAN2).	Engine torque reduced.
P0087	ECM detects measured fuel rail pressure below commanded fuel rail pressure by at least 200 bar (2,900 psi).	
P0088	ECM detects fuel rail pressure greater than commanded fuel rail pressure by 200 bar (2,900 psi) or fuel rail pressure exceeded 2150 bar (31,183 psi).	
P0184	Difference between fuel temperature and ambient temperature is greater than 15°C (59° F) or 25° C (77° F).	
P0252	ECM detects fuel pump actuator overheated.	
P0344	ECM detects crankshaft position does not match camshaft position.	
P0524	ECM detects engine oil pressure less than 60 kPa.	
P061A	Fueling commands inconsistent with engine running conditions.	
P061B		
P1451	ECM detects soot load of diesel particulate filter reached first stage plugging.	
P203B	DEF control module detects DEF tank level sensor signal circuit less than 0.3V.	
P203C		
P203D	DEF control module detects DEF tank level sensor signal circuit greater than 4.8V.	
P205C	DEF control module detects DEF tank temperature sensor signal circuit less than 0.17V.	
P205D		
P206B	DEF quality sensor reports an internal error.	
P21C4	ECM detects DEF fluid line heater relay driver signal short to voltage.	
P229E	Internal circuit error detected in outlet NOx sensor.	
P2413	ECM detects EGR temperature greater than 250° C (482° F).	
P2BAC	ECM detects critical DTCs related to engine operation are CRNT and engine continues to operate.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U040D	ECM communication with rotary turbine control valve actuator (CAN2).	• Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P009E	ECM detects fuel pressure relief valve closed-loop compensation value outside calibrated limits.	
P00AF	Rotary turbine control valve actuator detects internal error.	
P009E	ECM detects fuel pressure relief valve closed-loop compensation value outside calibrated limits.	
P00AF	Rotary turbine control valve actuator detects internal error.	
P0107	ECM detects charge air cooler outlet pressure signal voltage less than 0.2V.	
P0108	ECM detects charge air cooler outlet pressure signal voltage greater than 4.8V.	
P0237	ECM detects low pressure turbocharger boost pressure sensor signal voltage less than 0.2V.	
P0238	ECM detects low pressure turbocharger boost pressure sensor signal voltage greater than 4.8V.	
P0405	ECM detects EGR valve position signal voltage less than 0.3 V.	
P0406	ECM detects EGR valve position signal voltage greater than 4.7V.	
P046C	ECM detects EGR valve unable to reach commanded position.	
P0489	ECM detects low voltage on EGR valve.	
P0490	ECM detects high voltage on EGR valve.	
P1A62	Turbocharger failed to detect endpoint or stop references.	
P200C	DPF temperature sensor module temperature reading greater than 810° C (1,490° F).	
P2262	Rotary turbine control valve actuator could not meet commanded position.	
P226C	ECM detects difference between actual and commanded turbocharger position is too large.	
P22CB	ECM detects compressor bypass solenoid circuit shorted low.	
P22CC	ECM detects compressor bypass solenoid circuit open or shorted high.	
P242F	ECM detects soot load of DPF filter exceeds maximum.	
P244A	ECM detects DPF differential pressure too low.	
P245C	ECM detects EGR bypass valve circuit short to ground.	
P245D	ECM detects EGR bypass valve circuit short to voltage.	
P2493	ECM detects EGR bypass valve stuck.	
P2494	ECM detects EGR bypass valve position signal voltage less than 0.3V.	
P2495	ECM detects EGR bypass valve position signal voltage greater than 4.7V.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U040F	DEF control module communication with ECM (CAN2).	• DEF fluid injection disabled. • Engine torque reduced.
U3017	ECM communication with SCR temperature sensor module (CAN2).	
P1624	DPF temperature sensor module reports an internal error.	
P1625	DPF temperature sensor module supply voltage greater than 18V.	
P1626	DPF temperature sensor module supply less than 6.5V.	
P1627	DPF temperature sensor module internal temperature greater than 150° C (302° F).	
P1628	ECM detects SCR temperature sensor module intermittent supply voltage resulting in internal module reset.	
P202E	ECM detects DEF dosing valve stuck.	
P204A	DEF dosing valve unable to maintain commanded pressure.	
P204C	ECM detects DPF differential pressure sensor signal voltage less than 0.5V.	
P204D	ECM detects DPF differential pressure sensor signal voltage greater than 4.5V.	
P207F	• DEF quality sensor detects DEF concentration below critical threshold. • DEF quality sensor unable to determine DEF concentration.	
P208A	DEF control module detects an open circuit in DEF dosing pump motor phases.	
P208C	DEF control module detects DEF dosing pump motor circuit short to ground.	
P208D	DEF control module detects DEF dosing pump motor circuit short to voltage.	
P20FF	ECM detects and internal error in DEF control module via CAN2.	
P214C	ECM detects SCR temperature sensor module above critical threshold.	
P21CA	DEF control module supply voltage greater than 5.1V or less than 4.8V.	
P2202	Internal circuit error detected in intake NOx sensor.	
P2454	ECM detects DPF sensor differential pressure signal voltage less than 0.25V.	
P2455	ECM detects DPF sensor differential pressure signal voltage greater than 4.7V.	
P2456	ECM detects DPF outlet pressure greater than 1.5 kPa (0.22 psi) or less than 1.5 kPa (0.22 psi).	
P2470	SCR temperature sensor module signal out of range low.	
P2471	SCR temperature sensor module signal out of range high.	
P2472	ECM detects SCR temperature sensor module signal irrational.	
P2481	SCR temperature sensor module short to ground.	
P2482	SCR temperature sensor module open or short to voltage.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U1611	ECM communication with DPF temperature sensor module (CAN2).	• Active and stationary regeneration of diesel particulate filter disabled. • Engine torque reduced.
P1484	DPF temperature sensor module reading greater than 650° C (1,202° F).	
P1613	DPF temperature sensor module internal error.	
P1614	DPF temperature sensor module supply voltage greater than 18V.	
P1615	DPF temperature sensor module supply voltage less than 6.5V.	
P1616	DPF temperature sensor module internal temperature greater than 150° C (302° F).	
P1623	ECM detects DPF temperature sensor module intermittent supply voltage resulting in internal module reset.	
P200E	DPF temperature sensor module temperature greater than 735° C (1,355° F).	
P244D	DPF outlet temperature sensor greater than 650° C (1,202° F).	
P0046	Rotary turbine control valve actuator communication with ECM.	• DEF fluid injection disabled. • EGR valve operation disabled. • Engine torque reduced.
P0102	ECM detects MAF sensor signal short to ground.	
P0049	• ECM detects turbocharger speed greater than 330k rpm for more than 5 seconds. • Engine derated due to turbocharger speed above normal operating range for 10 seconds.	• ECM estimates turbocharger speed. • Engine torque reduced.
P007C	ECM detects engine charge air cooler outlet temperature signal voltage low.	ECM uses default value for intake manifold temperature.
P007D	ECM detects engine charge air cooler outlet temperature signal voltage greater than 4.7V.	
P00C6	ECM detects fuel rail pressure less than 120 bar (1,740 psi) while cranking.	Engine may not start.
P0604	ECM detects software or calibration error.	
P0605		
P060A		
P060B		
P06B8		
P0606	ECM detects read/write error.	
P0103	ECM detects MAF sensor signal short to voltage.	• Active and stationary regeneration of diesel particulate filter disabled. • DEF fluid injection disabled. • EGR valve operation disabled. • Engine torque reduced.
P0106	ECM detects intake manifold pressure sensor reading higher or lower than expected.	
P040B	ECM detects EGR temperature too high or too low, or temperature did not rise 0.5° C (33° F) at start up.	
P0111	ECM detects intake manifold temperature sensor reading higher or lower than other temperature sensors.	• EGR valve operation disabled. • ECM uses default value for intake manifold temperature. • Engine torque reduced.
P0112	ECM detects intake manifold temperature sensor signal voltage less than 0.06V.	• EGR valve operation disabled. • Active and stationary regeneration of diesel particulate filter disabled. • ECM uses default value for intake manifold temperature. • Engine torque reduced.
P0113	ECM detects intake manifold temperature sensor signal voltage greater than 4.7V.	

DTC No.	Detected condition	Action taken when DTC is CRNT
P0116	ECM detects coolant temperature sensor reading higher or lower than other temperature sensors.	ECM uses default value for coolant temperature.
P0117	ECM detects coolant temperature sensor signal voltage less than 0.108V.	
P0118	ECM detects coolant temperature sensor signal voltage greater than 4.95V.	
P0127	ECM detects intake manifold temperature greater than 120° C (248° F) or 132° C (270° F) for longer than 5 seconds.	Maximum engine operating speed decreased.
P012B	ECM detects barometric pressure reading higher or lower than other temperature sensors.	ECM uses default value for barometric pressure.
P0182	ECM detects fuel temperature sensor signal voltage less than 0.108V.	ECM uses default value for fuel temperature.
P0183	ECM detects fuel temperature sensor signal voltage greater than 4.97V.	
P0191	ECM detects fuel rail pressure sensor signal voltage greater than 0.6V (ignition ON) or less than 0.4V (ignition OFF).	• EGR valve operation disabled. • Engine torque reduced.
P0217	ECM detects engine coolant temperature above threshold and closes EGR valve to reduce temperature.	
P2457	ECM detects EGR temperature greater than 260° C (500° F).	
P2560	ECM detects coolant level sensor signal voltage greater than 3V.	
P0192	ECM detects fuel rail pressure sensor signal voltage less than 0.2V.	ECM uses default value for fuel rail pressure.
P0193	ECM detects fuel rail pressure sensor signal voltage greater than 4.8V.	
P0201	ECM detects open in fuel injector no. 1 harness or injector.	• Fuel injector disabled. • Engine torque reduced.
P0202	ECM detects open in fuel injector no. 2 harness or injector.	
P0203	ECM detects open in fuel injector no. 3 harness or injector.	
P0204	ECM detects open in fuel injector no. 4 harness or injector.	
P0205	ECM detects open in fuel injector no. 5 harness or injector.	
P0206	ECM detects open in fuel injector no. 6 harness or injector.	
P0207	ECM detects open in fuel injector no. 7 harness or injector.	
P0208	ECM detects open in fuel injector no. 8 harness or injector.	
P0262	ECM detects fuel injector no. 1 short to voltage or low injector solenoid resistance.	
P0265	ECM detects fuel injector no. 2 short to voltage or low injector solenoid resistance.	
P0268	ECM detects fuel injector no. 3 short to voltage or low injector solenoid resistance.	
P0271	ECM detects fuel injector no. 4 short to voltage or low injector solenoid resistance.	
P0274	ECM detects fuel injector no. 5 short to voltage or low injector solenoid resistance.	
P0277	ECM detects fuel injector no. 6 short to voltage or low injector solenoid resistance.	
P0280	ECM detects fuel injector no. 7 short to voltage or low injector solenoid resistance.	
P0283	ECM detects fuel injector no. 8 short to voltage or low injector solenoid resistance.	

DTC No.	Detected condition	Action taken when DTC is CRNT
P0219	ECM detects engine speed exceeded 4,600 rpm.	Fueling to engine stops until engine speed drops to normal operating speeds
P0253	ECM detects fuel pump actuator signal voltage less than 2.7V.	• Sensed fuel rail pressure does not match commanded fuel rail pressure. • Engine torque reduced.
P0254	ECM detects fuel pump actuator signal open, short to voltage or short pin to pin.	
P0335	ECM detects loss of crankshaft position sensor signal.	ECM uses backup engine speed sensor for engine speed signal.
P0698	ECM detects crankshaft position sensor signal voltage less than 4.8V.	
P0699	ECM detects crankshaft position sensor signal voltage greater than 5.4V.	
P040C	ECM detects EGR temperature sensor signal voltage less than 0.05V.	• ECM uses default value for EGR temperature. • Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P040D	ECM detects EGR temperature sensor signal voltage greater than 4.9V.	
P0471	• ECM detects exhaust gas pressure higher or lower than other absolute pressure sensors. • ECM detects exhaust gas pressure higher or lower than expected during normal engine operation.	• ECM uses default value for exhaust gas pressure sensor. • EGR valve operation disabled. • Engine torque reduced.
P0472	ECM detects exhaust gas pressure sensor signal voltage less than 0.25V.	• ECM uses default value for exhaust gas pressure sensor. • Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P0473	ECM detects exhaust gas pressure sensor signal voltage greater than 4.75V.	
P051C	ECM detects crankcase pressure sensor signal voltage less than 0.25V.	ECM uses default value for crankcase pressure.
P051D	ECM detects crankcase pressure sensor signal voltage greater than 4.7V.	
P0544	ECM detects difference between intake NOx sensor and DPF temperature sensor module data.	• ECM uses default value for intake NOx sensor. • DEF fluid injection disabled. • Engine torque reduced.
P2031	ECM detects difference between intake NOx sensor and outlet NOx sensor data.	
P0545	DPF temperature sensor module detects a sensor short to ground.	• ECM uses default value for intake NOx sensor. • DEF fluid injection disabled. • Active and stationary regeneration of diesel particulate filter disabled. • Engine torque reduced.
P0546	DPF temperature sensor module detects a sensor open or short to voltage.	
P2032	DPF temperature sensor module detects a sensor short to ground.	
P2033	DPF temperature sensor module detects a sensor open or short to voltage.	
P062C	ECM detects vehicle speed is greater than 5 mph (8 km/h) over targeted cruise speed.	Cruise control temporarily inhibited.
P0653	ECM detects sensor supply signal voltage greater than 5.3V.	ECM uses default value for the following components: • Camshaft position sensor • Fuel rail pressure sensor • Exhaust gas pressure sensor • Low pressure turbocharger boost pressure sensor • Engine charge air cooler outlet pressure/temperature sensor • Turbocharger compressor intake pressure/temperature sensor • EGR valve • EGR bypass valve • Crankcase pressure sensor • Turbocharger speed sensor • Fuel pressure sensor

DTC No.	Detected condition	Action taken when DTC is CRNT
P0691	ECM detects fan control circuit PWM signal not at system voltage when signal commanded ON.	Fan operation disabled.
P0692	ECM detects fan control circuit PWM signal voltage greater than 0 V when signal commanded OFF.	
P06A4	ECM detects APP sensor 1 supply voltage less than 4.7V.	Engine will only idle.
P06A5	ECM detects APP sensor 1 supply voltage greater than 5.3V.	
P06D3	ECM detects APP sensor 2 supply voltage less than 4.7V.	Engine will have limp home throttle control only.
P06D4	ECM detects APP sensor 2 supply voltage greater than 5.3V.	
P2121	ECM detects values between APP sensor 1 and APP sensor 2 differ by greater than 10%.	
P2299	ECM detects accelerator pedal and brake pedal were depressed simultaneously.	
P1191	ECM detects turbocharger compressor intake temperature sensor reading higher or lower than other temperature sensors, or sensor reading erratic.	• ECM uses default value for turbocharger compressor intake temperature sensor. • Engine torque reduced.
P1192	ECM detects turbocharger compressor intake temperature sensor signal voltage less than 0.1V.	ECM uses default value for turbocharger compressor intake temperature sensor.
P1193	ECM detects turbocharger compressor intake temperature sensor signal voltage greater than 4.7V.	
P1484	ECM detects DPF temperature sensor module greater than 800° C (1472° F), or temperature differential greater than 540° C (1,004° F).	• Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled.
P1A77	ECM shuts down engine due to critical aftertreatment temperature faults.	Engine shuts down after a short period of time.
P202B	DEF control module detects open or short to ground on DEF tank heater circuit.	• Diesel exhaust fluid tank heating disabled. • Engine torque reduced.
P202C	DEF control module detects short to voltage on DEF tank heater circuit.	
P2044	ECM detects DEF tank temperature signal voltage out of range high.	DEF fluid injection disabled.
P2045	ECM detects DEF tank temperature signal voltage out of range low.	
P214D	ECM detects temperature at SCR temperature sensor module above 800° C (1,472° F).	
P21CB	DEF control module detects supply voltage less than 9V.	
P21CC	DEF control module detects supply voltage greater than 16V.	
P2080	ECM detects temperature at intake NOx sensor greater than critical limit.	• ECM uses default value for intake NOx sensor. • Active and stationary regeneration of diesel particulate filter disabled.
P20B9	DEF control module detects DEF line heater open circuit.	• DEF line heater disabled. • Engine torque reduced.
P20BC	DEF control module detects DEF line heater circuit short to voltage.	
P20BB	DEF control module detects DEF line heater circuit short to ground.	• DEF line heater disabled. • DEF fluid injection disabled. • Engine torque reduced.
P2146	ECM detects injector group 1 (fuel injector no. 1, 4, 6 and 7) short to voltage or low injector solenoid resistance.	Fuel injectors disabled.
P2149	ECM detects injector group 2 (fuel injector no. 2, 3, 5 and 8) short to voltage or low injector solenoid resistance.	

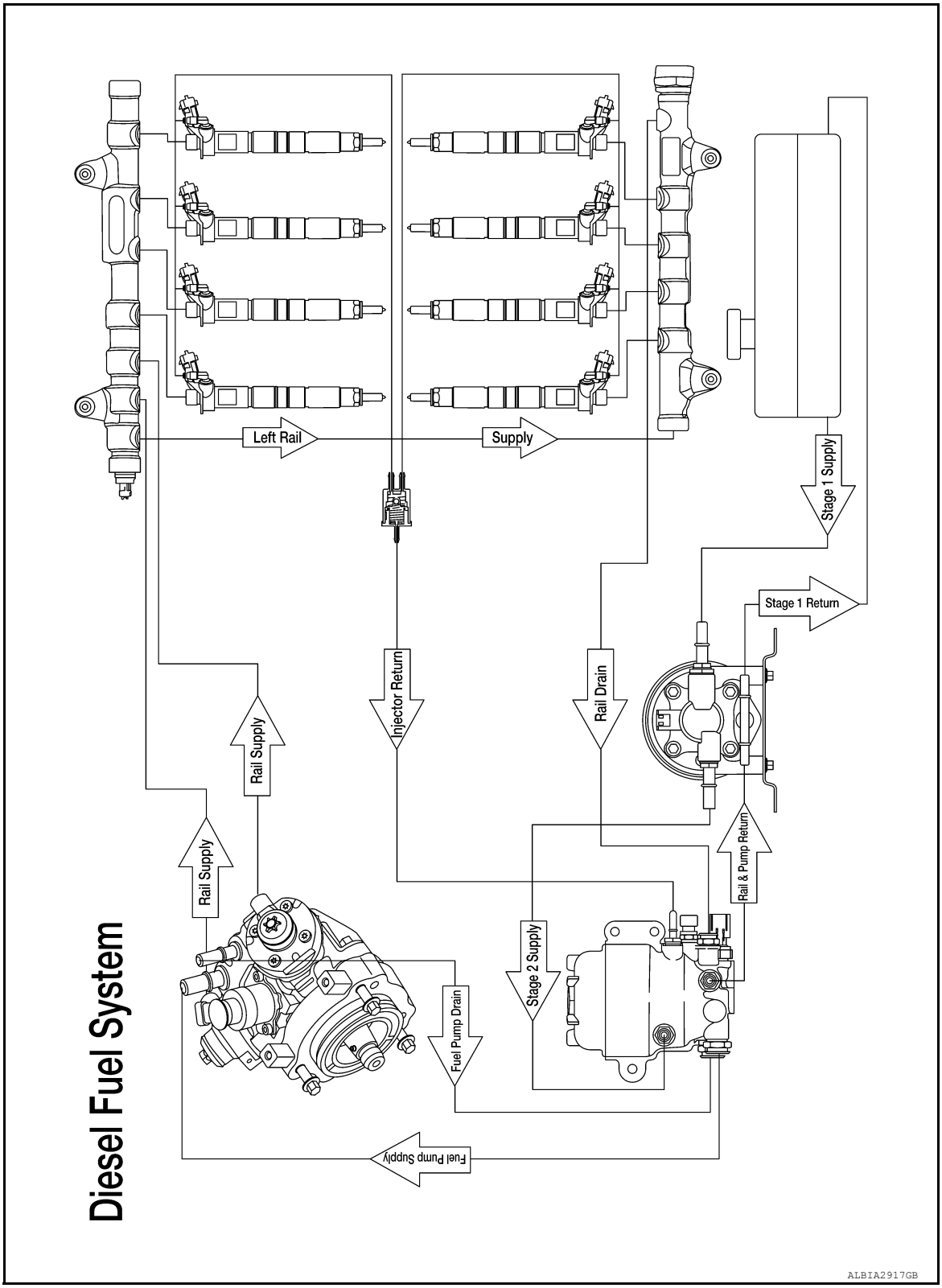
DTC No.	Detected condition	Action taken when DTC is CRNT
P214A	ECM detects SCR temperature sensor module above critical threshold.	• Engine torque reduced. • Engine will be shut down if Engine Protection Shutdown is enabled.
P214B	ECM detects SCR temperature above 700° C (1,292° F).	Engine will be shut down if Engine Protection Shutdown is enabled.
P242B	ECM detects DPF outlet temperature sensor reading did not change with engine operating conditions.	• ECM uses default value for DPF outlet temperature sensor. • DEF fluid injection disabled. • Engine torque reduced.
P242C	DPF temperature sensor module detects a short to ground condition.	
P242D	DPF temperature sensor module detects an open or short to voltage condition.	
P245F	ECM detects DPF differential pressure greater than 1.5 kPa (0.44 Hg).	ECM uses default value for DPF differential pressure sensor.
P2460	ECM detects DPF differential pressure sensor signal voltage less than 0.25V.	• ECM uses default value for DPF differential pressure sensor. • Active and stationary regeneration of diesel particulate filter disabled. • Engine torque reduced.
P2461	ECM detects DPF differential pressure sensor signal voltage greater than 4.7V.	
P2462	ECM detects DPF differential pressure greater than 1.5 kPa (0.44 Hg).	• ECM uses default value for DPF differential pressure sensor. • Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P2463	ECM detects soot load of diesel particulate filter moderately severe.	• Mobile regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P2483	ECM detects SCR temperature sensor module signal irrational.	• ECM uses default value for SCR catalyst outlet temperature. • DEF fluid injection disabled. • Engine torque reduced.
P2541	ECM detects fuel pressure signal voltage less than 0.2V.	• ECM uses default value for fuel delivery pressure reading. • Engine torque reduced.
P2542	ECM detects fuel pressure signal voltage greater than 4.8V.	ECM uses default value for fuel delivery pressure reading.
P2579	ECM detects turbocharger shaft stuck.	ECM estimates turbocharger speed.
P2580	ECM detects turbocharger speed less than 15,000 rpm.	

FUEL SUPPLY CONTROL

FUEL SUPPLY CONTROL : System Description

INFOID:0000000014419918

SYSTEM DIAGRAM



FUEL SUPPLY

Fuel System

The fuel system on the Cummins 5.0L V8 Turbo Diesel engine includes low pressure, high pressure, and return paths. The following information introduces the main components of the fuel delivery system and traces the flow of fuel from the fuel tank to the injectors and back to the fuel tank.

Fuel Inlet Restriction

A vacuum gauge can be installed between the fuel tank and the stage 1 fuel filter lift pump assembly to check for fuel line restriction. If the fuel inlet restriction is too high, check the fuel lines from the tank for proper size. Make certain there are no kinks or bends in the fuel lines and the fuel lines are not clogged between the fuel supply line and the inlet to the lift pump. The maximum allowed fuel inlet line restriction vacuum at idle is 20 kPa (6 in-Hg). With the engine running, there should not be any air bubbles in the clear pressure adapter test line at the Stage 1 fuel filter inlet. Air bubbles are a sign of severe inlet restriction, loose suction-side fittings, or a system that is not yet primed. If the fuel inlet restriction is too high, check the fuel lines from the tank for proper size. Make certain there are no kinks or bends in the fuel lines and the fuel lines are not clogged. Check the fuel supply tanks for debris (plastic wrappers, paper, etc.) that can intermittently block the fuel pickup tubes.

Check the fuel lines for internal damage, such as damaged wall linings, that can intermittently block fuel flow.

- Check the fuel supply tanks for debris (plastic wrappers, paper, etc.) that can intermittently block the fuel pickup tubes.
- Check the fuel lines for internal damage, such as damaged wall linings, that can intermittently block fuel flow.
- Check the fuel tank vents or fill cap vents for plugging.
- Make sure there are no clogged fuel strainers or filters or malfunctioning check valves.

Stage 1 Fuel Filter Housing

The stage 1 fuel filter housing is located just in front of the fuel tank. The stage 1 fuel filter housing includes the following components:

- 5-micron fuel filter with replaceable O-ring: filters particles and water from the fuel.
- 12-volt fuel lift pump: supplies low-pressure fuel to the stage 2 filter housing and high pressure.
- Water in fuel (WIF) sensor: detects the presence of water in the bottom of the stage 1 fuel filter housing and illuminates an icon in the combination meter.
- Water/fuel separator drain valve: 1/4-turn drain valve used for draining unwanted water from the filter housing.
- Thermal recirculating valve: when fuel is cold, this valve redirects fuel back to the unfiltered side of the stage 1 fuel filter housing rather than to the fuel tank
- Pressure relief valve to protect the 12-volt lift pump.

Lift Pump

Whenever the ignition is cycled ON, the lift pump operates for approximately 1 minute to prime the fuel system. Normal lift pump supply pressure is approximately 350 to 600 kPa absolute (3.5 to 6 bar) (51 to 87 psi) with the engine cranking or running.

Stage 2 Fuel Filter Housing

The stage 2 fuel filter housing is mounted on the intake manifold at the left side of the engine. This assembly also serves as a supply and return manifold for fuel. The stage 2 fuel filter housing includes the following components:

- 3.5-micron fuel filter with replaceable O-ring: filters particles in the fuel.
- Fuel Pressure Sensor: senses lift pump pressure in the stage 2 filter housing after the filter.
- Fuel Temperature Sensor: senses the temperature of fuel to help calculate fuel delivery requirements based on viscosity.

High Pressure Fuel Pump

The high pressure fuel pump is located at the front of the engine valley. The 2-cylinder pump is sealed to the cylinder block with bolts and an O-ring and is driven by a chain and sprocket at a 1:1 ratio to the crankshaft. The fuel pump is timed from the factory and includes an alignment key that is turned to the 2 o'clock position when cylinder 1 is at TDC.

The high pressure fuel pump is the first component in the high pressure side of the fuel system.The pump can generate fuel pressures up to 29,000 psi (2,000 bar) under high-load operation. When filtered fuel from the stage 2 filter enters the pump, it is either pumped to the fuel rail or delivered back to the stage 2 fuel filter housing, depending on fuel pressure needs. A cascade overflow valve within the pump regulates fuel for lubrication and regulates fuel to the fuel pump actuator and to the fuel return. A high pressure check valve within the pump keeps high pressure from damaging the pump.

Fuel Rail Pressure Sensor

The fuel rail pressure sensor monitors the fuel pressure within the fuel rails and communicates this data to the ECM. The ECM uses fuel pressure data to adjust the PWM signal to the fuel pump actuator and fuel pressure relief valve to achieve the desired fuel pressure for optimum fuel injection.

Fuel Pressure Relief Valve

The fuel pressure relief valve is a normally open, PWM valve. The ECM monitors fuel rail pressure sensor data and adjusts the PWM signal to the fuel pump actuator and fuel pressure relief valve to maintain the desired fuel pressure. The fuel pressure relief valve can bleed excess fuel rail pressure from the rails through the fuel rail return line back to the stage 2 fuel filter housing.

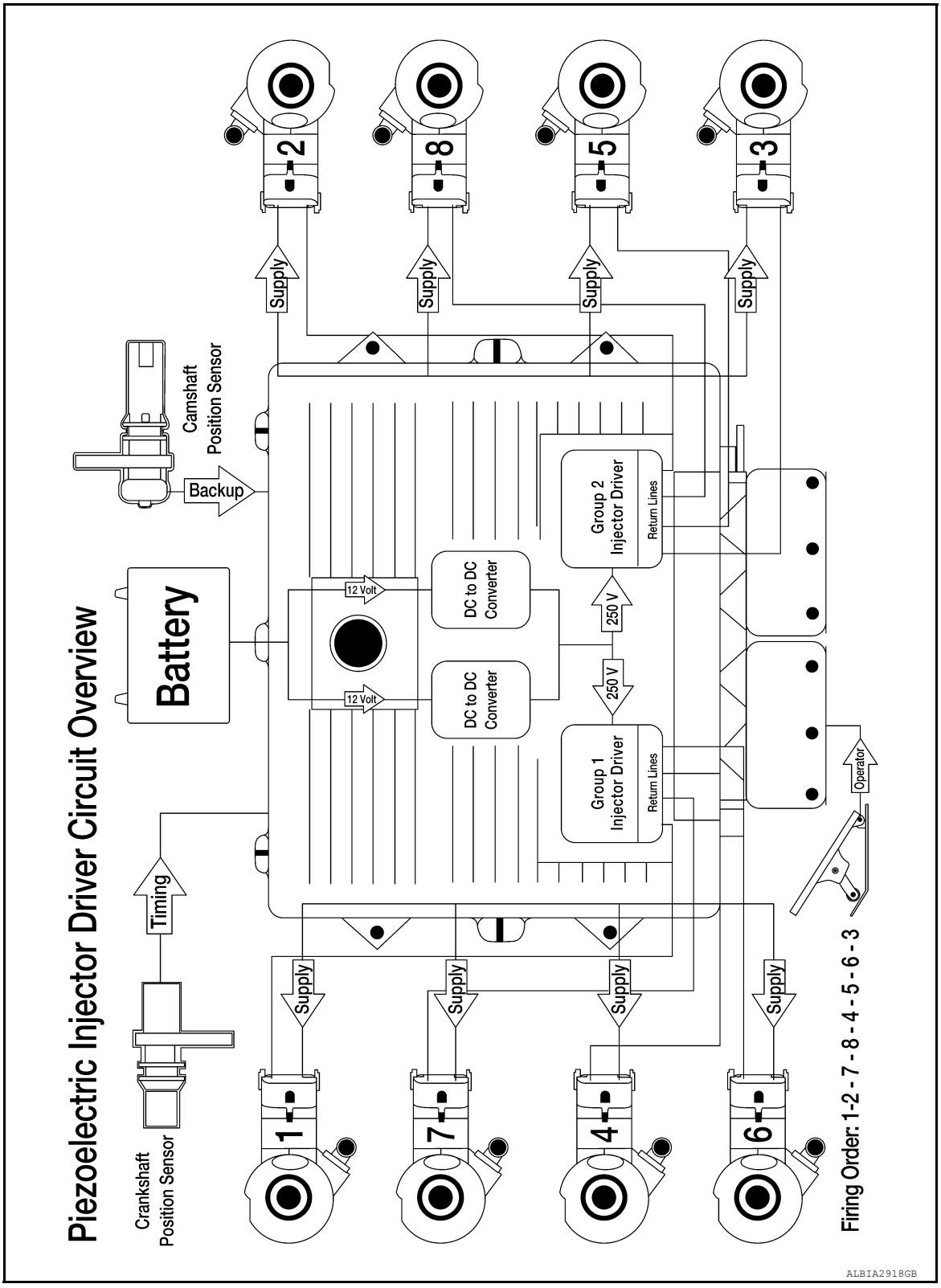
When the engine is turned off, the fuel pressure relief valve opens, allowing fuel pressure inside the rail to depressurize. It may take up to 10 minutes for high pressure to bleed down enough to service high pressure fuel system components.

FUEL INJECTION CONTROL

FUEL INJECTION CONTROL : System Description

INFOID:0000000014419919

SYSTEM DIAGRAM



SYSTEM DESCRIPTION

If the fuel injector, fuel rail pressure sensor or fuel pressure relief valve is replaced, the fuel table reset procedure must be performed with CONSULT. The fuel table reset will reset the data tables for corresponding components to factory default values (unlearned values).

Fuel Injectors

Fuel Injector Supply Lines

Fuel injector supply lines carry high pressure fuel from the fuel rails to the supply fittings on the fuel injectors. Each supply line includes a vibration isolator to enhance durability. Always note the position of the fuel injector supply line prior to removal so it can be installed in the same orientation. As with all fuel system fittings, ports should be capped for the duration of the repair to prevent debris from entering the fuel system. When installing a fuel injector supply line, hand tighten the fittings first and then torque to specification. Finally, perform the high pressure fuel system leak test to make sure the system does not leak.

Fuel Rail Return Line

A fuel rail return line is located between the left fuel rail and the stage 2 fuel filter housing. When the ECM determines that fuel pressure should be reduced in the fuel rails, the fuel pressure relief valve allows fuel in the rail to be drained to the stage 2 fuel filter housing (return manifold) through the fuel rail return line.

If the fuel rail return line becomes restricted, a no-start condition may occur. If the fuel system cannot control fuel rail pressure by bleeding fuel from the rails, fuel flow will stop.

Fuel Injectors

This engine uses eight piezoelectric fuel injectors to supply atomized fuel to the cylinders for combustion. Fuel is supplied to the top of the injector, and return fuel is directed back to the stage 2 filter housing through a return line. Injector hold-down clamps are used to secure pairs of adjacent injectors. Each injector includes a replaceable O-ring and a replaceable sealing washer where the injector seals in the cylinder head. A special tool must be used to remove the injectors without damage.

Piezoelectric injectors require electrical current, high pressure fuel, low pressure fuel, and reversed electrical current to inject fuel and close the injector after injection. Piezoelectric injectors use high and low fuel pressure within the injector and piezo crystals within a stack of ceramic discs. High pressure fuel near the top of the high pressure control chamber holds the injector needle in place until it is time to inject. When the ECM sends current through the piezo stack, the piezo crystals expand. This expansion is amplified by the hydraulic pressure of the fuel in the low pressure chamber to move the control valve. High pressure fuel in the control chamber exits to the low pressure chamber when the control valve opens. This action unseats the injector needle and fuel is injected. To close the injector, current must flow in the opposite direction (reverse polarity) to retract the piezo crystals and allow fuel pressure in the injector to seat the injector needle.

The ECM includes two individual injector driver circuits and two internal DC to DC converters. These converters step the 12V feed from the battery up to 170V when the injectors are connected. Each converter controls four injectors, with each driver controlling every other injector in the firing order. Immediately following injection, the polarity of the injector circuit is reversed, allowing the piezo stack to retract.

The injector driver circuit is set up so that companion cylinders are on the same group of injectors on the driver circuit. The circuit is designed to supply the 250V to only a single group of injectors at one time so that a short in one of the groups will not adversely affect the other group. When the circuit is operating with the piezoelectric injectors connected, the circuit will supply 170V with amperage as high as 19 amps. However, if the injector is disconnected, the voltage can be as high as 250V. It is never advised to disconnect piezoelectric injectors while running as engine damage or physical injury can occur.

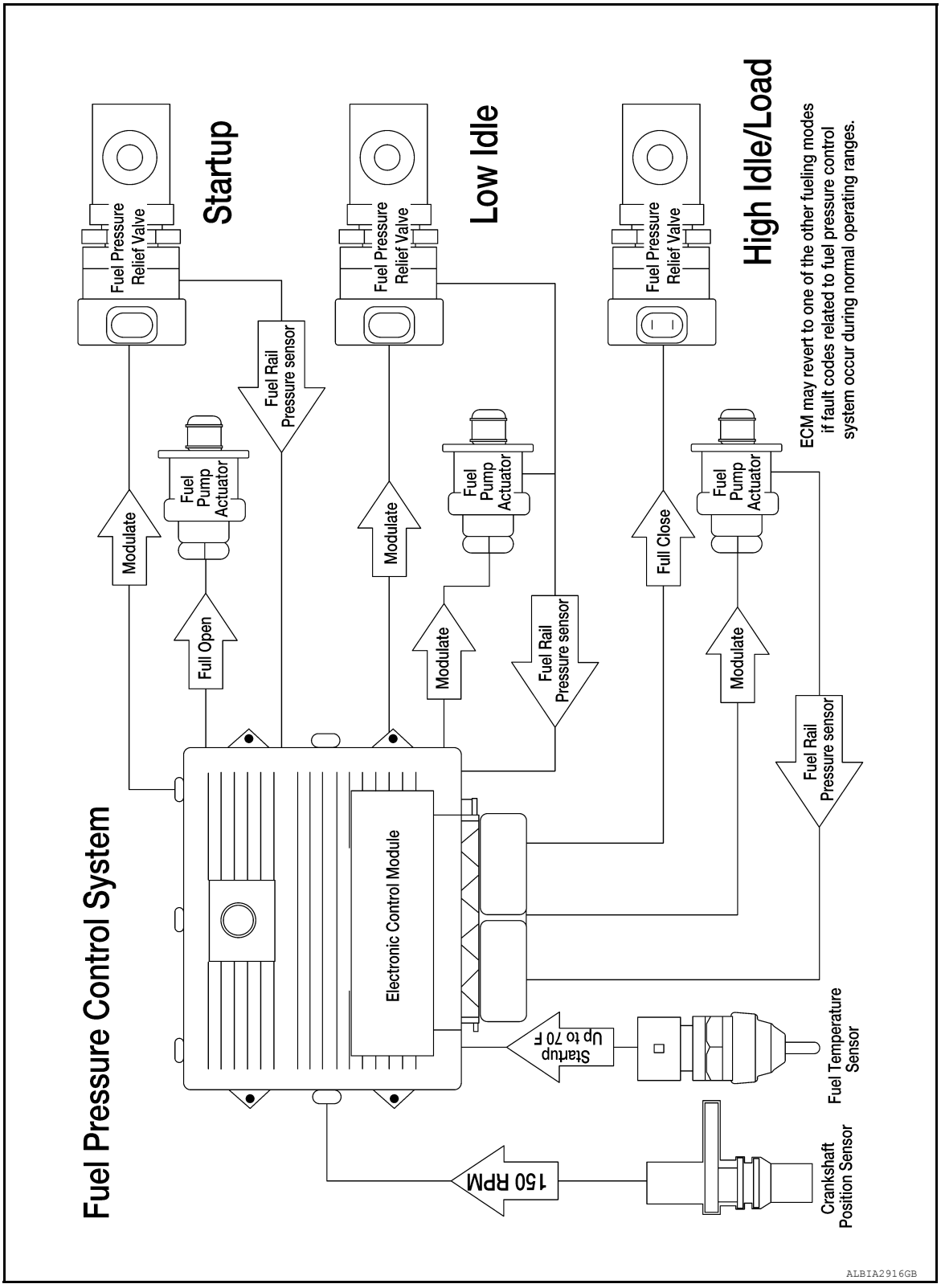
Primary inputs for injection include the accelerator pedal sensor input (driver) and the crankshaft position sensor. After the ECM determines top dead center of cylinder number 1 on the compression stroke at startup (using the camshaft position sensor), the ECM then relies on the crankshaft position sensor to control the timing of the injections. A variety of other inputs affect injection timing and volume, such as charge air cooler outlet pressure, coolant temperature, and speed/load conditions. At least 150 rpm and a minimum rail pressure of 1,800 psi is necessary for the engine to start.

FUEL PRESSURE CONTROL

FUEL PRESSURE CONTROL : System Description

INFOID:0000000014419920

SYSTEM DIAGRAM



SYSTEM DESCRIPTION

The ECM controls fuel rail pressure by opening, closing, or modulating the fuel pump actuator and fuel pressure relief valve. Various fueling modes are available based on engine load, temperatures, and pressures. The following fueling modes are available:

- Startup: This mode is used until fuel temperature reaches approximately 70° F. The ECM modulates the fuel pressure relief valve while allowing the fuel pump actuator to stay open.
- Low Idle: The ECM modulates the fuel pump actuator and fuel pressure relief valve as needed to achieve the desired fuel rail pressure.
- High Idle/Load: This mode is used under high load conditions. The ECM closes the fuel pressure relief valve to help build fuel pressure for additional fuel delivery needs. The ECM modulates the fuel pump actuator as necessary to maintain a higher fuel pressure.

ENGINE TORQUE CONTROL

ENGINE TORQUE CONTROL : System Description

INFOID:0000000014419921

SYSTEM DESCRIPTION

The torque function can be explained by the following:
- Accessories torque management
- Engine torque losses
- Minimum available torque
- Maximum available torque
- Fast set-points to complete torque request
- Final torque requests setting

ACCESSORIES TORQUE MANAGEMENT

Air Conditioning Power

The amount of power absorbed by the air conditioning is useful for the engine control to compute the torque requirement for air conditioning. Therefore, ECM can adapt dynamically the engine speed regulation depending on the load variations.

The power absorbed by the air conditioning depends on the refrigerant pressure and the compressor speed.

The air conditioning system power correction for idle speed regulation avoids engine speed undershoots and overshoots at the compressor compressed volume variation.

ENGINE TORQUE LOSSES

The torque losses are the sum of three components: the rubbing, the pumping, and the torque losses caused by accessories consumption.
- The basic friction torque loss uses the coolant temperature sensor and the engine speed for the torque correction.
- the pumping torque is an estimation of the mean indicated torque in the low pressure cycle by using intake air and exhaust gas pressures, the engine capacity displacement, the number of cylinders, and the form factor of the low pressure cycle.
- Accessories′ consumption is caused by additional electrical (electric consumers) and mechanical (air conditioning) components.

MINIMUM AVAILABLE TORQUE

The minimum available torque is used for the minimum driver set point calculation and the intersystem information.

The minimum torque is designed with a hyperbolic shape depending on the difference between the engine speed and the idle speed set-point:
- When the engine speed is under the idle speed set-point, the minimum torque is equal to the hyperbolic torque which increases to avoid engine stalling.
- When the engine speed is over an engine speed threshold, the minimum torque reaches the engine torque losses with a ramp.

When the engine starts, a specific torque set-point is calculated to ensure the engine start. This torque is dependent on the engine speed and the coolant temperature.

At first, a calculation of the starting torque value is performed. In case of a difficult start (too long), this torque may be increased thanks to ramp.

The start torque offset is progressively set to zero to ensure a transition with the current torque set-point.

MAXIMUM AVAILABLE TORQUE

The maximum available torque results in a minimum selection including all powertrain constraints:
- Transmission torque limitation
- Maximum engine torque
- Torque reduction for the heating protection
- Torque for the smoke limitation

• Fail-safe

Transmission torque limitation

This limitation is the maximum torque to protect the transmission from a mechanical overload:

• The limitation value is directly supplied by the automatic transmission.

Maximum engine torque

The maximum torque depends on the engine speed and the manifold air pressure. It is corrected by:

• The soot mass value in order to take into account the limitations due to the particulate filter
• The atmospheric pressure
• The intake pressure temperature sensor

The maximum engine also depends on the combustion mode (the normal or the regeneration combustion mode). In some conditions (DPF clogging, etc.), this maximum available torque is reduced in order to keep the engine within its safety working limits.

Torque reduction for the heating protection

This torque limitation is dedicated to the protection of the engine from an overheating. This limitation calculation depends on the engine speed, the engine coolant temperature, the intake air temperature and the vehicle speed.

Torque for the smoke limitation

This torque limitation is used to reduce the smoke emissions during a high torque driver request. The maximum fuel mass that can be injected is limited according to the maximum richness depending on the gear ratio, the engine speed, and the intake air mass flow. This value is corrected depending on the vehicle speed and the coolant temperature.

Fail-safe

The ECM limits engine torque in case of malfunction of engine component or ECM.

Depending on the engine components, ECM activates the fail-safe mode of the torque limitation level 1 (low limitation), level 2 (moderate limitation), or level 3 (severe limitation function of vehicle speed).

FAST SET-POINTS TO COMPLETE TORQUE REQUEST

For each combustion mode (the normal combustion mode, the regeneration combustion mode, and the protection combustion mode), a torque model is designed to calculate the total fuel mass quantity, the estimated mean effective torque, the combustion efficiency and the current fuel consumption for the final torque set-point and the engine current speed.

The total fuel mass quantity is corrected to take into account the main injection advance deviation and the mass air flow deviation.

For each combustion mode, the after and the post injection relative efficiencies are calculated to determine the fuel mass quantity needed to perform the engine inner torque.

The after injection relative efficiency is equal to one in normal combustion mode and to zero in a regeneration combustion mode or in a protection combustion mode.

The post injection relative efficiency is a function of the post injection timing and the difference between the current and the basic post injection timing.

FINAL TORQUE REQUESTS SETTING

The final torque requests are computed by the arbitration with the driver request, the intersystem torque request, and the torque limitations.

The engine torque losses and the idle speed torque are added.

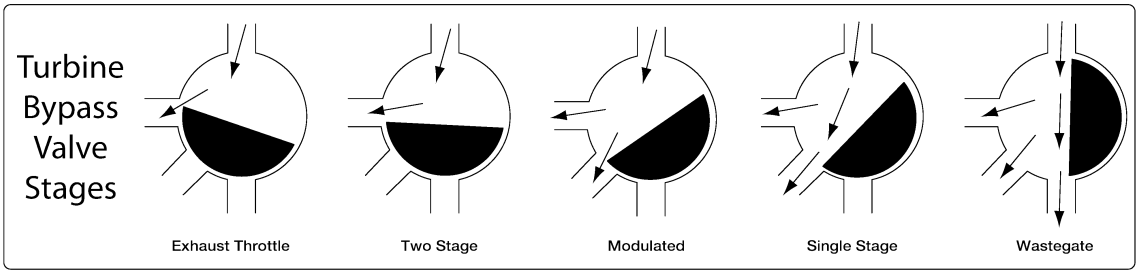
The static torque is the maximum available torque. The raw torque is used by the turbocharger and the EGR regulations.

The set-point torque is used for fuel mass calculation.

TURBOCHARGER BOOST CONTROL

TURBOCHARGER BOOST CONTROL : System Description

INFOID:0000000014419922



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DESCRIPTION

The ECM controls the positions of the compressor bypass valve and rotary turbine control valve to produce different turbocharger modes, depending on the driving condition or aftertreatment system needs. The following 5 positions describe these different turbocharger modes.

CAUTION:

To stop the engine immediately after high-load driving, park the vehicle with the engine at idle before turning OFF the ignition switch.

Exhaust Throttle

Exhaust Throttle mode is used at lower engine speeds and lower torque situations. During Exhaust Throttle mode, air enters the low pressure turbocharger compressor. The compressor bypass valve is closed. Air travels into, and is compressed in the high pressure turbocharger compressor because it is the only path for air flow when the compressor bypass valve is closed. The rotary turbine control valve is positioned to restrict exhaust flow. This creates heat for the aftertreatment system during regeneration, drives additional EGR into the intake manifold, and provides a faster engine warm-up.

Two Stage

Two Stage operation is used when boost pressure is needed quickly, such as high load conditions off idle. During Two Stage mode, air enters the low pressure turbocharger compressor.The compressor bypass valve is closed. Air travels into, and is compressed in the high pressure turbocharger compressor because it is the only path for air flow when the compressor bypass valve is closed. The rotary turbine control valve directs all exhaust flow to the high pressure turbocharger turbine first, and then to the low pressure turbocharger turbine. The high pressure turbocharger spins, producing boost quickly to eliminate turbo lag.

Two Stage Modulated

Two Stage Modulated operation occurs when transitioning between Two Stage and Single Stage operation. When Two Stage Modulated operation is needed, the compressor bypass valve opens. When the compressor bypass valve opens, the path of least resistance becomes the passage from the low pressure turbocharger compressor to the charge air cooler. The rotary turbine control valve directs exhaust flow in varying proportions to both high and low pressure turbocharger turbines.

Single Stage

Single Stage operation occurs when maximum boost is needed for higher speeds or high loads when the high pressure turbocharger can no longer supply sufficient air volume to achieve desired boost. During Single Stage operation, the compressor bypass valve remains open, allowing unrestricted air flow from the low pressure turbocharger to the charge air cooler. The rotary turbine control valve directs full exhaust flow to the low pressure turbocharger turbine with only residual exhaust gas exposed to the high pressure turbocharger turbine.

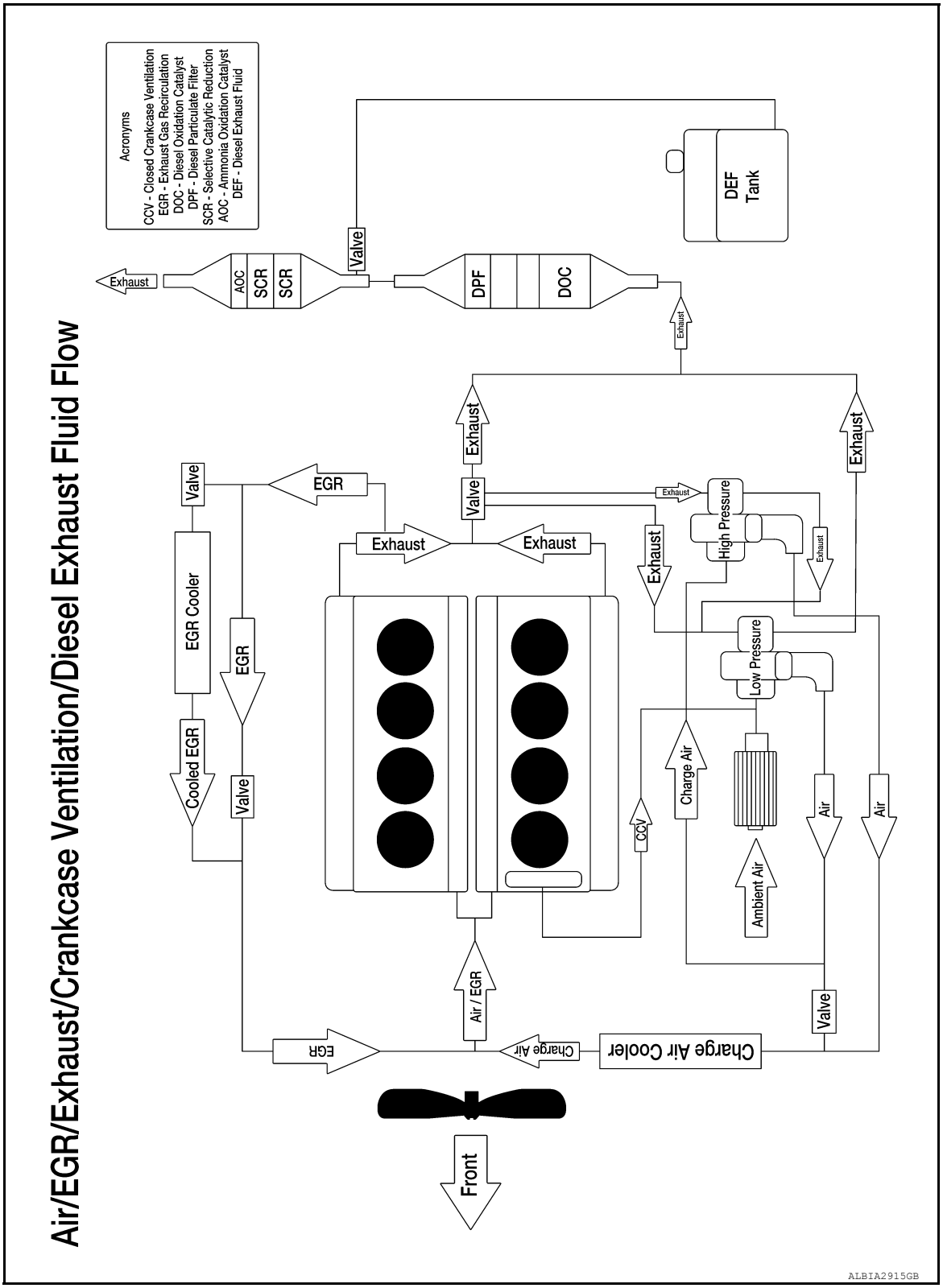
Wastegate

Wastegate operation is used to limit boost pressure. During Wastegate operation, the compressor bypass valve remains open, allowing unrestricted air flow from the low pressure turbocharger to the charge air cooler. The rotary turbine control valve directs exhaust flow directly to the aftertreatment system, bypassing both turbines.

EGR SYSTEM

EGR SYSTEM : System Description

INFOID:0000000014419923



DESCRIPTION

The EGR system is designed to reduce oxides of nitrogen (NOx) in the exhaust stream that result from diesel combustion. The following information describes the function of EGR components and EGR operation.

EXHAUST MANIFOLDS AND EGR PIPING

After combustion, exhaust gases exit the combustion chambers through the exhaust manifolds and enter the EGR piping. Exhaust gases can take three distinct directions, depending on which is the path of least resis-

tance. The ECM controls the positions of the rotary turbine control valve, EGR valve, and EGR cooler bypass valve to determine the paths that exhaust gas takes.

EGR VALVE

The EGR valve is located on the right side of the engine at the back of the EGR cooler. The ECM varies the position of the EGR valve to regulate the amount of exhaust gas that enters the EGR cooler from the right bank EGR pipe. The EGR valve includes an internal sensor that provides EGR valve position to the ECM. The EGR valve may close under certain conditions like cold start, low engine speeds or loads, or if active EGR DTCs are present.

EGR COOLER

The EGR cooler is located on the right side of the engine just outside the air intake manifold. The EGR cooler assembly includes a cast iron coolant manifold that secures the cooler to the air intake manifold. The EGR cooler receives engine coolant from the water pump and circulates coolant through the manifold and cooler to lower the temperature of exhaust gases before they are recirculated into the combustion chamber as cooled EGR. When EGR gases are cooled, combustion temperatures are lowered, and as a result, NOx levels are also lowered. Coolant flows through the EGR cooler in the same direction as exhaust gas flow. The EGR valve is also cooled by engine coolant.

EGR COOLER BYPASS VALVE

The EGR cooler bypass valve is located behind the air intake connector. The EGR cooler bypass valve allows EGR to be diverted around the EGR cooler and directly into the charge air stream when conditions require (cold start, regeneration, or times when combustion temperatures must be raised.) The EGR cooler bypass valve includes an internal sensor that communicates EGR cooler bypass valve position to the ECM. The EGR cooler bypass valve is also cooled by engine coolant.

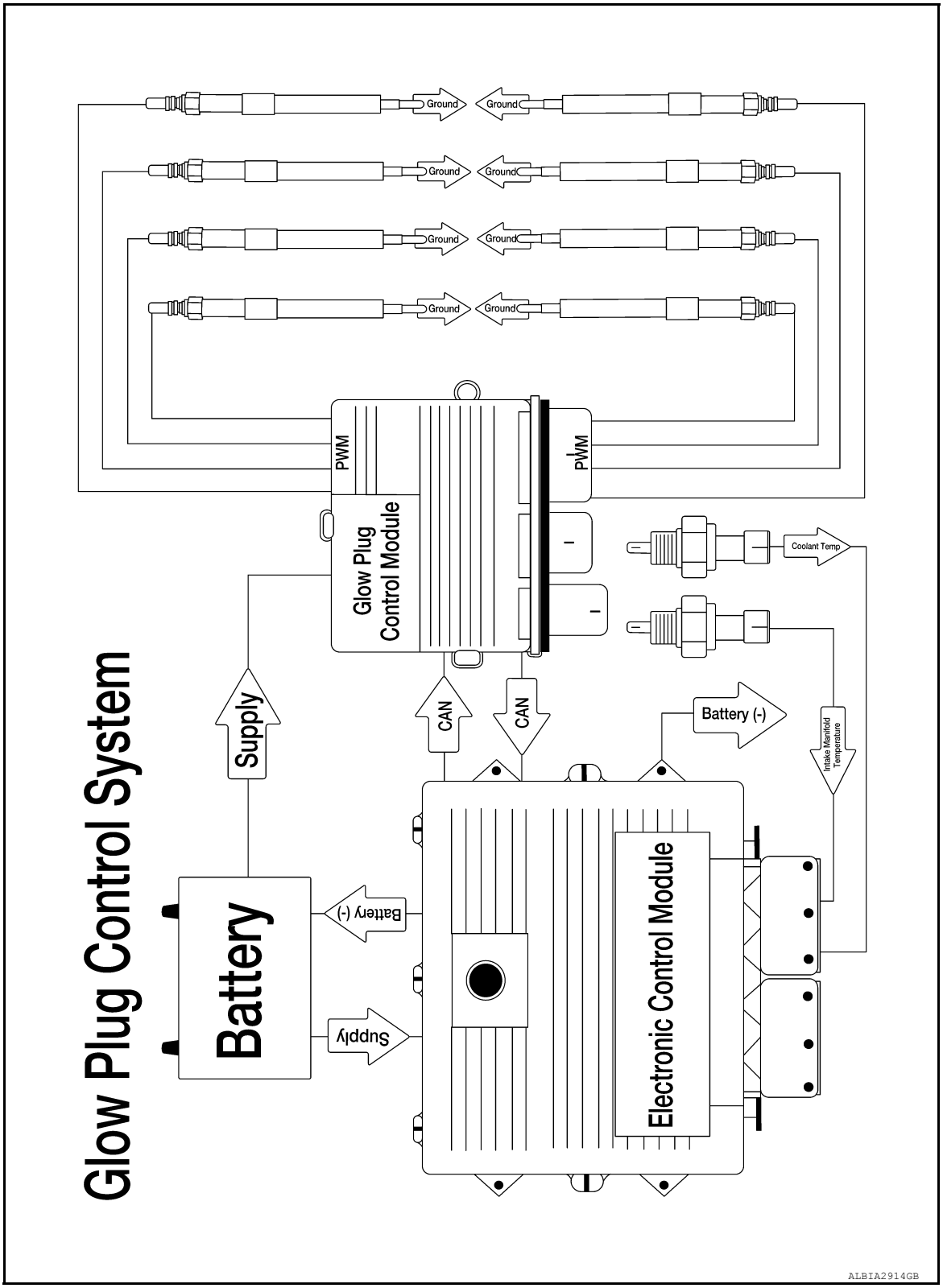
EGR FLOW CALCULATIONS

During Exhaust Throttle mode, the ECM closes the EGR valve and opens the EGR cooler bypass valve to prevent EGR cooling. This is done to heat the engine quicker during cold start and for regeneration. For all other turbocharger modes, the ECM opens or closes the EGR valve and EGR cooler bypass valve as needed based on pressures and temperatures. The ECM compares the charge air cooler outlet pressure sensor and exhaust gas pressure sensor measurements to help determine the EGR flow relative to the position sensors in the EGR valve and EGR cooler bypass valve. The ECM also uses the EGR temperature sensor to determine the temperature of EGR gases before they mix with charge air. If this temperature is too high, the ECM may command the EGR valve closed to protect the EGR cooler from high temperature damage. The ECM also uses the air intake manifold temperature sensor to calculate EGR entering the air intake manifold prior to combustion. CONSULT data monitor item “FAF/EGR AIR FLOW” displays the combination of mass air flow and EGR air flow.

GLOW CONTROL

GLOW CONTROL : System Description

INFOID:0000000014419924



SYSTEM DESCRIPTION

The glow plug control system is controlled by the ECM and the glow plug control module. The glow plug control module is located in the back left corner of the engine compartment to the left of the brake booster. The glow plug control module receives fused power directly from the batteries. The ECM communicates with the glow plug control module over the CAN. The glow plugs are grounded through the cylinder head. The ECM calculates an average temperature based on inputs from the engine coolant temperature sensor, the air intake

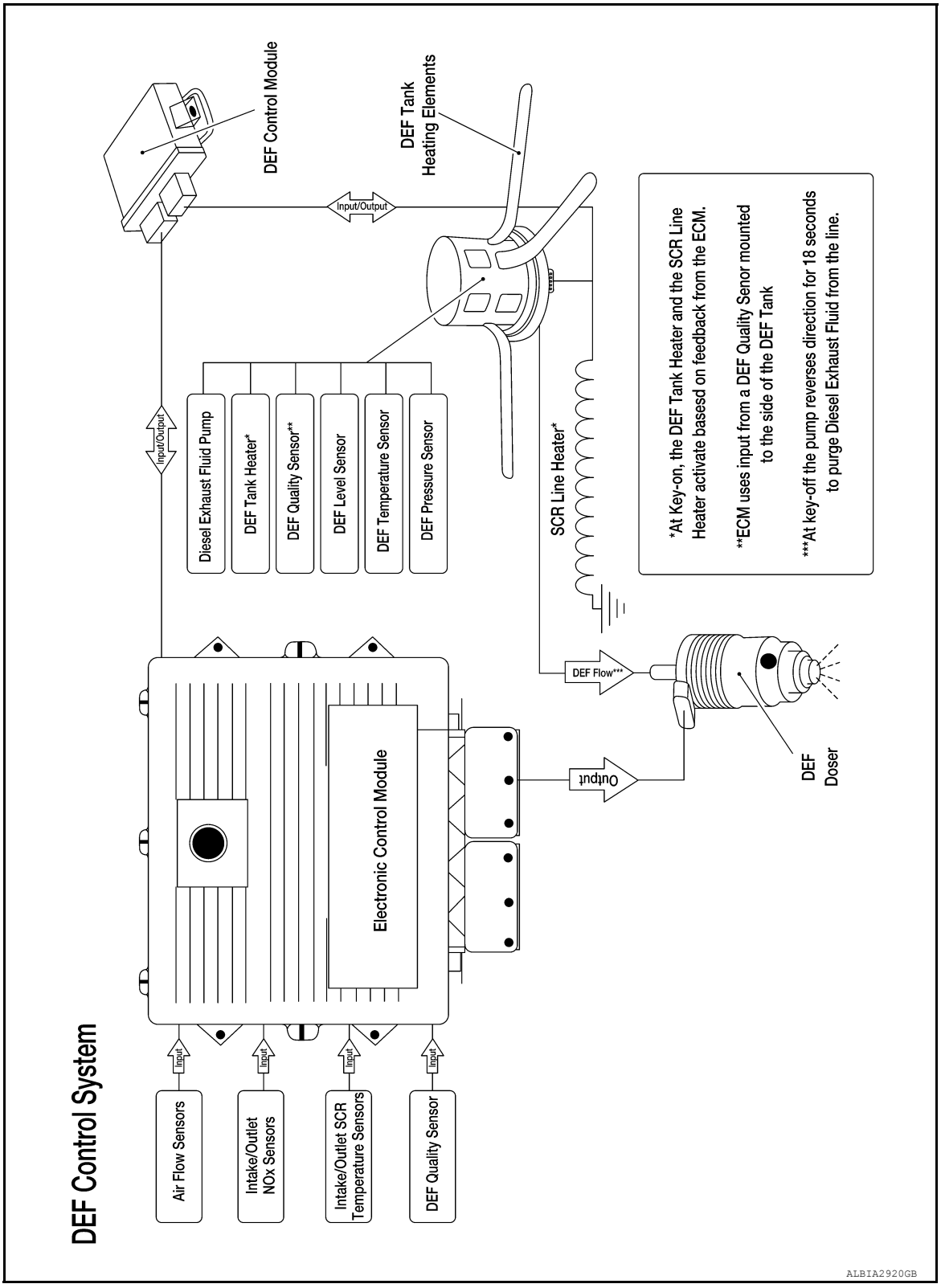
manifold temperature sensor, and an internal temperature sensor in the glow plug control module. After the required conditions are met, the glow plug control module sends an output to each of the eight glow plugs individually. The glow plug control module monitors the operation of individual glow plugs and reports failures back to the ECM. Glow plugs begin activating when the ignition switch is on during the wait-to-start sequence, and will continue to operate after cranking if the ECM determines the glow plugs are needed.

DEF CONTROL SYSTEM

DEF CONTROL SYSTEM : System Description

INFOID:0000000014419925

SYSTEM DIAGRAM



SYSTEM DESCRIPTION

The EGR system is very effective at reducing NOx emissions in the engine, but current NOx emissions standards require additional measures to further reduce this pollutant. As a result, the Cummins 5.0L V8 Turbo Diesel engine uses a comprehensive DEF system in conjunction with a SCR system to reduce NOx levels.

NOTE:

DEF may be referred to as “Reductant” in the CONSULT.

Diesel Exhaust Fluid

DEF is a non-toxic, non-flammable liquid that is injected into the exhaust stream to help convert NOx into harmless tailpipe emissions. DEF is composed of purified water and 32.5% urea. DEF is readily available from the pump at many fuel stations, or it can be obtained in containers. DEF is not harmful to handle, but it can be corrosive to certain metals. DEF may be stored in sealed containers, away from direct sunlight, and in temperatures between -5° and 25° C (23° and 77° F) for up to 18 months. However, for each 5° C (9° F) increment in above this recommended temperature, shelf life is reduced by 6 months. In addition, DEF should not remain in the DEF tank of an unused vehicle for more than 6 months. DEF has a freezing point of approximately -11° C (12° F). Water should never be added to DEF. Adding water to DEF will change the DEF concentration, which will reduce SCR effectiveness. Chemicals introduced by adding unpurified water can also corrode or damage aftertreatment components or damage the DEF dosing valve. In addition, adding water to DEF will raise the freezing point. DEF concentration can be tested using a refractometer that is calibrated for DEF.

DEF Tank

The DEF tank is mounted under the vehicle, behind the fuel tank. The DEF tank stores DEF that is used by the SCR system. DEF is added to the tank through a filler neck to the right of the diesel fuel filler neck. The DEF tank houses numerous components of the DEF system, including:

- DEF control unit
- DEF pump assembly
- DEF fluid line and heater
- DEF quality sensor

DEF Control Module

The DEF control module is mounted on the side of the DEF tank. The DEF control module monitors DEF component readiness and communicates this status to the ECM.

DEF Quality Sensor

A DEF quality sensor is also mounted on the side of the DEF tank. This sensor detects the level of urea in the DEF to ensure the DEF concentration is acceptable for effective dosing (approximately 32.5% urea). If the DEF quality sensor detects an incorrect DEF concentration, the DEF warning lamp in the combination meter will illuminate. In some cases, the MIL may also illuminate.

DEF Pump Assembly

The DEF pump assembly is mounted to the bottom of the DEF tank. The DEF pump is secured to the tank with a locking ring and O-ring seal. The DEF pump assembly includes the following components:

- DEF pump with non-replaceable filter
- DEF tank heater
- DEF level sensor
- DEF temperature sensor
- DEF pressure sensor
- DEF dosing line heater

The DEF pump is commanded by the DEF control unit based on communication from the ECM. The DEF control unit monitors the DEF temperature, DEF pressure, and DEF level sensors to determine if the pump should operate. When commanded to operate (dosing state), the DEF pump maintains pressure up to 90 psi in the DEF dosing line. DEF dosing will be covered in the upcoming topics in this section.

DEF Tank Heater

The DEF pump assembly includes a DEF tank heater to thaw frozen DEF in the tank. The DEF heater is a series of heated strips that are designed to evenly thaw frozen DEF in the tank. The DEF temperature sensor detects the temperature of the DEF and determines if tank heater operation is necessary. The DEF pump will not prime until the DEF temperature has reached a sufficient temperature for dosing to occur. The DEF heater will activate and continue to heat the DEF based on pre-programmed values in the ECM.

DEF Temperature Sensor

The DEF temperature sensor is used as a key input for determining DEF heater and DEF pump operation.

DEF Level Sensor

The DEF level sensor reports the quantity of DEF in the DEF tank to the ECM. DEF level can be checked in the combination meter at any time.

DEF Pressure Sensor

The DEF pressure sensor monitors the pressure in the DEF dosing line to make sure adequate pressure is available for DEF dosing. The DEF pressure sensor also monitors the line pressure after engine shut down to ensure DEF has been purged from the line.

DEF Dosing Line Heater

A DEF dosing line heater is located at the end of the DEF dosing line where it meets the DEF pump. This heater is used to heat the dosing line between the DEF pump and the DEF dosing valve to prevent freezing.

DEF Dosing Valve

The DEF dosing valve is located on the decomposition tube. The DEF dosing valve is a PWM valve that injects a fine mist of DEF into the exhaust stream when commanded by the ECM. This injection of DEF is sometimes called SCR dosing because the SCR catalyst uses DEF to chemically convert NOx to nitrogen and water.

DEF Dosing Condition

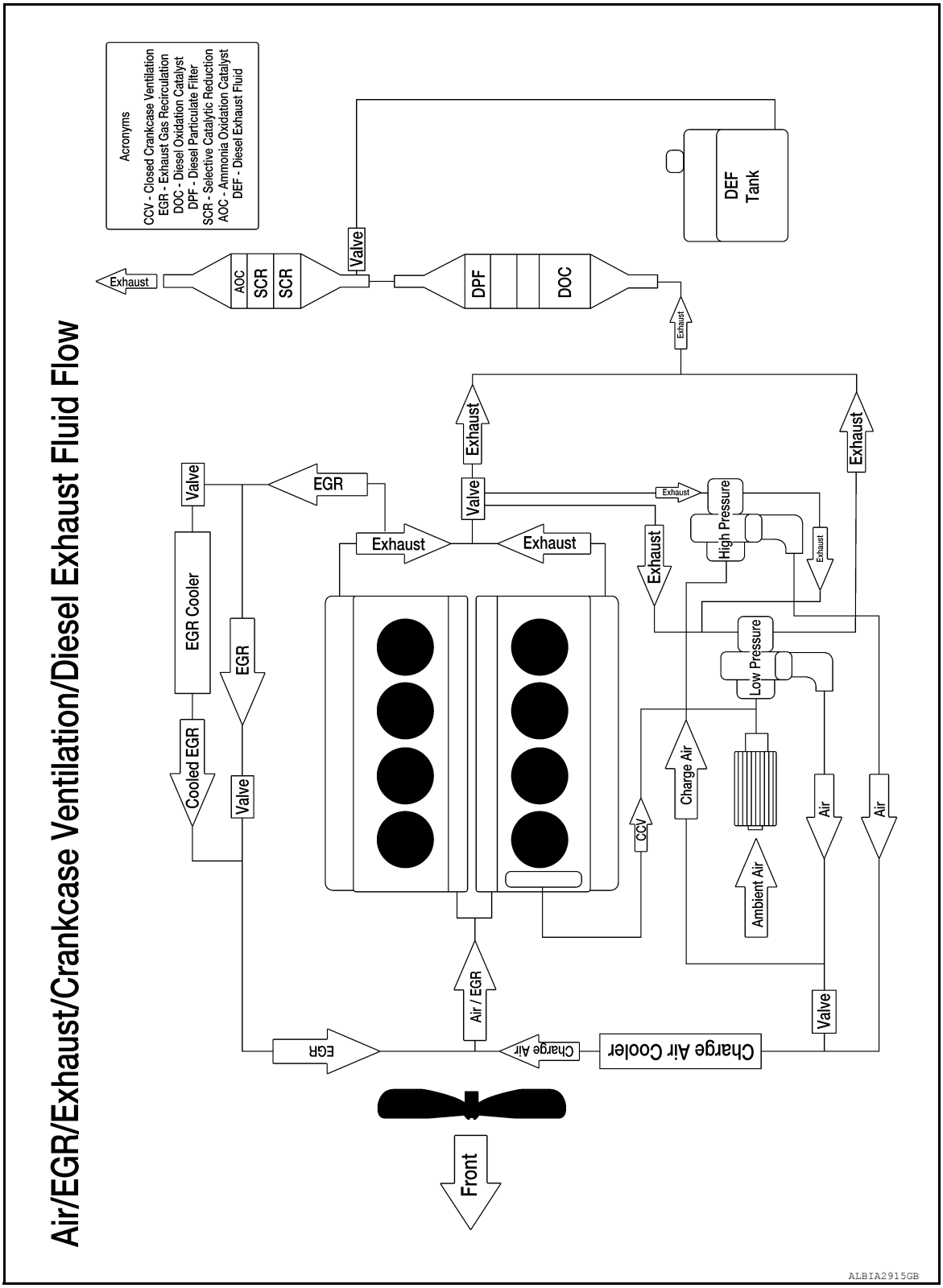
Certain conditions must be met for the DEF system to be active and ready to dose. Effective dosing requires the following:

- DEF tank level must be above 6% filled with DEF.
- DEF quality must be verified.
- The SCR intake and SCR outlet temperatures must be at least 392° F (200° C).
- Both NOx sensors must be turned on and reading NOx levels.
- No active SCR system diagnostic trouble codes can be present.
- DEF temperature must be above 27°F (-3°C).

AFTER TREATMENT SYSTEM

AFTER TREATMENT SYSTEM : System Description

INFOID:0000000014419926



SYSTEM DESCRIPTION

This system has two main functions:

- Use the present oxygen in exhaust gases to transform the CO in CO2, and the HC in CO2 and H2O.
- Increase the temperature of exhaust gases (with the exothermal energy of the oxidation reaction) to allow the regeneration in the DPF (Diesel Particulate Filter).

To be effective, the catalytic converter must reach the working temperature of 400° C (752° F) to possess an essential role in the operation of regeneration of the DPF.

The term “exhaust aftertreatment” refers to the use of additional components in the exhaust system that help produce chemical reactions to reduce harmful tailpipe emissions. It also includes many sensors that help determine system operation and evaluate the effectiveness of the system in reducing these emissions. The aftertreatment system is primarily used to reduce Particulate Matter (PM) and oxides of nitrogen (NOx) emissions. PM may also be referred to as soot.

The front of the aftertreatment system includes the Diesel Oxidation Catalyst (DOC), Diesel Particulate Filter (DPF), and various sensors that measure temperatures, pressures, and incoming NOx content. Soot is oxidized in this front portion of the system. The second part of the aftertreatment system includes the decomposition tube, Diesel Exhaust Fluid (DEF) dosing valve and associated components for DEF dosing, Selective Catalytic Reduction (SCR) catalysts, Ammonia Slip Catalyst (ASC), and various sensors that measure temperatures, pressures and outgoing NOx content. NOx is significantly reduced in this second part of the aftertreatment system.

AFTERTREATMENT SYSTEM

Aftertreatment components are presented in the order of exhaust flow from the front of the aftertreatment system to the end of the aftertreatment system. Mechanical components are presented first, followed by control modules and sensors.

Diesel Oxidation Catalyst (DOC)

The DOC is the first element in the aftertreatment system. The DOC is a flow-through catalyst that uses hydrocarbons (unburned fuel) to create heat in the aftertreatment system. This heat is necessary for the DPF to oxidize soot and for chemical reactions to occur in the entire aftertreatment system. The DOC cannot be cleaned or replaced individually; it is part of the entire DOC/DPF assembly.

Diesel Particulate Filter (DPF)

The DPF is located directly downstream of the DOC. The DPF is a wall-flow design that allows exhaust gas to pass through while collecting particulate matter (soot). When exhaust temperature reaches at least 600°F (316°C), the soot begins to oxidize in the DPF. The DPF cannot be removed and cleaned, and cannot be replaced individually; it is part of the entire DOC/DPF assembly.

Decomposition Tube

The decomposition tube is located downstream of the DPF and is considered the first part of the SCR system. The decomposition tube serves as the mounting point for the DEF dosing valve. Decomposition refers to the process of injecting DEF into the hot exhaust stream to produce chemical reactions that produce carbon dioxide and provide ammonia for the SCR catalysts.

Selective Catalytic Reduction (SCR) Catalyst

The SCR catalyst is located downstream of the decomposition tube. The SCR catalyst is a two-part, flow-through catalyst that is effective at reducing NOx. When ammonia and NOx from the decomposition tube flow through the SCR catalyst, nitrogen (N2) and water vapor (H2O) are produced.

Ammonia Oxidation Catalyst (AOC)

The AOC is located downstream of the second SCR catalyst. The AOC is a flow-through catalyst that removes any trace amounts of ammonia from the exhaust stream before the exhaust exits the aftertreatment system. This component may also be called the ammonia brick.

DIESEL EXHAUST FLUID (DEF) SYSTEM

The EGR system is very effective at reducing NOx emissions in the engine, but current NOx emissions standards require additional measures to further reduce this pollutant. As a result, the Cummins 5.0L V8 Turbo Diesel engine uses a comprehensive DEF system in conjunction with an SCR system to reduce NOx levels.

NOTE:

DEF may be referred to as “Reductant” in the CONSULT.

REGENERATION

The purpose of regeneration is to burn the particulates accumulated in the filter. In presence of oxygen, the particulate combustion regeneration occurs naturally when the temperature of exhaust gases exceeds 570° C (1,058° F). In urban driving conditions, the engine barely reaches high temperature, and the exhaust gas temperature consequently varies between 150° C (302° F) and 200° C (392° F). Therefore, the DPF regeneration system is necessary to burn and eliminate soot particulates accumulated in DPF. The DPF regeneration is automatically performed while driving, and this does not influence driving conditions.

A DPF differential pressure sensor detects filter load status (particulate mass) and triggers the regeneration operation. This takes place by means of a controlled combustion that raises the exhaust gas temperature up between 550° C (1,022° F) and 650° C (1,202° F) at the filter intake.
Regeneration is continuously executed according to the following.

Regarding driving conditions:
- Vehicle speed
- Ambient pressure
- Temperature upstream DPF
- Engine coolant temperature

DPF charging level criteria:
- Soot mass [(computed using DPF charging curves (exhaust gas flow according to differential pressure)]
- Simulated soot mass [computed using mapped soot mass emission speed (g/s)]
- Driven distance since last successful regeneration
- Regeneration error counter

ECM activates many engine management functions to ensure good regeneration efficiency:
- Fuel system: A specific injection pattern using post injections is activated.
- Air system: EGR volume control valve is closed and throttle valve (intake) is used to control engine air flow. In regeneration mode, other boost pressure set points are defined.

REGULATION OF TEMPERATURE BEFORE DPF

Regulation of the exhaust gas temperature before DPF is needed to complete a secure regeneration. This strategy uses the dosing (exhaust line) injector and engine fuel injectors.
ECM computes the fuel mass flow injected by injectors according to several parameters:
- Exhaust line temperature before DPF
- Atmospheric pressure
- Intake air temperature
- Differential pressure of the DPF
- Minimum level of fuel
- Engine speed
- Engine torque

AUTOMATIC SPEED CONTROL DEVICE (ASCD)

AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description

INFOID:0000000014419927

BASIC ASCD SYSTEM

Automatic Speed Control Device (ASCD) allows a driver to keep vehicle at predetermined constant speed without depressing accelerator pedal. Driver can set vehicle speed in advance between approximately 40 km/h (25 MPH) and 170 km/h (105 MPH).
ECM controls fuel injector to regulate engine speed.
Operation status of ASCD is indicated on the information display in the combination meter. If any malfunction occurs in ASCD system, it automatically deactivates control.
NOTE:
Always drive vehicle in a safe manner according to traffic conditions and obey all traffic laws.

SET OPERATION

Press ASCD MAIN switch. (CRUISE will be indicated on the information display.)
When vehicle speed reaches a desired speed between approximately 40 km/h (25 MPH) and 170 km/h (105 MPH), press COAST/SET switch. (SET will be indicated on the information display.)

ACCELERATE OPERATION

If the ACCEL/RES switch is pressed during cruise control driving, vehicle speed will increase until the switch is released or vehicle speed reaches maximum speed controlled by the system.
And then ASCD will keep the new set speed.

CANCEL OPERATION

When any of following conditions exist, cruise operation will be canceled.
- CANCEL switch is pressed.
- More than 2 switches at ASCD steering switch are pressed at the same time (Set speed will be cleared).
- Brake pedal is depressed.
- Clutch pedal is depressed or gear position is changed to N (neutral) position.
- Vehicle speed decreased under 15% of the set speed from the set speed.

• TCS system is operated.

When the ECM detects any of the following conditions, the ECM will cancel the cruise operation and inform the driver by blinking indicator.

• Engine coolant temperature is slightly higher than the normal operating temperature; CRUISE indicator may blink slowly.
  When the engine coolant temperature decreases to the normal operating temperature, CRUISE indicator will stop blinking and the cruise operation will be able to work by pressing COAST/SET switch or ACCEL/RES switch.
• Malfunction for some self-diagnoses regarding ASCD control: SET indicator will blink quickly.

If MAIN switch is turned to OFF during ASCD is activated, all of ASCD operations will be canceled and vehicle speed memory will be erased.

COAST OPERATION

When the COAST/SET switch is pressed during cruise control driving, vehicle set speed will decrease until the switch is released, and then ASCD will keep the new set speed.

RESUME OPERATION

When the ACCEL/RES switch is pressed after cancel operation other than pressing ASCD MAIN switch is performed, vehicle speed will return to last set speed. To resume vehicle set speed, the vehicle must meet the following conditions.

• Brake pedal is released.
• Clutch pedal is released.
• Vehicle speed is greater than 40 km/h (25 MPH) and less than 170 km/h (105 MPH).

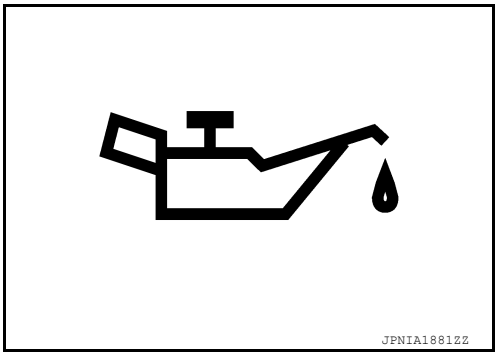
WARNING LAMPS/INDICATOR LAMPS

WARNING LAMPS/INDICATOR LAMPS : Engine Oil Pressure Warning Lamp

INFOID:0000000014419928

DESIGN/PURPOSE

When engine oil pressure is low, the oil pressure warning lamp informs the driver of low oil pressure to prevent damage to the engine.



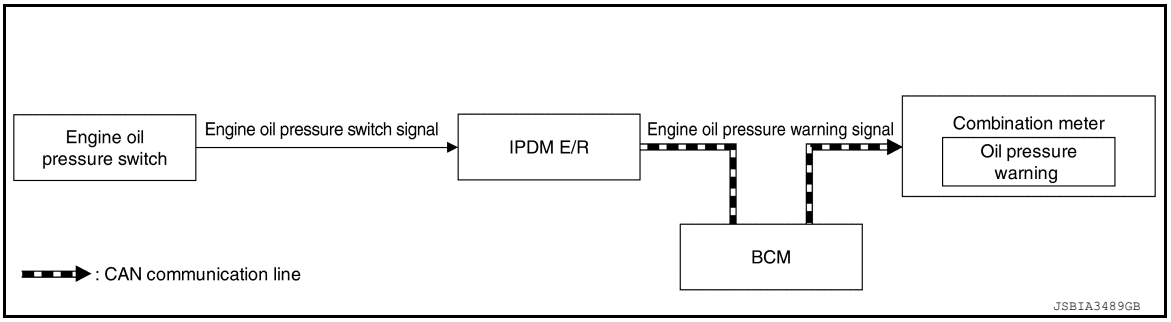
BULB CHECK

Not applicable

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL

For the operation for CAN communication blackout or abnormal signal reception, refer to MWI-17, "METER SYSTEM : Fail-safe".

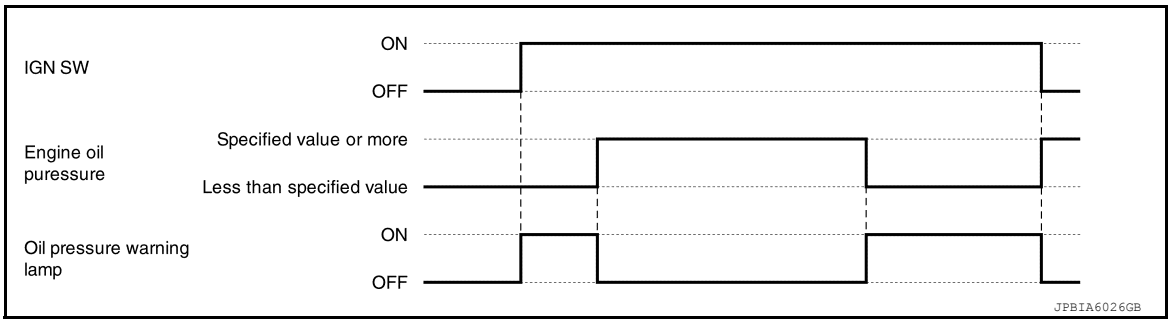
SYSTEM DIAGRAM



SIGNAL PATH
IPDM E/R received the engine oil pressure switch status from the oil pressure switch. With engine running when the oil pressure switch is OFF and at least 5 seconds, IPDM E/R transmits the engine oil pressure warning signal to combination meter via CAN communication through BCM. Then the engine oil pressure warning displays.

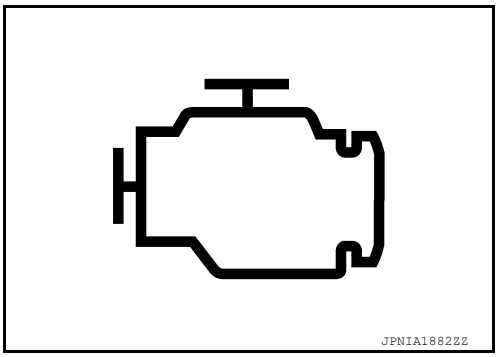
LIGHTING CONDITION
When any of the following conditions is satisfied:
- Ignition switch: OFF
- Engine oil pressure is the specified value or more.

SHUTOFF CONDITION
When any of the following conditions is satisfied:
- Ignition switch: OFF
- Engine oil pressure is the specified value or more.

TIMING CHART


WARNING LAMPS/INDICATOR LAMPS : Malfunction Indicator Lamp (MIL)
INFOID:0000000014419929

DESIGN/PURPOSE
When a malfunction which increases exhaust gases is detected, ECM turns ON MIL and informs the driver of the necessity of inspection and repair.
When a malfunction which causes damage to the catalyst is detected, ECM immediately blinks MIL to alert the driver.
NOTE:
- ECM turns ON MIL (yellow) when an emission-related malfunction occurs or when a component part specified by local laws and regulations becomes inoperable three trips in a row.
- ECM may turn ON MIL (red) when a malfunction occurs in the engine.

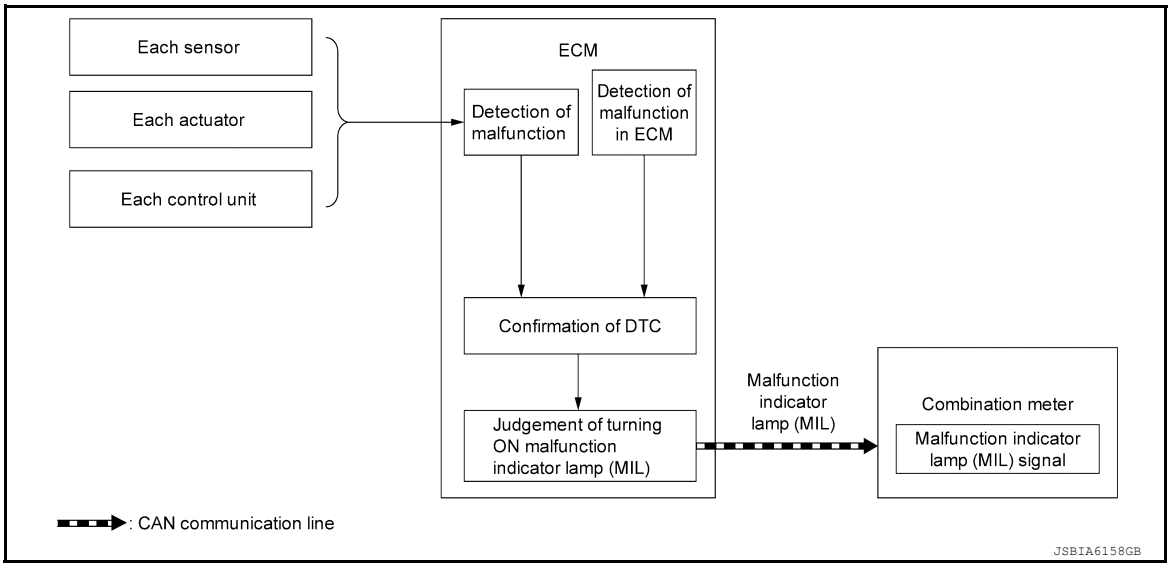


BULB CHECK
The bulb turns ON after turning ON the ignition switch (engine stop) and turns OFF after restarting the engine.

SYNCHRONIZATION WITH MASTER WARNING LAMP
Not applicable

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL
For the operation for CAN communication blackout in the combination meter, refer to MWI-17, "METER SYSTEM : Fail-safe".

SYSTEM DIAGRAM



SIGNAL PATH

- When the lighting conditions of the malfunction indicator lamp (MIL) are satisfied, ECM transmits a malfunction indicator lamp (MIL) signal to the combination meter via CAN communication.
- The combination meter turns ON or blinks the malfunction indicator lamp (MIL) according to a signal received from ECM.

LIGHTING CONDITION

When all of the following conditions are satisfied:

- Ignition switch: ON
- DTC which influences on exhaust gases is judged.

NOTE:

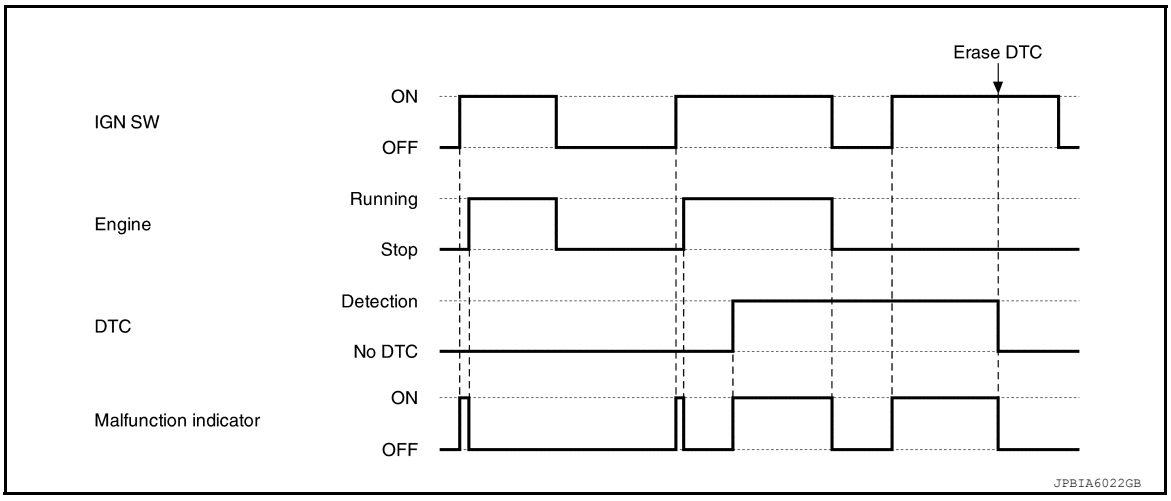
- For DTCs that the malfunction indicator lamp turns ON and the number of DTC diagnosis trips, refer to MWI-36, "DTC Index".

SHUTOFF CONDITION

When any of the following conditions is satisfied:

- Ignition switch: OFF
- Erase DTC.

TIMING CHART

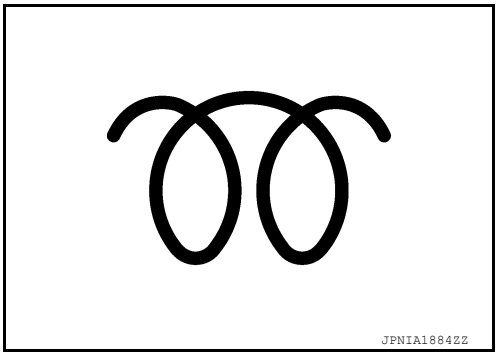


WARNING LAMPS/INDICATOR LAMPS : Glow Indicator Lamp

INFOID:0000000014419930

DESIGN/PURPOSE

The glow indicator lamp turns ON in quick preheat mode and informs the driver that the glow plug is under preheating condition.



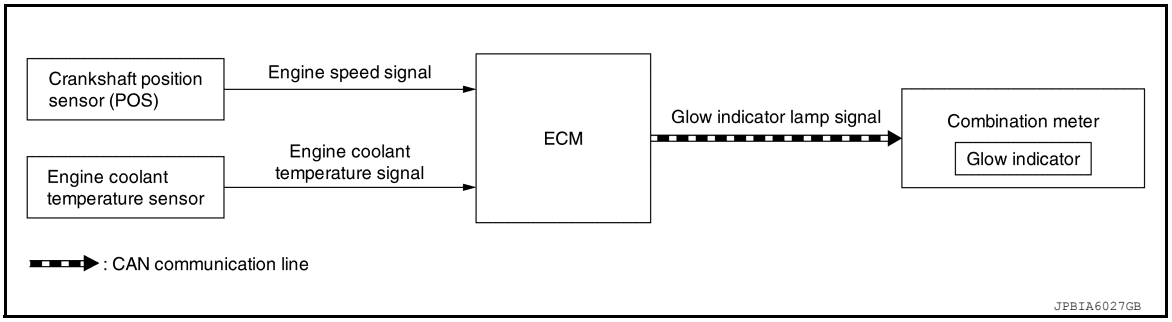
BULB CHECK

Not applicable

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL

For the operation for CAN communication blackout or abnormal signal reception, refer to MWI-35, "Fail-safe".

SYSTEM DIAGRAM



SIGNAL PATH

- ECM performs the glow control according to an IGN ON signal, water temperature signal, and engine speed signal. ECM transmits a glow indicator lamp signal to the combination meter in quick preheat mode via CAN communication.
- The combination meter turns ON the glow indicator lamp according to a glow indicator lamp signal received from ECM via CAN communication.

LIGHTING CONDITION

When any of the following conditions is satisfied:

- Ignition switch: ON.
- Mode: Quick preheat mode.

NOTE:

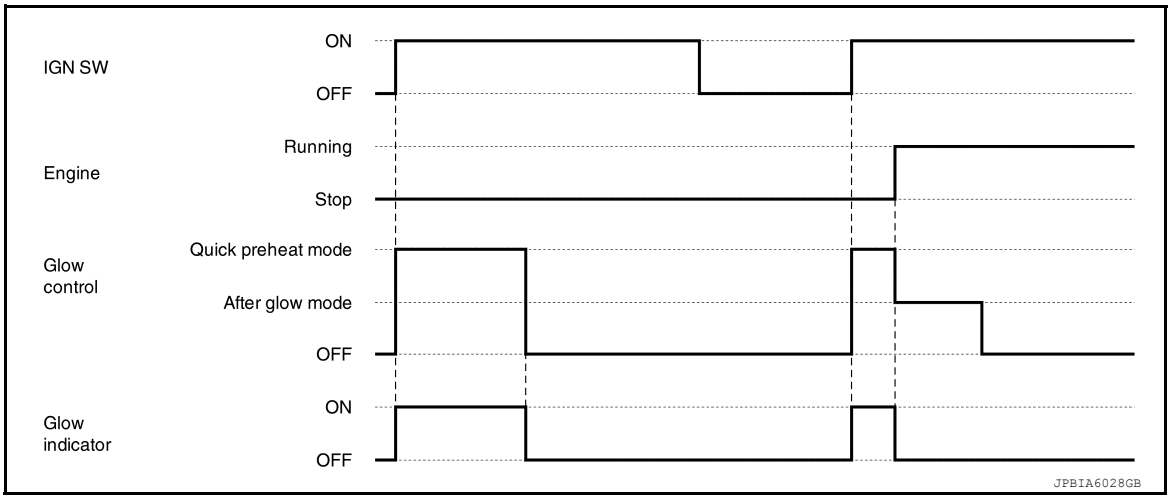
The glow indicator lamp does not turn ON in after glow mode.

SHUTOFF CONDITION

When any of the following conditions is satisfied:

- Ignition switch: OFF.
- Quick preheat mode is complete.
- Engine start.

TIMING CHART



WARNING LAMPS/INDICATOR LAMPS : DPF (Diesel Particulate Filter) Warning Lamp

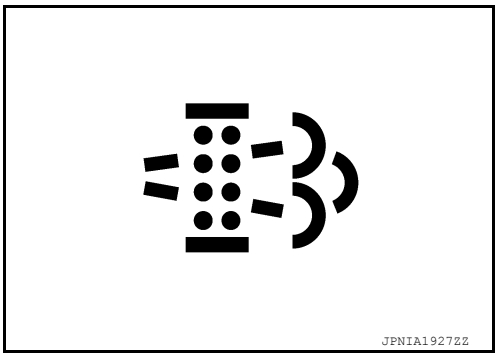
INFOID:0000000014419931

DESIGN/PURPOSE

When a certain amount of PM (particulate matter) accumulates in the DPF (Diesel Particulate Filter), the warning lamp/indicator lamp turns ON to inform the driver of the necessity of the DPF (Diesel Particulate Filter) regeneration.

NOTE:

For the outline of DPF (Diesel Particulate Filter) control and regeneration, refer to EC-785, "AFTER_TREATMENT_SYSTEM : System Description".



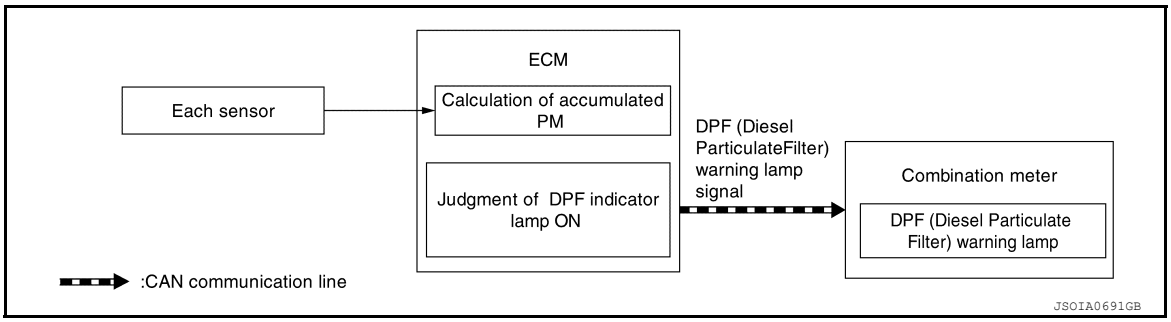
BULB CHECK

The bulb turns ON when the ignition switch is turned ON (engine stop) and turns OFF after the engine is started.

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL

For the operation for CAN communication blackout or abnormal signal reception, refer to MWI-35, "Fail-safe".

SYSTEM DIAGRAM



SIGNAL PATH

- When calculating and judging that the amount of PM (particulate matter) accumulated in DPF (Diesel Particulate Filter) reaches the specified amount, ECM transmits a DPF warning lamp signal to the combination meter via CAN communication.
- The combination meter turns ON the DPF (Diesel Particulate Filter) warning lamp according to a DPF (Diesel Particulate Filter) warning lamp signal received from ECM via CAN communication.

LIGHTING CONDITION

When all of the following conditions are satisfied:

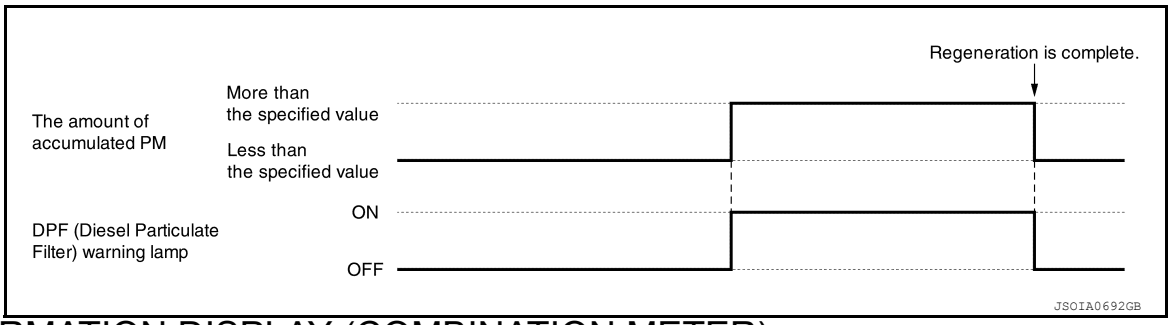
- Ignition switch: ON
- The amount of PM in DPF (Diesel Particulate Filter) is more than the specified amount.

SHUTOFF CONDITION

When any of the following conditions is satisfied:

- Ignition switch: OFF
- The amount of PM in DPF (Diesel Particulate Filter) is less than the specified amount. (Regeneration is complete.)

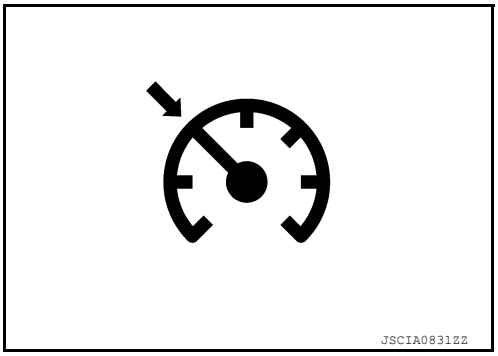
TIMING CHART



INFORMATION DISPLAY (COMBINATION METER)

INFORMATION DISPLAY (COMBINATION METER) : ASCD Indicator

INFOID:0000000014419932

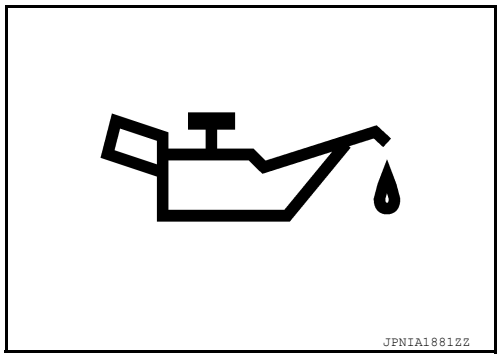
Item	Symbol	Function
ASCD indicator	 JSCIA0831ZZ Message: - - Km/h / - - MPH	For detail of ASCD function, refer to EC-787, "AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description".

INFORMATION DISPLAY (COMBINATION METER) : Engine Oil Pressure Warning

INFOID:0000000014419933

DESIGN/PURPOSE

When engine oil pressure is low, the engine oil pressure warning informs the driver of low oil pressure to prevent damage to the engine.

Symbol	Message
	• Low Oil Pressure • Stop Vehicle

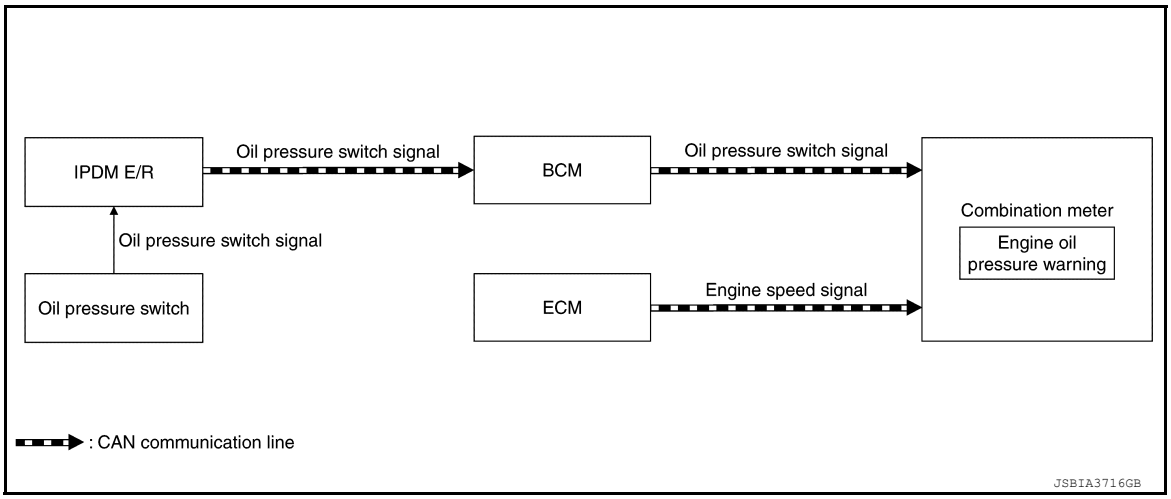
BULB CHECK

Not applicable

OPERATION AT COMBINATION METER CAN COMMUNICATION CUT-OFF OR UNUSUAL SIGNAL

For the operation for CAN communication blackout or abnormal signal reception, refer to MWI-35, "Fail-safe".

SYSTEM DIAGRAM



SIGNAL PATH

- IPDM E/R receives a signal from the engine oil pressure switch and transmits an oil pressure switch signal to BCM via CAN communication.
- BCM transmits the received oil pressure switch signal to the combination meter via CAN communication.
- The information display (on combination meter) engine oil pressure warning is SHOWN/HIDDEN according to the oil pressure switch signal received from BCM.

LIGHTING CONDITION

When all of the following conditions for at least 5 seconds are satisfied:

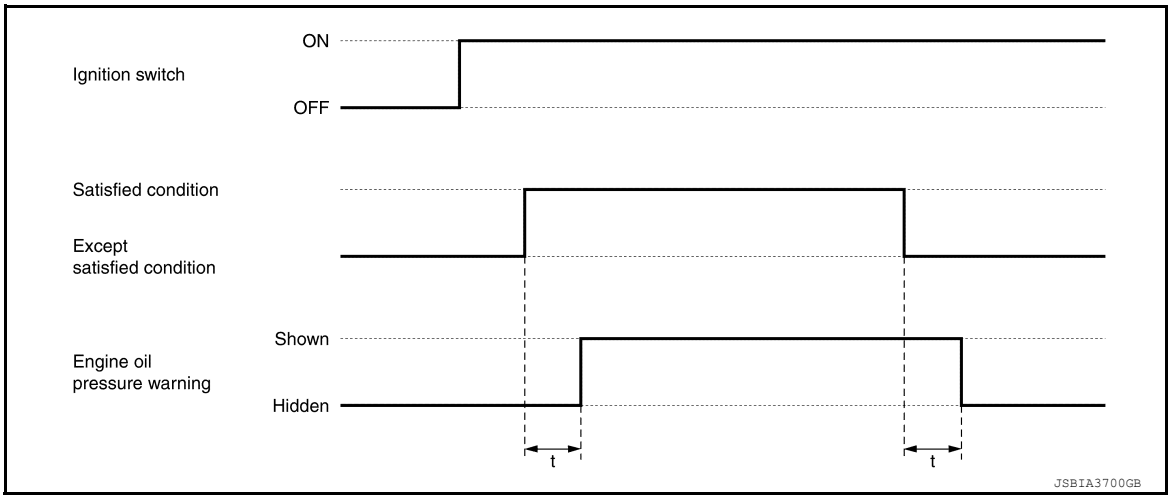
- Ignition switch: ON
- Engine oil pressure is less than specified value. (Oil pressure switch signal: ON)
- Engine speed is more than 500 rpm.

SHUTOFF CONDITION

When any of the following conditions is satisfied:

- Ignition switch: OFF
- Engine oil pressure is the specified value or more. (Oil pressure switch signal: OFF)
- Engine speed is less than 500 rpm.

TIMING CHART



t: 100 ms

WARNING/INDICATOR/CHIME LIST

WARNING/INDICATOR/CHIME LIST : Warning lamps/Indicator lamps

INFOID:0000000014419934

Name	Design	Arrangement/Function
Engine oil pressure warning lamp		Regarding the function, refer to EC-788, "WARNING LAMPS/INDICATOR LAMPS : Engine Oil Pressure Warning Lamp".
Malfunction indicator lamp (MIL)		Regarding the function, refer to EC-789, "WARNING LAMPS/INDICATOR LAMPS : Malfunction Indicator Lamp (MIL)".
Glow indicator lamp		Regarding the function, refer to EC-790, "WARNING LAMPS/INDICATOR LAMPS : Glow Indicator Lamp".
DPF (Diesel Particulate Filter) warning lamp		Regarding the function, refer to EC-792, "WARNING LAMPS/INDICATOR LAMPS : DPF (Diesel Particulate Filter) Warning Lamp".

WARNING/INDICATOR/CHIME LIST : Warning/Indicator (On Information Display)

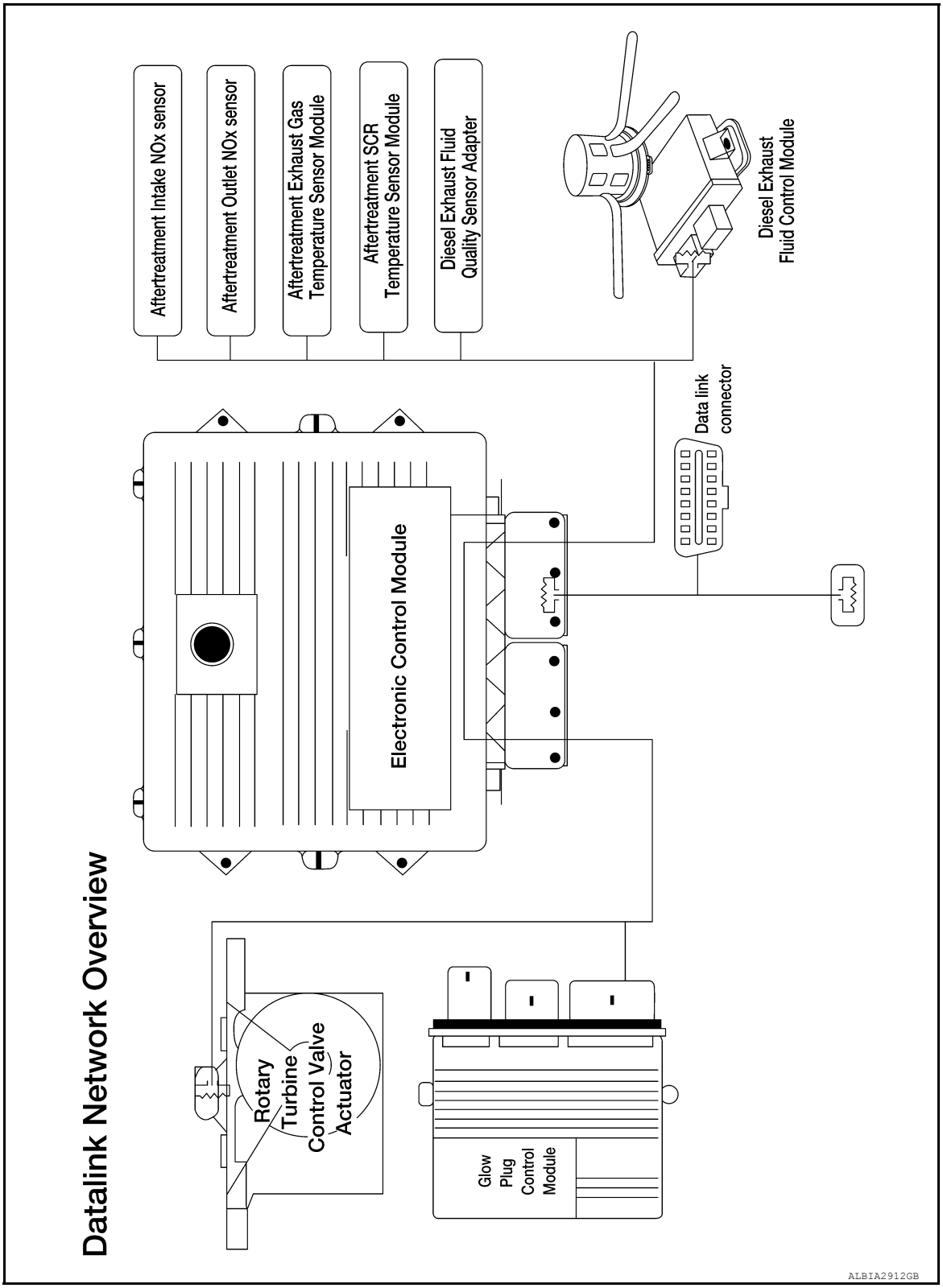
INFOID:0000000014419935

Name	Function
ASCD indicator	Refer to EC-793, "INFORMATION DISPLAY (COMBINATION METER) : ASCD Indicator".
Engine oil pressure warning	Refer to EC-793, "INFORMATION DISPLAY (COMBINATION METER) : Engine Oil Pressure Warning".

CAN COMMUNICATION

CAN COMMUNICATION : System Description

INFOID:0000000014419936



CAN (Controller Area Network) is a serial communication line for real time application. It is an on-vehicle multiplex communication line with high data communication speed and excellent error detection ability. Many electronic control units are equipped onto a vehicle, and each control unit shares information and links with other control units during operation (not independent). In CAN communication, control units are connected with 2 communication lines (CAN H-line, CAN L-line), allowing a high rate of information transmission with less wiring. Each control unit transmits/receives data but selectively reads required data only.

Refer to LAN-74, "CAN COMMUNICATION SYSTEM : CAN Communication Signal Chart" for details about CAN communication.

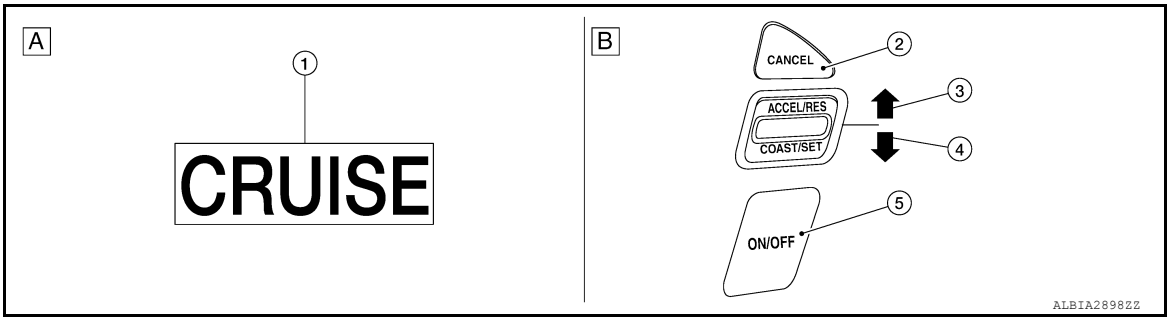
OPERATION

AUTOMATIC SPEED CONTROL DEVICE (ASCD)

AUTOMATIC SPEED CONTROL DEVICE (ASCD) : Switch Name and Function

INFOID:0000000014419937

SWITCHES AND INDICATORS



A On the combination meter
B On the steering wheel
① ASCD indicator
② CANCEL switch
③ ACCEL/RES
④ COAST/SET
⑤ MAIN switch

SET SPEED RANGE

ASCD system can be set to the following vehicle speed.

Minimum speed (Approx.)	Maximum speed (Approx.)
40 km/h (25 MPH)	170 km/h (105 MPH)

SWITCH OPERATION

Item	Function
CANCEL switch	Cancels the cruise control driving.
ACCEL/RES switch	• Resumes the set speed. • Increases speed incrementally during cruise control driving.
COAST/SET switch	• Sets desired cruise speed. • Decreases speed incrementally during cruise control driving.
MAIN switch	Master switch to activate the ASCD system.

Refer to EC-787, "AUTOMATIC SPEED CONTROL DEVICE (ASCD) : System Description" for ASCD operating instructions.

OIL CONTROL SYSTEM

OIL CONTROL SYSTEM : Switch Name and Function

INFOID:0000000014419938

SWITCH OPERATION

Item	Function
Engine oil switch	Refer to MWI-102, "Description".

RESET OPERATION

CAUTION:

When an alert was displayed, change the engine oil, and reset the engine oil data.

1. Turn ignition switch ON.
2. On information display, select “Settings” >> “Maintenance” >> “Service”.
3. Press “ENTER” switch until “YES/NO” appears.
4. Select “YES”.

5. Check that “– – –” is displayed.

ON BOARD DIAGNOSTIC (OBD) SYSTEM

Diagnosis Description

INFOID:0000000014419939

DESCRIPTION

This system uses two malfunction indicator lamps. When detecting a system error, ECM turns ON the malfunction indicator lamp to alert the driver of the presence of malfunction. Refer to MWI-12, "METER SYSTEM : Combination Meter".

MALFUNCTION INDICATOR LAMP (MIL) (YELLOW)

ECM turns ON MIL (yellow) when an emission-related malfunction occurs.

MALFUNCTION INDICATOR LAMP (MIL) (RED)

ECM may turn ON MIL (red) when a severe malfunction related to high temperature occurs in the engine.

GST (Generic Scan Tool)

INFOID:0000000014419940

When GST is connected with a data link connector equipped on the vehicle side, it will communicate with the control module equipped in the vehicle and then enable various kinds of diagnostic tests. Refer to GI-55, "Description".

NOTE:

Service $0A is not applied for regions where it is not mandated.

DIAGNOSIS SYSTEM (ECM)

System Readiness Test (SRT) Code

INFOID:0000000014419941

System Readiness Test (SRT) code is specified in Service $01 of SAE J1979/ISO 15031-5.
As part of an enhanced emissions test for Inspection & Maintenance (I/M), certain states require the status of SRT be used to indicate whether the ECM has completed self-diagnosis of major emission systems and components. Completion must be verified in order for the emissions inspection to proceed.
If a vehicle is rejected for a State emissions inspection due to one or more SRT items indicating “INCMP”, use the information in this Service Manual to set the SRT to “CMPLT”.
In most cases the ECM will automatically complete its self-diagnosis cycle during normal usage, and the SRT status will indicate “CMPLT” for each application system. Once set as “CMPLT”, the SRT status remains “CMPLT” until the self-diagnosis memory is erased.
Occasionally, certain portions of the self-diagnostic test may not be completed as a result of the customer's normal driving pattern; the SRT will indicate “INCMP” for these items.

NOTE:
The SRT will also indicate “INCMP” if the self-diagnosis memory is erased for any reason or if the ECM memory power supply is interrupted for several hours.
If, during the state emissions inspection, the SRT indicates “CMPLT” for all test items, the inspector will continue with the emissions test. However, if the SRT indicates “INCMP” for one or more of the SRT items the vehicle is returned to the customer untested.

NOTE:
If permanent DTC is stored or MIL illuminates during the state emissions inspection, the vehicle is also returned to the customer untested even though the SRT indicates “CMPLT” for all test items. Therefore, it is important to check SRT (“CMPLT”), DTC (No DTCs) and permanent DTC (NO permanent DTCs) before the inspection.

SRT SET TIMING

SRT is set as “CMPLT” after self-diagnosis has been performed one or more times. Completion of SRT is done regardless of whether the result is OK or NG. The set timing is different between OK and NG results and is shown in the table below.

Self-diagnosis result		Example				
		Diagnosis	Ignition cycle ← ON →	OFF	← ON →	OFF ← ON → OFF ← ON →
All OK	Case 1	P0401	OK (1)	— (1)	OK (2)	— (2)
		P0402	OK (1)	— (1)	— (1)	OK (2)
		P040B	OK (1)	OK (2)	— (2)	— (2)
		SRT of EGR	“CMPLT”	“CMPLT”	“CMPLT”	“CMPLT”
	Case 2	P0401	OK (1)	— (1)	— (1)	— (1)
		P0402	— (0)	— (0)	OK (1)	— (1)
		P040B	OK (1)	OK (2)	— (2)	— (2)
		SRT of EGR	“INCMP”	“INCMP”	“CMPLT”	“CMPLT”
NG exists	Case 3	P0401	OK	OK	—	—
		P0402	—	—	—	—
		P040B	NG	—	NG	NG (Consecutive NG)
		(1st trip) DTC	1st trip DTC	—	1st trip DTC	DTC (= MIL ON)
		SRT of EGR	“INCMP”	“INCMP”	“INCMP”	“CMPLT”

OK: Self-diagnosis is carried out and the result is OK.

NG: Self-diagnosis is carried out and the result is NG.

—: Self-diagnosis is not carried out.

When all SRT related self-diagnoses show OK results in a single cycle (Ignition OFF-ON-OFF), the SRT will indicate “CMPLT”. → Case 1 above

When all SRT related self-diagnoses show OK results through several different cycles, the SRT will indicate “CMPLT” at the time the respective self-diagnoses have at least one OK result. → Case 2 above
If one or more SRT related self-diagnoses show NG results in 2 consecutive cycles, the SRT will also indicate “CMPLT”. → Case 3 above
The table above shows that the minimum number of cycles for setting SRT as “INCMP” is the number one (1) for each self-diagnosis (Case 1 & 2) or the number two (2) for one of self-diagnoses (Case 3). However, in preparation for the state emissions inspection, it is unnecessary for each self-diagnosis to be executed twice (Case 3) for the following reasons:

- The SRT will indicate “CMPLT” at the time the respective self-diagnoses have one (1) OK result.
- The emissions inspection requires “CMPLT” of the SRT only with OK self-diagnosis results.
- During SRT driving pattern, the 1st trip DTC (NG) is detected prior to “CMPLT” of SRT and the self-diagnosis memory must be erased from the ECM after repair.
- If the 1st trip DTC is erased, all the SRT will indicate “INCMP”.

NOTE:
SRT can be set as “CMPLT” together with the DTC(s). Therefore, DTC check must always be carried out prior to the state emission inspection even though the SRT indicates “CMPLT”.

Permanent Diagnostic Trouble Code (Permanent DTC)

INFOID:0000000014419942

Permanent DTC is defined in SAE J1979/ISO 15031-5 Service $0A.
ECM stores a DTC issuing a command of turning on MIL as a permanent DTC and keeps storing the DTC as a permanent DTC until ECM judges that there is no presence of malfunction.
Permanent DTCs cannot be erased by using the erase function of CONSULT or Generic Scan Tool (GST) and by disconnecting the battery to shut off power to ECM. This prevents a vehicle from passing the in-use inspection without repairing a malfunctioning part.
When not passing the in-use inspection due to more than one permanent DTC, permanent DTCs should be erased, referring to this manual.

NOTE:

- The important items in in-use inspection are that MIL is not ON, SRT test items are set, and permanent DTCs are not included.
- Permanent DTCs do not apply for regions that permanent DTCs are not regulated by law.

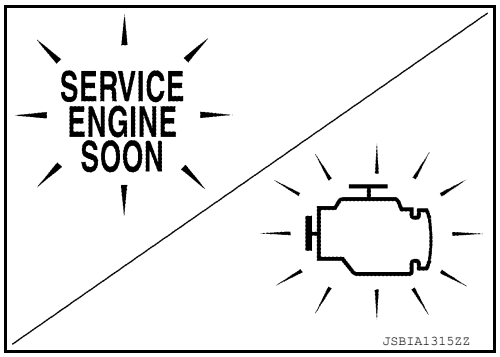
PERMANENT DTC SET TIMING

The setting timing of permanent DTC is stored in ECM with the lighting of MIL when a DTC is confirmed.

Malfunction Indicator Lamp (MIL)

INFOID:0000000014419943

When emission related ECU detects a malfunction in the emission control systems components and/or the powertrain control components (which affect vehicle emissions), it turns on/blinks MIL to inform the driver that a malfunction has been detected.



1. The MIL illuminates when ignition switch is turned ON (engine is not running).
   NOTE:
   Check the MIL circuit if MIL does not illuminate. Refer to EC-881, "Work Flow".
2. When the engine is started, the MIL should go off.
   NOTE:
   If MIL continues to illuminate/blink, perform self-diagnoses and inspect/repair accordingly because an emission related ECU has detected a malfunction in the emission control systems components and/or the powertrain control components (which affect vehicle emissions).

On Board Diagnosis Function

INFOID:0000000014419944

ON-BOARD DIAGNOSIS ITEM

The on-board diagnostic system has the following functions.

Diagnostic test mode	Function
Bulb check	MIL can be checked.
SRT status	ECM can read if SRT codes are set.

Diagnostic test mode	Function
Malfunction warning	If ECM detects a malfunction, it illuminates or blinks MIL to inform the driver that a malfunction has been detected.
Self-diagnostic results	DTCs or 1st trip DTCs stored in ECM can be read.

BLUB CHECK MODE

Description
This function allows damage inspection in the MIL bulb (blown, open circuit, etc.).

Operation Procedure

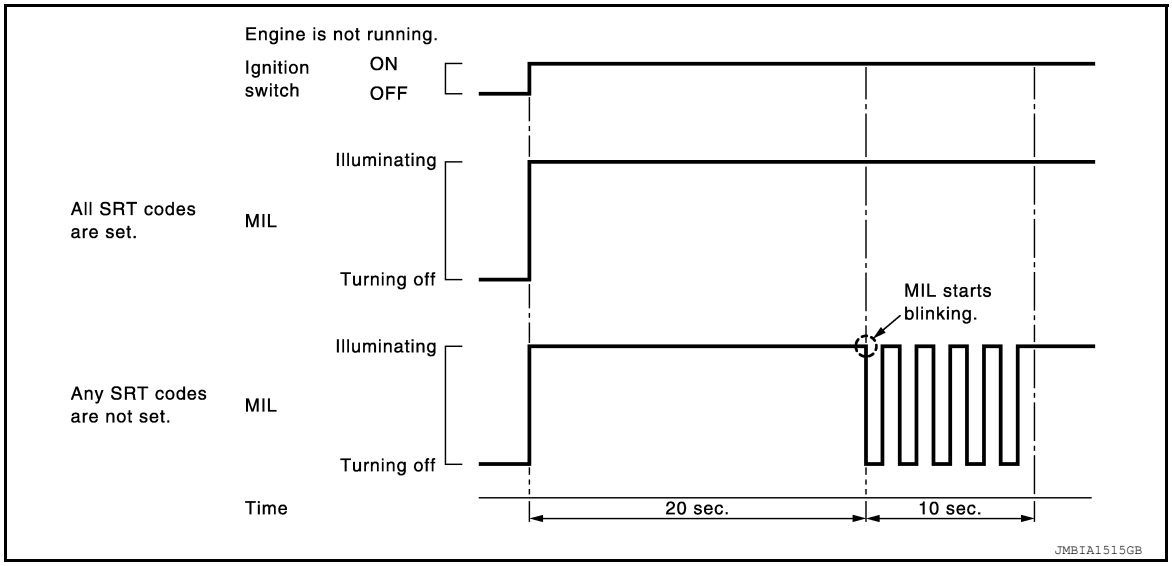
1. Turn ignition switch ON.
2. The MIL on the instrument panel should stay ON.
   If it remains OFF, check MIL circuit. Refer to EC-856, "Wiring Diagram".

SRT STATUS MODE

Description
This function allows to read if ECM has completed the self-diagnoses of major emission control systems and components. For SRT, refer to EC-801, "System Readiness Test (SRT) Code".

Operation Procedure

1. Turn ignition switch ON and wait 20 seconds.
2. SRT status is indicated as shown blow.
   - ECM continues to illuminate MIL if all SRT codes are set.
   - ECM blinks MIL for about 10 seconds if all SRT codes are not set.



MALFUNCTION WARNING MODE

Description
In this function ECM turns on or blinks MIL when it detects a malfunction in the emission control system components and/or the powertrain control components (which affect vehicle emissions) to inform the driver that a malfunction has been detected.

Operation Procedure

1. Turn ignition switch ON.
2. Check that MIL illuminates.
   If it remains OFF, check MIL circuit. Refer to EC-856, "Wiring Diagram".
3. Start engine and let it idle.
   - For two trip detection logic diagnoses, ECM turns on MIL when it detects the same malfunction twice in the two consecutive driving cycles.
   - For 1st trip detection logic diagnoses, ECM turns on MIL when it detects a malfunction in one driving cycle.
   - ECM blinks MIL when it detects a malfunction that may damage the three way catalyst (misfire).

SELF-DIAGNOSTIC RESULTS MODE

Description

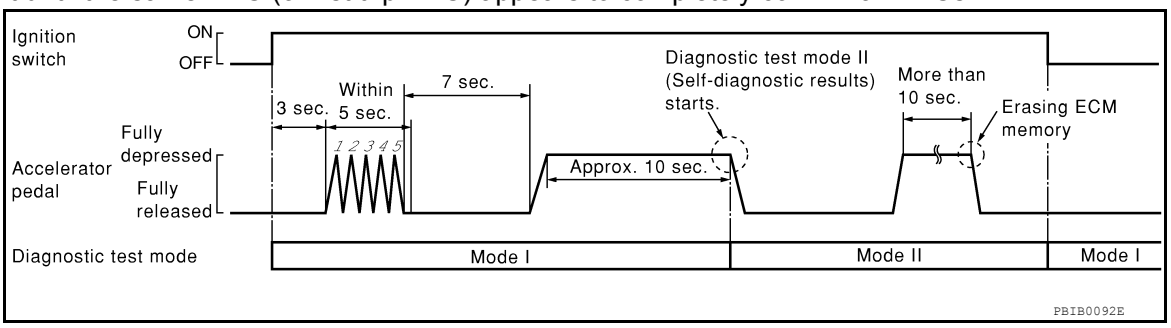
This function allows to indicate DTCs or 1st trip DTCs stored in ECM according to the number of times MIL is blinking.

How to Set Self-diagnostic Results Mode

NOTE:

- It is better to count the time accurately with a clock.
- After ignition switch is turned off, ECM is always released from the “Self-diagnostic results” mode.

1. Confirm that accelerator pedal is fully released, turn ignition switch ON and wait 3 seconds.
2. Repeat the following procedure quickly five times within 5 seconds.
   - Fully depress the accelerator pedal.
   - Fully release the accelerator pedal.
3. Wait 7 seconds, fully depress the accelerator pedal and keep it depressed for approx. 10 seconds until the MIL starts blinking.
   NOTE:
   Do not release the accelerator pedal for 10 seconds if MIL starts blinking during this period. This blinking is displaying SRT status and is continued for another 10 seconds.
4. Fully release the accelerator pedal.
   ECM has entered to Self-diagnostic results mode.
   NOTE:
   Wait until the same DTC (or 1st trip DTC) appears to completely confirm all DTCs.

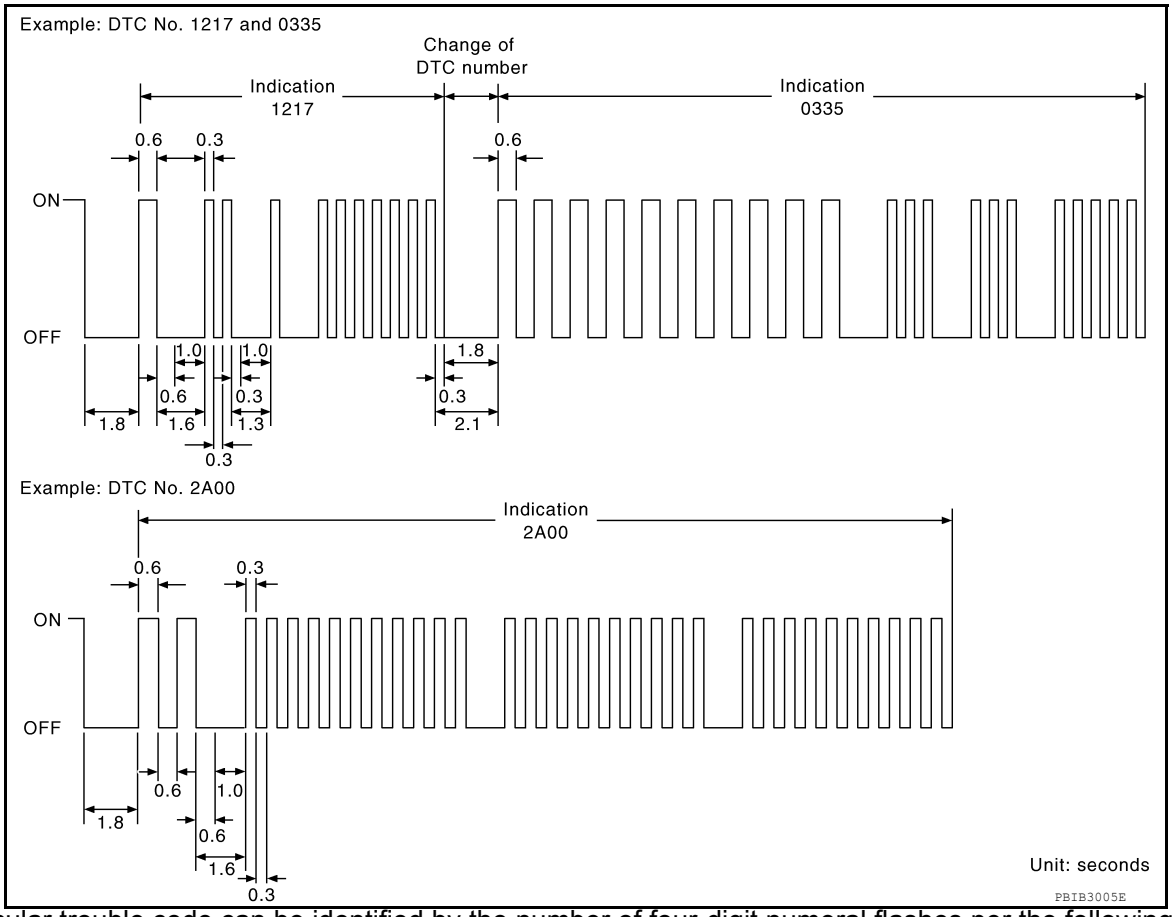


How to Read Self-diagnostic Results

The DTC and 1st trip DTC are indicated by the number of blinks of the MIL as shown below.

The DTC and 1st trip DTC are displayed at the same time. If the MIL does not illuminate in diagnostic test mode I (Malfunction warning), all displayed items are 1st trip DTCs. If only one code is displayed when the MIL illuminates in “malfunction warning” mode, it is a DTC; if two or more codes are displayed, they may be either

DTCs or 1st trip DTCs. DTC No. is same as that of 1st trip DTC. These unidentified codes can be identified by using the CONSULT or GST. A DTC will be used as an example for how to read a code.



A particular trouble code can be identified by the number of four-digit numeral flashes per the following.

Number	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Flashes	10	1	2	3	4	5	6	7	8	9	11	12	13	14	15	16

The length of time the 1,000th-digit numeral flashes on and off is 1.2 seconds consisting of an ON (0.6-seconds) - OFF (0.6-seconds) cycle.
The 100th-digit numeral and lower digit numerals consist of a 0.3-seconds ON and 0.3-seconds OFF cycle.
A change from one digit numeral to another occurs at an interval of 1.0-second OFF. In other words, the later numeral appears on the display 1.3 seconds after the former numeral has disappeared.
A change from one trouble code to another occurs at an interval of 1.8-seconds OFF.
In this way, all the detected malfunctions are classified by their DTC numbers. The DTC 0000 refers to no malfunction. Refer to EC-838, "DTC Index".

How to Erase Self-diagnostic Results

By performing this procedure, ECM memory is erased and the following diagnostic information is erased as well.

- Diagnostic trouble codes
- 1st trip diagnostic trouble codes
- Freeze frame data
- 1st trip freeze frame data
- System readiness test (SRT) codes
- Test values

NOTE:

Also, if a battery terminal is disconnected, ECM memory is erased and the diagnostic information as listed above is erased. (The amount of time required for erasing may vary from a few seconds to several hours.)

1. Turn ignition switch OFF and wait at least 10 seconds.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.

4. Turn ignition switch ON.
5. Set ECM in Self-diagnostic results.
6. The diagnostic information has been erased from the backup memory in the ECM.
   Fully depress the accelerator pedal and keep it depressed for more than 10 seconds.
7. Fully release the accelerator pedal, and confirm the DTC 0000 is displayed.

CONSULT Function

INFOID:0000000014419945

FUNCTION

Diagnostic test mode	Function
Self Diagnostic Result	Self diagnostic results such as DTC can be read and erased quickly.*
Data Monitor	Input/Output data in the ECM can be read.
Work support	This mode enables a technician to adjust some devices faster and more accurately by following the indications on the CONSULT unit.
Active Test	Diagnostic Test Mode in which CONSULT drives some actuators apart from the ECMs and also shifts some parameters in a specified range.
ECU Identification	ECM part number can be read.

*: The following emission-related diagnostic information is cleared when the ECM memory is erased.

- Diagnostic trouble codes

SELF DIAGNOSTIC MODE

Self Diagnostic Item

Regarding items detected in “SELF DIAG RESULTS” mode, refer to EC-838, "DTC Index".

DATA MONITOR MODE

NOTE:

The following table includes information (items) inapplicable to this vehicle. For information (items) applicable to this vehicle, refer to CONSULT display items.

Monitor item	Unit	Description
DPF OPERTING STATE	NONE	DPF filter not applicable for the application.
	OK	DPF filter operating normally.
	DENOX	DPF control system operating in a NOx catalyst regeneration.
	MSRGN	DPF filter currently operating in a non-service induced (mobile) regeneration event.
	DESOX	DPF control system operating in a NOx catalyst regeneration.
	PRTCT	DPF control system operating in a condition to protect the DPF.
	H2ODB	DPF control system operating in a condition to warm up.
	HCDB	DPF control system operating in a condition to warm up.
	NMRGN	DPF filter currently operating in a service induced (stationary) regeneration event.
	SCRTM	DPF control system operating in a condition to warm up SCR system.
	MNTN	DPF control system operating in a condition to warm up.
	MDRT	DPF control system has detected the SCR system to be operating in moderate mode.
DPF OUTLET PRESS	-3 – +3 kPa G	Indicates the gauge pressure reading of the DPF outlet.
DPF OUTLET PRESS SENS V	0 – 5V	Indicates the voltage reading of the DPF outlet pressure sensor.
DEF QLTY SENS	31 – 34%	Indicates the measured quality of the diesel exhaust fluid in the pump.
INTAKE NOX	ppm	Indicates the parts per million (ppm) NOx measurement prior to the diesel oxidation catalyst.

Monitor item	Unit	Description
INTAKE NOX CORRCTD	ppm	Indicates the filtered parts per million (ppm) NOx measurement prior to the diesel oxidation catalyst.
INTAKE NOX READNG STBL	NA	Indicates the parts per million (ppm) measurement is not available.
	NG	Indicates the parts per million (ppm) measurement is inaccurate.
	OK	Indicates the parts per million (ppm) measurement is accurate.
	ERROR	Indicates the parts per million (ppm) measurement is in error.
DPF FACEPLUG COUNT	≥	Indicates the number of times the ECM has detected the DPF is face plugged.
AFT MAINTENANCE STATUS	Inactive≥	Indicates the aftertreatment reset request has not been requested.
	ACTIV	Indicates the aftertreatment reset request has been requested.
	CMPLT	Indicates the aftertreatment data has been reset.
	PROHB	Indicates the aftertreatment reset request could not be completed due to a condition detected by ECM.
AFT NOX OUT TEST STATUS	NG	Indicates the test has determined a condition that caused a decision of Fail/Bad.
	OK	Indicates the test has determined a condition that caused a decision of OK/GOOD.
	NA	Indicates the test is actively executing.
	ACTIV	Indicates the test has not been aborted for execution.
	ABORT	Indicates the test has been requested for some ECM detected condition.
	NS	Indicates the test is not supported.
OUTLET NOX	ppm	Indicates the parts per million (ppm) NOx measurement after the SCR system.
OUTLET NOX CORRCTD	ppm	Indicates the filtered parts per million (ppm) NOx measurement after the SCR system.
ACC POS SENS 2 SPLY V	4.7 – 5.2V	Indicates the voltage supply value for the accelerator pedal position (APP) sensor 2.
ACC POS SENS 2 V	0 – 2V	Indicates the measured voltage value for the accelerator pedal position (APP) sensor 2.
ACC POS SENS SPLY V	4.7 – 5.2V	Indicates the voltage supply value for the accelerator pedal position (APP) sensor 1.
ACC POS SENS V	1 – 4V	Indicates the measured voltage value for the accelerator pedal position (APP) sensor 1.
OUTLET NOX RDNG STBL	NA	Indicates the parts per million (ppm) measurement is not available.
	NG	Indicates the parts per million (ppm) measurement is inaccurate.
	OK	Indicates the parts per million (ppm) measurement is accurate.
	ERROR	Indicates the parts per million (ppm) measurement is in error.
DPF DOSING CMD	ON	Indicates the DEF injector is dosing.
	OFF	Indicates the DEF injector is not dosing.

Monitor item	Unit	Description
AFT DPF REGEN STATUS	INACT	Indicates the stationary regen has not been requested.
	ACTIV	Indicates the stationary regen has been requested.
	CMPLT	Indicates the stationary regen request was been completed as requested.
	FAULT	Indicates the ECM has detected a DTC which prevents the test from executing.
	PROHB	Indicates the ECM has detected a non DTC related prevention condition.
	SERBK	Indicates the ECM has detected the stop lamp switch being activated.
	PRKBK	Indicates the ECM has detected the park brake switch being activated.
	THRTL	Indicates the ECM has detected the accelerator pedal being depressed to a value greater than 0%.
	INGR	Indicates the ECM has detected the transmission to be in any position other than P (park).
	PTO	Indicates the ECM has detected a PTO request.
	OEMSN	Indicates the ECM has detected the supplied sensor is at or below requested comparison value.
	VEHSP	Indicates the ECM has detected the vehicle to be moving or VSS failure.
	AIRHD	Indicates the ECM has detected a failure with a air handling system.
	GOV	Indicates the ECM has detected a condition in which the service test could not be performed.
	EPD	Indicates the ECM is currently operating in an engine protection condition.
	Ewo	Indicates the ECM has detected low engine coolant temperature.
TIME SINCE ACTIVE REGEN	Hr	Indicates the amount of time since a non mobile regeneration event.
TIME SINCE REACT REGEN	Hr	Indicates the amount of time since a mobile regeneration event.
DPF SOOT LOAD MNTR	gm	Indicates the DPF estimated soot load value.
SOOT LOAD MNTR STATUS	NORM	Indicates the DPF is operating in normal soot condition.
	LOW	Indicates the DPF is operating in least severe soot condition.
	MED	
	HIGH	Indicates the DPF is operating in moderately severe soot condition.
	SEV	Indicates the DPF is operating in most severe soot condition.
BOOST PRESSURE	-10.3 – +10.3 kPa	Indicates the measured gauge pressure prior to entering the intake manifold (Key ON/engine OFF).
BOOST PRES SENS V	0 – 5V	Indicates the measured sensor voltage of the boost pressure sensor.
Byte order	L ENDI	Indicates the data shall not be byte swapped.
	B ENDI	Indicates the data shall be interpreted as byte swapped.
DOC INLET TEMP	≥ 250°C	Indicates the diesel oxidation catalyst inlet measured temperature.
DPF INLET TEMP	200°C > DOC INLET TEMP	Indicates the diesel oxidation catalyst outlet measured temperature.
DPF DELTA PRESS SENS V	0 – 5V	Indicates the measured sensor voltage of the DPF differential pressure sensor.
DPF DELTA PRESS	-3 – +3 kPa	Indicates the measured pressure difference across the DPF.
DPF OUTLET TEMP	°C	Indicates the DPF outlet measured temperature.
CAC OUT TEMP	± 5.5°C of ambient temperature	Indicates the charge air cooler outlet measured temperature.
CAC OUT TEMP SENS V	0 – 5V	Indicates the measured sensor voltage of the charge air cooler outlet temperature sensor.

Monitor item	Unit	Description
ACCEL PEDAL POS	%	Indicates the interpreted pedal position in percentage as determined by the ECM.
COOLANT LEVEL	NG	Indicates the coolant level to be at a system hindrance level.
	OK	Indicates the coolant level to be normal.
	LOW	Indicates the coolant level to be at a slightly low value.
COOLANT TEMP	90.5 – 105.5°C	Indicates the measured coolant temperature.
ENGINE COOLANT TEMPERATURE SEN VOLTAGE	0 – 5V	Indicates the measured sensor voltage of the coolant temperature sensor.
BATTERY VOLTAGE	11 – 14V	Indicates the measured battery voltage as seen by the ECM.
CC ACCEL S/W	OFF	Indicates the ACCEL/RES switch is not pressed.
	ON	Indicates the ACCEL/RES switch is pressed.
CRUISE CANCEL S/W	OFF	Indicates the CANCEL switch is not pressed.
	ON	Indicates the CANCEL switch is pressed.
CRUISE COAST SW	OFF	Indicates the COAST/SET switch is not pressed.
	ON	Indicates the COAST/SET switch is pressed.
CC TARGET SPEED	km/h / mph	Indicates the vehicle speed that cruise control is currently attempting to hold to.
CRUISE CNTL STAT	OFF	Indicates the cruise control is not active.
	ON	Indicates the cruise control is active.
DEF PRIME TEST STATUS	INACT	Indicates the test is currently not executing.
	ACTIV	Indicates the test is currently executing.
	ENGSP	Indicates the test has aborted/is not running due to engine speed.
	FAULT	Indicates the test has aborted/is not running due to CRNT DTC.
	RTYLM	Indicates the test retry limit has been reached.
	PURGE	Indicates the DEF system is purging.
	TMPLO	Indicates the DEF tank temperature is below proper test condition.
	FROZE	Indicates the DEF fluid has been detected to be frozen.
	TANKLO	Indicates the DEF tank level is below proper test condition.
	PRIMTO	Indicates the DEF system is unable to prime.
	PRIME	Indicates the DEF system is priming.
	LPRESS	Indicates the DEF system has detected low DEF line pressure.
	PROHB	Indicates the test is could not execute due to vehicle condition.
DPF SOOT LOAD	gm	Indicates the quantity of soot in the DPF.
DEF LINE HTR STAT	OFF	Indicates the DEF heater is not energized.
	ON	Indicates the DEF heater is energized.
DEF LINE PRESS	kPa	Indicates the DEF line pressure measured by the DEF tank's built in pressure sensor.
DEF LAMP STATUS	OFF	Indicates the DEF lamp is OFF. DEF level is in the normal range
	ON	Indicates the DEF lamp is ON. DEF level is in the low range
	BLINK	Indicates the DEF lamp is flashing. DEF level is in the very low range
DUAL VALVE FUEL CNTRL	VOL	Indicates the fuel system is currently in a fuel volume controlled state (high idle/load).
	PRESS	Indicates the fuel system is currently in a fuel pressure controlled state (start-up).
	BOTH	Indicates the fuel system is currently in a fuel pressure and volume controlled state (low idle).

Monitor item	Unit	Description
TOTAL KEY ON TIME	Numerical	Indicates the accumulated number of seconds the ECM has been in a Key ON state.
VARIANT ID	Numerical	Indicates the current tool interface version number currently supported by the ECM.
EGR BYPASS VLV CMD	%	Indicates the EGR cooler bypass valve's commanded position.
EGR BYPASS VLV POS V	0 – 5V	Indicates the EGR cooler bypass valve's position sensor voltage.
EGR COOLER EFFICIENCY	%	Indicates the overall effectiveness of the EGR cooler to lower exhaust gas temperature.
EGR ORIFICE TEMP	± 5.5°C of ambient temperature	Indicates EGR path's measured temperature.
EGR ORIFICE TEMP V	0 – 5V	Indicates the EGR temperature sensor voltage.
EGR VALVE POS	%	Indicates the EGR valve's actual measured position.
EGR VALVE POS CMD	%	Indicates the EGR valve's actual commanded position.
EGR POS/S VOLT	V	Indicates the EGR valve position sensor voltage.
ELECTRIC LIFT PUMP CMD	OFF	Indicates the fuel pump relay is not energized.
	ON	Indicates the fuel pump relay is energized.
TOTAL ENGINE RUN TIME	Numerical	Indicates the amount of time the engine has been in the RUN state.
ENGINE SPEED	RPM	Indicates the engine speed computed from the CKP and CMP sensors.
CAM SPD SPLY STAT	NG	Indicates the CMP sensor supply voltage is inadequate.
	OK	Indicates the CMP sensor supply voltage is OK.
	NA	Indicates the CMP sensor supply voltage is non existent.
CAM SPD SIGNAL STATUS	OK	Indicates the ECM has detected the correct CMP pulse signal.
	VOLTLO	Indicates the ECM has detected a low voltage CMP pulse signal.
	VOLTHI	Indicates the ECM has detected a high voltage CMP pulse signal.
	NA	Indicates the ECM has detected no CMP pulse signal.
CAM/CRANK SYNC	NOPUL	Indicates the ECM has detected no pulse signal.
	OK	Indicates the ECM is able to determine a synch between CMP and CKP sensors.
	NG	Indicates the ECM is unable to determine a synch between CMP and CKP sensors.
	START	Indicates the ECM is trying to detect a synch between CMP and CKP sensors.
CRANK SPD SPLY STAT	NG	Indicates the CKP sensor supply voltage is inadequate.
	OK	Indicates the CKP sensor supply voltage is OK.
	NA	Indicates the CKP sensor supply voltage is non existent.
CRANK SPD SIGNAL STATUS	OK	Indicates the ECM has detected the correct CKP pulse signal.
	VOLTLO	Indicates the ECM has detected a low voltage CKP pulse signal.
	VOLTHI	Indicates the ECM has detected a high voltage CKP pulse signal.
	NA	Indicates the ECM has detected no CKP pulse signal.
CRANK SPD SYNC	NOPUL	Indicates the ECM has detected no pulse signal.
	OK	Indicates the ECM is able to determine a synch between CMP and CKP sensors.
	NG	Indicates the ECM is unable to determine a synch between CMP and CKP sensors.
	START	Indicates the ECM is trying to detect a synch between CMP and CKP sensors.
ENGINE SPEED SIG SEL	CRNK	Indicates the ECM is using CKP sensor for engine speed.
	CAM	Indicates the ECM is using CMP sensor for engine speed.

Monitor item	Unit	Description
ENGINE SPEED STATUS	NG	Indicates the ECM has detected a faulty condition in engine speed processing.
	DGRD	Indicates the ECM has detected a concern with engine speed processing.
	OK	Indicates the ECM has detected that engine speed processing is OK.
	STOP	Indicates the ECM is in a condition where engine speed processing has stopped.
EXHAUST PRESS	± 5% of barometric air pressure (kPa)	Indicates the exhaust pressure measured.
EXHAUST PRESS SENS V	0 – 5V	Indicates the exhaust pressure sensor voltage.
FAN CLTCH PWM DC	0 – 100%	Indicates the status of the fan clutch.
ENGINE FAN CTRL	OFF	Indicates nothing is currently requesting fan actuation.
	IMT	Indicates high intake manifold temperature detection.
	CLNT	Indicates high coolant temperature detection.
	ENG	Indicates engine speed conditions and control have been satisfied.
	DFTL	Indicates the control condition is in an error state.
	EXTRN	Indicates an external source request.
	AC	Indicates an A/C system request.
	TOOL	Indicates Active Test is currently executing.
	ENGBK	Indicates an engine brake request.
	OTHER	Indicates another non-specific condition request.
	FUEL	Indicates high fuel temperature detection.
	OEMP1	Indicates specific pressure sensor 1 request.
	OEMP2	Indicates specific pressure sensor 2 request.
	OEMT1	Indicates specific temperature sensor 1 request.
	OEMT2	Indicates specific temperature sensor 2 request.
	EXHDR	Indicates high exhaust temperature detection.
	REGEN	Indicates DPF regeneration event detected.
	DLINE	Indicates a driveline engine brake request.
	CAC	Indicates high charge air cooler temperature detection.
FAN SPEED	RPM	Indicates the measured value of fan speed.
FUEL RAIL PRESSURE	bar A	Indicates the absolute measured fuel pressure on the common rail.
FUEL RAIL PRESS CMD	250 – 2000 bar	Indicates the fuel pressure commanded on the common rail.
FUEL RAIL PRESS RQSTD	bar	Indicates the fuel pressure commanded during Active Test.
FUEL RAIL PRESS V	0 – 5V	Indicates the signal voltage value detected by the ECM for the fuel rail pressure sensor.
FUEL SPLY PRESS	450 – 700 kPa	Indicates the measured fuel pressure from lift pump to stage 2 fuel filter.
FUEL SPLY PRESS V	0 – 5V	Indicates the signal voltage value detected by the ECM for the fuel supply pressure.
FUEL TEMP	< 75°C	Indicates the measured fuel temperature at the stage 2 fuel filter.
FUEL TEMP SEN V	0 – 5V	Indicates the signal voltage value detected by the ECM for the fuel supply sensor.
GLOW PLUG CMD STATUS	OFF	Indicates the ECM is commanding the glow plugs OFF.
	ON	Indicates the ECM is commanding the glow plugs ON.
INTAKE MANIFOLD TEMP	± 5.5°C of ambient temperature	Indicates the measured fresh air temperature at the air inlet connection.

Monitor item	Unit	Description
INTAKE MFOLD TEMP SENS V	0 – 5V	Indicates the signal voltage value detected by the ECM for the fuel temperature sensor.
TURBO PRESS SENSOR	± 5% of barometric air pressure (kPa)	Indicates the measured pressure from the low pressure turbo side sensor.
TURBO PRESS SENSOR V	0 – 5V	Indicates the signal voltage value detected by the ECM for the low pressure turbo side sensor.
MASS AIR FLOW	Kg/min	Indicates the translated rate of fresh air flow into the engine.
FUEL PMP ACT CMD	0 – 2A	Indicates the current (amps) being commanded of the fuel pump actuator.
FUEL PMP ACT FDBK	0 – 2A	Indicates the current (amps) feedback being received from the fuel pump actuator.
MILEAGE SINCE LAST OIL RESET	Numerical	Indicates the actual vehicle distance traveled as calculated by ECM since last oil change reset.
OIL PRESSURE	kPa G	Indicates the calculated value of the oil pressure.
FUEL PRESS RELIEF CRNT	0 – 2A	Indicates the current (amps) being commanded of the fuel pressure control valve.
FUEL PRESS RELIEF FBK	0 – 2A	Indicates the current (amps) feedback being received from the pressure control valve.
MAX FUEL RAIL PRESS	bar	Indicates the max fuel rail pressure detected by the ECM in current operation cycle.
VEHICLE SPEED	km/h / mph	Indicates the vehicle speed computed from the output speed sensor signal.
SCR INLET TEMP	°C	Indicates the SCR inlet measured temperature.
SCR OUTLET TEMP	°C	Indicates the SCR outlet measured temperature.
DEF LINE HTR OP STATE	INIT	Indicates the DEF line heater is preparing to turn ON.
	DFRST	Indicates the DEF line heater is partially ON.
	ON	Indicates the DEF line heater is currently ON.
	OFF	Indicates the DEF line heater is currently OFF.
	N/A	Indicates the DEF line heater is not available.
DEF PUMP STATE	INIT	Indicates the DEF pump is preparing to engage.
	OFF	Indicates the DEF pump is currently OFF.
	PRIME	Indicates the DEF pump is priming.
	DOSE	Indicates the DEF pump is dosing.
	PURGE	Indicates the DEF pump is purging.
	WAIT	Indicates the DEF pump is waiting to purge.
	TIMEOUT	Indicates the DEF pump is not communicating with the ECM.
DEF TANK HTR OPERATION STATE	DFRST	Indicates the DEF tank heater is partially ON.
	ON	Indicates the DEF tank heater is currently ON.
	OFF	Indicates the DEF tank heater is currently OFF.
	N/A	Indicates the DEF tank heater is not available.
SEN SUPPLY N-1 VOL	4.7 – 5.2 V	Indicates ECM output voltage of sensor supply 1.
SEN SUPPLY N-3 VOL	4.7 – 5.2 V	Indicates ECM output voltage of sensor supply 3.
SEN SUPPLY N-4 VOL	4.7 – 5.2 V	Indicates ECM output voltage of sensor supply 4.
SEN SUPPLY N-5 VOL	4.7 – 5.2 V	Indicates ECM output voltage of sensor supply 5.
SEN SUPPLY N-6 VOL	4.7 – 5.2 V	Indicates ECM output voltage of sensor supply 6.
BRAKE SWITCH	ON	Indicates the brake pedal is depressed.
	OFF	Indicates the brake pedal is not depressed.

Monitor item	Unit	Description
BRAKE SWITCH SIG 2	ON	Indicates the brake pedal is depressed.
	OFF	Indicates the brake pedal is not depressed.
TURBO COMP IN TEMP V	0 – 5V	Indicates the signal voltage value detected by the ECM for turbocharger compressor inlet.
TURBO COMP IN TEMP	± 5.5°C of ambient temperature	Indicates the measured temperature at turbocharger compressor inlet.
TURBO SPEED	< 40 KR/M	Indicates the measured speed at which the turbocharger is rotating.
DEF TANK LEVEL	%	Indicates actual DEF tank level.
UREA TANK TEMP	°C	Indicates the measured temperature of the DEF fluid within the DEF tank.
DEF TANK TEMP SENS V	0 – 5V	Indicates the signal voltage value detected by the ECM for DEF tank temperature.
WAIT START CMD	ON	Indicates the Wait to Start lamp is ON.
	OFF	Indicates the Wait to Start lamp is OFF.
WATER IN FUEL V	0 – 5V	Indicates the measured signal voltage from the water in fuel sensor.
WATER IN FUEL	NOWTR	Indicates no water in fuel detected.
	WTR	Indicates water in fuel detected.
TOTAL WATER IN FUEL TIME	Numerical	Indicates the total time water has been detected in the fuel over the life of the ECM.
ENGINE OPER STATE	Fueling stop state	Indicator of which fueling selection is controlling the engine.
DEF PUMP ASH	gm	Indicates the amount of ash estimated in the DPF.
ENGINE SERIAL NUMBER	Numerical	Indicates the engine serial number.
CRANKCASE PRESS	-0.63 – +0.63 kPa	Indicates the purging value for the DEF line is closed.
CRANKCASE PRESS V	0 – 5V	Indicates the signal voltage as measured by the ECM for crankcase pressure sensor.
DEF QUALITY SENSOR TEMP	°C	Indicates the temperature as measured by the DEF quality sensor.
DEF DOSING VALVE POS CMD	Close	Indicates the current position commanded for the DEF injector.
	Open	
DEF REVERT VALVE POS	Close	Indicates the purging value for the DEF line.
	Open	
DEF PUMP DUTY CYCLE	0 – 100%	Indicates the current dosing commanded of the DEF pump.
COMP BYPASS VALVE TEST STAT	INACT	Indicates the module is currently not executing the test.
	ACTIV	Indicates the module is currently executing the test.
	VSSPD	Indicates the test has detected vehicle speed.
	BATLO	Indicates the test has detected battery voltage below test threshold condition.
INTAKE O2 STATE	NG	Indicates the oxygen reading is not valid.
	READY	Indicates the oxygen reading is OK.
	ERROR	Indicates the oxygen reading is not valid.
	NA	Indicates the oxygen reading is not available.
INTAKE O2	%	Indicates the current percent oxygen level detected at the inlet of the SCR component.
IGN STATE	On	Indicates the current state of the ignition switch as detected by the ECM.
	Off	
NO OF KEY OFF EVENTS	Numerical	Indicates the number of times the ECM has fully powered down.
NO OF KEY ON EVENTS	Numerical	Indicates the number of times the ECM has fully powered up.
INSTANTANEOUS PERCENT LOAD	%	Indicates the percentage load on the engine at any given point.

Monitor item	Unit	Description
ENGINE TORQUE	Nm	Indicates the torque amount the engine is producing.
TOTAL FUELING	mg/stroke	Indicates the amount of fuel being dispersed at a given time.
FAF/EGR AIR FLOW	Kg/min	Indicates the calculated combined fresh and EGR air flow.
A/C PRESS SW	ON	Indicates the current state of the A/C pressure switch.
	OFF	
PUSHER FAN SPEED STATUS	ON	Indicates the current state of the pusher fan.
	OFF	
OIL PRESSURE SENS V	0 – 5V	Indicates measured signal voltage from the oil pressure sensor.
RTCV ACTUATOR POS	0 – 100%	Indicates the actual rotary control valve actuator position.
RTCV CALIB STATUS	INACT	Indicates the module is currently not executing the test.
	ACTIV	Indicates the module is currently executing the test.
	FAIL	Indicates the rotary turbine control valve system is suspect.
	CCOMP	Indicates the rotary turbine control valve actuator has performed calibrate successfully.
	ENGSP	Indicates the test has aborted/is not running due to engine speed.
	FAULT	Indicates the test has aborted/is not running due to CRNT DTC.
RTCV HYSTERESIS STATUS	INACT	Indicates the module is currently not executing the test.
	ACTIV	Indicates the module is currently executing the test.
	PASS	Indicates the rotary turbine control valve system functions as expected.
	FAIL	Indicates the rotary turbine control valve system is suspect.
	ERROR	Indicates the test has aborted/is not running due to CRNT DTC.
	LOCLT	Indicates the test has detected coolant temperature below test minimum threshold.
	HICLT	Indicates the test has detected coolant temperature above test maximum threshold.
	ENGSP	Indicates the test has aborted/is not running due to engine speed.
	BATLO	Indicates the test has detected battery voltage below test threshold condition.
	PROHB	Indicates the test could not execute due to vehicle condition.
TURBO COMP INLET PRESS	± 1 kPa of barometric air pressure	Indicates the absolute measured pressure at turbocharger compressor inlet.
TURBO COMP INLET PRESS V	0 – 5V	Indicates the signal voltage as measured by the ECM for fresh air flow pressure.

NOTE:
Any monitored item that does not match the vehicle being diagnosed is deleted from the display automatically.

WORK SUPPORT MODE

Work Item

Work item	Description	Usage
Reset fuel consumption short term log	In this mode, VIN is registered in ECM.	When registering VIN in ECM.
AFT maintenance	In this mode, aftertreatment maintenance is performed.	The amount of particulate matter in DPF reaches a high level.

Work item	Description	Usage
Reset fuel and timing learn tables	In this mode, physical characteristics of replaced component are matched with a preset value in the ECM.	• When injector is replaced.* • When fuel rail pressure sensor is replaced. • When fuel pressure relief valve is replaced. • When crankshaft position sensor is replaced.* • When camshaft position sensor is replaced.
VIN REGISTRATION	In this mode, specific vehicle build is identified.	To identify any possible build variations.
ENTERINJECTOR CODES	In this mode, fuel injector adjustment value is registered.	• When ECM is replaced.* • When fuel injector(s) is replaced.
SAVE COMPUTER DATA	In this mode, save data that is in ECM.	When ECM is replaced.*
WRITE SAVED DATA	In this mode, write data stored by “SAVE COMPUTER DATA” in "WORK SUPPORT" mode to ECM.	When ECM is replaced.*
RTCV actuator calibrate	In this mode, the rotary turbine control valve (RTCV) end limits are learned.	When the RTCV is disconnected or replaced.
Engine serial number	In this mode, engine serial number is learned.	To identify engine specific components.

*: The necessary operation is different depending on the operation result of ECM data save or write. Always perform the operation according to procedures. Refer to EC-885, "Description".

ACTIVE TEST MODE

Test item	Condition	Judgment	Check item (Remedy)
DPF Regeneration	• Engine: Running • Self-directed test once selection is made in CONSULT.	Increases RPM and cleans up the aftertreatment system.	Performance of the aftertreatment system.
DPF System Leak Test	• Ignition switch: ON • DPF pump is energized while the tank pressure sensor is monitored.	Determines whether there is a leak by means of checking the pressure drop.	DPF system is checked for leaks.
DPF Dosing Unit Override Test	• Ignition switch: ON • DPF pump and dosing valves are energized while checking the spray pattern of the dosing valve.	Dosing valve is operated.	Dosing valve spray pattern.
Fuel System Leakage Test	• Engine: Running • High and low fuel pump are operating while the fuel pressure sensor is monitored for any reading drop.	High pressure fuel pump is driven while stage 1 fuel pump is energized.	Fuel system is checked for leaks.
DEF Line Heater Test	• Ignition switch: ON • DEF line heater is energized while the temperature is monitored.	DEF line heater is operated.	DEF line heater is checked for providing heat.
DEF Tank Heater Test	• Ignition switch: ON • DEF tank heater is energized while the temperature is monitored.	DEF tank heater is operated.	DEF tank heater is checked for providing heat.
RTCV Hysteresis Test	• Ignition switch: ON • Checking the operation of the rotary turbine control valve (RTCV).	RTCV is operated.	RTCV is checked for proper operation.
Fuel Supply Pump Override Test	• Ignition switch: ON • Stage 1 fuel pump is energized while the fuel pressure sensor is monitored for pressure drop.	Stage 1 fuel pump is operated.	Fuel system is checked for leaks.

Test item	Condition	Judgment	Check item (Remedy)
Cylinder Cutout Test	• Engine: Running • Power is suspended from the specific injector.	Injector is checked for making a difference.	Fuel injector.
Engine Fan Override Test	• Engine: Running • Duty cycle of fan is changed and checked.	Fan clutch is operated.	Fan clutch is checked.
Electric Fan Override Test	• Ignition switch: ON • Electric fan motor is commanded ON.	Electric fan motor is operated.	Electric fan motor is checked for proper operation.
HPCR Fuel Act Override	• Engine: Running • High pressure fuel system is energized.	Fuel pump is operated.	Fuel system and valves are checked for proper operation.

ECU DIAGNOSIS INFORMATION

ECM

Reference Value

INFOID:0000000014419946

VALUES ON THE DIAGNOSIS TOOL

Monitor Item	Condition	Value/Status
DPF OPERTING STATE	DPF filter not applicable for the application.	NONE
	DPF filter operating normally.	OK
	DPF control system operating in a NOx catalyst regeneration.	DENOX
	DPF filter currently operating in a non-service induced (mobile) regeneration event.	MSRGN
	DPF control system operating in a NOx catalyst regeneration.	DESOX
	DPF control system operating in a condition to protect the DPF.	PRTCT
	DPF control system operating in a condition to warm up.	H2ODB
	DPF control system operating in a condition to warm up.	HCDB
	DPF filter currently operating in a service induced (stationary) regeneration event.	NMRGN
	DPF control system operating in a condition to warm up SCR system.	SCRTM
	DPF control system operating in a condition to warm up.	MNTN
	DPF control system has detected the SCR system to be operating in moderate mode.	MDRT
DPF OUTLET PRESS	Indicates the gauge pressure reading of the DPF outlet.	-3 – +3 kPa G
DPF OUTLET PRESS SENS V	Indicates the voltage reading of the DPF outlet pressure sensor.	0 – 5V
DEF QLTY SENS	Indicates the measured quality of the diesel exhaust fluid in the pump.	31 – 34%
INTAKE NOX	Indicates the parts per million (ppm) NOx measurement prior to the diesel oxidation catalyst.	ppm
INTAKE NOX CORRCTD	Indicates the filtered parts per million (ppm) NOx measurement prior to the diesel oxidation catalyst.	ppm
INTAKE NOX READNG STBL	Indicates the parts per million (ppm) measurement is not available.	NA
	Indicates the parts per million (ppm) measurement is inaccurate.	NG
	Indicates the parts per million (ppm) measurement is accurate.	OK
	Indicates the parts per million (ppm) measurement is in error.	ERROR
DPF FACEPLUG COUNT	Indicates the number of times the ECM has detected the DPF is face plugged.	≥
AFT MAINTENANCE STATUS	Indicates the aftertreatment reset request has not been requested.	Inactive
	Indicates the aftertreatment reset request has been requested.	ACTIV
	Indicates the aftertreatment data has been reset.	CMPLT
	Indicates the aftertreatment reset request could not be completed due to a condition detected by ECM.	PROHB

Monitor Item	Condition	Value/Status
AFT NOX OUT TEST STATUS	Indicates the test has determined a condition that caused a decision of Fail/Bad.	NG
	Indicates the test has determined a condition that caused a decision of OK/GOOD.	OK
	Indicates the test is actively executing.	NA
	Indicates the test has not been aborted for execution.	ACTIV
	Indicates the test has been requested for some ECM detected condition.	ABORT
	Indicates the test is not supported.	NS
OUTLET NOX	Indicates the parts per million (ppm) NOx measurement after the SCR system.	ppm
OUTLET NOX CORRCTD	Indicates the filtered parts per million (ppm) NOx measurement after the SCR system.	ppm
OUTLET NOX READNG STBL	Indicates the parts per million (ppm) measurement is not available.	NA
	Indicates the parts per million (ppm) measurement is inaccurate.	NG
	Indicates the parts per million (ppm) measurement is accurate.	OK
	Indicates the parts per million (ppm) measurement is in error.	ERROR
DPF DOSING CMD	Indicates the DEF injector is dosing.	ON
	Indicates the DEF injector is not dosing.	OFF
AFT DPF REGEN STATUS	Indicates the stationary regen has not been requested.	INACT
	Indicates the stationary regen has been requested.	ACTIV
	Indicates the stationary regen request was been completed as requested.	CMPLT
	Indicates the ECM has detected a DTC which prevents the test from executing.	FAULT
	Indicates the ECM has detected a non DTC related prevention condition.	PROHB
	Indicates the ECM has detected the stop lamp switch being activated.	SERBK
	Indicates the ECM has detected the park brake switch being activated.	PRKBK
	Indicates the ECM has detected the accelerator pedal being depressed to a value greater than 0%.	THRTL
	Indicates the ECM has detected the transmission to be in any position other than P (park).	INGR
	Indicates the ECM has detected the vehicle to be moving or VSS failure.	VEHSP
	Indicates the ECM has detected a condition in which the service test could not be performed.	GOV
	Indicates the ECM is currently operating in an engine protection condition.	EPD
	Indicates the ECM has detected low engine coolant temperature.	Ewo
TIME SINCE ACTIVE REGEN	Indicates the amount of time since a non mobile regeneration event.	Hr
TIME SINCE REACT REGEN	Indicates the amount of time since a mobile regeneration event.	Hr
DPF SOOT LOAD MNTR	Indicates the DPF estimated soot load value.	gm
SOOT LOAD MNTR STATUS	Indicates the DPF is operating in normal soot condition.	NORM
	Indicates the DPF is operating in least severe soot condition.	LOW
		MED
	Indicates the DPF is operating in moderately severe soot condition.	HIGH
	Indicates the DPF is operating in most severe soot condition.	SEV

Monitor Item	Condition	Value/Status
ACC POS SENS 2 SPLY V	Indicates the voltage supply value for the accelerator pedal position (APP) sensor 2.	4.7 – 5.2V
ACC POS SENS 2 V	Indicates the measured voltage value for the accelerator pedal position (APP) sensor 2.	0 – 2V
ACC POS SENS SPLY V	Indicates the voltage supply value for the accelerator pedal position (APP) sensor 1.	4.7 – 5.2V
ACC POS SENS V	Indicates the measured voltage value for the accelerator pedal position (APP) sensor 1.	1 – 4V
BATTERY VOLTAGE	Indicates the measured battery voltage as seen by the ECM.	11 – 14V
BOOST PRESSURE	Indicates the measured gauge pressure prior to entering the intake manifold.	-10.3 – +10.3 kPa
BOOST PRES SENS V	Indicates the measured sensor voltage of the boost pressure sensor.	0 – 5V
Byte order	Indicates the data shall not be byte swapped.	L ENDI
	Indicates the data shall be interpreted as byte swapped.	B ENDI
DOC INLET TEMP	Indicates the diesel oxidation catalyst inlet measured temperature.	≥ 250°C
DPF INLET TEMP	Indicates the diesel oxidation catalyst outlet measured temperature.	200°C > DOC INLET TEMP
DPF DELTA PRESS SENS V	Indicates the measured sensor voltage of the DPF differential pressure sensor.	0 – 5V
DPF DELTA PRESS	Indicates the measured pressure difference across the DPF.	-3 – +3 kPa
DPF OUTLET TEMP	Indicates the DPF outlet measured temperature.	°C
CAC OUT TEMP	Indicates the charge air cooler outlet measured temperature.	± 5.5°C of ambient temperature
CAC OUT TEMP SENS V	Indicates the measured sensor voltage of the charge air cooler outlet temperature sensor.	0 – 5V
ACCEL PEDAL POS	Indicates the interpreted pedal position in percentage as determined by the ECM.	%
COOLANT LEVEL	Indicates the coolant level to be at a system hindrance level.	NG
	Indicates the coolant level to be normal.	OK
	Indicates the coolant level to be at a slightly low value.	LOW
COOLANT TEMP	Indicates the measured coolant temperature.	90.5 – 105.5°C
ENGINE COOLANT TEMPERATURE SEN VOLTAGE	Indicates the measured sensor voltage of the coolant temperature sensor.	0 – 5V
CC ACCEL S/W	Indicates the ACCEL/RES switch is not pressed.	OFF
	Indicates the ACCEL/RES switch is pressed.	ON
CRUISE CANCEL S/W	Indicates the CANCEL switch is not pressed.	OFF
	Indicates the CANCEL switch is pressed.	ON
CRUISE COAST SW	Indicates the COAST/SET switch is not pressed.	OFF
	Indicates the COAST/SET switch is pressed.	ON
CC TARGET SPEED	Indicates the vehicle speed that cruise control is currently attempting to hold to.	km/h / mph
CRUISE CNTL STAT	Indicates the cruise control is not active.	OFF
	Indicates the cruise control is active.	ON

Monitor Item	Condition	Value/Status
DEF PRIME TEST STATUS	Indicates the test is currently not executing.	INACT
	Indicates the test is currently executing.	ACTIV
	Indicates the test has aborted/is not running due to engine speed.	ENGSP
	Indicates the test has aborted/is not running due to CRNT DTC.	FAULT
	Indicates the test retry limit has been reached.	RTYLM
	Indicates the DEF system is purging.	PURGE
	Indicates the DEF tank temperature is below proper test condition.	TMPLO
	Indicates the DEF fluid has been detected to be frozen.	FROZE
	Indicates the DEF tank level is below proper test condition.	TANKLO
	Indicates the DEF system is unable to prime.	PRIMTO
	Indicates the DEF system is priming.	PRIME
	Indicates the DEF system has detected low DEF line pressure.	LPRESS
	Indicates the test is could not execute due to vehicle condition.	PROHB
DPF SOOT LOAD	Indicates the quantity of soot in the DPF.	gm
DEF LINE HTR STAT	Indicates the DEF heater is not energized.	OFF
	Indicates the DEF heater is energized.	ON
DEF LINE PRESS	Indicates the DEF line pressure measured by the DEF tank's built in pressure sensor.	kPa
DEF LAMP STATUS	Indicates the DEF lamp is OFF. DEF level is in the normal range	OFF
	Indicates the DEF lamp is ON. DEF level is in the low range	ON
	Indicates the DEF lamp is flashing. DEF level is in the very low range	BLINK
DUAL VALVE FUEL CNTRL	Indicates the fuel system is currently in a fuel volume controlled state.	VOL
	Indicates the fuel system is currently in a fuel pressure controlled state.	PRESS
	Indicates the fuel system is currently in a fuel pressure and volume controlled state.	BOTH
VARIANT ID	Indicates the current tool interface version number currently supported by the ECM.	Numerical
EGR BYPASS VLV CMD	Indicates the EGR cooler bypass valve's commanded position.	%
EGR BYPASS VLV POS V	Indicates the EGR cooler bypass valve's position sensor voltage.	0 – 5V
EGR COOLER EFFICIENCY	Indicates the overall effectiveness of the EGR cooler to lower exhaust gas temperature.	%
EGR ORIFICE TEMP	Indicates EGR path's measured temperature.	± 5.5°C of ambient temperature
EGR ORIFICE TEMP V	Indicates the EGR temperature sensor voltage.	0 – 5V
EGR VALVE POS	Indicates the EGR valve's actual measured position.	%
EGR VALVE POS CMD	Indicates the EGR valve's actual commanded position.	%
EGR POS/S VOLT	Indicates the EGR valve position sensor voltage.	V
ELECTRIC LIFT PUMP CMD	Indicates the fuel pump relay is not energized.	OFF
	Indicates the fuel pump relay is energized.	ON
TOTAL ENGINE RUN TIME	Indicates the amount of time the engine has been in the RUN state.	Numerical
ENGINE SPEED	Indicates the engine speed computed from the CKP and CMP sensors.	RPM
CAM SPD SPLY STAT	Indicates the CMP sensor supply voltage is inadequate.	NG
	Indicates the CMP sensor supply voltage is OK.	OK
	Indicates the CMP sensor supply voltage is non existent.	NA

Monitor Item	Condition	Value/Status
CAM SPD SIGNAL STATUS	Indicates the ECM has detected the correct CMP pulse signal.	OK
	Indicates the ECM has detected a low voltage CMP pulse signal.	VOLTLO
	Indicates the ECM has detected a high voltage CMP pulse signal.	VOLTHI
	Indicates the ECM has detected no CMP pulse signal.	NA
CAM/CRANK SYNC	Indicates the ECM has detected no pulse signal.	NOPUL
	Indicates the ECM is able to determine a synch between CMP and CKP sensors.	OK
	Indicates the ECM is unable to determine a synch between CMP and CKP sensors.	NG
	Indicates the ECM is trying to detect a synch between CMP and CKP sensors.	START
CRANK SPD SPLY STAT	Indicates the CKP sensor supply voltage is inadequate.	NG
	Indicates the CKP sensor supply voltage is OK.	OK
	Indicates the CKP sensor supply voltage is non existent.	NA
CRANK SPD SIGNAL STATUS	Indicates the ECM has detected the correct CKP pulse signal.	OK
	Indicates the ECM has detected a low voltage CKP pulse signal.	VOLTLO
	Indicates the ECM has detected a high voltage CKP pulse signal.	VOLTHI
	Indicates the ECM has detected no CKP pulse signal.	NA
CRANK SPD SYNC	Indicates the ECM has detected no pulse signal.	NOPUL
	Indicates the ECM is able to determine a synch between CMP and CKP sensors.	OK
	Indicates the ECM is unable to determine a synch between CMP and CKP sensors.	NG
	Indicates the ECM is trying to detect a synch between CMP and CKP sensors.	START
ENGINE SPEED SIG SEL	Indicates the ECM is using CKP sensor for engine speed.	CRNK
	Indicates the ECM is using CMP sensor for engine speed.	CAM
ENGINE SPEED STATUS	Indicates the ECM has detected a faulty condition in engine speed processing.	NG
	Indicates the ECM has detected a concern with engine speed processing.	DGRD
	Indicates the ECM has detected that engine speed processing is OK.	OK
	Indicates the ECM is in a condition where engine speed processing has stopped.	STOP
EXHAUST PRESS	Indicates the exhaust pressure measured.	± 5% of barometric air pressure (kPa)
EXHAUST PRESS SENS V	Indicates the exhaust pressure sensor voltage.	0 – 5V
FAN CLTCH PWM DC	Indicates the status of the fan clutch.	0 – 100%

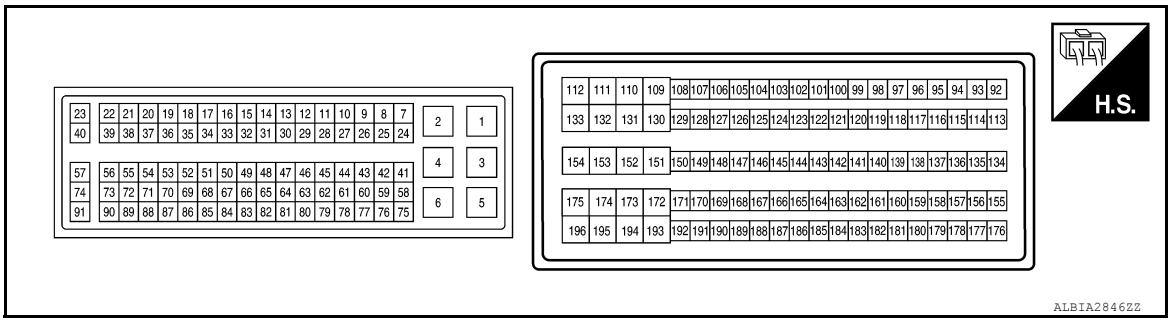
Monitor Item	Condition	Value/Status
ENGINE FAN CTRL	Indicates nothing is currently requesting fan actuation.	OFF
	Indicates high intake manifold temperature detection.	IMT
	Indicates high coolant temperature detection.	CLNT
	Indicates engine speed conditions and control have been satisfied.	ENG
	Indicates the control condition is in an error state.	DFTL
	Indicates an external source request.	EXTRN
	Indicates an A/C system request.	AC
	Indicates Active Test is currently executing.	TOOL
	Indicates an engine brake request.	ENGBK
	Indicates high fuel temperature detection.	FUEL
	Indicates high exhaust temperature detection.	EXHDR
	Indicates DPF regeneration event detected.	REGEN
	Indicates a driveline engine brake request.	DLINE
	Indicates high charge air cooler temperature detection.	CAC
FAN SPEED	Indicates the measured value of fan speed.	RPM
FUEL RAIL PRESSURE	Indicates the absolute measured fuel pressure on the common rail.	bar A
FUEL RAIL PRESS CMD	Indicates the fuel pressure commanded on the common rail.	250 – 2000 bar
FUEL RAIL PRESS RQSTD	Indicates the fuel pressure commanded during Active Test.	bar
FUEL RAIL PRESS V	Indicates the signal voltage value detected by the ECM for the fuel rail pressure sensor.	0 – 5V
FUEL SPLY PRESS	Indicates the measured fuel pressure from lift pump to stage 2 fuel filter.	450 – 700 kPa
FUEL SPLY PRESS V	Indicates the signal voltage value detected by the ECM for the fuel supply pressure.	0 – 5V
FUEL TEMP	Indicates the measured fuel temperature at the stage 2 fuel filter.	< 75°C
FUEL TEMP SEN V	Indicates the signal voltage value detected by the ECM for the fuel supply sensor.	0 – 5V
GLOW PLUG CMD STATUS	Indicates the ECM is commanding the glow plugs OFF.	OFF
	Indicates the ECM is commanding the glow plugs ON.	ON
INTAKE MANIFOLD TEMP	Indicates the measured fresh air temperature at the air inlet connection.	± 5.5°C of ambient temperature
INTAKE MFOLD TEMP SENS V	Indicates the signal voltage value detected by the ECM for the fuel temperature sensor.	0 – 5V
TURBO PRESS SENSOR	Indicates the measured pressure from the low pressure turbo side sensor.	± 5% of barometric air pressure (kPa)
TURBO PRESS SENSOR V	Indicates the signal voltage value detected by the ECM for the low pressure turbo side sensor.	0 – 5V
MASS AIR FLOW	Indicates the translated rate of fresh air flow into the engine.	Kg/min
FUEL PMP ACT CMD	Indicates the current (amps) being commanded of the fuel pump actuator.	0 – 2A
FUEL PMP ACT FDBK	Indicates the current (amps) feedback being received from the fuel pump actuator.	0 – 2A
Mileage since last oil reset	Indicates the actual vehicle distance traveled as calculated by ECM since last oil change reset.	Numerical
OIL PRESSURE	Indicates the calculated value of the oil pressure.	kPa G
FUEL PRESS RELIEF CRNT	Indicates the current (amps) being commanded of the fuel pressure control valve.	0 – 2A
FUEL PRESS RELIEF FBK	Indicates the current (amps) feedback being received from the pressure control valve.	0 – 2A

Monitor Item	Condition	Value/Status
MAX FUEL RAIL PRESS	Indicates the max fuel rail pressure detected by the ECM in current operation cycle.	bar
VEHICLE SPEED	Indicates the vehicle speed computed from the output speed sensor signal.	km/h / mph
SCR INLET TEMP	Indicates the SCR inlet measured temperature.	°C
SCR OUTLET TEMP	Indicates the SCR outlet measured temperature.	°C
DEF LINE HTR OP STATE	Indicates the DEF line heater is preparing to turn ON.	INIT
	Indicates the DEF line heater is partially ON.	DFRST
	Indicates the DEF line heater is currently ON.	ON
	Indicates the DEF line heater is currently OFF.	OFF
	Indicates the DEF line heater is not available.	N/A
DEF PUMP STATE	Indicates the DEF pump is preparing to engage.	INIT
	Indicates the DEF pump is currently OFF.	OFF
	Indicates the DEF pump is priming.	PRIME
	Indicates the DEF pump is dosing.	DOSE
	Indicates the DEF pump is purging.	PURGE
	Indicates the DEF pump is waiting to purge.	WAIT
	Indicates the DEF pump is not communicating with the ECM.	TIMEOUT
Def tank htr operation state	Indicates the DEF tank heater is partially ON.	DFRST
	Indicates the DEF tank heater is currently ON.	ON
	Indicates the DEF tank heater is currently OFF.	OFF
	Indicates the DEF tank heater is not available.	N/A
SEN SUPPLY N-1 VOL	Indicates ECM output voltage of sensor supply 1.	4.7 – 5.2 V
SEN SUPPLY N-3 VOL	Indicates ECM output voltage of sensor supply 3.	4.7 – 5.2 V
SEN SUPPLY N-4 VOL	Indicates ECM output voltage of sensor supply 4.	4.7 – 5.2 V
SEN SUPPLY N-5 VOL	Indicates ECM output voltage of sensor supply 5.	4.7 – 5.2 V
SEN SUPPLY N-6 VOL	Indicates ECM output voltage of sensor supply 6.	4.7 – 5.2 V
BRAKE SWITCH	Indicates the brake pedal is depressed.	ON
	Indicates the brake pedal is not depressed.	OFF
BRAKE SWITCH SIG 2	Indicates the brake pedal is depressed.	ON
	Indicates the brake pedal is not depressed.	OFF
TURBO COMP IN TEMP V	Indicates the signal voltage value detected by the ECM for turbocharger compressor inlet.	0 – 5V
TURBO COMP IN TEMP	Indicates the measured temperature at turbocharger compressor inlet.	± 5.5°C of ambient temperature
TURBO SPEED	Indicates the measured speed at which the turbocharger is rotating.	< 40 KR/M
DEF TANK LEVEL	Indicates actual DEF tank level.	%
UREA TANK TEMP	Indicates the measured temperature of the DEF fluid within the DEF tank.	°C
DEF TANK TEMP SENS V	Indicates the signal voltage value detected by the ECM for DEF tank temperature.	0 – 5V
WAIT START CMD	Indicates the Wait to Start lamp is ON.	ON
	Indicates the Wait to Start lamp is OFF.	OFF
WATER IN FUEL V	Indicates the measured signal voltage from the water in fuel sensor.	0 – 5V
WATER IN FUEL	Indicates no water in fuel detected.	NOWTR
	Indicates water in fuel detected.	WTR

Monitor Item	Condition	Value/Status
TOTAL WATER IN FUEL TIME	Indicates the total time water has been detected in the fuel over the life of the ECM.	Numerical
ENGINE OPER STATE	Indicator of which fueling selection is controlling the engine.	Fueling stop state
DEF PUMP ASH	Indicates the amount of ash estimated in the DPF.	gm
Engine serial number	Indicates the engine serial number.	Numerical
CRANKCASE PRESS	Indicates the purging value for the DEF line is closed.	-0.63 – +0.63 kPa
CRANKCASE PRESS VOLT	Indicates the signal voltage as measured by the ECM for crankcase pressure sensor.	0 – 5V
DEF QUALITY SENSOR TEMP	Indicates the temperature as measured by the DEF quality sensor.	°C
DEF DOSING VALVE POS CMD	Indicates the current position commanded for the DEF injector.	Close
		Open
DEF REVERT VALVE POS	Indicates the purging value for the DEF line.	Close
		Open
DEF PUMP DUTY CYCLE	Indicates the current dosing commanded of the DEF pump.	0 – 100%
Comp bypass valve test stat	Indicates the module is currently not executing the test.	INACT
	Indicates the module is currently executing the test.	ACTIV
	Indicates the test has detected vehicle speed.	VSSPD
	Indicates the test has detected battery voltage below test threshold condition.	BATLO
INTAKE O2 STATE	Indicates the oxygen reading is not valid.	NG
	Indicates the oxygen reading is OK.	READY
	Indicates the oxygen reading is not valid.	ERROR
	Indicates the oxygen reading is not available.	NA
INTAKE O2	Indicates the current percent oxygen level detected at the inlet of the SCR component.	%
IGN STATE	Indicates the current state of the ignition switch as detected by the ECM.	On
		Off
NO OF KEY OFF EVENTS	Indicates the number of times the ECM has fully powered down.	Numerical
NO OF KEY ON EVENTS	Indicates the number of times the ECM has fully powered up.	Numerical
Instantaneous percent load	Indicates the percentage load on the engine at any given point.	%
ENGINE TORQUE	Indicates the torque amount the engine is producing.	Nm
TOTAL FUELING	Indicates the amount of fuel being dispersed at a given time.	mg/stroke
FAF/EGR AIR FLOW	Indicates the calculated combined fresh and EGR air flow.	Kg/min
A/C PRESS SW	Indicates the current state of the A/C pressure switch.	On
		Off
OIL PRESSURE SENS V	Indicates measured signal voltage from the oil pressure sensor.	0 – 5V
RTCV ACTUATOR POS	Indicates the actual rotary control valve actuator position.	0 – 100%

Monitor Item	Condition	Value/Status
RTCV INSTALL/CALIB STATUS	Indicates the module is currently not executing the test.	INACT
	Indicates the module is currently executing the test.	ACTIV
	Indicates the rotary turbine control valve actuator has performed install successfully.	ICOMP
	Indicates the rotary turbine control valve system is suspect.	FAIL
	Indicates the rotary turbine control valve actuator has performed calibrate successfully.	CCOMP
	Indicates the rotary turbine control valve should have an installation performed.	IRQRD
	Indicates the test has aborted/is not running due to engine speed.	ENGSP
	Indicates the test has aborted/is not running due to CRNT DTC.	FAULT
RTCV HYSTERESIS STATUS	Indicates the module is currently not executing the test.	INACT
	Indicates the module is currently executing the test.	ACTIV
	Indicates the rotary turbine control valve system functions as expected.	PASS
	Indicates the rotary turbine control valve system is suspect.	FAIL
	Indicates the test has aborted/is not running due to CRNT DTC.	ERROR
	Indicates the test has detected coolant temperature below test minimum threshold.	LOCLT
	Indicates the test has detected coolant temperature above test maximum threshold.	HICLT
	Indicates the test has aborted/is not running due to engine speed.	ENGSP
	Indicates the test has detected battery voltage below test threshold condition.	BATLO
	Indicates the test could not execute due to vehicle condition.	PROHB
TURBO COMP INLET PRESS	Indicates the absolute measured pressure at turbocharger compressor inlet.	± 1 kPa of barometric air pressure
TURBO COMP INLET PRESS V	Indicates the signal voltage as measured by the ECM for fresh air flow pressure.	0 – 5V

TERMINAL LAYOUT



PHYSICAL VALUES

Terminal (Wire color)		Description		Condition		Reference value (Approx.)
+	–	Signal name	Input/ Output	Ignition switch	Operation	
1 (B)	Ground	Ground	—	ON	—	0 V
2 (B)	Ground	Ground	—	ON	—	0 V

Terminal (Wire color)		Description		Condition		Reference value (Approx.)
+	–	Signal name	Input/ Output	Ignition switch	Operation	
3 (BR)	Ground	ECM relay power supply	Input	ON		Battery voltage
4 (B)	Ground	Ground	—	ON	—	0 V
5 (BR)	Ground	ECM relay power supply	Input	ON		Battery voltage
6 (BR)	Ground	ECM relay power supply	Input	ON		Battery voltage
7 (O)	Ground	DPF differential pressure signal	Input	ON		
15 (L/R)	Ground	DPF differential pressure sensor return	Input	ON		
16 (P)	—	CAN low	Input/ Output	—	—	—
18 (G)	—	CAN2 low	Input/ Output	—	—	—
20 (G)	Ground	Actuator power relay control	Input	ON		
24 (SB)	Ground	DPF outlet gas pressure signal	Input	ON		
26 (R/L)	Ground	Refrigerant pressure sensor signal	Input	ON		
32 (Y)	Ground	DPF differential pressure sensor 5 volt reference	Output	ON		5.0 V
33 (L)	—	CAN high	Input/ Output	—	—	—
35 (Y)	—	CAN2 high	Input/ Output	—	—	—
37 (L)	Ground	ECM relay control	Input	ON		
40 (GR)	Ground	Fuel pump relay control	Input	ON		
41 (BR)	Ground	ASCD cancel switch, coolant level sensor and water in fuel sensor return	Input	ON		
53 (R/G)	Ground	Stop lamp switch[1] or stop lamp relay[2] signal	Input	ON		
54 (L)	Ground	ASCD cancel switch signal	Input	ON		
59 (G/Y)	Ground	ASCD steering switch signal	Input	ON		
61 (B/Y)	Ground	ASCD steering switch return	Input	ON		
62 (R)	Ground	Accelerator pedal position sensor 2 return	Input	ON		
63 (R)	Ground	Accelerator pedal position sensor 1 return	Input	ON		
64 (R/W)	Ground	Refrigerant pressure sensor return	Input	ON		

Terminal (Wire color)		Description		Condition		Reference value (Approx.)
+	–	Signal name	Input/ Output	Ignition switch	Operation	
65 (L/W)	Ground	Ignition power supply	Input	ON	—	Battery voltage
73 (B)	Ground	DEF dosing valve return	Input	ON		
74 (GR/R)	Ground	DEF dosing valve signal	Output	ON		
75 (L/W)	Ground	Coolant level sensor signal	Input	ON		
77 (L)	Ground	Water in fuel sensor signal	Input	ON		
78 (L)	Ground	Accelerator pedal position sensor 2 signal	Input	ON		
79 (BR)	Ground	Accelerator pedal position sensor 1 signal	Input	ON		
80 (W)	Ground	Accelerator pedal position sensor 1 5 volt reference	Output	ON		5.0 V
81 (B)	Ground	Accelerator pedal position sensor 2 5 volt reference	Output	ON		5.0 V
83 (BR)	Ground	Battery power supply	Input	OFF	—	Battery voltage
92 (B)	Ground	Fuel injector no. 2 return	Input	ON		
93 (B/Y)	Ground	Fuel injector no. 8 return	Input	ON		
94 (B)	Ground	Fuel injector no. 5 return	Input	ON		
95 (B/R)	Ground	Fuel injector no. 3 return	Input	ON		
97 (B/SB)	Ground	Fuel pressure relief valve signal	Input	ON		
102 (DG)	—	CAN2 low	Input/ Output	—	—	—
103 (LG/B)	—	CAN3 low	Input/ Output	—	—	—
106 (P)	Ground	Sensor and valve 5 volt reference	Output	ON		5.0 V
109 (W/SB)	Ground	Turbocharger compressor intake temperature sensor signal	Input	ON		
110 (W/V)	Ground	Engine charge air cooler outlet temperature sensor signal	Input	ON		
111 (W/R)	Ground	Crankcase pressure sensor signal	Input	ON		
113 (R/B)	Ground	Fuel injector no. 2 signal	Output	ON		
114 (R/Y)	Ground	Fuel injector no. 8 signal	Output	ON		
115 (R)	Ground	Fuel injector no. 5 signal	Output	ON		

Terminal (Wire color)		Description		Condition		Reference value (Approx.)
+	–	Signal name	Input/ Output	Ignition switch	Operation	
116 (R/B)	Ground	Fuel injector no. 3 signal	Output	ON		
118 (B/W)	Ground	Fuel pump actuator signal	Input	ON		
123 (Y)	—	CAN2 high	Input/ Output	—	—	—
124 (Y/B)	—	CAN3 high	Input/ Output	—	—	—
127 (B)	Ground	Sensor and valve return	Input	ON		
128 (B/W)	Ground	Fuel rail pressure sensor return	Input	ON		
129 (W/O)	Ground	Turbocharger compressor intake pressure signal	Input	ON		
130 (W/B)	Ground	Fuel pressure sensor signal	Input	ON		
132 (W/LG)	Ground	Exhaust gas pressure sensor signal	Input	ON		
134 (R)	Ground	EGR valve signal	Output	ON		
135 (B)	Ground	EGR valve return	Output	ON		
137 (R)	Ground	Compressor bypass valve signal	Output	ON		
138 (R/V)	Ground	Mass air flow sensor 5 volt reference	Output	ON		5.0 V
139 (B)	Ground	Compressor bypass valve return	Input	ON		
143 (W/SB)	Ground	Oil pressure switch signal	Input	ON		
152 (W/Y)	Ground	EGR valve position sensor signal	Input	ON		
154 (W)	Ground	EGR temperature sensor signal	Input	ON		
155 (R/B)	Ground	Fuel injector no. 1 signal	Output	ON		
156 (R/Y)	Ground	Fuel injector no. 7 signal	Output	ON		
157 (R)	Ground	Fuel injector no. 4 signal	Output	ON		
158 (R/B)	Ground	Fuel injector no. 6 signal	Output	ON		
159 (B/SB)	Ground	EGR bypass valve return	Output	ON		
166 (W)	Ground	Fan clutch assembly signal	Input	ON		
168 (W/V)	Ground	Camshaft position sensor signal	Input	ON		
169 (B)	Ground	Crankshaft position sensor return	Input	ON		

Terminal (Wire color)		Description		Condition		Reference value (Approx.)
+	–	Signal name	Input/ Output	Ignition switch	Operation	
170 (B)	Ground	Sensor return	Input	ON		
171 (W/DG)	Ground	Fuel rail pressure sensor signal	Input	ON		
172 (W/Y)	Ground	EGR bypass valve position sensor signal	Output	ON		
174 (W/SB)	Ground	Fuel temperature sensor signal	Input	ON		
176 (B)	Ground	Fuel injector no. 1 return	Input	ON		
177 (B/Y)	Ground	Fuel injector no. 7 return	Input	ON		
178 (B)	Ground	Fuel injector no. 4 return	Input	ON		
179 (B/R)	Ground	Fuel injector no. 6 return	Input	ON		
180 (R/V)	Ground	EGR bypass valve signal	Output	ON		
181 (B/W)	Ground	Fan clutch assembly return	Input	ON		
187 (W/Y)	Ground	Mass air flow sensor signal	Input	ON		
188 (W/SB)	Ground	Turbocharger speed sensor signal	Input	ON		
189 (W/O)	Ground	Crankshaft position sensor signal	Input	ON		
190 (P)	Ground	Crankshaft position sensor 5 volt reference	Output	ON		5.0 V
193 (W/R)	Ground	Coolant temperature sensor signal	Input	ON		
194 (W/B)	Ground	Engine charge air cooler outlet pressure signal	Input	ON		
195 (W/P)	Ground	Intake manifold temperature sensor signal	Input	ON		
196 (W/O)	Ground	Low pressure turbocharger boost pressure sensor signal	Input	ON		

[1]: With LED rear combination lamps

[2]: Without LED rear combination lamps

Fail safe

INFOID:0000000014419947

DTC RELATED ITEM

DTC No.	Detected condition	Action taken when DTC is CRNT
U0106 U0307 U0407	ECM communication with glow plug control module (CAN2).	Glow plug operation disabled.
P0383	Glow plug control module supply voltage less than 6V.	
P0384	Glow plug control module supply voltage greater than 16V.	
P064C	Glow plug control module internal error.	
P06E5		
P263E	Glow plug control module internal temperature greater than 125° C (257° F).	
U010E U11C1	ECM communication with DEF control module (CAN2).	• DEF fluid injection disabled. • Engine torque reduced. • Vehicle speed limited to 8 km/h (5 mph).
U029D	ECM communication with intake NOx sensor (CAN2).	
P1C54	ECM detects NOx conversion efficiency of intake NOx sensor critically low.	
P2048	ECM detects DEF dosing valve circuit open, short high or short low.	
P20B7	ECM detects DEF dosing heater temperature not rising when commanded ON.	
P2201	ECM detects intake NOx sensor not reading 0 while in motoring (non fueling) condition.	
U029E	ECM communication with outlet NOx sensor (CAN2).	• Engine torque reduced. • Vehicle speed limited to 8 km/h (5 mph).
P1C70	ECM detects engine operated for extended period with critical faults.	
P203F	DEF tank level critically low.	
P20E8	• DEF supply pump assembly unable to successfully prime. • DEF control unit detects DEF supply pressure does not reach 460 kPa during priming, or less than 400 kPa during dosing.	
P20E9	DEF control unit detects diesel exhaust fluid pressure greater than 600 kPa (87 psi).	
P2BA7	DEF tank level critically low.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U02A2	ECM communication with DEF quality sensor (CAN2).	Engine torque reduced.
P0087	ECM detects measured fuel rail pressure below commanded fuel rail pressure by at least 200 bar (2,900 psi).	
P0088	ECM detects fuel rail pressure greater than commanded fuel rail pressure by 200 bar (2,900 psi) or fuel rail pressure exceeded 2150 bar (31,183 psi).	
P0184	Difference between fuel temperature and ambient temperature is greater than 15°C (59° F) or 25° C (77° F).	
P0252	ECM detects fuel pump actuator overheated.	
P0344	ECM detects crankshaft position does not match camshaft position.	
P0524	ECM detects engine oil pressure less than 60 kPa.	
P061A	Fueling commands inconsistent with engine running conditions.	
P061B		
P1451	ECM detects soot load of diesel particulate filter reached first stage plugging.	
P203B	DEF control module detects DEF tank level sensor signal circuit less than 0.3V.	
P203C		
P203D	DEF control module detects DEF tank level sensor signal circuit greater than 4.8V.	
P205C	DEF control module detects DEF tank temperature sensor signal circuit less than 0.17V.	
P205D		
P206B	DEF quality sensor reports an internal error.	
P21C4	ECM detects DEF fluid line heater relay driver signal short to voltage.	
P229E	Internal circuit error detected in outlet NOx sensor.	
P2413	ECM detects EGR temperature greater than 250° C (482° F).	
P2BAC	ECM detects critical DTCs related to engine operation are CRNT and engine continues to operate.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U040D	ECM communication with rotary turbine control valve actuator (CAN2).	• Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P009E	ECM detects fuel pressure relief valve closed-loop compensation value outside calibrated limits.	
P00AF	Rotary turbine control valve actuator detects internal error.	
P009E	ECM detects fuel pressure relief valve closed-loop compensation value outside calibrated limits.	
P00AF	Rotary turbine control valve actuator detects internal error.	
P0107	ECM detects charge air cooler outlet pressure signal voltage less than 0.2V.	
P0108	ECM detects charge air cooler outlet pressure signal voltage greater than 4.8V.	
P0237	ECM detects low pressure turbocharger boost pressure sensor signal voltage less than 0.2V.	
P0238	ECM detects low pressure turbocharger boost pressure sensor signal voltage greater than 4.8V.	
P0405	ECM detects EGR valve position signal voltage less than 0.3 V.	
P0406	ECM detects EGR valve position signal voltage greater than 4.7V.	
P046C	ECM detects EGR valve unable to reach commanded position.	
P0489	ECM detects low voltage on EGR valve.	
P0490	ECM detects high voltage on EGR valve.	
P1A62	Turbocharger failed to detect endpoint or stop references.	
P200C	DPF temperature sensor module temperature reading greater than 810° C (1,490° F).	
P2262	Rotary turbine control valve actuator could not meet commanded position.	
P226C	ECM detects difference between actual and commanded turbocharger position is too large.	
P22CB	ECM detects compressor bypass solenoid circuit shorted low.	
P22CC	ECM detects compressor bypass solenoid circuit open or shorted high.	
P242F	ECM detects soot load of DPF filter exceeds maximum.	
P244A	ECM detects DPF differential pressure too low.	
P245C	ECM detects EGR bypass valve circuit short to ground.	
P245D	ECM detects EGR bypass valve circuit short to voltage.	
P2493	ECM detects EGR bypass valve stuck.	
P2494	ECM detects EGR bypass valve position signal voltage less than 0.3V.	
P2495	ECM detects EGR bypass valve position signal voltage greater than 4.7V.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U040F	DEF control module communication with ECM (CAN2).	• DEF fluid injection disabled. • Engine torque reduced.
U3017	ECM communication with SCR temperature sensor module (CAN2).	
P1624	DPF temperature sensor module reports an internal error.	
P1625	DPF temperature sensor module supply voltage greater than 18V.	
P1626	DPF temperature sensor module supply less than 6.5V.	
P1627	DPF temperature sensor module internal temperature greater than 150° C (302° F).	
P1628	ECM detects SCR temperature sensor module intermittent supply voltage resulting in internal module reset.	
P202E	ECM detects DEF dosing valve stuck.	
P204A	DEF dosing valve unable to maintain commanded pressure.	
P204C	ECM detects DPF differential pressure sensor signal voltage less than 0.5V.	
P204D	ECM detects DPF differential pressure sensor signal voltage greater than 4.5V.	
P207F	• DEF quality sensor detects DEF concentration below critical threshold. • DEF quality sensor unable to determine DEF concentration.	
P208A	DEF control module detects an open circuit in DEF dosing pump motor phases.	
P208C	DEF control module detects DEF dosing pump motor circuit short to ground.	
P208D	DEF control module detects DEF dosing pump motor circuit short to voltage.	
P20FF	ECM detects and internal error in DEF control module via CAN2.	
P214C	ECM detects SCR temperature sensor module above critical threshold.	
P21CA	DEF control module supply voltage greater than 5.1V or less than 4.8V.	
P2202	Internal circuit error detected in intake NOx sensor.	
P2454	ECM detects DPF sensor differential pressure signal voltage less than 0.25V.	
P2455	ECM detects DPF sensor differential pressure signal voltage greater than 4.7V.	
P2456	ECM detects DPF outlet pressure greater than 1.5 kPa (0.22 psi) or less than 1.5 kPa (0.22 psi).	
P2470	SCR temperature sensor module signal out of range low.	
P2471	SCR temperature sensor module signal out of range high.	
P2472	ECM detects SCR temperature sensor module signal irrational.	
P2481	SCR temperature sensor module short to ground.	
P2482	SCR temperature sensor module open or short to voltage.	

DTC No.	Detected condition	Action taken when DTC is CRNT
U1611	ECM communication with DPF temperature sensor module (CAN2).	• Active and stationary regeneration of diesel particulate filter disabled. • Engine torque reduced.
P1484	DPF temperature sensor module reading greater than 650° C (1,202° F).	
P1613	DPF temperature sensor module internal error.	
P1614	DPF temperature sensor module supply voltage greater than 18V.	
P1615	DPF temperature sensor module supply voltage less than 6.5V.	
P1616	DPF temperature sensor module internal temperature greater than 150° C (302° F).	
P1623	ECM detects DPF temperature sensor module intermittent supply voltage resulting in internal module reset.	
P200E	DPF temperature sensor module temperature greater than 735° C (1,355° F).	
P244D	DPF outlet temperature sensor greater than 650° C (1,202° F).	
P0046	Rotary turbine control valve actuator communication with ECM.	• DEF fluid injection disabled. • EGR valve operation disabled. • Engine torque reduced.
P0102	ECM detects MAF sensor signal short to ground.	
P0049	• ECM detects turbocharger speed greater than 330k rpm for more than 5 seconds. • Engine derated due to turbocharger speed above normal operating range for 10 seconds.	• ECM estimates turbocharger speed. • Engine torque reduced.
P007C	ECM detects engine charge air cooler outlet temperature signal voltage low.	ECM uses default value for intake manifold temperature.
P007D	ECM detects engine charge air cooler outlet temperature signal voltage greater than 4.7V.	
P00C6	ECM detects fuel rail pressure less than 120 bar (1,740 psi) while cranking.	Engine may not start.
P0604	ECM detects software or calibration error.	
P0605		
P060A		
P060B		
P06B8		
P0606	ECM detects read/write error.	
P0103	ECM detects MAF sensor signal short to voltage.	• Active and stationary regeneration of diesel particulate filter disabled. • DEF fluid injection disabled. • EGR valve operation disabled. • Engine torque reduced.
P0106	ECM detects intake manifold pressure sensor reading higher or lower than expected.	
P040B	ECM detects EGR temperature too high or too low, or temperature did not rise 0.5° C (33° F) at start up.	
P0111	ECM detects intake manifold temperature sensor reading higher or lower than other temperature sensors.	• EGR valve operation disabled. • ECM uses default value for intake manifold temperature. • Engine torque reduced.
P0112	ECM detects intake manifold temperature sensor signal voltage less than 0.06V.	• EGR valve operation disabled. • Active and stationary regeneration of diesel particulate filter disabled. • ECM uses default value for intake manifold temperature. • Engine torque reduced.
P0113	ECM detects intake manifold temperature sensor signal voltage greater than 4.7V.	

DTC No.	Detected condition	Action taken when DTC is CRNT
P0116	ECM detects coolant temperature sensor reading higher or lower than other temperature sensors.	ECM uses default value for coolant temperature.
P0117	ECM detects coolant temperature sensor signal voltage less than 0.108V.	
P0118	ECM detects coolant temperature sensor signal voltage greater than 4.95V.	
P0127	ECM detects intake manifold temperature greater than 120° C (248° F) or 132° C (270° F) for longer than 5 seconds.	Maximum engine operating speed decreased.
P012B	ECM detects barometric pressure reading higher or lower than other temperature sensors.	ECM uses default value for barometric pressure.
P0182	ECM detects fuel temperature sensor signal voltage less than 0.108V.	ECM uses default value for fuel temperature.
P0183	ECM detects fuel temperature sensor signal voltage greater than 4.97V.	
P0191	ECM detects fuel rail pressure sensor signal voltage greater than 0.6V (ignition ON) or less than 0.4V (ignition OFF).	• EGR valve operation disabled. • Engine torque reduced.
P0217	ECM detects engine coolant temperature above threshold and closes EGR valve to reduce temperature.	
P2457	ECM detects EGR temperature greater than 260° C (500° F).	
P2560	ECM detects coolant level sensor signal voltage greater than 3V.	
P0192	ECM detects fuel rail pressure sensor signal voltage less than 0.2V.	ECM uses default value for fuel rail pressure.
P0193	ECM detects fuel rail pressure sensor signal voltage greater than 4.8V.	
P0201	ECM detects open in fuel injector no. 1 harness or injector.	• Fuel injector disabled. • Engine torque reduced.
P0202	ECM detects open in fuel injector no. 2 harness or injector.	
P0203	ECM detects open in fuel injector no. 3 harness or injector.	
P0204	ECM detects open in fuel injector no. 4 harness or injector.	
P0205	ECM detects open in fuel injector no. 5 harness or injector.	
P0206	ECM detects open in fuel injector no. 6 harness or injector.	
P0207	ECM detects open in fuel injector no. 7 harness or injector.	
P0208	ECM detects open in fuel injector no. 8 harness or injector.	
P0262	ECM detects fuel injector no. 1 short to voltage or low injector solenoid resistance.	
P0265	ECM detects fuel injector no. 2 short to voltage or low injector solenoid resistance.	
P0268	ECM detects fuel injector no. 3 short to voltage or low injector solenoid resistance.	
P0271	ECM detects fuel injector no. 4 short to voltage or low injector solenoid resistance.	
P0274	ECM detects fuel injector no. 5 short to voltage or low injector solenoid resistance.	
P0277	ECM detects fuel injector no. 6 short to voltage or low injector solenoid resistance.	
P0280	ECM detects fuel injector no. 7 short to voltage or low injector solenoid resistance.	
P0283	ECM detects fuel injector no. 8 short to voltage or low injector solenoid resistance.	

DTC No.	Detected condition	Action taken when DTC is CRNT
P0219	ECM detects engine speed exceeded 4,600 rpm.	Fueling to engine stops until engine speed drops to normal operating speeds
P0253	ECM detects fuel pump actuator signal voltage less than 2.7V.	• Sensed fuel rail pressure does not match commanded fuel rail pressure. • Engine torque reduced.
P0254	ECM detects fuel pump actuator signal open, short to voltage or short pin to pin.	
P0335	ECM detects loss of crankshaft position sensor signal.	ECM uses backup engine speed sensor for engine speed signal.
P0698	ECM detects crankshaft position sensor signal voltage less than 4.8V.	
P0699	ECM detects crankshaft position sensor signal voltage greater than 5.4V.	
P040C	ECM detects EGR temperature sensor signal voltage less than 0.05V.	• ECM uses default value for EGR temperature. • Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P040D	ECM detects EGR temperature sensor signal voltage greater than 4.9V.	
P0471	• ECM detects exhaust gas pressure higher or lower than other absolute pressure sensors. • ECM detects exhaust gas pressure higher or lower than expected during normal engine operation.	• ECM uses default value for exhaust gas pressure sensor. • EGR valve operation disabled. • Engine torque reduced.
P0472	ECM detects exhaust gas pressure sensor signal voltage less than 0.25V.	• ECM uses default value for exhaust gas pressure sensor. • Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P0473	ECM detects exhaust gas pressure sensor signal voltage greater than 4.75V.	
P051C	ECM detects crankcase pressure sensor signal voltage less than 0.25V.	ECM uses default value for crankcase pressure.
P051D	ECM detects crankcase pressure sensor signal voltage greater than 4.7V.	
P0544	ECM detects difference between intake NOx sensor and DPF temperature sensor module data.	• ECM uses default value for intake NOx sensor. • DEF fluid injection disabled. • Engine torque reduced.
P2031	ECM detects difference between intake NOx sensor and outlet NOx sensor data.	
P0545	DPF temperature sensor module detects a sensor short to ground.	• ECM uses default value for intake NOx sensor. • DEF fluid injection disabled. • Active and stationary regeneration of diesel particulate filter disabled. • Engine torque reduced.
P0546	DPF temperature sensor module detects a sensor open or short to voltage.	
P2032	DPF temperature sensor module detects a sensor short to ground.	
P2033	DPF temperature sensor module detects a sensor open or short to voltage.	
P062C	ECM detects vehicle speed is greater than 5 mph (8 km/h) over targeted cruise speed.	Cruise control temporarily inhibited.
P0653	ECM detects sensor supply signal voltage greater than 5.3V.	ECM uses default value for the following components: • Camshaft position sensor • Fuel rail pressure sensor • Exhaust gas pressure sensor • Low pressure turbocharger boost pressure sensor • Engine charge air cooler outlet pressure/temperature sensor • Turbocharger compressor intake pressure/temperature sensor • EGR valve • EGR bypass valve • Crankcase pressure sensor • Turbocharger speed sensor • Fuel pressure sensor

DTC No.	Detected condition	Action taken when DTC is CRNT
P0691	ECM detects fan control circuit PWM signal not at system voltage when signal commanded ON.	Fan operation disabled.
P0692	ECM detects fan control circuit PWM signal voltage greater than 0 V when signal commanded OFF.	
P06A4	ECM detects APP sensor 1 supply voltage less than 4.7V.	Engine will only idle.
P06A5	ECM detects APP sensor 1 supply voltage greater than 5.3V.	
P06D3	ECM detects APP sensor 2 supply voltage less than 4.7V.	Engine will have limp home throttle control only.
P06D4	ECM detects APP sensor 2 supply voltage greater than 5.3V.	
P2121	ECM detects values between APP sensor 1 and APP sensor 2 differ by greater than 10%.	
P2299	ECM detects accelerator pedal and brake pedal were depressed simultaneously.	
P1191	ECM detects turbocharger compressor intake temperature sensor reading higher or lower than other temperature sensors, or sensor reading erratic.	• ECM uses default value for turbocharger compressor intake temperature sensor. • Engine torque reduced.
P1192	ECM detects turbocharger compressor intake temperature sensor signal voltage less than 0.1V.	ECM uses default value for turbocharger compressor intake temperature sensor.
P1193	ECM detects turbocharger compressor intake temperature sensor signal voltage greater than 4.7V.	
P1484	ECM detects DPF temperature sensor module greater than 800° C (1472° F), or temperature differential greater than 540° C (1,004° F).	• Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled.
P1A77	ECM shuts down engine due to critical aftertreatment temperature faults.	Engine shuts down after a short period of time.
P202B	DEF control module detects open or short to ground on DEF tank heater circuit.	• Diesel exhaust fluid tank heating disabled. • Engine torque reduced.
P202C	DEF control module detects short to voltage on DEF tank heater circuit.	
P2044	ECM detects DEF tank temperature signal voltage out of range high.	DEF fluid injection disabled.
P2045	ECM detects DEF tank temperature signal voltage out of range low.	
P214D	ECM detects temperature at SCR temperature sensor module above 800° C (1,472° F).	
P21CB	DEF control module detects supply voltage less than 9V.	
P21CC	DEF control module detects supply voltage greater than 16V.	
P2080	ECM detects temperature at intake NOx sensor greater than critical limit.	• ECM uses default value for intake NOx sensor. • Active and stationary regeneration of diesel particulate filter disabled.
P20B9	DEF control module detects DEF line heater open circuit.	• DEF line heater disabled. • Engine torque reduced.
P20BC	DEF control module detects DEF line heater circuit short to voltage.	
P20BB	DEF control module detects DEF line heater circuit short to ground.	• DEF line heater disabled. • DEF fluid injection disabled. • Engine torque reduced.
P2146	ECM detects injector group 1 (fuel injector no. 1, 4, 6 and 7) short to voltage or low injector solenoid resistance.	Fuel injectors disabled.
P2149	ECM detects injector group 2 (fuel injector no. 2, 3, 5 and 8) short to voltage or low injector solenoid resistance.	

DTC No.	Detected condition	Action taken when DTC is CRNT
P214A	ECM detects SCR temperature sensor module above critical threshold.	• Engine torque reduced. • Engine will be shut down if Engine Protection Shutdown is enabled.
P214B	ECM detects SCR temperature above 700° C (1,292° F).	Engine will be shut down if Engine Protection Shutdown is enabled.
P242B	ECM detects DPF outlet temperature sensor reading did not change with engine operating conditions.	• ECM uses default value for DPF outlet temperature sensor. • DEF fluid injection disabled. • Engine torque reduced.
P242C	DPF temperature sensor module detects a short to ground condition.	
P242D	DPF temperature sensor module detects an open or short to voltage condition.	
P245F	ECM detects DPF differential pressure greater than 1.5 kPa (0.44 Hg).	ECM uses default value for DPF differential pressure sensor.
P2460	ECM detects DPF differential pressure sensor signal voltage less than 0.25V.	• ECM uses default value for DPF differential pressure sensor. • Active and stationary regeneration of diesel particulate filter disabled. • Engine torque reduced.
P2461	ECM detects DPF differential pressure sensor signal voltage greater than 4.7V.	
P2462	ECM detects DPF differential pressure greater than 1.5 kPa (0.44 Hg).	• ECM uses default value for DPF differential pressure sensor. • Active and stationary regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P2463	ECM detects soot load of diesel particulate filter moderately severe.	• Mobile regeneration of diesel particulate filter disabled. • EGR valve operation disabled. • Engine torque reduced.
P2483	ECM detects SCR temperature sensor module signal irrational.	• ECM uses default value for SCR catalyst outlet temperature. • DEF fluid injection disabled. • Engine torque reduced.
P2541	ECM detects fuel pressure signal voltage less than 0.2V.	• ECM uses default value for fuel delivery pressure reading. • Engine torque reduced.
P2542	ECM detects fuel pressure signal voltage greater than 4.8V.	ECM uses default value for fuel delivery pressure reading.
P2579	ECM detects turbocharger shaft stuck.	ECM estimates turbocharger speed.
P2580	ECM detects turbocharger speed less than 15,000 rpm.	

DTC Index

INFOID:0000000014419948

×:Applicable —: Not applicable

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
U0002	0002	High Speed CAN Communication Bus Performance	1	—	EC-914, "DTC Description"
U0101	0101	LOST COMM TCM	1	×	EC-916, "DTC Description"
U0106	0106	Lost Communication With Glow Plug Control Module	1	×	EC-918, "DTC Description"
U010C	010C	Lost Communication With Turbocharger Control Module “A”	1	—	EC-922, "DTC Description"
U010E	010E	Lost Communication With Reductant Control Module	1	×	EC-927, "DTC Description"
U029D	029D	Lost Communication With NOx sensor “A”	2	×	EC-931, "DTC Description"
U029E	029E	Lost Communication With NOx sensor “B”	2	×	EC-935, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
U02A2	02A2	Lost Communication With Reductant Quality Module	1	—	EC-939, "DTC Description"
U0307	0307	Software Incompatibility With Glow Plug Control Module	1	×	EC-943, "DTC Description"
U0402	0402	Invalid Data Received From TCM	1	×	EC-944, "DTC Description"
U0407	0407	Invalid Data Received From Glow Plug Control Module	2	×	EC-945, "DTC Description"
U040D	040D	Invalid Data Received From Turbocharger Control Module “A”	1	×	EC-946, "DTC Description"
U040F	040F	Invalid Data Received From Reductant Control Module	1	×	EC-948, "DTC Description"
U0415	0415	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module	1	×	EC-951, "DTC Description"
U0426	0426	Invalid Data Received From Vehicle Immobilizer Control Module	1	—	EC-953, "DTC Description"
U059E	059E	Invalid Data Received From NOx sensor “A”	2	×	EC-955, "DTC Description"
U059F	059F	Invalid Data Received From NOx sensor “B”	2	×	EC-957, "DTC Description"
U1000	1000[4]	CAN COMM CIRCUIT	1	× —	EC-959, "DTC Description"
U1001	1001[4]	CAN COMM CIRCUIT	1	× —	EC-962, "DTC Description"
U11C1	11C1	Reductant Control Module Received Implausible Data From ECM	1	×	EC-964, "DTC Description"
U1611	1611	Lost Communication with DPF Temperature Sensor Module	1	×	EC-967, "DTC Description"
U1612	1612	Lost Communication with SCR Temperature Sensor Module	1	×	EC-971, "DTC Description"
U3017	3017	Control Module Timer Performance	2	×	EC-975, "DTC Description"
P0046	0046	Turbocharger Boost Control “A” Circuit Range/Performance	1	×	EC-977, "DTC Description"
P0047	0047	Turbocharger Boost Control “A” Circuit Low	1	×	EC-980, "DTC Description"
P0049	0049	Turbocharger Turbine Overspeed	2 1	× —	EC-983, "DTC Description"
P004E	004E	Turbocharger Boost Control “A” Circuit Intermittent	1	×	EC-986, "DTC Description"
P007B	007B	Charge Air Cooler Temperature Sensor Circuit Performance	2	×	EC-988, "DTC Description"
P007C	007C	Charge Air Cooler Temperature Sensor Circuit Low	2	×	EC-992, "DTC Description"
P007D	007D	Charge Air Cooler Temperature Sensor Circuit High	2	×	EC-995, "DTC Description"
P0087	0087	LOW FUEL PRES	1	×	EC-998, "DTC Description"
P0088	0088	HIGH FUEL PRES	1	×	EC-1000, "DTC Description"
P008A	008A	Low Pressure Fuel System Pressure Too Low	1	—	EC-1002, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P009C	009C	Fuel Pressure Relief Control Circuit Low	2	×	EC-1005, "DTC Description"
P009D	009D	Fuel Pressure Relief Control Circuit High	2	×	EC-1008, "DTC Description"
P009E	009E	Fuel Pressure Relief Control Performance	2	×	EC-1011, "DTC Description"
P00AF	00AF	Turbocharger Boost Control “A” Module Performance	1	×	EC-1015, "DTC Description"
P00B7	00B7	Coolant Level Below Normal Operating Range	2	×	EC-1017, "DTC Description"
P00C6	00C6	Fuel Rail Pressure Too Low Engine Cranking	2	×	EC-1018, "DTC Description"
P0101	0101	MAF SENSOR	1	×	EC-1020, "DTC Description"
P0102	0102	MAF SEN/CIRCUIT	1	×	EC-1024, "DTC Description"
P0103	0103	MAF SEN/CIRCUIT	1	×	EC-1028, "DTC Description"
P0106	0106	Manifold Absolute Pressure Sensor Circuit Range/Performance	1	×	EC-1031, "DTC Description"
P0107	0107	Manifold Absolute Pressure Sensor Circuit Low	1	×	EC-1036, "DTC Description"
P0108	0108	Manifold Absolute Pressure Sensor Circuit High	1	×	EC-1040, "DTC Description"
P0111	0111	Intake Air Temperature Sensor 1 Circuit Performance	2	×	EC-1044, "DTC Description"
P0112	0112	IAT SEN/CIRCUIT	1	×	EC-1047, "DTC Description"
P0113	0113	IAT SEN/CIRCUIT	1	×	EC-1050, "DTC Description"
P0116	0116	ECT SENSOR	2	×	EC-1053, "DTC Description"
P0117	0117	ECT SEN/CIRCUIT	1	×	EC-1057, "DTC Description"
P0118	0118	ECT SEN/CIRCUIT	1	×	EC-1060, "DTC Description"
P0127	0127	IAT SENSOR-B1	1	—	EC-1063, "DTC Description"
P0128	0128	THERMSTAT FNCTN	2	×	EC-1064, "DTC Description"
P012B	012B	Turbocharger Inlet Pressure Sensor Circuit Range/Performance	2	×	EC-1066, "DTC Description"
P012C	012C	Turbocharger Inlet Pressure Sensor Circuit Low	1	×	EC-1069, "DTC Description"
P012D	012D	Turbocharger Inlet Pressure Sensor Circuit High	1	×	EC-1073, "DTC Description"
P0168	0168	Fuel Temperature Too High	1	—	EC-1077, "DTC Description"
P0169	0169	Incorrect Fuel Composition	1	—	EC-1078, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0181	0181	FTT SENSOR	2	×	EC-1079, "DTC Description"
P0182	0182	FUEL TEMP SEN/CIRC	1	—	EC-1082, "DTC Description"
P0183	0183	FUEL TEMP SEN/CIRC	1	—	EC-1085, "DTC Description"
P0184	0184	Fuel Temperature Sensor “A” Circuit Intermittent	2	×	EC-1088, "DTC Description"
			1	—	
P0191	0191	FRP SENSOR	2	×	EC-1089, "DTC Description"
P0192	0192	FRP SEN/CIRC	1	×	EC-1092, "DTC Description"
P0193	0193	FRP SEN/CIRC	1	×	EC-1096, "DTC Description"
P0201	0201	CYL1 INJECTOR	1	×	EC-1100, "DTC Description"
P0202	0202	CYL2 INJECTOR	1	×	EC-1103, "DTC Description"
P0203	0203	CYL3 INJECTOR	1	×	EC-1106, "DTC Description"
P0204	0204	CYL4 INJECTOR	1	×	EC-1109, "DTC Description"
P0205	0205	INJECTOR CIRC-CYL5	1	×	EC-1112, "DTC Description"
P0206	0206	INJECTOR CIRC-CYL6	1	×	EC-1115, "DTC Description"
P0207	0207	INJECTOR CIRC-CYL7	1	×	EC-1118, "DTC Description"
P0208	0208	INJECTOR CIRC-CYL8	1	×	EC-1121, "DTC Description"
P020A	020A	Cylinder 1 Injection Timing	1	×	EC-1124, "DTC Description"
P020B	020B	Cylinder 2 Injection Timing	1	×	EC-1126, "DTC Description"
P020C	020C	Cylinder 3 Injection Timing	1	×	EC-1128, "DTC Description"
P020D	020D	Cylinder 4 Injection Timing	1	×	EC-1130, "DTC Description"
P020E	020E	Cylinder 5 Injection Timing	1	×	EC-1132, "DTC Description"
P020F	020F	Cylinder 6 Injection Timing	1	×	EC-1134, "DTC Description"
P0217	0217	ENG OVER TEMP	1	—	EC-1136, "DTC Description"
P0219	0219	ENG OVER SPD	1	—	EC-1137, "DTC Description"
P021A	021A	Cylinder 7 Injection Timing	1	×	EC-1139, "DTC Description"
P021B	021B	Cylinder 8 Injection Timing	1	×	EC-1141, "DTC Description"
P0237	0237	TC BOOST SEN/CIRC	1	×	EC-1143, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0238	0238	TC BOOST SEN/CIRC	1	×	EC-1147, "DTC Description"
P0252	0252	Injection Pump Fuel Metering Control “A” Performance	1	×	EC-1151, "DTC Description"
P0253	0253	Injection Pump Fuel Metering Control “A” Low	2	×	EC-1154, "DTC Description"
P0254	0254	Injection Pump Fuel Metering Control “A” High	2	×	EC-1157, "DTC Description"
P0257	0257	Injection Pump Fuel Metering Control “B” Performance	1	×	EC-1160, "DTC Description"
P0261	0261	CYL1 INJECTOR	2	×	EC-1163, "DTC Description"
P0262	0262	CYL1 INJECTOR	2	×	EC-1166, "DTC Description"
P0263	0261	Cylinder 1 Balance	2	×	EC-1169, "DTC Description"
P0264	0264	CYL2 INJECTOR	2	×	EC-1171, "DTC Description"
P0265	0265	CYL2 INJECTOR	2	×	EC-1174, "DTC Description"
P0266	0266	Cylinder 2 Balance	2	×	EC-1177, "DTC Description"
P0267	0267	CYL3 INJECTOR	2	×	EC-1179, "DTC Description"
P0268	0268	CYL3 INJECTOR	2	×	EC-1182, "DTC Description"
P0269	0269	Cylinder 3 Balance	2	×	EC-1185, "DTC Description"
P026A	026A	Charge Air Cooler Efficiency Below Threshold	2	×	EC-1187, "DTC Description"
P026B	026B	Injection Timing Performance	1	×	EC-1189, "DTC Description"
P0270	0270	CYL4 INJECTOR	2	×	EC-1190, "DTC Description"
P0271	0271	CYL4 INJECTOR	2	×	EC-1193, "DTC Description"
P0272	0272	Cylinder 4 Balance	2	×	EC-1196, "DTC Description"
P0273	0273	Cylinder 5 Injector Circuit Low	2	×	EC-1198, "DTC Description"
P0274	0274	Cylinder 5 Injector Circuit High	2	×	EC-1201, "DTC Description"
P0275	0275	Cylinder 5 Balance	2	×	EC-1204, "DTC Description"
P0276	0276	Cylinder 6 Injector Circuit Low	2	×	EC-1206, "DTC Description"
P0277	0277	Cylinder 6 Injector Circuit High	2	×	EC-1209, "DTC Description"
P0278	0278	Cylinder 6 Balance	2	×	EC-1212, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0279	0279	Cylinder 7 Injector Circuit Low	2	×	EC-1214, "DTC Description"
P0280	0280	Cylinder 7 Injector Circuit High	2	×	EC-1217, "DTC Description"
P0281	0281	Cylinder 7 Balance	2	×	EC-1220, "DTC Description"
P0282	0282	Cylinder 8 Injector Circuit Low	2	×	EC-1222, "DTC Description"
P0283	0283	Cylinder 8 Injector Circuit High	2	×	EC-1225, "DTC Description"
P0284	0284	Cylinder 8 Balance	2	×	EC-1228, "DTC Description"
P0299	0299	TC SYSTEM	2	×	EC-1230, "DTC Description"
P02EE	02EE	Cylinder 1 Injector Circuit Performance	2	×	EC-1233, "DTC Description"
P02EF	02EF	Cylinder 2 Injector Circuit Performance	2	×	EC-1236, "DTC Description"
P02F0	02F0	Cylinder 3 Injector Circuit Performance	2	×	EC-1239, "DTC Description"
P02F1	02F1	Cylinder 4 Injector Circuit Performance	2	×	EC-1242, "DTC Description"
P02F2	02F2	Cylinder 5 Injector Circuit Performance	2	×	EC-1245, "DTC Description"
P02F3	02F3	Cylinder 6 Injector Circuit Performance	2	×	EC-1248, "DTC Description"
P02F4	02F4	Cylinder 7 Injector Circuit Performance	2	×	EC-1251, "DTC Description"
P02F5	02F5	Cylinder 8 Injector Circuit Performance	2	×	EC-1254, "DTC Description"
P0300	0300	MULTI CYL MISFIRE	2	×	EC-1257, "DTC Description"
P0301	0301	CYL 1 MISFIRE	2	×	EC-1259, "DTC Description"
P0302	0302	CYL 2 MISFIRE	2	×	EC-1261, "DTC Description"
P0303	0303	CYL 3 MISFIRE	2	×	EC-1263, "DTC Description"
P0304	0304	CYL 4 MISFIRE	2	×	EC-1265, "DTC Description"
P0305	0305	CYL 5 MISFIRE	2	×	EC-1267, "DTC Description"
P0306	0306	CYL 6 MISFIRE	2	×	EC-1269, "DTC Description"
P0307	0307	CYL 7 MISFIRE	2	×	EC-1271, "DTC Description"
P0308	0308	CYL 8 MISFIRE	2	×	EC-1273, "DTC Description"
P0335	0335	CKP SEN/CIRCUIT	2	×	EC-1275, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0340	0340	CMP SEN/CIRCUIT	2	×	EC-1280, "DTC Description"
P0344	0344	CMP/CKP RELATION	1	× —	EC-1284, "DTC Description"
P0383	0383	Glow Plug Control Module 1 Control Circuit Low	2	×	EC-1287, "DTC Description"
P0384	0385	Glow Plug Control Module 1 Control Circuit High	2	×	EC-1290, "DTC Description"
P0401	0401	EGR SYSTEM	2	×	EC-1292, "DTC Description"
P0402	0402	EGR SYSTEM	2	×	EC-1295, "DTC Description"
P0405	0405	EGR SENSOR	2	×	EC-1297, "DTC Description"
P0406	0406	EGR SENSOR	1	×	EC-1301, "DTC Description"
P040B	040B	EGR Temperature Sensor “A” Circuit Range/Performance	2	×	EC-1305, "DTC Description"
P040C	040C	EGR Temperature Sensor “A” Circuit Low	1	×	EC-1308, "DTC Description"
P040D	040D	EGR Temperature Sensor “A” Circuit High	1	×	EC-1311, "DTC Description"
P0420	0420	CATALYST	1	×	EC-1314, "DTC Description"
P0421	0421	Catalyst 1 Efficiency Below Threshold	2	×	EC-1316, "DTC Description"
P0461	0461	FUEL LEVEL SENSOR	1	—	EC-1318, "DTC Description"
P0462	0462	FUEL LEVL SEN/CIRC	1	—	EC-1320, "DTC Description"
P0463	0463	FUEL LEVL SEN/CIRC	1	—	EC-1321, "DTC Description"
P046C	046C	EGR Sensor “A” Circuit Range/Performance	2	×	EC-1322, "DTC Description"
P0471	0471	DIFF EX PRESS SEN	2	×	EC-1326, "DTC Description"
P0472	0472	DFF PRESS SEN/CIRC	1	×	EC-1330, "DTC Description"
P0473	0473	DFF PRESS SEN/CIRC	1	×	EC-1334, "DTC Description"
P0489	0489	Exhaust Gas Recirculation Control Circuit Low	1	×	EC-1338, "DTC Description"
P0490	0490	Exhaust Gas Recirculation Control Circuit High	1	×	EC-1341, "DTC Description"
P04DB	04DB	Engine Crankcase Ventilation Hose Disconnected	2	×	EC-1344, "DTC Description"
P0501	0501	VEHICLE SPEED	1	×	EC-1347, "DTC Description"
P0506	0506	ISC SYSTEM	2	×	EC-1349, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0507	0507	ISC SYSTEM	2	×	EC-1351, "DTC Description"
P0513	0513	Incorrect Immobilizer Key	1	—	EC-1353, "DTC Description"
P051B	051B	Crankcase Pressure Sensor Circuit Range/Performance	2	×	EC-1354, "DTC Description"
P051C	051C	Crankcase Pressure Sensor Circuit Low	2	×	EC-1357, "DTC Description"
P051D	051D	Crankcase Pressure Sensor Circuit High	2	×	EC-1361, "DTC Description"
P0521	0521	Engine Oil Pressure Sensor/Switch Range/Performance	1	—	EC-1365, "DTC Description"
P0524	0524	ENGINE OIL PRESSURE	1	—	EC-1368, "DTC Description"
P0532	0532	A/C Refrigerant Pressure Sensor “A” Low	1	—	EC-1369, "DTC Description"
P0533	0533	A/C Refrigerant Pressure Sensor “A” High	1	—	EC-1372, "DTC Description"
P053E	053E	Crankcase Pressure Too High	1	—	EC-1376, "DTC Description"
P0544	0544	Exhaust Gas Temperature Sensor Circuit	2	×	EC-1378, "DTC Description"
P0545	0545	Exhaust Gas Temperature Sensor Circuit Low	2	×	EC-1380, "DTC Description"
P0546	0546	Exhaust Gas Temperature Sensor Circuit High	2	×	EC-1381, "DTC Description"
P054E	054E	Idle Control System Fuel Quantity Lower Than Expected	2	×	EC-1382, "DTC Description"
P054F	054F	Idle Control System Fuel Quantity Higher Than Expected	2	×	EC-1384, "DTC Description"
P0562	0562	BATTERY VOLTAGE	1	—	EC-1386, "DTC Description"
P0563	0563	BATTERY VOLTAGE	1	—	EC-1389, "DTC Description"
P0579	0579	Cruise Control Multi-Function Input “A” Circuit Range/Performance	1	—	EC-1391, "DTC Description"
P057E	057E	Brake Pedal Position Sensor “A” Circuit Intermittent	1	—	EC-1393, "DTC Description"
P0581	0581	STRG SW/CIRC	1	—	EC-1397, "DTC Description"
P0591	0591	Cruise Control Multi-Function Input “B” Circuit Range/Performance	1	—	EC-1399, "DTC Description"
P0601	0601	Internal Control Module Memory Checksum Error	2	×	EC-1401, "DTC Description"
P0604	0604	ECM	2	×	EC-1402, "DTC Description"
P0605	0605	ECM	2	×	EC-1404, "DTC Description"
P0606	0606	ECM	1	×	EC-1405, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0607	0607	ECM	1	×	EC-1406, "DTC Description"
P060A	060A	Internal Control Module Monitoring Processor Performance	1	—	EC-1409, "DTC Description"
P060B	060B	Internal Control Module A/D Processor Performance	1	—	EC-1410, "DTC Description"
P060C	060C	Internal Control Module Main Processor Performance	1	—	EC-1411, "DTC Description"
P0611	0611	ECM	1	×	EC-1414, "DTC Description"
P061A	061A	Internal Control Module Torque Performance	1	—	EC-1416, "DTC Description"
P061B	061B	Internal Control Module Torque Calculation Performance	1	—	EC-1418, "DTC Description"
P061C	061C	Internal Control Module Engine RPM Performance	1	—	EC-1420, "DTC Description"
P061E	061E	Internal Control Module Brake Signal Performance	1	—	EC-1422, "DTC Description"
P0628	0628	FUEL PUMP/CIRC	1	—	EC-1424, "DTC Description"
P0629	0629	FUEL PUMP/CIRC	1	—	EC-1427, "DTC Description"
P062B	062B	Internal Control Module Fuel Injector Performance	1	×	EC-1430, "DTC Description"
P062C	062C	Internal Control Module Vehicle Speed Performance	1	—	EC-1432, "DTC Description"
P0630	0630	VIN Not Programmed or Incompatible - ECM	1	×	EC-1433, "DTC Description"
P064C	064C	Glow Plug Control Module	2	×	EC-1434, "DTC Description"
P0652	0652	SENSOR PWR/CIRC2	1	×	EC-1437, "DTC Description"
P0653	0653	SENSOR PWR/CIRC2	1	×	EC-1445, "DTC Description"
P0667	0667	ECM Internal Temperature Sensor Range/ Performance	2	×	EC-1447, "DTC Description"
P066A	066A	Cylinder 1 Glow Plug Control Circuit Low	1	×	EC-1448, "DTC Description"
P066B	066B	Cylinder 1 Glow Plug Control Circuit High	1	×	EC-1450, "DTC Description"
P066C	066C	Cylinder 2 Glow Plug Control Circuit Low	1	×	EC-1452, "DTC Description"
P066D	066D	Cylinder 2 Glow Plug Control Circuit High	1	×	EC-1454, "DTC Description"
P066E	066E	Cylinder 3 Glow Plug Control Circuit Low	1	×	EC-1456, "DTC Description"
P066F	066F	Cylinder 3 Glow Plug Control Circuit High	1	×	EC-1458, "DTC Description"
P0671	0671	Cylinder 1 Glow Plug Circuit	2	×	EC-1460, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P0672	0672	Cylinder 2 Glow Plug Circuit	2	×	EC-1463, "DTC Description"
P0673	0673	Cylinder 3 Glow Plug Circuit	2	×	EC-1466, "DTC Description"
P0674	0674	Cylinder 4 Glow Plug Circuit	2	×	EC-1469, "DTC Description"
P0675	0675	Cylinder 5 Glow Plug Circuit	2	×	EC-1472, "DTC Description"
P0676	0676	Cylinder 6 Glow Plug Circuit	2	×	EC-1475, "DTC Description"
P0677	0677	Cylinder 7 Glow Plug Circuit	2	×	EC-1478, "DTC Description"
P0678	0678	Cylinder 8 Glow Plug Circuit	2	×	EC-1481, "DTC Description"
P067A	067A	Cylinder 4 Glow Plug Control Circuit Low	1	×	EC-1484, "DTC Description"
P067B	067B	Cylinder 4 Glow Plug Control Circuit High	1	×	EC-1486, "DTC Description"
P067C	067C	Cylinder 5 Glow Plug Control Circuit Low	1	×	EC-1488, "DTC Description"
P067D	067D	Cylinder 5 Glow Plug Control Circuit High	1	×	EC-1490, "DTC Description"
P067E	067E	Cylinder 6 Glow Plug Control Circuit Low	1	×	EC-1492, "DTC Description"
P067F	067F	Cylinder 6 Glow Plug Control Circuit High	1	×	EC-1494, "DTC Description"
P0687	0687	ECM Power Relay Control Circuit	2	×	EC-1496, "DTC Description"
P068C	068C	Cylinder 7 Glow Plug Control Circuit Low	1	×	EC-1499, "DTC Description"
P068D	068D	Cylinder 7 Glow Plug Control Circuit High	1	×	EC-1501, "DTC Description"
P068E	068E	Cylinder 8 Glow Plug Control Circuit Low	1	×	EC-1503, "DTC Description"
P068F	068F	Cylinder 8 Glow Plug Control Circuit High	1	×	EC-1505, "DTC Description"
P0691	0691	Fan 1 Control Circuit Low	1	—	EC-1507, "DTC Description"
P0692	0692	Fan 1 Control Circuit High	1	—	EC-1510, "DTC Description"
P0698	0698	Sensor Reference Voltage “C” Circuit Low	2	×	EC-1513, "DTC Description"
P0699	0699	Sensor Reference Voltage “C” Circuit High	2	×	EC-1515, "DTC Description"
P06A4	06A4	Sensor Reference Voltage “D” Circuit Low	1	×	EC-1517, "DTC Description"
P06A5	06A5	Sensor Reference Voltage “D” Circuit High	2	×	EC-1520, "DTC Description"
P06B8	06B8	Internal Control Module Non-Volatile Random Access Memory (NVRAM) Error	2	×	EC-1522, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P06B9	06B9	Cylinder 1 Glow Plug Circuit Range/Performance	2	×	EC-1523, "DTC Description"
P06BA	06BA	Cylinder 2 Glow Plug Circuit Range/Performance	2	×	EC-1525, "DTC Description"
P06BB	06BB	Cylinder 3 Glow Plug Circuit Range/Performance	2	×	EC-1527, "DTC Description"
P06BC	06BC	Cylinder 4 Glow Plug Circuit Range/Performance	2	×	EC-1530, "DTC Description"
P06BD	06BD	Cylinder 5 Glow Plug Circuit Range/Performance	2	×	EC-1533, "DTC Description"
P06BE	06BE	Cylinder 6 Glow Plug Circuit Range/Performance	2	×	EC-1535, "DTC Description"
P06BF	06BF	Cylinder 7 Glow Plug Circuit Range/Performance	2	×	EC-1537, "DTC Description"
P06C0	06C0	Cylinder 8 Glow Plug Circuit Range/Performance	2	×	EC-1539, "DTC Description"
P06D3	06D3	Sensor Reference Voltage “E” Circuit Low	1	×	EC-1541, "DTC Description"
P06D4	06D4	Sensor Reference Voltage “E” Circuit High	2	×	EC-1544, "DTC Description"
P06D7	06D7	Sensor Reference Voltage “F” Circuit Low	2	×	EC-1546, "DTC Description"
P06D8	06D8	Sensor Reference Voltage “F” Circuit High	2	×	EC-1549, "DTC Description"
P06E5	06E5	Glow Plug Control Module 1 Performance	2	×	EC-1551, "DTC Description"
P0700	0700	TCM	1	×	EC-1554, "DTC Description"
P0A0F	0A0F	Engine Failed to Start	2	×	EC-1555, "DTC Description"
P1191	1191	Inlet Air Temperature Sensor Performance	2	×	EC-1559, "DTC Description"
P1192	1192	Inlet Air Temperature Sensor Low	1	×	EC-1562, "DTC Description"
P1193	1193	Inlet Air Temperature Sensor High	1	×	EC-1565, "DTC Description"
P1451	1451	Diesel Particulate Filter System Performance	1	—	EC-1568, "DTC Description"
P1484	1484	Catalyst Overheat Detection	1	×	EC-1570, "DTC Description"
P1612	1612	Datalink Error	1	—	EC-1572, "DTC Description"
P1613	1613	DPF Temperature Sensor Module Performance	2	×	EC-1573, "DTC Description"
P1614	1614	DPF Temperature Sensor Module Shorted High	2	×	EC-1575, "DTC Description"
P1615	1615	DPF Temperature Sensor Module Shorted Low	2	×	EC-1578, "DTC Description"
P1616	1616	DPF Temperature Sensor Module Over Temperature	2	×	EC-1581, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P1623	1623	DPF Temperature Sensor Module Circuit	1	×	EC-1583, "DTC Description"
P1624	1624	SCR Temperature Sensor Module Performance	1	×	EC-1586, "DTC Description"
P1625	1625	SCR Temperature Sensor Module Shorted High	2	×	EC-1588, "DTC Description"
P1626	1626	SCR Temperature Sensor Module Shorted Low	2	×	EC-1591, "DTC Description"
P1627	1627	SCR Temperature Sensor Module Over Temperature	2	×	EC-1594, "DTC Description"
P1628	1628	SCR Temperature Sensor Module Circuit	2	×	EC-1596, "DTC Description"
P1A11	1A11	ENG OVER TEMP	1	—	EC-1599, "DTC Description"
P1A12	1A12	Catalyst Overheat Detection	1	×	EC-1600, "DTC Description"
P1A62	1A62	Turbo Actuator Software Error	1	×	EC-1602, "DTC Description"
P1A77	1A77	Aftertreatment Over Temp	1	×	EC-1604, "DTC Description"
P1A78	1A78	Forced Engine Shutdown	1	—	EC-1605, "DTC Description"
P1A7A	1A7A	Engine Coolant Level Low	1	×	EC-1606, "DTC Description"
P1C54	1C54	SCR NOx Catalyst Missing	1	×	EC-1607, "DTC Description"
P1C55	1C55	NOx Sensor Bank 1 Sensor 1 Sensor Circuit Intermittent	2	×	EC-1610, "DTC Description"
P1C56	1C56	NOx Sensor Bank 1 Sensor 2 Sensor Circuit Intermittent	2	×	EC-1612, "DTC Description"
P1C70	1C70	SCR Error Detected	1	—	EC-1614, "DTC Description"
P200C	200C	Diesel Particulate Filter Over Temperature	1	×	EC-1615, "DTC Description"
P200E	200E	Catalyst System Over Temperature	1	×	EC-1618, "DTC Description"
P202B	202B	Reductant Tank Heater Control Circuit Low	1	×	EC-1620, "DTC Description"
P202C	202C	Reductant Tank Heater Control Circuit High	2	×	EC-1623, "DTC Description"
P202E	202E	Reductant Injection Valve Circuit Range/Performance	2	×	EC-1626, "DTC Description"
P2031	2031	Exhaust Gas Temperature Sensor Circuit	2	×	EC-1628, "DTC Description"
P2032	2032	Exhaust Gas Temperature Sensor Circuit Low	2	×	EC-1630, "DTC Description"
P2033	2033	Exhaust Gas Temperature Sensor Circuit High	2	×	EC-1632, "DTC Description"
P203B	203B	Reductant Level Sensor Circuit Range/Performance	2	×	EC-1634, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P203C	203C	Reductant Level Sensor Circuit Low	1	×	EC-1637, "DTC Description"
P203D	203D	Reductant Level Sensor Circuit High	2	×	EC-1641, "DTC Description"
P203F	203F	Reductant Level Too Low	1	—	EC-1644, "DTC Description"
P2044	2044	Reductant Temperature Sensor Circuit Low	1	—	EC-1646, "DTC Description"
P2045	2045	Reductant Temperature Sensor Circuit High	1	—	EC-1648, "DTC Description"
P2048	2048	Reductant Injector Circuit Low	1	×	EC-1650, "DTC Description"
P204A	204A	Reductant Pressure Sensor Circuit	1	×	EC-1653, "DTC Description"
P204C	204C	Reductant Pressure Sensor Circuit Low	1	×	EC-1656, "DTC Description"
P204D	204D	Reductant Pressure Sensor Circuit High	1	×	EC-1660, "DTC Description"
P205C	205C	Reductant Tank Temperature Sensor Circuit Low	2	×	EC-1663, "DTC Description"
P205D	205D	Reductant Tank Temperature Sensor Circuit High	1	×	EC-1666, "DTC Description"
P205E	205E	Reductant Tank Temperature Sensor Circuit Intermittent	2	×	EC-1669, "DTC Description"
P206B	206B	Reductant Quality Sensor Circuit Range/Performance	1	—	EC-1672, "DTC Description"
P206D	206D	Reductant Quality Sensor Circuit High	1	—	EC-1674, "DTC Description"
P207F	207F	Reductant Quality Performance	1	× —	EC-1676, "DTC Description"
P2080	2080	Exhaust Gas Temperature Sensor Circuit Range/Performance	1	×	EC-1678, "DTC Description"
P208A	208A	Reductant Pump Control Circuit	1	×	EC-1680, "DTC Description"
P208C	208C	Reductant Pump Control Circuit Low	1	×	EC-1683, "DTC Description"
P208D	208D	Reductant Pump Control Circuit High	1	×	EC-1686, "DTC Description"
P209F	209F	Reductant Tank Heater Control Circuit Performance	2	×	EC-1689, "DTC Description"
P20B7	20B7	Reductant Metering Unit Heater Control Circuit Low	2	×	EC-1692, "DTC Description"
P20B8	20B8	Reductant Metering Unit Heater Control Circuit High	2	×	EC-1695, "DTC Description"
P20B9	20B9	Reductant Heater “A” Control Circuit	1	×	EC-1698, "DTC Description"
P20BB	20BB	Reductant Heater “A” Control Circuit Low	1	×	EC-1701, "DTC Description"
P20BC	20BC	Reductant Heater “A” Control Circuit High	2	×	EC-1704, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P20E8	20E8	Reductant Pressure Too Low	2 1	×	EC-1706, "DTC Description"
P20E9	20E9	Reductant Pressure Too High	1	×	EC-1709, "DTC Description"
P20EE	20EE	SCR NOx Catalyst Efficiency Below Threshold	1	×	EC-1711, "DTC Description"
P20FF	20FF	Reductant Control Module Performance	2	×	EC-1714, "DTC Description"
P2121	2121	Throttle/Pedal Position Sensor/Switch “D” Circuit Range/Performance	1	×	EC-1716, "DTC Description"
P2122	2122	THROTTLE/PDL POSITION SEN/SW D	1	×	EC-1720, "DTC Description"
P2123	2123	THROTTLE/PDL POSITION SEN/SW D	1	×	EC-1724, "DTC Description"
P2127	2127	THROTTLE/PDL POSITION SEN/SW E	1	×	EC-1728, "DTC Description"
P2128	2128	THROTTLE/PDL POSITION SEN/SW E	1	×	EC-1732, "DTC Description"
P2146	2146	INJ PWR/CIRC	1	×	EC-1736, "DTC Description"
P2149	2149	INJ PWR/CIRC	1	×	EC-1740, "DTC Description"
P214A	214A	SCR NOx Catalyst Inlet Temperature Too High	1	×	EC-1744, "DTC Description"
P214B	214B	SCR NOx Catalyst Inlet Temperature Too High During Particulate Filter Regeneration	1	×	EC-1746, "DTC Description"
P214C	214C	SCR NOx Catalyst Outlet Temperature Too High	1	×	EC-1748, "DTC Description"
P214D	214D	SCR NOx Catalyst Outlet Temperature Too High During Particulate Filter Regeneration	1	×	EC-1750, "DTC Description"
P218F	218F	Reductant No Flow Detected	2	×	EC-1752, "DTC Description"
P21C4	21C4	Reductant Heater Relay Control Circuit High	1	×	EC-1754, "DTC Description"
P21CA	21CA	Reductant Control Module Supply Voltage Circuit	1	×	EC-1756, "DTC Description"
P21CB	21CB	Reductant Control Module Supply Voltage Low	1	×	EC-1759, "DTC Description"
P21CC	21CC	Reductant Control Module Supply Voltage High	1	×	EC-1762, "DTC Description"
P2201	2201	NOx Sensor Circuit Range/Performance	2 1	×	EC-1764, "DTC Description"
P2202	2202	NOx Sensor Circuit Low Input	2	×	EC-1766, "DTC Description"
P2204	2204	Outlet NOx Sensor Out of Calibration	2	×	EC-1768, "DTC Description"
P2209	2209	NOx Sensor Heater Sense Circuit Range/Performance	2	×	EC-1770, "DTC Description"
P220A	220A	NOx Sensor Circuit	2	×	EC-1773, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P220B	220B	NOx Sensor Circuit	2	×	EC-1776, "DTC Description"
P221A	221A	NOx Sensor 1/2 Correlation	2	×	EC-1779, "DTC Description"
P225C	225C	Aftertreatment Intake Oxygen Sensor Signal Drifted High	2	×	EC-1782, "DTC Description"
P225D	225D	Aftertreatment Intake Oxygen Sensor Signal Drifted Low	2	×	EC-1784, "DTC Description"
P225E	225E	Aftertreatment Outlet Oxygen Sensor Signal Drifted High	2	×	EC-1786, "DTC Description"
P225F	225F	Aftertreatment Outlet Oxygen Sensor Signal Drifted Low	2	×	EC-1788, "DTC Description"
P2262	2262	Turbocharger Boost Pressure Not Detected - Mechanical	1	×	EC-1790, "DTC Description"
P2263	2263	Turbocharger Boost System Performance	2	×	EC-1793, "DTC Description"
P2267	2267	Water in Fuel Sensor Circuit High	1	—	EC-1797, "DTC Description"
P2269	2269	Water in Fuel Condition	1	—	EC-1800, "DTC Description"
P226C	226C	Turbocharger Boost Control “A” Slow Response	2	×	EC-1804, "DTC Description"
P2280	2280	Air Flow Restriction/Air Leak Between Air Filter and MAF	1	—	EC-1807, "DTC Description"
P2299	2299	Brake Pedal Position/Accelerator Pedal Position Incompatible	1	—	EC-1809, "DTC Description"
P229E	229E	NOx Sensor Circuit	2	×	EC-1811, "DTC Description"
P229F	229F	NOx Sensor Circuit Range/Performance	2	×	EC-1813, "DTC Description"
P22A2	22A2	Intake NOx Sensor Out of Calibration	2	×	EC-1815, "DTC Description"
P22A7	22A7	NOx Sensor Heater Sense Circuit Range/Performance	2	×	EC-1817, "DTC Description"
P22CB	22CB	Turbocharger Compressor Outlet Switching Valve Control Circuit Low	1	×	EC-1820, "DTC Description"
P22CC	22CC	Turbocharger Compressor Outlet Switching Valve Control Circuit High	1	×	EC-1823, "DTC Description"
P22CD	22CD	Turbocharger Compressor Outlet Switching Valve Stuck Open	1	×	EC-1826, "DTC Description"
P22CE	22CE	Turbocharger Compressor Outlet Switching Valve Stuck Closed	1	×	EC-1829, "DTC Description"
P2413	2413	Exhaust Gas Recirculation System Performance	1	—	EC-1835, "DTC Description"
P242B	242B	Exhaust Gas Temperature Sensor Circuit Range/Performance	2	×	EC-1838, "DTC Description"
P242C	242C	Exhaust Gas Temperature Sensor Circuit Low	2	×	EC-1840, "DTC Description"
P242D	242D	Exhaust Gas Temperature Sensor Circuit High	2	×	EC-1842, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P242F	242F	Particulate Filter Restriction - Ash Accumulation	1	×	EC-1844, "DTC Description"
P244A	244A	Particulate Filter Differential Pressure Too Low	2	×	EC-1846, "DTC Description"
P244D	244D	Exhaust Temperature Too High For Particulate Filter Regeneration	1	×	EC-1848, "DTC Description"
P2453	2453	Particulate Filter Pressure Sensor “A” Circuit Range/Performance	2	×	EC-1850, "DTC Description"
P2454	2454	Particulate Filter Pressure Sensor “A” Circuit Low	2	×	EC-1854, "DTC Description"
P2455	2455	Particulate Filter Pressure Sensor “A” Circuit High	2	×	EC-1858, "DTC Description"
P2456	2456	Particulate Filter Pressure Sensor “A” Circuit Intermittent	2	×	EC-1862, "DTC Description"
P2457	2457	EGR Cooler “A” Efficiency Below Threshold	2	×	EC-1867, "DTC Description"
			1	—	
P2459	2459	Particulate Filter Regeneration Frequency	1	×	EC-1871, "DTC Description"
P245C	245C	EGR Cooler Bypass Control Circuit Low	1	×	EC-1876, "DTC Description"
P245D	245D	EGR Cooler Bypass Control Circuit High	1	×	EC-1879, "DTC Description"
P245F	245F	Particulate Filter Pressure Sensor “B” Circuit Range/Performance	2	×	EC-1881, "DTC Description"
P2460	2460	Particulate Filter Pressure Sensor “B” Circuit Low	2	×	EC-1885, "DTC Description"
P2461	2461	Particulate Filter Pressure Sensor “B” Circuit High	2	×	EC-1889, "DTC Description"
P2462	2462	Particulate Filter Pressure Sensor “B” Circuit Intermittent	2	×	EC-1893, "DTC Description"
P2463	2463	Particulate Filter Restriction - Soot Accumulation	1	×	EC-1897, "DTC Description"
P2470	2470	Exhaust Gas Temperature Sensor Circuit Low	2	×	EC-1899, "DTC Description"
P2471	2471	Exhaust Gas Temperature Sensor Circuit High	1	×	EC-1901, "DTC Description"
P2472	2472	Exhaust Gas Temperature Sensor Circuit Intermittent	2	×	EC-1903, "DTC Description"
P2481	2481	Exhaust Gas Temperature Sensor Circuit Low	2	×	EC-1908, "DTC Description"
P2482	2482	Exhaust Gas Temperature Sensor Circuit High	1	×	EC-1910, "DTC Description"
P2483	2483	Exhaust Gas Temperature Sensor Circuit Range/Performance	2	×	EC-1912, "DTC Description"
P2493	2493	EGR Cooler Bypass Position Sensor Circuit Range/Performance	1	×	EC-1914, "DTC Description"
P2494	2494	EGR Cooler Bypass Position Sensor Circuit Low	2	×	EC-1918, "DTC Description"
P2495	2495	EGR Cooler Bypass Position Sensor Circuit High	2	×	EC-1922, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P249E	249E	Closed Loop Reductant Injection Control At Limit - Flow Too High	2	×	EC-1926, "DTC Description"
P24A0	24A0	Closed Loop Particulate Filter Regeneration Control At Limit - Temperature Too Low	2	×	EC-1929, "DTC Description"
P24A2	24A2	Particulate Filter Regeneration Incomplete	1	×	EC-1931, "DTC Description"
P2509	2509	ECM Power Input Signal Intermittent	1	—	EC-1935, "DTC Description"
P2540	2540	Low Pressure Fuel System Sensor Circuit Range/Performance	1	—	EC-1939, "DTC Description"
P2541	2541	Low Pressure Fuel System Sensor Circuit Low	1	—	EC-1943, "DTC Description"
P2542	2542	Low Pressure Fuel System Sensor Circuit High	1	—	EC-1947, "DTC Description"
P2558	2558	Engine Coolant Level Sensor/Switch Circuit Low	1	×	EC-1951, "DTC Description"
P2559	255	Engine Coolant Level Sensor/Switch Circuit High	1	×	EC-1954, "DTC Description"
P2560	2560	Engine Coolant Level Low	1	× —	EC-1957, "DTC Description"
P2579	2579	Turbocharger Speed Sensor Circuit Range/Performance	1	×	EC-1958, "DTC Description"
P2580	2580	Turbocharger Speed Sensor Circuit Low	2	×	EC-1961, "DTC Description"
P2581	2581	Turbocharger Speed Sensor Circuit High	2	×	EC-1964, "DTC Description"
P262A	262A	Fuel Injector - Pilot Injection Not Learned	1	×	EC-1967, "DTC Description"
P262D	262D	Sensor Reference Voltage “G” Circuit Low	2	×	EC-1968, "DTC Description"
P263E	263E	Glow Plug Control Module 1 Over Temperature	2	×	EC-1970, "DTC Description"
P268C	268C	Cylinder 1 Injector Data Incompatible	1	×	EC-1972, "DTC Description"
P268D	268D	Cylinder 2 Injector Data Incompatible	1	×	EC-1973, "DTC Description"
P268E	268E	Cylinder 3 Injector Data Incompatible	1	×	EC-1974, "DTC Description"
P268F	268F	Cylinder 4 Injector Data Incompatible	1	×	EC-1975, "DTC Description"
P2690	2690	Cylinder 5 Injector Data Incompatible	1	×	EC-1976, "DTC Description"
P2691	2691	Cylinder 6 Injector Data Incompatible	1	×	EC-1977, "DTC Description"
P2692	2692	Cylinder 7 Injector Data Incompatible	1	×	EC-1978, "DTC Description"
P2693	2693	Cylinder 8 Injector Data Incompatible	1	×	EC-1979, "DTC Description"
P2BA7	2BA7	NOx Exceedence - Empty Reagent Tank	1	—	EC-1980, "DTC Description"

DTC[1]		Items (CONSULT screen terms)	Trip	MIL	Reference page
CONSULT GST[2]	ECM[3]				
P2BAC	2BAC	NOX EXCEEDENCE	1	—	EC-1981, "DTC Description"
P2BAD	2BAD	NOx Exceedence - Root Cause Unknown	2	×	EC-1982, "DTC Description"
P2BAF	2BAF	NOx System Driver Inducement Active	1	×	EC-1984, "DTC Description"

[1]: 1st trip DTC No. is the same as DTC No.

[2]: This number is prescribed by SAE J1979/ISO 15031-5.

[3]: In Diagnostic Test Mode II (Self diagnostic results), this number is controlled by NISSAN.

[4]: The troubleshooting for this DTC needs CONSULT.

WIRING DIAGRAM

ENGINE CONTROL SYSTEM

Wiring Diagram

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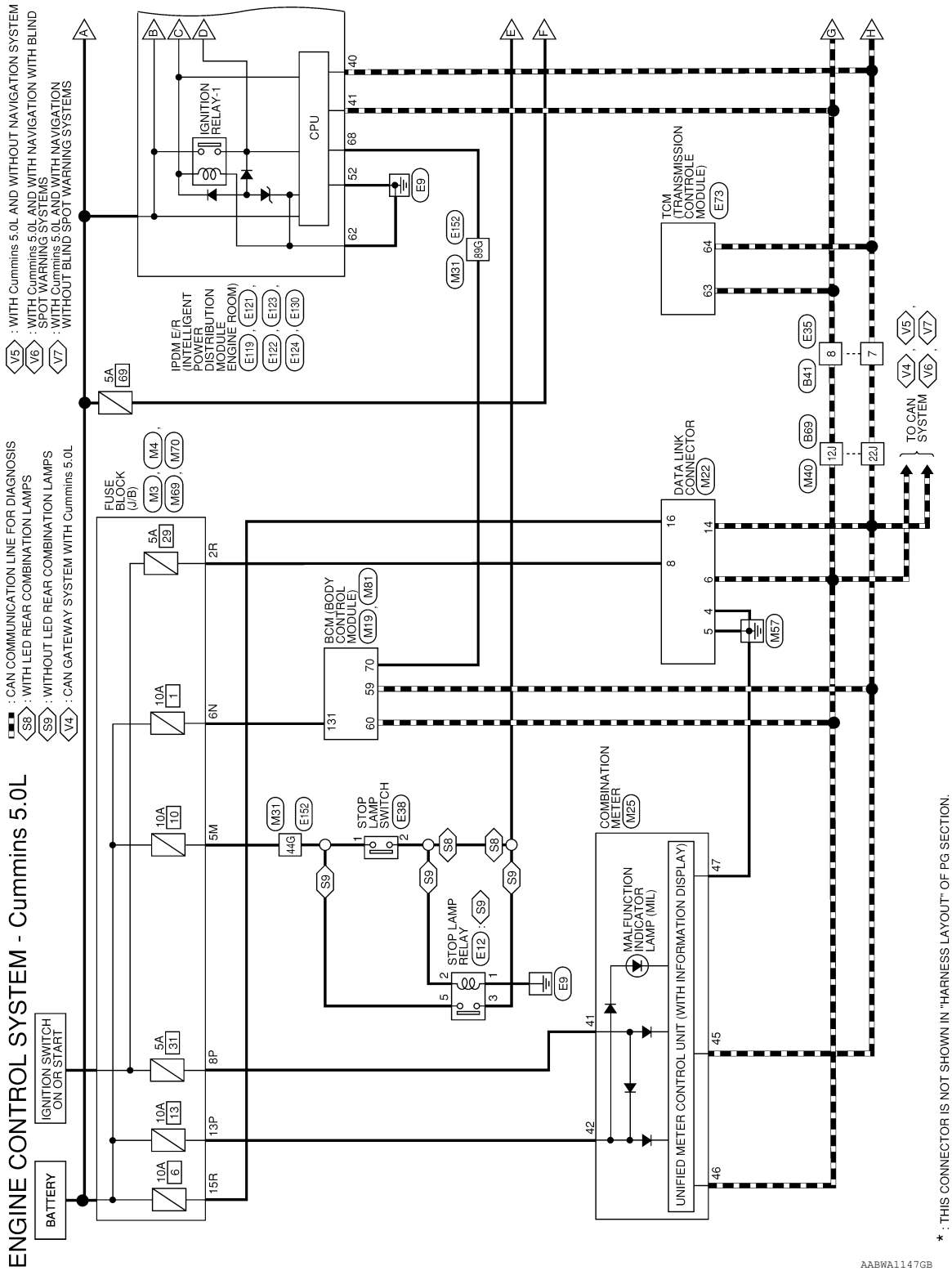

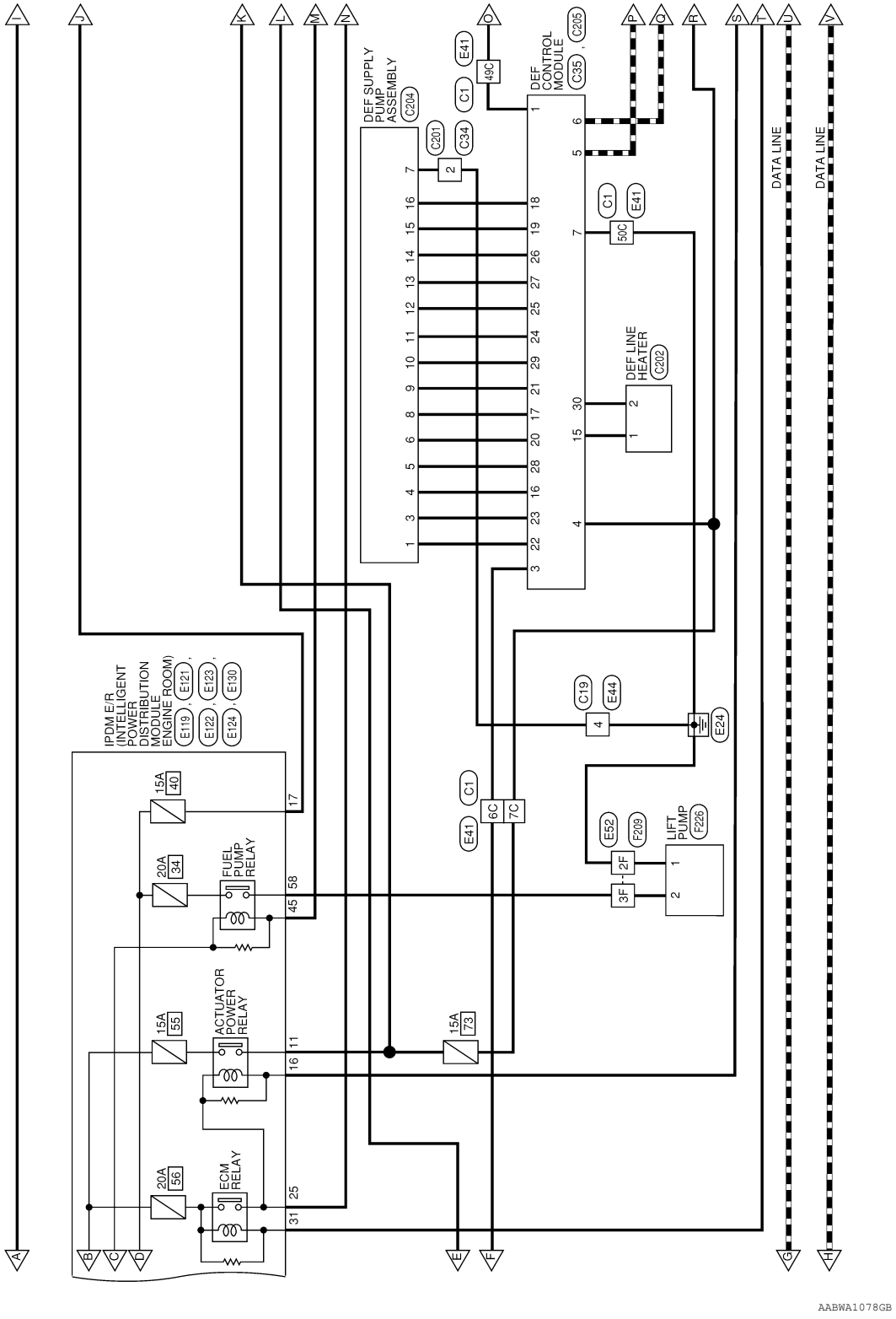
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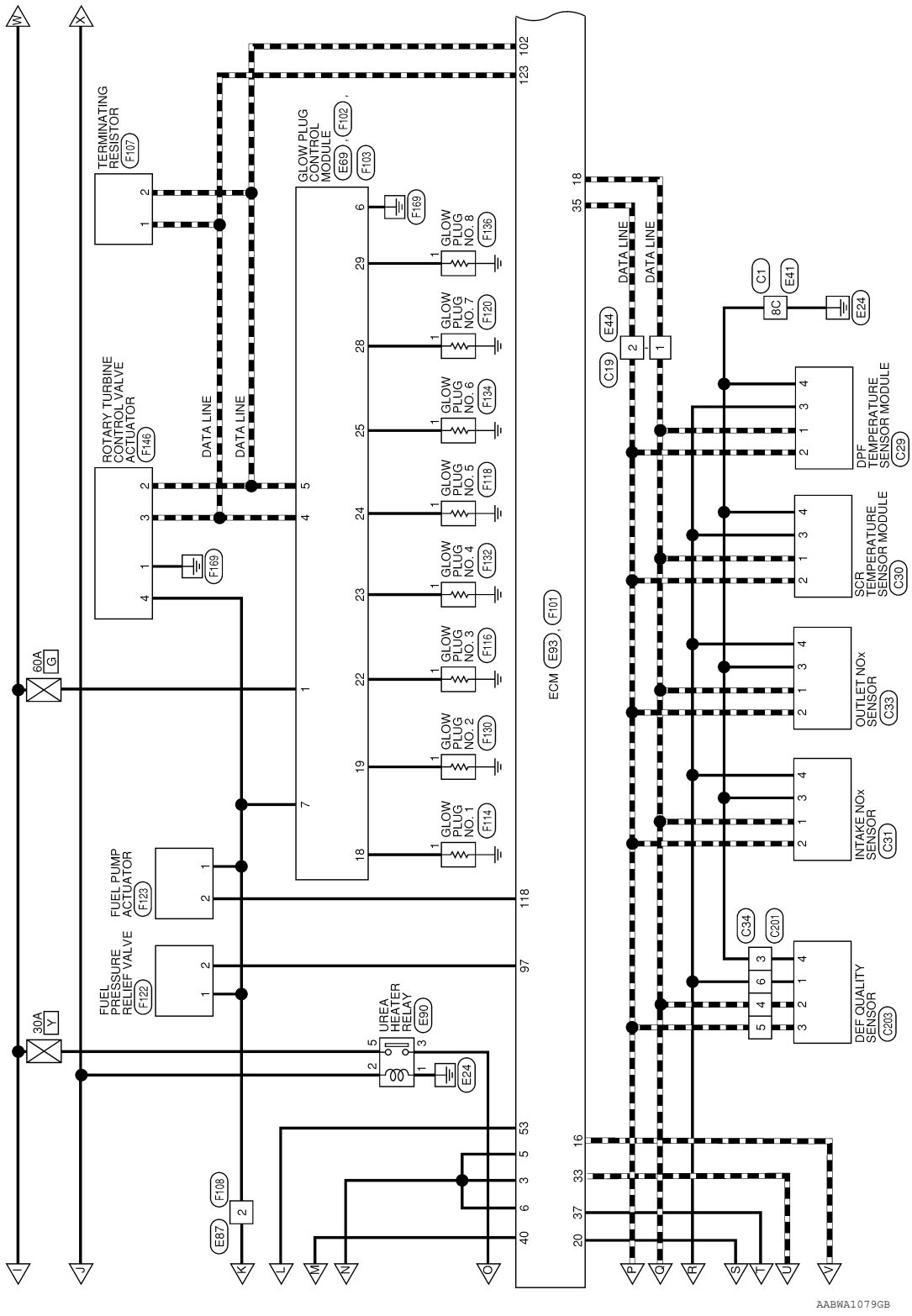
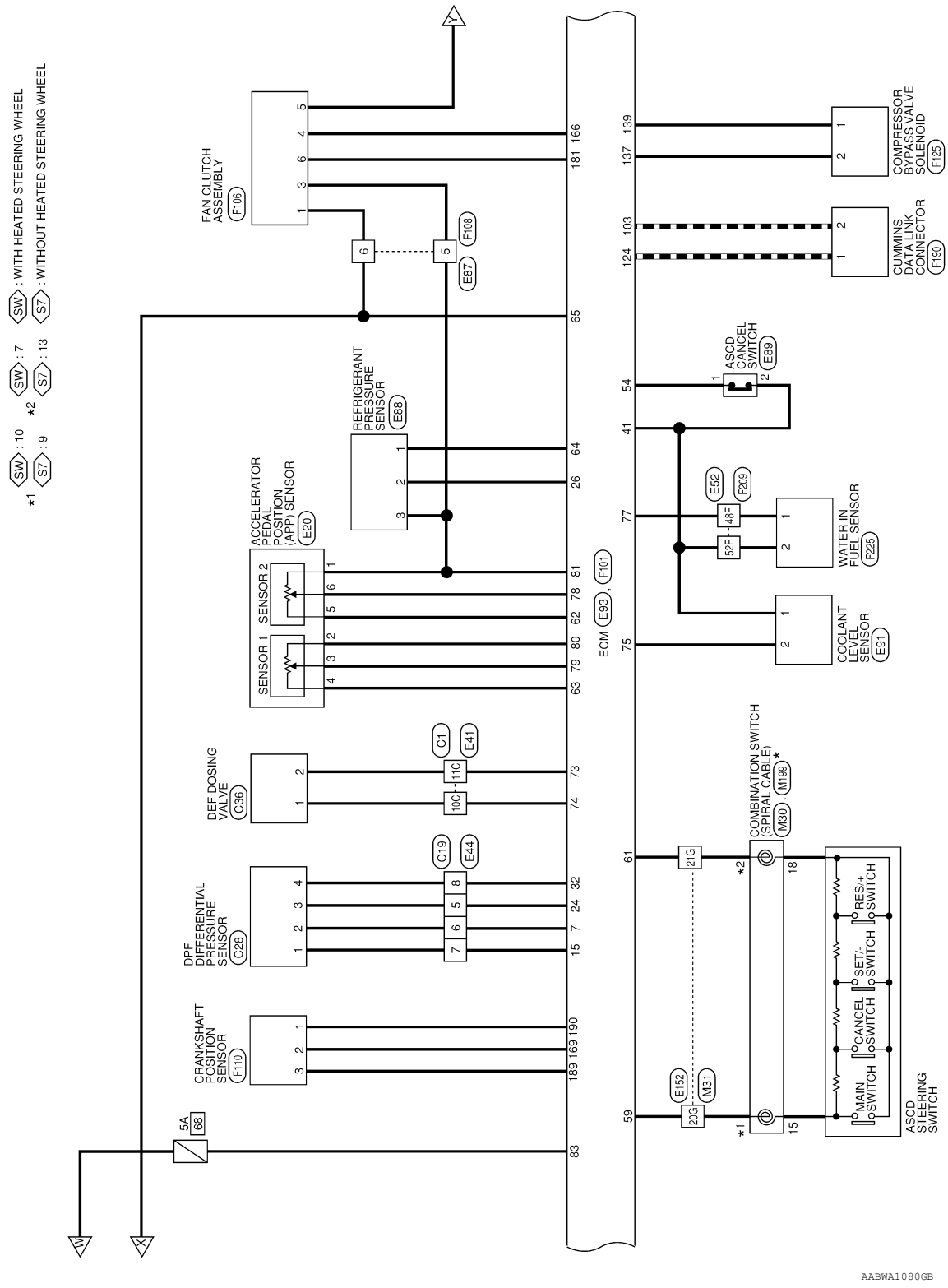
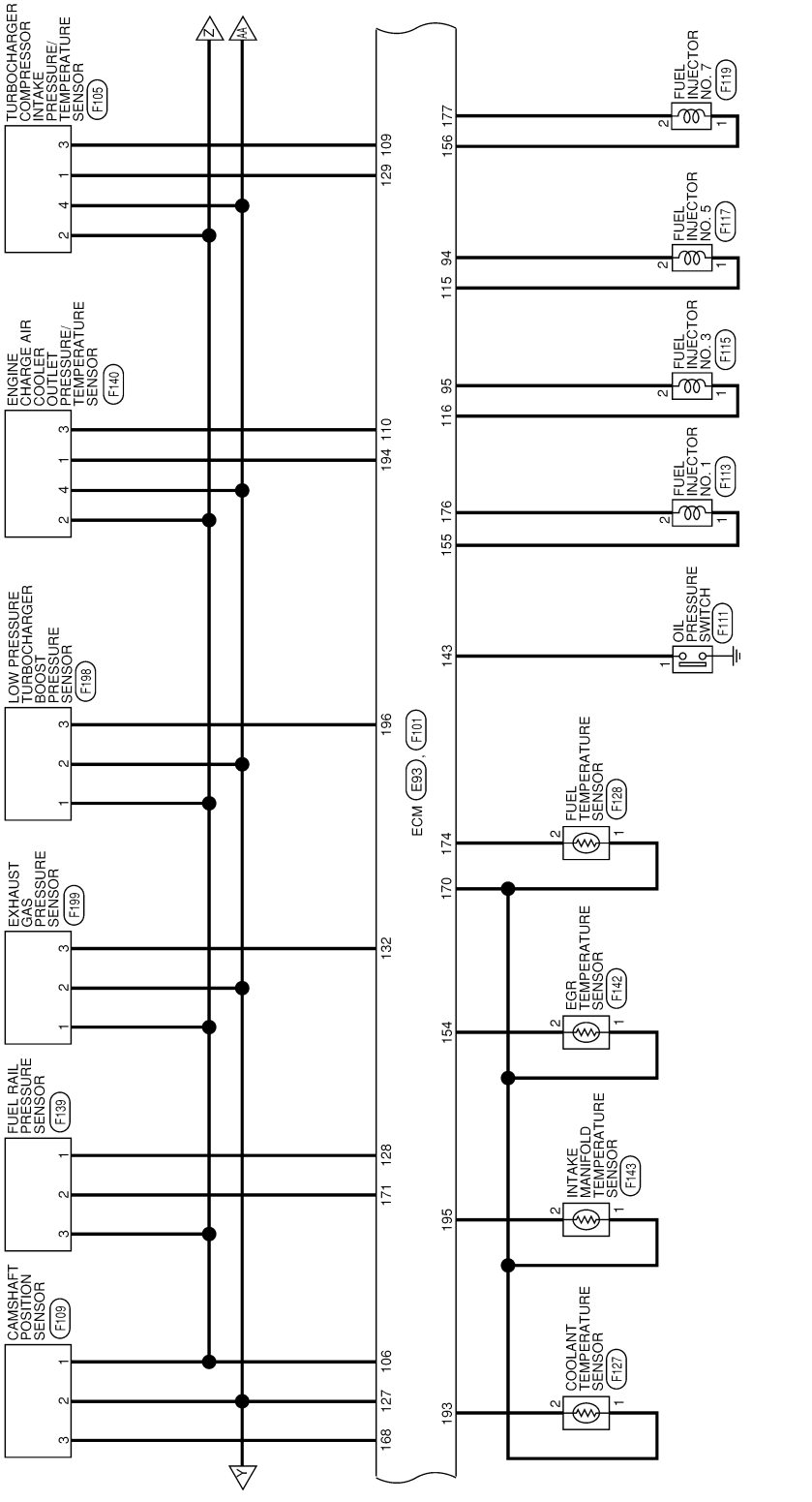
C201
C34
2
C1
E41
49C
DEF CONTROL MODULE C35, C205
C1
E41
50C
DEF LINE HEATER C202
DATA LINE
DATA LINE
IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM) E119, E121, E123, E130, E122, E124
15A 40
20A 34
FUEL PUMP RELAY
15A 55
ACTUATOR POWER RELAY
20A 56
ECM RELAY
15A 73
C19
E44
4
E24
C1
E41
6C
7C
E52
F209
2F
3F
LIFT PUMP F226
AABWA1078GB


TERMINATING RESISTOR F107
GLOW PLUG CONTROL MODULE E69, F102, F103
ROTARY TURBINE CONTROL VALVE ACTUATOR F146
DATA LINE
DATA LINE
DATA LINE
DATA LINE
GLOW PLUG NO. 8 F136
GLOW PLUG NO. 7 F120
GLOW PLUG NO. 6 F134
GLOW PLUG NO. 5 F118
GLOW PLUG NO. 4 F132
GLOW PLUG NO. 3 F116
GLOW PLUG NO. 2 F130
GLOW PLUG NO. 1 F114
F169
60A G
30A Y
FUEL PUMP ACTUATOR F123
FUEL PRESSURE RELIEF VALVE F122
UREA HEATER RELAY E90
E24
F108
E87
ECM E93, F101
C1
E41
8C
E24
C19
E44
DPF TEMPERATURE SENSOR MODULE C29
SCR TEMPERATURE SENSOR MODULE C30
OUTLET NOx SENSOR C33
INTAKE NOx SENSOR C31
C34
C201
DEF QUALITY SENSOR C203
AABWA1079GB


SW : WITH HEATED STEERING WHEEL
S7 : WITHOUT HEATED STEERING WHEEL
SW : 10
S7 : 9
*1
SW : 7
S7 : 13
*2
FAN CLUTCH ASSEMBLY F106
F108
E87
REFRIGERANT PRESSURE SENSOR E88
ACCELERATOR PEDAL POSITION (APP) SENSOR E20
SENSOR 2
SENSOR 1
DEF DOSING VALVE C36
C1
E41
111C
10C
DPF DIFFERENTIAL PRESSURE SENSOR C28
C19
E44
CRANKSHAFT POSITION SENSOR F110
5A 68
ECM E93, F101
COMPRESSOR BYPASS VALVE SOLENOID F125
CUMMINS DATA LINK CONNECTOR F190
ASCD CANCEL SWITCH E89
E52
F209
48F
52F
WATER IN FUEL SENSOR F225
COOLANT LEVEL SENSOR E91
COMBINATION SWITCH (SPIRAL CABLE) M30, M199*
21G
E152
M31
20G
MAIN SWITCH
CANCEL SWITCH
SET/- SWITCH
RES/+ SWITCH
ASCD STEERING SWITCH
W
A
AABWA1080GB



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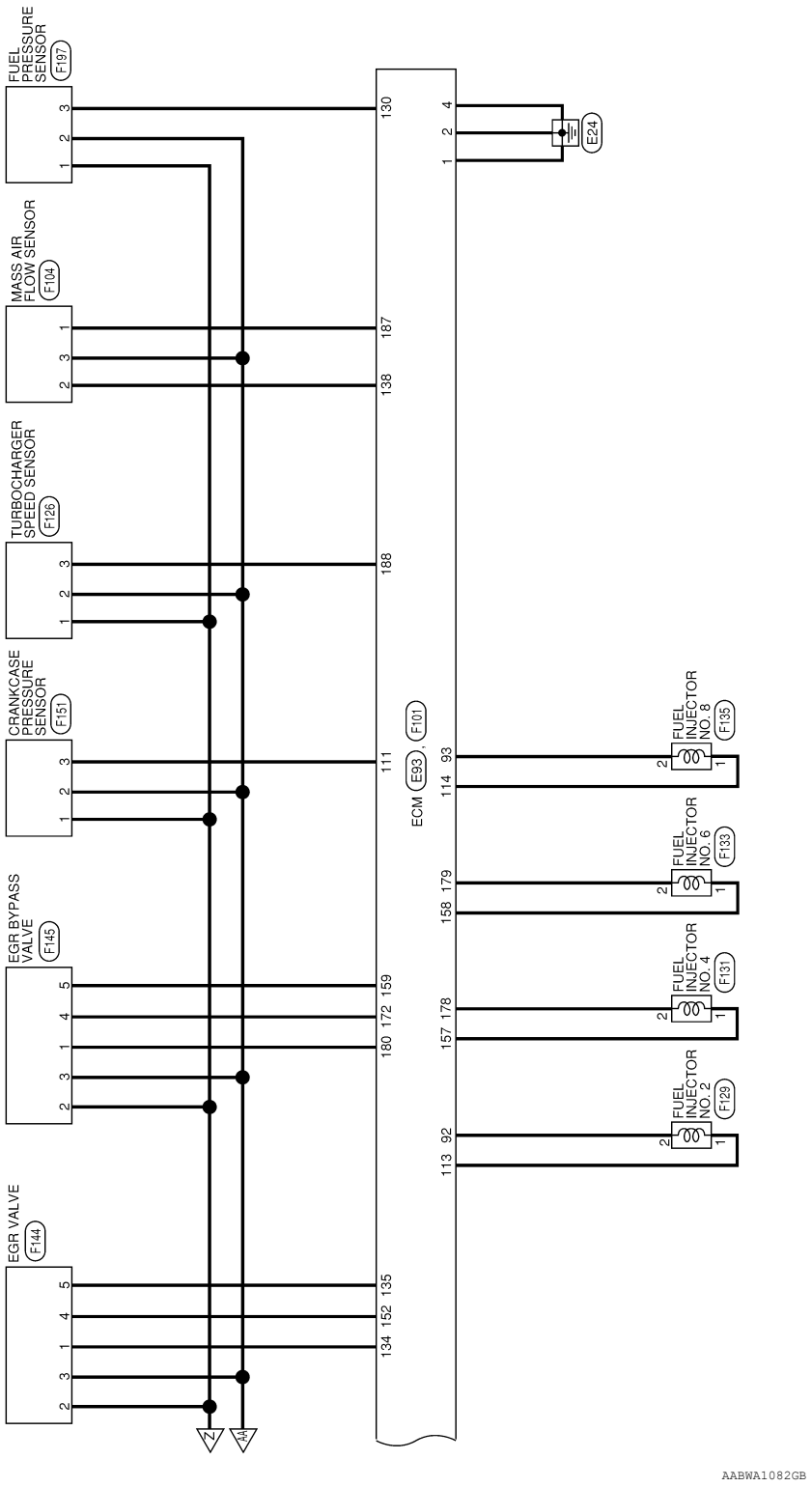
FUEL PRESSURE SENSOR F197
MASS AIR FLOW SENSOR F104
TURBOCHARGER SPEED SENSOR F126
CRANKCASE PRESSURE SENSOR F151
EGR BYPASS VALVE F145
EGR VALVE F144
ECM E93, F101
E24
FUEL INJECTOR NO. 8 F135
FUEL INJECTOR NO. 6 F133
FUEL INJECTOR NO. 4 F131
FUEL INJECTOR NO. 2 F129
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ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	B41
Connector Name	WIRE TO WIRE
Connector Type	NS12MW-CS
Connector Color	WHITE

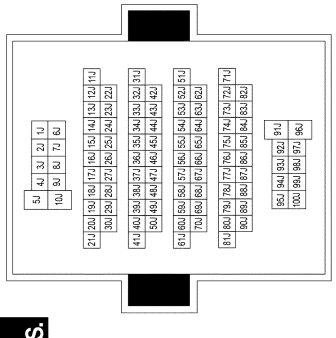
H.S.

1	2	3		4	5
6	7	8	9	10	11	12

Terminal No.	Color of Wire	Signal Name
1	Y	TO ENGINE ROOM HARNESS
2	V	TO ENGINE ROOM HARNESS
3	L	TO ENGINE ROOM HARNESS
4	L/G	TO ENGINE ROOM HARNESS
5	R/G	TO ENGINE ROOM HARNESS
6	SB	TO ENGINE ROOM HARNESS
7	P	TO ENGINE ROOM HARNESS
8	L	TO ENGINE ROOM HARNESS
9	SHIELD	TO ENGINE ROOM HARNESS
10	W/G	TO ENGINE ROOM HARNESS
11	L	TO ENGINE ROOM HARNESS
12	BR	TO ENGINE ROOM HARNESS

Connector No.	B69
Connector Name	WIRE TO WIRE
Connector Type	TH80MW-CS16-TM4
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
1J	P	TO MAIN HARNESS
2J	R/Y	TO MAIN HARNESS
3J	L	TO MAIN HARNESS
4J	L/B	TO MAIN HARNESS
5J	G/W	TO MAIN HARNESS
6J	LG/Y	TO MAIN HARNESS
7J	BR/LG	TO MAIN HARNESS
8J	SB/BR	TO MAIN HARNESS
9J	BR	TO MAIN HARNESS
10J	BR	TO MAIN HARNESS
11J	O/B	TO MAIN HARNESS
12J	L	TO MAIN HARNESS
13J	SB/O	TO MAIN HARNESS
14J	Y	TO MAIN HARNESS
15J	–	TO MAIN HARNESS
16J	R	TO MAIN HARNESS
17J	G	TO MAIN HARNESS
18J	SB	TO MAIN HARNESS
19J	O	TO MAIN HARNESS
20J	O/B	TO MAIN HARNESS
21J	Y/R	TO MAIN HARNESS
22J	P	TO MAIN HARNESS
23J	W	TO MAIN HARNESS
24J	W/R	TO MAIN HARNESS
25J	V	TO MAIN HARNESS
26J	L	TO MAIN HARNESS
27J	R	TO MAIN HARNESS
28J	L	TO MAIN HARNESS
29J	G/O	TO MAIN HARNESS
30J	SB	TO MAIN HARNESS
31J	LG	TO MAIN HARNESS
32J	R	TO MAIN HARNESS
33J	L	TO MAIN HARNESS
34J	Y	TO MAIN HARNESS
35J	P	TO MAIN HARNESS
36J	G/R	TO MAIN HARNESS
37J	LG/B	TO MAIN HARNESS
38J	SB	TO MAIN HARNESS
39J	Y/L	TO MAIN HARNESS
40J	BR	TO MAIN HARNESS
41J	L	TO MAIN HARNESS
42J	L	TO MAIN HARNESS
43J	SB	TO MAIN HARNESS
44J	BR	TO MAIN HARNESS
45J	BG	TO MAIN HARNESS
46J	P/Y	TO MAIN HARNESS
47J	Y/GR	TO MAIN HARNESS
48J	V	TO MAIN HARNESS
49J	BR/Y	TO MAIN HARNESS
50J	G/W	TO MAIN HARNESS
51J	–	TO MAIN HARNESS
52J	SHIELD	TO MAIN HARNESS
53J	R	TO MAIN HARNESS
54J	L	TO MAIN HARNESS
55J	R	TO MAIN HARNESS
56J	W	TO MAIN HARNESS
57J	L/G	TO MAIN HARNESS
58J	O	TO MAIN HARNESS
59J	–	TO MAIN HARNESS
60J	SHIELD	TO MAIN HARNESS
61J	G	TO MAIN HARNESS
62J	–	TO MAIN HARNESS
63J	R/W	TO MAIN HARNESS
64J	L/W	TO MAIN HARNESS
65J	SHIELD	TO MAIN HARNESS
66J	B	TO MAIN HARNESS
67J	SHIELD	TO MAIN HARNESS
68J	O/L	TO MAIN HARNESS
69J	SHIELD	TO MAIN HARNESS
70J	BR	TO MAIN HARNESS
71J	L/W	TO MAIN HARNESS
72J	–	TO MAIN HARNESS
72J	–	TO MAIN HARNESS
73J	–	TO MAIN HARNESS
74J	SHIELD	TO MAIN HARNESS
75J	LG/B	TO MAIN HARNESS
76J	R	TO MAIN HARNESS
77J	SHIELD	TO MAIN HARNESS
78J	GR/B	TO MAIN HARNESS
79J	B	TO MAIN HARNESS
80J	W	TO MAIN HARNESS
81J	SHIELD	TO MAIN HARNESS
82J	L/R	TO MAIN HARNESS
83J	–	TO MAIN HARNESS
84J	–	TO MAIN HARNESS
85J	Y/B	TO MAIN HARNESS
86J	G	TO MAIN HARNESS
87J	B/R	TO MAIN HARNESS
88J	SHIELD	TO MAIN HARNESS
89J	GR/R	TO MAIN HARNESS
90J	L	TO MAIN HARNESS
91J	L/B	TO MAIN HARNESS
92J	SB	TO MAIN HARNESS
93J	B	TO MAIN HARNESS
94J	L	TO MAIN HARNESS
95J	LG	TO MAIN HARNESS
96J	R	TO MAIN HARNESS
97J	B/Y	TO MAIN HARNESS
98J	L/B	TO MAIN HARNESS
99J	W/L	TO MAIN HARNESS
100J	SB	TO MAIN HARNESS

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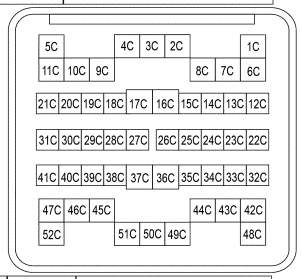
ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	C1
Connector Name	WIRE TO WIRE
Connector Type	RK26FGY-RS20-X6
Connector Color	GRAY

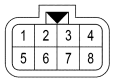
H.S.



Terminal No.	Color of Wire	Signal Name
1C	Y/V	TO ENGINE ROOM HARNESS
2C	W/L	TO ENGINE ROOM HARNESS
3C	B	TO ENGINE ROOM HARNESS
4C	BR/W	TO ENGINE ROOM HARNESS
5C	BR/Y	TO ENGINE ROOM HARNESS
6C	Y	TO ENGINE ROOM HARNESS
7C	G/R	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
7C	R	TO ENGINE ROOM HARNESS - (WITH VK56VD)
8C	B	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
8C	O/B	TO ENGINE ROOM HARNESS - (WITH VK56VD)
9C	W/L	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
9C	SB	TO ENGINE ROOM HARNESS - (WITH VK56VD)
10C	GR/R	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
10C	GR	TO ENGINE ROOM HARNESS - (WITH VK56VD)
11C	B	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
11C	R/W	TO ENGINE ROOM HARNESS - (WITH VK56VD)
12C	Y	TO ENGINE ROOM HARNESS
13C	B	TO ENGINE ROOM HARNESS
14C	BG	TO ENGINE ROOM HARNESS
15C	Y	TO ENGINE ROOM HARNESS
16C	B	TO ENGINE ROOM HARNESS
17C	V	TO ENGINE ROOM HARNESS
18C	BG	TO ENGINE ROOM HARNESS
19C	L	TO ENGINE ROOM HARNESS
20C	W	TO ENGINE ROOM HARNESS
21C	LG	TO ENGINE ROOM HARNESS
22C	SHIELD	TO ENGINE ROOM HARNESS
23C	G/B	TO ENGINE ROOM HARNESS
24C	G/B	TO ENGINE ROOM HARNESS
25C	W	TO ENGINE ROOM HARNESS
26C	B	TO ENGINE ROOM HARNESS
27C	LG	TO ENGINE ROOM HARNESS
28C	G/W	TO ENGINE ROOM HARNESS
29C	R/LG	TO ENGINE ROOM HARNESS
30C	R/L	TO ENGINE ROOM HARNESS
31C	B	TO ENGINE ROOM HARNESS
32C	R	TO ENGINE ROOM HARNESS
33C	L/W	TO ENGINE ROOM HARNESS
34C	L	TO ENGINE ROOM HARNESS
35C	R/W	TO ENGINE ROOM HARNESS
36C	L	TO ENGINE ROOM HARNESS
37C	Y	TO ENGINE ROOM HARNESS
38C	GR	TO ENGINE ROOM HARNESS
39C	R	TO ENGINE ROOM HARNESS
40C	P	TO ENGINE ROOM HARNESS
41C	V	TO ENGINE ROOM HARNESS
42C	LG/B	TO ENGINE ROOM HARNESS
43C	Y/B	TO ENGINE ROOM HARNESS
44C	R	TO ENGINE ROOM HARNESS
45C	G	TO ENGINE ROOM HARNESS
46C	BR	TO ENGINE ROOM HARNESS
47C	B	TO ENGINE ROOM HARNESS
48C	Y/R	TO ENGINE ROOM HARNESS
49C	R/Y	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
49C	V	TO ENGINE ROOM HARNESS - (WITH VK56VD)
50C	B	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
50C	B/Y	TO ENGINE ROOM HARNESS - (WITH VK56VD)
51C	V	TO ENGINE ROOM HARNESS - (WITH CUMMINS 5.0L)
51C	B	TO ENGINE ROOM HARNESS - (WITH VK56VD)
52C	V/W	TO ENGINE ROOM HARNESS

Connector No.	C19
Connector Name	WIRE TO WIRE
Connector Type	RS08MGY-PR
Connector Color	GRAY

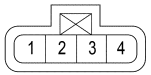
H.S.



Terminal No.	Color of Wire	Signal Name
1	G	TO ENGINE ROOM HARNESS
2	Y	TO ENGINE ROOM HARNESS
3	–	TO ENGINE ROOM HARNESS
4	B	TO ENGINE ROOM HARNESS
5	LG	TO ENGINE ROOM HARNESS
6	O	TO ENGINE ROOM HARNESS
7	L/R	TO ENGINE ROOM HARNESS
8	Y	TO ENGINE ROOM HARNESS

Connector No.	C28
Connector Name	DPF DIFFERENTIAL PRESSURE SENSOR
Connector Type	E04FGY-RS
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1	L/R	SENSOR RETURN
2	O	DPF PRESSURE SENSOR
3	LG	DPF PRESS OUT
4	Y	SENSOR SUPPLY POWER

Connector No.	C29
Connector Name	DPF TEMPERATURE SENSOR MODULE
Connector Type	TB04FW
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	G	J1939 - (CAN)
2	Y	J1939 + (CAN)
3	G/R	IGNITION POWER
4	B	GROUND

Connector No.	C30
Connector Name	SCR TEMPERATURE SENSOR MODULE
Connector Type	TB04FW
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	G	J1939 - (CAN)
2	Y	J1939 + (CAN)
3	G/R	IGNITION POWER
4	B	GROUND

Connector No.	C31
Connector Name	INTAKE NOX SENSOR
Connector Type	TB04FW
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	G	J1939 - (CAN)
2	Y	J1939 + (CAN)
3	B	GROUND
4	G/R	IGNITION POWER

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ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

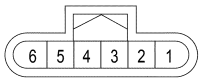
Connector No.	C33
Connector Name	OUTLET NOX SENSOR
Connector Type	TB04FW
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	G	J1939 - (CAN)
2	Y	J1939 + (CAN)
3	B	GROUND
4	G/R	IGNITION POWER

Connector No.	C34
Connector Name	WIRE TO WIRE
Connector Type	RH06FB
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	–	TO DEF TANK SUB-HARNESS
2	B	TO DEF TANK SUB-HARNESS
3	B	TO DEF TANK SUB-HARNESS
4	G	TO DEF TANK SUB-HARNESS
5	Y	TO DEF TANK SUB-HARNESS
6	LG/R	TO DEF TANK SUB-HARNESS

Connector No.	C35
Connector Name	DEF CONTROL MODULE
Connector Type	YEA10GY-YHA4
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1	R/Y	HEATER PWR SUPPLY
2	–	–
3	Y	SCR PWR SUPPLY
4	LG/R	WAKE UP CMD
5	Y	J1939 +
6	G	J1939 -
7	B	V GND
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–

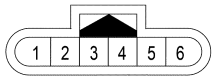
Connector No.	C36
Connector Name	DEF DOSING VALVE
Connector Type	RK02FBR
Connector Color	BROWN

H.S.

Terminal No.	Color of Wire	Signal Name
1	GR/R	DOSER HS
2	B	DOSER RETURN

Connector No.	C201
Connector Name	WIRE TO WIRE
Connector Type	RH06MB
Connector Color	BLACK

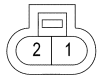
H.S.



Terminal No.	Color of Wire	Signal Name
1	–	TO DEF TANK SUB-HARNESS
2	B	TO DEF TANK SUB-HARNESS
3	BR	TO DEF TANK SUB-HARNESS
4	B	TO DEF TANK SUB-HARNESS
5	L	TO DEF TANK SUB-HARNESS
6	B	TO DEF TANK SUB-HARNESS

Connector No.	C202
Connector Name	DEF LINE HEATER
Connector Type	15326801
Connector Color	BLACK

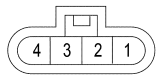
H.S.



Terminal No.	Color of Wire	Signal Name
1	BR	LINE HEAT -
2	W	LINE HEAT +

Connector No.	C203
Connector Name	DEF QUALITY SENSOR
Connector Type	33104797
Connector Color	BLACK

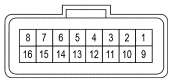
H.S.



Terminal No.	Color of Wire	Signal Name
1	BR	SSI UTC POWER
2	L	CAN -
3	B	CAN +
4	B	SSI UTC GROUND

Connector No.	C204
Connector Name	DEF SUPPLY PUMP ASSEMBLY
Connector Type	13935934
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	W	TANK HEAT +
2	–	–
3	BR	TANK HEAT -
4	L	Q SENSOR SIGNAL
5	L	LEVEL SENOR/QUAL 5V
6	BR	LEVEL SENSOR SIGNAL
7	B	SHIELD DRAIN
8	SB	PHASE C
9	BR	T SENS SIG
10	L	T SENS GND
11	BR	P SENS GND
12	L	P SENS SIG
13	L	P SENS 5V
14	B	L SENS & QUAL GND
15	W	PHASE A
16	Y	PHASE B

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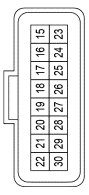
ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	C205
Connector Name	DEF CONTROL MODULE
Connector Type	13578135
Connector Color	GRAY

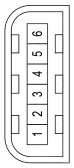
H.S.



Terminal No.	Color of Wire	Signal Name
15	W	LINE HEAT +
16	L	Q SENSOR SIGNAL
17	SB	PHASE C
18	Y	PHASE B
19	W	PHASE A
20	BR	LEVEL SENSOR SIGNAL
21	BR	T SENS SIG
22	W	TANK HEAT +
23	BR	TANK HEAT -
24	BR	P SENS GND
25	L	P SENS SIG
26	B	L SENS & QUAL GND
27	L	P SENS 5V
28	L	LEVEL SENSOR/QUAL 5V
29	L	T SENS GND
30	BR	LINE HEAT -

Connector No.	E20
Connector Name	ACCELERATOR PEDAL POSITION (APP) SENSOR
Connector Type	AEY06FB-RH
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	B	PPS2 SUPPLY - (WITH CUMMINS 5.0L)
1	L/W	AVCC2 APS 2 (WITH VK56VD)
2	W	PPS1 SUPPLY- (WITH CUMMINS 5.0L)
2	W/G	AVCC1 APS 1 (WITH VK56VD)
3	BR	PPS1 SIGNAL - (WITH CUMMINS 5.0L)
3	W/R	APS 1 (WITH VK56VD)
4	R	PPS1 RETURN - (WITH CUMMINS 5.0L)
4	R/Y	GND A APS1 (WITH VK56VD)
5	R	PPS2 RETURN - (WITH CUMMINS 5.0L)
5	P/L	GND A APS 2 (WITH VK56VD)
6	L	PPS2 SIGNAL - (WITH CUMMINS 5.0L)
6	O	APS 2 (WITH VK56VD)

7	P	TO BODY HARNESS
8	L	TO BODY HARNESS
9	SHIELD	TO BODY HARNESS
10	B	TO BODY HARNESS
11	R	TO BODY HARNESS
12	BR	TO BODY HARNESS

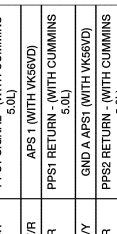
Connector No.	E38
Connector Name	STOP LAMP SWITCH
Connector Type	M04FW-LC
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1	R/Y	BATTERY
2	W	RELAY CONT - (WITHOUT LED REAR COMBINATION LAMPS)
2	R/G	STOP LAMPS - (WITH LED REAR COMBINATION LAMPS)
3	GR	IGNITION
4	R/B	STOP 2

Connector No.	E35
Connector Name	WIRE TO WIRE
Connector Type	NS12FW-CS
Connector Color	WHITE

H.S.



Terminal No.	Color of Wire	Signal Name
1	Y	TO BODY HARNESS
2	V	TO BODY HARNESS
3	L	TO BODY HARNESS
4	W	TO BODY HARNESS
5	R/G	TO BODY HARNESS
6	SB	TO BODY HARNESS

Connector No.	E12
Connector Name	STOP LAMP RELAY
Connector Type	MS02FL-M2-LC
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	GROUND
2	W	RELAY CONTROL
3	R/G	STOP LAMPS
5	R/Y	BATTERY

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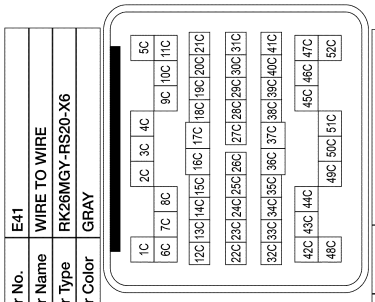
ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	E41
Connector Name	WIRE TO WIRE
Connector Type	RK26MGY-RS20-X6
Connector Color	GRAY

H.S.

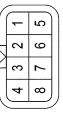


Terminal No.	Color of Wire	Signal Name
1C	Y/V	TO CHASSIS HARNESS
2C	W/L	TO CHASSIS HARNESS
3C	B	TO CHASSIS HARNESS
4C	BR/W	TO CHASSIS HARNESS
5C	BR/Y	TO CHASSIS HARNESS
6C	Y	TO CHASSIS HARNESS
7C	G/R	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
7C	R	TO CHASSIS HARNESS - (WITH VK56VD)
8C	B	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
8C	O/B	TO CHASSIS HARNESS - (WITH VK56VD)
9C	W/L	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
9C	SB	TO CHASSIS HARNESS - (WITH VK56VD)
10C	GR/R	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
10C	GR	TO CHASSIS HARNESS - (WITH VK56VD)
11C	B	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
11C	R/W	TO CHASSIS HARNESS - (WITH VK56VD)
12C	Y	TO CHASSIS HARNESS
13C	B	TO CHASSIS HARNESS
14C	BG	TO CHASSIS HARNESS
15C	Y	TO CHASSIS HARNESS
16C	B	TO CHASSIS HARNESS
17C	V	TO CHASSIS HARNESS
18C	BG	TO CHASSIS HARNESS
19C	L	TO CHASSIS HARNESS
20C	BG	TO CHASSIS HARNESS
21C	B	TO CHASSIS HARNESS

22C	SHIELD	TO CHASSIS HARNESS
23C	G/B	TO CHASSIS HARNESS
24C	G/Y	TO CHASSIS HARNESS
25C	W	TO CHASSIS HARNESS
26C	B	TO CHASSIS HARNESS
27C	LG	TO CHASSIS HARNESS
28C	G/W	TO CHASSIS HARNESS
29C	G/R	TO CHASSIS HARNESS - (WITH BULB CHECK)
29C	R/G	TO CHASSIS HARNESS - (WITHOUT BULB CHECK)
30C	R/L	TO CHASSIS HARNESS
31C	B	TO CHASSIS HARNESS
32C	R	TO CHASSIS HARNESS
33C	L/W	TO CHASSIS HARNESS
34C	L	TO CHASSIS HARNESS
35C	R/W	TO CHASSIS HARNESS
36C	L	TO CHASSIS HARNESS
37C	Y	TO CHASSIS HARNESS
38C	BR	TO CHASSIS HARNESS
39C	R	TO CHASSIS HARNESS
40C	P	TO CHASSIS HARNESS
41C	V	TO CHASSIS HARNESS
42C	G/B	TO CHASSIS HARNESS
43C	Y/B	TO CHASSIS HARNESS
44C	R	TO CHASSIS HARNESS
45C	G	TO CHASSIS HARNESS
46C	BR	TO CHASSIS HARNESS
47C	B	TO CHASSIS HARNESS
48C	Y/R	TO CHASSIS HARNESS
49C	R/Y	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
49C	V	TO CHASSIS HARNESS - (WITH VK56VD)
50C	B	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
50C	B/Y	TO CHASSIS HARNESS - (WITH VK56VD)
51C	V	TO CHASSIS HARNESS - (WITH CUMMINS 5.0L)
51C	B	TO CHASSIS HARNESS - (WITH VK56VD)
52C	B	TO CHASSIS HARNESS - (WITHOUT FFV)
52C	L	TO CHASSIS HARNESS - (WITH FFV)
52C	V/W	TO CHASSIS HARNESS

Connector No.	E44
Connector Name	WIRE TO WIRE
Connector Type	RS08FGY-PR
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1	G	TO ENGINE CONTROL HARNESS
2	Y	TO ENGINE CONTROL HARNESS
3	–	TO ENGINE CONTROL HARNESS
4	–	TO ENGINE CONTROL HARNESS
5	SB	TO ENGINE CONTROL HARNESS
6	O	TO ENGINE CONTROL HARNESS
7	L/R	TO ENGINE CONTROL HARNESS
8	Y	TO ENGINE CONTROL HARNESS

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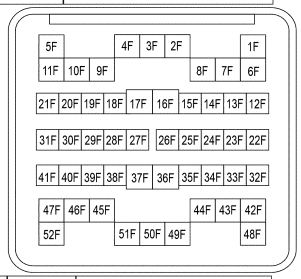
ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	E52
Connector Name	WIRE TO WIRE
Connector Type	RK26FGY-RS20-X6
Connector Color	GRAY

H.S.



Terminal No.	Color of Wire	Signal Name
1F	Y	TO ENGINE CONTROL NO. 2 HARNESS
2F	B	TO ENGINE CONTROL NO. 2 HARNESS
3F	BR	TO ENGINE CONTROL NO. 2 HARNESS
4F	W/R	TO ENGINE CONTROL NO. 2 HARNESS
5F	B/R	TO ENGINE CONTROL NO. 2 HARNESS
6F	O	TO ENGINE CONTROL NO. 2 HARNESS
7F	GR/Y	TO ENGINE CONTROL NO. 2 HARNESS
8F	V	TO ENGINE CONTROL NO. 2 HARNESS
9F	BR	TO ENGINE CONTROL NO. 2 HARNESS
10F	Y/B	TO ENGINE CONTROL NO. 2 HARNESS
11F	L	TO ENGINE CONTROL NO. 2 HARNESS
12F	R	TO ENGINE CONTROL NO. 2 HARNESS
13F	Y	TO ENGINE CONTROL NO. 2 HARNESS
14F	V	TO ENGINE CONTROL NO. 2 HARNESS
15F	SB	TO ENGINE CONTROL NO. 2 HARNESS
16F	P	TO ENGINE CONTROL NO. 2 HARNESS
17F	Y/R	TO ENGINE CONTROL NO. 2 HARNESS
18F	R	TO ENGINE CONTROL NO. 2 HARNESS
19F	V	TO ENGINE CONTROL NO. 2 HARNESS
20F	BR	TO ENGINE CONTROL NO. 2 HARNESS
21F	L/R	TO ENGINE CONTROL NO. 2 HARNESS
22F	L/W	TO ENGINE CONTROL NO. 2 HARNESS
23F	R/L	TO ENGINE CONTROL NO. 2 HARNESS
24F	W/L	TO ENGINE CONTROL NO. 2 HARNESS
25F	W/R	TO ENGINE CONTROL NO. 2 HARNESS
26F	B/R	TO ENGINE CONTROL NO. 2 HARNESS
27F	Y	TO ENGINE CONTROL NO. 2 HARNESS
28F	W/R	TO ENGINE CONTROL NO. 2 HARNESS
29F	L/O	TO ENGINE CONTROL NO. 2 HARNESS
30F	B	TO ENGINE CONTROL NO. 2 HARNESS
31F	B	TO ENGINE CONTROL NO. 2 HARNESS
32F	V/W	TO ENGINE CONTROL NO. 2 HARNESS
33F	GR	TO ENGINE CONTROL NO. 2 HARNESS
34F	L/R	TO ENGINE CONTROL NO. 2 HARNESS
35F	R/W	TO ENGINE CONTROL NO. 2 HARNESS
36F	L/B	TO ENGINE CONTROL NO. 2 HARNESS
37F	L	TO ENGINE CONTROL NO. 2 HARNESS
38F	R/Y	TO ENGINE CONTROL NO. 2 HARNESS
39F	R/Y	TO ENGINE CONTROL NO. 2 HARNESS
40F	B/R	TO ENGINE CONTROL NO. 2 HARNESS
41F	W	TO ENGINE CONTROL NO. 2 HARNESS
42F	Y	TO ENGINE CONTROL NO. 2 HARNESS
43F	B/P	TO ENGINE CONTROL NO. 2 HARNESS
44F	Y/B	TO ENGINE CONTROL NO. 2 HARNESS
45F	L/Y	TO ENGINE CONTROL NO. 2 HARNESS
46F	O	TO ENGINE CONTROL NO. 2 HARNESS
47F	W/R	TO ENGINE CONTROL NO. 2 HARNESS
48F	L	TO ENGINE CONTROL NO. 2 HARNESS
49F	BR	TO ENGINE CONTROL NO. 2 HARNESS
50F	SHIELD	TO ENGINE CONTROL NO. 2 HARNESS
51F	L	TO ENGINE CONTROL NO. 2 HARNESS
52F	BR	TO ENGINE CONTROL NO. 2 HARNESS

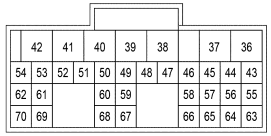
Connector No.	E69
Connector Name	GLOW PLUG CONTROL MODULE
Connector Type	RS01FB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	B/R	BATTERY

Connector No.	E73
Connector Name	TCM (TRANSMISSION CONTROL MODULE) (WITH CUMMINS 5.0L)
Connector Type	AAH28FW-TK7
Connector Color	WHITE

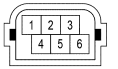
H.S.



Terminal No.	Color of Wire	Signal Name
36	B	GND
37	B	GND
38	L/Y	LINE PRESSURE SOLENOID VALVE (+)
39	O	LINE PRESSURE SOLENOID VALVE (-)
40	–	–
41	R/W	BATT
42	R/W	BATT
43	L/R	C1 CLUTCH SOLENOID VALVE (+)
44	R/W	C1 CLUTCH SOLENOID VALVE (-)
45	R/Y	C2 CLUTCH SOLENOID VALVE (-)
46	R/Y	C2 CLUTCH SOLENOID VALVE (+)
47	B/R	C3 CLUTCH SOLENOID VALVE (+)
48	W	C3 CLUTCH SOLENOID VALVE (-)
49	R/L	B1 BRAKE SOLENOID VALVE (-)
50	L/W	B1 BRAKE SOLENOID VALVE (+)
51	–	–
52	–	–
53	–	–
54	P	ACCESSORY RELAY-2
55	–	–
56	–	–
57	V	A/T FLUID TEMPERATURE SENSOR 1 (+)
58	SB	A/T FLUID TEMPERATURE SENSOR 1 (-)
59	Y	B2 BRAKE SOLENOID VALVE (-)
60	W/L	B2 BRAKE SOLENOID VALVE (+)
61	–	–
62	–	–
63	L	CAN-H
64	P	CAN-L
65	L/B	A/T FLUID TEMPERATURE SENSOR 2 (+)
66	L	A/T FLUID TEMPERATURE SENSOR 2 (-)
67	V/W	TORQUE CONVERTER CLUTCH SOLENOID VALVE (-)
68	Y/B	TORQUE CONVERTER CLUTCH SOLENOID VALVE (+)
69	–	–
70	W/R	FAIL-SAFE SOLENOID VALVE

Connector No.	E87
Connector Name	WIRE TO WIRE
Connector Type	54200608
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	–	TO ENGINE CONTROL HARNESS - DIESEL
2	P	TO ENGINE CONTROL HARNESS - DIESEL
3	Y/B	TO ENGINE CONTROL HARNESS - DIESEL
4	–	TO ENGINE CONTROL HARNESS - DIESEL
5	B	TO ENGINE CONTROL HARNESS - DIESEL
6	L/W	TO ENGINE CONTROL HARNESS - DIESEL

AABIA1999GB

ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	E88
Connector Name	REFRIGERANT PRESSURE SENSOR
Connector Type	RK03FB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	R/W	REF PRESS SENS RETURN
2	R/L	REF PRESS SENS SIGNAL
3	B	PPS2 SUPPLY

Connector No.	E89
Connector Name	ASCD CANCEL SWITCH
Connector Type	M02FBR-LC
Connector Color	BROWN

H.S.

Terminal No.	Color of Wire	Signal Name
1	L	BRAKE NC
2	BR	SW RETURN

Connector No.	E90
Connector Name	UREA HEATER RELAY
Connector Type	MS02FL-M2-LC
Connector Color	BLUE

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	GROUND
2	L/W	IGNITION

3	R/Y	HEATER POWER SUPPLY
5	W/R	BATTERY

Connector No.	E91
Connector Name	COOLANT LEVEL SENSOR
Connector Type	PEZ03FB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	BR	SW RETURN
2	L/W	COOLANT SIGNAL
3	–	–

Connector No.	E93
Connector Name	ECM (WITH CUMMINS 5.0L)
Connector Type	1-928-405-452
Connector Color	BLACK

H.S.

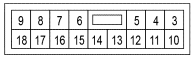
Terminal No.	Color of Wire	Signal Name
1	B	GROUND
2	B	GROUND
3	BR	SW BATTERY
4	B	GROUND
5	BR	SW BATTERY
6	BR	SW BATTERY
7	O	DOF DELTA PRESS
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–
15	L/R	AT SENSOR RTN
16	P	CAN-L
17	–	–
18	G	J1939 +
19	–	–
20	G	SMART POWER LSD
21	–	–
22	–	–
23	–	–
24	SB	DPF OUT PRESS
25	–	–
26	R/L	REF PRESS SENS SIGNAL
27	–	–
28	–	–
29	–	–
30	–	–
31	–	–
32	Y	AT SSR SUPPLY
33	L	CAN-H
34	–	–
35	Y	J1939 +
36	–	–
37	L	MAIN RLY LSD
38	–	–
39	–	–
40	GR	FUEL PUMP RLY SIG
41	BR	SW RETURN
42	–	–
43	–	–
44	–	–
45	–	–
46	–	–
47	–	–
48	–	–
49	–	–
50	–	–
51	–	–
52	–	–
53	R/G	BRAKE SW OPEN
54	L	BRAKE NC
55	–	–
56	–	–
57	–	–
58	–	–
59	G/Y	ASCD SIGNAL
60	–	–
61	B/Y	ASCD RETURN
62	R	PPS2 RETURN
63	R	PPS1 RETURN
64	R/W	REF PRESS SENS RETURN
65	L/W	IGN/KEYSWITCH
66	–	–
67	–	–
68	–	–
69	–	–
70	–	–
71	–	–
72	–	–
73	B	DOSER RETURN
74	GR/R	DOSER HS
75	L/W	COOLANT SIGNAL
76	–	–
77	L	WIF SIGNAL
78	L	PPS2 SIGNAL
79	BR	PPS1 SIGNAL
80	W	PPS1 SUPPLY
81	B	PPS2 SUPPLY
82	–	–
83	BR	BATTERY
84	–	–
85	–	–
86	–	–
87	–	–
88	–	–
89	–	–
90	–	–
91	–	–

AABIA2000GB

ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	E119
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS16FW-CS
Connector Color	WHITE

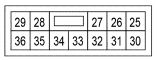
H.S.



Terminal No.	Color of Wire	Signal Name
3	–	–
4	B/R	NP SW
5	L/W	H/LAMP HI RH
6	G	H/LAMP HI LH
7	L	H/LAMP LO LH
8	R/Y	H/LAMP LO RH
9	G/W	FR FOG/L LH
10	–	–
11	P	ETC VB - (WITH CUMMINS 5.0L)
11	O	ETC VB - (WITH VK56VD)
12	W/R	FR FOG/L RH
13	Y/R	A/T ECU IGN
14	G	REVERSE LAMP IGN
15	GR	ABS ECU IGN
16	G	ETC RLY CONT - (WITH CUMMINS 5.0L)
16	V/R	ETC RLY CONT - (WITH VK56VD)
17	L/W	IGN COIL - (WITH CUMMINS 5.0L)
17	W	IGN COIL - (WITH VK56VD)
18	–	–

Connector No.	E121
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS12FBR-CS
Connector Color	BROWN

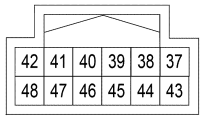
H.S.



Terminal No.	Color of Wire	Signal Name
25	BR	ECM VB - (WITH CUMMINS 5.0L)
25	W	ECM VB - (WITH VK56VD)
26	V	O2 SENS - (WITH VK56VD)
27	R/L	PARKING RH
28	R/L	TAIL 1
29	Y	FR WIPER HI
30	–	–
31	L	ECM RLY CONT
32	L	ECM BAT - (WITH VK56VD)
33	R/L	PARKING LH
34	R/W	TAIL 2
35	BR	FR WIPER LO
36	–	–

Connector No.	E122
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	TH12FW-NH
Connector Color	WHITE

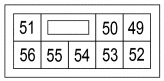
H.S.



Terminal No.	Color of Wire	Signal Name
37	–	–
38	–	–
39	L/Y	WIPER AUTO STOP SW
40	P	CAN-L
41	L	CAN-H
42	BR	DTRL RLY
43	–	–
44	W/B	START CONT
45	GR	FUEL RLY CONT
46	Y	HOOD SW
47	Y	ALT C - (WITH VK56VD)
48	R/W	HORN RLY CONT

Connector No.	E123
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS08FBR-CS
Connector Color	BROWN

H.S.



Terminal No.	Color of Wire	Signal Name
49	Y/B	A/C COMP - (WITH CUMMINS 5.0L)
49	GR/R	A/C COMP - (WITH VK56VD)
50	BR	TRAILER TOW
51	–	–
52	B	S-GND
53	–	–
54	–	–
55	–	–
56	–	–

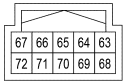
Connector No.	E124
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	M06FB-LC
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
57	W/B	RR DEF
58	BR	FUEL PUMP - (WITH CUMMINS 5.0L)
58	B/Y	FUEL PUMP - (WITH VK56VD)
59	–	–
60	–	–
61	–	–
62	B	P GND

Connector No.	E130
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	TH10FB-NH
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
63	–	–
64	R	DETENT SW
65	–	–
66	P	PUSH START SW
67	–	–
68	L	IGN SIGNAL
69	–	–
70	–	–
71	SB	HOOD SW2
72	W	E-CPLG - (WITH VK56VD)

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ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	E152
Connector Name	WIRE TO WIRE
Connector Type	TH80MW-CS16-TM4
Connector Color	WHITE

H.S.

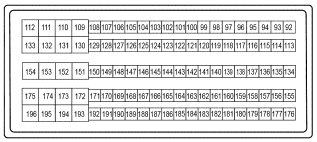
Terminal No.	Color of Wire	Signal Name
1G	G	TO MAIN HARNESS
2G	B/R	TO MAIN HARNESS
3G	W/B	TO MAIN HARNESS
4G	BR/W	TO MAIN HARNESS
5G	BR	TO MAIN HARNESS
6G	P	TO MAIN HARNESS - (WITH VK56VD)
6G	R/W	TO MAIN HARNESS - (WITH CUMMINS 5.0L)
7G	Y	TO MAIN HARNESS
8G	G	TO MAIN HARNESS
9G	R	TO MAIN HARNESS
10G	W	TO MAIN HARNESS
11G	R/G	TO MAIN HARNESS
12G	W/B	TO MAIN HARNESS
13G	BR	TO MAIN HARNESS
14G	Y/B	TO MAIN HARNESS
15G	G/W	TO MAIN HARNESS
16G	G	TO MAIN HARNESS
17G	G/Y	TO MAIN HARNESS
18G	G/Y	TO MAIN HARNESS
19G	Y/V	TO MAIN HARNESS
20G	G/Y	TO MAIN HARNESS
21G	B/Y	TO MAIN HARNESS
22G	G/R	TO MAIN HARNESS
23G	Y/R	TO MAIN HARNESS
24G	G/B	TO MAIN HARNESS
25G	R/W	TO MAIN HARNESS
26G	R	TO MAIN HARNESS
27G	LG	TO MAIN HARNESS
28G	G/B	TO MAIN HARNESS
29G	G/B	TO MAIN HARNESS
30G	BR/Y	TO MAIN HARNESS
31G	P	TO MAIN HARNESS - (WITH CUMMINS 5.0L)
31G	R	TO MAIN HARNESS - (WITH VK56VD)
32G	P	TO MAIN HARNESS
33G	Y/L	TO MAIN HARNESS
34G	GR	TO MAIN HARNESS
35G	G/R	TO MAIN HARNESS
36G	SB	TO MAIN HARNESS
37G	R/W	TO MAIN HARNESS
38G	BR	TO MAIN HARNESS
39G	BR	TO MAIN HARNESS
40G	–	TO MAIN HARNESS
41G	R/G	TO MAIN HARNESS
42G	O	TO MAIN HARNESS
43G	B	TO MAIN HARNESS - (WITH CUMMINS 5.0L)
43G	G	TO MAIN HARNESS - (WITH VK56VD)
44G	R/Y	TO MAIN HARNESS
45G	G	TO MAIN HARNESS
46G	LG	TO MAIN HARNESS
47G	R	TO MAIN HARNESS
48G	W	TO MAIN HARNESS
49G	–	TO MAIN HARNESS
50G	BR	TO MAIN HARNESS
51G	R	TO MAIN HARNESS
52G	L	TO MAIN HARNESS
53G	W	TO MAIN HARNESS
54G	W	TO MAIN HARNESS
55G	G	TO MAIN HARNESS
56G	W	TO MAIN HARNESS
57G	Y	TO MAIN HARNESS
58G	BG	TO MAIN HARNESS
59G	BG	TO MAIN HARNESS
60G	BG	TO MAIN HARNESS
61G	B	TO MAIN HARNESS
62G	W	TO MAIN HARNESS
63G	R	TO MAIN HARNESS
64G	W/L	TO MAIN HARNESS
65G	W/R	TO MAIN HARNESS
66G	BG	TO MAIN HARNESS
67G	BG	TO MAIN HARNESS
68G	B	TO MAIN HARNESS
69G	Y	TO MAIN HARNESS
70G	L	TO MAIN HARNESS
71G	R/W	TO MAIN HARNESS
72G	L/W	TO MAIN HARNESS
73G	SHIELD	TO MAIN HARNESS
74G	W	TO MAIN HARNESS
75G	R	TO MAIN HARNESS
76G	R/G	TO MAIN HARNESS
77G	G	TO MAIN HARNESS
78G	W	TO MAIN HARNESS
79G	–	TO MAIN HARNESS
80G	R	TO MAIN HARNESS
81G	L	TO MAIN HARNESS
82G	R	TO MAIN HARNESS
83G	L	TO MAIN HARNESS
84G	L	TO MAIN HARNESS
85G	W/B	TO MAIN HARNESS
86G	B/R	TO MAIN HARNESS
87G	W/B	TO MAIN HARNESS
88G	P	TO MAIN HARNESS
89G	L	TO MAIN HARNESS
90G	G	TO MAIN HARNESS
91G	G	TO MAIN HARNESS
92G	V/W	TO MAIN HARNESS
93G	BR	TO MAIN HARNESS
94G	G	TO MAIN HARNESS
95G	G	TO MAIN HARNESS
96G	W	TO MAIN HARNESS
97G	R	TO MAIN HARNESS
98G	W/B	TO MAIN HARNESS
99G	BR	TO MAIN HARNESS
100G	GR/W	TO MAIN HARNESS

AABIA2002GB

ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	F101
Connector Name	ECM (WITH CUMMINS 5.0L)
Connector Type	1-928-405-455
Connector Color	BLACK

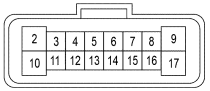
H.S.



Terminal No.	Color of Wire	Signal Name
92	B	FUEL INJECTOR DRIVER 2
93	B/Y	FUEL INJECTOR DRIVER 8
94	B	FUEL INJECTOR DRIVER 5
95	B/R	FUEL INJECTOR DRIVER 3
96	–	–
97	B/SB	PCV LSP
98	–	–
99	–	–
100	–	–
101	–	–
102	DG	J1939-
103	LG/B	J1939-
104	–	–
105	–	–
106	P	VS01 5V
107	–	–
108	–	–
109	W/SB	INLET AIR TEMPERATURE
110	W/V	CHARGE AIR CLR OUT TEMPERATURE
111	W/R	CCV PRESSURE SENSOR SIGNAL
112	–	–
113	R/B	FUEL INJECTOR SIGNAL 2
114	R/Y	FUEL INJECTOR SIGNAL 8
115	R	FUEL INJECTOR SIGNAL 5
116	R/B	FUEL INJECTOR SIGNAL 3
117	–	–
118	B/W	ME UN LSP
119	–	–
120	–	–
121	–	–
122	–	–
123	Y	J1939+
124	Y/B	J1939+
125	–	–
126	–	–
127	B	VS01RTN
128	B/W	RPS RTN
129	W/O	INLET AIR PRESSURE
130	W/B	LOW FUEL PRESSURE SENSOR SIGNAL
131	–	–
132	W/LG	EXHAUST PRESSURE SENSOR SIGNAL
133	–	–
134	R	EGR VALVE +
135	B	EGR VALVE -
136	–	–
137	R	COMPRESSOR BYPASS VALVE
138	R/V	MAF HSP
139	B	COMPRESSOR BYPASS VALVE RETURN
140	–	–
141	–	–
142	–	–
143	W/SB	OIL PRESSURE SWITCH SIGNAL
144	–	–
145	–	–
146	–	–
147	–	–
148	–	–
149	–	–
150	–	–
151	–	–
152	W/Y	EGR POSITION SIGNAL
153	–	–
154	W	EGR ORFICE TEMP
155	R/B	FUEL INJECTOR SIGNAL 1
156	R/Y	FUEL INJECTOR SIGNAL 7
157	R	FUEL INJECTOR SIGNAL 4
158	R/B	FUEL INJECTOR SIGNAL 6
159	B/SB	EGR BYPASS VALVE -
160	–	–
161	–	–
162	–	–
163	–	–
164	–	–
165	–	–
166	W	FAN SPEED
167	–	–
168	W/V	ENGINE POSITION
169	B	VS03RTN
170	B	COMMON SENSOR RETURN
171	W/DG	RAIL PRESSURE SENSOR SIGNAL
172	W/Y	EGR BYPASS POSITION SIGNAL
173	–	–
174	W/SB	FUEL TEMPERATURE
175	–	–
176	B	FUEL INJECTOR DRIVER 1
177	B/Y	FUEL INJECTOR DRIVER 7
178	B	FUEL INJECTOR DRIVER 4
179	B/R	FUEL INJECTOR DRIVER 6
180	R/V	EGR BYPASS VLAVE +
181	B/W	FAN CLUTCH LSP
182	–	–
183	–	–
184	–	–
185	–	–
186	–	–
187	W/Y	MASS AIR FLOW SIGNAL
188	W/SB	TURBO SPEED SENSOR SIGNAL
189	W/O	ENGINE SPEED
190	P	VS03 5V
191	–	–
192	–	–
193	W/R	COOLANT TEMPERATURE
194	W/B	BOOST PRESSURE
195	W/P	INTAKE MANIFOLD TEMPERATURE
196	W/O	INTERSTAGE BOOST PRESSURE SENSOR SIG

Connector No.	F102
Connector Name	GLOW PLUG CONTROL MODULE
Connector Type	33476-1601
Connector Color	BLACK

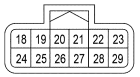
H.S.



Terminal No.	Color of Wire	Signal Name
2	–	–
3	–	–
4	Y	J1939+
5	DG	J1939-
6	B	GND
7	O	POWER
8	–	–
9	–	–
10	–	–
11	–	–
12	–	–
13	–	–
14	–	–
15	–	–
16	–	–
17	–	–

Connector No.	F103
Connector Name	GLOW PLUG CONTROL MODULE
Connector Type	33472-1201
Connector Color	BLACK

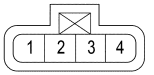
H.S.



Terminal No.	Color of Wire	Signal Name
18	B	GLOW PLUG 1
19	B/W	GLOW PLUG 2
20	–	–
21	–	–
22	B/Y	GLOW PLUG 3
23	B	GLOW PLUG 4
24	B/Y	GLOW PLUG 5
25	B	GLOW PLUG 6
26	–	–
27	–	–
28	B/W	GLOW PLUG 7
29	B	GLOW PLUG 8

Connector No.	F104
Connector Name	MASS AIR FLOW SENSOR
Connector Type	54200409
Connector Color	BLACK

H.S.



Terminal No.	Color of Wire	Signal Name
1	W/Y	SIGNAL
2	R/V	5 VOLT SUPPLY
3	B	GROUND
4	–	–

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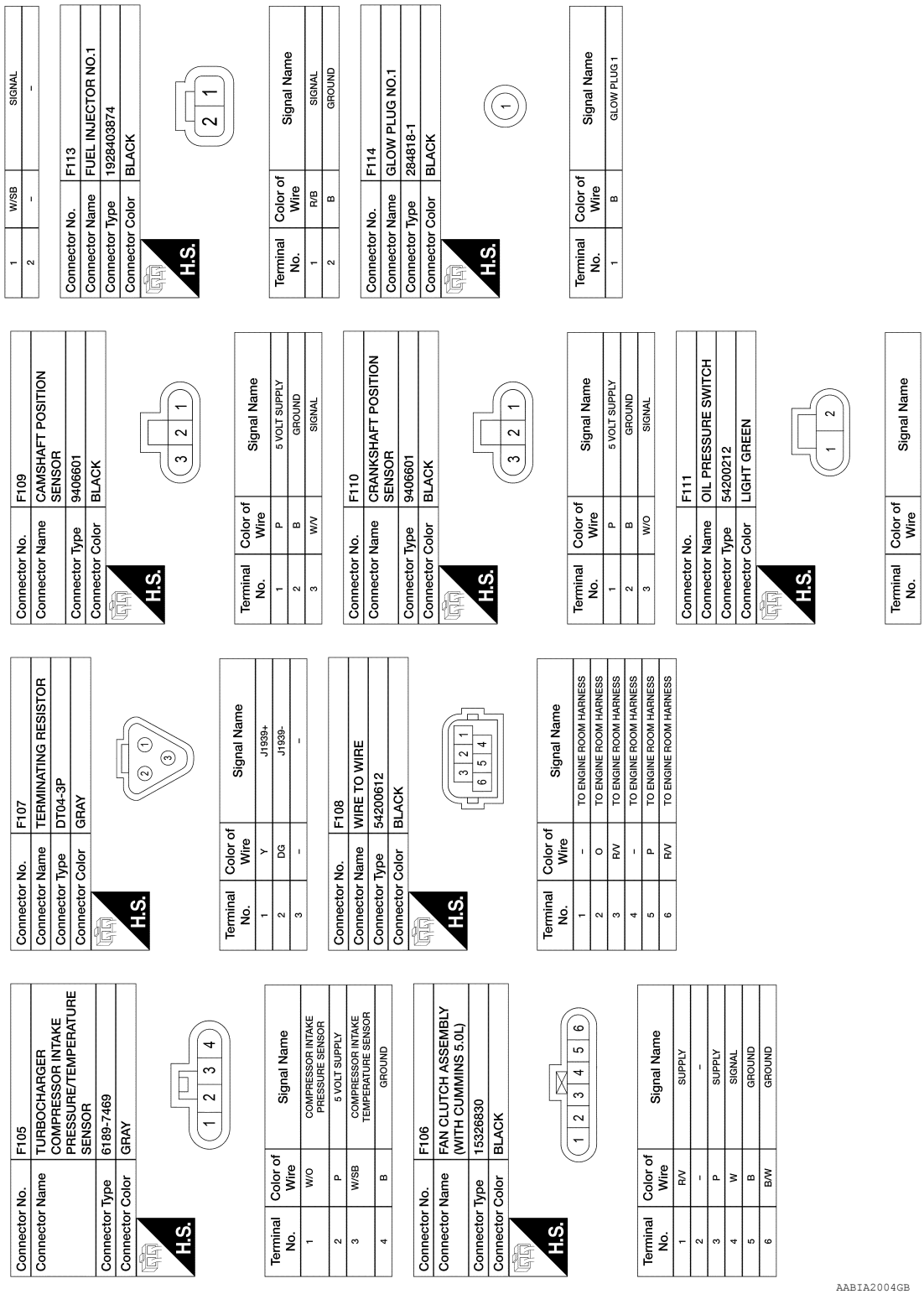
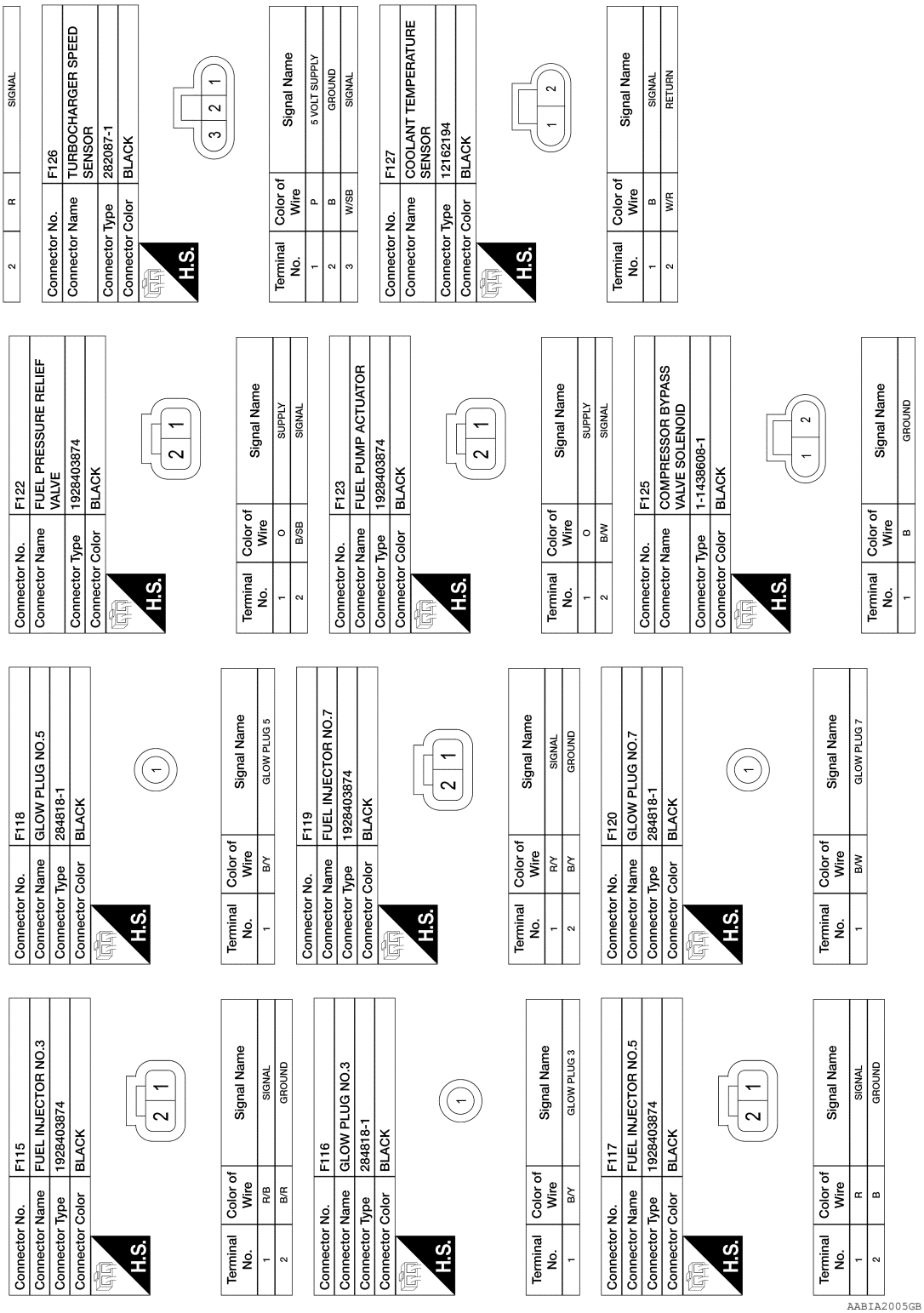
ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L



ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L



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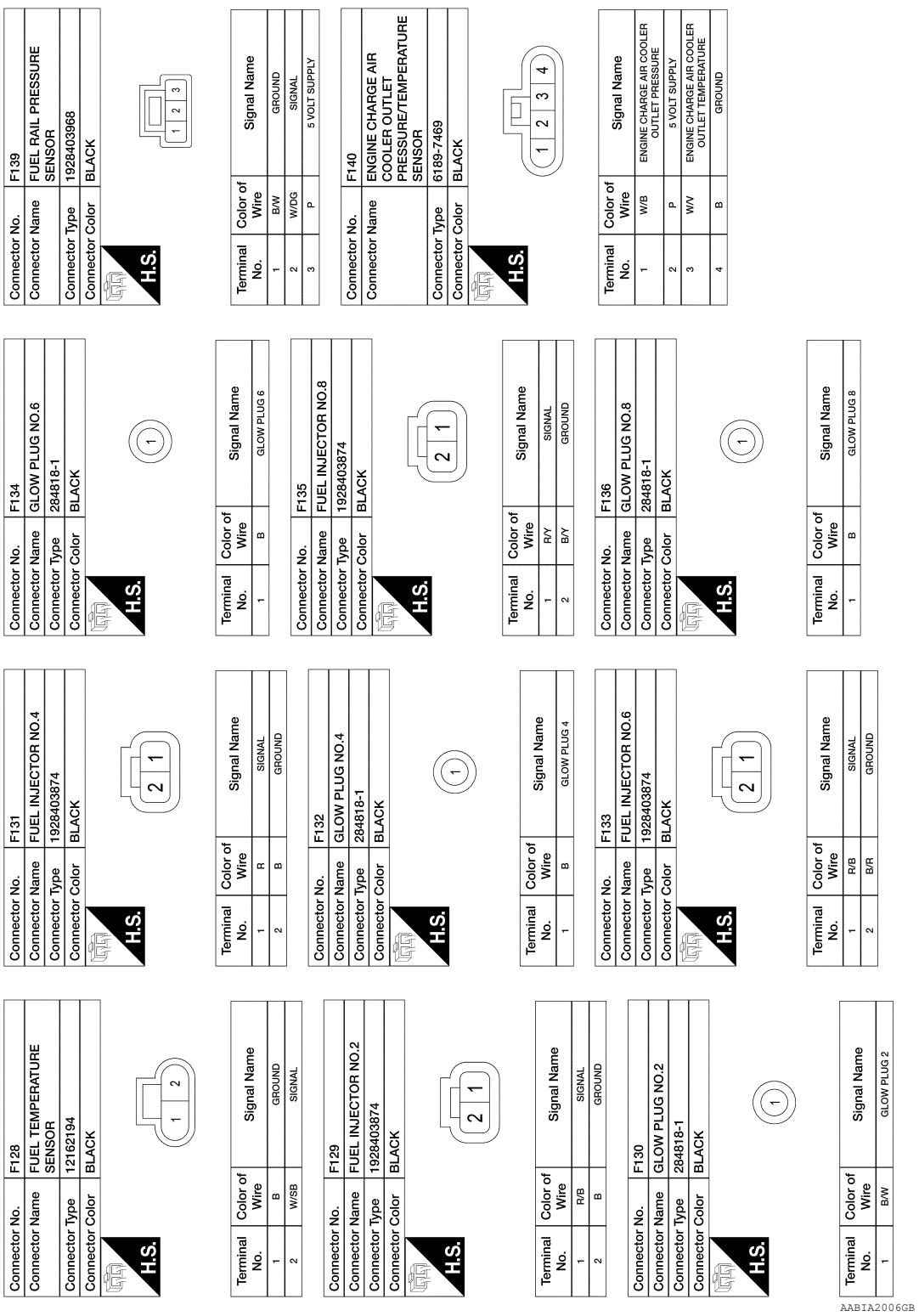
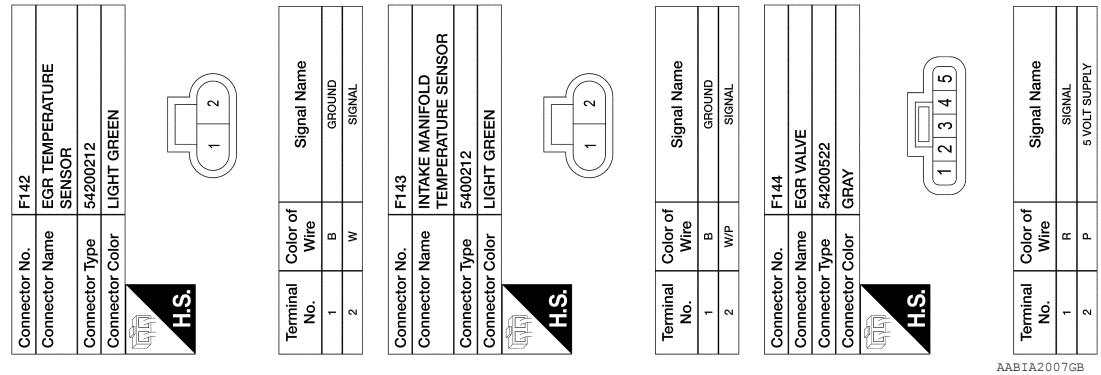
ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L



ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L



ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	F209
Connector Name	WIRE TO WIRE
Connector Type	RK26MGY-RS20-X6
Connector Color	GRAY

H.S.

Terminal No.	Color of Wire	Signal Name
1F	Y/R	TO ENGINE ROOM HARNESS
2F	B	TO ENGINE ROOM HARNESS
3F	B/Y	TO ENGINE ROOM HARNESS
4F	W/R	TO ENGINE ROOM HARNESS
5F	B/R	TO ENGINE ROOM HARNESS
6F	O/L	TO ENGINE ROOM HARNESS
7F	GR	TO ENGINE ROOM HARNESS
8F	P	TO ENGINE ROOM HARNESS
9F	BR/W	TO ENGINE ROOM HARNESS
10F	G/Y	TO ENGINE ROOM HARNESS
11F	L/W	TO ENGINE ROOM HARNESS
12F	R/W	TO ENGINE ROOM HARNESS
13F	G/Y	TO ENGINE ROOM HARNESS
14F	V/W	TO ENGINE ROOM HARNESS
15F	LG	TO ENGINE ROOM HARNESS
16F	R/Y	TO ENGINE ROOM HARNESS
17F	BR/Y	TO ENGINE ROOM HARNESS
18F	R	TO ENGINE ROOM HARNESS
19F	V	TO ENGINE ROOM HARNESS
20F	BR	TO ENGINE ROOM HARNESS
21F	L/R	TO ENGINE ROOM HARNESS
22F	L/LG	TO ENGINE ROOM HARNESS
23F	SB	TO ENGINE ROOM HARNESS
24F	W/L	TO ENGINE ROOM HARNESS
25F	W/B	TO ENGINE ROOM HARNESS
26F	B/Y	TO ENGINE ROOM HARNESS
27F	Y	TO ENGINE ROOM HARNESS
28F	W/R	TO ENGINE ROOM HARNESS
29F	L/O	TO ENGINE ROOM HARNESS
30F	B	TO ENGINE ROOM HARNESS
31F	B	TO ENGINE ROOM HARNESS
32F	V	TO ENGINE ROOM HARNESS
33F	BG	TO ENGINE ROOM HARNESS
34F	L/R	TO ENGINE ROOM HARNESS
35F	R/W	TO ENGINE ROOM HARNESS
36F	L/B	TO ENGINE ROOM HARNESS
37F	L/O	TO ENGINE ROOM HARNESS
38F	Y/W	TO ENGINE ROOM HARNESS
39F	R/Y	TO ENGINE ROOM HARNESS
40F	G/B	TO ENGINE ROOM HARNESS
41F	W	TO ENGINE ROOM HARNESS
42F	Y	TO ENGINE ROOM HARNESS
43F	B/P	TO ENGINE ROOM HARNESS
44F	Y/B	TO ENGINE ROOM HARNESS
45F	L/Y	TO ENGINE ROOM HARNESS
46F	O	TO ENGINE ROOM HARNESS
47F	W/L	TO ENGINE ROOM HARNESS
48F	L	TO ENGINE ROOM HARNESS
49F	BR	TO ENGINE ROOM HARNESS
50F	SHIELD	TO ENGINE ROOM HARNESS
51F	L	TO ENGINE ROOM HARNESS
52F	BR	TO ENGINE ROOM HARNESS

Connector No.	F225
Connector Name	WATER IN FUEL SENSOR
Connector Type	RS02FB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	L	WIF SIGNAL
2	BR	SIGNAL RETURN

Connector No.	F226
Connector Name	LIFT PUMP
Connector Type	RS02FB
Connector Color	BLACK

H.S.

Terminal No.	Color of Wire	Signal Name
1	B	GROUND
2	B/Y	FUEL PUMP RELAY

Connector No.	M3
Connector Name	FUSE BLOCK (J/B)
Connector Type	CS06FW-M2
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1N	–	–
2N	W	BATTERY
3N	W	BLOWER FAN RELAY OUT
4N	V	BATTERY
5N	Y	BATTERY
6N	W	BATTERY
7N	L	ACC RELAY OUT
8N	W	IGNITION

Connector No.	M4
Connector Name	FUSE BLOCK (J/B)
Connector Type	NS16FW-CS
Connector Color	WHITE

H.S.

Terminal No.	Color of Wire	Signal Name
1P	R	IGNITION
2P	Y	IGNITION
3P	G	IGNITION RELAY OUT
4P	B/W	RR DEF RLY
5P	B/W	RR DEF RLY
6P	O	RR DEF RLY OUT
7P	G	IGNITION
8P	W	IGNITION
9P	L	BATTERY
10P	–	–
11P	–	–
12P	–	–
13P	R	BATTERY
14P	Y	BATTERY
15P	Y/LG	BATTERY
16P	W	BLOWER FAN RELAY OUT

AABIA2008GB

ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	M19
Connector Name	BCM (BODY CONTROL MODULE)
Connector Type	TH40FB-NH
Connector Color	BLACK

H.S.

60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41
80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61

Terminal No.	Color of Wire	Signal Name
41	Y/L	TRAILER LIGHT CHECK RELAY OUT
42	R/Y	CARGO LAMP OUT
43	–	–
44	–	–
45	–	–
46	–	–
47	–	–
48	R	HIGH SIDE START SW LED
49	–	–
50	–	–
51	–	–
52	W	AUDIO DONGLE
53	–	–
54	W/L	PW UART
55	W/B	L&R SENSOR K-LINE
56	–	–
57	–	–
58	–	–
59	P	CAN-L
60	L	CAN-H
61	O	REAR DEFOGGER RELAY OUT
62	W	STARTER RELAY OUT
63	–	–
64	P	BUZZER OUT
65	–	–
66	W	BLOWER FAN RELAY OUT
67	G	IGN ELEC RELAY OUT 2
68	L	MR OUTPUT
69	R/B	AT DEVICE OUT
70	P	IGN USM OUT 1
71	O	DR REQUEST SW
72	G	AS REQUEST SW
73	–	–
74	–	–
75	L/W	COMBI SW OUT 5
76	P	COMBI SW OUT 4
77	L	COMBI SW OUT 3
78	O/B	COMBI SW OUT 2
79	R/W	COMBI SW OUT 1
80	–	–

Connector No.	M22
Connector Name	DATA LINK CONNECTOR
Connector Type	BD16FW
Connector Color	WHITE

H.S.

9	10	11	12	13	14	15	16
1	2	3	4	5	6	7	8

Terminal No.	Color of Wire	Signal Name
1	–	–
2	–	–
3	LG	M-CAN-L
4	B	BODY GND
5	B	ENG GND
6	L	CAN-H
7	BR	K-LINE
8	G/R	IGN SW
9	–	–
10	–	–
11	SB	M-CAN-H
12	R	CAN-L
13	L	CAN-H
14	P	CAN-L
15	–	–
16	Y	BATTERY

Connector No.	M25
Connector Name	COMBINATION METER (WITH TYPE A)
Connector Type	TH12FW-NH
Connector Color	WHITE

H.S.

46	45	44	43	42	41
52	51	50	49	48	47

Terminal No.	Color of Wire	Signal Name
41	W	IGN
42	R	BAT
43	Y/V	FUEL SENSOR GND
44	GR	ILL CONT OUTPUT
45	P	CAN-L
46	L	CAN-H
47	B	G1
48	BR/Y	FUEL SENSOR
49	–	–
50	–	–
51	LG	M CAN-L
52	SB	M CAN-H

Connector No.	M30
Connector Name	COMBINATION SWITCH (SPIRAL CABLE)
Connector Type	TK08FGY-1V
Connector Color	GRAY

H.S.

10	9	8	7
14	13	12	11

Terminal No.	Color of Wire	Signal Name
7	B/Y	ASCD GND -(WITH HEATED STEERING WHEEL)
8	GR	ILL (-) - (WITHOUT HEATED STEERING WHEEL)
8	R	AUDIO STRG SW REMOTE B - (WITH HEATED STEERING WHEEL)
9	G/Y	ASCD SW - (WITHOUT HEATED STEERING WHEEL)
9	P	AUDIO STRG SW REMOTE A - (WITH HEATED STEERING WHEEL)
10	P	AUDIO STRG SW REMOTE A - (WITHOUT HEATED STEERING WHEEL)
10	G/Y	ASCD SW - (WITH HEATED STEERING WHEEL)
11	R/W	HORN SWITCH OUTPUT - (WITHOUT HEATED STEERING WHEEL)
11	B	AUDIO STRG SW GND - (WITH HEATED STEERING WHEEL)
12	B	AUDIO STRG SW GND -(WITHOUT HEATED STEERING WHEEL)
13	B/Y	ASCD GND -(WITHOUT HEATED STEERING WHEEL)
14	R	AUDIO STRG SW REMOTE B - (WITHOUT HEATED STEERING WHEEL)

AABIA2009GB

ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	M31
Connector Name	WIRE TO WIRE
Connector Type	TH80FW-CS16-TM4
Connector Color	WHITE

H.S.

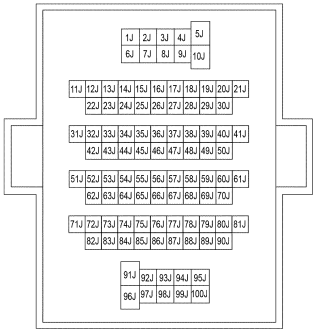
Terminal No.	Color of Wire	Signal Name
1G	G	TO ENGINE ROOM HARNESS
2G	B/R	TO ENGINE ROOM HARNESS
3G	W	TO ENGINE ROOM HARNESS
4G	BR/W	TO ENGINE ROOM HARNESS
5G	–	TO ENGINE ROOM HARNESS
6G	R/W	TO ENGINE ROOM HARNESS
7G	Y	TO ENGINE ROOM HARNESS
8G	G	TO ENGINE ROOM HARNESS
9G	R	TO ENGINE ROOM HARNESS
10G	W	TO ENGINE ROOM HARNESS
11G	R/G	TO ENGINE ROOM HARNESS
12G	W/B	TO ENGINE ROOM HARNESS
13G	BR	TO ENGINE ROOM HARNESS
14G	Y/B	TO ENGINE ROOM HARNESS
15G	G/W	TO ENGINE ROOM HARNESS
16G	G	TO ENGINE ROOM HARNESS
17G	O	TO ENGINE ROOM HARNESS
18G	G/Y	TO ENGINE ROOM HARNESS
19G	Y/V	TO ENGINE ROOM HARNESS
20G	G/Y	TO ENGINE ROOM HARNESS
21G	B/Y	TO ENGINE ROOM HARNESS
22G	G/R	TO ENGINE ROOM HARNESS
23G	Y/R	TO ENGINE ROOM HARNESS
24G	G/B	TO ENGINE ROOM HARNESS
25G	R/W	TO ENGINE ROOM HARNESS
26G	R	TO ENGINE ROOM HARNESS
27G	LG	TO ENGINE ROOM HARNESS
28G	G/B	TO ENGINE ROOM HARNESS
29G	G/B	TO ENGINE ROOM HARNESS
30G	BR/Y	TO ENGINE ROOM HARNESS
31G	R	TO ENGINE ROOM HARNESS
32G	R	TO ENGINE ROOM HARNESS
33G	Y/L	TO ENGINE ROOM HARNESS
34G	GR	TO ENGINE ROOM HARNESS
35G	G/R	TO ENGINE ROOM HARNESS
36G	SB	TO ENGINE ROOM HARNESS
37G	R/W	TO ENGINE ROOM HARNESS
38G	BR	TO ENGINE ROOM HARNESS
39G	BR	TO ENGINE ROOM HARNESS
40G	–	TO ENGINE ROOM HARNESS
41G	R/G	TO ENGINE ROOM HARNESS
42G	O	TO ENGINE ROOM HARNESS
43G	G	TO ENGINE ROOM HARNESS
44G	R/Y	TO ENGINE ROOM HARNESS
45G	G	TO ENGINE ROOM HARNESS
46G	LG	TO ENGINE ROOM HARNESS
47G	R	TO ENGINE ROOM HARNESS
48G	W	TO ENGINE ROOM HARNESS
49G	–	TO ENGINE ROOM HARNESS
50G	BR	TO ENGINE ROOM HARNESS
51G	R	TO ENGINE ROOM HARNESS
52G	L	TO ENGINE ROOM HARNESS
53G	W	TO ENGINE ROOM HARNESS
54G	W	TO ENGINE ROOM HARNESS
55G	G	TO ENGINE ROOM HARNESS
56G	W	TO ENGINE ROOM HARNESS
57G	Y	TO ENGINE ROOM HARNESS
58G	BG	TO ENGINE ROOM HARNESS
59G	BG	TO ENGINE ROOM HARNESS
60G	BG	TO ENGINE ROOM HARNESS
61G	O	TO ENGINE ROOM HARNESS
62G	W	TO ENGINE ROOM HARNESS
63G	O	TO ENGINE ROOM HARNESS
64G	W/L	TO ENGINE ROOM HARNESS
65G	W/R	TO ENGINE ROOM HARNESS
66G	BG	TO ENGINE ROOM HARNESS
67G	O	TO ENGINE ROOM HARNESS
68G	B	TO ENGINE ROOM HARNESS
69G	Y	TO ENGINE ROOM HARNESS
70G	L	TO ENGINE ROOM HARNESS
71G	R/W	TO ENGINE ROOM HARNESS
72G	L/W	TO ENGINE ROOM HARNESS
73G	SHIELD	TO ENGINE ROOM HARNESS
74G	W	TO ENGINE ROOM HARNESS
75G	R	TO ENGINE ROOM HARNESS
76G	R/G	TO ENGINE ROOM HARNESS
77G	BG	TO ENGINE ROOM HARNESS
78G	P	TO ENGINE ROOM HARNESS
79G	–	TO ENGINE ROOM HARNESS
80G	R	TO ENGINE ROOM HARNESS
81G	L	TO ENGINE ROOM HARNESS
82G	R	TO ENGINE ROOM HARNESS
83G	L	TO ENGINE ROOM HARNESS
84G	L	TO ENGINE ROOM HARNESS
85G	W	TO ENGINE ROOM HARNESS
86G	B/R	TO ENGINE ROOM HARNESS
87G	W	TO ENGINE ROOM HARNESS
88G	G	TO ENGINE ROOM HARNESS
89G	P	TO ENGINE ROOM HARNESS
90G	G	TO ENGINE ROOM HARNESS
91G	P	TO ENGINE ROOM HARNESS
92G	V/W	TO ENGINE ROOM HARNESS
93G	BR	TO ENGINE ROOM HARNESS
94G	B	TO ENGINE ROOM HARNESS
95G	G	TO ENGINE ROOM HARNESS
96G	R	TO ENGINE ROOM HARNESS
97G	R	TO ENGINE ROOM HARNESS
98G	W/B	TO ENGINE ROOM HARNESS
99G	R	TO ENGINE ROOM HARNESS
100G	GR/W	TO ENGINE ROOM HARNESS

AABIA2010GB

ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	M40
Connector Name	WIRE TO WIRE
Connector Type	TH80FW-CS16-TM4
Connector Color	WHITE

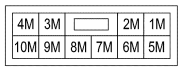
H.S.



Terminal No.	Color of Wire	Signal Name
1J	G	TO BODY HARNESS
2J	R/Y	TO BODY HARNESS
3J	L	TO BODY HARNESS
4J	L/B	TO BODY HARNESS
5J	B	TO BODY HARNESS
6J	BR	TO BODY HARNESS
7J	BG	TO BODY HARNESS
8J	SB	TO BODY HARNESS
9J	BR	TO BODY HARNESS
10J	R	TO BODY HARNESS
11J	O/B	TO BODY HARNESS
12J	L	TO BODY HARNESS
13J	W	TO BODY HARNESS
14J	Y	TO BODY HARNESS
15J	–	TO BODY HARNESS
16J	R	TO BODY HARNESS
17J	G	TO BODY HARNESS
18J	SB	TO BODY HARNESS
19J	O	TO BODY HARNESS
20J	O/B	TO BODY HARNESS
21J	Y	TO BODY HARNESS
22J	P	TO BODY HARNESS
23J	W	TO BODY HARNESS
24J	W/R	TO BODY HARNESS
25J	P	TO BODY HARNESS
26J	L	TO BODY HARNESS
27J	R	TO BODY HARNESS
28J	L	TO BODY HARNESS
29J	G/O	TO BODY HARNESS
30J	SB	TO BODY HARNESS
31J	L/G	TO BODY HARNESS
32J	R	TO BODY HARNESS
33J	BG	TO BODY HARNESS
34J	Y	TO BODY HARNESS
35J	P	TO BODY HARNESS
36J	G/R	TO BODY HARNESS
37J	LG	TO BODY HARNESS
38J	SB	TO BODY HARNESS
39J	Y	TO BODY HARNESS
40J	SB	TO BODY HARNESS
41J	L	TO BODY HARNESS
42J	L	TO BODY HARNESS
43J	W	TO BODY HARNESS
44J	BR	TO BODY HARNESS
45J	BG	TO BODY HARNESS
46J	P	TO BODY HARNESS
47J	O	TO BODY HARNESS
48J	V	TO BODY HARNESS
49J	BR	TO BODY HARNESS
50J	G/W	TO BODY HARNESS
51J	–	TO BODY HARNESS
52J	SHIELD	TO BODY HARNESS
53J	R	TO BODY HARNESS
54J	L	TO BODY HARNESS
55J	R	TO BODY HARNESS
56J	W	TO BODY HARNESS
57J	R	TO BODY HARNESS
58J	B	TO BODY HARNESS
59J	–	TO BODY HARNESS
60J	SHIELD	TO BODY HARNESS
61J	G	TO BODY HARNESS
62J	–	TO BODY HARNESS
63J	R/W	TO BODY HARNESS
64J	L/W	TO BODY HARNESS
65J	SHIELD	TO BODY HARNESS
66J	B	TO BODY HARNESS
67J	SHIELD	TO BODY HARNESS
68J	W	TO BODY HARNESS
69J	SHIELD	TO BODY HARNESS
70J	B/R	TO BODY HARNESS
71J	L/W	TO BODY HARNESS
72J	–	TO BODY HARNESS
73J	–	TO BODY HARNESS
74J	SHIELD	TO BODY HARNESS
75J	R	TO BODY HARNESS
76J	O	TO BODY HARNESS
77J	SHIELD	TO BODY HARNESS
78J	W	TO BODY HARNESS
79J	B	TO BODY HARNESS
80J	W	TO BODY HARNESS
81J	SHIELD	TO BODY HARNESS
82J	L/R	TO BODY HARNESS
83J	–	TO BODY HARNESS
84J	–	TO BODY HARNESS
85J	W	TO BODY HARNESS
86J	G	TO BODY HARNESS
87J	W	TO BODY HARNESS
88J	SHIELD	TO BODY HARNESS
89J	R	TO BODY HARNESS
90J	L	TO BODY HARNESS
91J	L/B	TO BODY HARNESS
92J	SB	TO BODY HARNESS
93J	B	TO BODY HARNESS
94J	LG	TO BODY HARNESS
95J	L	TO BODY HARNESS
96J	G	TO BODY HARNESS
97J	B/Y	TO BODY HARNESS
98J	L/B	TO BODY HARNESS
99J	W/L	TO BODY HARNESS
100J	Y	TO BODY HARNESS

Connector No.	M69
Connector Name	FUSE BLOCK (J/B)
Connector Type	NS10FW-CS
Connector Color	WHITE

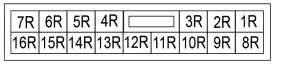
H.S.



Terminal No.	Color of Wire	Signal Name
1M	GR	IGNITION
2M	–	–
3M	–	–
4M	–	–
5M	R/Y	BATTERY
6M	R/W	TAIL LAMP 2
7M	–	–
8M	–	–
9M	–	–
10M	W/R	IGNITION

Connector No.	M70
Connector Name	FUSE BLOCK (J/B)
Connector Type	NS16FBR-CS
Connector Color	BROWN

H.S.



Terminal No.	Color of Wire	Signal Name
1R	L	TAIL LAMP 2
2R	G/R	IGNITION
3R	Y/R	BATTERY
4R	–	–
5R	W	BATTERY
6R	G/W	ACCESSORY
7R	–	–
8R	–	–
9R	–	–
10R	W	BATTERY
11R	–	–
12R	BG	BATTERY
13R	B	ACCESSORY
14R	G/Y	BATTERY
15R	Y	BATTERY
16R	G/R	ACCESSORY

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ENGINE CONTROL SYSTEM CONNECTORS - Cummins 5.0L

Connector No.	M81
Connector Name	BCM (BODY CONTROL MODULE)
Connector Type	FEA09FW-FHA6-SA
Connector Color	WHITE

H.S.

137	136	135	134	133	132	131	130	129
143	142	141	140	139	138			

Terminal No.	Color of Wire	Signal Name
129	P/G	BATTERY SAVER OUT
130	LG	SUPER LOCK/DOOR UNLOCK AS
131	W	BAT BCM FUSE
132	Y	DOOR LOCK AS/RR/RL
133	BR	DOOR UNLOCK AS/RR/RL
134	B	GND2
135	O	DOOR LOCK DR/AS/FL
136	L	ROOM LAMP CONT
137	V	DOOR UNLOCK DR/AS/FL
138	V	BAT REAR DOOR
139	W	BAT-POWER F/L
140	LG	P/W POWER SUPPLY IGN
141	V	P/W POWER SUPPLY BAT
142	Y	BAT FRONT DOOR
143	B	GND1

21	P	ILL -
22	Y	ILL +

Connector No.	M199
Connector Name	COMBINATION SWITCH (SPIRAL CABLE)
Connector Type	TK08FGY
Connector Color	GRAY

H.S.

22	21	20	19	18	17	16	15

Terminal No.	Color of Wire	Signal Name
15	R	ASCD SW
16	W	AUDIO STRG SW REMOTE A
17	L	AUDIO STRG SW REMOTE B
18	B	ASCD GND
19	BR	AUDIO STRG SW GND
20	G	HORN SWITCH OUTPUT

AABIA2012GB

BASIC INSPECTION

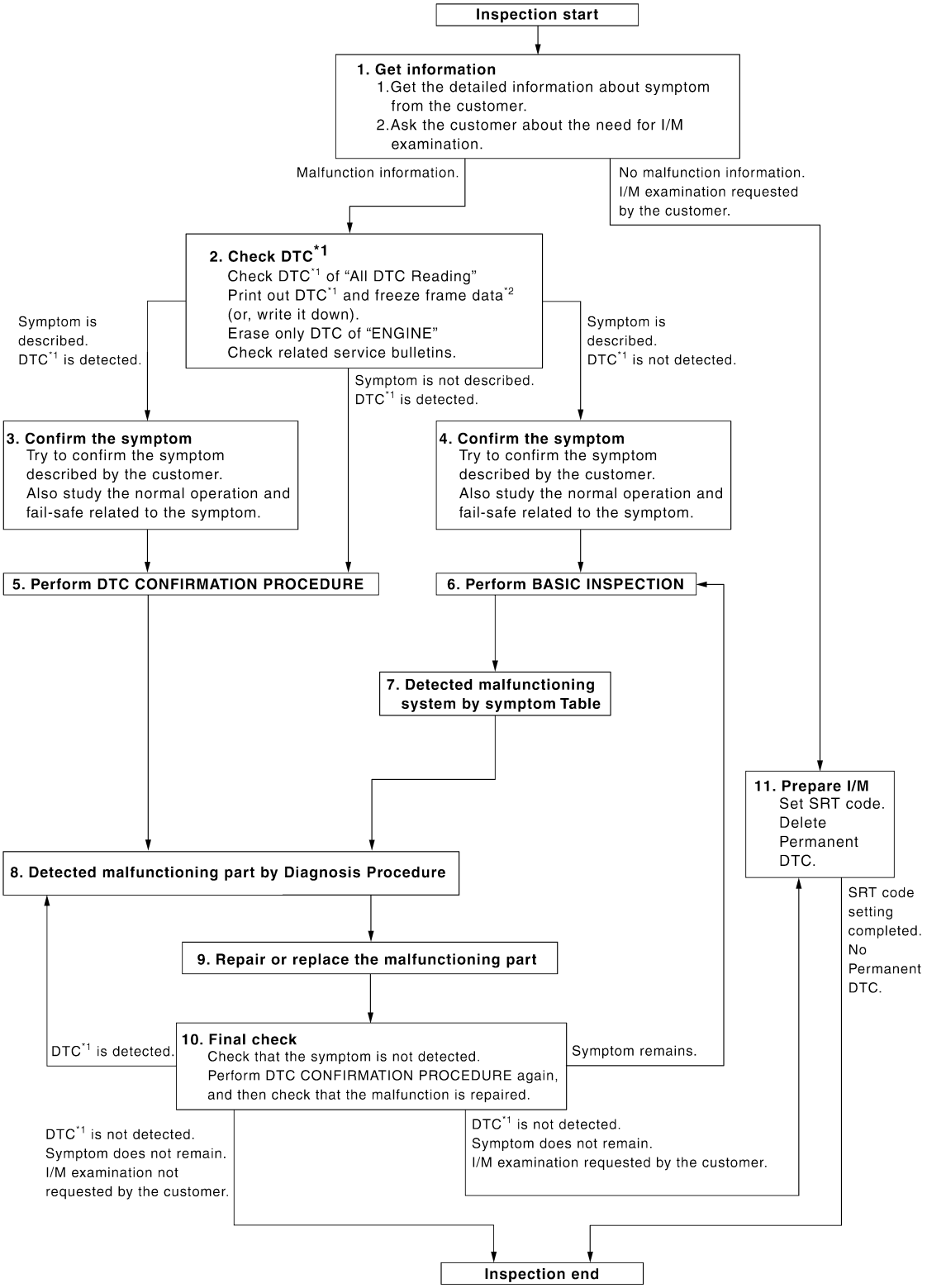
DIAGNOSIS AND REPAIR WORK FLOW

Work Flow

INFOID:0000000014419950

WORK FLOW

Overall Sequence



*1: Include 1st trip DTC.
*2: Include 1st trip freeze frame data.

Detailed Flow

1.GET INFORMATION FOR SYMPTOM

1. Get the detailed information from the customer about the symptom (the condition and the environment when the incident/malfunction occurred) using the “Diagnostic Work Sheet”.
2. Ask if the customer requests I/M examination.

Malfunction information, obtained>>GO TO 2.
No malfunction information, but a request for I/M examination>>GO TO 11.

2.CHECK DTC

1. Check DTC.
2. Perform the following procedure if DTC is displayed.

- Record DTC and freeze frame data. (Print them out with CONSULT or GST.)
- Erase DTC.
- Study the relationship between the cause detected by DTC and the symptom described by the customer. (Symptom Matrix Chart is useful. Refer to EC-1986, "Symptom Table".)

3. Check related service bulletins for information.

Are any symptoms described and any DTCs detected?

Symptom is described, DTC is detected>>GO TO 3.
Symptom is described, DTC is not detected>>GO TO 4.
Symptom is not described, DTC is detected>>GO TO 5.

3.CONFIRM THE SYMPTOM

Try to confirm the symptom described by the customer (except MIL ON).
Also study the normal operation and fail-safe related to the symptom. Refer to EC-829, "Fail safe".
Diagnosis Work Sheet is useful to verify the incident.
Verify relation between the symptom and the condition when the symptom is detected.

>> GO TO 5.

4.CONFIRM THE SYMPTOM

Try to confirm the symptom described by the customer.
Also study the normal operation and fail-safe related to the symptom. Refer to EC-829, "Fail safe".
Diagnosis Work Sheet is useful to verify the incident.
Verify relation between the symptom and the condition when the symptom is detected.

>> GO TO 6.

5.PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE for the displayed DTC, and then check that DTC is detected again.
If two or more DTCs are detected, refer to EC-838, "DTC Index" and determine trouble diagnosis order by performing all communication (UXXXX) DTCs before other (PXXXX) DTCs.

NOTE:

- Freeze frame data is useful if the DTC is not detected.
- Perform Component Function Check if DTC CONFIRMATION PROCEDURE is not included in Service Manual. This simplified check procedure is an effective alternative though DTC cannot be detected during this check.
  If the result of Component Function Check is NG, it is the same as the detection of DTC by DTC CONFIRMATION PROCEDURE.

Is DTC detected?

YES >> GO TO 8.
NO >> Check according to GI-47, "Intermittent Incident".

6.PERFORM BASIC INSPECTION

Perform EC-904, "Work Procedure".

>> GO TO 7.

7.DETECT MALFUNCTIONING SYSTEM BY SYMPTOM TABLE

Detect malfunctioning system according to EC-1986, "Symptom Table" based on the confirmed symptom in step 4, and determine the trouble diagnosis order based on possible causes and symptoms.

>> GO TO 8.

8.DETECT MALFUNCTIONING PART BY DIAGNOSIS PROCEDURE

Inspect according to Diagnosis Procedure of the system.

NOTE:

The Diagnosis Procedure in EC section is described based on open circuit inspection. A short circuit inspection is also required for the circuit check in the Diagnosis Procedure. For details, refer to GI-49, "Circuit Inspection".

Is a malfunctioning part detected?

YES >> GO TO 9.

NO >> Monitor input data from related sensors or check voltage of related ECM terminals using CONSULT. Refer to EC-817, "Reference Value".

9.REPAIR OR REPLACE THE MALFUNCTIONING PART

1. Repair or replace the malfunctioning part.
2. Reconnect parts or connectors disconnected during Diagnosis Procedure again after repair and replacement.
3. Check DTC. If DTC is displayed, erase it.

>> GO TO 10.

10.FINAL CHECK

When DTC was detected in step 2, perform DTC CONFIRMATION PROCEDURE or Component Function Check again, and then check that the malfunction has been completely repaired.

When symptom was described from the customer, refer to confirmed symptom in step 3 or 4, and check that the symptom is not detected.

Is DTC detected and does symptom remain?

YES-1 >> DTC is detected: GO TO 8.

YES-2 >> Symptom remains: GO TO 6.

NO-1 >> Before returning the vehicle to the customer, always erase unnecessary DTC in ECM and TCM (Transmission Control Module). If the completion of SRT is needed, drive vehicle under the specific driving pattern. Refer to EC-806, "CONSULT Function".

NO-2 >> I/M examination, requested from the customer: GO TO 11.

11.PREPARE FOR I/M EXAMINATION

1. Set SRT codes. Refer to EC-906, "Description".
2. Erase permanent DTCs. Refer to EC-912, "Description".

>> INSPECTION END

Diagnostic Work Sheet

INFOID:0000000014419951

DESCRIPTION

There are many operating conditions that lead to the malfunction of engine components. A good grasp of such conditions can make troubleshooting faster and more accurate.
In general, each customer feels differently about an incident. It is important to fully understand the symptoms or conditions for a customer complaint.
Utilize a diagnostic worksheet like the one shown below in order to organize all the information for troubleshooting.
Some conditions may cause the MIL to come on steady and DTC to be detected. Examples:

- Vehicle ran out of fuel, which caused the engine to misfire.
- Fuel filler cap was left off or incorrectly screwed on, allowing fuel to evaporate into the atmosphere.

KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

SEF907L

WORKSHEET SAMPLE

Customer name MR/MS		Model & Year	VIN
Engine #		Trans.	Mileage
Incident Date		Manuf. Date	In Service Date
Fuel and fuel filler cap		☐ Vehicle ran out of fuel causing misfire ☐ Fuel filler cap was left off or incorrectly screwed on.	
Symptoms	☐ Startability	☐ Impossible to start ☐ No combustion ☐ Partial combustion ☐ Partial combustion affected by throttle position ☐ Partial combustion NOT affected by throttle position ☐ Possible but hard to start ☐ Others [ ]	
	☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]	
	☐ Driveability	☐ Stumble ☐ Surge ☐ Knock ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]	
	☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading	
Incident occurrence		☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime	
Frequency		☐ All the time ☐ Under certain conditions ☐ Sometimes	
Weather conditions		☐ Not affected	
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH	
Malfunction indicator lamp		☐ Turned on ☐ Not turned on	

MTBL0017

SERVICE AFTER REPLACING OR REMOVING ENGINE PARTS

Description

INFOID:0000000014419952

×:Applicable

Part name	Service performed		Required service	Reference
	Replace-ment	Removal*		
ECM	×	—	Additional service when replacing ECM	EC-886
Fuel injector	×	—	Injector adjustment value registration	EC-894
DPF (Diesel Particulate Filter)	×	—	DPF (Diesel Particulate Filter) data clear	EC-893

*: Harness connector disconnection included.

ADDITIONAL SERVICE WHEN REPLACING ECM

Description

INFOID:0000000014419953

When replacing ECM, this procedure must be performed.
NOTE:
The necessary operation is different depending on the operation result of ECM data save or write. Always perform the operation according to procedures. (For details, refer to EC-886, "Work Procedure".)

Work Procedure

INFOID:0000000014419954

1.SAVE ECM DATA

1. Turn ignition switch OFF and wait at least 1 minute.
2. Reconnect all harness connectors disconnected.
3. Turn ignition switch ON.
4. Select “SAVE COMPUTER DATA” in “Work support” mode of “ENGINE” using CONSULT.
5. Follow the instructions on CONSULT display.
   NOTE:
   Necessary data in ECM is copied and saved to CONSULT.

Is operation completed successfully?

YES >> GO TO 2.
NO >> GO TO 7.

2.REPLACE THE ECM

1. Turn ignition switch OFF and wait at least 1 minute.
2. Replace the ECM. Refer to EC-1994, "Removal and Installation".

>> GO TO 3.

3.PERFORM PROGRAMMING

Refer to CONSULT Operation Manual.

>> GO TO 4.

4.PERFORM ECM KEY ID REGISTRATION

Refer to CONSULT Immobilizer mode and follow the on-screen instructions.

>> GO TO 5.

5.PERFORM CONFIGURATION REGISTRATION

1. Turn ignition switch OFF and wait at least 1 minute.
2. Turn ignition switch ON.
3. Check that the battery voltage is between 11V and 14V.
4. Wait at least 10 seconds.
   CAUTION:
   During this step, never perform any vehicle operation.
5. If necessary, perform configuration registration using CONSULT function.

>> GO TO 6.

6.WRITE ECM DATA

1. Select “WRITE SAVED DATA” in “Work support” mode of “ENGINE” using CONSULT.
2. Follow the instructions on CONSULT display.
   NOTE:
   The data saved by “WRITE SAVED DATA” is written to ECM.

Is operation completed successfully?

YES >> GO TO 12.
NO >> GO TO 10.

7.REPLACE THE ECM

1. Turn ignition switch OFF and wait at least 1 minute.
2. Replace the ECM. Refer to EC-1994, "Removal and Installation".

>> GO TO 8.

8.PERFORM PROGRAMMING

Refer to CONSULT Operation Manual.

>> GO TO 9.

9.PERFORM ECM KEY ID REGISTRATION

Refer to CONSULT Immobilizer mode and follow the on-screen instructions.

>> GO TO 10.

10.PERFORM CONFIGURATION REGISTRATION

1. Turn ignition switch OFF and wait at least 1 minute.
2. Turn ignition switch ON.
3. Check that the battery voltage is between 11V and 14V.
4. Wait at least 10 seconds.
   CAUTION:
   During this step, never perform any vehicle operation.
5. If necessary, perform configuration registration using CONSULT function.

>> GO TO 11.

11.PERFORM INJECTOR ADJUSTMENT VALUE REGISTRATION

Perform EC-894, "Description".

>> GO TO 12.

12.PERFORM VIN REGISTRATION

Perform EC-895, "Description".

>> GO TO 13.

13.PERFORM SERVICE REGENERATION

Perform EC-889, "Aftertreatment DPF Regeneration Test".

>> GO TO 14.

14.CHANGE ENGINE OIL

Refer to LU-35, "Changing Engine Oil".

>> GO TO 15.

15.CHECK DTC

1. Turn ignition switch OFF and wait at least 1 minute.
2. Turn ignition switch ON.
3. Check DTC. If DTC is displayed, erase it.

>> Inspection End.

DIESEL PARTICLE FILTER REGENERATION

Aftertreatment SCR Performance Test

INFOID:0000000014419955

GENERAL INFORMATION

- Use the following procedure for additional information on the aftertreatment system. Refer to EX-42, "Removal and Installation".
- The following procedure contains information on how to perform an SCR Performance Test using CONSULT.
- The CONSULT SCR Performance Test uses the intake nitrogen oxides (NOx) sensor and outlet NOx sensor readings to test the efficiency of the SCR catalyst.

INSPECTION

- Use CONSULT to check for DTCs. If **any** DTCs are present, follow the corresponding diagnosis procedure before performing **any** part of this procedure.
- The DTC diagnosis procedure, in some cases, will refer back to this procedure to complete the diagnostics.

TEST

WARNING:

Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

Before performing an SCR Performance Test, follow the steps listed below:

- Select an appropriate location to park the vehicle:
  - On a surface that will **not** burn or melt under high temperatures (such as clean concrete or gravel, **not** grass or asphalt).
  - Away from anything that can burn, melt, or explode.
- Nothing within 0.6 m (2 ft) of the exhaust outlet.
- Nothing that can burn, melt, or explode within 1.5 m (5 ft) (such as gasoline, wood, paper, plastics, fabric, compressed gas containers, and hydraulic lines).
- Park the vehicle securely.
  - Set the parking brake.
  - Place the transmission in P (Park).
  - Set the wheel chocks at the front and rear of at least one tire.
- Set up a safe exhaust area.
  - If bystanders can possibly enter the area, use barriers to keep people at least 1.5 m (5 ft) from the exhaust outlet during the SCR Performance Test.
  - When indoors, attach an exhaust discharge pipe rated for at least 800° C (1,500° F).
  - Keep a fire extinguisher nearby.
- Check exhaust system surfaces.
  - Confirm that nothing is on or near the exhaust system surfaces (such as tools, rags, grease, or debris).
- Prepare for engine speed changes during the SCR Performance Test.
  - Stay clear of the engine compartment.
- Begin the SCR Performance Test.
  - CONSULT **must** be used to perform the SCR Performance Test.
  - The engine will create enough heat to run the test. Engine speed will increase and the turbocharger can whistle loudly during the testing process. Once the test is complete, the engine will automatically return to normal idle speed.
- Monitor the area.
  - Make sure that the vehicle and surrounding area are monitored during the SCR Performance Test. If **any** unsafe condition occurs, shut the engine OFF immediately.

To stop the test, engage the brake or throttle pedal, or turn the engine OFF.

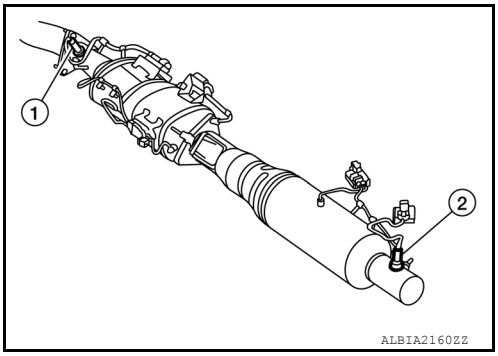
Once the test is complete, exhaust gas and exhaust surface temperatures will remain elevated for 3 to 5 minutes.

1. Before starting the SCR Performance Test, inspect the exhaust piping for leaks, cracks, and loose connections.

Tighten the exhaust clamps, if necessary. Inspect the exhaust and system for leaks. Tighten clamps as necessary. Refer to the appropriate procedure or equipment manufacturer service information for torque specifications.
Any leaks in the exhaust system will cause the SCR Performance Test to be less efficient. This will result in the test running longer and possibly **not** completing.

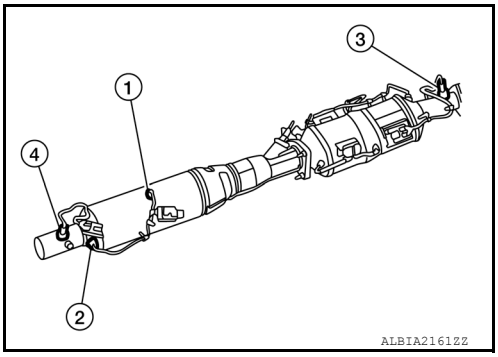
2. Select “SCR Performance Test” in “Active Test” mode of “ENGINE” using CONSULT.
3. Follow the instructions on CONSULT display.
To stop the SCR Performance Test at **any** time during the test:
   - Select End on the CONSULT screen.
   - Depress the brake.
   - Depress the accelerator pedal.
   - Turn the engine off.
4. The SCR Performance Test will perform the following actions:
Clean the aftertreatment system of **any** diesel exhaust fluid deposits.
   - Cleaning the aftertreatment system of diesel exhaust fluid deposits can take up to 2 hours to complete. If deposits are detected after 2 hours of run time, the test will time out.

Perform a NOx sensor rationality test.
   - The intake NOx sensor (1) and outlet NOx sensor (2) readings will be compared to determine if they are working properly.
   - If one, or both, of the NOx sensors fail the rationality test, the test will stop and a pop-up message will be displayed, stating that the NOx sensor has failed and troubleshooting is required.



Check the SCR catalyst efficiency.
   - Diesel exhaust fluid will be injected into the aftertreatment system and the outlet NOx sensor reading will be compared to the intake NOx sensor reading to determine the efficiency of the SCR catalyst.
   - If the SCR catalyst fails the efficiency test, a pop-up message will be displayed, stating that the SCR catalyst **must** be replaced.

5. During the SCR Efficiency Test, the following will be monitored:
   - SCR inlet temperature (1)
   - SCR outlet temperature (2)
   - Intake NOx sensor reading (3)
   - Outlet NOx sensor reading (4)

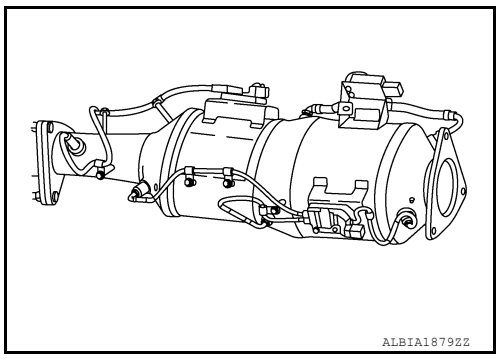


6. Once the SCR Performance Test is started, follow the instructions on CONSULT display. When the test is started, the engine idle speed will be raised automatically to the required level.
   - Through engine controls, the engine will operate in a manner to build exhaust heat. The turbocharger will emit a slight whining noise during this test. This is normal.
   - Once the SCR Performance Test is complete, the engine will automatically return to normal idle speed.
7. Once the test is complete, check for current DTCs and/or engine indicator lamps. If **any** current DTCs are present, follow the appropriate DTC diagnosis procedure.

Aftertreatment DPF Regeneration Test

INFOID:0000000014419956

GENERAL INFORMATION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Use the following procedure for additional information on the aftertreatment system. Refer to EX-10, "System Description".
The following procedure contains information about how to inspect the diesel particulate filter (DPF) and perform a stationary regeneration.
There are two main steps when checking the DPF:
- The Initial Check section of this procedure is used to determine the condition of the DPF without removal of the diesel oxidation catalyst diesel particulate filter (DOC DPF). The Initial Check step should be used to determine if the DPF has malfunctioned due to progressive damage.
- The Test section of the procedure explains how to perform a stationary regeneration using CONSULT. The Test step should **only** be performed when troubleshooting procedures and/or engine indicator lamps indicate this is necessary.

If the DPF requires replacement, before replacement:
- Troubleshoot and clear all DTCs.
- Verify the correct fuel type is being used.
- Troubleshoot **any** oil consumption complaint.
- Troubleshoot **any** coolant consumption complaint.
- Inspect the diesel oxidation catalyst (DOC) inlet. Refer to EX-42, "Removal and Installation".

The CONSULT DPF Stationary Regeneration Test can be used to:
- Regenerate an aftertreatment DPF.
- Recover the aftertreatment diesel oxidation catalyst and aftertreatment DPF after coolant contamination.
- Reset the stored soot load in the engine control module (ECM).
- Check the aftertreatment diesel oxidation catalyst efficiency.
- Check for the presence of the DOC.
- Check for the correct installation of the temperature sensors.

The DPF Stationary Regeneration Test can be used to regain functionality of the DOC and DPF after either or both have been exposed to coolant.
The temperatures that are achieved during regeneration are high enough to evaporate the coolant out of both components and return them to normal operating specifications.
NOTE:
If these components are suspected of having coolant contamination, do **not** perform the Snap Acceleration Test before performing the regeneration.

INITIAL CHECK

1. Using CONSULT, check for DTCs. If **any** DTCs are present, follow the corresponding diagnosis procedure before performing **any** part of this procedure.
   - The DTC diagnosis procedure, in some cases, will refer back to this procedure to complete the diagnostics.
   - Inspection of the exhaust system outlet can reveal the condition of the DPF. The exhaust system outlet should appear clean with little to **no** exhaust residue/soot buildup.
   - The DPF is **not** 100% efficient. Some accumulation of exhaust residue/soot is normal and does **not** indicate a malfunctioning DPF.
   - A heavy buildup of exhaust residue/soot can indicate a malfunctioning DPF.

   To determine if the exhaust residue/soot accumulation on the exhaust system outlet is the result of a malfunctioning DPF, perform one of the following:
   - Snap Acceleration Test. Refer to EC-896, "Work Procedure".
   - Clean the last 152 to 254 mm (6 to 10 in) of the exhaust system outlet. Operate the vehicle for one shift or trip and inspect the exhaust system outlet for exhaust residue/soot accumulation.
   - Inspect the aftertreatment DPF. Refer to EX-42, "Removal and Installation".

TEST

WARNING:
Exhaust system components can become hot enough during operation and testing to cause burns or ignite and melt combustible materials. The exhaust and exhaust components can remain hot after the vehicle stops moving and has been shut down. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning repairs or service. Make sure that no combustible materials are located where they are likely to come in contact with hot exhaust or exhaust components.

NOTE:
If the stationary regeneration is being performed to recover either the DOC or DPF, or both, after coolant contamination, the DOC does **not** need to be removed or inspected unless there are current DTCs that require inspection as part of the DTC troubleshooting steps.
Before performing stationary regeneration, follow the steps listed below:
- Select an appropriate location to park the vehicle.
  - On a surface that will **not** burn or melt under high temperatures (such as clean concrete or gravel, **not** grass or asphalt)
  - Away from anything that can burn, melt, or explode
- Nothing within 0.6 m (2 ft) of the exhaust outlet
- Nothing that can burn, melt, or explode within 1.5 m (5 ft) (such as gasoline, wood, paper, plastics, fabric, compressed gas containers, and hydraulic lines)
- Park the vehicle securely.
  - Set the parking brake.
  - Place the transmission in P (Park).
  - Set the wheel chocks at the front and rear of at least one tire.
- Set up a safe exhaust area.
  - If bystanders can possibly enter the area, use barriers to keep people at least 1.5 m (5 ft) from the exhaust outlet during regeneration.
  - When indoors, attach an exhaust discharge pipe rated for at least 800° C (1,500° F).
  - Keep a fire extinguisher nearby.
- Check exhaust system surfaces.
  - Confirm that nothing is on or near the exhaust system surfaces (such as tools, rags, grease, or debris).
- Prepare for engine speed changes during regeneration.
  - Stay clear of the engine compartment.
- Begin the stationary regeneration.
  - CONSULT can be used to perform regeneration by starting the DPF Regeneration Test.
  - The engine will create enough heat to regenerate the DPF. Engine speed will increase and the turbocharger can whistle loudly during the regeneration process. Once the DPF is regenerated, the engine will automatically return to normal idle speed.
  - Make sure that the vehicle and surrounding area is monitored during regeneration. If **any** unsafe condition occurs, shut the engine off immediately.
- Monitor the area.
  - Make sure that the vehicle and surrounding area are monitored during regeneration. If **any** unsafe condition occurs, shut the engine OFF immediately.

To stop a stationary regeneration, engage the brake or throttle pedal, or turn off the engine.
Once regeneration is complete, exhaust gas and exhaust surface temperatures will remain elevated for 3 to 5 minutes.

1. Select “DPF Regeneration” in “Active Test” mode of “ENGINE” using CONSULT.
2. Follow the instructions on CONSULT display.
   To stop the stationary regeneration test at **any** time during the test:
   - Select End on CONSULT screen.
   - Depress the brake.
   - Depress the accelerator pedal.
   - Turn the engine off.
3. During the Aftertreatment DPF Regeneration Test, the following will be monitored:
   - Aftertreatment DPF Soot Load: Informs the user of the current soot load of the filter.
     - Normal: No regeneration is necessary.
     - Above Normal: Least Severe Level - A stationary regeneration can be performed.
     - Above Normal: Moderately Severe Level - A stationary regeneration can be performed.
     - Above Normal: Most Severe Level - A stationary regeneration should **not** be performed unless the filter is cleaned or a new filter has been installed and the troubleshooting steps indicate it should be performed.
   - DPF Outlet Temperature
   - DPF Inlet Temperature
   - Diesel Oxidation Catalyst Inlet Temperature
4. Before starting the Aftertreatment DPF Regeneration Test, inspect the exhaust piping for leaks, cracks, and loose connections. Refer to EX-19, "Checking Exhaust System".
   Tighten the exhaust clamps (if necessary). Refer to EX-24, "Exploded View".

Any leaks in the exhaust system will cause the Aftertreatment DPF Regeneration Test to be less efficient in reducing the soot load of the filter. This will result in the test running longer and possibly **not** completing.

5. Once the Aftertreatment DPF Regeneration Test is started, follow the instructions on CONSULT display. When the test is started, the engine idle speed will be raised automatically to the required level.
   The engine will, through engine controls, operate in a manner to build exhaust heat. The turbocharger will emit a slight whining noise during this test. This is normal.
   Once the Aftertreatment DPF Regeneration Test is complete, the engine will automatically return to normal idle speed.
6. Once the test is complete, check for current DTCs and/or engine indicator lamps for high diesel particulate soot load after performing the Aftertreatment DPF Regeneration Test. If **any** current DTCS are present, follow the appropriate DTC diagnosis procedure.

DIESEL PARTICULATE FILTER DATA CLEAR

Description

INFOID:0000000014419957

Perform “AFT maintenance” in “Work support” mode of “ENGINE” with CONSULT when oxidation catalyst with diesel particulate filter is replaced with a new one. Based on the signal from sensors, ECM estimates the amount of particulate matter in diesel particulate filter and stores the value in EEPROM as diesel particulate filter data. When oxidation catalyst with diesel particulate filter is replaced with a new one, there is a difference between diesel particulate filter data stored in ECM and the actual amount of particulate matter in diesel particulate filter because no particulate matter is trapped in new diesel particulate filter. In this case, ECM cannot perform regeneration control correctly. So perform “AFT maintenance” in “Work support” mode of “ENGINE” using CONSULT to clear diesel particulate filter data stored in ECM. Refer to EC-893, "Work Procedure".

CAUTION:

Never perform “AFT maintenance” in “Work support” mode of “ENGINE” using CONSULT when oxidation catalyst with diesel particulate filter is not replaced with a new one. Diesel particulate filter may be damaged because regeneration is not performed at appropriate timing.

Work Procedure

INFOID:0000000014419958

1.PERFORM AFT MAINTENANCE

1. Turn ignition switch ON.
2. Select “AFT maintenance” in “Work support” mode of “ENGINE” using CONSULT.
3. Follow the instructions on CONSULT display.
4. It is normal to have DTC P2463 at this point. Refer to EC-1897, "DTC Description" to clear DTC.

>> Inspection End.

INJECTOR ADJUSTMENT VALUE REGISTRATION

Description

INFOID:0000000014419959

Injector adjustment value indicates manufacturing tolerance and the value is printed on the top of fuel injector. The injector adjustment value which is correctly stored in ECM is needed for precise fuel injection control.
A performance of emission control and drivability may affect when there is a mismatch between the following two values:
- The injector adjustment value stored in ECM
- The injector adjustment value of the injector which is installed on the vehicle

Injector Adjustment Value Registration must be performed after the following cases:
- Injector(s) are replaced.
- Injector Adjustment Value Registration for the replaced fuel injector must be performed.
- ECM is replaced.
- Injector Adjustment Value Registration for all the fuel injectors must be performed.

NOTE:
The necessary operation is different depending on the operation result of ECM data save or write. Always perform the operation according to procedures. Refer to EC-886, "Description".

Work Procedure

INFOID:0000000014419960

1.START

NOTE:
- **Before performing this procedure, record injector adjustment value printed on a fuel injector.**

1. Turn ignition switch ON (engine stopped).
2. Select “ENTER INJECTOR CODES” in “Work support” mode of “ENGINE” using CONSULT.
3. Touch “START”.
   NOTE:
   When touching “START”, CONSULT reads injector adjustment values stored in ECM.
4. Select the number of the cylinder which needs Injector Adjustment Value Registration.
5. Input injector adjustment value.
6. Repeat step 4 - 5 until there is no cylinder which needs Injector Adjustment Value Registration, and touch “START”.
   NOTE:
   When touching “START”, injector adjustment values stored in CONSULT are written onto ECM memory.
7. Check that the following values are same for each cylinder:
   - Injector adjustment value which is printed on a fuel injector.
   - Injector adjustment value which is displayed on CONSULT screen.

   NOTE:
   - In this step, CONSULT reads injector adjustment values stored in ECM and displays the values on the CONSULT screen. This is for checking if injector adjustment values are written onto ECM memory correctly.
   - If DTC is detected, perform DTC Confirmation Procedure for the DTC, and check if the same DTC is detected again.
8. Turn ignition switch OFF and wait at least 1 minute.

>> Inspection End.

VIN REGISTRATION

Description

INFOID:0000000014419961

VIN Registration is an operation to register VIN in ECM. It must be performed each time ECM is replaced. (For details, refer to EC-895, "Work Procedure".)

Work Procedure

INFOID:0000000014419962

1.CHECK VIN

Check the VIN of the vehicle and note it. Refer to GI-36, "Identification Number".

>> GO TO 2.

2.PERFORM VIN REGISTRATION

With CONSULT

1. Turn ignition switch ON and engine stopped.
2. Select “VIN REGISTRATION” in “Work support” mode of “ENGINE”.
3. Follow the instructions on CONSULT display.

>> Inspection End.

SNAP ACCELERATION TEST

Work Procedure

INFOID:0000000014419963

NOTE:
If any DTCs are present, diagnose DTCs before performing any part of this procedure.

AFTERTREATMENT CONNECTED

Monitoring the condition of the exhaust leaving the exhaust system outlet during a Snap Acceleration Test can reveal the condition of the aftertreatment diesel particulate filter (DPF).

NOTE:
The engine must be at minimum operating temperature or above when completing this test

1. Place vehicle transmission in N (Neutral) and apply the parking brake.
2. Start and idle the engine.
3. Rapidly depress the accelerator pedal from 0-100%. This can be performed multiple times, if necessary.
4. Check for black smoke exiting the exhaust stack as the engine is accelerated from low idle to high idle.
   NOTE:
   In some applications, a Snap Acceleration Test may not provide the conditions necessary to reveal a malfunctioning aftertreatment DPF. If there is a heavy buildup of exhaust residue/soot on the exhaust system outlet and a Snap Acceleration Test does not reveal a condition outlined in the following steps, it may be necessary to perform a brief acceleration run under partial to full load.

- White smoke can indicate condensation in the exhaust and/or some unburned fuel. White smoke is not an indication of a malfunction of the aftertreatment system.
- Visible gray smoke or faint black smoke out of the exhaust system outlet indicates that the aftertreatment DPF is damaged. Inspect the aftertreatment DPF.
- Visible black smoke out of the exhaust system outlet indicates a malfunction of the aftertreatment DPF.

AFTERTREATMENT DISCONNECTED

WARNING:
The exhaust and exhaust components can remain hot after the engine has been shut down or secured. To avoid the risk of fire, property damage, burns or other serious personal injury, allow the exhaust system to cool before beginning this procedure or repair and make sure that no combustible materials are located where they might come in contact with hot exhaust or exhaust components.

1. Remove the diesel oxidation catalyst diesel particulate filter (DOC DPF) assembly. Refer to EX-42, "Removal and Installation".
2. Place vehicle transmission in N (Neutral) and apply the parking brake.
3. Start and idle the engine.
4. Quickly depress the accelerator pedal from 0-100%. Hold for 5 seconds and then release. This can be performed multiple times, if necessary.
5. Check for black smoke exiting the turbocharger turbine outlet as the engine is accelerated from low idle to high idle and at high idle.

- A small puff of black smoke upon acceleration that clears at a steady high idle speed is normal.
- White smoke during the Snap Acceleration Test does not indicate a malfunction.
- Heavy black smoke indicates other upstream engine issues that need to be diagnosed.

6. Connect the diesel oxidation catalyst diesel particulate filter (DOC DPF) assembly. Refer to EX-42, "Removal and Installation".
7. Inspect the exhaust piping for leaks, cracks, and loose connections.
8. Perform the Aftertreatment DPF Regeneration. Refer to EC-889, "Aftertreatment DPF Regeneration Test".
9. Check for current DTCs and/or engine indicator lamps for high aftertreatment diesel particulate soot load. If any current DTCs are present. Refer to EC-838, "DTC Index".

CYLINDER CUTOUT TEST

Description

INFOID:0000000014419964

Use the Single-Cylinder Cutout Test to remove individual cylinders from the engine firing cycle and to monitor a running engine while the selected cylinder is disabled. The system displays the rpm values while the cylinder is disabled.

Work Procedure

INFOID:0000000014419965

1.PERFORM CYLINDER CUTOUT TEST

With CONSULT

1. Engine running at idle and A/C OFF.
2. Select “Cylinder Cutout Test” in “” mode of “ENGINE”.
3. Follow the instructions on CONSULT display.

>> Inspection End.

DEF SYSTEM LEAK TEST

Work Procedure

INFOID:0000000014419966

GENERAL INFORMATION

If the aftertreatment diesel exhaust fluid (DEF) dosing system has been serviced or repaired, it will be necessary to prime the DEF dosing system in order to check for proper operation.
This test will cause the DEF dosing unit to draw DEF from the tank and pressurize it in the DEF dosing valve supply line. During this test, the dosing unit will continuously run and all unused DEF will return to the tank. An audible pumping noise will be noticeable during the test

INITIAL SETUP

NOTE:
It may be necessary to allow the aftertreatment system time to cool to allow for accessibility to check for leaking components.

- Make sure the DEF tank is full of DEF.
- Make sure the DEF is not frozen. If the DEF is frozen, it will be necessary to run the engine to allow the system to thaw.
- Make sure all DEF dosing system lines are properly connected to the DEF tank and the DEF dosing valve.
- Connect CONSULT.

PRIME

1. Turn ignition switch ON.
2. Select “DEF System Leak Test” in “Active Test” mode of “ENGINE” using CONSULT.
3. Touch “Start”. During the initialization of this test, a note will appear on the screen indicating that the system has reached a primed state.

NOTE:

- The dosing system should prime in under 1 minute for a system without leaks. If the dosing system does not prime, it may be due to a leak in the dosing valve or supply line.
- If the system fails to prime, a key cycle will be required before attempting to run the DEF System Leak Test again.
- The DEF System Leak Test can only be attempted twice consecutively. A key cycle will be required before attempting to run the DEF System Leak Test again after two attempts.

INSPECT

NOTE:
If the system is unable to prime due to leaks, it will be necessary to turn the ignition switch OFF in order to stop the dosing unit. The dosing unit cannot be stopped using CONSULT.
While the test is running, inspect all DEF lines, fittings, and connections for external leaks.

NOTE:

- If the system cannot build pressure, it will attempt to prime multiple times before setting a DTC.
- If any DTCs occur while running this test, reference the appropriate DTC. Refer to EC-838, "DTC Index".

FINISHING STEPS

- During the test, a small quantity of DEF is sprayed into the aftertreatment decomposition tube. After completion of the test, it is necessary to run the engine at high idle for 5 minutes in order to prevent DEF deposits from forming in the aftertreatment decomposition tube.
- Check for DTCs using CONSULT.

DEF DOSING UNIT OVERRIDE TEST

Work Procedure

INFOID:0000000014419967

GENERAL INFORMATION

Perform a dosing cycle to check the:
- Aftertreatment diesel exhaust fluid (DEF) dosing valve spray characteristics.
- Amount of DEF to be delivered in a specified time (6 minutes).

INITIAL CHECK

- Check for any leaks, blockages, or restrictions in the DEF line between the aftertreatment DEF dosing unit and the aftertreatment DEF dosing valve.
- Check for an adequate amount of DEF in the DEF tank prior to starting this test.
- Check the concentration and quality of the DEF.

PREPARATION

NOTE:
Low battery voltage can cause the dosing volume to be low. Check the batteries. See equipment manufacturer service information.
- Disconnect the batteries. Refer to PG-185, "Battery Disconnect".
- Remove the aftertreatment DEF dosing valve. Refer to EX-64, "Removal and Installation".

SETUP

WARNING:
To reduce the risk of personal injury, do not get Diesel Exhaust Fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.
CAUTION:
- **Care should be taken when handling and/or disconnecting the DEF line from the aftertreatment DEF dosing valve. The intake connection of the aftertreatment DEF dosing valve is plastic and can be easily damaged.**
- **Do not connect a 12V or 24V supply to the aftertreatment DEF dosing valve as this will cause permanent damage.**

NOTE:
It is usually easier to capture the DEF in a clean container and then transfer it to the measuring device for the final measurement.
Obtain a clear plastic container (large enough to hold the aftertreatment DEF dosing valve) and a graduated beaker, or equivalent. A measuring cup that is marked in milliliters (ml) or ounces (oz) can also be used.
The measuring device must be capable of measuring between 0 ml (0.0 oz) and 500 ml (17.0 oz) in 5 ml (0.34 oz) increments
1. Connect the electrical and DEF lines.
2. Place the aftertreatment DEF dosing valve into the container.
3. When the test begins, briefly monitor the spray pattern of the DEF exiting the aftertreatment DEF dosing valve. Check for the following:

- Signs of larger drops and/or dripping DEF from the tip.
- Spray pattern that is not symmetrical (sprays more to one side).

NOTE:
- When the test is started, the dosing system will first prime. During this process, the aftertreatment DEF dosing valve will open intermittently to purge air from the system. In doing so, some DEF will be sprayed from the tip. This is a normal operating characteristic.
- When the test is being performed, the aftertreatment DEF dosing valve will spray a very fine mist of DEF. To prevent fine mist from escaping into the air and to make sure of an accurate measurement, place a clean shop towel or cover over the valve and container.

FLOW TEST

NOTE:
Prior to performing this test, if not already directed by a DTC, view and troubleshoot any DTCs.
1. Turn the ignition switch ON.
2. Select “DEF Dosing Unit Override Test” in “Active Test” mode of “ENGINE” using CONSULT.
3. Touch “Start”.
4. Follow the instructions on CONSULT display.

NOTE:
CONSULT will start the test and will inject the DEF for 6 minutes. CONSULT will automatically disable the injector at the end of the test. If the test needs to be stopped before finishing, touch “End”.

5. Perform the test three times. The amount of DEF measured for each test must be within specification.

DEF dosing valve volume : 85-115 mm (2.9-3.9 in)

6. If the amount of DEF is not within specification, verify the DEF filter is not plugged and check for leaks, blockages, or restrictions in the DEF line between the DEF dosing unit and the DEF dosing valve.
NOTE:
- Do not pour the DEF back into the DEF tank. Dispose of the DEF in accordance with local environmental regulations.
- The DEF dosing valve may have been plugged by debris. Inspect the DEF dosing unit filter for signs of contamination and debris prior to installing the new DEF dosing valve.

7. Disconnect the electrical and DEF lines.

FINISHING STEPS

- Install the DEF dosing valve. Refer to EX-64, "Removal and Installation".
- Connect the batteries. Refer to PG-185, "Battery Disconnect".

ROTARY TURBINE CONTROL VALVE ACTUATOR TEST

Description

INFOID:0000000014419968

The test confirms the rotary control valve can achieve all positions in its operating range. The test results determine if further inspection is required of the following components:

- Rotary turbine control valve linkage and actuators
- Turbocharger

Work Procedure

INFOID:0000000014419969

1.PERFORM RTCV HYSTERESIS TEST

1. Turn ignition switch ON.
2. Select “RTCV Hysteresis Test” in “Active Test” mode of “ENGINE” using CONSULT.
3. Touch “Start”.
4. Follow the instructions on CONSULT display.

>> Inspection End.

ROTARY TURBINE CONTROL VALVE ACTUATOR CALIBRATION

Description

INFOID:0000000014419970

The rotary turbine control valve actuator must be calibrated to the rotary turbine control valve. This step must be performed to be sure proper turbocharger operation is achieved.
(For details, refer to EC-902, "Work Procedure".)

Work Procedure

INFOID:0000000014419971

1.PERFORM ROTARY TURBINE CONTROL VALVE ACTUATOR CALIBRATION

CONSULT
1. Turn ignition switch ON.
2. Select “RTCV actuator calibrate” in “Work support” mode of “ENGINE”.
3. **NOTE:**
   The calibrate command must only be performed with the actuator mounted to the engine and attached to the linkage.
   Touch “Calibrate”.
4. Follow the instructions on CONSULT display.
   NOTE:
   It is normal to have DTC P2262 at this point.
5. If CONSULT indicates the procedure was stopped or failed, turn the ignition switch OFF for 70 seconds, then turn the ignition switch ON and repeat steps 3 and 4 up to (5) times.
6. After (5) consecutive failed attempts, it is necessary to replace the rotary turbine control valve actuator linkage.
7. Using CONSULT, erase "ENGINE" diagnostic trouble codes.

>> GO TO 2.

2.VERIFY ROTARY TURBINE CONTROL VALVE ACTUATOR CALIBRATION

Operate the engine to be sure the turbocharger actuator operates correctly and all turbocharger actuator DTCs are past.

>> Inspection End.

FAN OVERRIDE TEST

Work Procedure

INFOID:0000000014419972

1.PERFORM ENGINE FAN OVERRIDE TEST

CONSULT

1. Engine running at idle and A/C OFF.
2. Select “Engine Fan Override Test” in “Active Test” mode of “ENGINE”.
3. Touch “Start”.
4. Follow the instructions on CONSULT display.

>> Inspection End.

BASIC INSPECTION

Work Procedure

INFOID:0000000014419973

1.INSPECTION START

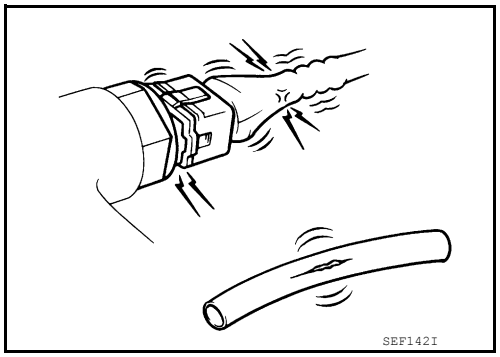
1. Check service records for any recent repairs that may indicate a related incident.
2. Check the current need for scheduled maintenance, especially for fuel filter and air cleaner filter. Refer to EC-1989, "Inspection".
3. Open hood and check the following:

- Harness connectors for improper connections
- Vacuum hoses for splits, kinks, or improper connections
- Wiring for improper connections, pinches, or cuts

4. Confirm that electrical or mechanical loads are not applied.

- Headlamp switch is OFF.
- Air conditioner switch is OFF.
- Steering wheel is in the straight-ahead position, etc.

5. Start engine and warm it up to the normal operating temperature.



>> GO TO 2.

2.CHECK IDLE SPEED

Check idle speed.
For procedure, refer to EC-1989, "Inspection".
For specification, refer to EM-529, "GENERAL SPECIFICATIONS".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.CHECK FOR INTAKE AIR LEAK

Listen for an intake air leak after the mass air flow sensor.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace the malfunctioning part.

4.BLEED AIR FROM FUEL SYSTEM

1. Stop engine.
2. Bleed air from fuel system. Refer to FL-24, "Low-Pressure System Check".

>> GO TO 5.

5.CHECK IDLE SPEED AGAIN

1. Start engine.
2. Check idle speed.
   For procedure, refer to EC-1989, "Inspection".
   For specification, refer to EM-529, "GENERAL SPECIFICATIONS".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 6.

6.DRAIN WATER FROM FUEL FILTER

1. Stop engine.
2. Drain water from fuel filter. Refer to FL-31, "Drain".

>> GO TO 7.

7.CHECK IDLE SPEED AGAIN

1. Start engine.
2. Check idle speed.
   For procedure, refer to EC-1989, "Inspection".
   For specification, refer to EM-529, "GENERAL SPECIFICATIONS".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 8.

8.CHECK AIR CLEANER FILTER

1. Stop engine.
2. Check air cleaner filter for clogging or breaks.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace air cleaner filter.

9.CHECK BATTERY VOLTAGE

Check battery voltage.

Voltage: More than 12.13V

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10.CHECK BATTERY

Refer to PG-175, "How to Handle Battery".

Is the inspection result normal?

YES >> Check charging system. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".
NO >> Repair or replace the malfunctioning part.

11.CHECK COMPRESSION PRESSURE

Check compression pressure. Refer to EM-203, "Compression Check".

Is the inspection result normal?

YES >> GO TO 12.
NO >> Follow the instruction of “CHECKING COMPRESSION PRESSURE”.

12.CHECK IDLE SPEED AGAIN

Check idle speed.
For procedure, refer to EC-1989, "Inspection".
For specification, refer to EM-529, "GENERAL SPECIFICATIONS".

Is the inspection result normal?

YES >> INSPECTION END
NO >> Check fuel injector. Refer to FL-24, "Low-Pressure System Check". And then, GO TO 2.

HOW TO SET SRT CODE

Description

INFOID:0000000014419974

OUTLINE

In order to set all SRTs, the self-diagnoses as in the “SRT ITEM” table must have been performed at least once. Each diagnosis may require actual driving for a long period of time under various conditions.

SRT ITEM

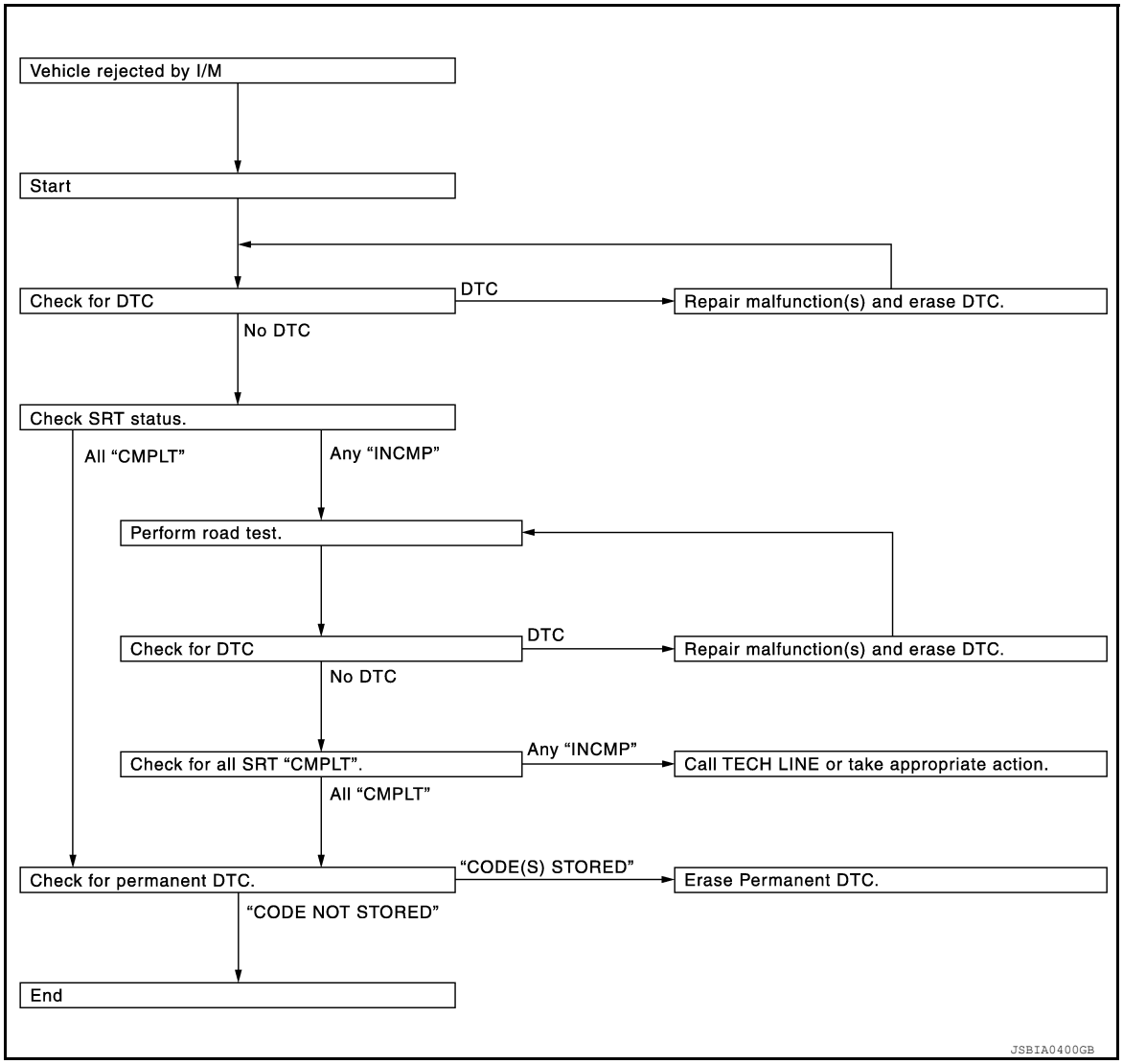
The table below shows required self-diagnostic items to set the SRT to “CMPLT”.

SRT item (CONSULT indication)	Performance Priority*	Required self-diagnostic items to set the SRT to “CMPLT”	Corresponding DTC No.
EGR/VVT SYSTEM	1	EGR and EGR cooler functions	P0406, P040C, P040D, P2457, P245C, P245D, P2493
	2	EGR and EGR cooler functions	P0401, P0402, P0405, P040B, P046C, P2494, P2495
PARTICULATE MATTER SENSOR	—	Not equipped. This item is listed, but not applied currently	N/A
EXHAUST GAS SYSTEM	1	Exhaust gas monitoring	P0489, P0490, P2080, P2413, P2471, P2482
	2	Exhaust gas monitoring	P0544, P0545, P0546, P2031, P2032, P2033, P242B, P242C, P242D, P2470, P2472, P2481, P2483
BOOST PRESSURE	1	Turbo charger boost pressure system	P0046, P0047, P004E, P00AF, P0237, P0238, P0262
	2	Turbo charger boost pressure system	P0263, P226C
NOx/SCR after monitor ready	1	NOx and SCR monitoring	P1C54, P1C70, P20EE, P214A, P214B, P214C, P214D, P2201, P2BA7, P2BAC, P2BAF
	2	NOx and SCR monitoring	U029D, U029E, U059E, U059F, P1C55, P1C56, P2202, P2209, P220A, P220B, P221A, P229E, P229F, P22A7, P2BAD
CATALYST	1	Catalyst efficiency	P0420, P1484, P200E
	2	Catalyst efficiency	P0421

*: If completion of several SRTs is required, perform driving patterns (DTC confirmation procedure), one by one based on the priority for models with CONSULT.

SRT SERVICE PROCEDURE

If a vehicle has failed the state emissions inspection due to one or more SRT items indicating “INCMP”, review the flowchart diagnostic sequence, referring to the following flowchart.

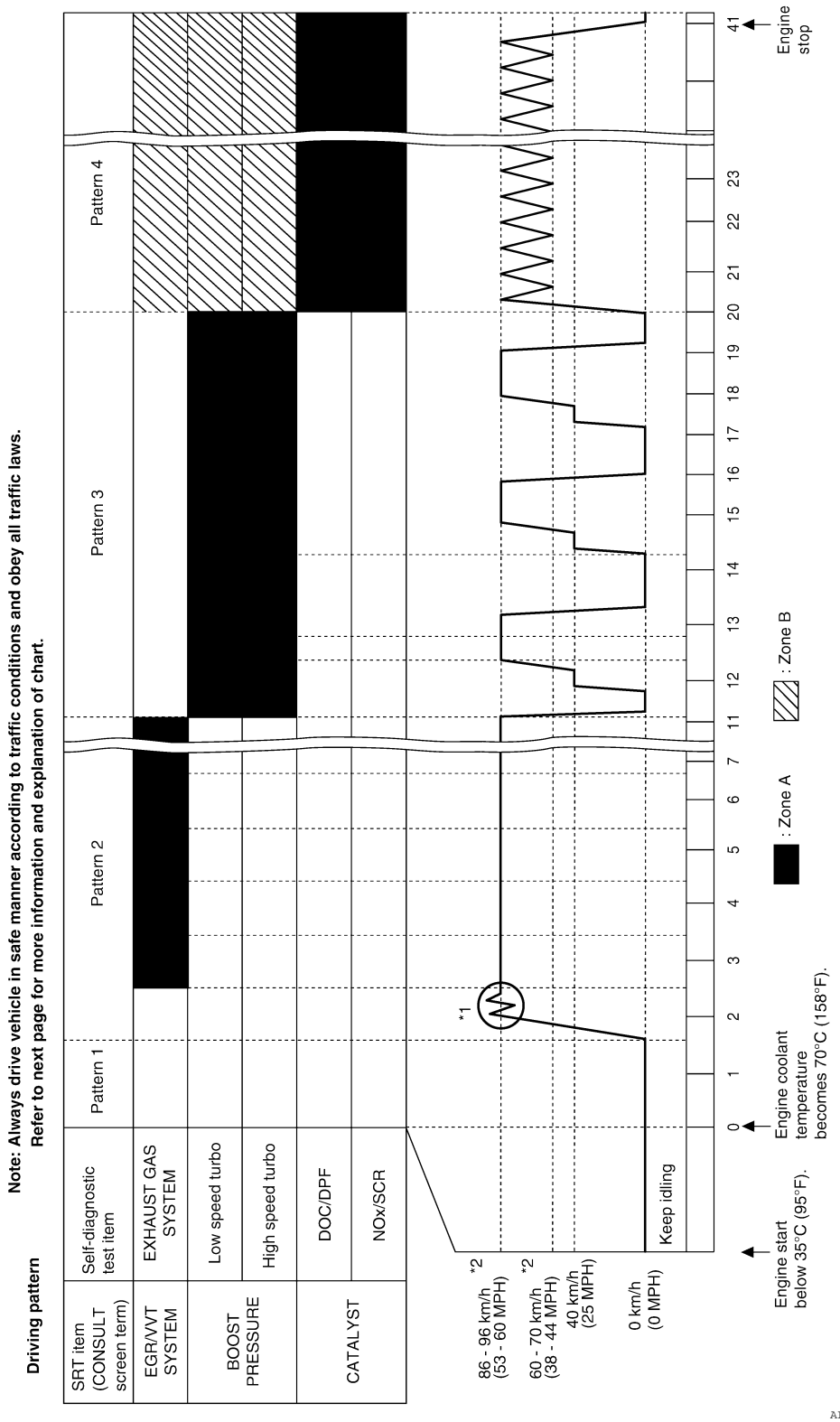


SRT Set Driving Pattern

INFOID:0000000014419975

CAUTION:

Always drive the vehicle in safe manner according to traffic conditions and obey all traffic laws.



ALBIA3001GB

*1: Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

*2: Checking the vehicle speed with GST is advised.

- The time required for each diagnosis varies with road surface conditions, weather, altitude, individual driving habits, etc.
  Zone A refers to the range where the time, required for the diagnosis under normal conditions*, is the shortest.

Zone B refers to the range where the diagnosis can still be performed if the diagnosis is not completed within zone A.

*: Normal conditions refer to the following:

- Sea level
- Flat road
- Ambient air temperature: 20 - 30°C (68 - 86°F)
- Diagnosis is performed as quickly as possible under normal conditions.
  Under different conditions [For example: ambient air temperature other than 20 - 30°C (68 - 86°F)], diagnosis may also be performed.

Work Procedure

INFOID:0000000014419976

1.CHECK DTC

Check DTC.

Is any DTC detected?

YES >> Repair malfunction(s) and erase DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK SRT STATUS

WITH CONSULT
Select “SRT STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
WITHOUT CONSULT
Perform “SRT status” mode with EC-801, "System Readiness Test (SRT) Code".
WITH GST
Select Service $01 with GST.

Is SRT code(s) set?

YES >> GO TO 10.
NO-1 >> With CONSULT: GO TO 3.
NO-2 >> Without CONSULT: GO TO 4.

3.DTC CONFIRMATION PROCEDURE

1. Select “SRT WORK SUPPORT” in “DTC & SRT CONFIRMATION” mode with CONSULT.
2. For SRT(s) that is not set, perform the corresponding “DTC CONFIRMATION PROCEDURE” according to the “Performance Priority” in the “SRT ITEM” table. Refer to EC-801, "System Readiness Test (SRT) Code".
3. Check DTC.

Is any DTC detected?

YES >> Repair malfunction(s) and erase DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 9.

4.PERFORM ROAD TEST

- Check the “Performance Priority” in the “SRT ITEM” table. Refer to EC-801, "System Readiness Test (SRT) Code".
- Perform the most efficient SRT set driving pattern to set the SRT properly. Refer to the applicable driving pattern below.
  In order to set all SRTs, the SRT set driving pattern must be performed at least once.

>> GO TO 5.

5.PATTERN 1

1. Check the vehicle condition;

- Engine coolant temperature is −10 to 35°C (14 to 95°F).
- Fuel tank temperature is more than 0°C (32°F).

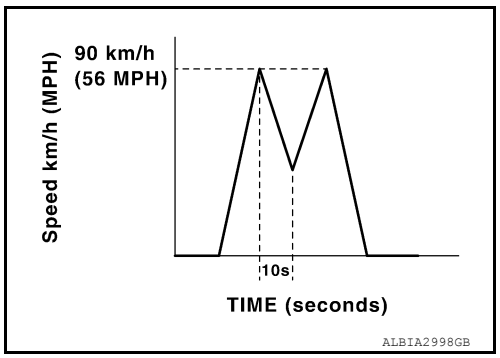
2. Start the engine.
3. Keep engine idling until the engine coolant temperature is greater than 70°C (158°F)

>> GO TO 6.

6.PATTERN 2

1. Accelerate the vehicle to reach a speed of 90 km/h (56 MPH).
   CAUTION:
   Always drive vehicle at safe speed.
2. Release the accelerator pedal for more than 10 seconds.
3. Accelerate to reach a speed of 90 km/h (56 MPH) again.
4. Bring the vehicle to a complete stop.

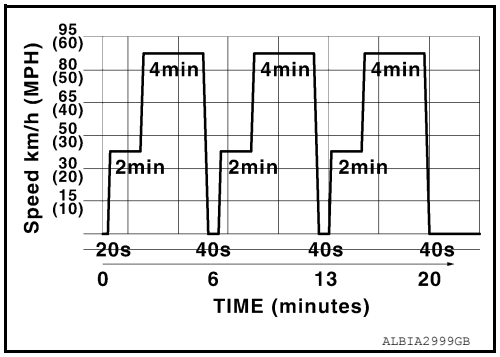
NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.



>> GO TO 7.

7.PATTERN 3

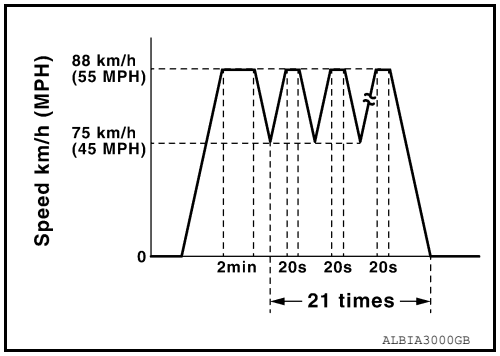
1. Accelerate the vehicle to reach 40 km/h (25 MPH), and continue at this speed for 2 minutes.
2. Increase vehicle speed to 88 km/h (55 MPH), and continue at this speed for 4 minutes.
3. Bring the vehicle to a complete stop by braking as little as possible and idle for 40 seconds.
4. Repeat steps 1 through 3 two more times.



>> GO TO 8.

8.PATTERN 4

1. Accelerate the vehicle to reach 88 km/h (55 MPH), and continue at this speed for 2 minutes.
2. Release the accelerator to decrease vehicle speed to 75 km/h (45 MPH).
3. Accelerate to 88 km/h (55MPH), and continue at this speed for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.



>> GO TO 9.

9.CHECK SRT STATUS

WITH CONSULT
Select “SRT STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
WITHOUT CONSULT
Perform “SRT status” mode with EC-801, "System Readiness Test (SRT) Code".
WITH GST
Select Service $01 with GST.

Is SRT(s) set?

YES >> GO TO 10.
NO >> Call TECH LINE or take appropriate action.

10.CHECK PERMANENT DTC

NOTE:
Permanent DTC cannot be checked with a tool other than CONSULT or GST.
With CONSULT
Select “SRT STATUS” in “DTC & SRT CONFIRMATION” mode with CONSULT.
With GST

Select Service $0A with GST.

Is permanent DTC(s) detected?

YES >> Refer to EC-912, "Description".
NO >> END

HOW TO ERASE PERMANENT DTC

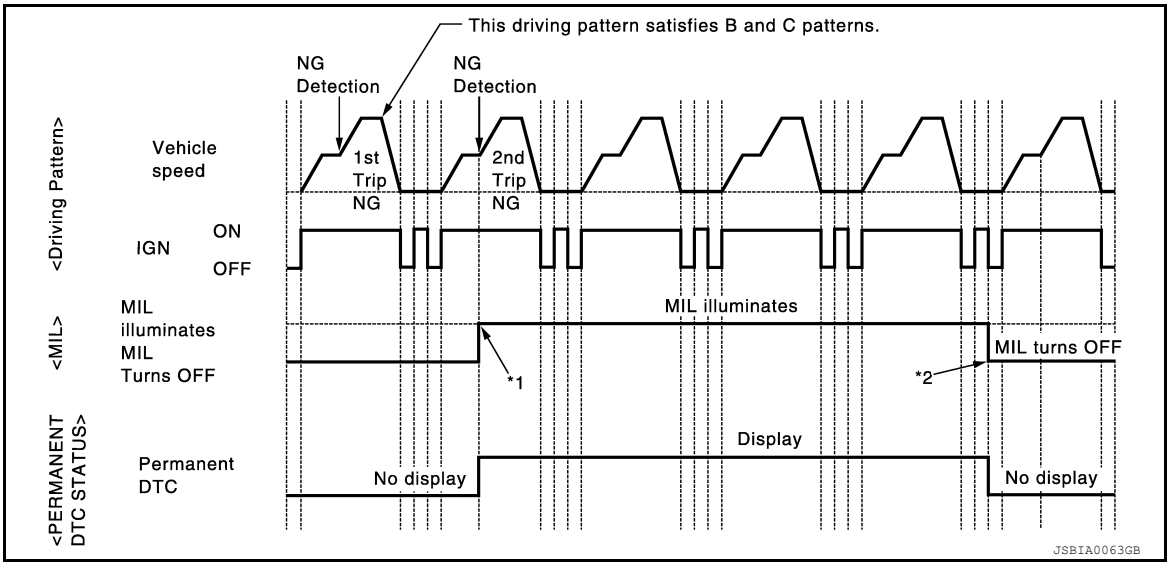
Description

INFOID:0000000014419977

OUTLINE

When a DTC is stored in ECM

When a DTC is stored in ECM and MIL is ON, a permanent DTC is erased with MIL shutoff if the same malfunction is not detected after performing the driving pattern for MIL shutoff three times in a raw.



*1: When the same malfunction is detected in two consecutive trips, MIL will illuminate.

*2: MIL will turn off after vehicle is driven 3 times without any malfunctions.

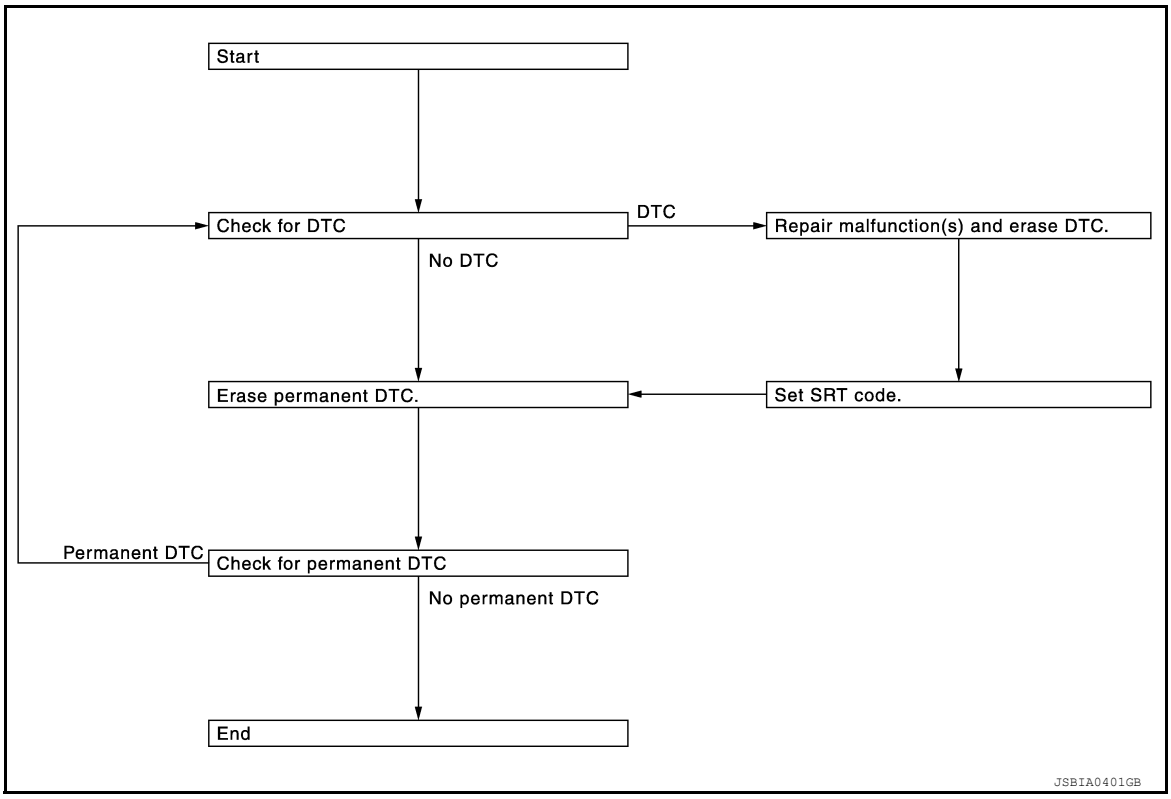
When a DTC is not stored in ECM

The erasing method depends on a permanent DTC stored in ECM. Perform “DTC CONFIRMATION PROCEDURE” for applicable DTCs.

PERMANENT DTC ITEM

For permanent DTC items, MIL turns ON. Refer to EC-838, "DTC Index".

PERMANENT DTC SERVICE PROCEDURE



DTC/CIRCUIT DIAGNOSIS

U0002 DRIVETRAIN CAN COMMUNICATION

DTC Description

INFOID:0000000014419978

CAN (Controller Area Network) is the high speed communication line for many of the Vehicle Electronic Control Units (VECU).The CAN communication bus has two 2 lines (CAN high line, CAN low line). These lines are inputted to the Engine Control Module. If the ECM does not receive any messages across the CAN bus for a period of time, this fault will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a loss of communication with the OEM Communication bus for a period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0002	(High Speed CAN Communication Bus Performance))	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	BUS off interrupt triggered by CAN hardware
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U0002 being current on the CONSULT screen.

Is DTC U0002 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419979

1.CHECK FOR ECM COMMUNICATION WITH CONSULT

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Verify CONSULT communication with the ECM.

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 4.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0562 being current on the CONSULT screen.

Is DTC P0562 detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> Go to 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0002 being current on the CONSULT screen.

Is DTC U0002 detected as current?

YES >> GO TO 4.
NO >> Refer to GI-47, "Intermittent Incident".

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM control module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR AN OPEN OR SHORT CIRCUIT IN THE ECM DATA LINK

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between ECM connector E93 terminal 16 and terminal 33.

ECM			Resistance
Connector	Terminal	Terminal	
E93	16	33	110-130 Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

6. INSPECT IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Inspect the IPDM E/R and fuses for the following:

- Blown power supply fuses
- Power supply fuse for cracks, burns, corrosion, or discolorations
- Corrosion
- Loose or expanded pins

Is the inspection result normal?

YES >> An OEM issue has been detected. Check the following:
- Terminating resistance
- Harness and connectors
- ECM

NO >> Repair or replace error-detected parts.

U0101 CAN COMM CIRCUIT

DTC Description

INFOID:0000000014419980

The Transmission Control Module communicates to the primary engine electronic control module (ECM) through the CAN data link. Messages sent from the Transmission Control Module (TCM) are received and monitored by the ECM. If the ECM does not receive a message from Transmission Control Module (TCM), a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) did not receive a message from the transmission control module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0101	LOST COMM TCM (Lost Communication with TCM)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received from TCM.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- A malfunctioning TCM.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC U0101 being current on the CONSULT screen.

Is DTC U0101 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419981

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0101 being current on the CONSULT screen.

s DTC U0101 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC being current on the CONSULT screen.

Are multiple DTCs detected as current?

YES >> A CAN issue has been detected. Check the following:
- Terminating resistances
- IPDM E/R
- Harness and connectors

NO >> A TCM issue has been detected. Check the following:
- TCM to data link connection
- Voltage to TCM

- Harness and connectors
- Malfunctioning TCM

U0106 LOST COMMUNICATION (GLOW OUTPUT STAGE)

DTC Description

INFOID:0000000014419982

The Glow Plug Control Module controls the timing and intensity of the glow plug outputs on the engine using data provided by the ECM through the CAN2 communication lines. The Glow Plug Control Module will not activate the glow plugs if the glow plug module reads a temperature greater than a calibrated amount. The Glow Plug Control Module receives fused power directly from the battery, and switched power through the ECM relay.

DTC DETECTION LOGIC

This DCT is triggered when the ECM loses CAN2 communications with the glow plug control module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0106	(Lost Communication With Glow Plug Control Module)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors
- Glow plug control module

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC U0106 being current on the CONSULT screen.

Is DTC U0106 current?

YES >> Go to EC-918, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419983

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106 being current or being past on more than 1 count on the CONSULT screen.

Is DTC U0106 detected as current or past for more than 1 count?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CORRECT ELECTRICAL SYSTEM VOLTAGE SETTING IN CONSULT

1. Turn ignition switch ON.
2. Connect CONSULT and make sure the electrical system voltage setting is correct for the engine configuration.
   NOTE:
   To check the voltage configuration of the engine, disconnect ECM connector E93 and measure the voltage from ECM connector E93 terminal 83 to ground.

Is the electrical system voltage setting correct for the engine configuration?

YES >> GO TO 3.
NO >> Use CONSULT to configure the electrical system voltage to match the engine configuration.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U010E being current or being past on more than 1 count on the CONSULT screen.

Is DTC U010E detected as current or past for more than 1 count?

YES >> GO TO 9.
NO >> GO TO 4.

4.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs U029D, U029E, U02A2, U1611 or U1612 being current or being past on more than 1 count on the CONSULT screen.

Are DTCs U029D, U029E, U02A2, U1611 or U1612 detected as current or past for more than 1 count?

YES >> GO TO 8.
NO >> GO TO 5.

5.INSPECT GLOW PLUG CONTROL MODULE AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module harness connector F102.
3. Inspect the glow plug control module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect glow plug control module harness connector F102.
3. Turn ignition switch ON.
4. Check voltage between glow plug control module connector F102 terminal 7 and ground.

Glow plug control module		Ground	Condition	Voltage (Approx.)
Connector	Terminal			
F102	7	–	Ignition switch ON	> 10.8 V
			Cranking engine	

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK FOR AN OPEN OR SHORT CIRCUIT IN THE GLOW PLUG CONTROL MODULE DATA LINK

1. Turn ignition switch OFF.
2. Disconnect the glow plug control module harness connector F102.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between glow plug control module connector F102 terminal 4 and terminal 5.

Glow plug control module connector F102		Resistance
Terminal	Terminal	
4	5	54 – 66 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 9.

8. INSPECT IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Inspect the IPDM E/R and fuses for the following:

- Blown power supply fuses
- Power supply fuse for cracks, burns, corrosion, or discolorations
- Corrosion
- Loose or expanded pins

Is the inspection result normal?

YES >> Repair or replace error-detected parts.
NO >> GO TO 9.

9. CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10. CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Disconnect the ECM harness connector E93.
4. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".
NO >> A malfunction has been detected in the engine side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

11. CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair or replace error-detected parts.

12. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

U010C CAN COMMUNICATION

DTC Description

INFOID:0000000014419984

The rotary turbine control valve and linkage is electronically controlled by the rotary turbine control valve actuator. This actuator is a smart device and receives information via the CAN communication lines from the primary engine control module (ECM). The rotary turbine control valve actuator performs its own diagnostics and reports malfunctions back to the primary engine ECM, using the CAN 2 communications lines. The ECM then decodes the error message and converts it to a fault code.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U010C	(Lost Communication With Turbocharger/Supercharger Control Module "A")	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

The Engine Control Module (ECM) did not receive a valid CAN 2 communication message from the rotary control valve actuator for more than 1 second.

POSSIBLE CAUSE

- No voltage to turbo actuator from ECM
- Rapid cycling of the ignition switch
- Harness and connectors
- Damaged termination resistor in engine data link harness

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition ON.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC U010C being current on the CONSULT screen.

Is DTC U010C current?

YES >> Go to EC-922, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419985

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U010C being current on the CONSULT screen.

Is DTC U010C detected as current or more than one past count?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC being current on the CONSULT screen.

Are DTCs U029E, U0106, U029D, U1611 or U1612 detected as current or are there more than one past count?

YES >> GO TO 7.
NO >> GO TO 3.

3.INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Inspect the rotary turbine control valve actuator connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Turn ignition switch ON.
4. Check voltage between rotary turbine control valve actuator connector F146 terminal 1 and 4.

Rotary turbine control valve actuator			Voltage (Approx.)
Connector	Terminal	Terminal	
F146	1	4	>10.8V

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 5.

5.INSPECT BATTERY TERMINAL CONNECTIONS

1. Turn ignition switch OFF.
2. Inspect the battery terminal connections for the following:

- Loose connector
- Corroded terminals
- Moisture in or on the connector
- Dirt or debris on the connector
- Wire insulation damage

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Check voltage between rotary turbine control valve actuator harness connector F146 terminal 4 and ground.

Rotary turbine control valve actuator		(–)	Voltage (Approx.)
Connector	Terminal		
F146	4	Ground	>10.8V

Is the inspection result normal?

YES >> An open or high resistance is present in the rotary turbine control valve actuator ground circuit. Repair or replace error-detected parts.
NO >> An open or high resistance is present in the rotary turbine control valve actuator power supply circuit. Repair or replace error-detected parts.

7.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.INSPECT CAN 2 COMMUNICATION HARNESS FOR OPEN

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator connector F146.
3. Disconnect ECM connector F101.
4. Measure the resistance between rotary turbine control valve actuator connector F146 terminal 3 and ECM connector F101 terminal 123.
5. Measure the resistance between rotary turbine control valve actuator connector F146 terminal 2 and ECM connector F101 terminal 102.

Rotary turbine control valve actuator		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F146	3	F101	123	<10 Ω
	2		102	

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.INSPECT CAN 2 COMMUNICATION HARNESS FOR SHORT CIRCUIT

1. Turn ignition switch OFF and wait at least 1 minute for the DEF control module to completely power down.
2. Disconnect outlet NOx sensor harness connector C33, intake NOx sensor harness connector C31, DPF temperature sensor module connector C29, SCR temperature sensor C30, rotary turbine control valve actuator connector F146, glow plug control module F102 and ECM connector E93 and F101.
3. Measure the resistance between ECM connector E93 terminal 35 and all other ECM connector E93 terminals.
4. Measure the resistance between ECM connector E93 terminal 18 and all other ECM connector E93 terminals.
5. Measure the resistance between ECM connector F101 terminal 123 and all other ECM connector F101 terminals.
6. Measure the resistance between ECM connector F101 terminal 102 and all other ECM connector F101 terminals.

ECM			Resistance
Connector	Terminal (+)	Terminal (–)	
E93	35	All others	>100K Ω
	18		
F101	123		
	102		

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair or replace error-detected parts.

10. INSPECT CAN 2 COMMUNICATION HARNESS FOR SHORT TO GROUND

1. Turn ignition switch OFF and wait at least 1 minute for the DEF control module to completely power down.
2. Measure the resistance between all ECM connector E93 terminals and ground.
3. Measure the resistance between all ECM connector F101 terminals and ground.

ECM			Resistance
Connector	Terminal (+)	Terminal (–)	
E93	All terminals	Ground	>100K Ω
F101	All terminals		

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK CAN 2 COMMUNICATION TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146 and ECM harness connector F101.
3. Measure the resistance between ECM harness connector F101 terminals 123 and 102.

ECM			Resistance
Connector	Terminal	Terminal	
F101	123	102	110-130 Ω

Is the inspection result normal?

YES >> GO TO 14.
NO >> GO TO 12.

12. CHECK CAN 2 COMMUNICATION TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146 and ECM harness connector E93.
3. Measure the resistance between ECM harness connector E93 terminals 35 and 18.

ECM			Resistance
Connector	Terminal	Terminal	
E93	3	2	110-130 Ω

Is the inspection result normal?

YES >> Repair or replace error-detected parts.
NO >> GO TO 13.

13. CHECK CAN 2 COMMUNICATION TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Measure the resistance between rotary turbine control valve actuator harness connector F146 terminals 3 and 2.

Rotary turbine control valve actuator			Resistance
Connector	Terminal	Terminal	
F146	3	2	110-130 Ω

Is the inspection result normal?

YES >> Repair or replace error-detected parts.
NO >> Replace rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".

14. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect rotary turbine control valve actuator harness connector F146.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC U010C being current on the CONSULT screen.

Is DTC U010C detected as current or more than one past count?

YES >> Replace rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".
NO >> Removal and installation of rotary turbine control valve actuator harness connector F146 corrected the fault.

15. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is U010C DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

U010E CAN COMMUNICATION

DTC Description

INFOID:0000000014419986

The aftertreatment diesel exhaust fluid controller is the central control for the selective catalytic reduction (SCR) diesel exhaust fluid dosing system, and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The diesel exhaust fluid controller communicates to the engine control module (ECM) via the CAN2 communication lines.

DTC DETECTION LOGIC

The ECM and the aftertreatment diesel exhaust fluid controller lost communication via the CAN2 communication line, or the ECM has detected the aftertreatment diesel exhaust fluid controller had gone into waiting to shutdown mode.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U010E	(Lost Communication With Reductant Control Module)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- No voltage to DEF control module
- No ground to DEF control module
- Harness and connectors
- Damaged DEF control module
- Blown or missing fuses on battery and ignition inputs to the DEF control module

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC U010E being current on the CONSULT screen.

Is DTC U010E current?

YES >> Go to EC-927, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419987

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U010E being current on the CONSULT screen.

Is DTC U010E detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC being current on the CONSULT screen.

Are DTCs U0106, U010C, U029D, U02A2, U1611 or U1612 detected as current?

YES >> GO TO 7.
NO >> GO TO 3.

3.INSPECT DEF CONTROL MODULE AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Inspect the glow plug control module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts. GO TO 8.

4.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Turn ignition switch ON.
4. Check voltage between DEF control module connector C35 terminals 3 and 7.

DEF control module connector C35		Condition	Voltage (Approx.)
Terminal	Terminal		
3	7	Ignition switch ON	> 10.8 V
		Cranking engine	

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5.CHECK FOR OPEN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Turn ignition switch ON.
4. Check voltage between DEF control module harness connector C35 terminal 3 and ground.

DEF control module		Ground	Condition	Voltage (Approx.)
Connector	Terminal			
C35	3	–	Ignition switch ON	> 10.8 V
			Cranking engine	

Is the inspection result normal?

YES >> An open or high resistance is present in the DEF control module ground circuit. Repair or replace error-detected parts.
NO >> An open or high resistance is present in the DEF control module supply circuit. Repair or replace error-detected parts.

6.CHECK TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between DEF control module harness connector C35 terminals 5 and 6.

DEF control module connector C35		Resistance
Terminal	Terminal	
5	6	54 – 66 Ω

Is the inspection result normal?

YES >> Replace DEF control module. Refer to EC-1999, "Removal and Installation".
NO >> GO TO 8.

7.INSPECT IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Inspect the IPDM E/R and fuses for the following:

- Blown power supply fuses
- Power supply fuse for cracks, burns, corrosion, or discolorations
- Corrosion
- Loose or expanded pins

Is the inspection result normal?

YES >> Repair or replace error-detected parts.
NO >> GO TO 8.

8.CHECK TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Measure the resistance between Cummins data link connector harness connector F190 terminals 1 and 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 9.

9.CHECK TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between Cummins data link connector harness connector F190 terminals 1 and 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A concern has been found in the aftertreatment side of the CAN2 communication line circuit. Repair or replace error-detected parts.
NO >> A concern has been found in the engine side of the CAN2 communication line circuit.Repair or replace error-detected parts.

10.CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 11.
NO >> A short circuit has been found in the CAN2 communication line circuit. Repair or replace error-detected parts.

11. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> A short circuit has been found in the CAN2 communication line circuit. Repair or replace error-detected parts.

U029D COMMUNICATION WITH NOX SENSOR 1

DTC Description

INFOID:0000000014419988

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the engine control module (ECM) via the CAN2 communication lines. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and can not be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

This DTC is triggered when the ECM loses CAN2 communications with the aftertreatment intake NOx sensor.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U029D	Timeout error check (Lost Communication With NOX Sensor "A")	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC U029D being current on the CONSULT screen.

Is DTC U029D current?

YES >> Go to EC-931, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419989

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U029D being current or being past on more than 1 count on the CONSULT screen.

Is DTC U029D detected as current or past for more than 1 count?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CORRECT ELECTRICAL SYSTEM VOLTAGE SETTING IN CONSULT

1. Turn ignition switch ON.
2. Connect CONSULT and make sure the electrical system voltage setting is correct for the engine configuration.
   NOTE:
   To check the voltage configuration of the engine, disconnect ECM connector E93 and measure the voltage from ECM connector E93 terminal 83 to ground.

Is the electrical system voltage setting correct for the engine configuration?

YES >> GO TO 3.
NO >> Use CONSULT to configure the electrical system voltage to match the engine configuration.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U010E being current or being past on more than 1 count on the CONSULT screen.

Is DTC U010E detected as current or past for more than 1 count?

YES >> GO TO 10.
NO >> GO TO 4.

4.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs U0106, U029D, U02A2, U1611 or U1612 being current or being past on more than 1 count on the CONSULT screen.

Is any applicable DTC current or past?

YES >> GO TO 9.
NO >> GO TO 5.

5.INSPECT INTAKE NOX SENSOR AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect intake NOx sensor harness connector C31.
3. Inspect the intake NOx sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect intake NOx sensor harness connector C31.
3. Turn ignition switch ON.
4. Check voltage between intake NOx sensor connector C31 terminal 4 and terminal 3.

Intake NOx sensor connector C31		Condition	Voltage (Approx.)
Terminal	Terminal		
4	3	Ignition switch ON	> 10.8 V
		Cranking engine	

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect intake NOx sensor harness connector C31.
3. Turn ignition switch ON.
4. Check voltage between intake NOx sensor connector C31 terminal 4 and ground.

Intake NOx sensor		Ground	Condition	Voltage (Approx.)
Connector	Terminal			
C31	4	(–)	Ignition switch ON	> 10.8 V
			Cranking engine	

Is the inspection result normal?

YES >> An open or high resistance is present on the ground circuit. Repair or replace error-detected parts.
NO >> An open or high resistance is present on the battery supply circuit. Repair or replace error-detected parts.

8.CHECK FOR AN OPEN OR SHORT CIRCUIT IN THE INTAKE NOX SENSOR DATA LINK

1. Turn ignition switch OFF.
2. Disconnect the intake NOx sensor harness connector C31.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between intake NOx sensor harness connector C31 terminal 1 and 2.

Intake NOx sensor connector C31		Resistance
Terminal	Terminal	
1	2	54 – 66 Ω

Is the inspection result normal?

YES >> Replace intake NOx sensor. Refer to EX-45, "Removal and Installation".
NO >> GO TO 10.

9.INSPECT IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Inspect the IPDM E/R and fuses for the following:

- Blown power supply fuses
- Power supply fuse for cracks, burns, corrosion, or discolorations
- Corrosion
- Loose or expanded pins

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair or replace error-detected parts.

10.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 12.
NO >> GO TO 11.

11.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Disconnect the ECM harness connector E93.
4. Disconnect intake NOx sensor harness connector C31.
5. Measure the resistance between intake NOx sensor connector C31 terminal 1 and terminal 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

NO >> A malfunction has been detected in the engine side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

12. CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	(–)	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 13.

NO >> Repair or replace error-detected parts.

13. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	(–)	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".

NO >> Repair or replace error-detected parts.

U029E COMMUNICATION WITH NOX SENSOR 2

DTC Description

INFOID:0000000014419990

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the engine control module (ECM) via the CAN2 communication lines. The aftertreatment outlet NOx sensor performs its own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The ECM lost communication with the aftertreatment outlet NOx sensor via the CAN2 communication lines.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U029E	Timeout error check (Lost Communication With NOX Sensor "B")	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC U029E being current on the CONSULT screen.

Is DTC U029E current?

YES >> Go to EC-935, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419991

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U029E being current or being past on more than 1 count on the CONSULT screen.

Is DTC U029E detected as current or past for more than 1 count?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CORRECT ELECTRICAL SYSTEM VOLTAGE SETTING IN CONSULT

1. Turn ignition switch ON.
2. Connect CONSULT and make sure the electrical system voltage setting is correct for the engine configuration.
   NOTE:
   To check the voltage configuration of the engine, disconnect ECM connector E93 and measure the voltage from ECM connector E93 terminal 83 to ground.

Is the electrical system voltage setting correct for the engine configuration?

YES >> GO TO 3.
NO >> Use CONSULT to configure the electrical system voltage to match the engine configuration.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U010E being current or being past on more than 1 count on the CONSULT screen.

Is DTC U010E detected as current or past for more than 1 count?

YES >> GO TO 10.
NO >> GO TO 4.

4.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs U0106, U029D, U02A2, U1611 or U1612 being current or being past on more than 1 count on the CONSULT screen.

Are DTCs U0106, U029D, U02A2, U1611 or U1612 detected as current or past for more than 1 count?

YES >> GO TO 9.
NO >> GO TO 5.

5.INSPECT OUTLET NOX SENSOR AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect outlet NOx sensor harness connector C33.
3. Inspect the outlet NOx sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect outlet NOx sensor harness connector C33.
3. Turn ignition switch ON.
4. Check voltage between outlet NOx sensor connector C33 terminal 4 and terminal 3.

Outlet NOx sensor connector C33		Condition	Voltage (Approx.)
Terminal	Terminal		
4	3	Ignition switch ON	> 10.8 V
		Cranking engine	

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 7.

7.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect outlet NOx sensor harness connector C33.
3. Turn ignition switch ON.
4. Check voltage between outlet NOx sensor connector C33 terminal 4 and ground.

Outlet NOx sensor		Ground	Condition	Voltage (Approx.)
Connector	Terminal			
C33	4	–	Ignition switch ON	> 10.8 V
			Cranking engine	

Is the inspection result normal?

YES >> An open or high resistance is present on the ground circuit. Repair or replace error-detected parts.
NO >> An open or high resistance is present on the battery supply circuit. Repair or replace error-detected parts.

8. CHECK FOR AN OPEN OR SHORT CIRCUIT IN THE OUTLET NOX SENSOR DATA LINK

1. Turn ignition switch OFF.
2. Disconnect the outlet NOx sensor harness connector C33.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between outlet NOx sensor harness connector C33 terminal 1 and 2.

Outlet NOx sensor connector C33		Resistance
Terminal	Terminal	
1	2	54 – 66 Ω

Is the inspection result normal?

YES >> Replace outlet NOx sensor. Refer to EX-48, "Removal and Installation".
NO >> GO TO 10.

9. INSPECT IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Inspect the IPDM E/R and fuses for the following:

- Blown power supply fuses
- Power supply fuse for cracks, burns, corrosion, or discolorations
- Corrosion
- Loose or expanded pins

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair or replace error-detected parts.

10. CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 12.
NO >> GO TO 11.

11. CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Disconnect the ECM harness connector E93.
4. Disconnect outlet NOx sensor harness connector C33.
5. Measure the resistance between outlet NOx sensor connector C33 terminal 1 and terminal 2.

Cummins data link connector F190		Resistance
Terminal	Terminal	
1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

NO >> A malfunction has been detected in the engine side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

12. CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 13.

NO >> Repair or replace error-detected parts.

13. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".

NO >> Repair or replace error-detected parts.

U02A2 CAN COMMUNICATION

DTC Description

INFOID:0000000014419992

The DEF quality sensor is a smart device and communicates with the engine electronic control module (ECM) via the CAN2 communication lines. The DEF quality sensor receives power and ground directly from the battery. The sensor performs its own internal diagnostics and reports malfunctions back to the ECM via the CAN2 communication lines. The DEF quality sensor is used to measure the concentration of the DEF in the tank.

DTC DETECTION LOGIC

The ECM lost communication with the aftertreatment DEF quality sensor via the CAN2 communication lines.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U02A2	(Lost Communication With Reductant Quality Module)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Message not received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors
- DEF quality sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC U02A2 being current on the CONSULT screen.

Is DTC U02A2 current?

YES >> Go to EC-939, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419993

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U02A2 being current or being past for more than 1 count on the CONSULT screen.

Is DTC U0106 detected as current or past for more than 1 count?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC being current on the CONSULT screen.

Is DTC P0687 detected as current?

YES >> Refer to EC-1496, "DTC Description".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs U0106, U010C, U029D, U029E, U1611 or U1612 being current or being past for more than 1 count on the CONSULT screen.

Are DTCs U0106, U010C, U029D, U029E, U1611 or U1612 detected as current or past for more than 1 count?

YES >> GO TO 8.
NO >> GO TO 4.

4.INSPECT DEF QUALITY SENSOR AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DEF quality sensor harness connector C203.
3. Inspect the DEF qualify sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect DEF quality sensor harness connector C203.
3. Turn ignition switch ON.
4. Check voltage between DEF quality sensor connector C203 terminals 1 and 4.

DEF quality sensor connector			Condition	Voltage (Approx.)
Connector	Terminal			
C203	1	4	Ignition switch ON	> 10.8 V
			Cranking engine	

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.CHECK POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect DEF quality sensor harness connector C203.
3. Turn ignition switch ON.
4. Check voltage between DEF quality sensor connector C203 terminal 1 and ground.

DEF quality sensor		Ground	Condition	Voltage (Approx.)
Connector	Terminal			
C203	1	–	Ignition switch ON	> 10.8 V
			Cranking engine	

Is the inspection result normal?

YES >> An open or high resistance is present on the ground circuit. Repair or replace error-detected parts.

NO >> An open or high resistance is present on the battery supply circuit. Repair or replace error-detected parts.

7.CHECK FOR AN OPEN OR SHORT CIRCUIT IN THE DEF QUALITY SENSOR DATA LINK

1. Turn ignition switch OFF.
2. Disconnect the DEF quality sensor harness connector C203.
3. Disconnect the data link adapter from the service data link connector harness connector.
4. Measure the resistance between DEF quality sensor harness connector C203 terminals 2 and 3.

DEF quality sensor connector			Resistance
Connector	Terminal		
C203	2	3	54 – 66 Ω

the inspection result normal?

YES >> Replace DEF quality sensor. Refer to EX-75, "Exploded View".
NO >> GO TO 9.

8.INSPECT IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Inspect the IPDM E/R, fuses and ECM relay for the following:

- Blown power supply fuses
- Power supply fuses and ECM relay for cracks, burns, corrosion, or discolorations
- Corrosion
- Loose or expanded pins

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Disconnect the ECM harness connector E93.
4. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".
NO >> A malfunction has been detected in the engine side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

11.CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 12.
NO >> A short circuit has been detected in the CAN2 communication line circuit. Repair or replace error-detected parts.

12. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> A short circuit has been detected in the CAN2 communication line circuit. Repair or replace error-detected parts.

U0307 CAN COMMUNICATION

DTC Description

INFOID:0000000014419994

The glow plug control module controls the timing and intensity of the glow plug output using data provided by the ECM through the CAN2 communication lines. The glow plug control module will not activate the glow plugs if the glow plug control module reads a temperature greater than the calibrated amount. The glow plug control module receives fused power from the battery supply circuit and ignition power from the ECM relay.

DTC DETECTION LOGIC

The ECM detected a software mismatch with the glow plug control module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0307	Software Incompatibility With Glow Plug Control Module 1 (Glow plug control module - out of calibration)	Diagnosis condition	Continuously when ignition switch is ON or the engine is running.
		Signal (terminal)	—
		Threshold	Incorrect software ID received.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Glow Plug Control Module
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U0307 being current on the CONSULT screen.

Is DTC U0307 current?

YES >> Go to EC-943, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419995

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0106 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0307 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace the glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

U0402 DRIVETRAIN CAN COMMUNICATION (TCM)

DTC Description

INFOID:0000000014419996

The transmission control module communicates to the engine control module (ECM) through the CAN data link. Messages sent from the transmission control module are received and monitored by the ECM. If the ECM does not receive a message from transmission control module, a DTC will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) did not receive a message from the transmission control module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0402	INVALID DATA RECEIVED FROM TCM (Invalid Data Received From Transmission Control Module)	Diagnosis condition	Continuously when ignition switch is ON or the engineis running.
		Signal (terminal)	(–)
		Threshold	Invalid status data received from transmission control module.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Transmission control module
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U0402 being current on the CONSULT screen.

Is DTC U0402 current?

YES >> Go to EC-944, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419997

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0101 being current on the CONSULT screen.

Is DTC U0101 detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0402 being current on the CONSULT screen.

Is DTC U0402 detected as current?

YES >> Replace transmission control module. Refer to TM-223, "Removal and Installation".
NO >> Inspection End.

U0407 CAN COMMUNICATION

DTC Description

INFOID:0000000014419998

The glow plug control module controls the timing and intensity of the glow plug outputs on the engine using data provided by the ECM through the CAN2 communication lines. The glow plug control module will not activate the glow plugs if the glow plug control module reads a temperature greater than a calibrated amount. The glow plug control module receives fused power directly from the battery and switched power through the smart power relay.

DTC DETECTION LOGIC

The Engine Control Module (ECM) received an invalid message from the glow plug control module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0407	(Invalid Data Received From Glow Plug Control Module)	Diagnosis condition	Continuously when ignition switch is ON or the engine is running.
		Signal (terminal)	(–)
		Threshold	Invalid status data received from glow plug control module.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U0407 being current on the CONSULT screen.

Is DTC U0407 current?

YES >> Go to EC-945, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014419999

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0407 being current on the CONSULT screen.

Is DTC U0407 detected as current?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> Inspection End.

U040D CAN COMMUNICATION

DTC Description

INFOID:0000000014420000

The rotary turbine control valve and linkage are electronically controlled by the rotary turbine control valve actuator. This actuator is a smart device and receives information via the CAN2 communication lines from the Engine Control Module (ECM). The rotary turbine control valve actuator performs its own diagnostics and reports malfunctions back to the ECM using the CAN2 communications lines. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

- The ECM has detected a calibration incompatibility between the RTC actuator and the ECM.
- The ECM has detected an incorrect RTC actuator installed on the turbocharger.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U040D	Invalid Data Received From Turbocharger Control Module “A” (Engine turbocharger turbine bypass actuator - out of calibration)	Diagnosis condition	Engine running.
		Signal (terminal)	—
		Threshold	The motor type received from the turbine bypass valve smart device does not equate to the expected motor type.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- ECM
- Incorrect RTC actuator
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC U040D being current on the CONSULT screen.

Is DTC U040D current?

YES >> Go to EC-946, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420001

1.CHECK DTC PRIORITY

1. Cycle the ignition switch ON several times, waiting 30 seconds between each cycle.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U040D being current on the CONSULT screen.

Is DTC U040D detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Inspect the rotary turbine control valve actuator connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK DTC PRIORITY

1. Connect rotary turbine control valve actuator harness connector F146.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Erase DTCs.
5. Turn ignition switch OFF.
6. Disconnect linkage from rotary turbine control valve actuator.
7. Turn ignition switch ON.
8. Rotary turbine control valve actuator should span.
9. Check for DTC U040D being current on the CONSULT screen.

Is DTC U040D detected as current?

YES >> Replace rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".
NO >> GO TO 4.

4. CHECK ROTARY TURBINE CONTROL VALVE ACTUATOR LINKAGE

Inspect the rotary turbine control valve actuator linkage.

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Replace rotary turbine control valve actuator linkage. Refer to EM-420, "Removal and Installation".

U040F CAN COMMUNICATION

DTC Description

INFOID:0000000014420002

The aftertreatment diesel exhaust fluid controller is the central control for the selective catalytic reduction (SCR) diesel exhaust fluid dosing system and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The diesel exhaust fluid controller communicates to the engine control module (ECM) via the CAN2 communication lines.

DTC DETECTION LOGIC

The aftertreatment diesel exhaust fluid controller (DCU) did not receive specific dosing request messages from the Engine Control Module (ECM).

DTC	CONSULT screen terms (Trouble diagnosis content)		DTC detection condition	
U040F	(Invalid Data Received From Reductant Control Module)	1	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	The flange controller unit (FCU) has detected an engine control module (ECM) SAE aftertreatment 1 SCR dosing system requests 1 message that is out of sequence.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.
		2	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	• The flange controller unit (FCU) has not received the SAE aftertreatment 1 SCR dosing system requests 1 message from the ECM. or • The FCU has not received the SAE aftertreatment 1 SCR dosing system requests 2 message from the ECM. or • The FCU has not received the SAE ambient conditions message from the ECM. or • The FCU has not received the diagnostic override message from the ECM.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors
- DEF control module
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U040F being current on the CONSULT screen.

Is DTC U040F current?

YES >> Go to EC-949, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420003

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U010E being current on the CONSULT screen.

Is DTC U010E detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT DEF CONTROL MODULE AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Inspect the DEF control module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Turn ignition switch ON and wait 30 seconds.
4. Check for DTC U010E being current on the CONSULT screen.

Is DTC U010E detected as current?

YES >> GO TO 4.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

4.CHECK DTCS AND VERIFY CONDITION

1. Turn ignition switch OFF.
2. Connect DEF control module harness connector C35.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC U040F become current?

YES >> GO TO 5.
NO >> The removal and installation of the connector corrected the issue.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC U040F being past on the CONSULT screen.

Is DTC U040F detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".

U0415 CAN COMMUNICATION

DTC Description

INFOID:0000000014420004

The anti-lock brake system communicates to the primary engine control module (ECM) through the CAN data link. Messages sent from the anti-lock brake system are received and monitored by the ECM. If the ECM does not receive a message from anti-lock brake system, a fault will be set.

DTC DETECTION LOGIC

The engine control module (ECM) received an error message from the anti-lock brake system (ABS) controller.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U0415	VDC CAN CIR2 (Invalid Data Received From Anti-Lock Brake System Control Module)	Diagnosis condition	Continuously when ignition switch is ON or the engine is running.
		Signal (terminal)	(–)
		Threshold	ECM received an error message from the ABS actuator and electric unit (control unit).
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- ABS actuator and electric unit (control unit)
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U0415 being current on the CONSULT screen.

Is DTC U0415 current?

YES >> Go to EC-951, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420005

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0415 being current on the CONSULT screen.

Is DTC U0415 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK CURRENT CAN DTCS

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for multiple CAN DTCs being current on the CONSULT screen.

Multiple CAN DTCs current?

YES >> CAN issue has been detected, check the following:
- Terminating resistances
- IPDM E/R
- Harness and connectors

NO >> ABS issue has been detected, check the following:
- ABS actuator and electric unit (control unit) voltage

- ABS actuator and electric unit (control unit)
- Harness and connectors

U0426 CAN COMMUNICATION (IMMOBILIZER)

DTC Description

INFOID:0000000014420006

The immobilizer anti-theft device communicates with the ECM through the CAN communication lines. Messages sent from the immobilizer anti-theft device are received by the ECM and are used to control the anti-theft features. If the ECM does not receive a message from the immobilizer anti-theft device, a DTC is set.

DTC DETECTION LOGIC

- The ECM received an invalid identification message from the immobilizer anti-theft device.
- The ECM received a key code error from the immobilizer anti-theft device.
- The ECM received a no key error from the immobilizer anti-theft device.
- Immobilizer anti-theft device has detected too many attempts to start vehicle with an invalid key. Engine start has been locked out.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
U0426	Invalid Data Received From Vehicle Immobilizer Control Module (Immobilizer ID invalid, key code error, no key error, lock mode error - condition exists)	1	Diagnosis condition	Continuously when ignition switch is ON or the engine is running
			Signal (terminal)	—
			Threshold	ECM cannot receive feedback message from immobilizer within expected period of time or ECM receives feedback from immobilizer, but message indicates communication error.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.
		2	Diagnosis condition	Continuously when ignition switch is ON or the engine is running.
			Signal (terminal)	—
			Threshold	ECM verification process at end of ignition ON communication fails 5 times.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.
		3	Diagnosis condition	Continuously when ignition switch is ON or the engine is running.
			Signal (terminal)	—
			Threshold	ECM receives message from immobilizer indicating key programmed in transponder carries wrong key code.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.
		4	Diagnosis condition	Continuously when ignition switch is ON or the engine is running.
			Signal (terminal)	—
			Threshold	ECM receives message from immobilizer indicating no key is programmed in transponder.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Immobilizer anti-theft device
- Harness or connectors
- Invalid key
- Rapid key cycles may cause this DTC to set.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U0426 being current on the CONSULT screen.

Is DTC U0426 current?

YES >> Go to EC-954, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420007

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for CAN communication DTCs being current on the CONSULT screen.

Are CAN communication DTCs detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0426 being current on the CONSULT screen.

Is DTC U0426 detected as current?

YES >> An immobilizer anti-theft device issue has been detected. Refer to SEC-12, "NISSAN VEHICLE IMMOBILIZER SYSTEM-NATS : System Description".
NO >> Refer to GI-47, "Intermittent Incident".

U059E CAN COMMUNICATION

DTC Description

INFOID:0000000014420008

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the engine control module (ECM) via the CAN 2 communication lines. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

The aftertreatment intake NOx sensor reading was not valid.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U059E	TIMEOUT ERROR CHECK (Invalid Data Received From NOX Sensor "A")	Diagnosis condition	Aftertreatment diesel oxidation catalyst intake temperature sensor has been above 150° C (302° F) for 5 seconds while the engine is running.
		Signal (terminal)	(–)
		Threshold	NOx sensor reading is not valid due to internal control loops within the sensor being unstable.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Intake NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and operate the engine to raise exhaust temperatures. This can be done by either driving the vehicle or initiating a stationary regeneration using CONSULT.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
   NOTE:
   Aftertreatment diesel oxidation catalyst intake temperature must be above 150° C (302° F) for 5 seconds before the aftertreatment intake NOx sensor can run its internal diagnostics.
3. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
4. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
5. Check for DTC U059E being current on the CONSULT screen.

Is DTC U059E current?

YES >> Go to EC-955, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420009

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- U029D
- P2202

- P220A

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U059E being current on the CONSULT screen.

Is DTC U059E detected as current?

YES >> Replace intake NOx sensor. Refer to EX-45, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

U059F CAN COMMUNICATION

DTC Description

INFOID:0000000014420010

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the engine control module (ECM) via the CAN 2 communication lines. The aftertreatment outlet NOx sensor performs its own internal diagnostics and reports malfunctions back to the primary ECM using the CAN2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The aftertreatment outlet NOx sensor reading was not valid.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U059F	TIMEOUT ERROR CHECK (Invalid Data Received From NOX Sensor "B")	Diagnosis condition	Aftertreatment SCR outlet temperature has been above 200° C (392° F) for a calibrated period of time while the engine is running.
		Signal (terminal)	(–)
		Threshold	Percent of time > 50% when NOx sensor reading is valid since internal control loops within the sensor have stabilized is invalid
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Outlet NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch ON.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U059F being current on the CONSULT screen.

Is DTC U059F current?

YES >> Go to EC-957, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420011

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- U029E
- P220B
- P229E

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U059F being current on the CONSULT screen.

Is DTC U059F detected as current?

YES >> Replace outlet NOx sensor. Refer to EX-48, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

U1000 CAN COMMUNICATION CIRCUIT

DTC Description

INFOID:0000000014420012

CAN (Controller Area Network) is a serial communication line for real time applications. It is an on-vehicle multiplex communication line with high data communication speed and excellent error detection ability. Modern vehicles are equipped with many electronic control units, and each control unit shares information and links with other control units during operation (not independent). In CAN communication, control units are connected with 2 communication lines (CAN high, CAN low), allowing a high rate of information transmission with less wiring. Each control unit transmits/receives data but selectively reads required data only. Refer to LAN-74, "CAN COMMUNICATION SYSTEM : CAN Communication Signal Chart".

DTC DETECTION LOGIC

- The ECM did not receive a message from the ABS actuator and electric unit (control unit).
- The ECM did not receive a message from the A/C auto amp. (automatic air conditioner) or front air control (manual air conditioner).
- The ECM did not receive a message from the air bag diagnosis sensor unit.
- The ECM did not receive a message from the body control module (BCM).
- The ECM did not receive a message from the combination meter.

DTC No.	CONSULT screen terms (Trouble diagnosis content)	DTC Detection Condition		
U1000	CAN COMM CIRCUIT (CAN communication circuit)	1	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from ABS actuator and electric unit (control unit) or torque values from ABS actuator and electric unit (control unit) exceed maximum or heartbeat counter value from ABS actuator and electric unit (control unit) is not incrementing
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.
		2	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from air bag diagnosis sensor unit
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.
		3	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from body control unit (BCM)
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.
		4	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from combination meter
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.
		5	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from immobilizer
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.
		6	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Heartbeat counter value from transmission control unit (TCU) is not incrementing
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.

POSSIBLE CAUSE

- Harness and connectors
- ABS actuator and electric unit (control unit)
- A/C auto amp. (automatic air conditioner)
- Air bag diagnosis sensor unit
- Body control module (BCM)
- Combination meter
- Front air control (manual air conditioner)

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.

2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U1000 being current on the CONSULT screen.

Is DTC U1000 current?

YES >> Go to EC-961, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420013

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1000 being current on the CONSULT screen.

Is DTC U1000 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for multiple CAN communication DTCs being current on the CONSULT screen.

Are multiple CAN communication DTCs detected as current?

YES >> Repair or replace error-detected parts.
NO >> Refer to GI-47, "Intermittent Incident".

U1001 CAN COMM CIRCUIT

DTC Description

INFOID:0000000014698176

CAN (Controller Area Network) is a serial communication line for real time applications. It is an on-vehicle multiplex communication line with high data communication speed and excellent error detection ability. Modern vehicles are equipped with many electronic control units, and each control unit shares information and links with other control units during operation (not independent). In CAN communication, control units are connected with 2 communication lines (CAN high, CAN low), allowing a high rate of information transmission with less wiring. Each control unit transmits/receives data but selectively reads required data only. Refer to LAN-74, "CAN COMMUNICATION SYSTEM : CAN Communication Signal Chart".

DTC DETECTION LOGIC

- The ECM did not receive a message from the A/C auto amp. (automatic air conditioner) or front air control (manual air conditioner).
- The ECM did not receive a message from the air bag diagnosis sensor unit.

DTC No.	CONSULT screen terms (Trouble diagnosis content)	DTC Detection Condition		
U1001	CAN COMM CIRCUIT (CAN communication circuit)	1	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from the A/C auto amp. (automatic air conditioner) or front air control (manual air conditioner)
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.
		2	Diagnosis condition	When ignition switch is ON.
			Signal (terminal)	—
			Threshold	Message not received from air bag diagnosis sensor unit
			Diagnosis delay time	Diagnostic runs continuously when ignition switch is ON or engine is running.

POSSIBLE CAUSE

- Harness and connectors
- A/C auto amp. (automatic air conditioner)
- Air bag diagnosis sensor unit
- Front air control (manual air conditioner)

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U1001 being current on the CONSULT screen.

Is DTC U1001 current?

YES >> Go to EC-962, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014698177

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1001 being current on the CONSULT screen.

Is DTC U1001 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for multiple CAN communication DTCs being current on the CONSULT screen.

Are multiple CAN communication DTCs detected as current?

YES >> Repair or replace error-detected parts.
NO >> Refer to GI-47, "Intermittent Incident".

U11C1 CAN COMMUNICATION

DTC Description

INFOID:0000000014420014

The aftertreatment diesel exhaust fluid controller is the central control for the selective catalytic reduction (SCR) diesel exhaust fluid dosing system, and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The diesel exhaust fluid controller communicates to the engine control module (ECM) via the CAN 2 communication lines.

DTC DETECTION LOGIC

The Engine Control Module (ECM) sent an unreadable or missing message to the diesel exhaust fluid controller via the CAN 2 communication lines.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
U11C1	(Reductant Control Module Received Implausible Data From ECM/PCM)	Diagnosis condition	Ignition switch is ON or engine running.
		Signal (terminal)	(–)
		Threshold	The Flange Control Unit (FCU) has detected that the internal data set checksum does not match the expected value.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors
- DEF control module
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U11C1 being current on the CONSULT screen.

Is DTC U11C1 current?

YES >> Go to EC-964, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420015

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U11C1 being current on the CONSULT screen.

Is DTC U11C1 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for other DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT DEF CONTROL MODULE AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DEF control module harness connector C35.
3. Inspect the DEF control module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR AN OPEN OR SHORT CIRCUIT IN THE DEF CONTROL MODULE DATA LINK

1. Turn ignition switch OFF.
2. Disconnect the DEF control module harness connector C35.
3. Disconnect the data link adapter from the service data link harness connector.
4. Measure the resistance between DEF control module connector C35 terminals 5 and 6.

DEF control module			Resistance
Connector	Terminal		
C35	5	6	54 – 66 Ω

Is the inspection result normal?

YES >> Replace DEF control module. Refer to EC-1999, "Removal and Installation".
NO >> GO TO 5.

5. CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link harness connector.
3. Measure the resistance between Cummins data link connector F190 terminals 1 and 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6. CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link connector harness connector.
3. Disconnect the ECM harness connector E93.
4. Measure the resistance between Cummins data link connector F190 terminals 1 and 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN 2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

NO >> A malfunction has been detected in the engine side of the CAN 2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

7. CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace harness for a short.

U1611 CAN COMMUNICATION

DTC Description

INFOID:0000000014420016

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via the CAN 2 communication lines. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN 2 communication lines. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a loss of communication with the aftertreatment diesel particulate filter temperature sensor module.

DTC	CONSULT screen terms (Trouble diagnosis content)		DTC detection condition	
U1611	(Loss Communication with DPF Temperature Sensor Module)	1	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	CAN 2 communication proprietary EGTS triple cold junction message not received.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.
		2	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	CAN 2 communication proprietary EGTS triple message not received.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors
- Low battery voltage
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U1611 being current on the CONSULT screen.

Is DTC U1611 current?

YES >> Go to EC-967, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420017

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1611 being current or more than 1 past count on the CONSULT screen.

Is DTC U1611 detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U010E being current or more than 1 past count on the CONSULT screen.

Is DTC U010E detected?

YES >> GO TO 9.
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current or more than 1 past count on the CONSULT screen:

- P0106
- P029D
- P029E
- P02A2
- P1612

Is applicable DTC detected?

YES >> GO TO 8.
NO >> GO TO 4.

4.INSPECT DPF TEMPERATURE SENSOR MODULE AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module harness connector C29.
3. Inspect the DPF temperature sensor module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK THE DPF TEMPERATURE SENSOR MODULE SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the DPF temperature sensor module harness connector C29.
3. Turn ignition switch ON.
4. Measure the voltage between DPF temperature sensor module harness connector C29 terminals 3 and 4.

DPF temperature sensor module			Voltage (Approx.)
Connector	Terminal	Terminal	
C29	3	4	> 10.8V

Is inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.CHECK THE DPF TEMPERATURE SENSOR MODULE VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the DPF temperature sensor module harness connector C29.
3. Turn ignition switch ON.

4. Measure the voltage between DPF temperature sensor module harness connector C29 terminal 3 and ground.

DPF temperature sensor module		Ground	Voltage (Approx.)
Connector	Terminal		
C29	3	—	> 10.8V

Is inspection result normal?

YES >> Repair or replace harness for an open ground circuit.
NO >> Repair or replace harness for an open battery voltage supply circuit.

7.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the DPF temperature sensor module harness connector C29.
3. Disconnect the data link adapter from the service data link harness connector.
4. Measure the resistance between DPF temperature sensor module harness connector C29 terminals 1 and 2.

DPF temperature sensor module			Resistance
Connector	Terminal		
C29	1	2	54 – 66 Ω

Is the inspection result normal?

YES >> Replace DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
NO >> GO TO 9.

8.CHECK FOR IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Check the IPDM E/R and fuses:

- Check for a blown aftertreatment sensor power supply fuse.
- Inspect the DPF temperature sensor power supply fuse for cracks, burns, corrosion, or discoloration.
- Inspect the IPDM E/R for loose or expanded pins.
- Inspect the IPDM E/R for corrosion.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link harness connector.
3. Measure the resistance between Cummins data link connector F190 terminals 1 and 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link harness connector.
3. Disconnect the ECM harness connector E93.
4. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN 2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

NO >> A malfunction has been detected in the engine side of the CAN 2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

11. CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 12.

NO >> Repair or replace error-detected parts.

12. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".

NO >> Repair or replace harness for a short.

U1612 CAN COMMUNICATION

DTC Description

INFOID:0000000014420018

The aftertreatment SCR (selective catalytic reduction) temperature sensor module is a smart device that communicates with the engine control module via the CAN 2 communication lines. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN 2 communication lines. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a loss of communication with the aftertreatment SCR temperature sensor module.

DTC	CONSULT screen terms (Trouble diagnosis content)		DTC detection condition	
U1612	(Loss Communication with SCR Temperature Sensor Module)	1	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	J1939 proprietary EGTS dual cold junction message not received.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.
		2	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	J1939 proprietary EGTS triple message not received.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness and connectors
- Low battery voltage
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC U1612 being current on the CONSULT screen.

Is DTC U1612 current?

YES >> Go to EC-971, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420019

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1612 being current or more than 1 past count on the CONSULT screen.

Is DTC U1612 detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U010E being current or more than 1 past count on the CONSULT screen.

Is DTC U010E detected?

YES >> GO TO 9.
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current or more than 1 past count on the CONSULT screen:

- P0106
- P029D
- P029E
- P02A2
- P1611

Is applicable DTC detected?

YES >> GO TO 8.
NO >> GO TO 4.

4.INSPECT SCR TEMPERATURE SENSOR MODULE AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module harness connector C30.
3. Inspect the SCR temperature sensor module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK THE SCR TEMPERATURE SENSOR MODULE SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the SCR temperature sensor module harness connector C30.
3. Turn ignition switch ON.
4. Measure the voltage between SCR temperature sensor module harness connector C30 terminals 3 and 4.

SCR temperature sensor module			Voltage (Approx.)
Connector	Terminal	Terminal	
C30	3	4	> 10.8V

Is inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.CHECK THE DPF TEMPERATURE SENSOR MODULE VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the SCR temperature sensor module harness connector C30.
3. Turn ignition switch ON.

4. Measure the voltage between DPF temperature sensor module harness connector C30 terminal 3 and ground.

SCR temperature sensor module		Ground	Voltage (Approx.)
Connector	Terminal		
C30	3	—	> 10.8V

Is inspection result normal?

YES >> Repair or replace harness for an open ground circuit.
NO >> Repair or replace harness for an open battery voltage supply circuit.

7.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the SCR temperature sensor module harness connector C30.
3. Disconnect the data link adapter from the service data link harness connector.
4. Measure the resistance between SCR temperature sensor module harness connector C30 terminals 1 and 2.

SCR temperature sensor module			Resistance
Connector	Terminal		
C30	1	2	54 – 66 Ω

Is the inspection result normal?

YES >> Replace DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
NO >> GO TO 9.

8.CHECK FOR IPDM E/R AND FUSES

1. Turn ignition switch OFF.
2. Check the IPDM E/R and fuses:

- Check for a blown aftertreatment sensor power supply fuse.
- Inspect the SCR temperature sensor power supply fuse for cracks, burns, corrosion, or discoloration.
- Inspect the IPDM E/R for loose or expanded pins.
- Inspect the IPDM E/R for corrosion.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link harness connector.
3. Measure the resistance between Cummins data link connector F190 terminals 1 and 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	54 – 66 Ω

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10.CHECK FOR TERMINATING RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the data link adapter from the service data link harness connector.
3. Disconnect the ECM harness connector E93.
4. Measure the resistance between Cummins data link connector F190 terminal 1 and terminal 2.

Cummins data link connector			Resistance
Connector	Terminal		
F190	1	2	108 – 132 Ω

Is the inspection result normal?

YES >> A malfunction has been detected in the aftertreatment side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

NO >> A malfunction has been detected in the engine side of the CAN2 communication line circuit. Refer to LAN-53, "Trouble Diagnosis Flow Chart".

11. CHECK CAN2 COMMUNICATION LINE (+) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 1 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	1	–	0.1 – 4.5V

Is the inspection result normal?

YES >> GO TO 12.

NO >> Repair or replace error-detected parts.

12. CHECK CAN2 COMMUNICATION LINE (–) FOR SHORT

1. Turn ignition switch ON.
2. Check voltage between Cummins data link connector F190 terminal 2 and ground.

Cummins data link connector		Ground	Voltage (Approx.)
Connector	Terminal		
F190	2	–	0.1 – 4.5V

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".

NO >> Repair or replace harness for a short.

U3017 CAN COMMUNICATION

DTC Description

INFOID:0000000014420020

The real-time clock consists of a timing chip internal to the engine control module (ECM) which monitors engine off time, i.e.how long the engine has been shut down.

DTC DETECTION LOGIC

The engine off timer was not counting correctly and does not match other timers in the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
U3017	(Control Module Timer/Clock Performance)	1	Diagnosis condition	When ignition switch is ON
			Signal (terminal)	(–)
			Threshold	Number of times that the engine off timer displays the same value ≥ 5 counts.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	When ignition switch is ON
			Signal (terminal)	(–)
			Threshold	Real-time clock elapsed time - 721 seconds > 120 seconds.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF for 1 minute.
   NOTE:
   Ensure engine coolant temperature is above 70°C (158°F).
2. Turn ignition switch ON for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC U3017 being current on the CONSULT screen.

Is DTC U3017 current?

YES >> Go to EC-975, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420021

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0606 being current on the CONSULT screen.

Is DTC P0606 detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch OFF for at least 1 minute.
2. Turn ignition switch ON for 15 minutes.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC U3017 being current on the CONSULT screen.

Is DTC U3017 detected as current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P0046 TC BOOST CONTROL CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420024

The rotary turbine control valve and linkage are electronically controlled by the rotary turbine control valve actuator. This actuator is a smart device and receives information via the CAN 2 communication lines from the engine control module (ECM). The rotary turbine control valve actuator performs its own diagnostics and reports malfunctions back to the ECM, using the CAN 2 communication lines. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The turbocharger actuator was expecting to see valid CAN 2 communication lines messages from the ECM, but the actual data received was unreadable or missing.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0046	(Turbocharger/Supercharger Boost Control Solenoid "A" Circuit Range/ Performance)	1	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	Turbocharger bypass valve has not received a position command message for greater than or equal to a calibrated time after previously having received a command message.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Ignition switch is ON or engine running.
			Signal (terminal)	(–)
			Threshold	Turbocharger bypass valve has not received a message from the ECM.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Rotary turbine control valve actuator
- Harness or connector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0046 being current on the CONSULT screen.

Is DTC P0046 current?

YES >> Go to EC-977, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420025

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U010C being current on the CONSULT screen.

Is DTC U010C detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Inspect the harness connector and rotary turbine control valve actuator pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC U010C become current?

YES >> GO TO 4.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

4. CHECK DTCS AND VERIFY ACTUATOR CONDITION

1. Turn ignition switch OFF.
2. Connect the rotary turbine control valve actuator harness connector F146.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0046 current?

YES >> GO TO 5.
NO >> The removal and installation of the connector corrected the issue.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.

NO >> Repair or replace error-detected parts.

6. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0046 being past on the CONSULT screen.

Is DTC P0046 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".

P0047 TC BOOST CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420026

The rotary turbine control valve and linkage are electronically controlled by the rotary turbine control valve actuator. This actuator is a smart device and receives information via the CAN 2 communication lines from the engine control module (ECM). The rotary turbine control valve actuator performs its own diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The voltage to the turbocharger bypass actuator was low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0047	(Turbocharger/Supercharger Boost Control Solenoid "A" Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running.
		Signal (terminal)	(–)
		Threshold	The voltage for turbocharger bypass valve smart device is less than a calibrated value.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Rotary turbine control valve actuator
- Harness or connector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0047 being current on the CONSULT screen.

Is DTC P0047 current?

YES >> Go to EC-980, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420027

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0562
- P0563
- P0687

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- U0106
- U010C
- U010E
- U029D
- U029E
- U1611
- U1612

Is applicable DTC detected?

YES >> Replace IPDM E/R. Refer to PCS-43, "Removal and Installation of IPDM E/R".
NO >> GO TO 3.

3.CHECK BATTERY TERMINALS

1. Turn ignition switch OFF.
2. Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 4.
NO >> Tighten and clean the terminals.

4.CHECK BATTERY VOLTAGE

1. Turn ignition switch ON.
2. Measure the voltage from the positive battery terminal to the negative battery terminal.

Is the battery voltage at least 12V?

YES >> GO TO 5.
NO >> Charge or replace battery(s). Refer to PG-187, "Removal and Installation - CUMMINS 5.0L".

5.INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Inspect the harness connector and rotary turbine control valve actuator pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE ROTARY TURBINE CONTROL VALVE ACTUATOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the rotary turbine control valve actuator harness connector F146.
3. Turn ignition switch ON.
4. Measure the voltage between rotary turbine control valve actuator harness connector F146 terminals 1 and 4.

Rotary turbine control valve actuator			Voltage (Approx.)
Connector	Terminal	Terminal	
F146	1	4	> 10V

Is inspection result normal?

YES >> Replace rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".
NO >> GO TO 7.

7. CHECK THE ROTARY TURBINE CONTROL VALVE ACTUATOR VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the rotary turbine control valve actuator harness connector F146.
3. Turn ignition switch ON.
4. Measure the voltage between rotary turbine control valve actuator harness connector F146 terminal 4 and ground.

Rotary turbine control valve actuator		Ground	Voltage (Approx.)
Connector	Terminal		
F146	4	—	> 10V

Is inspection result normal?

YES >> Repair or replace harness for an open ground circuit.
NO >> Repair or replace harness for an open battery voltage supply circuit.

P0049 TC TURBINE OVERSPEED

DTC Description

INFOID:0000000014420028

The turbocharger speed sensor is a Hall effect type sensor. The engine control module (ECM) provides a 5V supply to the position sensor and a return circuit. As the blades of the turbocharger spin past the speed sensor, a signal is generated on the position sensor signal circuit. The ECM interprets this signal and converts it to a turbocharger speed.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the turbocharger speed was greater than 330,000 rpm for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0049	(Turbocharger/Supercharger Turbine Overspeed)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Raw turbocharger speed value > 5,500 Hz (220K RPM)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger speed sensor
- Harness or connector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0049 being current on the CONSULT screen.

Is DTC P0049 current?

YES >> Go to EC-983, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420029

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0103
- P0107
- P0108
- P012C
- P012D
- P0652
- P1192

- P1193
- P22CD
- P22CE

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR INTERMITTENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and clear past “ENGINE” diagnostic trouble codes.
3. Start the engine.
4. Using accelerator pedal, increase engine speed to 1500 rpm for at least 20 seconds.
5. Allow engine to idle.
6. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
7. Check for DTC P0049 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT TURBOCHARGER SPEED SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger speed sensor harness connector F126.
3. Inspect the engine harness and turbocharger speed sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the turbocharger speed sensor harness connector F126.
3. Turn ignition switch ON.
4. Measure the voltage between turbocharger speed sensor harness connector F126 terminals 1 and 2.

Turbocharger speed sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F126	1	2	4.75V - 5.25V

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the turbocharger speed sensor harness connector F126.
4. Measure the resistance between the ECM harness connector F101 terminal 188 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	188	F101	All	> 100k Ω

Is the inspection result normal?

YES >> Replace turbocharger speed sensor. Refer to EM-407, "Removal and Installation".
NO >> Repair or replace the harness for a short.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between ECM harness connector F101 terminals 106 and 127.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75V -5.25V

Is the inspection result normal?

YES >> Repair or replace the harness for an open.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P004E TC BOOST CONTROL CIRCUIT INTERMITTENT

DTC Description

INFOID:0000000014420030

The dual stage turbocharger is electronically activated by the Rotary Turbine Control (RTC) actuator. The actuator is powered by the battery via the smart power relay. The RTC actuator is a smart device and receives information by the CAN 2 communication lines from the engine control module (ECM). The RTC actuator performs its own diagnostics and reports malfunctions back to the ECM, using the CAN 2 communication lines. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The internal temperature of the Rotary Turbine Control (RTC) actuator exceeded 125°C (257°F) for a period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P004E	(Turbocharger/Supercharger Boost Control Solenoid "A" Circuit Intermittent/Erratic)	Diagnosis condition	Ignition switch is ON or engine running.
		Signal (terminal)	(–)
		Threshold	Turbocharger bypass valve smart device has detected a warm temperature condition.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Rotary turbine control valve actuator
- Exhaust leak near turbocharger actuator
- Restricted air flow around turbocharger actuator

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P004E being current on the CONSULT screen.

Is DTC P004E current?

YES >> Go to EC-986, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420031

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P004E being current or more than 2 past counts on the CONSULT screen.

Is DTC P004E detected as current or more than 2 past counts?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR MOUNTING

1. Turn ignition switch OFF.
2. Check that rotary turbine control valve actuator is properly installed.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Relocate and/or secure the rotary turbine control valve actuator at the correct mounting location.

3. INSPECT AIR FLOW TO ROTARY TURBINE CONTROL VALVE ACTUATOR

1. Turn ignition switch OFF.
2. Check rotary turbine control valve actuator mounting for air flow restrictions or blockage that could cause the temperature sensor module to overheat such as:

- Debris on or around the actuator.
- Exhaust leaks allowing exhaust to overheat the actuator.

Is the inspection result normal?

YES >> Repair the cause of the restricted air flow.
NO >> Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".

P007B CHARGE AIR COOLER TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420032

The ECM supplies 5V to the engine charge air cooler outlet pressure/temperature sensor signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the charge air cooler outlet temperature. When the intake air is cold, the sensor (or thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or a high temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine charge air cooler outlet pressure/temperature sensor reading was higher or lower than estimated during engine running or after an 8 hour cold soak.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P007B	(Charge Air Cooler Temperature Sensor Circuit Range/Performance)	1	Diagnosis condition	Engine running.
			Signal (terminal)	(–)
			Threshold	Cumulative sum of error in 30 seconds is > 18,000°C, which is ≥ 24°C. Where tolerance is defined as 0°C.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	• 8 hour cold soak • Engine running.
			Signal (terminal)	(–)
			Threshold	Engine charge air cooler outlet pressure/temperature sensor is 13°C > then the tolerance of the second most accurate sensor of the remaining sensors
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Engine charge air cooler outlet pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF for 8 hours.
2. After an 8 hour cold soak, start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P007B being current on the CONSULT screen.

Is DTC P007B current?

YES >> Go to EC-988, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420033

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P007B being current on the CONSULT screen.

Is DTC P007B detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P007C
- P007D
- Any turbocharger DTCs
- P0236
- P0237
- P0238
- P1191
- P1192
- P1193
- P22CB
- P22CC
- P22CD
- P22CE

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK CHARGE AIR COOLER OUTLET TEMPERATURE SENSOR

1. Turn ignition switch ON.
2. Connect CONSULT and select “Data Monitor” mode.
3. Select “CHARGE AIR COOLER OUTLET TEMPERATURE SENSOR” and check the indication.
4. Compare engine charge air cooler outlet pressure/temperature sensor reading to ambient air temperature.

Monitor item	Condition	Indication
CHARGE AIR COOLER OUTLET TEMPERATURE SENSOR	Ignition switch ON (Engine stopped.)	Within 5.6C (10F) of ambient air temperature

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".

4.INSPECT CHARGE AIR COOLER

Inspect the charge-air cooler:
- Inspect the charge-air cooler for cracks, holes, and other damage.
- Inspect the tubes, fins, and welds for tears, breaks, or other damage.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace charge air cooler. Refer to EM-233, "Removal and Installation".

5.INSPECT ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Inspect the harness connector and engine charge air cooler outlet pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007D DTC become current?

YES >> GO TO 7.
NO >> GO TO 8.

7.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between engine charge air cooler pressure/temperature sensor harness connector F140 terminal 3 and 4.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007C DTC become current?

YES >> Replace engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> GO TO 8.

8.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007D DTC become current?

YES >> GO TO 10.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

10.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.

3. Connect a jumper wire between ECM harness connector F101 terminal 110 and 127.
4. Turn ignition switch ON.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007C DTC become current?

YES >> Repair or replace engine harness.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P007C CHARGE AIR COOLER TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420034

The ECM supplies 5V to the engine charge air cooler outlet pressure/temperature signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the charge air cooler outlet temperature. When the intake air is cold, the sensor (or thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or a high temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine charge air cooler outlet pressure/temperature signal voltage was out of range low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P007C	(Charge Air Cooler Temperature Sensor Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	Charge air cooler outlet temperature sensor voltage < 0.057V (> 130°C)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Engine charge air cooler outlet pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P007C being current on the CONSULT screen.

Is DTC P007C current?

YES >> Go to EC-992, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420035

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P007C being current on the CONSULT screen.

Is DTC P007C detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Inspect the harness connector and engine charge air cooler outlet pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins

- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007D DTC become current and P007C become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007C DTC become current?

YES >> Replace engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> The removal and installation of the connector corrected the fault.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007D DTC become current and P007C become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.

2. Disconnect the ECM harness connector F101.
3. Disconnect the engine charge air cooler outlet pressure/temperature sensor harness connector F140.
4. Measure the resistance between the ECM harness connector terminal 110 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	110	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the engine charge air cooler outlet pressure/temperature sensor harness connector F140.
4. Measure the resistance between the ECM harness connector F101 terminal 110 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	110	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short to ground.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007C DTC become current?

YES >> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been be detected.
NO >> The removal and installation of the connector corrected the fault.

P007D CHARGE AIR COOLER TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420036

The ECM supplies 5V to the engine charge air cooler outlet pressure/temperature sensor signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the engine charge air cooler outlet pressure/temperature sensor. When the intake air is cold, the sensor (or thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or a high temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine charge air cooler outlet pressure/temperature sensor signal was greater than 4.7V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P007D	(Charge Air Cooler Temperature Sensor Circuit High)	Diagnosis condition	Ignition switch ON or engine running.
		Signal (terminal)	(-)
		Threshold	Charge air cooler outlet temperature sensor value > 4.737V (< -40°C).
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Engine charge air cooler outlet pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P007D being current on the CONSULT screen.

Is DTC P007D current?

YES >> Go to EC-995, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420037

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P007D being current on the CONSULT screen.

Is DTC P007D detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Inspect the harness connector and engine charge air cooler outlet pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect charge air cooler outlet temperature sensor harness connector F140.
3. Connect a jumper wire between engine charge air cooler pressure/temperature sensor harness connector F140 terminal 3 and 4.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007C DTC become current and P007D become past?

YES >> Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> GO TO 4.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect engine charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007D DTC become current?

YES >> GO TO 5.
NO >> The removal and installation of the connector corrected the fault.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 110 and 127.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007C DTC become current and P007D become past?

YES >> GO TO 7.

NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the engine charge air cooler outlet pressure/temperature harness connector F140.
4. Measure the resistance between the ECM harness connector and the engine charge air cooler outlet pressure/temperature sensor harness connector.

ECM		Engine charge air cooler outlet pressure/temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	127	F140	4	< 10 Ω
	110		3	

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for an open.

8. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the engine charge air cooler outlet pressure/temperature sensor harness connector F140.
4. Measure the resistance between the ECM harness connector terminal 110 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	110	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P007D DTC become past?

YES >> The removal and installation of the connector corrected the fault.
NO >> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been be detected.

P0087 FUEL RAIL PRESSURE TOO LOW

DTC Description

INFOID:0000000014420038

The engine control module (ECM) provides a 5V supply and ground to the fuel rail pressure sensor using a dedicated sensor supply circuit. The pressure sensor delivers a fuel pressure signal to the ECM of the fuel rail. During engine operating conditions, the ECM commands and monitors the fuel rail pressure. If the fuel rail pressure exceeds or falls below commanded pressure, a DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the measured fuel rail pressure is below the commanded fuel rail pressure by at least 200 bar (2900 psi) for 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0087	LOW FUEL PRES (Fuel Rail/System Pressure - Too Low)	Diagnosis condition	Engine running
		Signal (terminal)	(-)
		Threshold	• Commanded fuel rail pressure - actual fuel rail pressure > reftable10 bar. • High pressure pump delivery volume set point ≥ 0 m3/sec.
		Diagnosis delay time	10 seconds

POSSIBLE CAUSE

- Fuel lift pump
- Air in fuel
- Leaking fuel rail pressure relief valve
- High-pressure fuel pump
- Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0087 being current on the CONSULT screen.

Is DTC P0087 current?

YES >> Proceed to EC-998, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420039

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for current injector DTCs.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P008A
- P009C
- P009D
- P0191
- P0192
- P0193
- P0252
- P0253
- P0254
- P0687
- P2540

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR LEAKS IN THE HIGH-PRESSURE FUEL SYSTEM

1. Turn ignition switch OFF.
2. Start and idle the engine.
3. Using CONSULT, perform High-Pressure Fuel System Leakage test.
4. Wait 1 minute after test is performed and check the following for leaks or moisture.

- Fuel rail supply line
- Fuel rail to fuel rail supply line
- Injector supply lines

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE FUEL PUMP ACTUATOR AND PRESSURE RELIEF VALVE

1. Turn ignition switch ON.
2. Using CONSULT, perform High-Pressure Fuel System Actuator Override test.

Are actuators within specifications?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK INJECTOR RETURN FLOW

1. Turn ignition switch ON.
2. Start and idle the engine.
3. Using CONSULT, perform High-Pressure Fuel Injector Return Flow test.
4. Wait 1 minute after test is performed and check the following for leaks or moisture.

- Fuel rail supply line
- Fuel rail to fuel rail supply line
- Injector supply lines

Is injector return flow within specifications?

YES >> Inspection End.
NO >> Replace applicable fuel injectors. Refer to EM-435, "Exploded View".

P0088 FUEL RAIL PRESSURE TOO HIGH

DTC Description

INFOID:0000000014420040

The engine control module (ECM) provides a 5V supply and ground to the fuel rail pressure sensor using a dedicated sensor supply circuit. The pressure sensor delivers a fuel pressure signal to the ECM of the fuel rail. During engine operating conditions, the ECM commands and monitors the fuel rail pressure. If the fuel rail pressure exceeds or falls below commanded pressure, a DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel rail pressure is greater than the commanded fuel rail pressure by 200 bar (2900 psi); or fuel rail pressure exceeded 2150 bar (31,500 psi).

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0088	HIGH_FUEL_PRES (Fuel Rail/System Pressure - Too High)	Diagnosis condition	Engine running
		Signal (terminal)	(-)
		Threshold	• Commanded fuel rail pressure - actual fuel rail pressure < reftable9 bar. • High pressure pump delivery volume set point ≤ 0 m3/sec. OR • Commanded fuel rail pressure - actual fuel rail pressure < -200 bar. • Pressure control valve (PCV) set point value < 10 bar.
		Diagnosis delay time	This diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Fuel pump actuator
- Fuel rail pressure relief valve

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0088 being current on the CONSULT screen.

Is DTC P0088 current?

YES >> Proceed to EC-1000, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420041

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen.

- P009C

- P009D
- P009E
- P0191
- P0252
- P0253
- P0254
- P0628
- P0629
- P2540

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK THE LIFT PUMP

1. Turn ignition switch ON.
2. Connect CONSULT and select “Data Monitor” mode.
3. Select “FUEL SUPPLY PRESSURE” and check the indication within 30 seconds.
4. Check fuel supply pressure in Freeze Frame Data.

Monitor item	Condition	Indication
FUEL SUPPLY PRESSURE	Ignition switch ON (Engine stopped.)	> 7 bar (102 psi)

Is the inspection result normal?

YES >> Replace lift pump. Refer to FL-43, "Removal and Installation".
NO >> GO TO 3.

3.CHECK THE FUEL PUMP ACTUATOR AND PRESSURE RELIEF VALVE

1. Turn ignition switch ON.
2. Using CONSULT, perform High-Pressure Fuel System Actuator Override test.

Are actuators within specifications?

YES >> GO TO 4.
NO >> Repair or replace error detected parts. Refer to EM-484, "Removal and Installation" or EM-482, "Removal and Installation".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0088 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P008A LOW FUEL PRESSURE CONTROL SYSTEM

DTC Description

INFOID:0000000014420042

The engine control module (ECM) provides a 5V supply and ground to the fuel pressure sensor on the sensor supply circuit. The Fuel pressure sensor provides a signal to the ECM on the fuel pressure sensor signal circuit. This sensor monitors the fuel pressure from the low fuel pressure system (lift pump to the stage 2 filter).

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the measured fuel pressure is less than 4.5 bar (66 psi).

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P008A	(Low Pressure Fuel System Pressure - Too Low)	Diagnosis condition	Engine running
		Signal (terminal)	(-)
		Threshold	A severity value of fuel pump inlet pressure minus 4.5 bar interpolated from reftable31. The accumulated severity reaches 500 secs.
		Diagnosis delay time	This diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Fuel pump
- Leak between lift pump and stage 2 filter
- Fuel filter
- Stage 2 filter housing

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
6. Check for DTC P008A being current on the CONSULT screen.

Is DTC P008A current?

YES >> Proceed to EC-1002, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420043

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen.

- P00C6
- P0461
- P0462
- P0463
- P0562
- P0563
- P0628
- P0629
- P2540
- P2541

- P2542

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.VERIFY FUEL LEVEL

1. Turn ignition switch ON.
2. Turn ignition switch OFF.
3. Verify there is fuel in the tank.
   NOTE:
   Do not rely on the fuel gauge. Check the actual tank level.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Add fuel to the tank.

3.CHECK THE LIFT PUMP VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the lift pump harness connector F226.
3. Turn ignition switch ON.
4. Measure the voltage between lift pump harness connector F226 terminals 1 and 2, while cranking the engine.

Lift pump			Condition	Voltage (Approx.)
Connector	Terminal			
F226	1	2	Engine cranking	> 8V

Is inspection result normal?

YES >> GO TO 4.
NO >> Check lift pump relay and lift pump harness. Repair or replace if necessary.

4.CHECK THE FUEL FILTERS

Check fuel filters for restriction.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace stage 1 and 2 fuel filters. Refer to FL-39, "Removal and Installation" and FL-41, "Removal and Installation".

5.CHECK FOR AIR IN THE FUEL

Check for air in the fuel system.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Remove air from the fuel system. Repair or replace error-detected parts.

6.CHECK FOR FUEL INLET RESTRICTION

1. Check the fuel lines to the tank for proper size, leaks, bends, or clogs.
2. Check the fuel tank vents for plugging.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.INSPECT FUEL SUPPLY LINES

Check suction and pressure side fuel supply lines for leaks or damage.

Is the inspection result normal?

YES >> • Replace the lift pump. Refer to FL-43, "Removal and Installation".
• GO TO 8.
NO >> Replace fuel supply line.

8.CHECK DTC PRIORITY

1. Connect all components.
2. Operate the vehicle according to the “”.

DTC P008A current?

YES >> Replace stage 2 fuel filter housing. Refer to FL-46, "Removal and Installation".
NO >> Repair End.

P009C FUEL PRESSURE RELIEF CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420044

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the high pressure common rail fuel pressure relief valve. The high pressure common rail fuel pressure relief valve is grounded in the ECM. The high pressure common rail fuel pressure relief valve is normally open. The PWM duty cycle to the high pressure common rail fuel pressure relief valve depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a short circuit to ground in the High Pressure Common Rail Fuel Pressure Relief Valve circuit signal or return circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P009C	(Fuel Pressure Relief Control Circuit Low)	Diagnosis condition	• Ignition is turned ON and before engine speed is detected. • Ignition OFF. The DTC will be active at the next ignition ON event.
		Signal (terminal)	(–)
		Threshold	PCV driver voltage < 3V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel pressure relief valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P009C being current on the CONSULT screen.

Is DTC P009C current?

YES >> Go to EC-1005, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420045

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P009C being current on the CONSULT screen.

Is DTC P009C detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL PRESSURE RELIEF VALVE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pressure relief valve harness connector F122.
3. Inspect the harness connector and fuel pressure relief valve pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins

- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between fuel pressure relief harness connector F122 terminal 2 and ground.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009D DTC become current and P009C become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect fuel pressure relief valve harness connector F122.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009C DTC become current?

YES >> Replace fuel pressure relief valve. Refer to EM-457, "Removal and Installation".
NO >> The removal and installation of the connector corrected the fault.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 97 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009D DTC become current and P009C become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.

2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pressure relief valve harness connector F122.
4. Measure the resistance between the ECM harness connector terminal 97 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	97	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pressure relief valve harness connector F122.
4. Measure the resistance between the ECM harness connector F101 terminal 97 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	97	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short to ground.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009C DTC become current?

YES >> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been be detected.
NO >> The removal and installation of the connector corrected the fault.

P009D FUEL PRESSURE RELIEF CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420046

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the high pressure common rail fuel pressure relief valve. The high pressure common rail fuel pressure relief valve is grounded in the ECM. The high pressure common rail fuel pressure relief valve is normally open. The PWM duty cycle to the high pressure common rail fuel pressure relief valve depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a short to battery, short pin-to-pin, or open circuit in the high pressure common rail fuel pressure relief valve circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)		DTC detection condition	
P009D	(Fuel Pressure Relief Control Circuit High)	1	Diagnosis condition	Engine running.
			Signal (terminal)	(-)
			Threshold	PCV driver voltage < 245V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Engine running.
			Signal (terminal)	(-)
			Threshold	PCV driver current > 10A
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel pressure relief valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P009D being current on the CONSULT screen.

Is DTC P009D current?

YES >> Go to EC-1008, "DTC Description".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420047

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P0563
- P0687
- P2503
- P2504

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P009D being current on the CONSULT screen.

Is DTC P009D detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT FUEL PRESSURE RELIEF VALVE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pressure relief valve harness connector F122.
3. Inspect the harness connector and fuel pressure relief valve pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel pressure relief valve harness connector F122.
3. Crank the engine 3-4 times.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009C DTC become current and P009D become past?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect fuel pressure relief valve harness connector F122.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009D DTC become current?

YES >> Replace fuel pressure relief valve. Refer to EM-457, "Removal and Installation".
NO >> The removal and installation of the connector corrected the fault.

6.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009D DTC become current and P009C become past?

YES >> GO TO 8.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

8.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pressure relief valve harness connector F122.
4. Measure the resistance between the ECM harness connector terminal 97 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	97	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short.

9.CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pressure relief valve harness connector F122.
4. Measure the resistance between the ECM harness connector F101 terminal 97 and the fuel pressure relief valve harness connector F122 terminal 2.

ECM		Fuel pressure relief valve		Resistance
Connector	Terminal	Connector	Terminal	
F101	97	F122	2	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 10.
NO >> Repair or replace the engine harness for an open.

10.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect all components.
3. Start the engine and idle for 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P009D DTC become current?

YES >> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been be detected.
NO >> The removal and installation of the connector corrected the fault.

P009E FUEL PRESSURE RELIEF CONTROL PERFORMANCE

DTC Description

INFOID:0000000014420048

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the high pressure common rail fuel pressure relief valve. The high pressure common rail fuel pressure relief valve is grounded in the ECM. The high pressure common rail fuel pressure relief valve is normally open. The PWM duty cycle to the high pressure common rail fuel pressure relief valve depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the fuel pressure relief valve closed-loop compensation value is outside of calibrated limits.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P009E	(Fuel Pressure Relief Control Performance/Stuck Off)	1	Diagnosis condition	Engine is running.
			Signal (terminal)	(-)
			Threshold	PCV Adaptation factor ≥ 1.3
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Engine is running.
			Signal (terminal)	(-)
			Threshold	PCV Adaptation factor ≤ 0.7
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel filter
- Fuel pump actuator
- Fuel pressure sensor
- Fuel pressure relief valve
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is DTC P009E current?

YES >> Go to EC-1011, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420049

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P009C
- P009D
- P0191
- P0192
- P0193
- P0252
- P0253
- P0254
- P0257
- P0686
- P0687
- P2540

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. INSPECT SMART POWER RELAY CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Inspect the engine harness and fuel rail sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE FUEL FILTERS

1. Turn ignition switch OFF.
2. Check for fuel filter restriction.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace stage 1 and 2 fuel filters. Refer to FL-39, "Removal and Installation" and FL-41, "Removal and Installation".

4. CHECK THE FUEL PUMP ACTUATOR AND PRESSURE RELIEF VALVE

1. Turn ignition switch ON.
2. Using CONSULT, perform High-Pressure Fuel System Actuator Override test.

Are actuators within specifications?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. INSPECT FUEL RAIL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Inspect the engine harness and fuel rail sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Start engine and idle for 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0193 current?

YES >> GO TO 7.
NO >> GO TO 8.

7. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between fuel rail pressure sensor harness connector F139 terminal 1 and 2.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0192 current?

YES >> Replace the fuel rail pressure sensor. Refer to EM-457, "Removal and Installation".
NO >> GO TO 8.

8. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0193 current?

YES >> GO TO 10.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

10. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between ECM harness connector F101 terminal 128 and 171.
3. Turn ignition switch ON and wait 30 seconds.

4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0192 current?

YES >> Repair or replace the engine harness.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P00AF BOOST PRESSURE CONTROL

DTC Description

INFOID:0000000014420050

The dual stage turbocharger is electronically activated by the Rotary Turbine Control (RTC) actuator. The actuator is powered by the battery via the smart power relay. The RTC actuator is a smart device and receives information by the CAN 2 communication lines from the primary engine control module (ECM). The RTC actuator performs its own diagnostics and reports malfunctions back to the primary engine ECM, using the CAN 2 communication lines. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The Rotary Turbine Control (RTC) actuator detected an internal error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P00AF	(Turbocharger/Supercharger Boost Control “A” Module Performance)	Diagnosis condition	Ignition switch is ON.
		Signal (terminal)	(–)
		Threshold	Turbocharger bypass valve smart device has detected an internal error which will prevent it from functioning normally.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Rotary turbine control valve actuator

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P00AF being current on the CONSULT screen.

Is DTC P00AF current?

YES >> Go to EC-1015, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420051

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P00AF being current on the CONSULT screen.

Is DTC P00AF detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

3. Check for DTC U010C or P0687 being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect rotary turbine control valve actuator harness connector F146.
3. Inspect the harness connector and rotary turbine control valve actuator pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation". GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR PROGRESSIVE DAMAGE TO AFTERTREATMENT SYSTEM

Perform the aftertreatment initial check procedure to test for a damaged DPF

Is the inspection result normal?

YES >> Check for active aftertreatment-related DTCs. Refer to EC-838, "DTC Index".
NO >> Replace the damaged aftertreatment component.

P00B7 COOLING SYSTEM

DTC Description

INFOID:0000000014698695

The coolant level sensor is a switch and is used to measure the level of the engine coolant in the radiator top tank. The coolant level sensor is immersed in the coolant and returns a different signal voltage when immersed in coolant verses being out of coolant. The Engine Control Module (ECM) monitors the change in the signal voltage to determine the level of the engine coolant.

DTC DETECTION LOGIC

The ECM detected the coolant level sensor signal voltage was higher than 3.0 V for more than 30 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P00B7	Engine Coolant Level Low (Coolant level - data valid but below normal operating range - moderately severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant level sensor voltage: • ≥ 3.00 V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Low coolant level
- Coolant level sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P00B7 being current on the CONSULT screen.

Is DTC P00B7 current?

YES >> Go to EC-1017, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014698696

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P00B7 being current or past on the CONSULT screen.

Is applicable DTC detected?

YES >> Check coolant level and add coolant if necessary. If DTC P00B7 is current and coolant level is not low, replace coolant level sensor. Refer to CO-52, "Exploded View".
NO >> Refer to GI-47, "Intermittent Incident".

P00C6 FUEL RAIL PRESSURE

DTC Description

INFOID:0000000014420052

The engine control module (ECM) provides a 5V supply and ground to the fuel rail pressure sensor using a dedicated sensor supply circuit. The pressure sensor delivers a fuel pressure signal to the ECM of the fuel rail. During engine operating conditions, the ECM commands and monitors the fuel rail pressure. If the fuel rail pressure exceeds or falls below commanded pressure, a fault will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel rail pressure was less than 120 bar (1740 psi) while cranking.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P00C6	(Fuel Rail Pressure Too Low - Engine Cranking Bank 1)	Diagnosis condition	During engine start
		Signal (terminal)	(-)
		Threshold	Fuel rail pressure was less than 120 bar (1740 psi) while cranking
		Diagnosis delay time	This diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Fuel lift pump
- Fuel rail pressure sensor
- High-pressure fuel pump
- Leaking fuel rail pressure relief valve

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P00C6 being current on the CONSULT screen.

Is DTC P00C6 current?

YES >> Proceed to EC-1018, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420053

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for current injector DTCs.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P008A
- P0088
- P009C
- P009D
- P009E

- P0191
- P0192
- P0193
- P0252
- P0253
- P0254
- P0686
- P0687
- P2540

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK HIGH-PRESSURE FUEL SYSTEM

1. Turn ignition switch ON and wait 30 seconds for lift pump to prime.
2. Check to see if engine starts.

NOTE:
It can be necessary to crank the engine for 30 seconds to prime the fuel system.

Is the inspection result normal?

YES >> Inspection End.
NO >> GO TO 4.

4. CHECK FOR LEAKS IN THE HIGH-PRESSURE FUEL SYSTEM

1. Turn ignition switch OFF.
2. Start and idle the engine.
3. Using CONSULT, perform High-Pressure Fuel System Leakage test.
4. Wait 1 minute after test is performed and check the following for leaks or moisture.

- Fuel rail supply line
- Fuel rail to fuel rail supply line
- Injector supply lines

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK THE FUEL PUMP ACTUATOR AND PRESSURE RELIEF VALVE

1. Turn ignition switch ON.
2. Using CONSULT, perform High-Pressure Fuel System Actuator Override test.

Are actuators within specifications?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK INJECTOR RETURN FLOW

1. Turn ignition switch ON.
2. Start and idle the engine.
3. Using CONSULT, perform High-Pressure Fuel Injector Return Flow test.
4. Wait 1 minute after test is performed and check the following for leaks or moisture.

- Fuel rail supply line
- Fuel rail to fuel rail supply line
- Injector supply lines

Is injector return flow within specifications?

YES >> Inspection End.
NO >> Replace applicable fuel injectors. Refer to EM-435, "Exploded View".

P0101 MAF SENSOR

DTC Description

INFOID:0000000014420054

NOTE:
If DTC P0101 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

The Mass Air Flow sensor is a frequency based device. A constant voltage is applied to a heated wire. The wire is positioned in the air stream and is heated by the electrical current that the voltage produces. As air flows across it, it cools down. The heated wire or film is a positive temperature coefficient (PTC) resistor. This means that the resistance drops when the temperature drops. The drop in resistance allows more current to flow through it in order to maintain the programmed temperature. This current is changed to a frequency which is sent to the ECM and interpreted as air flow. Adjustments to air temperature and humidity are taken into consideration since they also affect the temperature of the heated wire or film. The Mass Air Flow sensor receives a 12V power supply from the ECM.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Mass Air Flow sensor is at least 20% more than estimated:

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0101	MASS AIR FLOW (Mass or volume air flow “A” circuit range/performance)	1	Diagnosis condition	ECM detected MAF is 20% more than estimated
			Signal (terminal)	Voltage signal transmitted from MAF sensor to ECM
			Threshold	A high voltage (≥1.2 V) from the sensor is sent to ECM under light load driving condition
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	ECM detected MAF is 20% more than estimated
			Signal (terminal)	Voltage signal transmitted from MAF sensor to ECM
			Threshold	A low voltage (≤ 0.8 V from the sensor is sent to ECM under heavy load driving condition
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- MAF sensor
- Plugged air filter
- Leaks in the charge air system plumbing
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1021, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420055

1.CHECK FUEL SYSTEM DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.
3. If any fuel system or fuel injector related DTC exists, perform the confirmation procedure (diagnosis procedure) for other DTC:

- Fuel system related DTC
- Fuel injector related DTC

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK AIR FLOW DTC PRIORITY

1. Using CONSULT, check for other existing ENGINE diagnostic trouble codes.
2. If any air injection related DTC exists, perform the confirmation procedure (diagnosis procedure) for other DTC:

- NOx sensor related DTC
- EGR related DTC
- EGR bypass related DTC
- Turbocharger related DTC

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR ANOTHER RELATED DTC

Check for a current DTC P221A on the CONSULT screen.

Is applicable DTC current?

YES >> Refer to EC-1779, "DTC Description"
NO >> GO TO 4.

4.CHECK MASS AIR FLOW SENSOR

Check mass air flow sensor. Refer to EC-1023, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace mass air flow sensor. Refer to EM-224, "Removal and Installation".

5.INSPECT MASS AIR FLOW SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor from engine harness connector.
3. Remove the mass air flow sensor from its mounting location.
4. Inspect the mass air flow sensor body and heated wire measuring components for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK AIR INTAKE SYSTEM

1. Reinstall mass air flow sensor.
2. Check for an air intake leak between the air box and the intake manifold.

- Check all clamps and connectors for tightness.
- Check for disconnected or damaged air pipes.
- Perform a pressurized leak test of the system, if possible.

Was any leak found in the air intake system?

YES >> Repair or replace leaking component(s).
NO >> GO TO 7.

7. CHECK AIR FILTER CONDITION

Check the intake air filter for excessive buildup and restriction.
- Check the filter restriction monitor gauge, if equipped.
- Remove filter, if necessary, and inspect for excessive debris buildup or filter media damage.
- Insure the air filter was installed properly.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. PERFORM FUEL SYSTEM DIAGNOSTIC TEST

1. Turn ignition switch ON.
2. Using SST J-54421, perform the high pressure fuel injector drain flow test on bank 1, then on bank 2.
   NOTE:
   The purpose of this test is to check for excessive fuel drain from each injector, one bank at a time.

- Disconnect the fuel drain lines from the bank of injectors being tested.
- Plug injector drain lines with the plug provided in the kit.
- Connect the piezo adapter line drain tool connection to each of the injectors.
- Start the engine until top mark is reached or crank for 30 seconds if the engine does not start.
- The maximum permissible drain is 3 times the lowest measured drain quantity.
- A failed injector will have a higher flow and exhibits 3 times the lowest measured drain quantity.

Filling quantity up to:	Engine cranks but does not start (small diameter)		Engine starts (large diameter)	
	ml	oz	ml	oz
1	1.8	0.06	6	0.2
2	2.4	0.08	13	0.44
3	3.2	0.11	21	0.71
4	4	0.14	29	0.98
5	—	—	37	1.25
6	—	—	45	1.52
7	—	—	53	1.79

Does each fuel injector meet the specification in injector drain flow test?

YES >> • Replace mass air flow sensor. Refer to EM-224, "Removal and Installation".
• GO TO 9.
NO >> • Replace the leaking fuel injector. Refer to EM-435, "Exploded View".
• GO TO 9.

9. ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select ENGINE and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P0101 DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1020, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014420056

1. CHECK MASS AIR FLOW SENSOR

With CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Connect CONSULT and select “DATA MONITOR” mode.
5. Select “MASS AIR FLOW SENSOR” and check the indication.

Monitor item	Condition	Indication (V)
MASS AIR FLOW SENSOR	Ignition switch ON (Engine stopped.)	-2 lb/min(-120 lb/hr) to 2 lb/min(120 lb/hr)

Without CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F101	187	127	Ignition switch ON (Engine stopped.)	Less than 0.8V

Is the inspection result normal?

YES >> Inspection End.

NO >> Clean or replace malfunctioning mass air flow sensor. Refer to EM-224, "Removal and Installation".

P0102 MASS AIR FLOW SENSOR

DTC Description

INFOID:0000000014420057

NOTE:
If DTC P0102 is displayed with other DTC, first perform the trouble diagnosis for other DTC.

The Mass Air Flow sensor is a frequency based device. A constant voltage is applied to a heated wire. The wire is positioned in the air stream and is heated by the electrical current that the voltage produces. As air flows across it, it cools down. The heated wire or film is a positive temperature coefficient (PTC) resistor. This means that the resistance drops when the temperature drops. The drop in resistance allows more current to flow through it in order to maintain the programmed temperature. This current is changed to a frequency which is sent to the ECM and interpreted as air flow. Adjustments to air temperature and humidity are taken into consideration since they also affect the temperature of the heated wire or film. The Mass Air Flow sensor receives a 12 volt power supply from the ECM.

DTC DETECTION LOGIC

The Mass Air Flow sensor reading is less than the specified operating range for a calibrated amount of time:

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0102	MASS AIR FLOW (Mass or volume air flow “A” circuit range/performance)	Diagnosis condition	ECM detected MAF sensor signal was shorted to ground for a period of time
		Signal (terminal)	Voltage signal transmitted from MAF sensor to ECM
		Threshold	MAF sensor value < 1,000 Hz (> 27.5 kg/min)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- MAF sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0102 being current on the CONSULT screen.

Is DTC P0102 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420058

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0102 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CURRENT DTC RELATED TO SENSOR VOLTAGE SUPPLY

Using CONSULT, check for other ″current″ ENGINE diagnostic trouble codes.

Is DTC P262D detected?

YES >> Refer to EC-1968, "DTC Description".
NO >> GO TO 3.

3. CHECK MASS AIR FLOW SENSOR

1. Inspect the intake and exhaust systems for blockage or restrictions
- Inspect the air filter for excessive dirt, soiling or other problems that can cause restricted air flow
- Inspect the charge-air cooler hoses/tubes and connections
- Inspect all air intake, crankcase vent and turbocharger related hoses/tubes and connections for damage, air leaks or blockage
- Check charge-air cooler restriction
2. Inspect the exhaust system for damaged components that could cause exhaust flow blockage.

Are any blockages or damages found?

YES >> Repair or replace damaged or restricted component.
NO >> GO TO 4.

4. INSPECT MASS AIR FLOW SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor from engine harness connector.
3. Remove the mass air flow sensor from its mounting location.
4. Inspect the mass air flow sensor body and heated wire for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK MASS AIR FLOW SENSOR SUPPLY VOLTAGE AT SENSOR

1. Turn ignition switch ON.
2. Check the voltage between MAF sensor supply voltage and return circuit terminals.

MAF sensor			Voltage (V) Approx.
Connector	Terminal (+)	Terminal (-)	
F104	2	3	Battery voltage

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 8.

6. CHECK MASS AIR FLOW SENSOR POWER SUPPLY FOR SHORT CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Wait 30 seconds.
4. Measure the resistance between MAF sensor supply voltage and return circuit terminals.

MAF sensor			Resistance
Connector	Terminal	Terminal	
F104	2	3	> 100 KΩ

Is the inspection result normal?

YES >> GO TO 7.
NO >> • Repair or replace harness for a short circuit.
• GO TO 11.

7. CHECK MASS AIR FLOW SENSOR SIGNAL FOR SHORT CIRCUIT

Measure the resistance between MAF sensor signal circuit and return circuit terminals.

MAF sensor			Resistance
Connector	Terminal	Terminal	
F104	1	3	> 100 KΩ

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace harness for a short circuit.
• GO TO 11.

8. CHECK MASS AIR FLOW SENSOR SIGNAL FOR OPEN CIRCUIT

Measure the resistance of the MAF sensor signal circuit between the MAF sensor and the ECM.

MAF sensor		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F104	1	F101	187	< 10Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair or replace harness for a open circuit.
• GO TO 11.

9. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair or replace error-detected parts.
• GO TO 11.

10. CHECK SENSOR SUPPLY VOLTAGE AT THE ECM

1. Turn ignition switch ON.
2. With ECM connector F101 disconnected, check the voltage between MAF sensor supply voltage and return circuit pins at the ECM.

ECM			Voltage (V) Approx.
Connector	Terminal (+)	Terminal (-)	
F101	138	127	Battery voltage

Is the inspection result normal?

YES >> • Repair open circuit in harness or connectors.
• GO TO 11.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".

• GO TO 11.

11.CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON.
4. Using CONSULT, erase ENGINE diagnostic trouble codes.
5. Operate the engine within the ″Conditions for setting the DTC″.
6. Using CONSULT, check for ENGINE diagnostic trouble codes.

Is P0102 DTC detected?

YES >> Return to Diagnosis Procedure. Refer to EC-1024, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014420059

1.CHECK MASS AIR FLOW SENSOR

With CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Connect CONSULT and select “DATA MONITOR” mode.
5. Select “MASS AIR FLOW SENSOR” and check the indication.

Monitor item	Condition	Indication (V)
MASS AIR FLOW SENSOR	Ignition switch ON (Engine stopped.)	-2 lb/min(-120 lb/hr) to 2 lb/min(120 lb/hr)

Without CONSULT

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Start engine and warm it up to normal operating temperature.
4. Check the voltage between ECM harness connector terminals under the following conditions.

ECM			Condition	Voltage (V)
Connector	+	–		
	Terminal	Terminal		
F101	187	127	Ignition switch ON (Engine stopped.)	Less than 0.8V

Is the inspection result normal?

YES >> Inspection End.
NO >> Clean or replace malfunctioning mass air flow sensor. Refer to EM-224, "Removal and Installation".

P0103 MASS AIR FLOW SENSOR

DTC Description

INFOID:0000000014420060

The mass air flow sensor is a frequency based device. A constant voltage is applied to a heated wire. This wire is positioned in the air stream and is heated by the electrical current that the voltage produces. As air flows across it, it cools down. The heated wire or film is a positive temperature coefficient (PTC) resistor.This means that the resistance drops when the temperature drops. The drop in resistance allows more current to flow through it in order to maintain the programmed temperature. This current is changed to a frequency which is sent to the ECM and interpreted as air flow. Adjustments for air temperature and humidity are taken into consideration since they also affect the temperature of the heated wire or film. The mass air flow sensor receives a 12 volt power supply from the ECM.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the mass air flow sensor signal is shorted to battery for a period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0103	MAF_SEN/CIRCUIT (Mass or Volume Air Flow “A” Circuit High Input)	Diagnosis condition	Engine is running.
		Signal (terminal)	Mass air flow sensor (187)
		Threshold	Mass air flow sensor value > 15,100 Hz (< 0 kg/min)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Mass air flow sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0103 being current on the CONSULT screen.

Is DTC P0103 current?

YES >> Go to EC-1028, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420061

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0103 being past on the CONSULT screen.

Is DTC P0103 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 2.

2.CHECK INTAKE AND EXHAUST SYSTEM FOR RESTRICTIONS

1. Turn ignition switch OFF.
2. Inspect the intake and exhaust systems for blockage or restrictions.:

- Inspect the air filter for excessive dirt, soiling or other problems that can cause restricted air flow.
- Corroded pins
- Inspect the charge air cooler hoses/tubes and connections.

- Inspect all air intake, crankcase vent and turbocharger related hoses/tubes and connections for damage, air leaks, or blockage.
- Check charge air cooler restriction.
- Inspect the exhaust system for damaged components that could cause exhaust flow blockage.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT MASS AIR FLOW SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector F104.
3. Inspect the engine harness and mass air flow sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the mass air flow sensor harness connector F104.
3. Turn ignition switch ON.
4. Measure the voltage between mass air flow sensor harness connector F104 terminals 2 and 3.

Mass air flow sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F104	2	3	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor harness connector F104.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0102 become current and DTC P0103 become past?

YES >> Replace mass air flow sensor. Refer to EM-224, "Removal and Installation".
NO >> GO TO 8.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between ECM harness connector F101 terminals 127 and 138.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	127	138	Battery voltage

Is the inspection result normal?

YES >> Repair or replace the engine harness for an open.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

8. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0102 become current and DTC P0103 become past?

YES >> Repair or replace the engine harness for an open or short to voltage.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P0106 MANIFOLD ABSOLUTE PRESSURE SENSOR

DTC Description

INFOID:0000000014420062

The charge air cooler pressure sensor is used to measure charge air pressure entering the intake manifold. This information is used by the ECM to control emissions. The charge air cooler pressure sensor provides a voltage signal to the ECM. This sensor voltage changes, based on the pressure exiting the charge air cooler. The ECM also estimates the charge air cooler pressure. If the measured pressure differs from the estimated pressure by a calibrated amount, an error is set.

DTC DETECTION LOGIC

The ECM detected the intake manifold pressure sensor was reading higher or lower than expected at ignition OFF or during normal engine operation.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0106	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Range/Performance (Engine charge air cooler outlet pressure - data erratic, intermittent or incorrect)	1	Diagnosis condition	• First part runs continuously when key is ON, or engine is running • Second part runs when key is OFF
			Signal (terminal)	—
			Threshold	Cumulative sum of error in 45 seconds is ever > 270,000 kPa, which is equivalent to ≥ 60 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	• First part runs continuously when key is ON, or engine is running • Second part runs when key is OFF
			Signal (terminal)	—
			Threshold	Maximum value of in range high error cumulative sum plus the maximum value of in range low error cumulative sum in 45 seconds is ≥ 501,000 kPa which is equivalent to ≥ 111.333 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	• First part runs continuously when key is ON, or engine is running • Second part runs when key is OFF
			Signal (terminal)	—
			Threshold	Charge air pressure sensor reading < 18 kPa or charge air pressure sensor reading >144.31 kPa The tolerance of the remaining pressure sensors are: exhaust pressure sensor = 39.59 kPa and compressor inlet pressure sensor = 3.19 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Engine charge air cooler outlet pressure/temperature sensor
- Leaks in the charge air system plumbing
- Turbocharger
- Engine harness high resistance

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.

2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0106 being current on the CONSULT screen.

Is DTC P0106 current?

YES >> Go to EC-1032, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420063

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs P0101, P0102, P0103, P0107, P0108, P0237, P0238, P1191, P1192, P1193, P2280 or P2579 being current or past (high counts) on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

Check for any turbocharger, compressor bypass valve, EGR valve or EGR bypass valve DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DATA MONITOR

1. Check turbocharger compressor intake pressure Data Monitor item on the CONSULT screen.
2. Compare turbocharger compressor intake pressure to the local barometric pressure.

Is the reading within ± 2 kPa (0.3 psi) of local barometric pressure?

YES >> GO TO 4.
NO >> Replace the turbocharger compressor intake pressure sensor. Refer to EM-222, "Removal and Installation".

4.CHECK DATA MONITOR

Check charge air cooler outlet pressure Data Monitor item on the CONSULT screen.

Is the reading 0 ± 10.3 kPa (0 ± 1.5 psi)?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK CHARGE AIR COOLER

1. Start the engine.
2. Check the charge air cooler and connections for air leaks.

- Check for air leaks in connections and hoses between the turbocharger outlet and the charge air cooler inlet.

Are any air leaks present?

YES >> Repair or replace the leaking component.
NO >> GO TO 6.

6.CHECK DATA MONITOR

1. Turn ignition switch OFF.
2. Turn ignition switch ON.
3. Check intake and exhaust restriction Data Monitor items on the CONSULT screen.

Is the exhaust or intake restriction within specifications?

YES >> GO TO 14.
NO >> Repair or replace the restricted component.

7. INSPECT ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor connector F140.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK DTC PRIORITY

1. Engine charge air cooler outlet pressure/temperature sensor connector F140 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0107 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 9.
NO >> GO TO 11.

9. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect a jumper wire between terminals 1 and 2 of the engine charge air cooler outlet pressure/temperature sensor connector F140.
3. Turn ignition switch ON.
4. Check for DTC P0108 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 10.
NO >> GO TO 11.

10. CHECK ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Remove the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
3. Inspect the tip of the sensor for soot or carbon buildup.

Does the tip of the sensor display soot or carbon buildup?

YES >> Use compressed air to remove the soot or carbon buildup.
NO >> GO TO 14.

11. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair or replace error-detected parts.

12. CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0107 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 13.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

13. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect a jumper wire between terminals 106 and 194 of the ECM connector F101.
3. Turn ignition switch ON.
4. Check for DTC P0108 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> High resistance or a short circuit is detected in the engine harness. Repair or replace the harness.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

14. VERIFY THE VACUUM PUMP OUTPUT

1. Turn ignition switch OFF.
2. Install any previously removed components and connect any previously disconnected connectors.
3. Turn ignition switch ON.
4. Start the engine.
5. Connect a hand pump or vacuum gauge to the vacuum pump inlet.

Is the vacuum within specifications?

YES >> GO TO 15.
NO >> Replace the vacuum pump. Refer to EM-486, "Removal and Installation".

15. CHECK COMPRESSOR BYPASS VALVE ACTUATOR

1. Turn ignition switch OFF.
2. Using a hand pump, apply vacuum to the compressor bypass valve vacuum inlet. Verify that the valve moves from stop to stop.

Does the compressor bypass valve move from stop to stop?

YES >> GO TO 16.
NO >> Remove any obstructions preventing the valve from moving, or replace the compressor bypass valve. Refer to EM-422, "Exploded View".

16. CHECK DATA MONITOR

1. Turn ignition switch ON.
2. Monitor and record engine speed, charge air cooler outlet pressure and compressor bypass valve Data Monitor items on the CONSULT screen.
3. Start the engine.
4. Override the compressor bypass valve to OPEN.
5. Using the accelerator pedal, raise the engine speed to 2000 rpm and hold for 20 seconds.
6. Return the engine speed to idle.
7. Override the compressor bypass valve to CLOSED.
8. Using the accelerator pedal, raise the engine speed to 2000 rpm and hold for 20 seconds.
9. Return the engine speed to idle.

Did the charge air cooler outlet pressure increase by 50 kPa (7 psi) or more?

YES >> GO TO 17.

NO >> Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".

17. CHECK DATA MONITOR

1. Monitor and record engine speed, turbocharger speed and compressor bypass valve Data Monitor items on the CONSULT screen.
2. Start the engine.
3. Override the compressor bypass valve to OPEN.
4. Using the accelerator pedal, raise the engine speed to 2000 rpm and hold for 20 seconds.
5. Return the engine speed to idle.
6. Override the compressor bypass valve to CLOSED.
7. Using the accelerator pedal, raise the engine speed to 2000 rpm and hold for 20 seconds.
8. Return the engine speed to idle.

Was the turbocharger speed less than 130,000 rpm with the valve OPEN and between 140,000 and 160,000 rpm with the valve CLOSED?

YES >> GO TO 18.
NO >> Replace the turbocharger speed sensor. Refer to EM-407, "Removal and Installation".

18. CHECK DATA MONITOR

1. Monitor and record engine speed, low pressure turbocharger boost pressure, charge air cooler outlet pressure and compressor bypass valve Data Monitor items on the CONSULT screen.
2. Start the engine.
3. Override the compressor bypass valve to OPEN.
4. Using the accelerator pedal, raise the engine speed to 2000 rpm and hold for 20 seconds.
5. Return the engine speed to idle.
6. Override the compressor bypass valve to CLOSED.
7. Using the accelerator pedal, raise the engine speed to 2000 rpm and hold for 20 seconds.
8. Return the engine speed to idle.

Did the low pressure turbocharger boost pressure increase by 5 kPa (1 psi) or greater from the valve OPEN to the valve CLOSED at 2000 rpm?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Replace the low pressure turbocharger boost pressure sensor. Refer to EM-253, "Removal and Installation".

P0107 MAP SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420064

The ECM provides a 5V supply to the charge air cooler outlet pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The charge air cooler outlet pressure sensor provides a signal to the ECM on the charge air cooler outlet pressure circuit. This sensor signal voltage changes based on the pressure exiting the charge air cooler.

DTC DETECTION LOGIC

The ECM detected the charge air cooler outlet pressure signal voltage was less than 0.2V for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0107	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Low (Engine charge air cooler outlet pressure - voltage below normal or shorted to low source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Charge pressure sensor value < 0.2 V (44.81 kPa)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Intake manifold pressure sensor
- Engine harness short to ground

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0107 being current on the CONSULT screen.

Is DTC P0107 current?

YES >> Go to EC-1036, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420065

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for any sensor supply DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

Check for DTC P0107 being past on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor connector F140.

3. Inspect the harness and sensor connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DTC PRIORITY

1. Engine charge air cooler outlet pressure/temperature sensor connector F140 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0108 being current and DTC P0107 being past on the CONSULT screen after 30 seconds.

Are applicable DTCs detected?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK SENSOR SUPPLY VOLTAGE

Check voltage between the terminals of the engine charge air cooler outlet pressure/temperature sensor connector F140.

Engine charge air cooler outlet pressure/temperature sensor connector F140		Condition	Voltage
Terminal	Terminal		
2	4	Ignition switch ON	4.75V – 5.25V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect engine charge air cooler outlet pressure/temperature sensor connector F140.
3. Turn ignition switch ON.
4. Check for DTC P0107 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

7. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0108 being current and DTC P0107 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9.CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON.
4. Check for DTC P0107 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> A pin to pin short circuit has been detected on the signal circuit of the engine harness. Repair or replace the engine harness.

10.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11.CHECK SENSOR SUPPLY VOLTAGE

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the engine charge air cooler outlet pressure/temperature sensor connector F140.

Engine charge air cooler outlet pressure/temperature sensor connector F140		Condition	Voltage
Terminal	Terminal		
2	4	Ignition switch ON	4.75V – 5.25V

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12.CHECK DTC PRIORITY

1. Turn ignition switch OFF.

2. Connect all components.
3. Turn ignition switch ON.
4. Check for DTC P0107 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> An open has been detected on the return circuit of the engine harness. Repair or replace the engine harness.

P0108 MAP SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420066

The ECM provides a 5V supply to the charge air cooler outlet pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The charge air cooler outlet pressure sensor provides a signal to the ECM on the charge air cooler outlet pressure circuit. This sensor signal voltage changes based on the pressure exiting the charge air cooler.

DTC DETECTION LOGIC

The ECM detected the charge air cooler outlet pressure signal voltage was greater than 4.8V for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0108	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High (Engine charge air cooler outlet pressure - voltage above normal or shorted to high source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Charge pressure sensor value > 4.8 V (350 kPa)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Intake manifold pressure sensor
- Engine harness short to voltage

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0108 being current on the CONSULT screen.

Is DTC P0108 current?

YES >> Go to EC-1040, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420067

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for any sensor supply DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

Check for DTC P0108 being past on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT ENGINE CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect engine charge air cooler outlet pressure/temperature sensor connector F140.

3. Inspect the harness and sensor connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DTC PRIORITY

1. Engine charge air cooler outlet pressure/temperature sensor connector F140 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0107 being current and DTC P0108 being past on the CONSULT screen after 30 seconds.

Are applicable DTCs detected?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK SENSOR SUPPLY VOLTAGE

Check voltage between the terminals of the engine charge air cooler outlet pressure/temperature sensor connector F140.

Engine charge air cooler outlet pressure/temperature sensor connector F140		Condition	Voltage
Terminal	Terminal		
2	4	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect engine charge air cooler outlet pressure/temperature sensor connector F140.
3. Turn ignition switch ON.
4. Check for DTC P0108 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

7. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0107 being current and DTC P0108 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9.CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON.
4. Check for DTC P0108 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> A pin to pin short circuit has been detected on the signal circuit of the engine harness. Repair or replace the engine harness.

10.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11.CHECK SENSOR SUPPLY VOLTAGE

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the engine charge air cooler outlet pressure/temperature sensor connector F140.

Engine charge air cooler outlet pressure/temperature sensor connector F140		Condition	Voltage
Terminal	Terminal		
2	4	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12.CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON.
4. Check for DTC P0108 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> An open has been detected on the return circuit of the engine harness. Repair or replace the engine harness.

P0111 IAT SENSOR

DTC Description

INFOID:0000000014420068

The ECM provides 5V to the intake manifold temperature signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the intake manifold temperature. When the intake air is cold, the sensor (thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or high temperature.

DTC DETECTION LOGIC

The ECM detected the intake manifold temperature reading was higher or lower than other temperature sensors after 8 hours (engine OFF), or the sensor reading is erratic during engine running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance Bank 1 (Intake manifold 1 temperature - Data erratic, intermittent, or incorrect)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	—
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Intake manifold temperature sensor
- Engine harness high resistance

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

NOTE:

If the DTC does not go past, it may be necessary to perform a 8 hour cold soak with the ignition switch OFF, then turn the ignition switch to the ON position so that the key ON portion of the diagnostic will run.

1. Turn ignition switch ON.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0111 being current on the CONSULT screen.

Is DTC P0111 current?

YES >> Go to EC-1044, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420069

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0111 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC P0112 or P0113 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK DATA MONITOR

1. Check intake manifold temperature Data Monitor item on the CONSULT screen.
2. Compare intake manifold temperature to the ambient air temperature.

Is the reading within 5.6°C (10°F) of each other?

YES >> GO TO 4.
NO >> Replace the intake manifold temperature sensor. Refer to EM-250, "Removal and Installation".

4. INSPECT INTAKE MANIFOLD TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect intake manifold temperature sensor connector F143.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK DTC PRIORITY

1. Intake manifold temperature sensor connector F143 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0113 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect a jumper wire between terminals 1 and 2 of the intake manifold temperature sensor connector F143.
3. Turn ignition switch ON.
4. Check for DTC P0112 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the intake manifold temperature sensor. Refer to EM-250, "Removal and Installation".
NO >> GO TO 7.

7. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0113 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9.CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect a jumper wire between terminals 170 and 195 of the ECM connector F101.
3. Turn ignition switch ON.
4. Check for DTC P0112 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P0112 INTAKE AIR TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420070

The Engine Control Module (ECM) provides 5V to the intake manifold temperature signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the intake manifold temperature. When the intake air is cold, the sensor (or thermistor) resistance is high. The signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or a high temperature.

DTC DETECTION LOGIC

Charge temperature sensor reading less than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0112	INTAKE MANIFOLD TEMP	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Intake manifold temperature sensor signal
		Threshold	• The intake manifold temperature sensor signal is not detected by the ECM for a period of 10 seconds. • The proper manifold temperature sensor signal is not sent to ECM while the engine is running. • The manifold temperature sensor signal is not in the normal pattern during engine running. • The manifold temperature sensor signal is < 0.067 volt (> 250°C)
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
- Sensor signal circuit is shorted to ground in the harness.
- Sensor signal circuit is shorted to ground in the sensor.
- Intake Manifold Temperature Sensor.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check 1st trip DTC.

Is 1st trip DTC P0112 detected?

YES >> Go to EC-1047, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420071

1.CHECK FOR ACTIVE DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.
3. Check for DTC P0112 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT INTAKE MANIFOLD TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect intake manifold temperature sensor from engine harness connector.
3. Inspect intake manifold temperature sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the intake manifold temperature sensor from the engine harness.
3. Turn key ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0113 DTC become current and P0112 DTC become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Reconnect the intake manifold temperature sensor connector.
3. Turn key ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0112 DTC become current?

YES >> Replace the intake manifold temperature sensor. Refer to EM-250, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

5. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101 from engine harness connector.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch ON and wait 30 seconds.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0113 DTC become current and P0112 DTC become past?

YES >> GO TO 7.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK INTAKE MANIFOLD TEMPERATURE SENSOR SIGNAL CIRCUIT CONNECTOR FOR SHORT

1. Turn ignition switch OFF.
2. Disconnect ECM.
3. Check the continuity between intake manifold temperature sensor signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
F101	195	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness connector.

8.CHECK INTAKE MANIFOLD TEMPERATURE SENSOR SIGNAL CIRCUIT FOR SHORT

Check the continuity between intake manifold temperature sensor harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
F101	195	—	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair short circuit in harness or connectors.

9.CHECK FOR CURRENT DTC

1. Connect all disconnected harness connectors.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.

Is P0112 DTC CURRENT?

YES >> The troubleshooting procedure needs to be repeated. Refer to EC-1047, "DTC Description".
NO >> The removal and installation of the connector corrected the issue.

P0113 INTAKE AIR TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420072

The ECM provides 5V to the intake manifold temperature signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the intake manifold temperature. When the intake air is cold, the sensor (thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or high temperature.

DTC DETECTION LOGIC

The ECM detected the intake manifold temperature signal voltage was greater than 4.7V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0113	Intake Air Temperature Sensor 1 Circuit High Bank 1 (Intake manifold 1 temperature sensor circuit - voltage above normal or shorted to high source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Charge temperature sensor value > 4.738 V (< 250°C)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Open return circuit in harness, connectors, or sensor
- Open signal circuit or shorted to voltage source
- Intake manifold temperature sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0113 being current on the CONSULT screen.

Is DTC P0113 current?

YES >> Go to EC-1050, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420073

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0113 being past on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 2.

2.INSPECT INTAKE MANIFOLD TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect intake manifold temperature sensor connector F143.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins

- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK DTC PRIORITY

1. Intake manifold temperature sensor connector F143 remains disconnected.
2. Connect a jumper wire between terminals 1 and 2 of the intake manifold temperature sensor connector F143.
3. Turn ignition switch ON.
4. Check for DTC P0112 being current and P0113 being past on the CONSULT screen after 30 seconds.

Are the applicable DTCs detected?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect the intake manifold temperature sensor connector F143.
3. Turn ignition switch ON.
4. Check for DTC P0113 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the intake manifold temperature sensor. Refer to EM-250, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

5. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK DTC PRIORITY

1. Connect a jumper wire between terminals 170 and 195 of the ECM connector F101.
2. Turn ignition switch ON.
3. Check for DTC P0112 being current and P0113 being past on the CONSULT screen after 30 seconds.

Are the applicable DTCs detected?

YES >> GO TO 7.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR AN OPEN RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Remove the jumper wire between terminals 170 and 195 of the ECM connector F101.

3. Disconnect intake manifold temperature sensor connector F143.
4. Check resistance between ECM connector F101 and intake manifold temperature sensor connector F143.

ECM		Intake manifold temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	170	F143	1	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> An open return circuit has been detected in the engine harness. Repair or replace the engine harness.

8.CHECK FOR AN OPEN SIGNAL CIRCUIT

Check resistance between ECM connector F101 and intake manifold temperature sensor connector F143.

ECM		Intake manifold temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	195	F143	2	< 10 Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

9.CHECK FOR A PIN TO PIN SHORT CIRCUIT

Check resistance between ECM connector F101 and intake manifold temperature sensor connector F143.

ECM		Intake manifold temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	All terminals	F143	2	> 100k Ω

Is the inspection result normal?

YES >> GO TO 10.
NO >> A pin to pin short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

10.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Check for DTC P0113 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 1.

P0116 ECT SENSOR

DTC Description

INFOID:0000000014420074

The coolant temperature sensor is a variable resistor sensor and is used to measure the temperature of the coolant of the engine. The Engine Control Module (ECM) supplies 5V to the coolant temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the coolant temperature.

DTC DETECTION LOGIC

- Coolant temperature sensor reading sent to ECM is erratic, intermittent or incorrect.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0116	ECT SENSOR (Engine coolant temperature sensor circuit)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Voltage signal transmitted from engine coolant temperature sensor to ECM
		Threshold	An excessively high voltage (> 4.95 volt) from the sensor is sent to ECM for more than 10 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

P0116
- Harness or connectors (The sensor circuit is open or shorted.)
- Engine coolant temperature sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF.
2. Allow the engine to stay OFF for 8 hours.
3. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
4. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
5. Accelerate to 88 km/h (55 MPH) for 20 seconds.
6. Repeat steps 4 and 5 for 21 times.
7. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0116 being current on the CONSULT screen.

Is P0116 DTC current?

YES >> Go to EC-1053, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420075

1.CHECK FOR CURRENT RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following ″current″ ENGINE diagnostic trouble codes:

- P0117
- P0118

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC first. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK THE THERMOSTAT

Check the thermostat for correct operation.

Does the thermostat operate correctly?

YES >> GO TO 3.
NO >> Replace the thermostat. Refer to CO-66, "Removal and Installation".

3.INSPECT COOLANT TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the coolant temperature sensor from engine harness connector.
3. Inspect the coolant temperature sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait for 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P0118 DTC current?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK THE ECM RESPONSE

1. Connect a jumper wire between the coolant temperature sensor two connector terminals 1 and 2.
2. Wait for 30 seconds.
3. With CONSULT check for current ENGINE diagnostic trouble codes.

Is P0117 DTC current?

YES >> Replace the coolant temperature sensor. Refer to CO-80, "Removal and Installation".
NO >> GO TO 6.

6.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM engine harness connector F101.
3. Inspect the ECM connector F101 pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait for 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

NOTE:
Other DTCs will be set during this step.

Is P0118 DTC current?

YES >> GO TO 8.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

8.CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
- **Not to bend and damage pins and terminals.**
- **Not to probe or short unintended circuits and potentially damaging the control unit.**

1. Connect a jumper wire between ECM connector F101 pins 170 and 193.
2. Wait for 30 seconds.
3. With CONSULT check for current ENGINE diagnostic trouble codes.

Is P0117 DTC current?

YES >>
- High resistance or short circuit has been detected in the engine harness. Repair or replace the engine harness.
- GO TO 9.

NO >>
- Replace the ECM. Refer to EC-1994, "Removal and Installation".
- GO TO 9.

9.CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Using CONSULT, erase ENGINE diagnostic trouble codes.
6. Operate the engine within the ″Conditions for clearing the DTC″.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is P0116 DTC current?

YES >> Troubleshooting procedure need to be repeated. Go to EC-1053, "DTC Description".
NO >> The removal and installation of the connector corrected the issue.

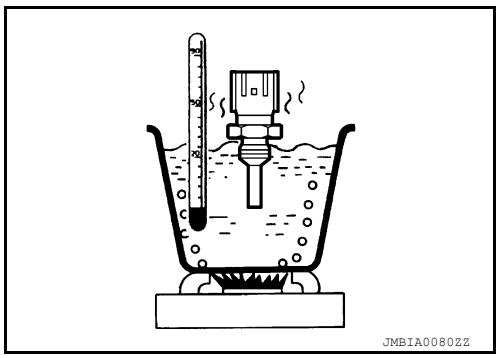
Component Inspection

INFOID:0000000014420076

1.CHECK ENGINE COOLANT TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor harness connector.
3. Remove engine coolant temperature sensor. Refer to CO-66, "Removal and Installation".

4. Check resistance between engine coolant temperature sensor terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.10 - 2.90
		50 (122)	0.68 - 1.00
		90 (194)	0.236 - 0.260

Is the inspection result normal?

YES >> Inspection End.
NO >> Replace engine coolant temperature sensor. Refer to CO-66, "Removal and Installation".

P0117 COOLANT TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420077

The coolant temperature sensor is a variable resistor sensor and is used to measure the temperature of the coolant of the engine. The Engine Control Module (ECM) supplies 5V to the coolant temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the coolant temperature.

DTC DETECTION LOGIC

- An excessively low voltage from the sensor is sent to ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0117	COOLANT TEMP (Engine coolant temperature sensor 1 circuit low)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Voltage signal transmitted from engine coolant temperature sensor to ECM
		Threshold	An excessively low voltage (< 0.108 volt) from the sensor is sent to ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

P0117
- Harness or connectors (The sensor circuit is open or shorted.)
- Engine coolant temperature sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.
3. Check for DTC P0117 being current on the CONSULT screen.

Is DTC P0117 current?

YES >> Go to EC-1057, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420078

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.
3. Check for DTC P0117 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT COOLANT TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the coolant temperature sensor from engine harness connector.
3. Inspect the coolant temperature sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. With the sensor disconnected, connect CONSULT and wait 30 seconds.
3. Check for current ENGINE diagnostic trouble codes.

Is P0118 DTC current and P0117 DTC past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Reconnect the coolant temperature sensor.
3. Turn ignition switch ON. Wait 30 seconds.
4. Recheck for current ENGINE diagnostic trouble codes.

Is P0117 DTC current and P0118 DTC past?

YES >> Replace the coolant temperature sensor. Refer to CO-63, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

5. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Inspect the ECM connector F101 pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM engine harness side connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is P0118 DTC current and P0117 DTC past?

YES >> GO TO 6.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK COOLANT TEMPERATURE SENSOR SIGNAL FOR SHORT TO OTHER CIRCUITS

Check the continuity between the coolant temperature sensor signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
F101	193	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness connector.

8.CHECK COOLANT TEMPERATURE SENSOR SIGNAL FOR SHORT TO GROUND

Check the continuity between ECM harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
F101	195 (+)	Ground (-)	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair short circuit in harness or connectors.

9.CHECK FOR INACTIVE DTC

1. Connect all components in the correct positions.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.

Is P0117 DTC past?

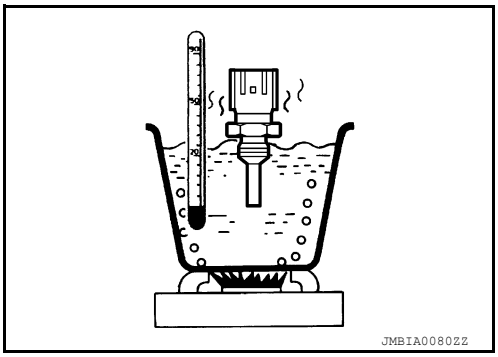
YES >> The removal and installation of the connector corrected the issue.
NO >> Troubleshooting procedure need to be repeated. Go to EC-1057, "DTC Description".

Component Inspection

INFOID:0000000014420079

1.CHECK ENGINE COOLANT TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor harness connector.
3. Remove engine coolant temperature sensor. Refer to CO-63, "Removal and Installation".
4. Check resistance between engine coolant temperature sensor terminals by heating with hot water as shown in the figure.



Terminals	Condition		Resistance (kΩ)
1 and 2	Temperature [°C (°F)]	20 (68)	2.10 - 2.90
		50 (122)	0.68 - 1.00
		90 (194)	0.236 - 0.260

Is the inspection result normal?

YES >> Inspection End.
NO >> Replace engine coolant temperature sensor. Refer to CO-63, "Removal and Installation".

P0118 COOLANT TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420080

The coolant temperature sensor is a variable resistor sensor and is used to measure the temperature of the coolant of the engine. The ECM supplies 5V to the coolant temperature sensor signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the coolant temperature.

DTC DETECTION LOGIC

The ECM detected the coolant temperature signal voltage was greater than 4.95V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0118	Engine Coolant Temperature Sensor 1 Circuit High (Engine coolant temperature 1 sensor circuit - voltage above normal or shorted to high source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant temperature sensor value > 4.966 V (< -40°C)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Open return circuit in harness, connectors, or sensor
- Open signal circuit or shorted to voltage source
- Coolant temperature sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0118 being current on the CONSULT screen.

Is DTC P0118 current?

YES >> Go to EC-1060, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420081

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0118 being past on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 2.

2.INSPECT COOLANT TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect coolant temperature sensor connector F127.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK COOLANT TEMPERATURE SENSOR RESISTANCE

1. Coolant temperature sensor connector F127 remains disconnected.
2. Check resistance between the terminals of coolant temperature sensor connector F127.

Coolant temperature sensor connector F127		Resistance
Terminal	Terminal	
1	2	180 – 160k Ω

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace the coolant temperature sensor. Refer to CO-63, "Removal and Installation".

4. CHECK DTC PRIORITY

1. Connect coolant temperature sensor connector F127.
2. Turn ignition switch ON.
3. Check for DTC P0118 being current and P0113 being past on the CONSULT screen after 30 seconds.

Are the applicable DTCs detected?

YES >> GO TO 5.
NO >> Refer to GI-47, "Intermittent Incident".

5. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK DTC PRIORITY

1. Connect a jumper wire between terminals 170 and 193 of the ECM connector F101.
2. Turn ignition switch ON.
3. Check for DTC P0117 being current and P0118 being past on the CONSULT screen after 30 seconds.

Are the applicable DTCs detected?

YES >> GO TO 7.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR AN OPEN RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Remove the jumper wire between terminals 170 and 193 of the ECM connector F101.
3. Disconnect engine coolant temperature sensor connector F127.

4. Check resistance between ECM connector F101 and coolant temperature sensor connector F127.

ECM		Coolant temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	170	F127	1	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> An open return circuit has been detected in the engine harness. Repair or replace the engine harness.

8. CHECK FOR AN OPEN SIGNAL CIRCUIT

Check resistance between ECM connector F101 and engine coolant temperature sensor connector F127.

ECM		Coolant temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	193	F127	2	< 10 Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

9. CHECK FOR A PIN TO PIN SHORT CIRCUIT

Check resistance between ECM connector F101 and coolant temperature sensor connector F127.

ECM		Coolant temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	All terminals	F127	2	> 100k Ω

Is the inspection result normal?

YES >> GO TO 10.
NO >> A pin to pin short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

10. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Check for DTC P0118 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 1.

P0127 IAT SENSOR

DTC Description

INFOID:0000000014420082

The ECM provides 5V to the intake manifold temperature signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the intake manifold temperature. When the intake air is cold, the sensor (thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or high temperature.

DTC DETECTION LOGIC

The ECM detected the intake manifold air temperature was greater than 132°C (270°F) for 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0127	Intake Air Temperature Too High - (Intake manifold 1 temperature - data valid but above normal operating range - most severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Intake manifold temperature ≥ 132°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Restricted air flow through the charge-air cooler
- Undersized charge-air cooler
- High turbocharger compressor outlet temperature

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0127 being current on the CONSULT screen.

Is DTC P0127 current?

YES >> Go to EC-1063, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420083

1.CHECK DATA MONITOR

1. Check intake manifold temperature “Data Monitor” item on the CONSULT screen.
2. Compare intake manifold temperature reading to a mechanical gauge or known value.

Does the reading correlate to a know value or a mechanical gauge?

YES >> Refer to Symptom Diagnosis EC-1986, "Symptom Table".
NO >> Replace the intake manifold temperature sensor. Refer to EM-250, "Removal and Installation".

P0128 THERMOSTAT FUNCTION

DTC Description

INFOID:0000000014420084

The coolant temperature sensor is a variable resistor sensor and is used to measure the temperature of the coolant of the engine. The ECM supplies 5V to the coolant temperature sensor signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the coolant temperature.

DTC DETECTION LOGIC

The ECM detected the engine coolant temperature did not reach 72°C (162°F) in a specified amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature) (Engine cooling system monitor - data valid but below normal operating range - moderately severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant temperature < -71.094°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Low coolant level, or air in the cooling system
- Engine coolant temperature sensor
- Engine coolant thermostat

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Let the engine cold soak for the coolant temperature to reach 50°C (122°F) or less.
2. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
3. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
5. Check for DTC P0128 being current on the CONSULT screen.

Is DTC P0128 current?

YES >> Go to EC-1064, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420085

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs P0116, P0117 or P0118 being past on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.PERFORM ACTIVE TEST

1. Start the engine and run at low idle.
2. Perform the Fan Override Test Active Test item on the CONSULT screen.

3. Verify that the fan operates correctly, is not stuck, and turns ON and OFF as commanded.

Is the fan clutch assembly operating correctly?

YES >> GO TO 3.
NO >> Troubleshoot and repair the cause of the malfunctioning engine fan operation. Inspect engine fan wiring for short or open circuits. Check engine fan switches for proper operation.

3. CHECK THERMOSTAT

1. Turn ignition switch OFF.
2. Check for a leaking or stuck open thermostat.

Is the thermostat operating correctly?

YES >> Replace the engine coolant temperature sensor. Refer to CO-63, "Removal and Installation".
NO >> Replace the thermostat. Refer toCO-66, "Removal and Installation" .

P012B TC BOOST SENSOR

DTC Description

INFOID:0000000014420086

The combination turbocharger compressor intake pressure/temperature sensor is used to measure ambient air pressure.The pressure measuring portion of the sensor responds to pressure changes in the atmospheric pressure, which occur based on elevation at which the engine is presently operating. The turbocharger compressor intake pressure sensor has a 5V supply circuit, a pressure sensor signal voltage, and a return circuit.The ECM will detect a low signal voltage when the vehicle is operating at high altitudes. The ECM will detect a high signal voltage when the vehicle is operating at sea level altitudes.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the barometric pressure reading was higher or lower than the other pressure sensors at ignition off, or the sensor reading is erratic during engine running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P012B	(Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/ Performance)	1	Diagnosis condition	Engine running.
			Signal (terminal)	(129)
			Threshold	Cumulative sum of error in 30 seconds is > 15 kPa, which is ≥ 0.1 kPa. Where tolerance is defined as 28.74 kPa.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	• 8 hour cold soak • Engine running.
			Signal (terminal)	(129)
			Threshold	Compressor inlet pressure sensor reading < 18 kPa OR Compressor inlet pressure sensor reading > 144.31 kPa OR Compressor inlet pressure to the most accurate remaining pressure sensor is > 3.19 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
   - If the fault code does not go inactive, it may be necessary to perform a 8 hour cold soak with the ignition OFF, then turn the ignition switch to the ON position so that the key ON portion of the diagnostic will run.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P012B being current on the CONSULT screen.

Is DTC P012B current?

YES >> Go to EC-1067, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420087

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen.

- P012C
- P012D

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P012C current?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminal 1 and 2.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P012D current?

YES >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P012C current?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 106 and 129.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P012D current?

YES >> Repair or replace engine harness.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P012C TC COMPRESSOR INLET PRESSURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420088

The combination turbocharger compressor intake pressure/temperature sensor is used to measure ambient air pressure.The pressure measuring portion of the sensor responds to pressure changes in the atmospheric pressure, which occur based on elevation at which the engine is presently operating. The turbocharger compressor intake pressure sensor has a 5V supply circuit, a pressure sensor signal voltage, and a return circuit.The ECM will detect a low signal voltage when the vehicle is operating at high altitudes. The ECM will detect a high signal voltage when the vehicle is operating at sea level altitudes.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the turbocharger compressor intake pressure sensor signal voltage was less than 0.25V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P012C	(Turbocharger/Supercharger Inlet Pressure Sensor Circuit Low)	Diagnosis condition	Ignition switch ON or engine running
		Signal (terminal)	(–)
		Threshold	Compressor inlet pressure sensor < 0.2V (44.82 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P012C being current on the CONSULT screen.

Is DTC P012C current?

YES >> Go to EC-1069, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420089

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0652 or P0653 being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P012C being current on the CONSULT screen.

Is DTC P012C detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND

CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON.
4. Measure the voltage between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminals 2 and 4.

Turbocharger compressor intake pressure/temperature sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F105	2	4	4.75V - 5.25V

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Connect a jumper wire between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminal 1 and 2.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P012D DTC become current and P012C become past?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P012C become current?

YES >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between terminal 106 and 127 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75V - 5.25V

Is inspection the result normal?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P012C being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the harness for an open or shorted circuit.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 106 and 129.

4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P012D become current and P012C become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P012C being past on the CONSULT screen.

Is DTC P012C detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open or pin-to-pin short.

P012D TC COMPRESSOR INLET PRESSURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420090

The combination turbocharger compressor intake pressure/temperature sensor is used to measure ambient air pressure.The pressure measuring portion of the sensor responds to pressure changes in the atmospheric pressure, which occur based on elevation at which the engine is presently operating. The turbocharger compressor intake pressure sensor has a 5V supply circuit, a pressure sensor signal voltage, and a return circuit.The ECM will detect a low signal voltage when the vehicle is operating at high altitudes. The ECM will detect a high signal voltage when the vehicle is operating at sea level altitudes.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the turbocharger compressor intake pressure sensor signal voltage was greater than 4.75-VDC for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P012D	(Turbocharger/Supercharger Inlet Pressure Sensor Circuit High)	Diagnosis condition	Ignition switch ON or engine running.
		Signal (terminal)	(-)
		Threshold	Compressor inlet pressure sensor value > 4.8V (110.32 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P012D being current on the CONSULT screen.

Is DTC P012D current?

YES >> Go to EC-1073, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420091

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0652 or P0653 being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P012D being current on the CONSULT screen.

Is DTC P012D detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND

CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P012C DTC become current and P012D become past?

YES >> GO TO 5.
NO >> GO TO 10.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON.
4. Measure the voltage between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminals 2 and 4.

Turbocharger compressor intake pressure/temperature sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F105	2	4	4.75-5.25

Is inspection result normal?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P012D become current?

YES >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P012C become current and P012D become past?

YES >> GO TO 9.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

9.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P012D being past on the CONSULT screen.

Is DTC P012D detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for a pin-to-pin short.

10.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between terminal 106 and 127 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75-5.25

Is inspection the result normal?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P012D being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the harness for an open circuit.

P0168 FUEL TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420092

The fuel temperature sensor is a variable resistor sensor and is used to measure the temperature of the fuel entering the high pressure pump. The ECM supplies 5V to the fuel temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the fuel temperature. The fuel temperature is used by the ECM for the engine protection system, timing, and fueling control.

DTC DETECTION LOGIC

The ECM detected the fuel temperature exceeded 75°C.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0168	Fuel Temperature Too High (Engine fuel temperature - data valid but above normal operating range - most severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	—
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel temperature sensor
- Operating the engine in a hot ambient environment with a low fuel tank level
- Wrong fuel grade/type

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Insure the fuel tank has more than 15% of fuel.
2. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
3. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
5. Check for DTC P0168 being current on the CONSULT screen.

Is DTC P0168 current?

YES >> Go to EC-1077, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420093

1.CHECK DATA MONITOR

1. Check fuel temperature “Data Monitor” item on the CONSULT screen.
2. Compare fuel temperature reading to a mechanical gauge or known value.

Does the reading correlate to a know value or a mechanical gauge?

YES >> Check for wrong fuel type/grade, fuel tank fuel level low, high fuel supply or return restriction, incorrect fuel tank installation, incorrectly routed fuel lines, high ambient air temperature or engine coolant overheating condition.
NO >> Replace the fuel temperature sensor. Refer to FL-54, "Removal and Installation".

P0169 INCORRECT FUEL COMPOSITION

DTC Description

INFOID:0000000014420094

The water-in-fuel sensor is in the fuel filter. The ECM provides a 5V reference signal to the water-in-fuel sensor. When the water collected in the fuel filter covers the sensor probes, the water-in-fuel sensor pulls the 5V reference voltage down, indicating high water accumulation in the fuel filter.

DTC DETECTION LOGIC

The ECM detected water in fuel for an extended period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0169	Incorrect Fuel Composition (Water in fuel indicator - data valid but above normal operating range - moderately severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Distance traveled with water in fuel detected ≥ 500.203 miles
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Water-in-fuel sensor
- Water in the fuel
- Water in the sensor connector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0169 being current on the CONSULT screen.

Is DTC P0169 current?

YES >> Go to EC-1078, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420095

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0169 being current or past on the CONSULT screen.

Is applicable DTC detected?

YES >> Drain water from the fuel filter. Check sensor and sensor connector for water intrusion. Clean or replace connector or sensor as necessary.
NO >> Refer to GI-47, "Intermittent Incident".

P0181 FUEL TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420096

The fuel temperature sensor is a variable resistor sensor and is used to measure the temperature of the fuel entering the high pressure pump. The ECM supplies 5V to the fuel temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the fuel temperature. The fuel temperature is used by the ECM for the engine protection system, timing, and fueling control.

DTC DETECTION LOGIC

The ECM detected the fuel temperature sensor was higher or lower than expected.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance (Engine fuel temperature - Data erratic, intermittent, or incorrect)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Fuel temperature > 75°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Fuel temperature - ambient air temperature > 60°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Fuel temperature - ambient air temperature < -25°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel temperature sensor
- Engine harness high resistance
- Operating the engine in a hot ambient environment with a low fuel tank level

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Insure the fuel tank has more than 15% of fuel.
2. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
3. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
5. Check for DTC P0181 being current on the CONSULT screen.

Is DTC P0181 current?

YES >> Go to EC-1080, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420097

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0181 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0182 or P0183 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FUEL TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect fuel temperature sensor connector F128.
3. Check resistance between the terminals of the fuel temperature sensor at room temperature (25°C [77°F]).

Fuel temperature sensor		Resistance
Terminal	Terminal	
1	2	9k – 11k Ω

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace the fuel temperature sensor. Refer to FL-54, "Removal and Installation".

4.INSPECT FUEL TEMPERATURE SENSOR AND CONNECTOR PINS

Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK DTC PRIORITY

1. Fuel temperature sensor connector F128 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0183 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK DTC PRIORITY

1. Fuel temperature sensor connector F128 remains disconnected.
2. Connect a jumper wire between terminals 1 and 2 of the fuel temperature sensor connector F128.
3. Turn ignition switch ON.
4. Check for DTC P0182 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the fuel temperature sensor. Refer to FL-54, "Removal and Installation".
NO >> GO TO 7.

7. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0183 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Connect a jumper wire between terminals 170 and 174 of the ECM connector F101.
3. Turn ignition switch ON.
4. Check for DTC P0182 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> High resistance or a short circuit has been detected in the engine harness. Repair or replace the engine harness.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P0182 FUEL TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420098

The fuel temperature sensor is a variable resistor sensor and is used to measure the temperature of the fuel entering the high pressure pump. The ECM supplies 5V to the fuel temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the fuel temperature. The fuel temperature is used by the ECM for the engine protection system, timing, and fueling control.

DTC DETECTION LOGIC

The ECM detected the fuel temperature sensor signal voltage was greater than 4.97V for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0182	Fuel Temperature Sensor “A” Circuit Low (Engine fuel temperature sensor 1 circuit - voltage below normal or shorted to low source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Fuel temperature sensor value < 0.089 V (> 150°C)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel temperature sensor
- Open return circuit in harness, connectors or sensor
- Open signal circuit or shorted to a voltage source

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0182 being current on the CONSULT screen.

Is DTC P0182 current?

YES >> Go to EC-1082, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420099

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0182 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel temperature sensor connector F128.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK DTC PRIORITY

1. Fuel temperature sensor connector F128 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0183 being current and DTC P0182 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect fuel temperature sensor connector F128.
3. Turn ignition switch ON.
4. Check for DTC P0182 being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the fuel temperature sensor. Refer to FL-54, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

5.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P0183 being current and DTC P0182 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 7.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK SENSOR SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Check resistance between the terminals of the ECM connector F101.

ECM connector F101		Resistance
Terminal	Terminal	
174	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> A pin to pin short circuit on the signal circuit has been detected. Repair or replace the engine harness.

8.CHECK FUEL TEMPERATURE SENSOR

Check resistance between the terminals of the fuel temperature sensor at room temperature (25°C [77°F]).

ECM		Ground	Resistance
Connector	Terminal		
F101	174	—	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> A short circuit to ground on the signal circuit has been detected. Repair or replace the engine harness.

9.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Check for DTC P0182 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 1.

P0183 FUEL TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420100

The fuel temperature sensor is a variable resistor sensor and is used to measure the temperature of the fuel entering the high pressure pump. The ECM supplies 5V to the fuel temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the fuel temperature. The fuel temperature is used by the ECM for the engine protection system, timing, and fueling control.

DTC DETECTION LOGIC

The ECM detected the fuel temperature sensor signal voltage was greater than 4.97V for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0183	Fuel Temperature Sensor “A” Circuit High (Engine fuel temperature sensor 1 circuit - voltage above normal or shorted to high source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Fuel temperature sensor value > 4.979 V (< 40°C)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel temperature sensor
- Open return circuit in harness, connectors or sensor
- Open signal circuit or shorted to a voltage source

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0183 being current on the CONSULT screen.

Is DTC P0183 current?

YES >> Go to EC-1085, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420101

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0183 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel temperature sensor connector F128.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK DTC PRIORITY

1. Fuel temperature sensor connector F128 remains disconnected.
2. Connect a jumper wire between terminals 1 and 2 of the fuel temperature sensor connector F128.
3. Turn ignition switch ON.
4. Check for DTC P0182 being current and P0183 being past on the CONSULT screen.

Are the applicable DTCs detected?

YES >> GO TO 4.
NO >> Replace the fuel temperature sensor. Refer to FL-54, "Removal and Installation".

4. CHECK DTC PRIORITY

1. Turn ignition switch OFF.
2. Connect fuel temperature sensor connector F128.
3. Turn ignition switch ON.
4. Check for DTC P0183 being current on the CONSULT screen after 30 seconds.

Are the applicable DTCs detected?

YES >> GO TO 5.
NO >> Refer to GI-47, "Intermittent Incident".

5. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK DTC PRIORITY

1. Connect a jumper wire between terminals 170 and 174 of the ECM connector F101.
2. Turn ignition switch ON.
3. Check for DTC P0182 being current and P0183 being past on the CONSULT screen after 30 seconds.

Are the applicable DTCs detected?

YES >> GO TO 7.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR AN OPEN RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Remove the jumper wire between terminals 170 and 174 of the ECM connector F101.
3. Disconnect fuel temperature sensor connector F128.
4. Check resistance between ECM connector F101 and fuel temperature sensor connector F128.

ECM		Fuel temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	170	F128	1	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> An open return circuit has been detected in the engine harness. Repair or replace the engine harness.

8.CHECK FOR AN OPEN SIGNAL CIRCUIT

Check resistance between ECM connector F101 and fuel temperature sensor connector F128.

ECM		Fuel temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	174	F128	2	< 10 Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

9.CHECK FOR A PIN TO PIN SHORT CIRCUIT

Check resistance between the terminals of the ECM connector F101.

ECM connector F101		Resistance
Terminal	Terminal	
174	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 10.
NO >> A pin to pin short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

10.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Check for DTC P0183 being past on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 1.

P0184 FUEL TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420102

The fuel temperature sensor is a variable resistor sensor and is used to measure the temperature of the fuel entering the high pressure pump. The ECM supplies 5V to the fuel temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the fuel temperature. The fuel temperature is used by the ECM for the engine protection system, timing, and fueling control.

DTC DETECTION LOGIC

The difference between fuel temperature and ambient temperature is greater than 15°C, while driving.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0184	Fuel Temperature Sensor “A” Circuit Intermittent (Engine fuel temperature - data valid but below normal operating range - moderately severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	—
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel temperature sensor
- Operating the engine in a hot ambient environment with a low fuel tank level
- Wrong fuel grade/type

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Insure the fuel tank has more than 15% of fuel.
2. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
3. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
5. Check for DTC P0184 being current on the CONSULT screen.

Is DTC P0184 current?

YES >> Go to EC-1088, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420103

1.CHECK DATA MONITOR

1. Check fuel temperature “Data Monitor” item on the CONSULT screen.
2. Compare fuel temperature reading to a mechanical gauge or known value.

Does the reading correlate to a know value or a mechanical gauge?

YES >> Refer to Symptom Diagnosis EC-1986, "Symptom Table".
NO >> Replace the fuel temperature sensor. Refer to FL-54, "Removal and Installation".

P0191 FUEL RAIL PRESSURE SENSOR

DTC Description

INFOID:0000000014420104

The engine control module (ECM) monitors engine operating conditions, including the reading of fuel rail pressure, and changes the flow command to either increase (OPEN the fuel metering valve) or decrease (CLOSE the fuel metering valve) the fuel supply to the high-pressure pump.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel rail pressure was greater than 0.6V (key on) or less than 0.4V (key off)

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0191	FRP_SENSOR (Fuel Rail Pressure Sensor "A" Circuit Range/Performance)	1	Diagnosis condition	• Ignition is turned ON and before engine speed is detected. • Ignition OFF. The DTC will be active at the next ignition ON event.
			Signal (terminal)	Fuel rail pressure sensor (–)
			Threshold	Rail pressure sensor at ignition ON > 0.609V (59.965 bar absolute) Or The delay tome after all enable conditions are satisfied is greater than a calculated threshold at ignition OFF and Rail pressure sensor at ignition OFF > 0.609V (59.965 bar absolute)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	• Ignition is turned ON and before engine speed is detected. • Ignition OFF. The DTC will be active at the next ignition ON event.
			Signal (terminal)	Fuel rail pressure sensor (171)
			Threshold	Rail pressure sensor at ignition ON < 0.424V (0 bar absolute) Or The delay tome after all enable conditions are satisfied is greater than a calculated threshold at ignition OFF and Rail pressure sensor at ignition OFF < 0.424V (0 bar absolute)
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Check that fuel temperature is above -7°C (19°F).
2. Turn ignition OFF for 1 minute, then turn ignition switch ON for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0191 being current on the CONSULT screen.

Is DTC P0191 current?

YES >> Go to EC-1090, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420105

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P008A
- P009C
- P009D
- P0192
- P0193
- P0252
- P0253
- P0254
- P2540

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT FUEL RAIL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Inspect the harness connector and fuel rail pressure sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON and wait 30 seconds.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0193 DTC become current?

YES >> Replace fuel rail pressure sensor. Refer to FL-56, "Removal and Installation".
NO >> GO TO 4.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between fuel rail pressure sensor signal circuit and return circuit at the sensor harness connector F139.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0192 DTC become current?

YES >> • Replace fuel rail pressure sensor. Refer to FL-56, "Removal and Installation".
• GO TO 7.
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.

3. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0193 DTC become current?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between ECM harness connector F101 terminals 128 and 171.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0192 DTC become current?

YES >> Repair or replace harness for an open circuit.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0192 FUEL RAIL PRESSURE SENSOR

DTC Description

INFOID:0000000014420106

The engine control module (ECM) provides a 5V supply to the fuel rail pressure sensor using a dedicated sensor supply circuit.The ECM also provides a ground on the sensor return circuit.The fuel rail pressure sensor provides a fuel pressure signal to the ECM on the fuel rail pressure sensor signal circuit. This sensor signal voltage changes based on the pressure in the fuel rail. The ECM will detect a high signal voltage at high rail pressure conditions. The ECM will detect a low signal voltage during low rail pressure conditions.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel rail pressure signal voltage is less than 0.2-VDC for more than 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0192	FRP_SEN/CIRC (Fuel Rail Pressure Sensor "A" Circuit Low)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Fuel rail pressure sensor (171)
		Threshold	Fuel Rail pressure sensor < 189 mV (0 bar absolute)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0192 being current on the CONSULT screen.

Is DTC P0192 current?

YES >> Go to EC-1092, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420107

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTCs PXXXX or P06D7 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0192 being past on the CONSULT screen.

Is DTC P0192 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT FUEL RAIL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect fuel rail pressure sensor harness connector F139.
3. Inspect the engine harness and fuel rail pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the fuel rail pressure sensor harness connector F139.
3. Turn ignition switch ON.
4. Measure the voltage between fuel rail pressure sensor harness connector F139 terminals 1 and 3.

Fuel rail pressure sensor		Fuel rail pressure sensor		Voltage (Approx.)
Connector	Terminal	Connector	Terminal	
F139	1	F139	3	4.75V - 5.25V

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor connector F139.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0193 become current and DTC P0192 become past?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect the fuel rail pressure sensor harness connector F139.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0192 become current?

YES >> Replace the fuel rail pressure sensor. Refer to FL-56, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between terminal 106 and 128 at the ECM connector F101.

ECM		ECM		Voltage (Approx.)
Connector	Terminal	Connector	Terminal	
F101	106	F101	128	4.75V - 5.25V

Is inspection the result normal?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0192 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the harness for an open or shorted circuit.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON. Wait 30 seconds.
4. With CONSULT check for current ENGINE diagnostic trouble codes.

Did P0193 DTC become current and P0192 DTC become past?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0192 being past on the CONSULT screen.

Is DTC P0192 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open or pin-to-pin short.

P0193 FUEL RAIL PRESSURE SENSOR

DTC Description

INFOID:0000000014420108

The engine control module (ECM) provides a 5V supply to the fuel rail pressure sensor using a dedicated sensor supply circuit.The ECM also provides a ground on the sensor return circuit.The fuel rail pressure sensor provides a fuel pressure signal to the ECM on the fuel rail pressure sensor signal circuit. This sensor signal voltage changes based on the pressure in the fuel rail. The ECM will detect a high signal voltage at high rail pressure conditions. The ECM will detect a low signal voltage during low rail pressure conditions.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel rail pressure signal voltage is greater than 4.8-VDC for more than 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0193	FRP_SEN/CIRC (Fuel Rail Pressure Sensor "A" Circuit High)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Fuel rail pressure sensor (171)
		Threshold	Fuel Rail pressure sensor > 4,810 mV (2,200 bar absolute)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel pressure sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0193 being current on the CONSULT screen.

Is DTC P0193 current?

YES >> Go to EC-1096, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420109

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTCs P0653 or P06D8 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0193 being past on the CONSULT screen.

Is DTC P0193 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT FUEL RAIL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Inspect the engine harness and fuel rail sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0192 become current and DTC P0193 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the fuel rail pressure sensor harness connector F139.
3. Turn ignition switch ON.
4. Measure the voltage between fuel rail pressure sensor harness connector F139 terminals 1 and 3.

Fuel rail pressure sensor		Fuel rail pressure sensor		Voltage (Approx.)
Connector	Terminal	Connector	Terminal	
F139	3	F139	1	4.75-5.25

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect the fuel rail pressure sensor harness connector F139.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0193 become current?

YES >> Replace the fuel rail pressure sensor. Refer to FL-56, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between terminal 106 and terminal 171 at the ECM engine connector F101.
4. Turn ignition switch ON. Wait 30 seconds.
5. With CONSULT check for current ENGINE diagnostic trouble codes.

Did P0192 DTC become current and P0193 DTC become past?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0193 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for a short circuit.

10. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect harness connector F101 from the ECM.
3. Turn ignition switch ON.
4. Measure the voltage between terminals 106 and 128 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	128	106	4.75-5.25

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0193 being past on the CONSULT screen.

Is DTC P0193 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open.

P0201 FUEL INJECTOR (CYLINDER 1)

DTC Description

INFOID:0000000014420110

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0201	CYL1 INJECTOR (Injector Circuit/Open – Cylinder 1)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 1 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 1 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 1 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 1 ≥ 5 μsecs • Actuator discharge time for cylinder number 1 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 1 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0201 being current on the CONSULT screen.

Is DTC P0201 current?

YES >> Go to EC-1101, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420111

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0201 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 1 harness connector F113.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F113.
3. Measure the resistance between the injector 1 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F113.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 1 harness connector F113 terminal 2 and ECM harness connector F101 terminal 176.

Fuel injector no. 1		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F113	2	F101	176	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F113.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 1 harness connector F113 terminal 1 and ECM harness connector F101 terminal 155.

Fuel injector no. 1		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F113	1	F101	155	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0201 DTC current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0202 FUEL INJECTOR (CYLINDER 2)

DTC Description

INFOID:0000000014420112

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0202	CYL2 INJECTOR (Injector Circuit/Open – Cylinder 2)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 2 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 2 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 2 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 2 ≥ 5 μsecs • Actuator discharge time for cylinder number 2 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 2 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0202 being current on the CONSULT screen.

Is DTC P0202 current?

YES >> Go to EC-1104, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420113

1. CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0202 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2. INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 2 harness connector F129.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F129.
3. Measure the resistance between the injector 2 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 5.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F129.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 2 harness connector F129 terminal 2 and ECM harness connector F101 terminal 92.

Fuel injector no. 2		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F129	2	F101	92	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F129.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 2 harness connector F129 terminal 1 and ECM harness connector F101 terminal 113.

Fuel injector no. 2		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F129	1	F101	113	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0202 DTC current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0203 FUEL INJECTOR (CYLINDER 3)

DTC Description

INFOID:0000000014420114

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0203	CYL3 INJECTOR (Injector Circuit/Open – Cylinder 3)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 3 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 3 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 3 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 3 ≥ 5 μsecs • Actuator discharge time for cylinder number 3 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 3 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0203 being current on the CONSULT screen.

Is DTC P0203 current?

YES >> Go to EC-1107, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420115

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0203 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 3 harness connector F115.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F115.
3. Measure the resistance between the injector 3 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F115.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 3 harness connector F115 terminal 2 and ECM harness connector F101 terminal 95.

Fuel injector no. 3		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F115	2	F101	95	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F115.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 3 harness connector F115 terminal 1 and ECM harness connector F101 terminal 116.

Fuel injector no. 3		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F115	1	F101	116	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0203 DTC current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0204 FUEL INJECTOR (CYLINDER 4)

DTC Description

INFOID:0000000014420116

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0204	CYL4 INJECTOR (Injector Circuit/Open – Cylinder 4)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 4 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 4 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 4 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 4 ≥ 5 μsecs • Actuator discharge time for cylinder number 4 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 4 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0204 being current on the CONSULT screen.

Is DTC P0204 current?

YES >> Go to EC-1110, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420117

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0204 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 4 harness connector F131.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F131.
3. Measure the resistance between the injector 4 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F131.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 4 harness connector F131 terminal 2 and ECM harness connector F101 terminal 178.

Fuel injector no. 4		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F131	2	F101	178	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F131.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 4 harness connector F131 terminal 1 and ECM harness connector F101 terminal 157.

Fuel injector no. 4		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F131	1	F101	157	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0204 DTC current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0205 FUEL INJECTOR (CYLINDER 5)

DTC Description

INFOID:0000000014420118

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0205	CYL5 INJECTOR (Injector Circuit/Open – Cylinder 5)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 5 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 5 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 5 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 5 ≥ 5 μsecs • Actuator discharge time for cylinder number 5 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 5 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0205 being current on the CONSULT screen.

Is DTC P0205 current?

YES >> Go to EC-1113, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420119

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0205 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 5 harness connector F117.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F117.
3. Measure the resistance between the injector 5 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F117.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 5 harness connector F117 terminal 2 and ECM harness connector F101 terminal 94.

Fuel injector no. 5		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F117	2	F101	94	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F117.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 5 harness connector F117 terminal 1 and ECM harness connector F101 terminal 115.

Fuel injector no. 5		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F117	1	F101	115	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0205 DTC current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0206 FUEL INJECTOR (CYLINDER 6)

DTC Description

INFOID:0000000014420120

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0206	CYL6 INJECTOR (Injector Circuit/Open – Cylinder 6)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 6 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 6 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 6 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 6 ≥ 5 μsecs • Actuator discharge time for cylinder number 6 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 6 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0206 being current on the CONSULT screen.

Is DTC P0206 current?

YES >> Go to EC-1116, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420121

1. CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0206 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2. INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 6 harness connector F133.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F133.
3. Measure the resistance between the injector 6 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 5.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F133.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 6 harness connector F133 terminal 2 and ECM harness connector F101 terminal 179.

Fuel injector no. 6		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F133	2	F101	179	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F133.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 6 harness connector F133 terminal 1 and ECM harness connector F101 terminal 158.

Fuel injector no. 6		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F133	1	F101	158	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0206 DTC current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0207 FUEL INJECTOR (CYLINDER 7)

DTC Description

INFOID:0000000014420122

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0207	CYL7 INJECTOR (Injector Circuit/Open – Cylinder 7)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 7 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 7 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 7 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 7 ≥ 5 μsecs • Actuator discharge time for cylinder number 7 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 7 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0207 being current on the CONSULT screen.

Is DTC P0207 current?

YES >> Go to EC-1119, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420123

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0207 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 7 harness connector F119.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F119.
3. Measure the resistance between the injector 7 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F119.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 7 harness connector F119 terminal 2 and ECM harness connector F101 terminal 177.

Fuel injector no. 7		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F119	2	F101	177	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F119.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 7 harness connector F119 terminal 1 and ECM harness connector F101 terminal 156.

Fuel injector no. 7		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F119	1	F101	156	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0207 DTC current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P0208 FUEL INJECTOR (CYLINDER 8)

DTC Description

INFOID:0000000014420124

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected an open circuit in the engine wiring harness or injector actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0208	CYL8 INJECTOR (Injector Circuit/Open – Cylinder 8)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 8 < 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge time for cylinder number 8 ≥ 35.2 μsecs • Actuator charge up voltage for cylinder number 8 ≤ injector charge voltage set point +80V • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or all of the following: • Actuator charging time for cylinder number 8 ≥ 5 μsecs • Actuator discharge time for cylinder number 8 ≤ 35.2 μsecs • Actuator charge up voltage for cylinder number 8 > injector charge voltage set point +80V • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.8A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Fuel injector
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0208 being current on the CONSULT screen.

Is DTC P0208 current?

YES >> Go to EC-1122, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420125

1. CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0208 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2. INSPECT HARNESS CONNECTIONS

1. Turn ignition switch OFF.
2. Check the following connections:

- ECM harness connector
- Injector harness connectors

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 8 harness connector F135.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR OPEN CIRCUIT IN THE INJECTOR

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F135.
3. Measure the resistance between the injector 8 terminal 1 and 2.

Is resistance greater than 210 ohms?

YES >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 5.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F135.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 8 harness connector F135 terminal 2 and ECM harness connector F101 terminal 93.

Fuel injector no. 8		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F135	2	F101	93	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a open.

7.CHECK FOR OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector harness connector F135.
3. Disconnect the ECM harness connector F101.
4. Measure the resistance between the injector 8 harness connector F135 terminal 1 and ECM harness connector F101 terminal 114.

Fuel injector no. 8		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F135	1	F101	114	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for a open.

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0208 DTC current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair complete.

P020A FUEL INJECTOR CYLINDER 1 TIMING

DTC Description

INFOID:0000000014420126

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P020A	(Cylinder 1 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 1 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 1 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P020A being current on the CONSULT screen.

Is DTC P020A current?

YES >> Go to EC-1124, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420127

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 1.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P020B FUEL INJECTOR CYLINDER 2 TIMING

DTC Description

INFOID:0000000014420128

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P020B	(Cylinder 2 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 2 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 2 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P020B being current on the CONSULT screen.

Is DTC P020B current?

YES >> Go to EC-1126, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420129

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen.

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 2.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P020C FUEL INJECTOR CYLINDER 3 TIMING

DTC Description

INFOID:0000000014420130

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P020C	(Cylinder 3 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 3 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 3 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P020C being current on the CONSULT screen.

Is DTC P020C current?

YES >> Go to EC-1128, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420131

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 3.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P020D FUEL INJECTOR CYLINDER 4 TIMING

DTC Description

INFOID:0000000014420132

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P020D	(Cylinder 4 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 4 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 4 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P020D being current on the CONSULT screen.

Is DTC P020D current?

YES >> Go to EC-1130, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420133

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen.

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 4.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P020E FUEL INJECTOR CYLINDER 5 TIMING

DTC Description

INFOID:0000000014420134

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P020E	(Cylinder 5 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 5 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 5 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P020E being current on the CONSULT screen.

Is DTC P020E current?

YES >> Go to EC-1132, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420135

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 5.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P020F FUEL INJECTOR CYLINDER 6 TIMING

DTC Description

INFOID:0000000014420136

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P020F	(Cylinder 6 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 6 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 6 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P020F being current on the CONSULT screen.

Is DTC P020F current?

YES >> Go to EC-1134, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420137

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 6.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0217 ENGINE OVER TEMPERATURE

DTC Description

INFOID:0000000014420138

The coolant temperature sensor is a variable resistor sensor and is used to measure the temperature of the coolant of the engine. The ECM supplies 5V to the coolant temperature sensor signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the coolant temperature.

DTC DETECTION LOGIC

The ECM detected the engine coolant temperature was above a threshold and closed the EGR valve to reduce the engine coolant temperature.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0217	Engine Coolant Over Temperature Condition (Engine coolant temperature - condition exists)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant temperature sensor ≥ 120°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0217 being current on the CONSULT screen.

Is DTC P0217 current?

YES >> Go to EC-1136, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420139

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0217 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> The EGR and EGR bypass valves were closed to reduce engine coolant temperature. No repair is necessary. Inspection End.
NO >> Refer to GI-47, "Intermittent Incident".

P0219 ENGINE OVER SPEED

DTC Description

INFOID:0000000014420140

The crankshaft position and camshaft position sensors are hall effect type sensors. The ECM provides a 5V supply to the position sensor and a return circuit. As the teeth on the crankshaft speed ring or the dimples in the back of the camshaft gear move past the position sensor, a signal is generated on the sensor signal circuit. The ECM interprets this signal and converts it to an engine speed. A missing tooth on the crankshaft gear is used by the ECM to determine the position of the engine.

DTC DETECTION LOGIC

The ECM detected the engine had exceeded 4600 rpm.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0219	Engine Overspeed Condition (Engine crankshaft speed/position - most severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Engine speed > 4,650 rpm
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- External fuel sources drawn into the intake air passage
- Reverse powering (motoring) of the engine
- Tampering of the engine speed/position sensors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0219 being current on the CONSULT screen.

Is DTC P0219 current?

YES >> Go to EC-1137, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420141

1.CHECK FOR PROPER OPERATING CONDITIONS

1. Turn ignition switch OFF.
2. Check for proper operating conditions.
3. Check if the engine was motoring downhill when the fault was logged.

Was the vehicle motoring downhill?

YES >> GO TO 2.
NO >> Check the base engine for damage due to overspeed condition.

2.CHECK FOR AN ALTERNATE FUEL SOURCE

1. Turn ignition switch OFF.
2. Check for an alternate fuel source.
3. Check if the driver reported a fuel-controlled event where the engine rapidly accelerated to or past 3400 rpm, followed by moderate deceleration to 3400 rpm.

Is there an alternate fuel source?

YES >> Locate any alternate fuel sources, such as operating the engine near flammable vapors, blown turbocharger seals, etc.
NO >> GO TO 3.

3.CHECK THE ENGINE RPM

1. Connect CONSULT.
2. Start engine.
3. Check engine rpm Data Monitor item on the CONSULT screen.
4. Compare the Data Monitor reading to a mechanical tachometer or the combination meter tachometer.

Is the rpm reading correct?

YES >> GO TO 4.
NO >> Refer to EC-1275, "DTC Description" and EC-1280, "DTC Description".

4.CHECK DTC PRIORITY

1. Check for ENGINE diagnostic trouble codes.
2. Check for DTC P0219 being current on the CONSULT screen when the engine is operating above 3200 rpm.

Is DTC P0219 current at low rpm?

YES >> GO TO 5.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

5.ROAD TEST

1. Road test the vehicle.
2. Check for DTC P0219 being past on the CONSULT screen.

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Test the vehicle in a road test or the vessel in a sea trail to determine if the overspeed condition is still present.

Is DTC P0219 past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 1.

P021A FUEL INJECTOR CYLINDER 7 TIMING

DTC Description

INFOID:0000000014420142

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P021A	(Cylinder 7 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 7 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 7 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P021A being current on the CONSULT screen.

Is DTC P021A current?

YES >> Go to EC-1139, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420143

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 7.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P021B FUEL INJECTOR CYLINDER 8 TIMING

DTC Description

INFOID:0000000014420144

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for the specified injector.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P021B	(Cylinder 8 Injection Timing)	1	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 8 > reftable38
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle
		2	Diagnosis condition	Engine running at idle
			Signal (terminal)	(–)
			Threshold	Corrected energizing time of injector number 8 < reftable39
			Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P021B being current on the CONSULT screen.

Is DTC P021B current?

YES >> Go to EC-1141, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420145

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen.

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0335, P0340 or P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:
The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3.PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 8.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

4.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P020A DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0237 BOOST PRESSURE SENSOR

DTC Description

INFOID:0000000014420146

The engine control module (ECM) provides a 5V supply and ground to the low pressure turbocharger boost pressure sensor.This sensor monitors the pressure of the compressed air exiting low pressure compressor turbocharger. The ECM interprets the signal voltage into a pressure reading. If the signal voltage is greater or less than a threshold, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module detected the low pressure turbocharger boost pressure signal voltage is less than 0.2V for a period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0237	TC_BOOST_SENSOR (Turbocharger/Supercharger Boost Sensor "A" Circuit Low)	Diagnosis condition	Ignition switch ON or engine running
		Signal (terminal)	(196)
		Threshold	Compressor interstage pressure sensor < 0.2V (44.81 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Low pressure Turbocharger boost pressure sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0237 being current on the CONSULT screen.

Is DTC P0237 current?

YES >> Go to EC-1143, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420147

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0652 or P0653 being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0237 being current on the CONSULT screen.

Is DTC P0237 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT LOW PRESSURE TURBOCHARGER BOOST PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect low pressure turbocharger boost pressure sensor harness connector F105.

3. Inspect the harness connector and low pressure turbocharger boost pressure sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the low pressure turbocharger boost pressure sensor harness connector F198.
3. Turn ignition switch ON.
4. Measure the voltage between low pressure turbocharger boost pressure sensor harness connector F198 terminals 1 and 2.

Low pressure turbocharger boost pressure sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F198	1	2	4.75-5.25

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect low pressure turbocharger boost pressure sensor harness connector F198.
3. Connect a jumper wire between low pressure turbocharger boost pressure sensor harness connector F198 terminal 1 and 3.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0238 DTC become current and P0237 become past?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTCS AND SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect low pressure turbocharger boost pressure sensor harness connector F198.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0237 become current?

YES >> Replace low pressure turbocharger boost pressure sensor. Refer to EM-253, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins

- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between terminal 106 and 127 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75-5.25

Is inspection the result normal?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0237 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the harness for an open or shorted circuit.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 106 and 196.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0238 become current and P0237 become past?

YES >> GO TO 12.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0237 being past on the CONSULT screen.

Is DTC P0237 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open or pin-to-pin short.

P0238 BOOST PRESSURE SENSOR

DTC Description

INFOID:0000000014420148

The engine control module (ECM) provides a 5V supply and ground to the low pressure turbocharger boost pressure sensor.This sensor monitors the pressure of the compressed air exiting low pressure compressor turbocharger. The ECM interprets the signal voltage into a pressure reading. If the signal voltage is greater or less than a threshold, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module detected the low pressure turbocharger boost pressure signal voltage is greater than 4.8V for a period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0238	TC_BOOST_SENSOR (Turbocharger/Supercharger Boost Sensor "A" Circuit High)	Diagnosis condition	Ignition switch ON or engine running.
		Signal (terminal)	(196)
		Threshold	Compressor interstage pressure sensor value > 4.8V (620.53 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Low pressure Turbocharger boost pressure sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0238 being current on the CONSULT screen.

Is DTC P0238 current?

YES >> Go to EC-1147, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420149

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0652 or P0653 being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0238 being current on the CONSULT screen.

Is DTC P0238 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT LOW PRESSURE TURBOCHARGER BOOST PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect low pressure turbocharger boost pressure sensor harness connector F105.
3. Inspect the harness connector and low pressure turbocharger boost pressure sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect low pressure turbocharger boost pressure sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0237 DTC become current and P0238 become past?

YES >> GO TO 5.
NO >> GO TO 10.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the low pressure turbocharger boost pressure sensor harness connector F105.
3. Turn ignition switch ON.
4. Measure the voltage between low pressure turbocharger boost pressure sensor harness connector F105 terminals 1 and 2.

Low pressure turbocharger boost pressure sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F105	1	2	4.75-5.25

Is inspection result normal?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK DTCS AND SENSOR CONDITION

1. Turn ignition switch OFF.
2. Disconnect low pressure turbocharger boost pressure sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0238 become current?

YES >> Replace low pressure turbocharger boost pressure sensor. Refer to EM-253, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0237 become current and P0238 become past?

YES >> GO TO 9.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0238 being past on the CONSULT screen.

Is DTC P0238 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for a pin-to-pin short.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between terminal 106 and 196 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	196	4.75-5.25

Is inspection the result normal?

YES >> GO TO 12.

NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0238 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the harness for an open circuit.

P0252 FUEL PUMP METERING CONTROL RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420150

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the fuel pump actuator.The actuator is grounded in the ECM. The actuator is normally open. The PWM duty cycle to the fuel pump actuator depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Fuel Pump Actuator driver has overheated

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0252	[Injection Pump Fuel Metering Control "A" Range/Performance (Cam/Rotor/Injector)]	Diagnosis condition	Ignition switch is ON
		Signal (terminal)	(–)
		Threshold	Volume control valve (VCV) driver ASIC temperature ≥ 165°C
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON

POSSIBLE CAUSE

- Fuel pump actuator
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0252 being current on the CONSULT screen.

Is DTC P0252 current?

YES >> Go to EC-1151, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420151

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P0253
- P0254
- P0667

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0252 being current on the CONSULT screen.

Is DTC P0252 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT FUEL PUMP ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pump actuator harness connector F123.
3. Inspect the harness connector and fuel pump actuator pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel pump actuator harness connector F123.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0254 DTC become current and P0252 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK DTCS AND SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect fuel pump actuator harness connector F123.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0252 become current?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. CHECK FUEL PUMP ACTUATOR

1. Turn ignition switch ON.
2. Using CONSULT, perform High Fuel Pressure Actuator Test.

Is the inspection result normal?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Replace the fuel pump actuator. Refer to EM-484, "Removal and Installation".

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0254 become current and P0252 become past?

YES >> Repair or replace harness for a short circuit.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0253 FUEL PUMP METERING CONTROL LOW

DTC Description

INFOID:0000000014420152

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the fuel pump pressurizing assembly. The actuator is grounded in the ECM. The actuator is normally open. The PWM duty cycle to the fuel pump pressurizing assembly depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel pump actuator signal voltage is less than 2.7V for 1 second commanded off.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0253	[Injection Pump Fuel Metering Control "A" Low (Cam/Rotor/Injector)]	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Volume control valve (VCV) driver voltage < 2.7V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Fuel pump actuator
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0253 being current on the CONSULT screen.

Is DTC P0253 current?

YES >> Go to EC-1154, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420153

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0253 being current on the CONSULT screen.

Is DTC P0253 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL PUMP ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pump actuator harness connector F123.
3. Inspect the harness connector and fuel pump actuator pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel pump actuator harness connector F123.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0254 DTC become current and P0253 become past?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK DTCS AND SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect fuel pump actuator harness connector F123.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0253 become current?

YES >> Replace fuel pump actuator. Refer to EM-484, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0254 become current and P0253 become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pump actuator harness connector F123.
4. Measure the resistance between the ECM harness connector terminal 118 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	118	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pump actuator harness connector F123.
4. Measure the resistance between the ECM harness connector F101 terminal 118 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	118	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short to ground.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0253 become past?

YES >> The removal and installation of the connector corrected the fault.
NO >> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been be detected.

P0254 FUEL PUMP METERING CONTROL HIGH

DTC Description

INFOID:0000000014420154

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the fuel pump pressurizing assembly. The actuator is grounded in the ECM. The actuator is normally open. The PWM duty cycle to the fuel pump pressurizing assembly depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a short to battery, short pin-to-pin, or open circuit in the fuel pump actuator circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0254	[Injection Pump Fuel Metering Control "A" High (Cam/Rotor/Injector)]	1	Diagnosis condition	Ignition switch is ON or engine is running
			Signal (terminal)	(–)
			Threshold	Volume control valve (VCV) driver voltage < 245V
			Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running
		2	Diagnosis condition	Ignition switch is ON or engine is running
			Signal (terminal)	(–)
			Threshold	Volume control valve (VCV) driver voltage > 600mV
			Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0254 being current on the CONSULT screen.

Is DTC P0254 current?

YES >> Go to EC-1157, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420155

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0254 being current on the CONSULT screen.

Is DTC P0254 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL PUMP ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pump actuator harness connector F123.
3. Inspect the harness connector and fuel pump actuator pins for the following:

- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel pump actuator harness connector F123.
3. Connect a jumper wire between fuel pump actuator harness connector F123 terminal 1 and 2.
4. Turn ignition switch ON and wait seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0253 become current and P0254 become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK DTCS AND FUEL PUMP ACTUATOR CONDITION

1. Turn ignition switch OFF.
2. Connect fuel pump actuator harness connector F123.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0254 become current?

YES >> Replace fuel pump actuator. Refer to EM-484, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

5. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between the fuel pump actuator signal circuit pin 118 and battery voltage at the ECM harness connector F101.
4. Turn ignition switch ON and wait 30 seconds.

Did P0253 DTC become current and P0254 become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Measure the resistance between the ECM harness connector F101 terminal 118 and the fuel pressure relief valve harness connector F123 terminal 2.

ECM		Fuel pump actuator		Resistance
Connector	Terminal	Connector	Terminal	
F101	118	F123	2	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for an open.

8.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fuel pump actuator harness connector F123.
4. Measure the resistance between the ECM harness connector terminal 118 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	118	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short.

9.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0254 become past?

YES >> The removal and installation of the connector corrected the fault.
NO >> Troubleshooting procedures need to be repeated from the beginning. A failure mode should have been be detected. Refer to EC-1157, "DTC Description".

P0257 FUEL PUMP METERING CONTROL RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420156

The circuit is a pulse-width modulation (PWM) driver in the engine control module (ECM) that controls the high pressure common rail fuel pressure relief valve. The high pressure common rail fuel pressure relief valve is grounded in the ECM. The high pressure common rail fuel pressure relief valve is normally open. The PWM duty cycle to the high pressure common rail fuel pressure relief valve depends on the difference between desired rail pressure and sensed rail pressure.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the internal temperature of the pressure relief valve driver has exceeded 160°C.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0257	[Injection Pump Fuel Metering Control "B" Range/Performance (Cam/Rotor/Injector)]	Diagnosis condition	Ignition switch is ON or engine is running
		Signal (terminal)	(–)
		Threshold	Fuel pressure relief valve driver has exceeded > 160°C
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Fuel pressure relief valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0257 being current on the CONSULT screen.

Is DTC P0257 current?

YES >> Go to EC-1160, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420157

1.CHECK DTC PRIORITY

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P009C
- P009D
- P0667

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0257 being current on the CONSULT screen.

Is DTC P0257 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT FUEL PRESSURE RELIEF VALVE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pressure relief valve harness connector F122.
3. Inspect the harness connector and fuel pressure relief valve pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel pressure relief valve harness connector F122.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P009D become current and P0257 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK DTCS AND SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect fuel pressure relief valve harness connector F122.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0257 become current?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. CHECK FUEL PRESSURE RELIEF VALVE

1. Turn ignition switch ON.
2. Using CONSULT, perform High Fuel Pressure Actuator Test.

Is the inspection result normal?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Replace the fuel pressure relief valve. Refer to EM-482, "Removal and Installation".

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P009D become current and P0257 become past?

YES >> Repair or replace the engine harness for a short.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0261 FUEL INJECTOR (CYLINDER 1)

DTC Description

INFOID:0000000014420158

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0261	CYL1 INJECTOR (Cylinder 1 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 1 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 1 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 1 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 1 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 1 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0261 being current on the CONSULT screen.

Is DTC P0261 current?

YES >> Go to EC-1164, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420159

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0261 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 1 harness connector F113.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 1 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector.
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 176 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	176	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace harness for a short.

6. CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 155 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	155	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace harness for a short.

7. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0261 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

8. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0261 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1163, "DTC Description".
NO >> Repair complete.

P0262 FUEL INJECTOR (CYLINDER 1)

DTC Description

INFOID:0000000014420160

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0262	CYL1 INJECTOR (Cylinder 1 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 1 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0262 being current on the CONSULT screen.

Is DTC P0262 current?

YES >> Go to EC-1166, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420161

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0262 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 1 harness connector F113.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 1 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM from engine harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

• Measure the resistance between ECM harness connector F101 terminal 176 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	176	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 155 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	155	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line. Refer to EM-475, "Removal and Installation".

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0262 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0262 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1166, "DTC Description".
NO >> Repair complete.

P0263 CYLINDER 1 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420162

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0263	(Cylinder 1 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 1 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0263 being current on the CONSULT screen.

Is DTC P0263 current?

YES >> Go to EC-1169, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420163

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 1.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0263 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0264 FUEL INJECTOR (CYLINDER 2)

DTC Description

INFOID:0000000014420164

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0264	CYL2 INJECTOR (Cylinder 2 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 2 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 2 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 2 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 2 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 2 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0264 being current on the CONSULT screen.

Is DTC P0264 current?

YES >> Go to EC-1172, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420165

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0264 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 2 harness connector F129.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 2 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

- Measure the resistance between ECM harness connector F101 terminal 92 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	92	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

- Measure the resistance between ECM harness connector F101 terminal 133 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	113	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace harness for a short.

7. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0264 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

8. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0264 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1171, "DTC Description".
NO >> Repair complete.

P0265 FUEL INJECTOR (CYLINDER 2)

DTC Description

INFOID:0000000014420166

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0265	CYL2 INJECTOR (Cylinder 2 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 2 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0265 being current on the CONSULT screen.

Is DTC P0265 current?

YES >> Go to EC-1174, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420167

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0265 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 2 harness connector F129.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 2 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 92 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	92	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

• Measure the resistance between ECM harness connector F101 terminal 133 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	113	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line.

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0265 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0265 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1174, "DTC Description".
NO >> Repair complete.

P0266 CYLINDER 2 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420168

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0266	(Cylinder 2 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 2 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0266 being current on the CONSULT screen.

Is DTC P0266 current?

YES >> Go to EC-1177, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420169

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 2.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0266 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0267 FUEL INJECTOR (CYLINDER 3)

DTC Description

INFOID:0000000014420170

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0267	CYL3 INJECTOR (Cylinder 3 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 3 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 3 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 3 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 3 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 3 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0267 being current on the CONSULT screen.

Is DTC P0267 current?

YES >> Go to EC-1180, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420171

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0267 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 3 harness connector F115.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 3 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 95 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	95	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

- Measure the resistance between ECM harness connector F101 terminal 116 and all other terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	116	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0267 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

8.ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0267 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1179, "DTC Description".
NO >> Repair complete.

P0268 FUEL INJECTOR (CYLINDER 3)

DTC Description

INFOID:0000000014420172

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0268	CYL3 INJECTOR (Cylinder 3 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 3 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0268 being current on the CONSULT screen.

Is DTC P0268 current?

YES >> Go to EC-1182, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420173

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0268 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 3 harness connector F115.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 3 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT HARNESS

• Measure the resistance between ECM harness connector F101 terminal 95 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	95	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

• Measure the resistance between ECM harness connector F101 terminal 116 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	116	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line.

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0268 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

9. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0268 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1182, "DTC Description".
NO >> Repair complete.

P0269 CYLINDER 3 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420174

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0269	(Cylinder 3 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 3 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blowby when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0269 being current on the CONSULT screen.

Is DTC P0269 current?

YES >> Go to EC-1185, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420175

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 3.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0269 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P026A CHARGE AIR COOLER EFFICIENCY BELOW NORMAL

DTC Description

INFOID:0000000014420176

The ECM supplies 5V to the Charge Air Cooler outlet temperature signal circuit, and monitors the change in voltage caused by changes in the resistance of the sensor to determine the Charge Air Cooler outlet temperature. When the intake air is cold, the sensor (or thermistor) resistance is high. The ECM signal voltage only pulls down a small amount through the sensor to a ground. Therefore, the ECM senses a high signal voltage or low temperature. When the intake air is warm, the sensor resistance is low. The signal voltage pulls down a large amount. Therefore, the ECM senses a low signal voltage, or a high temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Charge Air Cooler Temperature was higher than estimated.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P026A	(Charge Air Cooler Efficiency Below Threshold)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Cumulative sum of error in 50 seconds is > 600°C, which is ≥ 12°C. Where tolerance is defined as 0°C.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Intake manifold temperature sensor
- Charge-air cooler.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P026A being current on the CONSULT screen.

Is DTC P026A current?

YES >> Go to EC-1187, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420177

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P007B
- P007C
- P007D

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".

NO >> GO TO 2.

2. CHECK CHARGE AIR COOLER OUTLET TEMPERATURE SENSOR

1. Turn ignition switch ON.
2. Connect CONSULT and select “Data Monitor” mode.
3. Select “CHARGE AIR COOLER OUTLET TEMPERATURE SENSOR” and check the indication.
4. Compare charge air cooler outlet temperature sensor reading to a mechanical gauge or a known value.

Monitor item	Condition	Indication
CHARGE AIR COOLER OUTLET TEMPERATURE SENSOR	Ignition switch ON (Engine stopped.)	Varies

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Replace engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".

P026B INJECTION TIMING PERFORMANCE

DTC Description

INFOID:0000000014420178

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this fault code will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a fueling timing or quantity error for all injectors.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P026B	(Engine Fuel Injection Quantity Error for Multiple Cylinders Exists)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	Fuel quantity balancing control is not in closed loop mode.
		Diagnosis delay time	Diagnostic runs periodically when engine is running

POSSIBLE CAUSE

- Corrupted engine calibration
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P026B being current on the CONSULT screen.

Is DTC P026B current?

YES >> Go to EC-1189, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420179

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P026B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P0270 FUEL INJECTOR (CYLINDER 4)

DTC Description

INFOID:0000000014420180

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0270	CYL4 INJECTOR (Cylinder 4 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 4 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 4 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 4 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 4 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 4 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0270 being current on the CONSULT screen.

Is DTC P0270 current?

YES >> Go to EC-1191, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420181

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0270 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 4 harness connector F131.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 4 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 178 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	178	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 157 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	157	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0270 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

8.ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0270 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1190, "DTC Description".
NO >> Repair complete.

P0271 FUEL INJECTOR (CYLINDER 4)

DTC Description

INFOID:0000000014420182

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0271	CYL4 INJECTOR (Cylinder 4 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 4 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0271 being current on the CONSULT screen.

Is DTC P0271 current?

YES >> Go to EC-1193, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420183

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0271 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 4 harness connector F131.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 4 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 178 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	178	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 157 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	157	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line.

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0271 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0271 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1193, "DTC Description".
NO >> Repair complete.

P0272 CYLINDER 4 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420184

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0272	(Cylinder 4 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 4 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0272 being current on the CONSULT screen.

Is DTC P0272 current?

YES >> Go to EC-1196, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420185

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 4.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0272 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0273 FUEL INJECTOR (CYLINDER 5)

DTC Description

INFOID:0000000014420186

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0273	CYL5 INJECTOR (Cylinder 5 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 5 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 5 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 5 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 5 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 5 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0273 being current on the CONSULT screen.

Is DTC P0273 current?

YES >> Go to EC-1199, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420187

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0273 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 5 harness connector F117.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 5 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 94 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	94	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 115 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	115	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0273 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

8.ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0273 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1198, "DTC Description".
NO >> Repair complete.

P0274 FUEL INJECTOR (CYLINDER 5)

DTC Description

INFOID:0000000014420188

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0274	CYL5 INJECTOR (Cylinder 5 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 5 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0274 being current on the CONSULT screen.

Is DTC P0274 current?

YES >> Go to EC-1201, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420189

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0274 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 5 harness connector F117.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 5 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 94 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	94	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 115 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	115	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line. Refer to EM-475, "Removal and Installation".

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0274 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0274 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1201, "DTC Description".
NO >> Repair complete.

P0275 CYLINDER 5 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420190

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0275	(Cylinder 5 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 5 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0275 being current on the CONSULT screen.

Is DTC P0275 current?

YES >> Go to EC-1204, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420191

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 5.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0275 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0276 FUEL INJECTOR (CYLINDER 6)

DTC Description

INFOID:0000000014420192

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0276	CYL6 INJECTOR (Cylinder 6 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 6 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 6 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 6 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 6 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 6 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0276 being current on the CONSULT screen.

Is DTC P0276 current?

YES >> Go to EC-1207, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420193

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0276 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 6 harness connector F133.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 6 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 179 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	179	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 158 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	158	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0276 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

8.ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0276 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1206, "DTC Description".
NO >> Repair complete.

P0277 FUEL INJECTOR (CYLINDER 6)

DTC Description

INFOID:0000000014420194

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0277	CYL6 INJECTOR (Cylinder 6 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 6 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0277 being current on the CONSULT screen.

Is DTC P0277 current?

YES >> Go to EC-1209, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420195

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0277 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 6 harness connector F133.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 6 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 179 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	179	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 158 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	158	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line. Refer to EM-475, "Removal and Installation".

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0277 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0277 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1209, "DTC Description".
NO >> Repair complete.

P0278 CYLINDER 6 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420196

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0278	(Cylinder 6 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 6 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0278 being current on the CONSULT screen.

Is DTC P0278 current?

YES >> Go to EC-1212, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420197

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 6.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0278 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0279 FUEL INJECTOR (CYLINDER 7)

DTC Description

INFOID:0000000014420198

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0279	CYL7 INJECTOR (Cylinder 7 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 7 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 7 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 7 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 7 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 7 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0279 being current on the CONSULT screen.

Is DTC P0279 current?

YES >> Go to EC-1215, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420199

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0279 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 7 harness connector F119.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 7 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 177 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	177	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

1. Measure the resistance between ECM harness connector F101 terminal 156 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	156	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0279 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

8.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0279 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1214, "DTC Description".
NO >> Repair complete.

P0280 FUEL INJECTOR (CYLINDER 7)

DTC Description

INFOID:0000000014420200

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0280	CYL7 INJECTOR (Cylinder 7 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 7 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0280 being current on the CONSULT screen.

Is DTC P0280 current?

YES >> Go to EC-1217, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420201

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0280 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 7 harness connector F119.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 7 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 177 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	177	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 156 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	156	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line. Refer to EM-475, "Removal and Installation".

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0280 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0280 DTC current?

YES >> Return to the diagnosis procedure. Refer to EC-1217, "DTC Description".
NO >> Repair complete.

P0281 CYLINDER 7 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420202

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0281	(Cylinder 7 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 7 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0281 being current on the CONSULT screen.

Is DTC P0281 current?

YES >> Go to EC-1220, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420203

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 7.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0281 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0282 FUEL INJECTOR (CYLINDER 8)

DTC Description

INFOID:0000000014420204

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector low side driver is shorted to another injector or a high side driver.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0282	CYL8 INJECTOR (Cylinder 8 Injector Circuit Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 8 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A Or • Actuator charging time ≤ 100 secs • Actuator charging time for cylinder number 8 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Actuator discharge voltage < injector charge voltage set-point 0.55V • Actuator charge up voltage for cylinder number 8 < injector charge voltage set point +80V • Actuator charge up voltage for cylinder number 8 < injector charge voltage set point 0.7V • Actuator charge up voltage for cylinder number 8 < injector charge voltage set point 0.55V • Maximum injector current ≤ 32A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0282 being current on the CONSULT screen.

Is DTC P0282 current?

YES >> Go to EC-1223, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420205

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0282 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF
2. Disconnect injector 8 harness connector F135.
3. Inspect the harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

- Measure the resistance between the injector 8 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 93 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	93	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

- Measure the resistance between ECM harness connector F101 terminal 114 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	114	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0282 DTC past?

YES >> GO TO 8.
NO >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

8.ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0282 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1222, "DTC Description".
NO >> Repair complete.

P0283 FUEL INJECTOR (CYLINDER 8)

DTC Description

INFOID:0000000014420206

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0283	CYL8 INJECTOR (Cylinder 8 Injector Circuit High)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time > 100 secs • Actuator charging time for cylinder number 8 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≤ 9.8A • Differential current in the injector buffer shunt for current measurement and difference analysis ≤ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0283 being current on the CONSULT screen.

Is DTC P0283 current?

YES >> Go to EC-1225, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420207

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0283 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 8 harness connector F113.

3. Inspect the harness and connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR SHORT CIRCUIT IN THE INJECTOR

• Measure the resistance between the injector 8 terminal 1 and 2.

Is resistance less than 150K ohms?

YES >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Disconnect ECM harness connector F101.
2. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 93 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	93	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6.CHECK FOR SHORT CIRCUIT IN HARNESS

• Measure the resistance between ECM harness connector F101 terminal 114 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	114	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK THE INJECTOR DRAIN LINE

1. Turn ignition switch ON.
2. Connect CONSULT and perform Fuel Injector Line Restriction Test on the bank of this injector.

Injector drain flow meets specifications?

YES >> GO TO 8.
NO >> Replace the injector drain line. Refer to EM-475, "Removal and Installation".

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Start engine.
4. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P0283 DTC past?

YES >> GO TO 9.
NO >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

9. ERASE DTC

1. Using CONSULT erase ENGINE diagnostic trouble codes.
2. Perform DTC CONFIRMATION PROCEDURE.

Is P0283 DTC current?

YES >> Return to the Diagnosis Procedure. Refer to EC-1225, "DTC Description".
NO >> Repair complete.

P0284 CYLINDER 8 COMBUSTION DISORDER

DTC Description

INFOID:0000000014420208

Fuel Balancing is intended to decrease variances in fuel quantity from cylinder to cylinder. The change in engine speed due to a single cylinder combustion is calculated. The ECM will correct the fuel injected into each cylinder to reduce the variance in engine speed from cylinder to cylinder. If the variance is too large, this DTC will set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fueling correction for this cylinder exceeded its allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0284	(Cylinder 8 Contribution/Balance)	Diagnosis condition	Engine running at idle
		Signal (terminal)	(–)
		Threshold	Cylinder number 8 fuel balance control correction quantity > reftable27
		Diagnosis delay time	Diagnostic runs continuously when the engine is running at idle

POSSIBLE CAUSE

- Fuel injector
- High blow-by when engine is loaded
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 5 minutes.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0284 being current on the CONSULT screen.

Is DTC P0284 current?

YES >> Go to EC-1228, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420209

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed on the CONSULT screen:

- Any injector or rail pressure sensor DTCs current or with accumulated past counts.
- Any turbocharger, intake air throttle or EGR DTCs
- P0300
- P0301
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK INJECTOR TRIM CODE.

1. Turn ignition switch ON.
2. Using CONSULT, verify injector trim codes.

NOTE:

The factory installed injector bar code values can be found in website Online by entering the correct engine serial number (ESN), selecting Service, and then Engine Data Plate. The correct injector bar code values for that ESN are contained in the engine data plate section. If the engine has had a previous repair involving the replacement of injectors, the injector bar code values can be read directly off the top of each injector without the need of removing any additional parts.

Injector trim code missing or incorrect?

YES >> Using CONSULT correctly enter the injector bar code parameters into the ECM.
NO >> GO TO 3.

3. PERFORM THE HIGH PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 8.

Injectors meet specifications?

YES >> GO TO 4.
NO >> Replace malfunctioning fuel injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

4. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is P0284 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0299 BOOST PRESSURE

DTC Description

INFOID:0000000014420210

The engine control module (ECM) provides a 5V supply to the Charge Air Cooler outlet pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The Charge Air Cooler outlet pressure sensor provides a signal to the ECM on the Charge Air Cooler outlet pressure sensor signal circuit. This sensor signal voltage changes based on the pressure exiting the Charge Air Cooler.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the intake manifold pressure reading was below the expected level for the engine operating conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0299	TC_SYSTEM (Turbocharger/Supercharger Underboost)	Diagnosis condition	Ignition switch ON or engine running.
		Signal (terminal)	(–)
		Threshold	Cumulative sum of error in 120 seconds is > 1400 kg/min, which is ≥ 1.167 kg/min. Where tolerance is defined as 0 kg/min.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Air intake system leak between turbocharger and intake manifold
- Charge air cooler temperature sensor
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0299 being current on the CONSULT screen.

Is DTC P0299 current?

YES >> Go to EC-1230, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420211

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P007B being current on the CONSULT screen.

Is DTC P007B detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have high past counts on the CONSULT screen:

- P0101
- P0102
- P0103
- P0107
- P0108
- P012B
- P012C
- P012D
- P0471
- P2280
- P2580
- Any turbocharger, EGR bypass valve or EGR valve DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK DATA MONITOR

Using CONSULT, check “Data Monitor” mode.

Is the reading 0 ± 10.3 kPa (0 ±±?

YES >> GO TO 4.
NO >> Replace engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".

4. INSPECT CHARGE AIR COOLER

1. Operate the engine.
2. Inspect the charge-air cooler for the following:

- Leaks between the turbocharger compressor outlet and the charge-air cooler
- Connections between the charge-air cooler and the intake manifold
- intake manifold gasket for leaks
- Hoses for leaks or loose connections
- Clamps to make sure they are tight
- Charge-air plumbing for cracks

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. INSPECT CHARGE AIR COOLER FOR RESTRICTION

1. Turn ignition switch OFF.
2. Inspect the charge-air cooler and piping for damages or obstructions to airflow.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. INSPECT EGR SYSTEM FOR LEAKS AND RESTRICTIONS

1. Turn ignition switch OFF.
2. Inspect the EGR system plumbing for leaks and restrictions:

- Check the exhaust transfer tubes for leaks and restrictions.
- Check the exhaust bypass tubes for leaks and restrictions.
- Leaks can be easily noted by traces of soot.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. INSPECT AIR INTAKE FOR RESTRICTION

1. Connect all components.
2. Connect CONSULT and check for air intake restriction.

Is the inspection result normal?

YES >> Inspection End.
NO >> Repair or replace error-detected parts.

P02EE FUEL INJECTOR (CYLINDER 1)

DTC Description

INFOID:0000000014420212

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02EE	(Cylinder 1 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 1 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02EE being current on the CONSULT screen.

Is DTC P02EE current?

YES >> Go to EC-1233, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420213

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02EE being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 1 from engine harness connector F113.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector from the engine harness connector F113.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 1 RETURN terminal 176 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	176	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02EE DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02EE DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02EF FUEL INJECTOR (CYLINDER 2)

DTC Description

INFOID:0000000014420214

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02EF	(Cylinder 2 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 2 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02EF being current on the CONSULT screen.

Is DTC P02EF current?

YES >> Go to EC-1236, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420215

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02EF being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 2 from engine harness connector F129.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector from the engine harness connector F129.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 2 RETURN terminal 92 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	92	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02EF DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02EF DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02F0 FUEL INJECTOR (CYLINDER 3)

DTC Description

INFOID:0000000014420216

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02F0	(Cylinder 3 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 3 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02F0 being current on the CONSULT screen.

Is DTC P02F0 current?

YES >> Go to EC-1239, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420217

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02F0 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 3 from engine harness connector F115.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector from the engine harness connector F115.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 3 RETURN terminal 95 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	95	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02F0 DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02F0 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02F1 FUEL INJECTOR (CYLINDER 4)

DTC Description

INFOID:0000000014420218

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02F1	(Cylinder 4 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 4 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02F1 being current on the CONSULT screen.

Is DTC P02F1 current?

YES >> Go to EC-1242, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420219

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02F1 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 4 from engine harness connector F131.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector from the engine harness connector F131.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 4 RETURN terminal 178 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	178	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02F1 DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02F1 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02F2 FUEL INJECTOR (CYLINDER 5)

DTC Description

INFOID:0000000014420220

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02F2	(Cylinder 5 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 5 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02F2 being current on the CONSULT screen.

Is DTC P02F2 current?

YES >> Go to EC-1245, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420221

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02F2 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 5 from engine harness connector F117.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector 5 from the engine harness connector F117.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 1 RETURN terminal 94 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	94	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02F2 DTC past?

YES >> GO TO ^.
NO >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02F2 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02F3 FUEL INJECTOR (CYLINDER 6)

DTC Description

INFOID:0000000014420222

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02F3	(Cylinder 6 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 6 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02F3 being current on the CONSULT screen.

Is DTC P02F3 current?

YES >> Go to EC-1248, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420223

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02F3 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 6 from engine harness connector F133.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector from the engine harness connector F133.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 6 RETURN terminal 179 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	179	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02F3 DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02F3 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02F4 FUEL INJECTOR (CYLINDER 7)

DTC Description

INFOID:0000000014420224

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02F4	(Cylinder 7 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 7 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02F4 being current on the CONSULT screen.

Is DTC P02F4 current?

YES >> Go to EC-1251, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420225

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02F4 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 7 from engine harness connector F119.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector 7 from the engine harness connector F119.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 1 RETURN terminal 177 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	177	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02F4 DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02F4 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P02F5 FUEL INJECTOR (CYLINDER 8)

DTC Description

INFOID:0000000014420226

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each Group of Injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up Group 1. Fuel Injectors 2, 3, 5, and 8 make-up Group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Injector Low side driver is shorted to battery or a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P02F5	(Cylinder 8 Injector Circuit Range/ Performance)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Actuator charging time ≤ 100 μsecs • Actuator charging time for cylinder number 8 ≥ 5 μsecs • Differential current in the injector shunt for current measurement and difference analysis ≥ 9.8A • Injector buffer current during voltage discharging ≤ 9.6A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P02F5 being current on the CONSULT screen.

Is DTC P02F5 current?

YES >> Go to EC-1254, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420227

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P02F5 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect injector 8 from engine harness connector F135.
3. Inspect the harness and connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the injector 8 from the engine harness connector F135.
3. Disconnect the engine harness from the ECM connector F101.
4. Measure the resistance between the injector 1 RETURN terminal 93 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	93	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for a short.

5. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for past ENGINE diagnostic trouble codes.

Is P02F5 DTC past?

YES >> GO TO 6.
NO >> Replace the injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

6. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.

Is P02F5 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0300 MISFIRE

DTC Description

INFOID:0000000014420228

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a misfire of two or more cylinders.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0300	MULTI_CYL_MISFIRE (Random/Multiple Cylinder Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on each of at least two cylinders were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after the injection of each of at least two cylinders is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blowby when the engine is loaded
- Valve train malfunction
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0300 being current on the CONSULT screen.

Is DTC P0300 current?

YES >> Go to EC-1257, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420229

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0300 being current on the CONSULT screen.

Is DTC P0300 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to injectors?

YES >> Replace malfunctioning injectors. Refer to EM-435, "Exploded View".
NO >> GO TO 4.

4. PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on each bank.

Injectors meet specifications?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-435, "Exploded View".

P0301 CYLINDER 1 MISFIRE

DTC Description

INFOID:0000000014420230

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 1 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0301	CYL_1_MISFIRE (Cylinder 1 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 1 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 1 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0301 being current on the CONSULT screen.

Is DTC P0301 current?

YES >> Go to EC-1259, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420231

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0301 being current on the CONSULT screen.

Is DTC P0301 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 1 cylinder?

YES >> Replace cylinder 1 injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 1.

Is the symptom attributed to number 1 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

P0302 CYLINDER 2 MISFIRE

DTC Description

INFOID:0000000014420232

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 2 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0302	CYL_2_MISFIRE (Cylinder 2 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 2 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 2 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0302 being current on the CONSULT screen.

Is DTC P0302 current?

YES >> Go to EC-1261, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420233

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0302 being current on the CONSULT screen.

Is DTC P0302 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 2 cylinder?

YES >> Replace cylinder 2 injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 2.

Is the symptom attributed to number 2 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

P0303 CYLINDER 3 MISFIRE

DTC Description

INFOID:0000000014420234

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 3 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0303	CYL_3_MISFIRE (Cylinder 3 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 3 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 3 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0303 being current on the CONSULT screen.

Is DTC P0303 current?

YES >> Go to EC-1263, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420235

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0303 being current on the CONSULT screen.

Is DTC P0303 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 3 cylinder?

YES >> Replace cylinder 3 injector. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 3.

Is the symptom attributed to number 3 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)".

P0304 CYLINDER 4 MISFIRE

DTC Description

INFOID:0000000014420236

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 4 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0304	CYL_4_MISFIRE (Cylinder 4 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 4 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 4 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0304 being current on the CONSULT screen.

Is DTC P0304 current?

YES >> Go to EC-1265, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420237

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0304 being current on the CONSULT screen.

Is DTC P0304 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 4 cylinder?

YES >> Replace cylinder 4 injector. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 4.

Is the symptom attributed to number 4 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)".

P0305 CYLINDER 5 MISFIRE

DTC Description

INFOID:0000000014420238

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 5 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0305	CYL_5_MISFIRE (Cylinder 5 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 5 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 5 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0305 being current on the CONSULT screen.

Is DTC P0305 current?

YES >> Go to EC-1267, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420239

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0305 being current on the CONSULT screen.

Is DTC P0305 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 5 cylinder?

YES >> Replace cylinder 5 injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 5.

Is the symptom attributed to number 5 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

P0306 CYLINDER 6 MISFIRE

DTC Description

INFOID:0000000014420240

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 6 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0306	CYL_6_MISFIRE (Cylinder 6 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 6 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 6 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0306 being current on the CONSULT screen.

Is DTC P0306 current?

YES >> Go to EC-1269, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420241

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0306 being current on the CONSULT screen.

Is DTC P0306 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 6 cylinder?

YES >> Replace cylinder 6 injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 6.

Is the symptom attributed to number 6 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

P0307 CYLINDER 7 MISFIRE

DTC Description

INFOID:0000000014420242

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 7 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0307	CYL_1_MISFIRE (Cylinder 7 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 7 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 7 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0307 being current on the CONSULT screen.

Is DTC P0307 current?

YES >> Go to EC-1271, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420243

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0307 being current on the CONSULT screen.

Is DTC P0307 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 7 cylinder?

YES >> Replace cylinder 7 injector. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 7.

Is the symptom attributed to number 7 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)".

P0308 CYLINDER 8 MISFIRE

DTC Description

INFOID:0000000014420244

An algorithm in the ECM calibration monitors engine speed as each injector fires. If a cylinder(s) has high or low contribution to engine speed, the fault will become active. The intention of the fault is to assist in trouble-shooting performance complaints such as engine misfire and low power.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a cylinder 8 misfire.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0308	CYL_8_MISFIRE (Cylinder 8 Misfire Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	• At least 120 misfires on cylinder number 8 were detected during 440 crankshaft revs • The angular acceleration of the crankshaft after cylinder number 8 injection is below minimum threshold that is dynamically calculated from current injection quantity and engine speed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- High blow-by when the engine is loaded
- Valve train malfunction
- Extra, missing, or damaged sealing washer under an injector
- Injector malfunctions

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for up to 5 minutes.
   NOTE:
   The engine coolant temperature must be greater than 30°C [86°F] before this diagnostic will run.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0308 being current on the CONSULT screen.

Is DTC P0308 current?

YES >> Go to EC-1273, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420245

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current or have accumulated past counts on the CONSULT screen:

- Any fuel system, injector or rail pressure sensor DTCs
- Any turbocharger, crankcase or EGR related DTCs
- P0335
- P0340
- P0344

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0308 being current on the CONSULT screen.

Is DTC P0308 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.PERFORM CYLINDER CUTOUT TEST

1. Turn ignition switch ON.
2. Operate the engine under the conditions in which the complaint occurs.
3. Connect CONSULT and perform the Cylinder Cutout Test to disable individual injectors.

Is the symptom attributed to number 8 cylinder?

YES >> Replace cylinder 8 injector. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.PERFORM HIGH-PRESSURE FUEL INJECTOR DRAIN FLOW TEST

1. Turn ignition switch ON.
2. Perform the Fuel Injector Drain Flow Test on the bank of cylinder number 8.

Is the symptom attributed to number 8 cylinder?

YES >> Refer to Engine Runs Rough or Misfires troubleshooting symptom.
NO >> Replace malfunctioning injectors. Refer to EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

P0335 CKP SENSOR (POS)

DTC Description

INFOID:0000000014420246

The crankshaft position sensor is a hall effect type sensor. The Engine Control Module (ECM) provides a 5V supply to the position sensor and a return circuit. As the teeth on the crankshaft speed ring move past the position sensor, a signal is generated on the position sensor signal circuit. The ECM interprets this signal and converts it to an engine speed. A missing tooth on the crankshaft gear is used by the ECM to determine the position of the engine.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0335	CKP SEN/CIRCUIT (Crankshaft position sensor “A” circuit)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Crankshaft position sensor (POS) signal
		Threshold	• The crankshaft position sensor (POS) signal is not detected by the ECM during the first few seconds of engine cranking. • The proper pulse signal from the crankshaft position sensor (POS) is not sent to ECM while the engine is running. • The crankshaft position sensor (POS) signal is not in the normal pattern during engine running.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
  - CKP sensor 5V supply circuit is open or shorted.
  - CKP sensor return circuit is open or shorted.
  - CKP sensor signal circuit is open or shorted.
- Crankshaft position sensor (POS)
- Damaged tone wheel
- CKP air gap that is too small or too large

FAIL-SAFE

Not applicable

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

TESTING CONDITION:

Before performing the following procedure, confirm that battery voltage is more than 10.5V with ignition switch ON.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 5 seconds.
   If engine does not start, crank engine for at least 2 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-1276, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420247

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.

If DTC P0698 or P0699 is present, perform the confirmation procedure (trouble diagnosis) for these other DTCs first.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR ACTIVE CKP DTC

Check for DTC P0335 being active on the CONSULT screen.

Is applicable DTC active?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT CRANKSHAFT POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect crankshaft position sensor from engine harness connector.
3. Inspect the crankshaft position sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.INSPECT MASS AIR FLOW SENSOR AND CONNECTOR PINS

1. Remove the crankshaft position sensor from the gear housing.
2. Inspect the crankshaft position sensor for the following:

- Metal debris on the end of the sensor
- Damage to the end of the sensor caused by camshaft gear
- Oil leakage or insulation problems such as swelling
- Damaged electrical potting in sensing end of sensor

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK CRANKSHAFT POSITION SENSOR (CKP) POWER SUPPLY CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between crankshaft position sensor harness connector terminals.

CKP sensor			Voltage (V)
Connector	Terminal (+)	Terminal (-)	
F110	190	169	Approx. 5V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 11.

6. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK CKP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN

Check the continuity between CKP sensor harness connector and ECM harness connector.

CKP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F110	3	F101	189	Yes

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair open circuit in harness or connectors.

8. CHECK CKP SENSOR INPUT SIGNAL CIRCUIT FOR SHORT

Check the continuity between CKP sensor harness connector and ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
F101	189	All others	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair short circuit in harness connector.

9. INSPECT THE AIR GAP AND TARGET WHEEL

1. Inspect the air gap and target wheel.
2. With the crankshaft position sensor removed from the engine block, measure the air gap and runout at several points in the crankshaft's revolution.

Air gap		Runout
Minimum	Maximum	Maximum target
0.25 mm [0.009 in]	2.25 mm [0.089 in]	0.5 mm [0.02 in]

Is the inspection result normal?

YES >> GO TO 10.
NO >> Add shims or repair as necessary.

10. CHECK THE DTC AND VERIFY CKP SENSOR CONDITION

1. Connect all components in the correct positions.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF. Key ON.

4. Connect CONSULT and check for active ENGINE diagnostic trouble codes.

Is P0335 DTC active?

YES >> Replace the crankshaft position sensor. Refer to EM-344, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue

11. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair or replace error-detected parts.

12. CHECK CKP SENSOR CIRCUITS FOR OPEN

Check the continuity between CKP sensor (POS) harness connector and ECM harness connector.

CKP sensor (POS)		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F110	1	F101	190	Yes
	2		169	

Is the inspection result normal?

YES >> GO TO 13.
NO >> Repair open circuit in harness or connectors.

13. CHECK CKP SENSOR CIRCUITS FOR SHORT

Check the continuity between CKP sensor (POS) harness connector and ground.

CKP sensor (POS)		Ground	Continuity
Connector	Terminal		
F110	1(+)	(-)	No
	2(+)	(-)	

Is the inspection result normal?

YES >> GO TO 14.
NO >> Repair short circuit in harness or connectors.

14. CHECK THE DTC AND VERIFY CKP SENSOR CONDITION

1. Connect all components in the correct positions.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF. Key ON.
4. Connect CONSULT and check for active ENGINE diagnostic trouble codes.

Is P0335 DTC active?

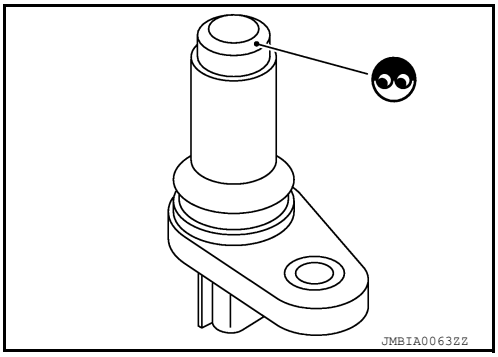
YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

Component Inspection

INFOID:0000000014420248

1. CHECK CRANKSHAFT POSITION SENSOR (POS)

1. Turn ignition switch OFF.
2. Loosen the fixing bolt of the sensor.
3. Disconnect crankshaft position sensor (POS) harness connector.
4. Remove the sensor. Refer to EM-344, "Removal and Installation".
5. Visually check the sensor for chipping.



Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace crankshaft position sensor (POS). Refer to EM-344, "Removal and Installation".

2. CHECK CRANKSHAFT POSITION SENSOR (POS)

Check resistance between crankshaft position sensor (POS) terminals as follows.

Terminals (Polarity)	Resistance (Ω)
1 (+) - 2 (-)	Except 0 or ∞ [at 25°C (77°F)]
1 (+) - 3 (-)	
2 (+) - 3 (-)	

Is the inspection result normal?

YES >> Inspection End.
NO >> Replace crankshaft position sensor (POS). Refer to EM-344, "Removal and Installation".

P0340 CMP SENSOR (PHASE)

DTC Description

INFOID:0000000014420249

The engine control module (ECM) provides a 5V supply to the engine camshaft speed/position sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The camshaft speed/position sensor provides a signal to the ECM on the camshaft speed/position sensor signal circuit. This sensor generates a signal to the ECM as the camshaft speed indicator lobe moves past the sensor. The ECM interprets this signal into an engine speed reading and determines engine position. This sensor is used as a backup sensor if the primary engine crankshaft speed/position signal is lost.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a loss of the camshaft speed/position sensor while the engine was running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0340	CMP_SEN/CIRCUIT (Camshaft Position Sensor “A” Circuit)	Diagnosis condition	Engine running
		Signal (terminal)	Camshaft position (168)
		Threshold	Detected when no camshaft signal is present and crankshaft signal is valid over calibrated threshold.
		Diagnosis delay time	Diagnostic runs continuously when engine is running

POSSIBLE CAUSE

- Camshaft position sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0340 being current on the CONSULT screen.

Is DTC P0340 current?

YES >> Go to EC-1280, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420250

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0652
- P0653

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0340 being current on the CONSULT screen.

Is DTC P0340 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT CAMSHAFT POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect camshaft position sensor harness connector F109.
3. Inspect the harness connector and camshaft position sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. INSPECT CAMSHAFT POSITION SENSOR

1. Turn ignition switch OFF.
2. Disconnect camshaft position sensor harness connector F109.
3. Remove camshaft position sensor.
4. Inspect camshaft position sensor for the following:

- Metal debris on the end of the sensor
- Damage to the end of the sensor caused by camshaft gear
- Oil leakage or insulation problems such as swelling
- Damaged electrical potting in sensing end of sensor

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace camshaft position sensor. Refer to EM-323, "Removal and Installation".

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the camshaft position sensor harness connector F109.
3. Turn ignition switch ON.
4. Measure the voltage between camshaft position sensor harness connector F109 terminals 1 and 2.

Camshaft position sensor			Voltage (Approx.)
Connector	Terminal	Terminal	
F109	1	2	4.75V - 5.25V

Is inspection result normal?

YES >> GO TO 6.
NO >> GO TO 11.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK FOR AN OPEN CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the camshaft position sensor harness connector F109.
4. Measure the resistance between the ECM harness connector F101 terminal 168 and the camshaft position sensor harness connector F109 terminal 3.

ECM		Camshaft position sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	168	F109	3	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness for an open.

8. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the camshaft position sensor harness connector F109.
4. Measure the resistance between the ECM harness connector F101 terminal 168 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	168	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the harness for a short.

9. VERIFY CAMSHAFT POSITION SENSOR AIR GAP

1. Turn ignition switch OFF.
2. Disconnect camshaft position sensor harness connector F109.
3. Remove camshaft position sensor.
4. Measure camshaft position sensor air gap at several points in the camshaft's revolution.

- Minimum Air Gap: 0.25 mm (0.009 in)
- Maximum Air Gap: 2.00 mm (0.078 in)

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace or shim the sensor if the air gap is out of specification. If the target runout is excessive, replace the target.

10. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect all components.
3. Start engine and let idle for 1 minute.
4. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.

Is DTC P0340 current?

YES >> Replace the camshaft position sensor. Refer to EM-323, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

11. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair or replace error-detected parts.

12. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between ECM harness connector F101 terminals 106 and 127.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75V - 5.25V

Is inspection result normal?

YES >> GO TO 13.
NO >> Repair or replace the harness.

13. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect all components.
3. Start engine and let idle for 1 minute.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0340 current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P0344 CKP - CMP CORRELATION

DTC Description

INFOID:0000000014722944

The engine control module (ECM) provides a 5V supply to the camshaft position sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. As slots in the front of the camshaft gear move past the position sensor, a signal is generated on the signal circuit. The ECM uses this signal to determine engine speed and position. Offset spacing of the cam gear slots indicate to the ECM the position of the engine. This sensor is used as a backup sensor if the engine crankshaft position signal is lost.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankshaft position does not match the camshaft position signal input to the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0344	CMP/CKP_RELATION (Crankshaft Position – Camshaft Position Correlation)	1	Diagnosis condition	Engine running
			Signal (terminal)	Camshaft position (168)
			Threshold	• Maximum camshaft tone wheel tooth angle offset from radial < 5.56° • Minimum camshaft tone wheel tooth angle offset from radial > -10.11°
			Diagnosis delay time	Diagnostic runs continuously when engine is running
		2	Diagnosis condition	Engine running
			Signal (terminal)	Camshaft position (168)
			Threshold	• Maximum camshaft tone wheel tooth angle offset relative to crankshaft < -6.7° • Minimum camshaft tone wheel tooth angle offset relative to crankshaft > 5.12°
			Diagnosis delay time	Diagnostic runs continuously when engine is running

POSSIBLE CAUSE

- Camshaft position sensor malfunction
- Damaged camshaft gear
- Malfunctioning ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0344 being current on the CONSULT screen.

Is DTC P0344 current?

YES >> Go to EC-1284, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014722945

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0344 being the only current DTC on the CONSULT screen.

Is DTC P0344 detected as the only current DTC?

YES >> GO TO 2.

NO >> Refer to EC-838, "DTC Index".

2. INSPECT ENGINE AND VEHICLE GROUNDS

1. Turn ignition switch OFF.
2. Inspect the engine and vehicle grounding:
- Check all engine block, starter, generator, chassis, and battery grounds.
- Verify all grounds are present and properly grounded.
- Verify all connections are free of corrosion and tight.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT CRANKSHAFT POSITION SENSOR

1. Turn ignition switch OFF.
2. Inspect the crankshaft sensors for damage.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace crankshaft position sensor. Refer to EM-344, "Removal and Installation".

4. INSPECT CRANKSHAFT TONE WHEEL

1. Turn ignition switch OFF.
2. Inspect the crankshaft tone wheel for:
- Missing or bent teeth
- Cracks
- Damaged surfaces

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft tone wheel. Refer to TM-248, "2WD : Removal and Installation" or TM-252, "4WD : Removal and Installation".

5. INSPECT CAMSHAFT POSITION SENSOR

1. Turn ignition switch OFF.
2. Inspect the camshaft position sensor for damage.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace camshaft position sensor. Refer to EM-323, "Removal and Installation".

6. INSPECT CAMSHAFT GEARS

1. Turn ignition switch OFF.
2. Inspect the camshaft gears for:
- Excessive wear
- Fretting
- Damaged surfaces

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace camshaft gears. Refer to EM-374, "Removal and Installation".

7. INSPECT STATIC TIMING

1. Turn ignition switch OFF.
2. Remove the valve covers.
3. Rotate the engine to top dead center (TDC) for the number 1 cylinder. Verify the camshaft gear timing marks are properly aligned.
4. Inspect the timing.

Is the inspection result normal?

YES >> GO TO 8.
NO >>
- Remove and install the camshaft to properly align timing marks at TDC.
- GO TO 8.

8. ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P0344 DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1284, "DTC Description".
NO >> Repair complete.

P0383 GLOW PLUG CONTROL MODULE CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420251

The Glow Plug Control Module controls the timing and intensity of the glow plug outputs on the engine using data provided by the ECM through the CAN2 communication lines. The Glow Plug Control Module will not activate the glow plugs if the glow plug module reads a temperature greater than a calibrated amount. The Glow Plug Control Module receives fused power directly from the battery, and switched power through the smart power relay.

DTC DETECTION LOGIC

The glow plug control module supply voltage was less than 6V.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0383	GLOW PLUG CONTROL MODULE 1 CONTROL CIRCUIT LOW (Glow Plug Control Module Control Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Glow plug control module supply voltage < 6V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Glow plug control module
- Harness and connectors
- Charging system

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0383 being current on the CONSULT screen.

Is DTC P0383 current?

YES >> Go to EC-1287, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420252

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0383 being current on the CONSULT screen.

Is DTC P0383 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0562
- P0563
- P0686
- P0687
- P2503
- P2504

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module harness connector F102.
3. Inspect the harness connector and glow plug control module pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the glow plug control module harness connector E69.
3. Turn ignition switch ON.
4. Measure the voltage between glow plug control module harness connector E69 terminal 1 and ground.

Glow plug control module		–	Voltage (Approx.)
Connector	Terminal		
E69	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect the glow plug control module connectors.
3. Turn ignition switch ON.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0383 current?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> The removal and installation of the connector corrected the fault.

6. CHECK THE BATTERY CONECTIONS

1. Turn ignition switch OFF.
2. Check battery terminal connections.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK FUSE

Check if the following fuse is blown.

Component	Capacity	Fuse No.
Fusible link box LH battery	60A	G

Is the inspection result normal?

YES >> GO TO 8.

NO >> Replace the blown fuse after repairing the affected circuit.

8. INSPECT THE CHARGING SYSTEM

Inspect charging system. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".

Is the inspection result normal?

YES >> Repair or replace the harness for an open.
NO >> Repair or replace error-detected parts.

P0384 GLOW PLUG CONTROL MODULE CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420253

The Glow Plug Control Module controls the timing and intensity of the glow plug outputs on the engine using data provided by the ECM through the CAN2 communication lines. The Glow Plug Control Module will not activate the glow plugs if the glow plug module reads a temperature greater than a calibrated amount. The Glow Plug Control Module receives fused power directly from the battery, and switched power through the smart power relay.

DTC DETECTION LOGIC

The glow plug control module supply voltage was greater than 16V.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0384	GLOW PLUG CONTROL MODULE 1 CONTROL CIRCUIT HIGH (Glow Plug Control Module Control Circuit High)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Glow plug control module supply voltage > 16V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Glow plug control module
- Harness and connectors
- Charging system

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0384 being current on the CONSULT screen.

Is DTC P0384 current?

YES >> Go to EC-1290, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420254

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0384 being current on the CONSULT screen.

Is DTC P0384 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0562
- P0563
- P0686
- P0687
- P2503
- P2504

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module harness connector F102.
3. Inspect the harness connector and glow plug control module pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the glow plug control module harness connector E69.
3. Turn ignition switch ON.
4. Measure the voltage between glow plug control module harness connector E69 terminal 1 and ground.

Glow plug control module		–	Voltage (Approx.)
Connector	Terminal		
E69	1	Ground	> 16.5V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect the glow plug control module connectors.
3. Turn ignition switch ON.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0384 current?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> The removal and installation of the connector corrected the fault.

6. CHECK THE BATTERY VOLTAGE

1. Turn ignition switch OFF.
2. Measure the voltage of the battery.

Is the battery voltage > 16.5V?

YES >> Troubleshoot the cause of the overcharging condition. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".
NO >> Inspection End.

P0401 FLOW IN THE EXHAUST GAS RECIRCULATION

DTC Description

INFOID:0000000014420255

The Engine Control Module (ECM) check for Exhaust Gas Recirculation (EGR) flow conditions that are outside of a calibrated amount by calculating an error based on the commanded and actual EGR flow. If the error is outside of the calibrated amount for a period of time, the diagnostic fails.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the actual EGR flow was less than what was being commanded based on the current engine operating conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0401	EGR_SYSTEM (Exhaust Gas Recirculation Flow Insufficient Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Cumulative sum of error (estimated flow - measured flow) over a 120 second period is ever > 3000 kg/min, which is equivalent to (average of error - tolerance) > 2.5 kg/min, where tolerance is defined as 0 kg/min
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR valve
- Leaks or restrictions in the EGR flow plumbing
- Drifted engine charge air cooler outlet pressure sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P0401 being current on the CONSULT screen.

Is DTC P0401 current?

YES >> Go to EC-1292, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420256

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current or do they have high past counts on the CONSULT screen:

- P012B
- P012C
- P012D
- P0101
- P0102
- P0103
- P0106

- P0107
- P0108
- P0299
- P0471
- P2280
- P2580
- Any turbocharger DTCs
- Any EGR bypass DTCs
- Any EGR valve DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DATA MONITOR

Using CONSULT, check charge air cooler outlet pressure in “Data Monitor” mode.

Is the reading 0 ± 10.3 kPa (0 ± 1.5 psi)?

YES >> GO TO 3.
NO >> Replace engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".

3.CHECK EGR SYSTEM FOR LEAKS AND RESTRICTION

1. Turn ignition switch OFF.
2. Check the EGR system plumbing for leaks and restrictions:
   NOTE:
   Leaks can be easily noted by traces of soot.
- Check the exhaust transfer tubes for leaks and restrictions.
- Check the exhaust bypass tubes for leaks and restrictions.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK EGR VALVE FOR RESTRICTION

Check the EGR valve for restrictions.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the EGR valve. Refer to EM-287, "Removal and Installation".

5.CHECK EGR COOLER FOR RESTRICTION

Check the EGR cooler for restrictions.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the EGR cooler. Refer to EM-276, "Removal and Installation".

6.CHECK CHARGE-AIR COOLER AND CHARGE-AIR PLUMBING FOR LEAKS

1. Start the engine.
2. Check the charge-air cooler and charge-air plumbing for leaks.
- Check the charge-air cooler connections for leaks between the turbocharger compressor outlet and the charge-air cooler.
- Check the charge-air cooler connections between the charge-air cooler and the intake manifold.
- Inspect the intake manifold gasket for leaks.
- Inspect the charge-air cooler hoses for leaks or loose connections. Check the Exhaust bypass tubes for leaks and restrictions.
- Inspect the charge-air cooler clamps to make sure they are tight.
- Inspect the charge-air plumbing for cracks.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK FOR AIR INTAKE RESTRICTION

Check for air intake restriction.

Is the inspection result normal?

YES >> Inspection End.
NO >> Repair or replace error-detected parts.

P0402 FLOW IN THE EXHAUST GAS RECIRCULATION

DTC Description

INFOID:0000000014420257

The Engine Control Module (ECM) check for Exhaust Gas Recirculation (EGR) flow conditions that are outside a calibrated amount by calculating an error based on the commanded and actual EGR flow. If the error is outside the calibrated amount for a period of time, the diagnostic fails.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the measured EGR flow was greater than what was being commanded based on the present engine.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0402	EGR_SYSTEM (Exhaust Gas Recirculation Flow Excessive Detected)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Cumulative sum of error (estimated flow - measured flow) in a 200 second period is ever > 800 kg/min, which is equivalent to (average of error - tolerance) ≥ 0.4 kg/min, where tolerance is defined as reftable23 kg/min
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

EGR valve

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0402 being current on the CONSULT screen.

Is DTC P0402 current?

YES >> Go to EC-1295, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420258

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current or do they have high past counts on the CONSULT screen:

- P012B
- P012C
- P012D
- P0101
- P0102
- P0103
- P0107
- P0108
- P0299
- P0471
- P0472
- P0473
- P2280
- P2580
- Any turbocharger DTCs

- Any EGR bypass DTCs
- Any EGR valve DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK EGR VALVE

1. Turn ignition switch OFF.
2. Remove the EGR valve from the engine.
3. Inspect the EGR valve,

- Check for a stuck open EGR valve.
- Check for a damaged EGR valve that allows flow when closed.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace EGR valve. Refer to EM-287, "Removal and Installation".

3.CHECK EXHAUST GAS PRESSURE SENSOR TUBE

1. Turn ignition switch ON.
2. Remove the exhaust gas pressure sensor tube.
3. Inspect the exhaust gas pressure sensor tube.

- Inspect the inside of the tube. If clogged, use compressed air to remove debris or soot buildup.
- Check the tube for cracks and thread damage.

Is the inspection result normal?

YES >> Inspection End.
NO >> Replace or repair the exhaust gas pressure sensor tube. Refer to EM-301, "Removal and Installation".

P0405 EGR SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420259

The engine control module (ECM) uses the EGR valve position sensor to determine whether or not the valve is meeting the commanded position. The ECM supplies 5V to the EGR valve position signal circuit, and the EGR valve position sensor outputs a voltage signal to the ECM, based on the valve position.The ECM converts this signal into a percentage value, 0 to 100, indicating valve position. A fully-opened valve is equivalent to 100%.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the EGR Valve position signal voltage was less than 0.3V for more than 3 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0405	EGR_SENSOR (Exhaust Gas Recirculation Sensor "A" Circuit Low)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	EGR position sensor (152)
		Threshold	Measure EGR H-bridge valve position < 0.259V (-8.448%)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR valve position sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch to ON for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0405 being current on the CONSULT screen.

Is DTC P0405 current?

YES >> Go to EC-1297, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420260

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTC P0652 or P0653 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0405 being current on the CONSULT screen.

Is DTC P0405 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT EGR VALVE POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR valve position sensor harness connector F144.
3. Inspect the engine harness and EGR valve connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0406 become current and DTC P0405 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the EGR valve harness connector F144.
3. Turn ignition switch ON.
4. Measure the voltage between EGR valve position sensor harness connector F144 terminals 2 and 3.

EGR valve			Voltage (Approx.)
Connector	Terminal	Terminal	
F144	2	3	4.75V - 5.25V

Is inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the EGR valve harness connector F144.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0405 current?

YES >> Replace the EGR valve. Refer to EM-287, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0406 become current and DTC P0405 become past?

YES >> GO TO 9.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0405 being current on the CONSULT screen.

Is DTC P0405 detected as current?

YES >> Repair or replace harness for an open.
NO >> The removal and installation of the connector corrected the issue.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

11. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between EGR valve harness connector F144 terminals 2 and 3.

EGR valve			Voltage (Approx.)
Connector	Terminal	Terminal	
F144	2	3	4.75-5.25

Is inspection result normal?

YES >> GO TO 12.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

12.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0405 being past on the CONSULT screen.

Is DTC P0405 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open.

P0406 EGR SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420261

The engine control module (ECM) uses the EGR valve position sensor to determine whether or not the valve is meeting the commanded position. The ECM supplies 5V to the EGR valve position signal circuit, and the EGR valve position sensor outputs a voltage signal to the ECM, based on the valve position.The ECM converts this signal into a percentage value, 0 to 100, indicating valve position. A fully-opened valve is equivalent to 100%.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the EGR Valve position signal voltage was greater than 4.7V for more than 3 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0406	EGR_SENSOR (Exhaust Gas Recirculation Sensor "A" Circuit High)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	EGR valve position (152)
		Threshold	Measured EGR H-bridge valve position > 4.737V (101.02%)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0406 being current on the CONSULT screen.

Is DTC P0406 current?

YES >> Go to EC-1301, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420262

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTCs P0652 or P0653 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0406 being current on the CONSULT screen.

Is DTC P0406 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT EGR VALVE POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Inspect the engine harness and EGR valve connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Connect a jumper wire between EGR valve harness connector F144 terminals 3 and 4.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0405 become current and DTC P0406 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the EGR valve harness connector F144.
3. Turn ignition switch ON.
4. Measure the voltage between EGR valve harness connector F144 terminals 2 and 3.

EGR valve			Voltage (Approx.)
Connector	Terminal	Terminal	
F144	2	3	4.75V - 5.25V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the EGR valve harness connector F144
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0406 current?

YES >> Replace the EGR valve. Refer to EM-287, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminals 127 and 152.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0405 become current and DTC P0406 become past?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0406 being current on the CONSULT screen.

Is the inspection result normal?

YES >> Repair or replace the engine harness.
NO >> The removal and installation of the connector corrected the issue.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between ECM harness connector F101 terminals 106 and 127.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75V - 5.25V

Is the inspection result normal?

YES >> GO TO 12.

NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0406 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the engine harness.

P040B EXHAUST GAS RECIRCULATION TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420263

The exhaust gas recirculation (EGR) temperature sensor is a variable resistor sensor and is used to measure the temperature of the EGR gas flow after it exits the EGR cooler. The engine control module (ECM) supplies 5V to the EGR temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the EGR flow temperature.The EGR temperature value is used by the ECM for the engine protection system and engine emissions control.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the EGR temperature reading was too high or too low for the operating conditions, or the EGR temperature reading did not raise 0.5 degree Celsius at start-up.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P040B	(EGR temperature sensor “A” circuit range/performance)	1	Diagnosis condition	Engine running for 2 minutes or more (2 Trips).
			Signal (terminal)	Exhaust gas temperature (–)
			Threshold	Cumulative sum of error in 60 seconds is > 6,000 Deg C.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Engine running for 2 minutes or more (2 Trips).
			Signal (terminal)	Exhaust gas temperature (–)
			Threshold	Maximum sensor value to minimum sensor value after 60 seconds is < 0.3° C.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	• Engine off time is 480 minutes or more. • The temperature drop detected on coolant temperature sensor is 1°C or less for 30 seconds after the engine is started up.
			Signal (terminal)	Exhaust gas temperature (–)
			Threshold	> 25 deg C of the second most accurate of the remaining temperature sensors
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR temperature sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

NOTE:

Allow the engine to rest for 8 hour cold soak with the ignition switch OFF, then turn the ignition switch to the ON position so that the key ON portion of the diagnostic will run.

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 eleven more times.

6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P040B being current on the CONSULT screen.

Is DTC P040B current?

YES >> Go to EC-1306, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420264

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P040C and P040D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> DTC P040C and P040D. Refer to EC-1308, "Diagnosis Procedure" or EC-1311, "Diagnosis Procedure".
NO >> GO TO 2.

2.INSPECT EGR TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR temperature sensor connector F142 from engine harness connector.
3. Inspect the engine harness and EGR temperature sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the EGR temperature sensor connector F142 from the engine harness.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040D become current?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between EGR temperature sensor connector F142 return terminal 2 and signal circuit terminal 1.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040C become current?

YES >> Replace the EGR temperature sensor. Refer to EM-236, "Removal and Installation".
NO >> GO TO 5.

5.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the engine harness connector F101 from the ECM.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040D become current?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR temperature sensor connector F142 from the engine harness.
3. Connect a jumper wire between EGR temperature return terminal 1 and signal circuit terminal 2 at the ECM connector F101.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040C become current?

YES >> Repair or replace the engine harness for an open or short.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P040C EXHAUST GAS RECIRCULATION TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420265

The exhaust gas recirculation (EGR) temperature sensor is a variable resistor sensor and is used to measure the temperature of the EGR gas flow after it exits the EGR cooler. The engine control module (ECM) supplies 5V to the EGR temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the EGR flow temperature.The EGR temperature value is used by the ECM for the engine protection system and engine emissions control.

DTC DETECTION LOGIC

The EGR orifice temperature sensor reading is less than the specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P040C	(EGR temperature sensor “A” circuit low)	Diagnosis condition	Engine running for 1 minute or more
		Signal (terminal)	Exhaust gas temperature sensor (–)
		Threshold	EGR orifice temperature sensor value > 500 Deg C (< 0.067V)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR temperature sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P040C being current on the CONSULT screen.

Is DTC P040C current?

YES >> Go to EC-1308, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420266

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P040C being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT EGR TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR temperature sensor from engine harness connector F142.
3. Inspect the engine harness and EGR temperature sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the EGR temperature sensor from the engine harness connector F142.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040D become current and DTC P040C become past?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect EGR temperature sensor to the engine harness connector F142.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040C become current?

YES >> Replace the EGR temperature sensor. Refer to EM-236, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

5.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the engine harness connector F101 from the ECM.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040D become current and DTC P040C become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the engine harness from the ECM connector F101.
3. Disconnect the EGR temperature sensor from the engine harness connector F142.

4. Measure the resistance between the EGR temperature sensor SIGNAL terminal 174 in the engine harness ECM connector and all other terminals in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	174	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> Repair or replace the engine harness for an open.
NO >> GO TO 8.

8. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the engine harness from the ECM connector F101.
3. Disconnect the EGR temperature sensor from the engine harness connector F142.
4. Measure the resistance between the EGR temperature sensor SIGNAL terminal 174 in the engine harness ECM connector F101 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	174	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for an short to ground.

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P040C being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> GO TO 2.

P040D EXHAUST GAS RECIRCULATION TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420267

The exhaust gas recirculation (EGR) temperature sensor is a variable resistor sensor and is used to measure the temperature of the EGR gas flow after it exits the EGR cooler. The engine control module (ECM) supplies 5V to the EGR temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the EGR flow temperature.The EGR temperature value is used by the ECM for the engine protection system and engine emissions control.

DTC DETECTION LOGIC

The EGR orifice temperature sensor reading is greater than the specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P040D	(EGR temperature sensor “A” circuit high)	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Exhaust gas temperature sensor (–)
		Threshold	EGR temperature signal voltage was greater than 4.9-VDC for more than 8seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR temperature sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P040D being current on the CONSULT screen.

Is DTC P040D current?

YES >> Go to EC-1311, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420268

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P040D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT EGR TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR temperature sensor from engine harness connector F142.
3. Inspect the engine harness and EGR temperature sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the EGR temperature sensor from the engine harness F142.
3. Connect a jumper wire between EGR temperature sensor return terminal 1 and signal circuit terminal 2 at EGR temperature sensor connector F142.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040C become current and DTC P040D become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the EGR temperature sensor to the engine harness connector F142.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for ENGINE diagnostic trouble codes.
5. Check for DTC P040D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace the EGR temperature sensor. Refer to EM-236, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

5. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the engine harness from the ECM.
3. Connect a jumper wire between EGR temperature sensor return terminal 170 and signal circuit terminal 154 at the ECM connector F101.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P040C become current and DTC P040D become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the engine harness from the ECM connector F101.
3. Disconnect the EGR temperature sensor from the engine harness connector F142.
4. Measure the resistance between the ECM connector F101 EGR temperature sensor terminal 170 and the engine harness EGR temperature sensor connector F142 terminal 1.

ECM		EGR temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	170	F142	1	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for an open.

8. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the engine harness from the ECM connector F101.
3. Disconnect the EGR temperature sensor from the engine harness connector F142.
4. Measure the resistance between the ECM connector F101 EGR temperature sensor SIGNAL terminal 154 and the engine harness EGR temperature sensor connector F142 terminal 2.

ECM		EGR temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	154	F142	2	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for an open.

9. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the engine harness from the ECM connector F101.
3. Disconnect the EGR temperature sensor from the engine harness connector F142.
4. Measure the resistance between the EGR temperature sensor SIGNAL terminal 154 in the engine harness ECM connector F101 and all other pins in the engine harness ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	154	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> Repair or replace the engine harness for an open.
NO >> GO TO 10.

10. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P040D being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> GO TO 2.

P0420 EFFICIENCY OF THE CATALYTIC CONVERTER

DTC Description

INFOID:0000000014420269

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via the CAN 2 communication lines. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN 2 communication lines. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Engine Control Module (ECM) calculated the DOC efficiency was less than required to successfully complete a regeneration.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0420	CATALYST (Catalyst System Efficiency Below Threshold)	1	Diagnosis condition	Engine is running and active regeneration of the aftertreatment diesel particulate filter is occurring.
			Signal (terminal)	(–)
			Threshold	Filtered value of hydrocarbon efficiency < 55% where hydrocarbon dosing efficiency is defined as DOC heat/DOC dosing heat
			Diagnosis delay time	Diagnostic runs continuously when the engine is running and active regeneration of the aftertreatment diesel particulate filter is occurring.
		2	Diagnosis condition	Engine is running and active regeneration of the aftertreatment diesel particulate filter is occurring.
			Signal (terminal)	(–)
			Threshold	DPF intake temperature - DOC intake temperature < 10°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running and active regeneration of the aftertreatment diesel particulate filter is occurring.

POSSIBLE CAUSE

Diesel oxidation catalyst

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0420 being current on the CONSULT screen.

Is DTC P0420 current?

YES >> Go to EC-1314, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420270

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0420 being current on the CONSULT screen.

Is DTC P0420 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- Any aftertreatment DOC temperature sensor or aftertreatment DPF temperature sensor DTCs
- Any turbocharger DTCs
- Any EGR valve DTCs
- Any fuel system DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK EXHAUST SYSTEM FOR LEAKS

1. Turn ignition switch OFF.
2. Inspect the exhaust system between the turbocharger outlet and the aftertreatment system:

- Inspect for loose connections.
- Inspect for leaking connections and broken exhaust system components.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.INSPECT AFTERTREATMENT DOC

1. Remove the aftertreatment DOC from the vehicle. Refer to EX-42, "Removal and Installation".
2. Inspect the aftertreatment DOC for:

- Plugging from soot or oil contamination
- Cracks or damage of any cells in the catalyst
- Soot plugging the front face of the catalyst

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the aftertreatment DOC.

5.INSPECT TURBOCHARGER EXHAUST OUTLET

1. Remove the exhaust plumbing from the turbocharger outlet.
2. Inspect the turbocharger exhaust outlet for signs of oil, coolant, or fuel being introduced into the aftertreatment system.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Locate the cause of possible diesel fuel, coolant, or engine oil being carried from the engine into the aftertreatment system.

6.INSPECT EXHAUST FOR EXCESSIVE BLACK SMOKE

1. Disconnect exhaust pipe from turbocharger outlet.
2. Start the engine.
3. Perform the Snap Acceleration - Aftertreatment Disconnected procedure to check for excessive black smoke. Refer to EC-896, "Work Procedure".

Is the inspection result normal?

YES >> Inspection End.
NO >> Refer to appropriate engine performance symptom table.

P0421 CATALYST EFFICIENCY BELOW THRESHOLD

DTC Description

INFOID:0000000014420271

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via the CAN 2 communication lines. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN 2 communication lines. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Engine Control Module (ECM) calculated the DOC efficiency was less than required to successfully complete a regeneration.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0421	CATALYST (Warm Up Catalyst Efficiency Below Threshold)	Diagnosis condition	Engine is running and active regeneration of the aftertreatment diesel particulate filter is occurring.
		Signal (terminal)	(–)
		Threshold	Aftertreatment Diesel Oxidation Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range
		Diagnosis delay time	Diagnostic runs continuously when the engine is running and active regeneration of the aftertreatment diesel particulate filter is occurring.

POSSIBLE CAUSE

- Diesel oxidation catalyst
- Aftertreatment diesel particulate filter temperature sensor module
- Excessive engine oil or diesel fuel being introduced into the exhaust system from the engine

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Using CONSULT, check for current “ENGINE“ diagnostic trouble codes.
3. Check for DTC P0421 being current on the CONSULT screen.

Is DTC P0421 current?

YES >> Go to EC-1316, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420272

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0421 being current on the CONSULT screen.

Is DTC P0421 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

3. Are any of the following displayed as current on the CONSULT screen:
- Any aftertreatment DOC temperature sensor or aftertreatment DPF temperature sensor DTCs
- Any turbocharger DTCs
- Any EGR valve DTCs
- Any fuel system DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK EXHAUST SYSTEM FOR LEAKS

1. Turn ignition switch OFF.
2. Inspect the exhaust system between the turbocharger outlet and the aftertreatment system:
- Inspect for loose connections.
- Inspect for leaking connections and broken exhaust system component.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. INSPECT AFTERTREATMENT DOC

1. Remove the aftertreatment DOC from the vehicle. Refer to EX-42, "Removal and Installation".
2. Inspect the aftertreatment DOC:
- Plugging from soot or oil contamination
- Soot plugging the front face of the catalyst

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the aftertreatment DOC.

5. INSPECT TURBOCHARGER EXHAUST OUTLET

1. Remove the exhaust plumbing from the turbocharger outlet.
2. Inspect the turbocharger exhaust outlet for signs of oil, coolant, or fuel being introduced into the aftertreatment system

Is the inspection result normal?

YES >> GO TO 6.
NO >> Locate the cause of possible diesel fuel, coolant, or engine oil being carried from the engine into the aftertreatment system.

6. INSPECT EXHAUST FOR EXCESSIVE BLACK SMOKE

1. Disconnect exhaust pipe from turbocharger outlet.
2. Start the engine.
3. Perform the Snap Acceleration - Aftertreatment Disconnected procedure to check for excessive black smoke. Refer to EC-896, "Work Procedure".

Is the inspection result normal?

YES >> Inspection End.
NO >> Refer to appropriate engine performance symptom table.

P0461 FUEL LEVEL SENSOR

DTC Description

INFOID:0000000014420273

The fuel level sensor measures the amount of fuel in the tank.The fuel level and circuit errors are diagnose internally by the instrument cluster and transmitted to the Engine Control Module (ECM) via the CAN line.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the vehicle has traveled over 500 miles with the fuel level at less than 15%

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0461	FUEL_LEVEL_SENSOR (Fuel Level Sensor “A” Circuit Range/Performance)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	Vehicle has traveled at least 192.625 miles while fuel level < 14.898%
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel level sensor
- VECU

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0461 being current on the CONSULT screen.

Is DTC P0461 current?

YES >> Go to EC-1318, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420274

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0461 being current on the CONSULT screen.

Is DTC P0461 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for CAN DTCs being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0462 or P0463 being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK FUEL LEVEL

1. Turn ignition switch ON engine OFF.
2. Check for adequate fuel supply; verify there is fuel in the tank.
   NOTE:
   Do not rely on the vehicle’s fuel gauge.

Is the inspection result normal?

YES >> Replace the fuel level sensor. Refer to FL-36, "Removal and Installation".
NO >> Add fuel to the fuel tank.

P0462 FUEL LEVEL SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420275

The fuel level input voltage received from the CAN message is greater than the calibrated maximum value allowed by the corresponding sensor. The fuel level message is received from the fuel level sensor through the CAN data link. The message is scaled to voltage and then checked for the out of range.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel level sensor signal voltage was out of range low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0462	FUEL_LEVL_SEN/CIRC (Fuel Level Sensor “A” Circuit Low)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	Fuel sensor voltage < 0.122V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel level sensor
- Harness or connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0462 being current on the CONSULT screen.

Is DTC P0462 current?

YES >> Go to EC-1320, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420276

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for CAN DTCs being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0462 being current on the CONSULT screen.

Is DTC P0462 detected as current?

YES >> Check the following:
- Vehicle electronic control unit-to-data link connection
- Voltage to the vehicle electronic control unit
- Fuel level sensor/unit
- Harness or connectors

NO >> Refer to GI-47, "Intermittent Incident".

P0463 FUEL LEVEL SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420277

The fuel level input voltage received from the CAN message is greater than the calibrated maximum value allowed by the corresponding sensor. The fuel level message is received from the fuel level sensor through the CAN data link. The message is scaled to voltage and then checked for the out of range.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel level sensor signal voltage was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0463	FUEL_LEVL_SEN/CIRC (Fuel Level Sensor “A” Circuit High)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	Fuel level sensor voltage is > 4.302V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel level sensor
- Harness or connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0463 being current on the CONSULT screen.

Is DTC P0463 current?

YES >> Go to EC-1321, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420278

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for CAN DTCs being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0463 being current on the CONSULT screen.

Is DTC P0463 detected as current?

YES >> Check the following:
- Vehicle electronic control unit-to-data link connection
- Voltage to the vehicle electronic control unit
- Fuel level sensor/unit
- Harness or connectors

NO >> Refer to GI-47, "Intermittent Incident".

P046C EGR VOLUME CONTROL VALVE POSITION SENSOR

DTC Description

INFOID:0000000014420279

The engine control module (ECM) uses the EGR valve position sensor to determine whether or not the valve is meeting the commanded position. The ECM supplies 5V to the EGR valve position signal circuit, and the EGR valve position sensor outputs a voltage signal to the ECM, based on the valve position.The ECM converts this signal into a percentage value, 0 to 100, indicating valve position. A fully-opened valve is equivalent to 100%

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the EGR valve was unable to reach the commanded position.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P046C	EGR_SENSOR (Exhaust Gas Recirculation Sensor "A" Circuit Range/Performance)	1	Diagnosis condition	Engine is running.
			Signal (terminal)	EGR position sensor (152)
			Threshold	Cumulative sum of error (commanded value - measured value) over a 30 second period is ever > 30,000%, which is equivalent to (average of in range low error - tolerance) > 20%, where tolerance is defined as 0%
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Engine is running.
			Signal (terminal)	EGR position sensor (152)
			Threshold	(Maximum value of in range high error cumulative sum plus maximum value of in range low error cumulative sum within a 30 second period is ever > 40,000%, which is equivalent to (average of in range high error - tolerance + average of in range low error - tolerance) > 26.667%, where in range high error is defined as (measured value - commanded value), In range low error is defined as (commanded value - measured value), and tolerance is defined as 0%
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR valve position sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P046C being current on the CONSULT screen.

Is DTC P046C current?

YES >> Go to EC-1323, "Diagnosis Procedure".

NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420280

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0405
- P0406
- P0489
- P0490
- P0652
- P0653

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT EGR VALVE POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR valve position sensor harness connector F144.
3. Inspect the engine harness and EGR valve connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0406 become current?

YES >> GO TO 4.
NO >> GO TO 6.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Connect a jumper wire between EGR valve harness connector F144 terminals 3 and 4.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0405 become current?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the EGR valve harness connector F144.
3. Turn ignition switch ON.

4. Measure the voltage between EGR valve position sensor harness connector F144 terminals 2 and 3.

EGR valve			Voltage (Approx.)
Connector	Terminal	Terminal	
F144	2	3	4.75V - 5.25V

Is inspection result normal?

YES >> Replace the EGR valve. Refer to EM-287, "Removal and Installation".
NO >> GO TO 6.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0406 become current?

YES >> GO TO 8.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminals 127 and 152.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0405 become current?

YES >> GO TO 9.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between ECM harness connector F101 terminals 106 and 127.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	106	127	4.75V - 5.25V

Is inspection result normal?

YES >> Repair or replace harness.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0471 EXHAUST PRESSURE SENSOR

DTC Description

INFOID:0000000014420281

The exhaust gas pressure sensor is used to measure exhaust gas pressure in the exhaust manifold. This information is used by the engine control module (ECM) to control emissions and exhaust gas recirculation (EGR) valve operation. The ECM provides a 5V supply to the exhaust gas pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The exhaust gas pressure sensor provides a signal to the ECM on the exhaust gas pressure sensor signal circuit. This sensor signal voltage changes, based on the pressure in the exhaust manifold.

DTC DETECTION LOGIC

- The Engine Control Module (ECM) detected the exhaust pressure reading was higher or lower than the other absolute pressure sensors when the ignition switch is OFF and the engine is not running.
- The Engine Control Module (ECM) detected the exhaust pressure was higher or lower than expected during normal engine operation.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0471	DIFF_EX_PRESS_SEN (Exhaust pressure sensor “A” circuit range/performance)	1	Diagnosis condition	Engine is running
			Signal (terminal)	Exhaust gas pressure sensor (–)
			Threshold	Exhaust pressure sensor reading < 18 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Engine is running
			Signal (terminal)	Exhaust gas pressure sensor (–)
			Threshold	Exhaust pressure sensor reading > 144.3 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	• Ignition switch is OFF 30 seconds or more. • Engine coolant temperature is above 70°C (158°F).
			Signal (terminal)	Exhaust gas pressure sensor (–)
			Threshold	• Exhaust pressure sensor reading < 18 kPa • Exhaust pressure sensor reading > 144.3 kPa
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Exhaust gas sensor pressure tube
- Harness and connectors
- Turbocharger turbine actuator linkage
- Exhaust gas pressure sensor
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Check that engine coolant temperature is above 70°C (158°F).
2. Turn ignition ON for 30 seconds, then turn ignition switch OFF and wait 30 seconds.
3. Start the engine and let it idle for 1 minute.
4. Accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
5. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

6. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
7. Check for DTC P0471 being current on the CONSULT screen.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again, even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is DTC P0471 current?

YES >> Go to EC-1327, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420282

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0101
- P0472
- P0473
- P2280
- Any turbocharger DTCs
- Any EGR or EGR bypass DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK THE EXHAUST GAS PRESSURE SENSOR TUBE

1. Turn ignition switch OFF.
2. Remove the exhaust gas pressure sensor tube.

- Inspect the inside of the tube. If clogged, use compressed air to remove debris or soot buildup.
- Check the tube for cracks and thread damage.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Clean or replace the exhaust gas sensor pressure tube.

3.INSPECT EXHAUST GAS PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor harness connector F199.
3. Inspect the harness connector and exhaust gas pressure sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON and wait 30 seconds.
2. With the exhaust gas temperature sensor harness connector F199 disconnected. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0472 DTC become current?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between exhaust gas pressure sensor harness connector F199 terminals 1 and 3.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P0473 DTC become current?

YES >> GO TO 7.
NO >> GO TO 6.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Check continuity between ECM harness connector F101 and exhaust gas pressure sensor harness connector F199.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	106	F199	1	< 10 Ω
	127		2	
	132		3	

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace harness for an open circuit.

8. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

Measure the resistance between the ECM harness connector F101 terminal 132 and all other F101 terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	132	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace harness for a short circuit.

9. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

Measure the resistance between ECM harness connector F101 terminal 132 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	132	—	> 100k Ω

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair or replace the engine harness for a short to ground.

10. INSPECT THE ROTARY TURBINE CONTROL VALVE ACTUATOR

1. Disconnect the rotary turbine control valve actuator harness connector F146.
2. Inspect the rotary turbine control valve actuator and harness connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. INSPECT THE TURBOCHARGER TURBINE ACTUATOR LINKAGE

Inspect the turbocharger turbine actuator linkage for damage.

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace the turbocharger turbine actuator linkage.

12. INSPECT THE TURBOCHARGER TURBINE ACTUATOR LINKAGE MOVEMENT

Rotate (by hand) the turbocharger turbine actuator linkage from stop to stop.

- Check for smooth movement between the stops.
- There will be an initial friction force that must be overcome before the linkage will move. Once movement is started, the actuator linkage must move to the other stop position by hand.

Is the inspection result normal?

YES >> Replace the exhaust gas pressure sensor. Refer to EM-304, "Removal and Installation".
NO >> Inspect the base engine components for damage. Replace the turbocharger assembly.

P0472 EXHAUST PRESSURE SENSOR

DTC Description

INFOID:0000000014420283

The exhaust gas pressure sensor is used to measure exhaust gas pressure in the exhaust manifold. This information is used by the engine control module (ECM) to control emissions and exhaust gas recirculation (EGR) valve operation. The ECM provides a 5V supply to the exhaust gas pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The exhaust gas pressure sensor provides a signal to the ECM on the exhaust gas pressure sensor signal circuit. This sensor signal voltage changes, based on the pressure in the exhaust manifold.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the exhaust gas pressure signal voltage was less than 0.25V for more than 8 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0472	DFF_PRESS_SEN/CIRC (Exhaust pressure sensor “A” circuit low)	Diagnosis condition	Engine running for 1 minute or more.
		Signal (terminal)	Exhaust gas pressure (–)
		Threshold	Exhaust gas pressure signal voltage was less than 0.25V for more than 8 seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Exhaust gas pressure sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0472 being current on the CONSULT screen.

Is DTC P0472 current?

YES >> Go to EC-1330, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420284

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0472 being past on the CONSULT screen.

Is DTC P0472 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT EXHAUST GAS PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor harness connector F199.
3. Inspect the engine harness and exhaust gas pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the exhaust gas pressure sensor harness connector F199.
3. Turn ignition switch ON.
4. Measure the voltage between exhaust gas pressure sensor harness connector F199 terminals 1 and 3.

Exhaust gas pressure sensor		Exhaust gas pressure sensor		Voltage (Approx.)
Connector	Terminal	Connector	Terminal	
F199	1	F199	3	4.75V - 5.25V

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor from the engine harness connector F199.
3. Connect a jumper wire between terminal 1 and 2 of exhaust gas pressure sensor harness connector F199.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0473 become current and DTC P0472 become past?

YES >> GO TO 6.
NO >> GO TO 10.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect the exhaust gas pressure sensor harness connector F199.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0472 become current?

YES >> Replace the exhaust gas pressure sensor. Refer to EM-304, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Turn ignition switch ON.
4. Measure the voltage between terminal 106 and 127 at the ECM connector F101.

ECM		ECM		Voltage (Approx.)
Connector	Terminal	Connector	Terminal	
F101	106	F101	127	4.75V - 5.25V

Is inspection the result normal?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0472 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace the harness for an open or shorted circuit.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between the exhaust gas pressure sensor SUPPLY terminal 106 and the exhaust gas pressure sensor SIGNAL terminal 132 at the ECM engine connector F101.
4. Turn ignition switch ON. Wait 30 seconds.

5. With CONSULT check for current ENGINE diagnostic trouble codes.

Did P0473 DTC become current and P0472 DTC become past?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0472 being past on the CONSULT screen.

Is DTC P0472 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open or pin-to-pin short.

P0473 EXHAUST PRESSURE SENSOR

DTC Description

INFOID:0000000014420285

The exhaust gas pressure sensor is used to measure exhaust gas pressure in the exhaust manifold. This information is used by the engine control module (ECM) to control emissions and exhaust gas recirculation (EGR) valve operation. The ECM provides a 5V supply to the exhaust gas pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The exhaust gas pressure sensor provides a signal to the ECM on the exhaust gas pressure sensor signal circuit. This sensor signal voltage changes, based on the pressure in the exhaust manifold.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the exhaust gas pressure signal voltage was greater than 4.75V for more than 8 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0473	DFF_PRESS_SEN/CIRC1 (Exhaust pressure sensor “A” circuit high)	Diagnosis condition	Engine running for 2 minutes or more.
		Signal (terminal)	Exhaust gas pressure (–)
		Threshold	Exhaust gas pressure signal voltage was greater than 4.75V for more than 8 seconds.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Exhaust gas pressure sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0473 being current on the CONSULT screen.

Is DTC P0473 current?

YES >> Go to EC-1334, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420286

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0473 being past on the CONSULT screen.

Is DTC P0473 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3. INSPECT EXHAUST GAS PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor harness connector F199.
3. Inspect the engine harness and exhaust gas pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor harness connector F199.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0472 become current and DTC P0473 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the exhaust gas pressure sensor from the engine harness connector F199.
3. Turn ignition switch ON.
4. Measure the voltage between exhaust gas pressure sensor harness connector F199 terminals 2 and 3.

Exhaust gas pressure sensor		Exhaust gas pressure sensor		Voltage (Approx.)
Connector	Terminal	Connector	Terminal	
F199	3	F199	2	4.75-5.25

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect the exhaust gas pressure sensor harness connector F199.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0473 become current?

YES >> Replace the exhaust gas pressure sensor. Refer to EM-304, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON. Wait 30 seconds.
4. With CONSULT check for current ENGINE diagnostic trouble codes.

Did P0472 DTC become current and P0473 DTC become past?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0473 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open or shorted SUPPLY circuit.

10.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect harness connector F101 from the ECM.
3. Turn ignition switch ON.
4. Measure the voltage between terminals 106 and 127 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	127	106	4.75-5.25

Is the inspection result normal?

YES >> GO TO 12.

NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P0473 being past on the CONSULT screen.

Is DTC P0473 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open or pin-to-pin short.

P0489 EGR CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420287

The EGR valve device driver in the ECM provides power to the EGR valve motor. The EGR valve motor is used to move the EGR valve to the correct position, as commanded by the ECM.The engine control module (ECM) uses the EGR valve position sensor to determine whether or not the valve is meeting the commanded position. The ECM supplies 5V to the EGR valve position signal circuit, and the EGR valve position sensor outputs a voltage signal to the ECM, based on the valve position. The ECM converts this signal into a percentage value, 0 to100, indicating valve position. A fully-opened valve is equivalent to 100%.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected low voltage on the EGR valve actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0489	(Exhaust Gas Recirculation Control Circuit Low)	Diagnosis condition	Ignition is turned ON after 30 seconds with ignition OFF.
		Signal (terminal)	(-)
		Threshold	The current rises above the high-side shutdown threshold of 12.6A when a high-side switch is turned ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
   NOTE:
   Ignition switch must be turned OFF for more than 30 seconds before this diagnostic will run at initial key ON
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0489 being current on the CONSULT screen.

Is DTC P0489 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420288

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0489 being current on the CONSULT screen.

Is DTC P0489 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT EGR VALVE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Inspect the engine harness and EGR valve connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK FOR A SHORT CIRCUIT TO GROUND IN THE EGR VALVE MOTOR

1. Turn ignition switch OFF.
2. Disconnect the EGR valve harness connector F144.
3. Measure the resistance between the ECM harness connector F101 terminals 134, 135 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	134	—	> 100k Ω
	135		

Is resistance greater than 100k ohms?

YES >> GO TO 4.
NO >> Replace the EGR valve. Refer to EM-290, "Removal and Installation".

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR A SHORT CIRCUIT TO GROUND IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the EGR valve harness connector F144.
4. Measure the resistance between the ECM harness connector F101 terminals 134, 135 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	134	—	> 100k Ω
	135		

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the EGR valve harness connector F144.
4. Measure the resistance between the ECM harness connector F101 terminals 134, 135 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	134	F101	All	> 100k Ω
	135			

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0489 being past on the CONSULT screen.

Is DTC P0489 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0490 EGR CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420289

The EGR valve device driver in the ECM provides power to the EGR valve motor. The EGR valve motor is used to move the EGR valve to the correct position, as commanded by the ECM.The engine control module (ECM) uses the EGR valve position sensor to determine whether or not the valve is meeting the commanded position. The ECM supplies 5V to the EGR valve position signal circuit, and the EGR valve position sensor outputs a voltage signal to the ECM, based on the valve position. The ECM converts this signal into a percentage value, 0 to100, indicating valve position. A fully-opened valve is equivalent to 100%.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected high voltage on the EGR Valve actuator.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0490	(Exhaust Gas Recirculation Control Circuit High)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	The current through the low side transistor is lower than the referenced current (1.5 mA to 1.0 mA) during PWM off-state.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- EGR valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0490 being current on the CONSULT screen.

Is DTC P0490 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420290

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0490 being current on the CONSULT screen.

Is DTC P0490 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT EGR VALVE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR valve harness connector F144.
3. Inspect the engine harness and EGR valve connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK FOR AN OPEN CIRCUIT IN THE EGR VALVE MOTOR CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Connect the EGR valve harness connector F144.
4. Measure the resistance between the ECM harness connector F101 terminals 134 and 135.

ECM			Resistance
Connector	Terminal	Terminal	
F101	134	135	< 15 Ω

Is resistance less than 15 ohms?

YES >> GO TO 6.
NO >> GO TO 4.

4. CHECK FOR AN OPEN CIRCUIT IN THE EGR VALVE MOTOR

1. Turn ignition switch OFF.
2. Disconnect the EGR valve harness connector F144.
3. Measure the resistance between the EGR connector F144 terminals 1 and 5.

EGR valve			Resistance
Connector	Terminal	Terminal	
F144	1	5	< 15 Ω

Is resistance less than 15 ohms?

YES >> GO TO 5.
NO >> Replace EGR valve assembly. Refer to EM-287, "Removal and Installation".

5. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the EGR valve harness connector F144.
4. Measure the resistance between the ECM harness connector F101 and EGR harness connector F144.

ECM		EGR valve		Resistance
Connector	Terminal	Connector	Terminal	
F101	134	F144	1	< 10 Ω
	135		5	

Is resistance less than 10 ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for an open.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK FOR A SHORT CIRCUIT TO VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the EGR valve harness connector F144.
4. Measure the voltage between the ECM harness connector F101 terminals 134, 135 and ground.

ECM		Ground	Voltage (V) (Approx.)
Connector	Terminal		
F101	134	(—)	< 1.5
	135		

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the EGR valve harness connector F144.
4. Measure the resistance between the ECM harness connector F144 terminals 134, 135 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	134	F101	All	> 100k Ω
	135			

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short.

9.CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0490 being past on the CONSULT screen.

Is DTC P0490 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P04DB CRANKCASE VENTILATION SYSTEM

DTC Description

INFOID:0000000014710130

The crankcase pressure sensor is used to monitor the pressure inside the crankcase. The engine control module (ECM) supplies the crankcase pressure sensor a 5V reference voltage. When the crankcase pressure is low, the sensor signal voltage is low. When the crankcase pressure is high, the sensor signal voltage is near the 5V reference voltage. The ECM monitors the crankcase pressure signal circuit voltage to calculate the pressure of the air within the crankcase.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankcase pressure was less than a calibrated value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P04DB	(Crankcase Pressure Sensor Circuit Range/Performance)	Diagnosis condition	• Ignition switch ON. • Engine running.
		Signal (terminal)	Crankcase pressure sensor
		Threshold	Crankcase pressure sensor < calibrated value
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Disconnected crankcase ventilation hose
- Resistance in the wiring harness
- A malfunctioning in-range pressure sensor
- Crankcase pressure sensor is not installed correctly in the housing

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is DTC P04DB current?

YES >> Go to EC-1344, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014710131

1.CHECK CRANKCASE PRESSURE SENSOR DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check ENGINE diagnostic trouble codes for the following:

- P051C
- P051D

Is any applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK THE OIL FILL CAP

1. Turn ignition switch OFF.

2. Check the oil fill cap for proper installation.

Oil fill cap properly installed?

YES >> GO TO 3.
NO >> Install the oil fill cap properly.

3. CHECK THE CRANKCASE FILTER TUBE

1. Check the crankcase breather tube between the engine and the crankcase filter assembly.
2. Make sure the breather tube is properly connected and there are no kinks or other restrictions present

Crankcase breather hose connected properly and free of restrictions?

YES >> GO TO 4.
NO >> Properly connect the crankcase breather hose.

4. INSPECT THE CRANKCASE PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector.
3. Inspect the crankcase pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Connect a jumper wire between crankcase harness connector F151 terminals 1 and 3.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P051D DTC become current?

YES >> Replace crankcase pressure sensor. Refer to EM-334, "Removal and Installation".
NO >> GO TO 6.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON and wait 30 seconds.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P051C current?

YES >> GO TO 8.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

8.CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
- **Not to bend and damage pins and terminals.**
- **Not to probe or short unintended circuits and potentially damaging the control unit.**

1. Turn ignition switch OFF.
2. Connect a jumper wire between ECM connector F101 pins 106 and 111.
3. Turn ignition switch ON and wait for 30 seconds.
4. With CONSULT check for current ENGINE diagnostic trouble codes.

Is P051D DTC current?

YES >>
- High resistance or short circuit has been detected in the engine harness. Repair or replace the engine harness.
- GO TO 9.

NO >>
- Replace the ECM. Refer to EC-1994, "Removal and Installation".
- GO TO 9.

9.CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Using CONSULT, erase ENGINE diagnostic trouble codes.
6. Operate the engine within the ″Conditions for clearing the DTC″.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is P04DB DTC current?

YES >> Troubleshooting procedure need to be repeated. Go to EC-1344, "DTC Description".
NO >> The removal and installation of the connector corrected the issue.

P0501 VEHICLE SPEED SIGNAL

DTC Description

INFOID:0000000014420291

The vehicle speed sensor senses the speed of the tail shaft gear on the vehicle's transmission. This speed signal is then transmitted to the Engine Control Module (ECM) and converted into a vehicle speed.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a loss of vehicle speed when other engine operating conditions indicated that the vehicle should be in motion. This fault code can also become active if the calculated gear ratio and actual gear ratio do not agree while the vehicle is in motion

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0501	VEHICLE_SPEED (Vehicle Speed Sensor "A" Range/ Performance)	1	Diagnosis condition	Vehicle is in motion
			Signal (terminal)	(–)
			Threshold	At ignition OFF vehicle speed is > 158.449 mph
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Vehicle is in motion
			Signal (terminal)	(–)
			Threshold	Actual gear ratio < 0.504
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	Vehicle is in motion
			Signal (terminal)	(–)
			Threshold	Difference between min and max vehicle speeds attained within a time window is less than 0.621 mph, while pedal position has changed by 20% at least 50 times in the time window
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		4	Diagnosis condition	Vehicle is in motion
			Signal (terminal)	(–)
			Threshold	• Vehicle speed = 0 and idle validation counter is ≥ 10 and boost transition counter ≥ 60 where idle validation counter is incremented on idle transitions from idle to non-idle, and boost transition counter is incremented when boost goes above 20 kPa for 5 seconds. • After engine has been running for at least 5 minutes, then at any instant of time when engine torque is > 116 Nm and unfiltered vehicle speed = 0 and filtered vehicle speed is > 9.942 mph
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Output shaft speed sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch ON.

2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0501 being current on the CONSULT screen.

Is DTC detected?

YES >> Proceed to EC-1348, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420292

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen.

- Any CAN DTCs
- Any accelerator pedal DTCs
- Any TCM DTCs

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0501 being current on the CONSULT screen.

Is DTC P0501 detected as current?

YES >> Repair or replace output shaft sensor. Refer to TM-232, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P0506 ISC SYSTEM

DTC Description

INFOID:0000000014420293

The Engine Control Module (ECM) continuously monitors the engine speed at idle and adjusts fueling to maintain governed idle speed. The ECM checks if engine speed is within nominal idle speed for an accumulated amount of time. When the accumulated amount of time exceeds the limit, the engine speed is checked once again. If the engine speed is higher or lower than the acceptable boundary, an error is set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine speed was 50 rpm below governed idle speed for 30 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0506	ISC SYSTEM (Idle Air Control System RPM Lower Than Expected)	Diagnosis condition	Engine running at idle.
		Signal (terminal)	(-)
		Threshold	Idle reference speed - Engine speed > 50 RPM, when the amount of time that engine speed is outside the idle reference speed band, by more than 50 RPM, is equal to 15 seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel system malfunction
- Crankshaft position sensor
- Camshaft position sensor
- Increased engine accessory load

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0506 being current on the CONSULT screen.

Is DTC P0506 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420294

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0506 being current on the CONSULT screen.

Is DTC P0506 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0501 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for current or past DTCs related to the fuel system, crankshaft position sensor or camshaft position sensor on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK ENGINE RPM

1. Start the engine.
2. Connect CONSULT and compare engine RPM in “Data Monitor” to mechanical tachometer or to the instrument cluster tachometer.

Is RPM reading correct?

YES >> GO TO 5.
NO >> Refer to EC-1276, "Diagnosis Procedure" and EC-1280, "Diagnosis Procedure".

5.CHECK ACCESSORY LOAD

1. Turn ignition switch OFF.
2. Check the accessory load on the engine:

- Inspect the engine for damaged or marginal accessories such as generator, refrigerant pumps, hydraulic pumps, air compressors, etc.
- Inspect for additional engine accessories that could increase the load on the engine.

Damaged or additional accessories found on the engine?

YES >> Repair or replace error-detected parts.
NO >> Refer to appropriate engine performance troubleshooting tree.

P0507 ISC SYSTEM

DTC Description

INFOID:0000000014420295

The Engine Control Module (ECM) continuously monitors the engine speed at idle and adjusts fueling to maintain governed idle speed. The ECM checks if engine speed is within nominal idle speed for an accumulated amount of time. When the accumulated amount of time exceeds the limit, the engine speed is checked once again. If the engine speed is higher or lower than the acceptable boundary, an error is set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine speed was 50 rpm above governed idle speed for 30 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0507	ISC SYSTEM (Idle Air Control System RPM Higher Than Expected)	Diagnosis condition	Engine running at idle.
		Signal (terminal)	(-)
		Threshold	Engine speed - idle reference speed > 50 RPM, when the amount of time that engine speed is outside the idle reference speed band, by more than 50 RPM, is equal to 15 seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel system
- Crankshaft position sensor
- Camshaft position sensor
- Alternate fuel source entering intake system

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0507 being current on the CONSULT screen.

Is DTC P0507 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420296

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0507 being current on the CONSULT screen.

Is DTC P0507 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0501 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for current or past DTCs related to the fuel system, crankshaft position sensor or camshaft position sensor on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK ENGINE RPM

1. Start the engine.
2. Connect CONSULT and compare engine RPM in Data Monitor to mechanical tachometer or to the instrument cluster tachometer.

Is RPM reading correct?

YES >> GO TO 5.
NO >> Refer to EC-1276, "Diagnosis Procedure" and EC-1280, "Diagnosis Procedure".

5.CHECK FOR ALTERNATE FUEL SOURCE

1. Turn ignition switch OFF.
2. Check for alternate fuel source:

- Check the oil contamination in the intake piping.
- Check for malfunctioning cold weather starting aids.
- Check for malfunctioning aftermarket devices.

Alternate fuel source found?

YES >> Repair or replace error-detected parts.
NO >> Refer to appropriate engine performance troubleshooting tree.

P0513 INCORRECT IMMOBILIZER KEY

DTC Description

INFOID:0000000014420297

The immobilizer anti-theft device communicates to the primary engine electronic control module (ECM) through the CAN data link. Messages sent from the immobilizer anti-theft device are received by the ECM and are used to control the anti-theft features.

DTC DETECTION LOGIC

The Engine Control Module (ECM) received an invalid key message from the immobilizer anti-theft system.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0513	(Incorrect Immobilizer Key)	Diagnosis condition	Ignition switch is ON
		Signal (terminal)	(–)
		Threshold	Driver used incorrect key
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Invalid key
- Antitheft device

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let it idle for 1 minute.
2. Check DTC.

Is DTC detected?

YES >> Proceed to EC-1348, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420298

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0513 being current on the CONSULT screen.

Is DTC P0513 detected as current?

YES >> Immobilizer anti-theft device has not been deactivated. Refer to SEC-12, "NISSAN VEHICLE IMMOBILIZER SYSTEM-NATS : System Description".
NO >> Refer to GI-47, "Intermittent Incident".

P051B CRANKCASE PRESSURE SENSOR RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420299

The crankcase pressure sensor is used to monitor the pressure inside the crankcase. The engine control module (ECM) supplies the crankcase pressure sensor a 5V reference voltage. When the crankcase pressure is low, the sensor signal voltage is low. When the crankcase pressure is high, the sensor signal voltage is near the 5V reference voltage. The ECM monitors the crankcase pressure signal circuit voltage to calculate the pressure of the air within the crankcase.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankcase pressure was greater than 0.5kPa or less than -0.5kPa at key on; or not changing during engine running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P051B	(Crankcase Pressure Sensor Circuit Range/Performance)	Diagnosis condition	• Ignition switch ON. • Engine running.
		Signal (terminal)	Crankcase pressure sensor (111)
		Threshold	Crankcase pressure sensor > 0.5 kPa Or Crankcase pressure sensor < -0.5 kPa
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Crankcase pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Bring the vehicle to a complete stop, and turn ignition switch OFF for 1 minute.
4. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
5. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
6. Accelerate to 88 km/h (55 MPH) for 20 seconds.
7. Repeat steps 5 and 6 for 21 times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P051B being current on the CONSULT screen.

Is DTC P051B current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420300

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.

3. Are any of the following displayed as current on the CONSULT screen.
- P051C
- P051D

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK OIL FILL CAP

Check the oil fill cap for proper installation.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Install oil fill cap.

3.INSPECT CRANKCASE PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Inspect the harness connector and crankcase pressure sensor pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P051C DTC become current?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Connect a jumper wire between crankcase harness connector F151 terminals 1 and 3.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P051D DTC become current?

YES >> Replace crankcase pressure sensor. Refer to EM-334, "Removal and Installation".
NO >> GO TO 6.

6.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P051C current?

YES >> GO TO 8.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

8. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between ECM harness connector F101 terminals 106 and 111.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P051D current?

YES >> Repair or replace harness for an open or short circuit.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P051C CRANKCASE PRESSURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420301

The crankcase pressure sensor is used to monitor the pressure inside the crankcase. The engine control module (ECM) supplies the crankcase pressure sensor a 5V reference voltage. When the crankcase pressure is low, the sensor signal voltage is low. When the crankcase pressure is high, the sensor signal voltage is near the 5V reference voltage. The ECM monitors the crankcase pressure signal circuit voltage to calculate the pressure of the air within the crankcase.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankcase pressure signal voltage was Less than 0.25V for more than 8seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P051C	(Crankcase Pressure Sensor Circuit Low)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Crankcase pressure sensor (111)
		Threshold	Crankcase pressure sensor value < 0.254V (-2.49 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Crankcase pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P051C being current on the CONSULT screen.

Is DTC P051C current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420302

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for sensor supply DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P051C being past on the CONSULT screen.

Is DTC P051C detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT CRANKCASE PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Inspect the engine harness and crankcase pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON.
4. Measure the voltage between crankcase pressure sensor harness connector F151 terminals 1 and 2.

Crankcase pressure sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
F151	1	2	4.75-5.25

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor connector F151.
3. Connect a jumper wire between crankcase pressure sensor harness connector F151 terminals 1 and 3.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P051D become current and DTC P051C become past?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0051C current?

YES >> Replace the crankcase pressure sensor. Refer to EM-334, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect harness connector F101 from the ECM.
3. Turn ignition switch ON.
4. Measure the voltage between terminals 106 and 127 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	127	106	4.75-5.25

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P051C being past on the CONSULT screen.

Is DTC P051C detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open.

10. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between crankcase pressure sensor harness connector F101 terminals 106 and 111.
4. Turn ignition switch ON. Wait 30 seconds.
5. With CONSULT check for current ENGINE diagnostic trouble codes.

Did P0051D DTC become current and P051C DTC become past?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12. CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P051C being current on the CONSULT screen.

Is DTC P051C detected as current?

YES >> Repair or replace harness for an open or pin-to-pin short.
NO >> The removal and installation of the connector corrected the issue.

P051D CRANKCASE PRESSURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420303

The crankcase pressure sensor is used to monitor the pressure inside the crankcase. The engine control module (ECM) supplies the crankcase pressure sensor a 5V reference voltage. When the crankcase pressure is low, the sensor signal voltage is low. When the crankcase pressure is high, the sensor signal voltage is near the 5V reference voltage. The ECM monitors the crankcase pressure signal circuit voltage to calculate the pressure of the air within the crankcase.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankcase pressure signal voltage was greater than 4.7V for more than8 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P051D	(Crankcase Pressure Sensor Circuit High)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Crankcase pressure sensor (111)
		Threshold	Crankcase pressure sensor > 4.746V (6.89 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Crankcase pressure sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P051D being current on the CONSULT screen.

Is DTC P051D current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420304

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for sensor supply DTCs P0653 or P06D8 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P051D being past on the CONSULT screen.

Is DTC P051D detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT CRANKCASE PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect crankcase pressure sensor harness connector F139.
3. Inspect the engine harness and crankcase pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P051C become current and DTC P051D become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON.
4. Measure the voltage between crankcase pressure sensor harness connector F151 terminals 1 and 2.

Crankcase pressure sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
F151	1	2	4.75-5.25

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0051D current?

YES >> Replace the crankcase pressure sensor. Refer to EM-334, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between terminal 106 and terminal 111 at the ECM engine connector F101.
4. Turn ignition switch ON. Wait 30 seconds.
5. With CONSULT check for current ENGINE diagnostic trouble codes.

Did P051C DTC become current and P051D DTC become past?

YES >> GO TO 9.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

9.CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ENGINE diagnostic trouble codes.
4. Check for DTC P051D being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for a short circuit.

10.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect harness connector F101 from the ECM.
3. Turn ignition switch ON.
4. Measure the voltage between terminals 106 and 127 at the ECM connector F101.

ECM			Voltage (Approx.)
Connector	Terminal	Terminal	
F101	127	106	4.75-5.25

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

12.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE diagnostic” trouble codes.
4. Check for DTC P051D being past on the CONSULT screen.

Is DTC P051D detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open.

P0521 ENGINE OIL PRESSURE

DTC Description

INFOID:0000000014420305

An engine oil pressure switch or oil pressure sensor is used by the Engine Control Module (ECM) to monitor the lubricating oil pressure. For engines with an oil pressure switch, the switch is normally closed when the engine is not running and open when oil pressure is present. For engines with an oil pressure sensor, the ECM will detect a low signal voltage at operating conditions when the oil pressure is low. The ECM will detect a high signal voltage at operating conditions when the oil pressure is high.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine oil pressure reading was higher or lower than the other absolute pressure sensors on the engine after the key switch has been turned OFF and the engine has stopped running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0521	(Engine Oil Pressure Sensor/Switch Range/Performance)	Diagnosis condition	1. Ignition switch ON. 2. Ignition switch OFF
		Signal (terminal)	Oil pressure switch (143)
		Threshold	• Oil pressure > 0 kPa at ignition ON and engine OFF • Number of times the oil pressure switch indicates positive oil pressure before engine start ≥ 5 counts
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Oil pressure switch
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0521 being current on the CONSULT screen.

Is DTC P0521 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420306

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0521 being current on the CONSULT screen.

Is DTC P0521 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2. INSPECT OIL PRESSURE SWITCH AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect oil pressure switch harness connector F111.
3. Inspect the engine harness and oil pressure switch connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK OIL PRESSURE SWITCH RESISTANCE

1. Turn ignition switch OFF.
2. Disconnect the oil pressure switch harness connector F111.
3. Measure the resistance between the oil pressure switch terminal 1 and ground.

Oil pressure switch Terminal	Ground	Resistance
1	—	< 10 Ω

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace oil pressure switch. Refer to LU-59, "Removal and Installation".

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the oil pressure switch harness connector F111.
4. Measure the resistance between the ECM harness connector F101 terminal 143 and the oil pressure switch harness connector F111 terminal 1.

ECM		Oil pressure switch		Resistance
Connector	Terminal	Connector	Terminal	
F101	143	F111	1	< 10 Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for an open.

6. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the refrigerant pressure sensor harness connector F111.
4. Measure the resistance between the ECM harness connector F101 terminal 143 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	143	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0521 being past on the CONSULT screen.

Is DTC P0521 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open.

P0524 ENGINE OIL PRESSURE

DTC Description

INFOID:0000000014420307

An engine oil pressure switch or oil pressure sensor is used by the Engine Control Module (ECM) to monitor the lubricating oil pressure. For engines with an oil pressure switch, the switch is normally closed when the engine is not running and open when oil pressure is present. For engines with an oil pressure sensor, the ECM will detect a low signal voltage at operating conditions when the oil pressure is low. The ECM will detect a high signal voltage at operating conditions when the oil pressure is high.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the engine oil pressure was less than 60 kPa for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0524	ENGINE OIL PRESSURE (Engine Oil Pressure Too Low)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Oil pressure switch (143)
		Threshold	Oil pressure sensor value < reftable50
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Oil pressure

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0524 being current on the CONSULT screen.

Is DTC P0524 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420308

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0524 being current or past on the CONSULT screen.

Is DTC P0524 detected?

YES >> Refer to Lubricating Oil Pressure Low or Lubricating Oil Pressure High.
NO >> GO TO 2.

2.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Perform “DTC CONFIRMATION PROCEDURE”.

Is P0524 DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again.
NO >> Repair complete.

P0532 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420309

The engine control module (ECM) provides a 5V supply and ground to the AC pressure sensor circuit. The AC pressure sensor provides a signal to the ECM. The ECM monitors the AC pressure signal voltage to diagnose the condition of the sensor circuit.

DTC DETECTION LOGIC

The Engine control module (ECM) detected the AC pressure sensor circuit is less than 0.3V for more than 5 seconds

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0532	(A/C Refrigerant Pressure Sensor “A” Circuit Low)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Refrigerant pressure sensor (26)
		Threshold	A/C pressure sensor value < 0.25V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Refrigerant pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0532 being current on the CONSULT screen.

Is DTC P0532 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420310

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for sensor supply DTC P06D3 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0532 being current on the CONSULT screen.

Is DTC P0532 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT REFRIGERANT PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect refrigerant pressure sensor harness connector E88.
3. Inspect the engine harness and refrigerant pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the refrigerant pressure sensor harness connector E88.
3. Turn ignition switch ON.
4. Measure the voltage between refrigerant pressure sensor harness connector F88 terminals 1 and 2.

Refrigerant pressure sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
E88	1	2	4.75-5.25

Is inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect refrigerant pressure sensor connector E88.
3. Connect a jumper wire between refrigerant pressure sensor harness connector E88 terminals 2 and 3.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0533 become current and DTC P0532 become past?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the refrigerant pressure sensor harness connector E88.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0532 current?

YES >> Replace the refrigerant pressure sensor. Refer to HAC-127, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the refrigerant pressure sensor harness connector E88.
4. Measure the resistance between the ECM harness connector E93 terminal 64 and the refrigerant pressure sensor harness connector E88 terminal 1.

ECM		Refrigerant pressure sensor		Resistance
Connector	Terminal	Connector	Terminal	
E93	64	E88	1	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for an open.

9. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the refrigerant pressure sensor harness connector E88.
4. Measure the resistance between the ECM harness connector E93 terminal 26 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	26	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 10.
NO >> Repair or replace the engine harness for a short.

10. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the refrigerant pressure sensor harness connector E88.
4. Measure the resistance between the ECM harness connector E93 terminal 26 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	26	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 11.
NO >> Repair or replace the engine harness for a short to ground.

11. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0532 being past on the CONSULT screen.

Is DTC P0532 detected as past?

YES >> The removal and installation of the connector corrected the issue.
NO >> Repair or replace harness for an open.

P0533 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420311

The engine control module (ECM) provides a 5V supply and ground to the AC pressure sensor circuit. The AC pressure sensor provides a signal to the ECM. The ECM monitors the AC pressure signal voltage to diagnose the condition of the sensor circuit.

DTC DETECTION LOGIC

The Engine control module (ECM) detected the AC pressure sensor circuit is greater than 4.7V for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0533	(A/C Refrigerant Pressure Sensor “A” Circuit High)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	Refrigerant pressure sensor (26)
		Threshold	A/C pressure sensor value > 0.4.75V (3,138 kPa)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Refrigerant pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0533 being current on the CONSULT screen.

Is DTC P0533 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420312

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for sensor supply DTCs P06D4 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0533 being past on the CONSULT screen.

Is DTC P0533 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 3.

3.INSPECT REFRIGERANT PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect refrigerant pressure sensor harness connector E88.
3. Inspect the engine harness and refrigerant pressure sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect refrigerant pressure sensor harness connector E88.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0532 become current and DTC P0533 become past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the refrigerant pressure sensor harness connector E88.
3. Turn ignition switch ON.
4. Measure the voltage between refrigerant pressure sensor harness connector E88 terminals 1 and 2.

Refrigerant pressure sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
E88	1	3	4.75-5.25

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect the refrigerant pressure sensor harness connector E88.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0533 current?

YES >> Replace the refrigerant pressure sensor. Refer to HAC-127, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the refrigerant pressure sensor harness connector E88.
4. Measure the resistance between the ECM harness connector E93 terminal 64 and the refrigerant pressure sensor harness connector E88 terminal 1.

ECM		Refrigerant pressure sensor		Resistance
Connector	Terminal	Connector	Terminal	
E93	64	E88	1	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for an open.

9.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the refrigerant pressure sensor harness connector E88.
4. Measure the resistance between the ECM harness connector E93 terminal 26 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	26	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 10.
NO >> Repair or replace the engine harness for a short.

10.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the refrigerant pressure sensor harness connector E88.
4. Disconnect all components connected to sensor supply 5.
5. Measure the resistance between the ECM harness connector E93 terminal 81 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	81	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 10.
NO >> Repair or replace the engine harness for a short.

11.CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0533 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.

NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P053E CRANKCASE PRESSURE TOO HIGH

DTC Description

INFOID:0000000014420313

The crankcase pressure sensor is used to monitor the pressure inside the crankcase. The engine control module (ECM) supplies the crankcase pressure sensor a 5V reference voltage. When the crankcase pressure is low, the sensor signal voltage is low. When the crankcase pressure is high, the sensor signal voltage is near the 5V reference voltage. The ECM monitors the crankcase pressure signal circuit voltage to calculate the pressure of the air within the crankcase.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankcase pressure was greater than 3.7 kPa

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P053E	(Crankcase Pressure - Data Valid but Above Normal Operational Range)	Diagnosis condition	Engine running.
		Signal (terminal)	Crankcase pressure sensor (111)
		Threshold	Crankcase pressure sensor > 3.7 kPa
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Crankcase pressure sensor
- Plugged or restricted crankcase breather draft tube

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P053E being current on the CONSULT screen.

Is DTC P053E current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420314

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P053E being current or multiple past counts on the CONSULT screen.

Is DTC P053E detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK CRANKCASE PRESSURE SENSOR

1. Turn ignition switch ON.
2. Connect CONSULT and select “Data Monitor” mode.
3. Select “CRANKCASE PRESSURE SENSOR” and check the indication.

Monitor item	Condition	Indication
CRANKCASE PRESSURE SENSOR	Ignition switch ON (Engine stopped.)	0 ± 0.28 kPa (0 ± 1.13 psi)

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace crankcase pressure sensor. Refer to EM-334, "Removal and Installation".

3. CHECK CRANKCASE FILTER TUBE

Check that the breather tube is properly connected and that kinks or other restrictions are not present.

Is the inspection result normal?

YES >> Troubleshoot the possible causes for excessive crankcase gases.
NO >> Replace or properly connect the crankcase breather hose. Refer to EM-332, "Removal and Installation".

P0544 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420315

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via the CAN2 communication link. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN2 communication link. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the difference between the aftertreatment diesel oxidation catalyst intake temperature sensor data and diesel particulate filter intake temperature sensor data did not match the expected value for the present engine operating conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0544	ECM RESERVATION (Exhaust gas temperature sensor circuit bank 1 sensor1)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	• Average temperature drop across DOC > 85 deg C or average temperature across DOC < -85 deg C • -85 deg C < average temperature drop across DPF < 85 deg C
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- aftertreatment diesel particulate filter intake temperature sensor
- aftertreatment diesel oxidation catalyst intake temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
6. Check for DTC P021A being current on the CONSULT screen.

Is DTC P0544 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420316

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U1611, P1614, P1615, P1616 or P1623 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace the aftertreatment DPF temperature sensor module. Refer to EX-52, "Removal and Installation".

P0545 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420317

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via the CAN2 communication link. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN2 communication link. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The aftertreatment Temperature Sensor Module has detected a sensor short to ground condition that causes a low input voltage.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0545	(Exhaust gas temperature sensor circuit low bank 1 sensor1)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Aftertreatment intake DOC gas temperature sensor input voltage < 1V (-40 Deg C).
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Aftertreatment diesel oxidation catalyst intake temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P0545 being current on the CONSULT screen.

Is DTC P0545 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420318

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U1611, P1614, P1615, P1616 or P1623 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace the aftertreatment diesel particulate filter (DPF) temperature sensor module. Refer to EX-52, "Removal and Installation".

P0546 EXHAUST GAS TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420319

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via the CAN2 communication link. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN2 communication link. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The aftertreatment Temperature Sensor Module has detected a sensor short to battery or open circuit condition that causes a high input voltage.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0546	(Exhaust gas temperature sensor circuit high bank 1 sensor1)	Diagnosis condition	Engine running.
		Signal (terminal)	(–)
		Threshold	Aftertreatment intake DOC gas temperature sensor input voltage > 5V (240 Deg C) or intake DOC gas temperature thermocouple impedance > 10 ohms.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Aftertreatment diesel oxidation catalyst intake temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0546 being current on the CONSULT screen.

Is DTC P0546 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420320

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1611, P1614, P1615, P1616 or P1623 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace the aftertreatment DPF temperature sensor module. Refer to EX-52, "Removal and Installation".

P054E IDLE FUEL QUANTITY LOWER THAN EXPECTED

DTC Description

INFOID:0000000014420321

The ECM uses diagnostic software to verify injector operation. During selected conditions, each injector is fired. The fueling quantity and timing are then compared to a specified threshold.

DTC DETECTION LOGIC

The ECM detected the fueling is lower than nominal at idle.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P054E	Idle Control System - Fuel Quantity Lower Than Expected (Engine idle fuel quantity - data valid but below normal operating range - moderately severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Idle fuel < 2 mg/stroke
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Engine calibration issue
- Malfunctioning fuel injectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P054E being current on the CONSULT screen.

Is DTC P054E current?

YES >> Go to EC-1382, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420322

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P054E being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTCs P0501, P2121, P2122, P2123, P2127 or P2128 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

Check for current DTCs related to any injector or rail pressure sensor circuit on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK DTC PRIORITY

1. Start the engine and operate at low idle.
2. Check for current DTCs related to turbocharger, intake air throttle or EGR on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.CHECK DTC PRIORITY

1. Continue operating engine at low idle.
2. Check for DTCs P0335, P0340 or P0344 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 6.

6.CHECK DTC PRIORITY

1. Continue operating engine at low idle.
2. Check for current DTCs related to misfire or high count past DTCs related to misfire on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 7.

7.PERFORM ACTIVE TEST

1. Turn ignition switch OFF.
2. Turn ignition switch ON.
3. Perform the high-pressure fuel injector return flow “Active Test” using CONSULT.

Does the Active Test meet specifications?

YES >> Refer to Symptom Diagnosis. Refer to EC-1986, "Symptom Table".
NO >> Replace the malfunctioning fuel injector(s). Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

P054F IDLE FUEL QUANTITY HIGHER THAN EXPECTED

DTC Description

INFOID:0000000014420323

The ECM uses diagnostic software to verify injector operation. During selected conditions, each injector is fired. The fueling quantity and timing are then compared to a specified threshold.

DTC DETECTION LOGIC

The ECM detected the fueling is higher than nominal at idle.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P054F	Idle Control System - Fuel Quantity Higher Than Expected (Engine idle fuel quantity - data valid but above normal operating range - moderately severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Idle fuel > 35 mg/stroke
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Engine calibration issue
- Malfunctioning fuel injectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P054F being current on the CONSULT screen.

Is DTC P054F current?

YES >> Go to EC-1384, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420324

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P054F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTCs P0501, P2121, P2122, P2123, P2127 or P2128 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

Check for current DTCs related to any injector or rail pressure sensor circuit on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK DTC PRIORITY

1. Start the engine and operate at low idle.
2. Check for current DTCs related to turbocharger or EGR on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5. CHECK DTC PRIORITY

1. Continue operating engine at low idle.
2. Check for DTCs P0335, P0340 or P0344 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 6.

6. CHECK DTC PRIORITY

1. Continue operating engine at low idle.
2. Check for current DTCs related to misfire or high count past DTCs related to misfire on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 7.

7. PERFORM ACTIVE TEST

1. Turn ignition switch OFF.
2. Turn ignition switch ON.
3. Perform the high-pressure fuel injector drain flow Active Test using CONSULT.

Does the Active Test meet specifications?

YES >> Refer to Symptom Diagnosis EC-1986, "Symptom Table".
NO >> Replace the malfunctioning fuel injector(s). Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

P0562 SYSTEM VOLTAGE LOW

DTC Description

INFOID:0000000014420325

The ECM is the brains for the engine operation. It interprets signals from sensors to determine actuator positions and fueling control. The ECM gathers and maintains data in it's internal memory. The ECM receives constant voltage from the batteries through unswitched battery connections. It also receives switched battery input through the ignition circuit when the vehicle is turned ON.

DTC DETECTION LOGIC

The ECM detected the main battery supply voltage was less than 8.2V.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0562	System Voltage Low (Battery 1 voltage - data valid but below normal operating range - moderately severe level)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	Battery voltage < 8.128 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P0562 being current on the CONSULT screen.

Is DTC P0562 current?

YES >> Go to EC-1386, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420326

1.CHECK BATTERY TERMINALS

1. Turn ignition switch OFF.
2. Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 2.
NO >> Tighten and clean the terminals.

2.CHECK BATTERY VOLTAGE

1. Turn ignition switch ON.
2. Measure the voltage from the positive battery terminal to the negative battery terminal while trying to start the engine.

- Normal condition: above 12 V
- Cranking condition: above 6.2 V

Is the battery voltage within specified range?

YES >> GO TO 3.
NO >> Charge or test battery(s). Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".

3.CHECK FUSE

1. Turn ignition switch OFF.

2. Verify that fuse 68 (5A) is installed correctly and that the fuse is not blown.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace the fuse.

4. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector E93.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR AN OPEN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM connector E93.
3. Check resistance between ECM connector E93 and battery positive terminal.

ECM			Resistance
Connector	Terminal	Battery terminal	
E93	83	(+)	< 10 Ω

4. Check resistance between ECM connector E93 and battery negative terminal.

ECM			Resistance
Connector	Terminal	Battery terminal	
E93	1	(–)	< 10 Ω
	2		
	4		

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the harness.

6. CHECK FOR A SHORT CIRCUIT

1. Disconnect the battery.
2. Check resistance between ECM connector terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	83	E93	1	> 100k Ω
			2	
			4	

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace the harness.

7.CHECK FOR A SHORT CIRCUIT TO GROUND

Check resistance between ECM connector E93 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	83	(–)	> 100k Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness.

8.CHECK FOR A PIN TO PIN SHORT CIRCUIT

Check resistance between ECM connector terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminals	
E93	83	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the harness.

9.CHECK ADD ON ACCESSORIES

Check for any add on accessory wiring connected to the battery positive terminal.
- Check for damaged insulation or an installation error that could cause a short to ground.

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace damaged wiring.

P0563 SYSTEM VOLTAGE HIGH

DTC Description

INFOID:0000000014420327

The ECM is the brains for the engine operation. It interprets signals from sensors to determine actuator positions and fueling control. The ECM gathers and maintains data in it's internal memory. The ECM receives constant voltage from the batteries through unswitched battery connections. It also receives switched battery input through the ignition circuit when the vehicle is turned ON.

DTC DETECTION LOGIC

The ECM detected the main battery supply voltage was greater than 17V.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0563	System Voltage High (Battery 1 voltage - data valid but above normal operating range - moderately severe level)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	Battery voltage > 17.766 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Malfunctioning generator or regulator overcharging system
- Batteries connected in series instead of parallel
- Incorrect jump-starting procedure

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P0563 being current on the CONSULT screen.

Is DTC P0563 current?

YES >> Go to EC-1389, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420328

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT.
3. Start the engine and let it idle for 1 minute.
4. Check for DTC P0563 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK BATTERY

1. Turn ignition switch OFF.
2. Check the battery terminal connections.

Are the battery terminal connected properly for the system voltage required?

YES >> GO TO 3.
NO >> Tighten and clean the terminals.

3.CHECK CHARGING SYSTEM

Test the charging system. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".

Is the generator charging within specifications?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair the charging system.

P0579 CRUISE CONTROL CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420329

The ASCD steering switch contains a signal and ground which are input to the ECM. When a switch is pressed, a voltage signal is sent to the ECM. The ECM monitors the voltage to determine if the switch is stuck, or the signal circuit is shorted.

DTC DETECTION LOGIC

The ECM detected cruise control switch input is not in the required voltage boundary.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0579	Cruise Control Multi-Function Input “A” Circuit Range/Performance (Cruise control enable switch - data erratic, intermittent or incorrect)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	—
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

ASCD steering switch

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and drive vehicle in cruise control mode.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0579 being current on the CONSULT screen.

Is DTC P0579 current?

YES >> Go to EC-1391, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420330

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0581 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

Check for DTC P0579 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector E93.
3. Disconnect ASCD steering switch connector M30.
4. Inspect the harnesses and module and switch connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins

- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

P057E BRAKE PEDAL POSITION SENSOR

DTC Description

INFOID:0000000014420331

The stop lamp switch (with LED rear combination lamps) or stop lamp relay (without LED rear combination lamps) and ASCD cancel switch each input a signal to the ECM. The ECM monitors both signals. If the stop lamp switch/relay is ON, the ASCD cancel switch will be ON. If both inputs are not equal for a period of time, the DTC will set.

DTC DETECTION LOGIC

The ECM detected the stop lamp switch/relay and ASCD cancel switch signals do not match.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P057E	Brake Pedal Position Sensor “A” Circuit Intermittent/Erratic (Brake pedal position - data erratic, intermittent, or incorrect)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Stop lamp switch/relay is ON and ASCD cancel switch is OFF or Stop lamp switch/relay is OFF and ASCD cancel switch is ON for 4 seconds
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Stop lamp switch (with LED rear combination lamps) or stop lamp relay (without LED rear combination lamps)
- ASCD cancel switch
- Engine harness short to ground
- Engine harness open

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P057E being current on the CONSULT screen.

Is DTC P057E current?

YES >> Go to EC-1393, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420332

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P057E being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FUSE

1. Turn ignition switch OFF.
2. Verify that fuse 10 (10A) is installed correctly and that the fuse is not blown.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Replace the fuse.

3.INSPECT STOP LAMP SWITCH/RELAY AND ASCD CANCEL SWITCH AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect stop lamp switch connector E38 (with LED rear combination lamps).
3. Disconnect stop lamp relay connector E12 (without LED rear combination lamps).
4. Disconnect ASCD cancel switch connector E89.
5. Inspect the harness and switches/relay connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector E93.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK STOP LAMP SWITCH/RELAY FOR AN OPEN CIRCUIT

1. Check resistance between ECM connector E93 and stop lamp switch connector E38 (with LED rear combination lamps).

With LED Rear Combination Lamps

ECM		Stop lamp switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	53	E38	2	< 10 Ω

2. Check resistance between ECM connector E93 and stop lamp relay connector E12 (without LED rear combination lamps).

Without LED Rear Combination Lamps

ECM		Stop lamp switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	53	E12	3	< 10 Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the harness.

6. CHECK ASCD CANCEL SWITCH FOR AN OPEN CIRCUIT

1. Check resistance between ECM connector E93 and ASCD cancel switch connector E89.

ECM		Stop lamp switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	54	E89	1	< 10 Ω
	41		2	

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness.

7.CHECK FOR A PIN TO PIN SHORT CIRCUIT

Check resistance between ECM connector terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminals	
E93	53	E93	All	> 100k Ω
	54			
	41			

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the harness.

8.CHECK SWITCH/RELAY

Perform the component inspection. Refer to EC-1395, "Component Inspection".

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Replace the applicable switch/relay.

Component Inspection

INFOID:0000000014420333

STOP LAMP SWITCH (WITH LED REAR COMBINATION LAMPS)

1.CHECK STOP LAMP SWITCH

1. Turn the ignition switch OFF.
2. Disconnect stop lamp switch connector E38.
3. Check the continuity of stop lamp switch.

Stop lamp switch terminals	Condition	Continuity
1 – 2	Stop lamp switch ON (Brake pedal depressed)	Yes
	Stop lamp switch OFF (Brake pedal released)	No

Is the inspection result normal?

YES >> Inspection End.
NO >> Replace the stop lamp switch. Refer to BR-21, "Exploded View".

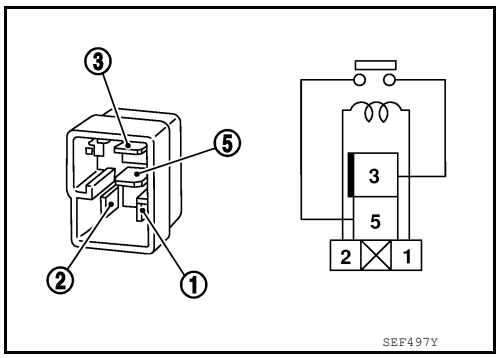
STOP LAMP RELAY (WITHOUT LED REAR COMBINATION LAMPS)

1. CHECK STOP LAMP RELAY

1. Turn the ignition switch OFF.
2. Disconnect stop lamp relay connector E12.

3. Check stop lamp relay.

Rear window defogger relay terminals		Condition	Continuity
3	5	12V direct current supply between terminals 1 and 2.	Yes
		No current supply	No



Is the inspection result normal?

YES >> Inspection End.
NO >> Replace stop lamp relay.

ASCD CANCEL SWITCH

1.CHECK ASCD CANCEL SWITCH

1. Turn the ignition switch OFF.
2. Disconnect ASCD cancel switch connector E89.
3. Check the continuity of ASCD cancel switch.

ASCD cancel switch terminals	Condition	Continuity
1 – 2	ASCD cancel switch ON (Brake pedal depressed)	Yes
	ASCD cancel switch OFF (Brake pedal released)	No

Is the inspection result normal?

YES >> Inspection End.
NO >> Replace the ASCD cancel switch. Refer to AV-289, "Removal and Installation".

P0581 CRUISE CONTROL SIGNAL CIRCUIT HIGH

DTC Description

INFOID:0000000014420334

The ASCD steering switch contains a signal and ground which are input to the ECM. When a switch is pressed, a voltage signal is sent to the ECM. The ECM monitors the voltage to determine if the switch is stuck or the signal circuit is shorted.

DTC DETECTION LOGIC

The ECM detected cruise control switch input voltage is greater than 4.88V for 20 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0581	Cruise Control Multi-Function Input “A” Circuit High (Cruise control (resistive) signal circuit - voltage above normal or shorted to high source)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	Cruise control switch value > 4.888 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- ASCD steering switch
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and drive vehicle in cruise control mode.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0581 being current on the CONSULT screen.

Is DTC P0581 current?

YES >> Go to EC-1397, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420335

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0581 being current on the CONSULT screen.

Is DTC P0581 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK FOR AN OPEN CIRCUIT

1. Disconnect ASCD steering switch connector M30.
2. Check resistance between ECM connector E93 and ASCD steering switch connector M30.

With Heated Steering Wheel

ECM		ASCD steering switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	59	M30	10	< 10 Ω

Without Heated Steering Wheel

ECM		ASCD steering switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	59	M30	9	< 10 Ω

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace the harness.

4.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT

Check resistance between ECM connector terminals.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	59	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the harness.

5.CHECK DTC PRIORITY

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0581 being past on the CONSULT screen.

Is DTC P0581 detected as past?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Replace the ASCD steering switch. Refer to AV-289, "Removal and Installation".

P0591 CRUISE CONTROL SYSTEM RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420336

The ASCD steering switch contains a signal and ground which are input to the ECM. When a switch is pressed, a voltage signal is sent to the ECM. The ECM monitors the voltage to determine if the switch is stuck, or the signal circuit is shorted.

DTC DETECTION LOGIC

The ECM detected cruise control switch has been stuck for longer than 60 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0591	Cruise Control Multi-Function Input “B” Circuit Range/Performance (Cruise control system command state - mechanical system not responding or out of adjustment)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	When the cruise switch input is sending an active signal continuously longer than 120 seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

ASCD steering switch

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and drive vehicle in cruise control mode.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0591 being current on the CONSULT screen.

Is DTC P0591 current?

YES >> Go to EC-1399, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420337

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0581 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

Check for DTC P0591 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector E93.
3. Disconnect ASCD steering switch connector M30.
4. Inspect the harnesses and module and switch connector pins for the following:

- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace error-detected parts.

P0601 ECM

DTC Description

INFOID:0000000014420338

The Engine Control Module (ECM) calculates a calibration memory check sum based on the values of certain parameters in the ECM. This check sum is compared to an expected value in the ECM to detect tampering.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the calibration memory check sum did not match the expected value or it did not complete before ECM shutdown.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0601	ECM (Internal Control Module Memory Check Sum Error)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	CRC on calibrations and unchanging trims, code block or other calibrations does not equal the expected values.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Malfunctioning software

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0601 being current on the CONSULT screen.

Is DTC P0601 current?

YES >> Go to EC-1401, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420339

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0601 being current on the CONSULT screen.

Is DTC P0601 detected as current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P0604 ECM

DTC Description

INFOID:0000000014420340

The Engine Control Module (ECM) contains microprocessors that calculates, interprets, and store data from connected inputs and output devices. The ECM runs diagnostics to check its internal memory and software. If the memory or software becomes corrupted, a fault will be set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a software or calibration error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0604	ECM (Internal Control Module Random Access Memory (RAM) Error)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	The value read from each location of RAM by the main ECM microprocessor does not match the value previously written to it.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Incorrect software
- Corrupted engine calibration

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0604 being current on the CONSULT screen.

Is DTC P0604 current?

YES >> Go to EC-1402, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420341

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P0562
- P0563
- P06B8
- P0601
- P0606
- P0607
- P2509

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0605 ECM

DTC Description

INFOID:0000000014420342

The Engine Control Module (ECM) contains microprocessors that calculates, interprets, and stores data from connected inputs and output devices. The ECM runs diagnostics to check its internal memory and software. If the memory or software becomes corrupted, a DTC will be set.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0605	ECM (Internal Control Module Read Only Memory (ROM) Error]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	The Engine Control Module (ECM) detected a software or calibration error.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Corrupted engine calibration
- Incorrect ECM software

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0605 being current on the CONSULT screen.

Is DTC P0605 current?

YES >> Proceed to EC-1405, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420343

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC confirmation procedure. Refer to EC-1404, "DTC Description".
4. Check the DTC.

Is the DTC displayed again?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P0606 ECM

DTC Description

INFOID:0000000014420344

The Engine Control Module (ECM) is the brain for engine operation. It intercepts signals from sensors to determine actuator positions and fueling control. The ECM gathers and maintains data in its internal memory. The ECM receives constant voltage from the batteries through unswitched battery connections. It also receives switched battery input through the vehicle key switch wire when the vehicle is turned ON.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0606	ECM [Internal control module read only memory (ROM) error]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	Malfunction in the internal ROM of ECM
		Diagnosis delay time	—

POSSIBLE CAUSE

- ECM internal memory error

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn engine OFF.
2. Turn ignition switch ON.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-1405, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420345

1.INSPECTION START

1. Turn ignition switch ON.
2. Erase DTC.
3. Perform DTC CONFIRMATION PROCEDURE. Refer to EC-1405, "DTC Description".

Is the 1st trip DTC P0606 displayed again?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P0607 ECM

DTC Description

INFOID:0000000014420346

The Engine Control Module (ECM) receives battery voltage through the battery supply circuit. The ECM receives ignition voltage through the ignition supply circuit when the ignition switch is in the ON or START position.
At ignition OFF, the ECM remains powered for a short period of time. During this period of time, the ECM saves important data to memory. If the ECM battery and ignition circuitry are malfunctioning, maintenance and DTC data could be corrupted or inaccurate.

DTC DETECTION LOGIC

The ECM detected a read or write error internal to the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0607	Control Module Performance (Engine control module warning internal hardware failure - bad intelligent device or component)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	The ECM stays powered on after the ignition is turned off
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	The monitoring microprocessor commands the torque actuator circuits (typically injector drivers) to shut down, but the torque actuator circuit feedbacks indicate the circuit is still active
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	The check sum of the ECM sub-processor memory does not equal the expected check-sum or the independent internal watchdog timer updated in conjunction with the sub-processors intended instructions indicates operation processing is lost > 500 microseconds or the register value of the sub-processor is not equal to the expected value in normal operation
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Harness or connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0607 being current on the CONSULT screen.

Is DTC P0607 current?

YES >> Go to EC-1407, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420347

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0607 being current or past for more than 3 counts on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK BATTERY

1. Turn ignition switch OFF.
2. Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 3.
NO >> Tighten and clean the terminals.

3.CHECK BATTERY VOLTAGE

1. Turn ignition switch ON.
2. Measure the voltage from the positive battery terminal to the negative battery terminal while trying to start the engine.

- Normal condition: above 12 V
- Cranking condition: above 6.2 V

Is the battery voltage within specified range?

YES >> GO TO 4.
NO >> Charge or test battery(s). Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".

4.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector E93.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR AN OPEN

Measure the voltage between ECM connector E93 and ground.

ECM		Ground	Voltage (V) (Approx.)
Connector	Terminal		
E93	83	(–)	≥ 10 V

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 6.

6.CHECK FUSE

1. Turn ignition switch OFF.
2. Verify that fuse 68 (5A) is installed correctly and that the fuse is not blown.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace the fuse.

7.CHECK ADD ON ACCESSORIES

Check for any add on accessory wiring connected to the battery positive terminal.
- Check for damaged insulation or an installation error that could cause a short to ground.

Is the inspection result normal?

YES >> Repair or replace engine harness.
NO >> Repair or replace damaged wiring.

8.CHECK FOR AN OPEN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect positive terminal from the battery.
3. Check resistance between ECM connector E93 and battery positive terminal.

ECM			Resistance
Connector	Terminal	Battery terminal	
E93	83	(+)	< 1.0 Ω

4. Check resistance between ECM connector E93 and battery negative terminal.

ECM			Resistance
Connector	Terminal	Battery terminal	
E93	1	(–)	< 1.0 Ω
	2		
	4		

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the harness.

9.CHECK IGNITION CIRCUIT

Check resistance between ECM connector E93 and push button ignition switch connector M46.

ECM		Push button ignition switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	65	M46	8	< 5.0 Ω

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace the harness.

P060A ECM

DTC Description

INFOID:0000000014420348

The Engine Control Module (ECM) contains microprocessors that calculates, interprets, and stores data from connected inputs and output devices. The ECM runs diagnostics to check its internal memory and software. If the memory or software becomes corrupted, a fault will be set.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P060A	ECM (Internal Control Module Read Only Memory (ROM) Error]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	The Engine Control Module (ECM) detected a software or calibration error.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Corrupted engine calibration
- Incorrect ECM software

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P060A being current on the CONSULT screen.

Is DTC P060A current?

YES >> Proceed to EC-1405, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420349

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0606 being current DTC on the CONSULT screen.

Is DTC P0606 detected as current?

YES >> Replace the ECM.
NO >> GO TO 2.

2.RECALIBRATE THE ECM

1. Turn ignition switch ON.
2. Connect CONSULT and recalibrate the ECM with the latest engine calibration.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P060A being current DTC on the CONSULT screen.

Is DTC P060A current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P060B ECM

DTC Description

INFOID:0000000014420350

The Engine Control Module (ECM) contains microprocessors that calculates, interprets, and stores data from connected inputs and output devices. The ECM runs diagnostics to check its internal memory and software. If the memory or software becomes corrupted, a fault will be set.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P060B	INTERNAL CONTROL MODULE A/D PROCESSOR PERFORMANCE (Internal Control Module A/D Processing Performance]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	The Engine Control Module (ECM) detected a software or calibration error.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Corrupted engine calibration
- Incorrect ECM software

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P060B being current on the CONSULT screen.

Is DTC P060B current?

YES >> Proceed to EC-1405, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420351

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0606 being current DTC on the CONSULT screen.

Is DTC P0606 detected as current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> GO TO 2.

2.RECALIBRATE THE ECM

1. Turn ignition switch ON.
2. Connect CONSULT and recalibrate the ECM with the latest engine calibration.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P060B being current DTC on the CONSULT screen.

Is DTC P060B current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P060C ECM

DTC Description

INFOID:0000000014420352

The Engine Control Module (ECM) controls engine operation. It interprets signals from sensors to determine outputs for actuators and fueling control. The ECM gathers and maintains data in it's internal memory. The ECM receives battery voltage through the battery supply circuit. The ECM receives ignition voltage through the ignition supply circuit when the ignition switch is in the ON or START position.

DTC DETECTION LOGIC

The ECM detected that the power supply was removed before power-down parameters could be saved.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P060C	Internal Control Module Main Processor Performance (Number of ECM resets - data valid but above normal operating range - moderately severe level)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	The monitoring microprocessor reset has been commanded 7 times with the ignition input ON
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	First reported engine speed after ECM initialization > 300 rpm and time since ECM power up is < 2 seconds or engine speed > 50 rpm and ECM reset occurs
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	The run-time response indicates an incorrect process sequence or the monitor micro new question update is ≤ 40 msec or the instruction path test fails consecutively for ≥ 0.5 seconds, or, the run-time response indicates an incorrect process sequence or the monitor micro new question update is ≤ 40 msec or the instruction path test fails for a cumulatively of time ≥ 4.8 seconds
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Battery(s)
- Harness or connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.

• When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P060C being current on the CONSULT screen.

Is DTC P060C current?

YES >> Go to EC-1412, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420353

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P060C being current or past for multiple counts on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK BATTERY

1. Turn ignition switch OFF.
2. Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 3.
NO >> Tighten and clean the terminals.

3.CHECK BATTERY VOLTAGE

1. Turn ignition switch ON.
2. Measure the voltage from the positive battery terminal to the negative battery terminal while trying to start the engine.

- Normal condition: above 12 V
- Cranking condition: above 6.2 V

Is the battery voltage within specified range?

YES >> GO TO 4.
NO >> Charge test battery(s). Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".

4.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector E93.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK FOR AN OPEN

Measure the voltage between ECM connector E93 and ground.

ECM		Ground	Voltage (Approx.)
Connector	Terminal		
E93	83	(–)	≥ 10 V

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 6.

6.CHECK FUSE

1. Turn ignition switch OFF.
2. Verify that fuse 68 (5A) is installed correctly and that the fuse is not blown.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace the fuse.

7.CHECK ADD ON ACCESSORIES

Check for any add on accessory wiring connected to the battery positive terminal.
- Check for damaged insulation or an installation error that could cause a short to ground.

Is the inspection result normal?

YES >> Repair or replace engine harness.
NO >> Repair or replace damaged wiring.

8.CHECK FOR AN OPEN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect positive terminal from the battery.
3. Check resistance between ECM connector E93 and battery positive terminal.

ECM			Resistance
Connector	Terminal	Battery terminal	
E93	83	(+)	< 1.0 Ω

4. Check resistance between ECM connector E93 and battery negative terminal.

ECM			Resistance
Connector	Terminal	Battery terminal	
E93	1	(–)	< 1.0 Ω
	2		
	4		

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the harness.

9.CHECK IGNITION CIRCUIT

Check resistance between ECM connector E93 and push button ignition switch connector M46.

ECM		Push button ignition switch		Resistance
Connector	Terminal	Connector	Terminal	
E93	65	M46	8	< 5.0 Ω

Is the inspection result normal?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> Repair or replace the harness.

P0611 ECM

DTC Description

INFOID:0000000014420354

The fuel injector timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator in the fuel injector. Energizing the actuator causes the needle valve to rise, allowing fuel to flow into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6 and 7 make up group 1 and fuel injectors 2, 3, 5 and 8 make up group 2.

DTC DETECTION LOGIC

The ECM detected a significant difference between main and calculated fueling.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P0611	Fuel Injector Control Module Performance (Injector power supply - bad intelligent device or component)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	Absolute value of the difference of engine speed calculated at a 10 ms interval and engine speed calculated at a 40 ms interval > 400 RPM
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Fuel system

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Bring the engine to a complete stop and let it idle for 1 minute.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
5. Check for DTC P0611 being current on the CONSULT screen.

Is DTC P0611 current?

YES >> Go to EC-1414, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420355

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0611 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for any fuel injector DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR INTERMITTENT CONDITION

Interview the customer on driving conditions.

Was the vehicle stalled at a recent key-off event?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 4.

4.CHECK ENGINE

Inspect the vehicle for signs of performance enhancement equipment.

Has the vehicle been modified with performance enhancement equipment?

YES >> Inspection End.
NO >> Refer to GI-47, "Intermittent Incident".

P061A ECM

DTC Description

INFOID:0000000014420356

The fuel injector timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator in the fuel injector. Energizing the actuator causes the needle valve to rise, allowing fuel to flow into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6 and 7 make up group 1 and fuel injectors 2, 3, 5 and 8 make up group 2.

DTC DETECTION LOGIC

Fueling commands were not consistent with engine running conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P061A	Internal Control Module Torque Performance (Governor fueling error - condition exists)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	Engine speed is > 1200 RPM and observed fueling value exceeds 4mg/stroke
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Stop lamp switch/relay
- Crankshaft position sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P061A being current on the CONSULT screen.

Is DTC P061A current?

YES >> Go to EC-1416, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420357

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for multiple DTCs being current on the CONSULT screen.

Are DTCs other than P061A detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FREEZE FRAME DATA

Read the DTC freeze frame data for DTC P061A.

Is the coolant temperature abnormally low for the operating conditions?

YES >> Replace the coolant temperature sensor. Refer to EM-347, "Removal and Installation".
NO >> GO TO 3.

3.CHECK DATA MONITOR

Monitor the accelerator position sensor 1 and 2 data monitor items while depressing the accelerator pedal.

Are the voltage transition readings smooth?

YES >> GO TO 4.
NO >> Refer to GI-47, "Intermittent Incident".

4.CHECK FREEZE FRAME DATA

Read the DTC freeze frame data for DTC P061A.

Is the exhaust gas pressure sensor reading higher than the boost pressure reading?

YES >> Replace the exhaust gas pressure sensor. Refer to EM-304, "Removal and Installation".
NO >> GO TO 5.

5.CHECK FREEZE FRAME DATA

Read the DTC freeze frame data for DTC P061A.

Is the boost pressure reading higher than the exhaust gas pressure sensor reading?

YES >> Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> GO TO 6.

6.CHECK DATA MONITOR

Monitor the brake switch data monitor item while depressing the brake pedal.

Does the brake switch status change accordingly?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 7.

7.INSPECT STOP LAMP SWITCH/RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the stop lamp switch connector E38 (with LED rear combination lamps).
3. Disconnect the stop lamp relay connector E12 (without LED rear combination lamps).
4. Inspect the harness and sensor/relay connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> Replace the stop lamp switch BR-21, "Exploded View".
NO >> Repair or replace harness or connectors.

P061B ECM

DTC Description

INFOID:0000000014420358

The fuel injector timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator in the fuel injector. Energizing the actuator causes the needle valve to rise, allowing fuel to flow into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6 and 7 make up group 1 and fuel injectors 2, 3, 5 and 8 make up group 2.

DTC DETECTION LOGIC

Fueling commands were not consistent with engine running conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P061B	Internal Control Module Torque Calculation Performance (Torque fueling performance beyond design limits - condition exists)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	Commanded fueling is > 100mg/stroke and engine speed is ≤ 4900 RPM
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- Stop lamp switch/relay
- Crankshaft position sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P061B being current on the CONSULT screen.

Is DTC P061B current?

YES >> Go to EC-1418, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420359

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for multiple DTCs being current on the CONSULT screen.

Are DTCs other than P061B detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FREEZE FRAME DATA

Read the DTC freeze frame data for DTC P061B.

Is the coolant temperature abnormally low for the operating conditions?

YES >> Replace the coolant temperature sensor. Refer to EM-347, "Removal and Installation".
NO >> GO TO 3.

3.CHECK DATA MONITOR

Monitor the accelerator position sensor 1 and 2 data monitor items while depressing the accelerator pedal.

Are the voltage transition readings smooth?

YES >> GO TO 4.
NO >> Refer to GI-47, "Intermittent Incident".

4.CHECK FREEZE FRAME DATA

Read the DTC freeze frame data for DTC P061B.

Is the exhaust gas pressure sensor reading higher than the boost pressure reading?

YES >> Replace the exhaust gas pressure sensor. Refer to EM-304, "Removal and Installation".
NO >> GO TO 5.

5.CHECK FREEZE FRAME DATA

Read the DTC freeze frame data for DTC P061B.

Is the boost pressure reading higher than the exhaust gas pressure sensor reading?

YES >> Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
NO >> GO TO 6.

6.CHECK DATA MONITOR

Monitor the brake switch data monitor item while depressing the brake pedal.

Does the brake switch status change accordingly?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 7.

7.INSPECT STOP LAMP SWITCH/RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the stop lamp switch connector E38 (with LED rear combination lamps).
3. Disconnect the stop lamp relay connector E12 (without LED rear combination lamps).
4. Inspect the harness and sensor/relay connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> Replace the stop lamp switch BR-21, "Exploded View".
NO >> Repair or replace harness or connectors.

P061C ECM

DTC Description

INFOID:0000000014420360

The crankshaft position and camshaft position sensors are Hall effect type sensors. The engine control module (ECM) provides a 5V supply and a return circuit to the position sensors. As holes drilled in the flywheel or slots in the front of the camshaft gear move past the position sensor, a signal is generated on the position sensor signal circuit. The ECM uses this signal to determine engine speed. Offset spacing of the drillings or slots indicate to the ECM the position of the engine.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P061C	ECM (Internal Control Module Engine RPM Performance]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	Absolute value of difference between Engine RPM and an independently calculated engine speed is greater than 500 RPM
		Diagnosis delay time	—

POSSIBLE CAUSE

- Crankshaft position sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P061C being current on the CONSULT screen.

Is DTC P061C current?

YES >> Proceed to EC-1405, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420361

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P061C being only current DTC on the CONSULT screen.

Is P061C only current DTC detected?

YES >> Replace the crankshaft position sensor. Refer to EM-344, "Removal and Installation". GO TO 2.
NO >> Refer to EC-838, "DTC Index".

2.ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing ENGINE diagnostic trouble codes.

Is DTC P061C current?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P061E ECM

DTC Description

INFOID:0000000014420362

The Engine Control Module (ECM) monitors brake switches and vehicle speed. The ECM will set a fault when it has detected the vehicle speed is above a threshold for a period of time and has stopped twice without brake activity and cycling of the key switch.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P061E	ECM (Internal Control Module Brake Signal Performance]	Diagnosis condition	Ignition switch ON
		Signal (terminal)	—
		Threshold	The Engine Control Module has detected the vehicle speed has been above 28 MPH for 5 minutes and has decreased to less than 2 MPH twice without brake activity.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Brake pedal position switch
- Vehicle speed sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P061E being current on the CONSULT screen.

Is DTC P061E current?

YES >> Proceed to EC-1405, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420363

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for current DTCs on the CONSULT screen.

ABS and/or ESC warning lamp/s on or vehicle speed DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INTERVIEW CUSTOMER.

1. The diagnostic is designed to detect a faulty brake switch.
2. Diagnostic runs when vehicle speed is above 48 km/h (30 mph) for more than five minutes.
3. Fault code will set when vehicle speed is detected at 3 km/h (2 mph) or less without brake activity.

Does customer coast to a near stop without using the service brake?

YES >> Explain the diagnostic operation to the customer. Repair Complete.
NO >> GO TO 3.

3. CHECK THE BRAKE SWITCH

1. Turn ignition switch ON.
2. Select “BRAKE SW1” in “DATA MONITOR” mode of “ENGINE” using CONSULT.
3. Check “BRAKE SW1” indication as per the following conditions.

Monitor item	Condition		Indication
BRAKE SW1	Brake pedal	Slightly depressed	OFF
		Fully released	ON

Brake switch status changing correctly?

YES >> Inspection End.
NO >> GO TO 4.

4. INSPECT BRAKE SWITCH AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the brake switch from the harness.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> Replace the brake switch. Refer to BR-21, "Exploded View".
NO >> Repair or replace error-detected parts.

P0628 FUEL PUMP CONTROL

DTC Description

INFOID:0000000014420364

The lift pump is powered by the battery using a relay. The ECM will commands the lift pump on (at ignition on) by grounding the coil of the lift pump relay. The lift pump draws fuel from the fuel tank through the stage 1 fuel filter. It supplies fuel to the high pressure fuel pump. The lift pump fuel pressure is regulated to 101PSI (7 bar) maximum.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the lift pump voltage was less than 5V when commanded off.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0628	FUEL_PUMP/CIRC (Fuel Pump “A” Control Circuit Low)	Diagnosis condition	Ignition switch is turned ON.
		Signal (terminal)	(-)
		Threshold	Fuel lift pump driver current > 4A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel lift pump
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0628 being current on the CONSULT screen.

Is DTC P0628 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420365

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0628 being current on the CONSULT screen.

Is DTC P628 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT LIFT PIMP RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector E122.
3. Inspect the engine harness and IPDM E/R connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the IPDM E/R harness connector E122.
4. Measure the resistance between the ECM harness connector E93 terminal 40 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	40	—	> 100k Ω

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the harness for a short.

5. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the IPDM E/R harness connector E122.
4. Measure the resistance between the ECM harness connector E93 terminal 40 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	40	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the harness for a short.

6. CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0628 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P0629 FUEL PUMP CONTROL

DTC Description

INFOID:0000000014420366

The lift pump is powered by the battery using a relay. The ECM will commands the lift pump on (at key on) by grounding the coil of the lift pump relay. The lift pump draws fuel from the fuel tank through the stage 1 fuel filter. It supplies fuel to the high pressure fuel pump. The lift pump fuel pressure is regulated to 101PSI (7 bar) maximum.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the lift pump driver circuit is shorted high or open when commanded on.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0629	FUEL_PUMP/CIRC (Fuel Pump “A” Control Circuit High)	Diagnosis condition	Ignition switch is turned ON.
		Signal (terminal)	(-)
		Threshold	Fuel lift pump driver voltage < 5V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel lift pump
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0629 being current on the CONSULT screen.

Is DTC P0629 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420367

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0629 being current on the CONSULT screen.

Is DTC P0629 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT LIFT PUMP RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector E122.
3. Inspect the engine harness and IPDM E/R connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins

- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK FOR AN OPEN CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the IPDM E/R harness connector E122.
4. Measure the resistance between the ECM harness connector E93 terminal 40 and the IPDM E/R harness connector E122 terminal 45.

ECM		IPDM E/R		Resistance
Connector	Terminal	Connector	Terminal	
E93	40	E122	45	< 10 Ω

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the engine harness for an open.

5. CHECK FOR A SHORT CIRCUIT TO VOLTAGE IN THE HARNESS

Measure the resistance between ECM harness connector E93 terminal 40 and battery positive terminal.

ECM		Battery positive	Resistance
Connector	Terminal		
E93	40	+	> 100k Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the harness for a short to voltage

6. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the IPDM E/R harness connector E122.
4. Measure the resistance between the ECM harness connector E93 terminal 40 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	40	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a short.

7.CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0629 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P062B ECM

DTC Description

INFOID:0000000014420368

The fuel injector timing and quantity are controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator in the fuel injector. Energizing the actuator causes the needle valve to rise, allowing fuel to flow into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6 and 7 make up group 1 and fuel injectors 2, 3, 5 and 8 make up group 2.

DTC DETECTION LOGIC

The ECM detected a significant difference between main and calculated fueling.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P062B	Internal Control Module Fuel Injector Control Performance (Fuel system shutdown failure - condition exists)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	Absolute difference between actual and calculated injection correction components for main injection 1, pilot injection 1, post injection 2 or post injection 3 ≥ 9.5 mg
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Fuel injector
- ECM
- Fuel system

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P062B being current on the CONSULT screen.

Is DTC P062B current?

YES >> Go to EC-1430, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420369

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P062B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for any fuel injector DTCs being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR INTERMITTENT CONDITION

Interview the customer about driving conditions.

Was the vehicle stalled at a recent key-off event?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 4.

4.CHECK ENGINE

Inspect the vehicle for signs of performance enhancement equipment.

Has the vehicle been modified with performance enhancement equipment?

YES >> Inspection End.
NO >> Refer to GI-47, "Intermittent Incident".

P062C ECM

DTC Description

INFOID:0000000014420370

While in cruise control, this monitor verifies vehicle speed stays within the cruise control set-point. This diagnostic detects a condition when the vehicle is traveling downhill, which could cause an increase in overall speed. The monitor will disable as engine speed decreases by a certain threshold, or if the brake or accelerator pedal is depressed. Cruise control will be disabled for the rest of the drive cycle (until ignition is OFF).

DTC DETECTION LOGIC

The ECM detected vehicle speed is more than 5 mph (8 km/h) over targeted cruise control speed.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P062C	Internal Control Module Vehicle Speed Performance (Cruise control set speed - out of calibration)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	Independently calculated road speed exceeds independently calculated cruise set speed by 6.214 mph and DTC P061A is current
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and drive vehicle in cruise control mode.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P062C being current on the CONSULT screen.

Is DTC P062C current?

YES >> Go to EC-1432, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420371

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P062C being current on the CONSULT screen.

Is DTC P062C the only DTC detected?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to EC-838, "DTC Index".

P0630 VIN NOT PROGRAMMED OR INCOMPATIBLE - ECM

DTC Description

INFOID:0000000014420372

The Engine Control Module (ECM) stores the Vehicle Identification Number (VIN) in it's internal memory. If the VIN is not entered at power up, the ECM will set the DTC.

DTC DETECTION LOGIC

The ECM detected the VIN was not programmed in the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0630	VIN Not Programmed or Incompatible - ECM/PCM (Vehicle identification number - out of calibration)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	—
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
3. Check for DTC P0630 being current on the CONSULT screen.

Is DTC P0630 current?

YES >> Go to EC-1433, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420373

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTC P0630 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P064C GLOW OUTPUT STAGE

DTC Description

INFOID:0000000014420374

The Glow Plug Control Module controls the timing and intensity of the glow plug output using data provided by the ECM through the CAN 2 communication lines. The Glow Plug Control Module will not activate the glow plugs if the glow plug module reads a temperature greater than the calibrated amount. The Glow Plug Control Module receives fused power from the battery supply circuit and ignition power from the ECM relay.

DTC DETECTION LOGIC

The glow plug module reported an internal error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P064C	Glow Plug Control Module 1 (Glow plug control module - bad intelligent device or component)	Diagnosis condition	Initial Key ON
		Signal (terminal)	—
		Threshold	The glow plug control module has not updated the status signal to indicate “No after-run delay requested”
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Glow Plug Control Module

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P064C being current on the CONSULT screen.

Is DTC P064C current?

YES >> Go to EC-1434, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420375

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0106, P0383 or P2509 being current or history on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch OFF and wait 5 seconds.
2. Start engine and let idle for 1 minute.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P064C being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the glow plug control module from engine harness connector.

3. Inspect the glow plug control module connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 7.

4. CHECK THE VOLTAGE TO THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch ON.
2. Check the voltage between the glow plug control module battery voltage supply circuit and engine block.
NOTE:
Check the voltage while cranking the engine, and with the engine at idle.

Glow plug control module			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E69	1	Engine block	>6

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK FOR DTCS

1. Turn ignition switch OFF.
2. Reconnect the glow plug control module connector.
3. Turn ignition switch ON.
4. Turn ignition switch OFF, and wait 5 seconds.
5. Start the engine and let it idle for 1 minute.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P064C DTC become ″Current″?

YES >> • A malfunctioning glow plug control module has been detected. Replace the glow plug control module. Refer to EC-1996, "Removal and Installation".
• GO TO 7.
NO >> GO TO 7.

6. CHECK THE BATTERY AND THE POWER CONNECTOR

1. Turn ignition switch OFF.
2. Inspect the battery connections for the following:
- Loose connector
- Corroded terminals

Are the connections tight and corrosion-free?

YES >> GO TO 7.
NO >> • Tighten the connections and clean the terminals.
• GO TO 7.

7. ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P064C DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1434, "DTC Description".
NO >> Repair complete.

P0652 SENSOR REFERENCE VOLTAGE B CIRCUIT LOW

DTC Description

INFOID:0000000014420376

The engine control module (ECM) provides a dedicated 5V supply to various engine sensors. The following sensors make-up sensor supply 1: rail fuel pressure, fuel pressure, exhaust gas pressure, Turbocharger Compressor Inlet Pressure, Camshaft Position, Charge-Air Cooler Outlet Pressure and Temperature, Turbocharger Compressor Intake Pressure and Temperature, Crankcase pressure, turbo speed, EGR bypass position and EGR position sensors.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the sensor supply 1 signal voltage was less than 4.64V for more than one second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0652	(Sensor Reference Voltage “B” Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 1 voltage < 4.644V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Fuel rail pressure sensor
- Fuel pressure sensor
- Exhaust gas pressure sensor
- Low pressure turbocharger boost pressure sensor
- Camshaft position sensor
- Engine charge air cooler outlet pressure/temperature sensor
- Turbocharger compressor intake pressure/temperature sensor
- Crankcase pressure sensor
- Turbocharger speed sensor
- EGR bypass valve
- EGR valve
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0652 being current on the CONSULT screen.

Is DTC P0652 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420377

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0652 being current on the CONSULT screen.

Is DTC P0652 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT CAMSHAFT POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect camshaft position sensor harness connector F109.
3. Inspect the harness connector and camshaft position sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect camshaft position sensor harness connector F109.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 4.
NO >> Replace camshaft position sensor. Refer to EM-323, "Removal and Installation".

4.INSPECT FUEL RAIL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Inspect the harness connector and fuel rail pressure sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure sensor harness connector F139.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 6.
NO >> Replace fuel rail pressure sensor. Refer to EM-457, "Removal and Installation".

6.INSPECT CHARGE AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect charge air cooler outlet pressure/temperature sensor harness connector F140.

3. Inspect the harness connector and charge air cooler outlet pressure/temperature sensor pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect charge air cooler outlet pressure/temperature sensor harness connector F140.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 8.
NO >> Replace charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".

8. INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 10.
NO >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".

10. INSPECT FUEL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel pressure sensor harness connector F197.

3. Inspect the harness connector and fuel pressure sensor pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace error-detected parts.

11. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fuel pressure sensor harness connector F197.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 12.
NO >> Replace fuel pressure sensor. Refer to EM-457, "Removal and Installation".

12. INSPECT EXHAUST GAS PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor harness connector F199.
3. Inspect the harness connector and exhaust gas pressure sensor pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 13.
NO >> Repair or replace error-detected parts.

13. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect exhaust gas pressure sensor harness connector F199.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 14.
NO >> Replace exhaust gas pressure sensor. Refer to EM-304, "Removal and Installation".

14. INSPECT LOW PRESSURE TURBOCHARGER BOOST PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect low pressure turbocharger boost pressure sensor harness connector F198.
3. Inspect the harness connector and low pressure turbocharger boost pressure sensor pins for the following:
- Loose connector
- Corroded pins

- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 15.
NO >> Repair or replace error-detected parts.

15. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect low pressure turbocharger boost pressure sensor harness connector F198.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 16.
NO >> Replace low pressure turbocharger boost pressure sensor. Refer to EM-253, "Removal and Installation".

16. INSPECT EGR VALVE POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR valve position sensor harness connector F144.
3. Inspect the harness connector and EGR valve position sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 17.
NO >> Repair or replace error-detected parts.

17. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR valve position sensor harness connector F144.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 18.
NO >> Replace EGR valve position sensor. Refer to EM-304, "Removal and Installation".

18. INSPECT TURBOCHARGER SPPED SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger speed sensor harness connector F126.
3. Inspect the harness connector and turbocharger speed sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals

- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 19.
NO >> Repair or replace error-detected parts.

19. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger speed sensor harness connector F126.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 20.
NO >> Replace turbocharger speed sensor. Refer to EM-407, "Removal and Installation".

20. INSPECT CRANKCASE PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Inspect the harness connector and crankcase pressure sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 21.
NO >> Repair or replace error-detected parts.

21. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankcase pressure sensor harness connector F151.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 22.
NO >> Replace crankcase pressure sensor. Refer to EM-334, "Removal and Installation".

22. INSPECT EGR BYPASS VALVE POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect EGR bypass valve position sensor harness connector F145.
3. Inspect the harness connector and EGR bypass valve position sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 23.
NO >> Repair or replace error-detected parts.

23. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect EGR bypass valve position sensor harness connector F145.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 24.
NO >> Replace EGR bypass valve position sensor. Refer to EM-290, "Removal and Installation".

24. INSPECT FAN CLUTCH ASSEMBLY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Inspect the harness connector and fan clutch assembly pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 25.
NO >> Repair or replace error-detected parts.

25. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 26.
NO >> Replace fan clutch assembly. Refer to CO-76, "Exploded View".

26. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 27.
NO >> Repair or replace error-detected parts.

27. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.

2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace the engine harness.

P0653 SENSOR REFERENCE VOLTAGE B CIRCUIT HIGH

DTC Description

INFOID:0000000014420378

The engine control module (ECM) provides a dedicated 5V supply to various engine sensors. The following sensors make-up sensor supply 1: rail fuel pressure, fuel pressure, exhaust gas pressure, Turbocharger Compressor Inlet Pressure, Camshaft Position, Charge-Air Cooler Outlet Pressure and Temperature, Turbocharger Compressor Intake Pressure and Temperature, Crankcase pressure, turbo speed, EGR bypass position and EGR position sensors.

DTC DETECTION LOGIC

The ECM detects that the sensor supply 1 signal voltage is greater than 5.3V for more than 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0653	(Sensor Reference Voltage “B” Circuit High)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 1 voltage > 5.356V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0653 being current on the CONSULT screen.

Is DTC P0653 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420379

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0653 being current on the CONSULT screen.

Is DTC P0653 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0653 current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace the engine harness for a short

P0667 CONTROL MODULE INTERNAL TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420380

The Engine Control Module (ECM) has an internal temperature sensor that is used to measure the temperature inside the ECM. If the internal temperature exceeds a threshold, a DTC will be set.

DTC DETECTION LOGIC

The ECM detected the internal temperature sensor circuit was irrational.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0667	Control Module Internal Temperature Sensor “A”/Performance (Engine ECU temperature - data erratic, intermittent, or incorrect)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	ECM internal temperature sensor > 35°C plus the tolerance of the most accurate remaining temperature sensor
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Allow the engine to cold soak for 8 hours with the ignition OFF.
2. Start the engine.
3. Connect CONSULT, select “ENGINE” and perform the ″Stationary Regeneration″ Active Test.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.
5. Check for DTC P0667 being current on the CONSULT screen.

Is DTC P0667 current?

YES >> Go to EC-1447, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420381

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0667 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P066A CYLINDER 1 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420382

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P066A	(Cylinder 1 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P066A being current on the CONSULT screen.

Is DTC P066A current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420383

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066A being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0671 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F114.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F114.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0671 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P066B CYLINDER 1 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420384

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P066B	(Cylinder 1 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P066B being current on the CONSULT screen.

Is DTC P066B current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420385

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0671 become current and P066B become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".GO TO 5.

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F114.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P066B become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P066C CYLINDER 2 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420386

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P066C	(Cylinder 2 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P066C being current on the CONSULT screen.

Is DTC P066C current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420387

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066C being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0672 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module.

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F130.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F130.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0672 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P066D CYLINDER 2 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420388

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P066D	(Cylinder 2 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P066D being current on the CONSULT screen.

Is DTC P066D current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420389

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0672 become current and P066D become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".GO TO 5.

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F130.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE”” diagnostic trouble codes.

Did DTC P066D become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P066E CYLINDER 3 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420390

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P066E	(Cylinder 3 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P066E being current on the CONSULT screen.

Is DTC P066E current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420391

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066E being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0673 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module.

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F116.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F116.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0673 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P066F CYLINDER 3 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420392

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P066F	(Cylinder 3 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P066F being current on the CONSULT screen.

Is DTC P066F current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420393

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0673 become current and P066F become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".GO TO 5.

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug from the harness connector F116.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P066F become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P0671 GLOW PLUG (CYLINDER 1)

DTC Description

INFOID:0000000014420394

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0671	CYLINDER 1 GLOW PLUG CIRCUIT (Glow plug heater circuit 1 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0671 being current on the CONSULT screen.

Is DTC P0671 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420395

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0671 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 18 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P066A become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for ENGINE diagnostic trouble codes.
6. Check for DTC P0671 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F114.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F114.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F114 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P066A become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0672 GLOW PLUG (CYLINDER 2)

DTC Description

INFOID:0000000014420396

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0672	CYLINDER 2 GLOW PLUG CIRCUIT (Glow plug heater circuit 2 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0672 being current on the CONSULT screen.

Is DTC P0672 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420397

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0672 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 19 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P066C become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for ENGINE diagnostic trouble codes.
6. Check for DTC P0672 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F130.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7.CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F130.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F130 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P066C become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0673 GLOW PLUG (CYLINDER 3)

DTC Description

INFOID:0000000014420398

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0673	CYLINDER 3 GLOW PLUG CIRCUIT (Glow plug heater circuit 3 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0673 being current on the CONSULT screen.

Is DTC P0673 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420399

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0673 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 22 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P066E become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
6. Check for DTC P0673 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F116.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F116.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F116 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P066E become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0674 GLOW PLUG (CYLINDER 4)

DTC Description

INFOID:0000000014420400

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0674	CYLINDER 4 GLOW PLUG CIRCUIT (Glow plug heater circuit 4 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0674 being current on the CONSULT screen.

Is DTC P0674 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420401

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0674 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 23 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P067A become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for ENGINE diagnostic trouble codes.
6. Check for DTC P0674 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F132.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7.CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F132.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F132 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P067A become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0675 GLOW PLUG (CYLINDER 5)

DTC Description

INFOID:0000000014420402

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0675	CYLINDER 5 GLOW PLUG CIRCUIT (Glow plug heater circuit 5 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0675 being current on the CONSULT screen.

Is DTC P0675 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420403

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0675 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 24 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P067C become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for ENGINE diagnostic trouble codes.
6. Check for DTC P0675 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F118.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F118.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F118 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P067C become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0676 GLOW PLUG (CYLINDER 6)

DTC Description

INFOID:0000000014420404

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0676	CYLINDER 6 GLOW PLUG CIRCUIT (Glow plug heater circuit 6 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0676 being current on the CONSULT screen.

Is DTC P0676 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420405

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0676 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 25 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P067E become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
6. Check for DTC P0676 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F134.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7.CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F134.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F134 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P067E become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0677 GLOW PLUG (CYLINDER 7)

DTC Description

INFOID:0000000014420406

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0677	CYLINDER 7 GLOW PLUG CIRCUIT (Glow plug heater circuit 7 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P0677 being current on the CONSULT screen.

Is DTC P0677 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420407

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0677 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 28 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P068C become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for ENGINE diagnostic trouble codes.
6. Check for DTC P0677 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F120.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F120.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F120 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P068C become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P0678 GLOW PLUG (CYLINDER 8)

DTC Description

INFOID:0000000014420408

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected an open circuit on this glow plug.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0678	CYLINDER 8 GLOW PLUG CIRCUIT (Glow plug heater circuit 8 low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current < 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P0678 being current on the CONSULT screen.

Is DTC P0678 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420409

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC U0106, U0307, P0383, P0384, P064C, P066A or P066B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0678 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Connect a jumper wire between glow plug heater terminal 29 at the glow plug control module connector F103 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P068E become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK DTC PRIORITY AND VERIFY GLOW PLUG HEATER CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect the glow plug control module to the harness connector F103.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
6. Check for DTC P0678 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 6.
NO >> The removal and installation of the connector corrected the malfunction.

6. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F136.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7.CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F136.
3. Connect a jumper wire between glow plug heater terminal 1 at the glow plug heater connector F136 and ground.
4. Turn ignition switch ON.
5. Connect CONSULT.
6. Wait 30 seconds.
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P068E become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for an open.

P067A CYLINDER 4 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420410

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P067A	(Cylinder 4 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P067A being current on the CONSULT screen.

Is DTC P067A current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420411

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P067A being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0674 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F132.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F132.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0674 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P067B CYLINDER 4 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420412

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P067B	(Cylinder 4 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P067B being current on the CONSULT screen.

Is DTC P067B current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420413

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P067B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0674 become current and P067B become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F132.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P067B become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P067C CYLINDER 5 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420414

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P067C	(Cylinder 5 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P067C being current on the CONSULT screen.

Is DTC P067C current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420415

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P067C being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0675 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F118.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F118.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0675 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P067D CYLINDER 5 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420416

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the Glow Plug Control Module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P067D	(Cylinder 5 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P067D being current on the CONSULT screen.

Is DTC P067D current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420417

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P067D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0675 become current and P067D become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F118.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P067D become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P067E CYLINDER 6 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420418

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P067E	(Cylinder 6 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P067E being current on the CONSULT screen.

Is DTC P067E current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420419

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P067E being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0676 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F134.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F134.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0676 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P067F CYLINDER 6 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420420

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P067F	(Cylinder 6 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P067F being current on the CONSULT screen.

Is DTC P067F current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420421

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P067F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P0676 become current and P067F become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F134.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P067F become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P0687 ECM POWER RELAY CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420422

The ECM relay provides battery voltage to the smart power sensors and actuators. The Engine Control Module (ECM) controls the grounds the coil of the relay at key ON. This will switch on power to the Aftertreatment Temperature sensor modules, aftertreatment DEF controller, aftertreatment DEF quality sensor, inlet and outlet NOx sensors, rotary turbine control valve actuator, fuel pump actuator, fuel pressure relief valve and glow plug module. A DTC is set when the ground wire is shorted to battery.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a short to battery on the ECM relay ground signal.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0687	(ECM/PCM Power Relay Control Circuit High)	Diagnosis condition	Ignition switch is turned ON or engine is running
		Signal (terminal)	(-)
		Threshold	Power supply to a device is > 16V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- IPDM E/R
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0687 being current on the CONSULT screen.

Is DTC P0687 current?

YES >> Go to EC-1496, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420423

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0562 being current on the CONSULT screen.

Is DTC P0562 detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0687 being current on the CONSULT screen.

Is DTC P0687 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ECM RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect IPDM E/R harness connector E121.
3. Inspect the engine harness and IPDM E/R connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the IPDM E/R harness connector E121.
4. Measure the resistance between the ECM harness connector E93 terminal 37 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	37	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the harness for a short.

6. CHECK FOR A SHORT CIRCUIT TO VOLTAGE IN THE HARNESS

Measure the resistance between ECM harness connector E93 terminal 37 and battery positive terminal.

ECM		Battery positive	Resistance
Connector	Terminal		
E93	37	+	> 100k Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the harness for a short to voltage

7. CHECK PAST DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P0687 being past on the CONSULT screen.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the IPDM E/R. Refer to PCS-43, "Removal and Installation of IPDM E/R".

P068C CYLINDER 7 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420424

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the Glow Plug Control Module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P068C	(Cylinder7 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P068C being current on the CONSULT screen.

Is DTC P068C current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420425

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P068C being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0677 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F120.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F120.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0677 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P068D CYLINDER 7 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420426

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P068D	(Cylinder 7 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P068D being current on the CONSULT screen.

Is DTC P068D current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420427

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P068D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0677 become current and P068D become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F120.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P068D become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P068E CYLINDER 8 GLOW PLUG CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420428

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P068E	(Cylinder 8 Glow Plug Control Circuit Low)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Current > 41 A or > 90A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P068E being current on the CONSULT screen.

Is DTC P068E current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420429

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P068E being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0678 become current?

YES >> GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. INSPECT GLOW PLUG AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug from the harness connector F136.
3. Inspect the glow plug connections and harness for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect the glow plug from the harness connector F136.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0678 become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> Repair or replace the glow plug harness for a short to ground.

P068F CYLINDER 8 GLOW PLUG CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420430

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

The Glow Plug Control Module detected that the glow plug circuit was shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P068F	(Cylinder 8 Glow Plug Control Circuit High)	Diagnosis condition	Initial key ON
		Signal (terminal)	(–)
		Threshold	Voltage is > 0.6 and MOFSET is commanded OFF or voltage is < 0.6 and MOFSET is commanded ON
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON for 2 minutes.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P068F being current on the CONSULT screen.

Is DTC P068F current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420431

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0383 or P0384 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE diagnostic trouble codes.
3. Check for DTC P068F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector F103 from the glow plug control module.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch OFF.
2. Disconnect the glow plug harness connector F103 from the glow plug control module.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P0678 become current and P068F become past?

YES >> Repair or replace the glow plug harness for a short to voltage. GO TO 5.
NO >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".

5. CHECK THE GLOW PLUG

1. Turn ignition switch OFF.
2. Connect the glow plug to the harness connector F136.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P068F become current?

YES >> Replace the glow plug. Refer to EM-260, "Removal and Installation".
NO >> The removal and installation of the connector corrected the malfunction.

P0691 COOLING FAN

DTC Description

INFOID:0000000014420432

The fan control circuit is a device used by the engine to control the fan operation. When the Engine Control Module (ECM) energizes the fan control circuit, the engine fan is engaged. The fan control circuit utilizes a Pulse Width Modulated (PWM) signal. A PWM signal is a pulsed voltage signal between 0V and system voltage. The frequency of the pulsed voltage signal is dependent on the application requirement.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fan control circuit Pulse Width Modulated (PWM) signal was not at system voltage when the Pulse Width Modulated (PWM) signal was commanded ON.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0691	RAD. FAN relay1 Short to GND (Fan 1 Control Circuit Low)	Diagnosis condition	Ignition switch is ON
		Signal (terminal)	(–)
		Threshold	Resistance between fan clutch driver and ground < 2 Ω
		Diagnosis delay time	Diagnostic runs when the ignition is ON and when the pulse width modulated (PWM) device is getting energized or de-energized. In some cases, the diagnostics can also run at some fixed intervals.

POSSIBLE CAUSE

- Fan clutch assembly
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0691 being current on the CONSULT screen.

Is DTC P0691 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420433

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0691 being current on the CONSULT screen.

Is DTC P0691 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FAN CLUTCH ASSEMBLY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Inspect the harness connector and fan clutch assembly pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE FAN CLUTCH VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect the fan clutch assembly harness connector F106.
3. Turn ignition switch ON.
4. Measure the voltage between fan clutch assembly harness connector F106 terminal 1 and ground.

Fan clutch assembly		(—)	Voltage (V) (Approx.)
Connector	Terminal		
F106	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace the engine harness for an open circuit.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0692 current?

YES >> Replace fan clutch assembly. Refer to CO-76, "Exploded View".
NO >> GO TO 5.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fan clutch assembly harness connector F106.
4. Measure the resistance between the ECM harness connector F101 terminal 181 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	181	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short to ground.

7. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fan clutch assembly harness connector F106.
4. Measure the resistance between the ECM harness connector terminal 80 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	181	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0691 past?

YES >> The removal and installation of the connector corrected the fault.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0692 COOLING FAN

DTC Description

INFOID:0000000014420434

The fan control circuit is a device used by the engine to control the fan operation. When the Engine Control Module (ECM) energizes the fan control circuit, the engine fan is engaged.The fan control circuit utilizes a Pulse Width Modulated (PWM) signal. A PWM signal is a pulsed voltage signal between 0Vand system voltage. The frequency of the pulsed voltage signal is dependent on the application requirement.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fan control circuit Pulse Width Modulated (PWM) signal voltage was greater then 0V when the PWM signal was commanded OFF.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0692	RAD. FAN relay1 Short to BATT (Fan 1 Control Circuit High)	Diagnosis condition	Ignition switch is ON
		Signal (terminal)	(–)
		Threshold	Resistance between fan clutch driver and ground > 500k Ω
		Diagnosis delay time	Diagnostic runs when the ignition is ON and when the pulse width modulated (PWM) device is getting energized or de-energized. In some cases, the diagnostics can also run at some fixed intervals.

POSSIBLE CAUSE

- Fan clutch assembly
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0692 being current on the CONSULT screen.

Is DTC P0692 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420435

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0692 being current on the CONSULT screen.

Is DTC P0692 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FAN CLUTCH ASSEMBLY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Inspect the harness connector and fan clutch assembly pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Connect a jumper wire between fan clutch assembly harness connector F106 terminal 1 and 6.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P0691 current?

YES >> Replace fan clutch assembly. Refer to CO-76, "Exploded View".
NO >> GO TO 4.

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fan clutch assembly harness connector F106.
4. Measure the resistance between the ECM harness connector F101 terminal 181 and the fan clutch assembly harness connector F106 terminal 6.

ECM		Fan clutch assembly		Resistance
Connector	Terminal	Connector	Terminal	
F101	181	F106	6	< 10 Ω

Is resistance less than 10 ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for an open.

6. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the fan clutch assembly harness connector F106.
4. Measure the resistance between the ECM harness connector terminal 181 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	181	F101	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short.

7. CHECK FOR PAST DTC

1. Connect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0692 past?

YES >> The removal and installation of the connector corrected the fault.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P0698 SENSOR REFERENCE VOLTAGE C CIRCUIT LOW

DTC Description

INFOID:0000000014420436

The Engine Control Module (ECM) provides a dedicated 5 volt supply and ground to the crankshaft position sensor. The ECM monitors the voltage level on the Crankshaft position sensor +5V supply circuit. If the voltage falls below a calibrated limit, this DTC is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the sensor supply 3 signal voltage was less than a 4.8V for more than 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0698	(Sensor Reference Voltage “C” Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 3 voltage < 4.644V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Crankshaft position sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0698 being current on the CONSULT screen.

Is DTC P0698 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420437

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0698 being current on the CONSULT screen.

Is DTC P0698 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT CRANKSHAFT POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect crankshaft position sensor harness connector F110.
3. Inspect the harness connector and crankshaft position sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect crankshaft position sensor harness connector F110.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0698 current?

YES >> GO TO 4.
NO >> Replace crankshaft position sensor. Refer to EM-344, "Removal and Installation".

4.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0698 current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace the engine harness.

P0699 SENSOR REFERENCE VOLTAGE C CIRCUIT HIGH

DTC Description

INFOID:0000000014420438

The Engine Control Module (ECM) provides a dedicated 5 volt supply and ground to the Crankshaft position sensor. The ECM monitors the voltage level on the Crankshaft position sensor +5V supply circuit. If the voltage falls below a calibrated limit, this fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the sensor supply 3 signal voltage was greater than a 5.4-VDC for more than 1second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0699	(Sensor Reference Voltage “C” Circuit High)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 3 voltage > 5.356V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0699 being current on the CONSULT screen.

Is DTC P0699 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420439

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0699 being current on the CONSULT screen.

Is DTC P0699 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0699 current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace the engine harness for a short

P06A4 SENSOR REFERENCE VOLTAGE D CIRCUIT LOW

DTC Description

INFOID:0000000014420440

The Engine Control Module (ECM) provides a dedicated 5V supply and ground to the primary pedal position sensor. The ECM monitors the voltage level on the sensor +5V supply circuit.If the voltage falls below or above a calibrated limit, this fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected this sensor supply voltage was less than 4.7V for 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06A4	(Sensor Reference Voltage “D” Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 4 voltage < 4.644V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Accelerator pedal position sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06A4 being current on the CONSULT screen.

Is DTC P06A4 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420441

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06A4 being current on the CONSULT screen.

Is DTC P06A4 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ACCELERATOR PEDAL POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect accelerator pedal position sensor harness connector E20.
3. Inspect the harness connector and accelerator pedal position sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect accelerator pedal position sensor harness connector E20.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P06A4 DTC current?

YES >> GO TO 4.
NO >> Replace accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the accelerator pedal position sensor harness connector E20.
4. Measure the resistance between the ECM harness connector terminal 80 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	80	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the accelerator pedal position sensor harness connector E20.
4. Measure the resistance between the ECM harness connector E93 terminal 80 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	80	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the engine harness for a short to ground.

7.CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor harness connector E20.
3. Turn ignition switch ON.
4. Measure the voltage between accelerator pedal position sensor harness connector E20 terminals 2 and 4.

Accelerator pedal position sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
E20	2	4	4.6

Is voltage below 4.6V?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P06A5 SENSOR REFERENCE VOLTAGE D CIRCUIT HIGH

DTC Description

INFOID:0000000014420442

The engine control module (ECM) provides a dedicated 5V supply and ground to the primary pedal position sensor. The ECM monitors the voltage level on the sensor +5V supply circuit.If the voltage falls below or above a calibrated limit, this fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected this sensor supply voltage was greater than 5.3V for 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06A5	(Sensor Reference Voltage “D” Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 4 voltage > 5.356V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06A5 being current on the CONSULT screen.

Is DTC P06A5 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420443

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06A5 being current on the CONSULT screen.

Is DTC P06A5 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connectors E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93 and F101.
3. Disconnect the all components connected to sensor supply 4.
4. Measure the resistance between the ECM harness connector terminal 80 and all other terminals in the ECM harness connector E93 and F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	80	E93	All	> 100k Ω
		F101		

Is resistance greater than 100k ohms?

YES >> GO TO 4.
NO >> Repair or replace the engine harness for a short.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor harness connector E20.
3. Turn ignition switch ON.
4. Measure the voltage between accelerator pedal position sensor harness connector E20 terminals 2 and 4.

Accelerator pedal position sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
E20	2	4	5.63

Is voltage greater than 5.63V?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Inspection End.

P06B8 ECM

DTC Description

INFOID:0000000014420444

The Engine Control Module (ECM) is the brains for engine operation. It interprets signals from sensors to determine actuator positions and fueling control. The ECM gather and maintain data in its internal memory. The ECM receives constant voltage from the batteries through unswitched battery connections. It also receives switched battery input through the vehicle key switch wire when the vehicle is turned ON.
The ECM has internal diagnostics that continuously run and check the internal memory.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a software or calibration error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06B8	EEPROM DIAGNOSIS STORAGE AREA DATA ABNORMALITY (Internal Control Module Non-Volatile Random Access Memory (NVRAM) Error)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	Data in flash memory does not match its image in RAM on 10 separate occurrences
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

ECM software

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06B8 being current on the CONSULT screen.

Is DTC P06B8 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420445

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0606 being current on the CONSULT screen.

Is DTC P0606 detected as current?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P06B9 CYLINDER 1 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420446

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06B9	Cylinder 1 Glow Plug Circuit Range/ Performance (Engine Glow Plug 1 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 1 signal (18)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06B9 being current on the CONSULT screen.

Is DTC P06B9 current?

YES >> Go to EC-1523, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420447

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066A, P066B or P0671 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06B9 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK GLOW PLUG NO. 1

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	18	—	< 1.5 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 5.

5. CHECK GLOW PLUG NO. 1 CIRCUIT

1. Disconnect glow plug no. 1 connector F114.
2. Check resistance between glow plug no. 1 terminal 1 and ground.

Glow plug no. 1 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> Repair or replace the glow plug harness for an open.
NO >> Replace glow plug no. 1. Refer to EM-260, "Removal and Installation".

P06BA CYLINDER 2 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420448

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06BA	Cylinder 2 Glow Plug Circuit Range/ Performance (Engine Glow Plug 2 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 2 signal (19)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06BA being current on the CONSULT screen.

Is DTC P06BA current?

YES >> Go to EC-1525, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420449

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066C, P066D or P0672 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06BA being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK GLOW PLUG NO. 2

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	19	—	< 1.5 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 5.

5.CHECK GLOW PLUG NO. 2 CIRCUIT

1. Disconnect glow plug no. 2 connector F130.
2. Check resistance between glow plug no. 2 terminal 1 and ground.

Glow plug no. 2 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> Repair or replace the glow plug harness for an open.
NO >> Replace glow plug no. 2. Refer to EM-260, "Removal and Installation".

P06BB CYLINDER 3 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420450

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06BB	Cylinder 3 Glow Plug Circuit Range/ Performance (Engine Glow Plug 3 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 3 signal (22)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06BB being current on the CONSULT screen.

Is DTC P06BB current?

YES >> Go to EC-1527, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420451

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P066E, P066F or P0673 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06BB being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK GLOW PLUG NO. 3

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	22	—	< 1.5 Ω

Is the inspection result normal?

YES >> • A malfunctioning glow plug control module has been detected. Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
• GO TO 6.
NO >> GO TO 5.

5.CHECK GLOW PLUG NO. 3 CIRCUIT

1. Disconnect glow plug no. 3 connector F116.
2. Check resistance between glow plug no. 3 terminal 1 and engine block.

Glow plug no. 3 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> • Repair or replace the glow plug harness for an open.
• GO TO 6.
NO >> • Replace glow plug no. 3. Refer to EM-260, "Removal and Installation".
• GO TO 6.

6.ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P06BB DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1527, "DTC Description".
NO >> Repair complete.

P06BC CYLINDER 4 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420452

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06BC	Cylinder 4 Glow Plug Circuit Range/ Performance (Engine Glow Plug 4 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 4 signal (23)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06BC being current on the CONSULT screen.

Is DTC P06BC current?

YES >> Go to EC-1530, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420453

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P0674, P067A or P067B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P06BC being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK GLOW PLUG NO. 4

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	23	—	< 1.5 Ω

Is the inspection result normal?

YES >> • A malfunctioning glow plug control module has been detected. Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
• GO TO 6.
NO >> GO TO 5.

5. CHECK GLOW PLUG NO. 4 CIRCUIT

1. Disconnect glow plug no. 4 connector F132.
2. Check resistance between glow plug no. 4 terminal 1 and ground.

Glow plug no. 4 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> • Repair or replace the glow plug harness for an open.
• GO TO 6.
NO >> • Replace glow plug no. 4. Refer to EM-260, "Removal and Installation".
• GO TO 6.

6. ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P06BC DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1530, "DTC Description".
NO >> Repair complete.

P06BD CYLINDER 5 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420454

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06BD	Cylinder 5 Glow Plug Circuit Range/ Performance (Engine Glow Plug 5 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 5 signal (24)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06BD being current on the CONSULT screen.

Is DTC P06BD current?

YES >> Go to EC-1533, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420455

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0675, P067C or P067D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06BD being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK GLOW PLUG NO. 5

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	24	—	< 1.5 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 5.

5.CHECK GLOW PLUG NO. 5 CIRCUIT

1. Disconnect glow plug no. 5 connector F118.
2. Check resistance between glow plug no. 5 terminal 1 and ground.

Glow plug no. 5 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> Repair or replace the glow plug harness for an open.
NO >> Replace glow plug no. 5. Refer to EM-260, "Removal and Installation".

P06BE CYLINDER 6 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420456

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06BE	Cylinder 6 Glow Plug Circuit Range/ Performance (Engine Glow Plug 6 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 6 signal (25)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06BE being current on the CONSULT screen.

Is DTC P06BE current?

YES >> Go to EC-1535, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420457

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0676, P067E or P067F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06BE being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK GLOW PLUG NO. 6

1. Turn ignition switch OFF.
2. Disconnect glow plug .
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	25	—	< 1.5 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 5.

5. CHECK GLOW PLUG NO. 6 CIRCUIT

1. Disconnect glow plug no. 6 connector F134.
2. Check resistance between glow plug no. 6 terminal 1 and ground.

Glow plug no. 6 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> Repair or replace the glow plug harness for an open.
NO >> Replace glow plug no. 6. Refer to EM-260, "Removal and Installation".

P06BF CYLINDER 7 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420458

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06BF	Cylinder 7 Glow Plug Circuit Range/ Performance (Engine Glow Plug 7 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 7 signal (28)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06BF being current on the CONSULT screen.

Is DTC P06BF current?

YES >> Go to EC-1537, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420459

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0677, P068C or P068D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06BF being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK GLOW PLUG NO. 7

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	28	—	< 1.5 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 5.

5.CHECK GLOW PLUG NO. 7 CIRCUIT

1. Disconnect glow plug no. 7 connector F120.
2. Check resistance between glow plug no. 7 terminal 1 and ground.

Glow plug no. 7 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> Repair or replace the glow plug harness for an open.
NO >> Replace glow plug no. 7. Reefer to EM-260, "Removal and Installation".

P06C0 CYLINDER 8 GLOW PLUG CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420460

Glow plugs provide rapid heating of the air inside the cylinder to aid in starting the engine during cold ambient conditions. The ceramic glow plug heating element extends into the combustion chamber area where the fuel will be injected. The voltage supplied through the glow plug control module is grounded through the cylinder head. When the glow plug control module commands the glow plugs to activate, the Wait to Start Lamp will be commanded by the ECM to turn ON. Allowing the Wait to Start Lamp to shut off before cranking the engine will ensure that the optimum conditions for starting are present in the cylinder.

DTC DETECTION LOGIC

This fault code sets when the glow plug is outside of the acceptable range of resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06C0	Cylinder 8 Glow Plug Circuit Range/ Performance (Engine Glow Plug 8 - Data Erratic, Intermittent or Incorrect)	Diagnosis condition	Initial Key ON
		Signal (terminal)	Glow plug 8 signal (29)
		Threshold	Current > 1.374 A
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow Plug Control Module
- Glow plug
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Bring the vehicle to a complete stop.
7. Repeat all of the above steps three more times.
8. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
9. Check for DTC P06C0 being current on the CONSULT screen.

Is DTC P06C0 current?

YES >> Go to EC-1539, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420461

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0678, P068E or P068F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06C0 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK GLOW PLUG NO. 8

1. Turn ignition switch OFF.
2. Disconnect glow plug control module connector F103.
3. Check resistance between glow plug control module connector F103 and ground.

Glow plug control module		Ground	Resistance
Connector	Terminal		
F103	29	—	< 1.5 Ω

Is the inspection result normal?

YES >> Replace glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> GO TO 5.

5. CHECK GLOW PLUG NO. 8 CIRCUIT

1. Disconnect glow plug no. 8 connector F136.
2. Check resistance between glow plug no. 8 terminal 1 and ground.

Glow plug no. 8 terminal	Ground	Resistance
1	—	< 1.0 Ω

Is the inspection result normal?

YES >> Repair or replace the glow plug harness for an open.
NO >> Replace glow plug no. 8. Refer to EM-260, "Removal and Installation".

P06D3 SENSOR REFERENCE VOLTAGE E CIRCUIT LOW

DTC Description

INFOID:0000000014420462

The Engine Control Module (ECM) provides a dedicated 5 volt supply and ground to the secondary pedal position sensor, refrigerant pressure sensor, and the Fan control assembly. The ECM monitors the voltage level on the sensor +5V supply circuit. If the voltage falls below or above a calibrated limit, this fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected this sensor supply voltage was less than 4.7V for 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06D3	(Sensor Reference Voltage “E” Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 5 voltage < 4.644V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- Accelerator pedal position sensor
- Fan clutch assembly
- Refrigerant pressure sensor
- Coolant level sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D3 being current on the CONSULT screen.

Is DTC P06D3 current?

YES >> Go to EC-1541, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420463

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D3 being current on the CONSULT screen.

Is DTC P06D3 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect accelerator pedal position sensor harness connector E20.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P06D3 current?

YES >> GO TO 3.
NO >> Replace accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect fan clutch assembly harness connector F106.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P0652 current?

YES >> GO TO 4.
NO >> Replace fan clutch assembly. Refer to CO-49, "Exploded View".

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect refrigerant pressure sensor harness connector E88.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P06D3 current?

YES >> GO TO 5.
NO >> Replace refrigerant pressure sensor. Refer to HAC-127, "Removal and Installation".

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect coolant level sensor harness connector E91.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P06D3 current?

YES >> GO TO 6.
NO >> Replace coolant level sensor. Refer to CO-52, "Exploded View".

6.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the accelerator pedal position sensor harness connector E20.
4. Disconnect the refrigerant pressure sensor harness connector E88.
5. Disconnect the fan clutch assembly harness connector F106.
6. Measure the resistance between the ECM harness connector terminal 81 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	81	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the accelerator pedal position sensor harness connector E20.
4. Disconnect the refrigerant pressure sensor harness connector E88.
5. Disconnect the fan clutch assembly harness connector F106.
6. Measure the resistance between the ECM harness connector E93 terminal 81 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	81	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 9.
NO >> Repair or replace the harness for a short to ground.

9. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase “ENGINE” diagnostic trouble codes.
4. Perform “DTC CONFIRMATION PROCEDURE”.

Is DTC P06D3 current?

YES >> GO TO 2.
NO >> Repair complete.

P06D4 SENSOR REFERENCE VOLTAGE E CIRCUIT HIGH

DTC Description

INFOID:0000000014420464

The engine control module (ECM) provides a dedicated 5V supply and ground to the secondary pedal position sensor, refrigerant pressure sensor, and the Fan control assembly. The ECM monitors the voltage level on the sensor +5V supply circuit. If the voltage falls below or above a calibrated limit, this fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected this sensor supply voltage was greater than 5.3V for 1 second

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06D4	(Sensor Reference Voltage “E” Circuit High)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 5 voltage > 5.356V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D4 being current on the CONSULT screen.

Is DTC P06D4 current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420465

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D4 being current on the CONSULT screen.

Is DTC P06D4 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the accelerator pedal position sensor harness connector E20.
4. Disconnect the coolant level sensor harness connector E91.
5. Disconnect the refrigerant pressure sensor harness connector E88.
6. Disconnect the fan clutch assembly harness connector F106.
7. Measure the resistance between the ECM harness connector terminal 81 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	81	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 4.
NO >> Repair or replace the engine harness for a short.

4. CHECK FOR A PIN-TO-VOLTAGE SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the accelerator pedal position sensor harness connector E20.
4. Disconnect the coolant level sensor harness connector E91.
5. Disconnect the refrigerant pressure sensor harness connector E88.
6. Disconnect the fan clutch assembly harness connector F106.
7. Measure the resistance between the ECM harness connector E93 terminal 81 and terminals 3, 5, 6, 65 and 83.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	81	E93	3	> 100k Ω
			5	
			6	
			65	
			83	

Is resistance greater than 100k ohms?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace the engine harness for a short to voltage.

P06D7 SENSOR REFERENCE VOLTAGE F CIRCUIT LOW

DTC Description

INFOID:0000000014420466

The engine control module (ECM) provides a dedicated 5V supply and ground to the Diesel Particulate Filter Differential Pressure sensor. The ECM monitors the voltage level on the DPF Differential (or Delta) Pressure sensor +5V supply circuit. If the voltage falls below or above a calibrated limit, a fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected this sensor supply voltage was less than 4.7V for 1 second.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06D7	(Sensor Reference Voltage “F” Circuit Low)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 6 voltage < 4.644V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- DPF differential pressure sensor
- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P06D7 being current on the CONSULT screen.

Is DTC P06D7 current?

YES >> Go to EC-1546, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420467

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D7 being current on the CONSULT screen.

Is DTC P06D7 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DPF DIFFERENTIAL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DPF differential pressure sensor harness connector C28.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage

- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect DPF differential pressure sensor harness connector C28.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is DTC P06D7 current?

YES >> GO TO 4.
NO >> Replace DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".

4. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Measure the resistance between the ECM harness connector terminal 32 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	32	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 6.
NO >> Repair or replace the engine harness for a short.

6. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Measure the resistance between the ECM harness connector E93 terminal 32 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	32	—	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 7.
NO >> Repair or replace the harness for a short to ground.

7.ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase “ENGINE” diagnostic trouble codes.
4. Perform DTC CONFIRMATION PROCEDURE.

Is DTC P06D7 current?

YES >> GO TO 2.
NO >> Inspection End.

P06D8 SENSOR REFERENCE VOLTAGE F CIRCUIT HIGH

DTC Description

INFOID:0000000014420468

The engine control module (ECM) provides a dedicated 5V supply and ground to the secondary pedal position sensor, refrigerant pressure sensor, and the Fan control assembly. The ECM monitors the voltage level on the sensor +5V supply circuit. If the voltage falls below or above a calibrated limit, this fault is recorded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected this sensor supply voltage was greater than 5.3V for 1 second

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06D8	(Sensor Reference Voltage “F” Circuit High)	Diagnosis condition	Ignition switch is ON or engine running
		Signal (terminal)	(–)
		Threshold	Sensor supply 6 voltage > 5.356V
		Diagnosis delay time	Diagnostic runs continuously when the ignition is ON or engine is running

POSSIBLE CAUSE

- ECM
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D8 being current on the CONSULT screen.

Is DTC P06D8 current?

YES >> Go to EC-1549, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420469

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06D8 being current on the CONSULT screen.

Is DTC P06D8 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the DPF differential pressure sensor harness connector C28.
4. Measure the resistance between the ECM harness connector E93 terminal 32 and all other terminals in the ECM harness connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	32	E93	All	> 100k Ω

Is resistance greater than 100k ohms?

YES >> GO TO 4.
NO >> Repair or replace the engine harness for a short.

4. CHECK FOR A PIN-TO-VOLTAGE SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector E93.
3. Disconnect the DPF differential pressure sensor harness connector C28.
4. Measure the resistance between the ECM harness connector E93 terminal 32 and terminals 3, 5, 6, 65 and 83.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	32	E93	3	> 100k Ω
			5	
			6	
			65	
			83	

Is resistance greater than 100k ohms?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace the engine harness for a short to voltage.

P06E5 GLOW PLUG CONTROL MODULE PERFORMANCE

DTC Description

INFOID:0000000014420470

The glow plug control module controls the timing and intensity of the glow plug outputs on the engine using data provided by the ECM through the CAN 2 communication lines. The glow plug control module will not activate the glow plugs if the glow plug module reads a temperature greater than a calibrated amount. The glow plug control module receives fused power directly from the battery, and switched power through the smart power relay.

DTC DETECTION LOGIC

The glow plug control module reported an internal error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P06E5	(Glow Plug Control Module - Root Cause Not Known)	Diagnosis condition	Ignition is ON or engine is running.
		Signal (terminal)	(-)
		Threshold	The glow plug control modules diagnostics on glow plug 1 circuit detect the following: • Voltage out of range low, shorted to ground resulting in too high of a current • Voltage out of range high, shorted to battery, or an internal GPCM MOFSET error • Current out of range low resulting from an open circuit that has not completed
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Glow plug control module not receiving power from battery supply circuit
- Open in harness, fuse, connector, or low voltage supplied by the battery
- Glow plug control module malfunction

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P06E5 being current on the CONSULT screen.

Is DTC P06E5 current?

YES >> Go to EC-1551, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420471

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for sensor supply DTC U0106 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-918, "DTC Description".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P06E5 being current on the CONSULT screen.

Is DTC P06E5 detected as current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT GLOW PLUG CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the glow plug control module from engine harness connector.
3. Inspect the glow plug control module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 7.

4. CHECK THE VOLTAGE TO THE GLOW PLUG CONTROL MODULE

1. Turn ignition switch ON.
2. Check the voltage between the glow plug control module ignition voltage supply circuit and ground circuit.

NOTE:
Check the voltage while cranking the engine, and with the engine at idle.

Glow plug control module			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F102	7	6	Battery voltage

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK THE VOLTAGE TO THE GLOW PLUG CONTROL MODULE

Check the voltage between the glow plug control module ignition voltage supply circuit and engine block.

NOTE:
Check the voltage while cranking the engine, and with the engine at idle.

Glow plug control module			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F102	7	Engine block	Battery voltage

Is the inspection result normal?

YES >> • A malfunction has been detected in the ground supply circuit. Repair or replace engine harness as necessary.
• GO TO 7.
NO >> • A malfunction has been detected in the ignition supply circuit. Repair or replace engine harness as necessary.
• GO TO 7.

6. CHECK FOR DTCS

1. Turn ignition switch OFF.
2. Reconnect the glow plug control module connector.
3. Turn ignition switch ON.
4. Turn ignition switch OFF, and wait 5 seconds.

5. Start the engine and let it idle for 1 minute.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P064C DTC become ″Current″?

YES >> • A malfunctioning glow plug control module has been detected. Replace the glow plug control module. Refer to EC-1996, "Removal and Installation".
• GO TO 7.

NO >> • The removal and installation of the connector corrected the malfunction.
• GO TO 7.

7.ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P06E5 DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1551, "DTC Description".
NO >> Repair complete.

P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

DTC Description

INFOID:0000000014420472

The Transmission Control Module (TCM) communicates to the engine Electronic Control Module (ECM) through the CAN data link. Messages sent from the Transmission Control Module are received and monitored by the ECM. If there is a transmission fault, the TCM will notify the to illuminate the MIL.

DTC DETECTION LOGIC

The Transmission Control Module (TCM) detected an issue and reported to the Engine Control Module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0700	TCM [Transmission Control System (MIL Request)]	Diagnosis condition	Ignition is ON or engine is running
		Signal (terminal)	(-)
		Threshold	OBD MIL requested
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Transmission control module

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0700 being current on the CONSULT screen.

Is DTC P0700 current?

YES >> Go to EC-1554, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420473

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P0700 being current on the CONSULT screen.

Is DTC P0700 detected as current?

YES >> Refer to TM-88, "Work Flow".
NO >> Refer to GI-47, "Intermittent Incident".

P0A0F THE ENGINE DOES NOT START

DTC Description

INFOID:0000000014420474

The crankshaft position and camshaft position sensors are Hall effect type sensors. The Engine Control Module (ECM) provides a 5V supply to the position sensor and a return circuit. As the teeth on the crankshaft speed ring or the dimples in the back of the camshaft gear move past the position sensor, a signal is generated on the position sensor signal circuit. The ECM interprets this signal and converts it to an engine speed. A missing tooth on the crankshaft gear is used by the ECM to determine the position of the engine.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the crankshaft position does not match the camshaft position signal input to the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P0A0F	ENGINE FAILED TO START (Engine Failed to Start)	Diagnosis condition	Engine cranking
		Signal (terminal)	(–)
		Threshold	Engine synchronization time > 5 seconds
		Diagnosis delay time	Diagnostic runs continuously when engine is running

POSSIBLE CAUSE

- Camshaft position sensor
- Crankshaft position sensor
- Tone wheel
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P0A0F being current on the CONSULT screen.

Is DTC P0A0F current?

YES >> Go to EC-1555, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420475

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any other DTCs displayed as current on the CONSULT screen.

Is DTC P0A0F only current DTC detected?

YES >> GO TO 2.
NO >> Refer to EC-838, "DTC Index".

2.INSPECT CAMSHAFT POSITION SENSOR

1. Turn ignition switch OFF.
2. Inspect camshaft position sensor for damage or misalignment.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Realign or replace camshaft position sensor. Refer to EM-323, "Removal and Installation".

3.INSPECT CRANKSHAFT POSITION SENSOR

1. Turn ignition switch OFF.
2. Inspect crankshaft position sensor for damage or misalignment.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Realign or replace crankshaft position sensor. Refer to EM-344, "Removal and Installation".

4. INSPECT CRANKSHAFT TONE WHEEL

1. Turn ignition switch OFF.
2. Inspect crankshaft tone wheel for damage.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft tone wheel. Refer to EM-388, "Removal and Installation".

5. CHECK THE CRANKSHAFT SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the crankshaft position sensor harness connector F110.
3. Turn ignition switch ON.
4. Measure the voltage between crankshaft position sensor harness connector F110 terminals 1 and 2.

Crankshaft position sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
F110	1	2	4.75-5.25

Is inspection result normal?

YES >> GO TO 10.
NO >> GO TO 6.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts

7. CHECK FOR AN OPEN CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the crankshaft position sensor harness connector F110.
4. Measure the resistance between the ECM harness connector F101 terminal 189 and the crankshaft position sensor harness connector F110 terminal 3.

ECM		Camshaft position sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	189	F110	3	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.

NO >> Repair or replace the harness for an open.

8. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the crankshaft position sensor harness connector F110.
4. Measure the resistance between the ECM harness connector F101 terminal 189 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	189	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the harness for a short.

9. VERIFY CRANKSHAFT POSITION SENSOR AIR GAP

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect crankshaft position sensor harness connector F110.
4. Remove crankshaft position sensor.
5. Measure crankshaft position sensor air gap at several points in the crankshaft's revolution. Refer to EC-1279, "Component Inspection".

Is the inspection result normal?

YES >> Replace the crankshaft position sensor. Refer to EM-344, "Removal and Installation".
NO >> Replace or shim the sensor if the air gap is out of specification.

10. CHECK THE CAMSHAFT SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the camshaft position sensor harness connector F109.
3. Turn ignition switch ON.
4. Measure the voltage between camshaft position sensor harness connector F109 terminals 1 and 2.

Camshaft position sensor			Voltage (V) (Approx.)
Connector	Terminal	Terminal	
F109	1	2	4.75-5.25

Is inspection result normal?

YES >> GO TO 15.
NO >> GO TO 11.

11. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 12.

NO >> Repair or replace error-detected parts.

12. CHECK FOR AN OPEN CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the camshaft position sensor harness connector F109.
4. Measure the resistance between the ECM harness connector F101 terminal 168 and the camshaft position sensor harness connector F109 terminal 3.

ECM		Camshaft position sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	168	F109	3	< 10 Ω

Is the inspection result normal?

YES >> GO TO 13.
NO >> Repair or replace the harness for an open.

13. CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the camshaft position sensor harness connector F109.
4. Measure the resistance between the ECM harness connector F101 terminal 168 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	168	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 14.
NO >> Repair or replace the harness for a short.

14. VERIFY CAMSHAFT POSITION SENSOR AIR GAP

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect camshaft position sensor harness connector F109.
4. Remove camshaft position sensor.
5. Measure camshaft position sensor air gap at several points in the camshaft's revolution. Refer to EC-1279, "Component Inspection".

Is the inspection result normal?

YES >> Replace the camshaft position sensor. Refer to EM-323, "Removal and Installation".
NO >> Replace or shim the sensor if the air gap is out of specification.

15. ERASE DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT erase "ENGINE" diagnostic trouble codes.
4. Perform "DTC CONFIRMATION PROCEDURE".

Is P0A0F DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and check again.
NO >> Inspection End.

P1191 TC INLET AIR TEMPERATURE SENSOR PERFORMANCE

DTC Description

INFOID:0000000014420476

The turbocharger compressor intake temperature sensor is a variable resistor sensor and is used to measure the temperature of the air entering the compressor intake of the turbocharger.The Engine Control Module (ECM) supplies 5V to the compressor intake temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the air temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Compressor Intake Temperature reading was higher or lower than other temperature sensors after 8 hours (engine off), or the sensor reading is erratic when engine running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1191	(Inlet Air Temperature Sensor Performance/Rationality)	1	Diagnosis condition	Engine running 2 minutes or more
			Signal (terminal)	(–)
			Threshold	Cumulative sum of error in 150 seconds is > 1,500°C, which is ≥ 2°C. Where tolerance is defined as 68.5°C.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	• 8 hour cold soak • Engine running.
			Signal (terminal)	(–)
			Threshold	Turbocharger compressor intake pressure/temperature sensor is 40°C > the tolerance of the second most accurate sensor of the remaining sensors
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

NOTE:

If the DTC does not go past, it may be necessary to perform an 8 hour cold soak with the ignition switch OFF.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1191 being current on the CONSULT screen.

Is DTC P1191 current?

YES >> Go to EC-1560, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420477

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1191 being current on the CONSULT screen.

Is DTC P1191 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P1192
- P1193

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1193 DTC become current?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminal 3 and 4.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1192 DTC become current?

YES >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".

NO >> GO TO 6.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1193 DTC become current?

YES >> GO TO 8.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 109 and 127.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1192 DTC become current?

YES >> Repair or replace engine harness.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P1192 TC INLET AIR TEMPERATURE SENSOR LOW

DTC Description

INFOID:0000000014420478

The turbocharger compressor intake temperature sensor is a variable resistor sensor and is used to measure the temperature of the air entering the compressor intake of the turbocharger. The Engine Control Module (ECM) supplies 5V to the compressor intake temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the air temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the compressor intake temperature signal voltage was less than 0.1V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1192	(Inlet Air Temperature Sensor Low)	Diagnosis condition	Engine running
		Signal (terminal)	(–)
		Threshold	Compressor air inlet temperature sensor voltage < 0.096V (> 120°C)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P1192 being current on the CONSULT screen.

Is DTC P1192 current?

YES >> Go to EC-1562, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420479

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1192 being current on the CONSULT screen.

Is DTC P1192 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P1193 DTC become current and P1192 become past?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1192 DTC become current?

YES >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P1193 become current and P1192 become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the turbocharger compressor intake pressure/temperature sensor harness connector F105.

4. Measure the resistance between the ECM harness connector terminal 109 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	109	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for a short.

8. CHECK FOR A PIN-TO-GROUND SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the turbocharger compressor intake pressure/temperature sensor harness connector F140.
4. Measure the resistance between the ECM harness connector F101 terminal 109 and ground.

ECM		Ground	Resistance
Connector	Terminal		
F101	109	—	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short to ground.

9. CHECK FOR PAST DTC

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1192 DTC become current?

YES >> Troubleshooting procedures need to be repeated from the beginning. A DTC mode should have been be detected.
NO >> The removal and installation of the connector corrected the issue.

P1193 TC INLET AIR TEMPERATURE SENSOR HIGH

DTC Description

INFOID:0000000014420480

The compressor intake air temperature sensor is a variable resistor sensor and is used to measure the temperature of the air entering the compressor intake of the turbocharger. The Engine Control Module (ECM) supplies 5V to the compressor intake temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the air temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the compressor intake temperature signal voltage was greater than 4.7V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1193	(Inlet Air Temperature Sensor High)	Diagnosis condition	Ignition switch ON or engine running.
		Signal (terminal)	(-)
		Threshold	Compressor inlet temperature sensor value > 4.737V (< -40°C)
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P1193 being current on the CONSULT screen.

Is DTC P1193 current?

YES >> Go to EC-1565, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420481

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1193 being current on the CONSULT screen.

Is DTC P1193 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector

- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Connect a jumper wire between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminal 3 and 4.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P1192 become current and P1193 become past?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P1193 current?

YES >> Replace the turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

5.INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 109 and 127.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P1192 become current and P1193 become past?

YES >> GO TO 7.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

7.CHECK FOR AN OPEN CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the turbocharger compressor intake pressure/temperature sensor harness connector F105.
4. Measure the resistance between the ECM harness connector and the turbocharger compressor intake pressure/temperature sensor harness connector.

ECM		Turbocharger compressor intake pressure/temperature sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	127	F105	4	< 10 Ω
	109		3	

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the engine harness for an open.

8.CHECK FOR A PIN-TO-PIN SHORT CIRCUIT IN THE ENGINE HARNESS

1. Turn ignition switch OFF.
2. Disconnect the ECM harness connector F101.
3. Disconnect the turbocharger compressor intake pressure/temperature sensor harness connector F105.
4. Measure the resistance between the ECM harness connector terminal 109 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	109	F101	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the engine harness for a short.

9.CHECK PAST DTC

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1193 DTC become past?

YES >> The removal and installation of the connector corrected the fault.
NO >> Troubleshooting procedures need to be repeated from the beginning. A DTC mode should have been be detected.

P1451 DIESEL PARTICULATE FILTER SYSTEM PERFORMANCE

DTC Description

INFOID:0000000014420482

The engine aftertreatment system monitors the soot load in the aftertreatment diesel particulate filter. Under normal operating conditions, the aftertreatment diesel particulate filter is self cleaning, where soot is converted to carbon dioxide, nitrogen, and water. Under light load operating conditions, it can be necessary to perform a stationary regeneration of the aftertreatment diesel particulate filter. The soot load in the aftertreatment diesel particulate filter is estimated using the aftertreatment differential pressure sensor and the calculated soot output of the engine.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the soot load of the aftertreatment diesel particulate filter reached the first stage of plugging.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1451	(Diesel Particulate Filter System Performance)	Diagnosis condition	Engine is running
		Signal (terminal)	(-)
		Threshold	Soot load estimate > 7 g/l
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Engine has been operating in light load operating conditions that prevent exhaust temperatures from being high enough to regenerate the aftertreatment diesel particulate filter
- Engine damage that causes excessive black smoke to be generated

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Perform the aftertreatment stationary regeneration procedure.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1451 being current on the CONSULT screen.

Is DTC P1451 current?

YES >> Go to EC-1568, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420483

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any other DTCs displayed as current on the CONSULT screen.

Is DTC P1451 only current DTC detected?

YES >> GO TO 2.
NO >> Refer to EC-838, "DTC Index".

2.PERFORM STATIONARY REGENERATION PROCEDURE

1. Turn ignition switch ON.
2. Start the engine and allow it to idle.
3. Perform the aftertreatment stationary regeneration procedure.
4. Using CONSULT, perform the aftertreatment diesel particulate filter regeneration test. Refer to EX-21, "Aftertreatment DPF Regeneration Test".
   NOTE:
   If current DTCs occur during the regeneration test, abort the test and troubleshoot the current DTCs.

Is DTC P1451 detected as current?

YES >> Check for DTCs that have become current during the regeneration event. Refer to EC-838, "DTC Index".

NO >> Inspection End.

P1484 CATALYST OVERHEAT DETECTION

DTC Description

INFOID:0000000014420484

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The DPF intake temperature sensor reading was greater than 650°C (1202°F) for 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1484	Catalyst Overheat Detection (Aftertreatment 1 diesel particulate filter intake temperature - data valid but below above operating range - least severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	DPF inlet temperature > 650°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	DPF inlet temperature > 800°C or DPF inlet temperature - DOC inlet temperature > 540°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Excessive engine oil or diesel fuel being introduced into the exhaust system from the engine
- A damaged engine fuel injector causing unburned diesel fuel to enter the exhaust system
- A face plugged aftertreatment diesel oxidation catalyst

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1484 being current on the CONSULT screen.

Is DTC P1484 current?

YES >> Go to EC-1570, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420485

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTCs U1611, P1613, P1614 or P1623 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.PERFORM ACTIVE TEST

1. Start the engine and run at low idle.
2. Perform the cylinder cutout “Active Test” using CONSULT.

Was engine misfire detected?

YES >> Determine the cause of misfire. Replace the injector, if necessary. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 3.

3.CHECK TURBOCHARGER OUTLET

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Inspect the turbocharger outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Is there engine oil or fuel contamination in the turbocharger exhaust outlet?

YES >> Repair or replace any components that caused the engine oil or diesel fuel contamination.
NO >> GO TO 4.

4.CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST

1. Remove the aftertreatment DPF assembly.
2. Inspect the intake face of the aftertreatment diesel oxidation catalyst for damage, soot accumulation or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the aftertreatment DPF assembly.
NO >> Refer to GI-47, "Intermittent Incident".

P1612 DATA COMMUNICATION

DTC Description

INFOID:0000000014420486

The immobilizer anti-theft device communicates with the ECM through the CAN communication lines. Messages sent from the immobilizer anti-theft device are received by the ECM and are used to control anti-theft features. If the ECM does not receive a message from immobilizer anti-theft device, a DTC will be set.

DTC DETECTION LOGIC

The ECM was not able to communicate with the immobilizer anti-theft system via the CAN communication lines.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1612	Data Link Error (Vehicle data link - abnormal update rate)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	—
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Malfunctioning anti-theft device
- Exhaust system leaks
- Short or open in data link wiring
- Rapid key cycles may cause this DTC to set

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1612 being current on the CONSULT screen.

Is DTC P1612 current?

YES >> Go to EC-1382, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420487

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1612 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for current DTCs related to the CAN system on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Refer to GI-47, "Intermittent Incident".

P1613 DPF TEMPERATURE SENSOR MODULE PERFORMANCE

DTC Description

INFOID:0000000014420488

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The DPF temperature sensor module reported an internal error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1613	DPF Temperature Sensor Module Performance (Aftertreatment DPF temperature sensor module - bad intelligence device or component)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	DPF Temperature Sensor Module cold junction temperature < -55°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	DPF Temperature Sensor Module cold junction temperature > 20°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	DPF Temperature Sensor Module cold junction temperature < 180°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		4	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	Mismatched or invalid CRC of the DPF Temperature Sensor Module ASIC's internal memory at power up
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		5	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	DPF Temperature Sensor Module's parameter storage within nonvolatile memory does not match the corresponding parameters volatile storage at power up
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

DPF temperature sensor module

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1613 being current on the CONSULT screen.

Is DTC P1613 current?

YES >> Go to EC-1574, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420489

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1611, P1614, P1615, P1616 or P1623 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace the DPF temperature sensor module. Refer to EX-52, "Removal and Installation".

P1614 DPF TEMPERATURE SENSOR MODULE SHORTED HIGH

DTC Description

INFOID:0000000014420490

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The DPF temperature sensor module battery supply voltage is greater than 18V for more than 4 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1614	DPF Temperature Sensor Module Shorted High (Aftertreatment DPF temperature sensor module - voltage above normal or shorted to high source)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	Battery supply voltage (3)
		Threshold	Current > 16 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

High battery supply voltage

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1614 being current on the CONSULT screen.

Is DTC P1614 current?

YES >> Go to EC-1575, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420491

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTC P1614 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC P0562, P0563, P2503 or P2504 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT DPF TEMPERATURE SENSOR MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK BATTERY SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.
3. Turn ignition switch ON.
4. Check voltage between DPF temperature sensor module connector C29 and ground.

DPF temperature sensor module		Ground	Condition	Voltage (V) (Approx.)
Connector	Terminal			
C29	3	—	Ignition switch ON	> 18 V
			Engine cranking	
			Engine at idle	

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 5.

5. CHECK FOR CORRECT DPF TEMPERATURE SENSOR MODULE

1. Turn ignition switch OFF.
2. Remove the DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
3. Verify that the DPF temperature sensor module is correct for the engine configuration.

Is the DPF temperature control module correct for the engine configuration?

YES >> GO TO 6.
NO >> Replace DPF temperature sensor module. Refer to EX-52, "Removal and Installation".

6. CHECK CONDITION OF DPF TEMPERATURE SENSOR MODULE

1. Turn ignition switch OFF.
2. Connect DPF temperature sensor module connector C29.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Start and idle the engine.
5. Check for DTC P1614 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

7. CHECK BATTERY VOLTAGE

Test the voltage of the battery. Refer to PG-175, "Work Flow".

Is the battery voltage greater than 18 V?

YES >> Check the battery overcharging condition. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".
NO >> GO TO 8.

8. CHECK BATTERY SUPPLY VOLTAGE CIRCUIT

1. Turn ignition switch OFF.

2. Disconnect DPF temperature sensor module connector C29.
3. Remove fuse no. 72.
4. Turn ignition switch ON.
5. Check voltage between DPF temperature sensor module connector C29 and ground.

DPF temperature sensor module		Ground	Voltage (V) (Approx)
Connector	Terminal		
C29	3	—	> 18 V

Is the inspection result normal?

YES >> Repair the short to voltage in the battery supply voltage circuit.
NO >> Refer to GI-47, "Intermittent Incident".

P1615 DPF TEMPERATURE SENSOR MODULE SHORTED LOW

DTC Description

INFOID:0000000014420492

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The DPF temperature sensor module battery supply voltage is less than 6.5V for more than 4 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1615	DPF Temperature Sensor Module Shorted Low (Aftertreatment DPF temperature sensor module - voltage below normal or shorted to low source)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	Battery supply voltage (3)
		Threshold	Current < 6 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- DPF temperature sensor module
- Low battery supply voltage

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1615 being current on the CONSULT screen.

Is DTC P1615 current?

YES >> Go to EC-1578, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420493

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1615 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC P0562, P0563, P2503 or P2504 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT DPF TEMPERATURE SENSOR MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.

3. Inspect the harness and module connector pins for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK BATTERY SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.
3. Turn ignition switch ON.
4. Check voltage between DPF temperature sensor module connector C29 and ground.

DPF temperature sensor module		Ground	Condition	Voltage (V) (Approx.)
Connector	Terminal			
C29	3	—	Ignition switch ON	< 6 V
			Engine cranking	
			Engine at idle	

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK CONDITION OF DPF TEMPERATURE SENSOR MODULE

1. Turn ignition switch OFF.
2. Connect DPF temperature sensor module connector C29.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Start and idle the engine.
5. Check for DTC P1615 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

6. CHECK BATTERY TERMINALS

Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 7.
NO >> Tighten and clean the terminals.

7. CHECK BATTERY SUPPLY VOLTAGE CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.
3. Turn ignition switch ON.
4. Check voltage between DPF temperature sensor module connector C29 and ground.

DPF temperature sensor module		Ground	Voltage (V) (Approx.)
Connector	Terminal		
C29	3	—	< 6 V

Is the inspection result normal?

YES >> Repair the open or high resistance condition in the battery supply voltage circuit.
NO >> Repair the open or high resistance condition in the ground circuit.

P1616 DPF TEMPERATURE SENSOR MODULE OVER TEMPERATURE

DTC Description

INFOID:0000000014420494

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The DPF temperature sensor module internal temperature is greater than 150°C.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1616	DPF Temperature Sensor Module Over Temperature (Aftertreatment DPF temperature sensor module - Data valid but above normal operating range)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	DPF temperature sensor module internal circuit board temperature > 150°C
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Exhaust system leaks
- Missing heat shields
- Dirt and debris that could lead to overheating

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1616 being current on the CONSULT screen.

Is DTC P1616 current?

YES >> Go to EC-1581, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420495

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTC P1614 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK THE DPF TEMPERATURE SENSOR MODULE INSTALLATION

1. Turn ignition switch OFF.
2. Verify that the DPF temperature sensor module is properly mounted and the proper heat shield is mounted over it.

Are the DPF temperature sensor module and heat shield properly installed?

YES >> GO TO 3.
NO >> Properly install the PDF temperature sensor module and heat shield. Refer to EX-51, "Exploded View".

3.CHECK FOR OBSTRUCTED OR RESTRICTED AIR FLOW TO THE DPF TEMPERATURE SENSOR MODULE

Check the DPF temperature sensor module mounting area for air flow obstructions:
- Debris on or around the temperature sensor module.
- Aftermarket shields, flaps, or brackets mounted too close to the module.
- Exhaust leaks allowing exhaust to overheat the temperature sensor module.

Are there any signs of air flow restriction or excessive heat around the DPF temperature sensor module?

YES >> Repair the cause of the restricted air flow. Remove any debris accumulated near the DPF temperature sensor module. Relocate any aftermarket accessories that might be restricting air flow.
NO >> Check for proper installation of the PDF temperature sensor module. Refer to EX-51, "Exploded View".

P1623 DPF TEMPERATURE SENSOR MODULE CIRCUIT

DTC Description

INFOID:0000000014420496

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The ECM detected an intermittent battery voltage supply to the DPF temperature sensor module resulting in an internal reset of the module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1623	DPF Temperature Sensor Module Circuit (Aftertreatment DPF temperature sensor module - Root cause not known)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	battery supply voltage (3)
		Threshold	The number of DPF temperature sensor module reset events within a 300 second window is ≥ 5 counts
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Intermittent battery voltage supply
- Harness or connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1623 being current on the CONSULT screen.

Is DTC P1623 current?

YES >> Go to EC-1583, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420497

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTC P1623 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC P0562, P0563, P2503 or P2504 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

Check for DTC U1611 or P1615 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.INSPECT DPF TEMPERATURE SENSOR MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK BATTERY SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect DPF temperature sensor module connector C29.
3. Turn ignition switch ON.
4. Check voltage between the terminals of the DPF temperature sensor module connector C29.

DPF temperature sensor module connector C29		Condition	Voltage (V) (Approx.)
Terminal	Terminal		
3	4	Ignition switch ON	< 6 V
		Engine cranking	
		Engine at idle	

Is the inspection result normal?

YES >> GO TO 6.
NO >> An intermittent connection has been detected at the DPF temperature sensor module. Inspect the connector and harness for signs of intermittent shorts or opens. Repair or replace the damaged component.

6.CHECK BATTERY TERMINALS

Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 7.
NO >> Tighten and clean the terminals.

7.CHECK BATTERY SUPPLY VOLTAGE CIRCUIT

1. Turn ignition switch OFF.
2. Turn ignition switch ON.

3. Check voltage between DPF temperature sensor module connector C29 and ground.

DPF temperature sensor module		Ground	Voltage (V) (Approx.)
Connector	Terminal		
C29	3	—	< 6 V

Is the inspection result normal?

YES >> Repair the open or high resistance condition in the battery supply voltage circuit.
NO >> Repair the open or high resistance condition in the ground circuit.

P1624 SCR TEMPERATURE SENSOR MODULE PERFORMANCE

DTC Description

INFOID:0000000014420498

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The SCR temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The SCR temperature sensor module reported an internal error.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1624	SCR Temperature Sensor Module Performance (Aftertreatment SCR temperature sensor module - bad intelligence device or component)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	SCR Temperature Sensor Module cold junction temperature < -55°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	SCR Temperature Sensor Module cold junction temperature > 20°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		3	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	SCR Temperature Sensor Module cold junction temperature < 180°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		4	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	Mismatched or invalid CRC of the SCR Temperature Sensor Module ASIC's internal memory at power up
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		5	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	CAN2 communication lines (18 and 35)
			Threshold	SCR Temperature Sensor Module's parameter storage within nonvolatile memory does not match the corresponding parameters volatile storage at power up
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

SCR temperature sensor module

DTC CONFIRMATION PROCEDURE

1. PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1624 being current on the CONSULT screen.

Is DTC P1624 current?

YES >> Go to EC-1587, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420499

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC U1612, P1625, P1626, P1627 or P1628 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".

P1625 SCR TEMPERATURE SENSOR MODULE SHORTED HIGH

DTC Description

INFOID:0000000014420500

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The SCR temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The SCR temperature sensor module battery supply voltage is greater than 18V for more than 4 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1625	SCR Temperature Sensor Module Shorted High (Aftertreatment SCR temperature sensor module - voltage above normal or shorted to high source)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	Battery supply voltage (3)
		Threshold	Current > 16 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

High battery supply voltage

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1625 being current on the CONSULT screen.

Is DTC P1625 current?

YES >> Go to EC-1588, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420501

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1625 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC P0562 or P0563 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT SCR TEMPERATURE SENSOR MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Inspect the harness and module connector pins for the following:

- Loose connector

- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK BATTERY SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Turn ignition switch ON.
4. Check voltage between the terminals of the SCR temperature sensor module connector C30.

SCR temperature sensor module connector C30		Condition	Voltage (V) (Approx.)
Terminal	Terminal		
3	4	Ignition switch ON	> 18 V
		Engine cranking	
		Engine at idle	

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK CONDITION OF SCR TEMPERATURE SENSOR MODULE

1. Turn ignition switch OFF.
2. Connect SCR temperature sensor module connector C30.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Start and idle the engine.
5. Check for DTC P1625 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

6. CHECK BATTERY VOLTAGE

Test the voltage of the battery. Refer to PG-175, "Work Flow".

Is the battery voltage greater than 18 V?

YES >> Check the battery overcharging condition. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or CHG-31, "Work Flow (Without EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)".
NO >> GO TO 7.

7. CHECK BATTERY SUPPLY VOLTAGE CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Remove fuse no. 72.
4. Turn ignition switch ON.
5. Check voltage between SCR temperature sensor module connector C30 and ground.

SCR temperature sensor module		Ground	Voltage (V) (Approx.)
Connector	Terminal		
C30	3	—	> 18 V

Is the inspection result normal?

YES >> Repair the short to voltage in the battery supply voltage circuit.
NO >> Refer to GI-47, "Intermittent Incident".

P1626 SCR TEMPERATURE SENSOR MODULE SHORTED LOW

DTC Description

INFOID:0000000014420502

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The SCR temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The SCR temperature sensor module battery supply voltage is less than 6.5V for more than 4 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1626	SCR Temperature Sensor Module Shorted Low (Aftertreatment DPF temperature sensor module - voltage below normal or shorted to low source)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	Battery supply voltage (3)
		Threshold	Current < 6 V
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- SCR temperature sensor module
- Low battery supply voltage

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1626 being current on the CONSULT screen.

Is DTC P1626 current?

YES >> Go to EC-1591, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420503

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTC P1626 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC P0562 or P0563 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT SCR TEMPERATURE SENSOR MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK BATTERY SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Turn ignition switch ON.
4. Check voltage between the terminals of the SCR temperature sensor module connector C30.

SCR temperature sensor module connector C30		Condition	Voltage (V) (Approx.)
Terminal	Terminal		
3	4	Ignition switch ON	< 6 V
		Engine cranking	
		Engine at idle	

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK CONDITION OF SCR TEMPERATURE SENSOR MODULE

1. Turn ignition switch OFF.
2. Connect SCR temperature sensor module connector C30.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Start and idle the engine.
5. Check for DTC P1626 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace SCR temperature sensor module. Refer to EX-52, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

6. CHECK BATTERY TERMINALS

Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 7.
NO >> Tighten and clean the terminals.

7. CHECK BATTERY SUPPLY VOLTAGE CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Turn ignition switch ON.
4. Check voltage between SCR temperature sensor module connector C30 and ground.

SCR temperature sensor module		Ground	Voltage (V) (Approx.)
Connector	Terminal		
C30	3	—	< 6 V

Is the inspection result normal?

YES >> Repair the open or high resistance condition in the battery supply voltage circuit.
NO >> Repair the open or high resistance condition in the ground circuit.

P1627 SCR TEMPERATURE SENSOR MODULE OVER TEMPERATURE

DTC Description

INFOID:0000000014420504

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The SCR temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The SCR temperature sensor module internal temperature is greater than 150°C.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1627	SCR Temperature Sensor Module Over Temperature (Aftertreatment SCR temperature sensor module - Data valid but above normal operating range)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	SCR temperature sensor module internal temperature > 150°C
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Exhaust system leaks
- Missing heat shields
- Dirt and debris that could lead to overheating

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1627 being current on the CONSULT screen.

Is DTC P1627 current?

YES >> Go to EC-1594, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420505

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1627 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK THE SCR TEMPERATURE SENSOR MODULE INSTALLATION

1. Turn ignition switch OFF.
2. Verify that the SCR temperature sensor module is properly mounted and the proper heat shield is mounted over it.

Are the SCR temperature sensor module and heat shield properly installed?

YES >> GO TO 3.
NO >> Properly install the SCR temperature sensor module and heat shield. Refer to EX-55, "Exploded View".

3. CHECK FOR OBSTRUCTED OR RESTRICTED AIR FLOW TO THE SCR TEMPERATURE SENSOR MODULE

Check the SCR temperature sensor module mounting area for air flow obstructions:
- Debris on or around the temperature sensor module.
- Aftermarket shields, flaps, or brackets mounted too close to the module.
- Exhaust leaks allowing exhaust to overheat the temperature sensor module.

Are there any signs of air flow restriction or excessive heat around the DPF temperature sensor module?

YES >> Repair the cause of the restricted air flow. Remove any debris accumulated near the SCR temperature sensor module. Relocate any aftermarket accessories that might be restricting air flow.
NO >> Check for proper installation of the SCR temperature sensor module. Refer to EX-55, "Exploded View".

P1628 SCR TEMPERATURE SENSOR MODULE CIRCUIT

DTC Description

INFOID:0000000014420506

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The SCR temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The ECM detected an intermittent battery voltage supply to the SCR temperature sensor module resulting in an internal reset of the module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1628	SCR Temperature Sensor Module Circuit (Aftertreatment SCR temperature sensor module - Root cause not known)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	battery supply voltage (3)
		Threshold	The number of SCR temperature sensor module reset events within a 300 second window is ≥ 5 counts
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Intermittent battery voltage supply
- Harness or connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1628 being current on the CONSULT screen.

Is DTC P1628 current?

YES >> Go to EC-1596, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420507

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1628 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTC U1612 or P1626 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. INSPECT SCR TEMPERATURE SENSOR MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK BATTERY SUPPLY VOLTAGE

1. Turn ignition switch OFF.
2. Disconnect SCR temperature sensor module connector C30.
3. Turn ignition switch ON.
4. Check voltage between the terminals of the SCR temperature sensor module connector C30.

SCR temperature sensor module connector C30		Condition	Voltage (Approx.)
Terminal	Terminal		
3	4	Ignition switch ON	< 6 V
		Engine cranking	
		Engine at idle	

Is the inspection result normal?

YES >> GO TO 5.
NO >> An intermittent connection has been detected at the SCR temperature sensor module. Inspect the connector and harness for signs of intermittent shorts or opens. Repair or replace the damaged component.

5. CHECK BATTERY TERMINALS

Check the battery terminal connections.

Are the battery terminal connections tight and corrosion free?

YES >> GO TO 6.
NO >> Tighten and clean the terminals.

6. CHECK BATTERY SUPPLY VOLTAGE CIRCUIT

1. Turn ignition switch OFF.
2. Turn ignition switch ON.
3. Check voltage between SCR temperature sensor module connector C30 and ground.

SCR temperature sensor module		Ground	Voltage (Approx.)
Connector	Terminal		
C30	3	—	< 6 V

Is the inspection result normal?

YES >> Repair the open or high resistance condition in the battery supply voltage circuit.
NO >> Repair the open or high resistance condition in the ground circuit.

P1A11 ENGINE OVER TEMPERATURE

DTC Description

INFOID:0000000014710133

The coolant temperature sensor is a variable resistor sensor and is used to measure the temperature of the coolant of the engine. The ECM supplies 5V to the coolant temperature sensor signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the coolant temperature.

DTC DETECTION LOGIC

The ECM detected the engine coolant temperature was above a threshold and closed the EGR valve to reduce the engine coolant temperature.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1A11	Engine Coolant Over Temperature Condition (Engine coolant temperature - condition exists)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant temperature sensor ≥ 120°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P1A11 being current on the CONSULT screen.

Is DTC P1A11 current?

YES >> Go to EC-1599, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014710134

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P1A11 being current on the CONSULT screen.

Is applicable DTC detected?

YES >>
- The EGR and EGR bypass valves were closed to reduce engine coolant temperature.
- No repair is necessary.
- Inspection End.

NO >> Refer to GI-47, "Intermittent Incident".

P1A12 CATALYST OVERHEAT DETECTION

DTC Description

INFOID:0000000014710135

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the ECM via the CAN2 communication lines. The DPF temperature sensor module performs it's own internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The DPF intake temperature sensor reading was greater than 650°C (1202°F) for 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1A12	Catalyst Overheat Detection (Aftertreatment 1 diesel particulate filter intake temperature - data valid but below above operating range - least severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	DPF inlet temperature > 650°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	DPF inlet temperature > 800°C or DPF inlet temperature - DOC inlet temperature > 540°C
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Excessive engine oil or diesel fuel being introduced into the exhaust system from the engine
- A damaged engine fuel injector causing unburned diesel fuel to enter the exhaust system
- A face plugged aftertreatment diesel oxidation catalyst

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1A12 being current on the CONSULT screen.

Is DTC P1A12 current?

YES >> Go to EC-1600, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014710136

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTCs U1611, P1613, P1614 or P1623 being current on the CONSULT screen.

Is any applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.PERFORM ACTIVE TEST

1. Start the engine and run at low idle.
2. Perform the cylinder cutout “Active Test” using CONSULT.

Was engine misfire detected?

YES >> Determine the cause of misfire. Replace the injector, if necessary. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 3.

3.CHECK TURBOCHARGER OUTLET

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Inspect the turbocharger outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Is there engine oil or fuel contamination in the turbocharger exhaust outlet?

YES >> Repair or replace any components that caused the engine oil or diesel fuel contamination.
NO >> GO TO 4.

4.CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST

1. Remove the aftertreatment DPF assembly.
2. Inspect the intake face of the aftertreatment diesel oxidation catalyst for damage, soot accumulation or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the aftertreatment DPF assembly.
NO >> Refer to GI-47, "Intermittent Incident".

P1A62 TC ACTUATOR POSITION

DTC Description

INFOID:0000000014420508

The dual stage turbocharger is electronically activated by the rotary turbine control valve actuator. The actuator is powered by the battery via the smart power relay. The rotary turbine control valve actuator is a smart device and receives information on the CAN2 communication lines from the ECM. The rotary turbine control valve actuator performs it's own diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The turbocharger has failed to detect endpoint or stop references under engine operating conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1A62	Turbo Actuator Software Error (Engine turbocharger 1 turbine - bypass actuator 1position - special instructions)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Turbine bypass valve reports that it is in a state with no known calibration data or it is in the process of doing an installation
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Rotary turbine control valve actuator
- Loose or damaged linkage
- Turbine bypass valve

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P1A62 being current on the CONSULT screen.

Is DTC P1A62 current?

YES >> Go to EC-1602, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420509

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTCs U010C, P00AF or P2262 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT ROTARY TURBINE CONTROL VALVE ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the rotary turbine control valve actuator connector F146.
3. Inspect the harness and actuator connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. PERFORM ACTIVE TEST

1. Turn ignition switch ON.
2. Perform the turbine bypass valve actuator electronic hysteresis “Active Test” using the CONSULT screen.

Did the turbine bypass valve actuator pass the test?

YES >> Refer to GI-47, "Intermittent Incident".
NO >> GO TO 4.

4. CHECK TURBOCHARGER TURBINE ACTUATOR LINKAGE

1. Turn ignition switch OFF.
2. Inspect the linkage on the turbocharger for damage.

Is the linkage broken or damaged?

YES >> Replace the turbine actuator linkage. Refer to EM-398, "Exploded View".
NO >> GO TO 5.

5. CHECK TURBINE ACTUATOR LINKAGE MOVEMENT

Rotate the turbocharger turbine actuator linkage from stop to stop by hand. Check for smooth movement between stops.

NOTE:
There will be an initial friction force that must be overcome before the actuator linkage will move. Once the movement is started, actuator linkage must move to the other stop position by hand.

Does the linkage rotate from stop to stop

YES >> Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".
NO >> Replace the turbocharger assembly. Refer to EM-399, "Removal and Installation".

P1A77 AFTERTREATMENT OVER TEMPERATURE

DTC Description

INFOID:0000000014420510

The Engine Control Module (ECM) monitors the aftertreatment for active over temperature DTCs. This DTC indicates that the aftertreatment temperature DTCs that have been active for an extended period of time and the ECM has shut down the engine.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has shut down the engine due to critical aftertreatment temperature DTCs have been active for a period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1A77	(Aftertreatment Over Temp)	1	Diagnosis condition	Engine is running
			Signal (terminal)	—
			Threshold	Aftertreatment temperature DTCs have been active for a period of time.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1A77 being current on the CONSULT screen.

Is DTC P1A77 current?

YES >> Go to EC-1604, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420511

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1A77 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> This is an information only DTC. Troubleshoot all other current aftertreatment temperature related DTCs. Refer to EC-838, "DTC Index".
NO >> Refer to GI-47, "Intermittent Incident".

P1A78 FUEL SHUTOFF - FORCED ENGINE SHUTDOWN

DTC Description

INFOID:0000000014420512

The airbag control unit communicates to the ECM through the CAN communication lines. Messages sent from the airbag control unit are received and monitored by the ECM. The airbag control unit sends a message to the ECM turns off fueling.

DTC DETECTION LOGIC

The ECM received a message from the airbag controller to cutoff fueling.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1A78	Forced Engine Shutdown (Engine fuel shutoff 1 control - special instructions)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Nissan airbag crash indicator = 0x54AB
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P1A78 being current on the CONSULT screen.

Is DTC P1A78 current?

YES >> Go to EC-1605, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420513

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P1A78 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> This is an information only DTC. Inspection End.
NO >> Refer to GI-47, "Intermittent Incident".

P1A7A ENGINE COOLANT LEVEL LOW

DTC Description

INFOID:0000000014698691

The coolant level sensor is a switch and is used to measure the level of the engine coolant in the radiator top tank. The coolant level sensor is immersed in the coolant and returns a different signal voltage when immersed in coolant verses being out of coolant. The Engine Control Module (ECM) monitors the change in the signal voltage to determine the level of the engine coolant.

DTC DETECTION LOGIC

The ECM detected the coolant level sensor signal voltage was higher than 3.0 V for more than 30 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1A7A	Engine Coolant Level Low (Coolant level - data valid but below normal operating range - most severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant level sensor voltage: < -71.094°C • ≥ 2.953 V • < 3.75 V • ≥ 3.75 V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Low coolant level
- Coolant level sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn the ignition switch ON.
2. Start the vehicle and let it idle for 1 minute.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P1A7A being current on the CONSULT screen.

Is DTC P1A7A current?

YES >> Go to EC-1606, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014698692

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTC P1A7A being current or past on the CONSULT screen.

Is applicable DTC detected?

YES >> Check coolant level and add coolant if necessary. If DTC P1A7A is current and coolant level is not low, replace coolant level sensor. Refer to CO-52, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P1C54 SCR NOX CATALYST MISSING

DTC Description

INFOID:0000000014420514

The ECM monitors the NOx concentration in the engine's exhaust gases using an aftertreatment intake NOx sensor and an aftertreatment outlet NOx sensor. By comparing these two values, the ECM is able to determine the conversion efficiency of the SCR catalyst and dosing system.

DTC DETECTION LOGIC

The ECM detected the NOx conversion efficiency of the SCR catalyst was critically low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1C54	SCR NOx Catalyst Missing (Aftertreatment 1 SCR catalyst system missing - condition exists)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	—
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Tampering with, removal of, or malfunction of SCR catalyst system
- Malfunctioning diesel exhaust fluid dosing system
- Exhaust system leaks
- Degraded, diluted, or incorrect diesel exhaust fluid
- Diesel exhaust fluid deposits in the decomposistion tube

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
6. Check for DTC P1C54 being current on the CONSULT screen.

Is DTC P1C54 current?

YES >> Go to EC-1607, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420515

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for "ENGINE" diagnostic trouble codes.
3. Check for DTC P1C54 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for current DTCs related to the aftertreatment intake NOx sensor and aftertreatment outlet NOx sensor on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

Check for current DTCs related to the aftertreatment SCR temperature sensor on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK DTC PRIORITY

Check for current DTCs related to the DEF dosing system and DEF quality sensor on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.CHECK EXHAUST SYSTEM FOR LEAKS

Check the exhaust system for leaks.
- Inspect the entire exhaust system between the turbocharger outlet and the SCR outlet.
- Inspect for loose connections and broken exhaust system components.

Are any leaks detected?

YES >> Repair or replace damaged exhaust system components.
NO >> GO TO 6.

6.CHECK DEF DOSING SYSTEM FOR LEAKS

Inspect all components of the aftertreatment DEF dosing system for signs of external leaks.
NOTE:
DEF will form white deposits around leaky fittings.
- DEF tank connectors.
- DEF dosing unit and dosing unit connectors.
- DEF lines.
- DEF dosing valve.

Are any leaks detected?

YES >> Repair the source of the external leak.
NO >> GO TO 7.

7.CHECK DEF QUALITY

Check the DEF quality.
- Inspect the DEF in the tank for signs of debris or contamination.
- Test the DEF concentration using DEF Refractometer 4919554.
- DEF lines.
- DEF dosing valve.

Is the DEF free from contamination and within concentration specifications?

YES >> GO TO 8.
NO >> Replace the DEF fluid.

8.CHECK DEF DOSING UNIT OPERATION

1. Connect all DEF lines and electrical connectors to the dosing unit and DEF tank.
2. Remove the aftertreatment DEF dosing using DEF valve from the decomposition tube.
3. Turn ignition switch ON.
4. Connect CONSULT and perform the “DEF doser pump override” in “Active Test”.
   NOTE:
   DEF dosing valve must be placed in a measuring container in order to perform in “Active Test”. Make sure valve is not plugged and DEF is flowing from all holes.

Does DEF dosing unit operate according to specifications?

YES >> GO TO 9.
NO >> Replace aftertreatment DEF dosing unit. Refer to EX-64, "Removal and Installation".

9.CHECK DEF DOSING VALVE OPERATION

Perform the DEF system leak Active Test.

Is DEF leaking from valve during Active Test?

YES >> Replace aftertreatment DEF dosing valve. Refer to EX-64, "Removal and Installation".
NO >> GO TO 10.

10. CHECK AFTERTREATMENT SYSTEM

1. Turn ignition switch OFF.
2. Inspect the decomposition tube for deposits.

- Remove the decomposition tube.
- Inspect for excessive DEF deposits.

Are any excessive DEF deposits detected?

YES >> Clean and install the decomposition tube.
NO >>
- Replace the aftertreatment SCR catalyst. Refer to EX-55, "Exploded View".
- Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".
- Replace the outlet NOx sensor. Refer to EX-48, "Removal and Installation".

P1C55 NOX SENSOR 1/1 INTERMITTENT

DTC Description

INFOID:0000000014420516

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN2 communication lines. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

The ECM detected the NOx reading was higher or lower than what was expected for the engine operating conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1C55	NOx Sensor Bank 1 Sensor 1 Sensor Circuit Intermittent/Erratic (Aftertreatment 1 intake NOx sensor - data erratic, intermittent, or incorrect)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	—
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- The ECM has detected the NOx reading is higher or lower than is possible from the engine output
- Exhaust system leaks
- Incorrectly installed aftertreatment intake NOx sensor
- Aftertreatment intake NOx sensor has carbon buildup on the tip
- Excessive oil consumption
- Possible engine misfire
- NOx sensor part number is incorrect

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 90 km/h (56 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to "P" park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P1C55 being current on the CONSULT screen.

Is DTC P1C55 current?

YES >> Go to EC-1610, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420517

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1C55 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTCS U029D, P2201, P2202, P2209 or P220A being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK EGR SYSTEM FOR LEAKS

Inspect the EGR system for external leaks:
- Leaks should be easily noted by traces of soot.
- If necessary, run the engine at idle speed to help detect any leaks.

Are any leaks detected?

YES >> Repair or replace leaking EGR system component.
NO >> Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".

P1C56 NOX SENSOR 1/2 INTERMITTENT

DTC Description

INFOID:0000000014420518

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a mismatch between the aftertreatment intake and outlet NOx sensor readings.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1C56	NOx Sensor Bank 1 Sensor 2 Sensor Circuit Intermittent/Erratic (Aftertreatment 1 outlet NOx sensor - data erratic, intermittent, or incorrect)	Diagnosis condition	Continuously while the Selective Catalytic Reduction (SCR) system is dosing diesel exhaust fluid into the aftertreatment system
		Signal (terminal)	—
		Threshold	—
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Excessive diesel exhaust fluid (DEF) deposits in the aftertreatment decomposition tube
- Exhaust system leaks
- Incorrectly installed aftertreatment outlet NOx sensor
- Aftertreatment outlet NOx sensor
- Aftertreatment intake NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 90 km/h (56 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to “P” park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P1C56 being current on the CONSULT screen.

Is DTC P1C56 current?

YES >> Go to EC-1612, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420519

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1C56 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

Check for DTCS U029E, P220B, P229E or P22A7 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

Check for DTCS U029D, U059E, P1C55, P2201, P2202, P2209 or P220A being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK INSTALLATION OF AFTERTREATMENT OUTLET NOX SENSOR

1. Turn ignition switch OFF.
2. Inspect aftertreatment outlet NOx sensor for proper installations.

Is the inspection result normal

YES >> GO TO 5.
NO >> Correct installation of the outlet NOx sensor. Refer to EX-45, "Removal and Installation".

5.CHECK DECOMPOSITION TUBE FOR CRYSTALLIZATION

1. Turn ignition switch OFF.
2. Disconnect the aftertreatment DEF decomposition tube.
3. Inspect the decomposition tube for crystallization.

Is the inspection result normal

YES >> GO TO 6.
NO >> Remove crystallization buildup.

6.CHECK EXHAUST SYSTEM FOR LEAKS

Inspect the exhaust system for leaks:
- Leaks should be easily noted by traces of soot.
- If necessary, run the engine at idle speed to help detect any leaks.

Are any leaks detected?

YES >> Repair or replace leaking exhaust system component.
NO >> Replace the outlet NOx sensor. Refer to EX-45, "Removal and Installation".

P1C70 SCR ERROR DETECTED - ENGINE DR-RATED

DTC Description

INFOID:0000000014420520

The ECM monitors the engine operation for critical Selective Catalytic Reduction (SCR) current DTCs. If the DTCs are current for an extended period of time and no repair action has been taken, the ECM will limit the engine torque depending on which SCR DTCs are current.

DTC DETECTION LOGIC

The ECM detected the engine has been operated for an extended amount of time with critical SCR DTCs current, and no repair action has been taken. This amount of time will vary, depending on which SCR DTCs are current.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P1C70	SCR Error Detected (Aftertreatment SCR operator inducement - data valid but above normal range - most severe level)	Diagnosis condition	Continuously when key is ON, or engine is running
		Signal (terminal)	—
		Threshold	One or more conditions exist requiring severe driver inducement
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P1C70 being current on the CONSULT screen.

Is DTC P1C70 current?

YES >> Go to EC-1614, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420521

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1C70 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> This is an information only DTC that will only become current if other SCR related DTCs are current for an extended period of time. Refer to EC-838, "DTC Index".
NO >> Refer to GI-47, "Intermittent Incident".

P200C DIESEL PARTICULATE FILTER

DTC Description

INFOID:0000000014420522

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the Engine Control Module (ECM) via CAN communication lines. The aftertreatment DPF temperature sensor module performs its own internal diagnostics and reports malfunctions back to the ECM using CAN data lines. The aftertreatment DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment DPF intake temperature, and aftertreatment DPF outlet temperature. The temperature probes are permanently attached to the aftertreatment DPF temperature sensor module and cannot be replaced individually. Progressive power reduction increasing in severity from time of alert.

DTC DETECTION LOGIC

Aftertreatment DPF outlet gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P200C	DPF OUTLET TEMP	1	Diagnosis condition	DPF outlet temperature is at a moderately severe level
			Signal (terminal)	DPF temperature sensor to DPF temperature sensor module
			Threshold	A high temperature 735°C (1355°F) from the sensor is sent to the module
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	DPF outlet temperature is at a most severe level
			Signal (terminal)	DPF temperature sensor to DPF temperature sensor module
			Threshold	A high temperature 810°C (1490°F) from the sensor is sent to the module
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

NOTE:
This DTC will become history after the aftertreatment temperatures drop below the warning limit and a key cycle has occurred, and will likely be "past" at the time of diagnosis. For these reasons this diagnosis procedure must be used for both current and history DTCs.

POSSIBLE CAUSE

- A malfunctioning fuel injector causing unburned fuel to enter the exhaust system.
- Excessive engine oil being introduced into the exhaust system from the engine.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-1021, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420523

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If any of the following DTCs exist, perform the confirmation procedure (trouble diagnosis) for other DTC:

- U1611
- P1613
- P1614
- P1615
- P1623

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Connect the CONSULT and perform the cylinder performance test.

Was an engine misfire detected?

YES >> GO TO 3.
NO >> GO TO 4.

3.TEST MALFUNCTIONING INJECTOR

Using the CONSULT, perform the Cylinder Cutout Test to isolate a malfunctioning injector.

Was a malfunctioning injector identified?

YES >> Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4.INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 5.

5.CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 6.

6.ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P200C DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1615, "DTC Description".
NO >> Repair complete.

P200E CATALYST SYSTEM OVER TEMPERATURE BANK 1

DTC Description

INFOID:0000000014420524

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the Engine Control Module (ECM) via CAN communication lines. The aftertreatment DPF temperature sensor module performs its own internal diagnostics and reports malfunctions back to the ECM using CAN data lines. The aftertreatment DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment DPF intake temperature, and aftertreatment DPF outlet temperature. The temperature probes are permanently attached to the aftertreatment DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment DOC delta gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P200E	DPF INLET TEMP	Diagnosis condition	DPF inlet temperature - DOC inlet temperature is above a high threshold.
		Signal (terminal)	DPF intake temperature sensor to DPF temperature sensor module.
		Threshold	A high temperature 735°C (1355°F) from the intake temperature sensor is sent to the module.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running and active regeneration of the aftertreatment DPF is not occurring.

NOTE:
This DTC will become history after the aftertreatment temperatures drop below the warning limit and a key cycle has occurred, and will likely be "past" at the time of diagnosis. For these reasons this diagnosis procedure must be used for both current and history DTCs.

POSSIBLE CAUSE

- Excessive engine oil being introduced into the exhaust system from the engine.
- A malfunctioning fuel injector causing unburned fuel to enter the exhaust system.
- A face plugged aftertreatment Diesel Oxidation Catalyst.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Proceed to EC-1021, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420525

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If any of the following DTCs exist, perform the confirmation procedure (trouble diagnosis) for other DTC:

- U1611
- P1613
- P1614
- P1615
- P1623

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Connect the CONSULT and perform the cylinder cutout test.

Was an engine misfire detected?

YES >> Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 3.

3. INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 4.

4. CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 5.

5. ERASE DTC.

1. Connect all harness connectors.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P200E DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1615, "DTC Description".
NO >> Repair complete.

P202B REDUCTANT TANK HEATER CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420526

The Diesel Exhaust Fluid (DEF) Tank has an internal heating coil to thaw frozen diesel exhaust fluid. The DEF Control Unit monitors the temperature of the diesel exhaust fluid in the tank. The DEF Control Unit activates the DEF Tank Heater, at freezing temperatures, to warm the Diesel Exhaust Fluid. The DEF Tank Heater is integrated into the DEF dosing unit. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the Selective Catalyst Reduction (SCR) control unit reporting DEF Tank Heater current is below an allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P202B	DEF TANK HEATER	Diagnosis condition	Diesel Exhaust Fluid Tank Heater is active.
		Signal (terminal)	Voltage signal transmitted to DEF tank heater
		Threshold	Tank heater current < 5 Amperes
		Diagnosis delay time	Diagnostic runs continuously when the DEF tank heating is being commanded.

POSSIBLE CAUSE

- Harness and connectors.
- A malfunctioning aftertreatment diesel exhaust fluid tank heater.
- DEF supply pump assembly.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch ON.
2. Connect CONSULT, select “ENGINE” and perform “DEF Tank Heater Test”.
3. Using CONSULT, check for existing “ENGINE” diagnostic trouble codes.
4. Check for DTC P202B being current on the CONSULT screen.

Is 1st trip DTC detected?

YES >> Proceed to EC-1620, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420527

1.CHECK FOR AN ACTIVE DTC

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P202B being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF SUPPLY PUMP ASSEMBLY AND CONNECTOR PINS

1. Turn ignition switch OFF and wait at least 90 seconds before proceeding to allow sufficient time for the aftertreatment DEF supply pump assembly to completely power down.
2. Disconnect the DEF supply pump assembly harness connector.
3. Inspect the DEF supply pump assembly connector pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.

- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT DEF CONTROL MODULE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DEF control module harness connector.
3. Inspect for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DEF TANK HEATER SUPPLY CIRCUIT FOR SHORT TO GROUND

Check the continuity between DEF tank heater supply circuit and ground.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	22	Ground	No

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace short circuit in harness.

5. CHECK DEF TANK HEATER CIRCUITS FOR OPEN

Check the supply and return circuits for continuity between the DEF control module harness connector and DEF supply pump assembly harness connector.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	22	C204	1	Yes
	23		3	

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit in harness or connectors.

6. CHECK THE CIRCUIT RESPONSE

1. Reconnect the DEF control module harness connector.
2. Connect a jumper wire between disconnected DEF supply pump assembly connector pins 1 and 3.
3. Turn ignition switch ON, start engine, and allow the engine to idle for 1 minute.
4. With CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P202C DTC current and P202B DTC past?

YES >> An open circuit or short circuit-to-ground has been detected in the aftertreatment DEF tank heater, which is internal to the aftertreatment DEF dosing unit. Replace the aftertreatment DEF dosing unit. Refer to EX-73, "Removal and Installation".

NO >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".

P202C REDUCTANT TANK HEATER CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420528

The Diesel Exhaust Fluid (DEF) Tank has an internal heating coil to thaw frozen diesel exhaust fluid. The DEF Control Unit monitors the temperature of the diesel exhaust fluid in the tank. The DEF Control Unit activates the DEF Tank Heater, at freezing temperatures, to warm the Diesel Exhaust Fluid. The DEF Tank Heater is integrated into the DEF dosing unit. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the Selective Catalyst Reduction (SCR) control unit reporting DEF Tank Heater current is above an allowable limit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P202C	DEF TANK HEATER	Diagnosis condition	Diesel Exhaust Fluid Tank Heater is active.
		Signal (terminal)	Voltage signal transmitted to DEF tank heater
		Threshold	DEF tank heater circuit shorted to battery
		Diagnosis delay time	Diagnostic runs continuously when the DEF tank heating is being commanded.

POSSIBLE CAUSE

- Harness and connectors
- A malfunctioning aftertreatment diesel exhaust fluid tank heater
- DEF supply pump assembly

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch ON.
2. Connect CONSULT and perform the Diesel Exhaust Fluid Doser System Heater Test.
3. Check for existing “ENGINE” diagnostic trouble codes.
4. Check for DTC P202C being current on the CONSULT screen.

Is 1st trip DTC detected?

YES >> Proceed to EC-1620, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420529

1.CHECK FOR AN ACTIVE DTC

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P202C being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF SUPPLY PUMP ASSEMBLY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly harness connector.
3. Inspect the DEF supply pump assembly harness and connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins

- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.INSPECT DEF CONTROL MODULE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF. Wait at least 90 seconds before proceeding to allow sufficient time for the after-treatment DEF control module to completely power down.
2. Disconnect the DEF control module harness connector.
3. Inspect for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK DEF TANK HEATER SUPPLY CIRCUIT FOR SHORT

Check the continuity between DEF tank heater supply circuit and all other circuits at the DEF control module connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	22	All others	No

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace short circuit in harness.

5.CHECK DEF TANK HEATER RETURN CIRCUIT FOR SHORT

Check the continuity between DEF tank heater return circuit and all other circuits at the DEF control module connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	23	All others	No

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace short circuit in harness.

6.CHECK THE CIRCUIT RESPONSE

1. Reconnect the DEF control module harness connector.
2. Connect a jumper wire between disconnected DEF supply pump assembly connector pins 1 and 3.
3. Turn ignition switch ON.
4. With CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P202B DTC current and P202C DTC past?

YES >> A short circuit has been detected in the aftertreatment DEF tank heater, which is internal to the aftertreatment DEF dosing unit. Replace the aftertreatment DEF dosing unit. Refer to EX-73, "Removal and Installation".

NO >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".

P202E REDUCTANT INJECTION VALVE CIRCUIT 1/1

DTC Description

INFOID:0000000014420530

The aftertreatment diesel exhaust fluid dosing valve is controlled by the ECM. When the Engine Control Module (ECM) commands DEF dosing, the ECM sends a Pulse Width Modulated (PWM) signal to the dosing valve, which opens the dosing valve and allows DEF to be sprayed into the exhaust stream.

DTC DETECTION LOGIC

The diagnostic checks whether the DEF supply pump assembly injector valve is mechanically stuck closed or mechanically stuck open based on the minimum pressure variation observed during On/ Off cycle at each injection period for 2 trips.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P202E	DEF DOSING VALVE POS CMP	Diagnosis condition	This diagnostic runs when the DEF dosing valve is being commanded ON. Diagnostic tests are performed 5 minutes apart.
		Signal (terminal)	DEF dosing valve signal
		Threshold	When Maximum DEF Supply Pressure - Minimum DEF Supply Pressure within one injection cycle is < 15 kPa (gauge) for greater than or equal to 2 out of 3 times within each set of diagnostic tests.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF dosing valve.
- Contamination of the DEF.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P202E being current on the CONSULT screen.

Is DTC P202E current?

YES >> Proceed to EC-1620, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420531

1.CHECK FOR A CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P202E being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF SUPPLY PUMP ASSEMBLY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Remove the DEF dosing valve.
3. Check for an adequate amount of DEF in the DEF tank prior to starting this test.
4. Place the dosing valve in a plastic container capable of measuring from 0 to 500 ml (0 to 17 oz) in 5 ml (0.34 oz) increments.

   WARNING:
   To reduce the risk of personal injury, do not get Diesel exhaust fluid (DEF) in your eyes as it contains urea. In case of contact, immediately flush eyes with large amounts of water for a minimum of 15 minutes. Do not swallow. In the event DEF is ingested, contact a physician immediately. Reference the Safety Data Sheet (SDS) for additional information.
   NOTE:
   When the test begins, briefly monitor the spray pattern of the DEF exiting the aftertreatment DEF dosing valve. Check for the following:
   - Signs of larger drops and/or dripping DEF from the tip.
   - Spray pattern that is not symmetrical (sprays more to one side).
5. Turn ignition switch ON.
6. Connect CONSULT and perform ″DEF Dosing Unit Override Test″ under ″ENGINE″ which will run for 6 minutes.

Did the DEF dosing valve pump between 85 mm (2.9 in) and 115 mm (3.9 in) in a uniform spray pattern?

YES >> GO TO 3.
NO >> Replace the DEF dosing valve. Refer to EX-64, "Exploded View".

3. ERASE DTC

1. Turn ignition switch OFF.
2. Reconnect the DEF dosing valve.
3. Turn ignition switch ON.
4. With CONSULT erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing the DTC" found in the DTC description.

Is P202E DTC current?

YES >> Return to the diagnosis procedure steps if all steps have been completed and checked again. Refer to EC-1626, "DTC Description".
NO >> Repair complete.

P2031 UPSTREAM DPF TEMPERATURE SENSOR

DTC Description

INFOID:0000000014420532

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the Engine Control Module via CAN lines. The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module performs its own internal diagnostics and reports malfunctions back to the Engine Control Module via CAN communication. The aftertreatment DPF temperature sensor module is used to measure the aftertreatment Diesel Oxidation Catalyst (DOC) intake temperature, aftertreatment DPF intake temperature, and aftertreatment DPF outlet temperature. The temperature probes are permanently attached to the aftertreatment DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment DPF intake gas temperature is in-range but not rational. Possible reduced engine performance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2031	DPF INLET TEMP	Diagnosis condition	Ignition switch ON and the engine is running.
		Signal (terminal)	DEF tank temperature sensor signal.
		Threshold	• Difference between DPF inlet and outlet temperature sensor data did not match the expected value for the present engine operating condition. • Average temperature drop across DOC > 85°C or average temperature drop across DOC < -85°C. • Average temperature drop across DPF > 85°C or average temperature drop across DPF < -85°C.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment diesel particulate filter intake temperature sensor.
- A malfunctioning aftertreatment diesel particulate filter outlet temperature sensor.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P2031 being current on the CONSULT screen.

Is P2031 DTC detected?

YES >> Proceed to EC-1620, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420533

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If any of the following DTCs exist, perform the confirmation procedure (trouble diagnosis) for other DTC:

- U1611
- P1614
- P1615

- P1616
- P1623

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> • Replace the aftertreatment DPF temperature sensor module. Refer to EX-51, "Exploded View".
• GO TO 2.

2.ERASE DTC.

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON.
4. With CONSULT, erase all DTCs.
5. Operate the engine within the conditions for setting DTC found in the DTC description.
6. Check for existing “ENGINE” diagnostic trouble codes.

Did the P2031 DTC return?

YES >> Diagnosis procedure needs to be repeated. Go to EC-1615, "DTC Description".
NO >> Repair complete.

P2032 TEMPERATURE SENSOR UPSTREAM DPF

DTC Description

INFOID:0000000014420534

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the Engine Control Module via CAN lines. The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module performs its own internal diagnostics and reports malfunctions back to the Engine Control Module via CAN communication. The aftertreatment DPF temperature sensor module is used to measure the aftertreatment Diesel Oxidation Catalyst (DOC) intake temperature, aftertreatment DPF intake temperature, and aftertreatment DPF outlet temperature. The temperature probes are permanently attached to the aftertreatment DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Smart Exhaust Gas Temperature Module has detected a sensor short to ground that causes too low of an input voltage condition in the outlet DOC thermocouple sensor circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2032	DPF INLET TEMP	Diagnosis condition	Ignition switch ON and the engine is running.
		Signal (terminal)	DEF tank temperature sensor signal
		Threshold	Aftertreatment outlet DOC gas temperature sensor input voltage ≤ 1 V (-40°C)
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment diesel particulate filter intake temperature sensor.
- Wiring harness.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check 1st trip DTC.

Is P2032 DTC detected?

YES >> Proceed to EC-1620, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420535

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If any of the following DTCs exist, perform the confirmation procedure (trouble diagnosis) for other DTC:

- U1611
- P1614
- P1615
- P1616
- P1623

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> • Replace the aftertreatment DPF temperature sensor module. Refer to EX-51, "Exploded View".
• GO TO 2.

2.ERASE DTC.

1. Turn ignition switch OFF.
2. Connect all components.

3. Turn ignition switch ON.
4. With CONSULT, erase all DTCs.
5. Operate the engine within the conditions for setting DTC found in the DTC description.
6. Check for existing “ENGINE” diagnostic trouble codes.

Did the P2032 DTC return?

YES >> Diagnosis procedure needs to be repeated. Go to EC-1630, "DTC Description".
NO >> Repair complete.

P2033 TEMPERATURE SENSOR UPSTREAM DPF

DTC Description

INFOID:0000000014420536

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the Engine Control Module via CAN lines. The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module performs its own internal diagnostics and reports malfunctions back to the Engine Control Module via CAN communication. The aftertreatment DPF temperature sensor module is used to measure the aftertreatment Diesel Oxidation Catalyst (DOC) intake temperature, aftertreatment DPF intake temperature, and aftertreatment DPF outlet temperature. The temperature probes are permanently attached to the aftertreatment DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Within the Smart Exhaust Gas Temperature Module an ASIC communication error is causing no data transfer between outlet DOC thermocouple and the internal ASIC.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2033	DEF INLET TEMP	Diagnosis condition	Ignition switch ON and the engine is running
		Signal (terminal)	DEF tank temperature sensor signal
		Threshold	The aftertreatment Temperature Sensor Module has detected a sensor short to battery or open circuit condition that causes a high input voltage.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment diesel particulate filter intake temperature sensor.
- Wiring harness.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-1620, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420537

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If any of the following DTCs exist, perform the confirmation procedure (trouble diagnosis) for other DTC:

- U1611
- P1614
- P1615
- P1616
- P1623

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> • Replace the aftertreatment DPF temperature sensor module. Refer to EX-51, "Exploded View".
• GO TO 2.

2.ERASE DTC.

1. Turn ignition switch OFF.
2. Connect all components.
3. Turn ignition switch ON.
4. With CONSULT, erase all DTCs.
5. Operate the engine within the conditions for setting DTC found in the DTC description.
6. Check for existing “ENGINE” diagnostic trouble codes.

Did the P2033 DTC return?

YES >> Diagnostic procedure needs to be repeated. Go to EC-1632, "DTC Description".
NO >> Repair complete.

P203B REDUCTANT LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420538

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1756, "DTC Description".

The Diesel Exhaust Fluid (DEF) Tank Level Sensor measures the level of the fluid inside the DEF Tank. The DEF Controller unit provides a 5V source and monitors the voltage that determines the fluid level in the tank. DEF Tank Level Sensor is integrated in the DEF Dosing Unit. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

Diesel Exhaust Fluid (DEF) tank level sensor circuit - Voltage below normal or shorted to low source. Low signal voltage detected at the DEF tank level sensor circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P203B	DEF TANK LEVEL	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF tank level sensor signal
		Threshold	DEF Tank Level Sensor Signal circuit is less than 0.3V for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF level sensor.
- SCR control unit.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P203B being current on the CONSULT screen.

Is P203B DTC current?

YES >> Go to EC-1634, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420539

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".

NO >> GO TO 2.

2. CHECK FOR CURRENT DEF LEVEL SENSOR DTC

Check for DTC P203B being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DEF LEVEL SENSOR POWER SUPPLY CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DEF supply pump assembly connector sensor supply voltage and ground circuit terminals.

DEF supply pump assembly			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C204	5	14	Approx. 5

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace the DEF control module harness for open or high resistance.

5. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Disconnect the DEF control module.
2. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK TANK LEVEL SENSOR CIRCUITS FOR OPEN

Check the signal and ground circuits for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	20	C204	6	Yes
	26		14	

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open signal circuit in harness or connectors.

7.CHECK THE CIRCUIT RESPONSE

1. Reconnect the DEF control module.
2. Connect a jumper wire between DEF supply pump assembly 5 volt supply terminal 5 and signal circuit terminal 6.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P203C DTC become current?

YES >> A damaged tank level sensor has been detected. Replace the aftertreatment DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> Replace the DEF control module. Refer to EC-1999, "Exploded View".

P203C REDUCTANT LEVEL SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420540

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1756, "DTC Description".

The Diesel Exhaust Fluid (DEF) Tank Level Sensor measures the level of the fluid inside the DEF Tank. The DEF Controller unit provides a 5V source and monitors the voltage that determines the fluid level in the tank. DEF Tank Level Sensor is integrated in the DEF Dosing Unit. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the DEF supply pump assembly Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage is below an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P203C	DEF TANK LEVEL	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF tank level sensor signal
		Threshold	DEF Tank Level Sensor Signal circuit is less than 0.32 volt (0% DEF tank level) for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF level sensor.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P203C being current on the CONSULT screen.

Is P203C DTC current?

YES >> Go to EC-1637, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420541

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF LEVEL SENSOR DTC

Check for DTC P203D current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK DEF LEVEL SENSOR POWER SUPPLY CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DEF supply pump assembly connector sensor supply voltage and return circuit terminals.

DEF supply pump assembly			Voltage (V) (Approx)
Connector	Terminal (+)	Terminal (-)	
C204	5	14	Approx. 5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between DEF supply pump assembly 5V supply terminal 5 and signal circuit terminal 6.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P203D become current and P203C become past?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P203C DTC become current?

YES >> A damaged tank level sensor has been detected. Replace the aftertreatment DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> The removal and installation of the connector corrected the issue. Repair complete.

7. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Disconnect the DEF control module.
2. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK TANK LEVEL SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	20	C204	6	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9. CHECK TANK LEVEL SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank level sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	20	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair short circuit in harness or connectors.

10. CHECK TANK LEVEL SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DEF tank level sensor signal circuit and ground.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	20	—	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace harness for a short to ground.

11. CHECK FOR CURRENT DTC

1. Connect all components in the correct positions.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P203C DTC current?

YES >> Replace DEF control module. Refer to EC-1999, "Exploded View".

NO >> The removal and installation of the connector corrected the issue.

P203D REDUCTANT LEVEL SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420542

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
• P21CA present. Refer to EC-1756, "DTC Description".

The Diesel Exhaust Fluid (DEF) Tank Level Sensor measures the level of the fluid inside the DEF Tank. The DEF Controller unit provides a 5V source and monitors the voltage that determines the fluid level in the tank. DEF Tank Level Sensor is integrated in the DEF Dosing Unit. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the DEF supply pump assembly Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage is in excess of an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P203D	DEF TANK LEVEL	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF tank level sensor signal
		Threshold	DEF Tank Level Sensor Signal circuit is greater than 4.8V (100% DEF tank level) for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

• DEF level sensor.
• Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P203D being current on the CONSULT screen.

Is P203D DTC current?

YES >> Go to EC-1641, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420543

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR CURRENT DEF LEVEL SENSOR DTC

Check for DTC P203D current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P203C current and P203D past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK DEF LEVEL SENSOR POWER SUPPLY AND SIGNAL CIRCUITS

1. Turn ignition switch ON.
2. Check voltage between DEF supply pump assembly connector sensor 5V and ground circuit terminals.

DEF supply pump assembly			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C204	5	14	Approx. 5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Turn ignition OFF.
2. Reconnect the DEF supply pump assembly.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P203D DTC current?

YES >> Replace the aftertreatment DEF dosing unit. Refer to EX-73, "Exploded View".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK TANK LEVEL SENSOR GROUND CIRCUIT FOR OPEN

Check the ground circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	26	C204	14	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9.CHECK TANK LEVEL SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank level sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	20	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair short circuit in harness or connectors.

10.CHECK TANK LEVEL SENSOR POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank level sensor 5 volt supply and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	28	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace harness for a short circuit.

11.CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Reconnect all components.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P203D DTC current?

YES >> Replace DEF control module. Refer to EC-1999, "Exploded View".
NO >> The removal and installation of the connector corrected the issue.

P203F REDUCTANT LEVEL TOO LOW

DTC Description

INFOID:0000000014420544

The Diesel Exhaust Fluid (DEF) Tank Level Sensor measures the level of the fluid inside the DEF Tank. The DEF control module provides a 5V source and monitors the voltage that determines the fluid level in the tank. DEF Tank Level Sensor is integrated in the DEF Dosing Unit. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The monitor checks whether the DEF tank is low, very low, or empty.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P203F	DEF TANK LEVEL	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF tank level sensor signal
		Threshold	• Stage 1: DEF tank level low (22% - 65%). • Stage 2: DEF tank level very low (19% - 35%). • Stage 3: DEF tank level empty (0%).
		Diagnosis delay time	—

POSSIBLE CAUSE

Low DEF tank level.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P203F being current on the CONSULT screen.

Is P203F DTC current?

YES >> Go to EC-1644, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420545

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P203F being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.DISABLE THE DTC

1. Low DEF level has been detected in the tank. Add DEF to the DEF tank.
2. Using CONSULT erase ENGINE diagnostic trouble codes.
3. Operate the engine within the "Conditions for Clearing the DTC" found in the DTC description.
4. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P203F DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1644, "DTC Description".
NO >> Repair complete.

P2044 REDUCTANT TEMPERATURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420546

NOTE:
If DTC P0687 is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P0687 present. Refer to EC-1496, "DTC Description".

The aftertreatment DEF quality sensor is a smart device that communicates to the ECM via CAN lines. The aftertreatment DEF quality sensor performs its own internal diagnostics and reports malfunctions back to the primary engine control module via the CAN lines. The aftertreatment DEF quality sensor is used to measure the concentration of the aftertreatment DEF in the tank.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid tank temperature signal voltage was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2044	DEF QUALITY SENSOR TEMP	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	DEF quality sensor signal.
		Threshold	DEF quality sensor temperature sensor element shorted to a high source for longer than 5 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF quality sensor.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2044 being current on the CONSULT screen.

Is P2044 DTC current?

YES >> Go to EC-1646, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420547

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P0687 is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1496, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF QUALITY SENSOR DTC

Check for DTC P2044 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> An internal error has been detected in the aftertreatment DEF quality temperature sensor circuit. Replace the aftertreatment DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> Repair or replace error-detected parts. GO TO 4.

4.CHECK FOR INACTIVE DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Connect CONSULT, and erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for Clearing DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2044 DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1646, "DTC Description".
NO >> The removal and installation of the connector corrected the issue.

P2045 REDUCTANT TEMPERATURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420548

NOTE:
If DTC P0687 is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P0687 present. Refer to EC-1496, "DTC Description".

The aftertreatment DEF quality sensor is a smart device that communicates to the ECM via CAN lines. The aftertreatment DEF quality sensor performs its own internal diagnostics and reports malfunctions back to the primary engine control module via the CAN lines. The aftertreatment DEF quality sensor is used to measure the concentration of the aftertreatment DEF in the tank.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid tank temperature signal voltage was out of range low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2045	DEF QUALITY SENSOR TEMP	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF quality sensor signal
		Threshold	DEF quality sensor temperature sensor element shorted to a low source for longer than 5 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF quality sensor.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2045 being current on the CONSULT screen.

Is P2045 DTC current?

YES >> Go to EC-1648, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420549

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P0687 is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1496, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF QUALITY SENSOR DTC

Check for DTC P2045 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> An internal error has been detected in the aftertreatment DEF quality temperature sensor circuit. Replace the aftertreatment DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> Repair or replace error-detected parts. GO TO 4.

4.CHECK FOR INACTIVE DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Connect CONSULT, and erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for Clearing DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2045 DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1648, "DTC Description".
NO >> The removal and installation of the connector corrected the issue.

P2048 REDUCTANT INJECTION VALVE CIRCUIT LOW 1/1

DTC Description

INFOID:0000000014420550

The aftertreatment diesel exhaust fluid dosing valve is controlled by the ECM. When the Engine Control Module (ECM) commands DEF dosing, the ECM sends a pulse width modulated (PWM) signal to the dosing valve, which opens the dosing valve and allows DEF to be sprayed into the exhaust stream.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid dosing valve circuit was shorted high, shorted low, or open.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2048	DEF DOSING VALVE POS CMD	Diagnosis condition	DEF dosing valve is being commanded ON
		Signal (terminal)	DEF dosing valve signal
		Threshold	Either one of DEF dosing valve circuits is shorted to ground.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF dosing valve.
- Harness and connectors.
- ECM.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate "DEF Dosing Unit Override Test".
3. The DTC will move to "Past" when the test runs and passes.

Is P2048 DTC current?

YES >> Go to EC-1650, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420551

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P2048 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF dosing valve.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE DEF DOSING VALVE

Check the DEF dosing valve. Refer to EC-1652, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace the DEF dosing valve. Refer to EX-64, "Exploded View".

4.CHECK DEF DOSING VALVE FOR A SHORT TO GROUND

Measure the resistance between the aftertreatment DEF dosing valve SIGNAL (pin 1) and the metal case of the aftertreatment DEF dosing valve.

Is the resistance above 100 Kohms?

YES >> GO TO 5.
NO >> Replace the DEF dosing valve. Refer to EX-64, "Exploded View".

5.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Disconnect the ECM.
2. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK DEF DOSING VALVE CIRCUITS FOR OPEN

Check the signal and ground circuits for continuity between the ECM and the DEF dosing valve.

ECM		DEF dosing valve		Continuity
Connector	Terminal	Connector	Terminal	
E93	73	C36	2	Yes
	74		1	

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open signal circuit in harness or connectors.

7.CHECK DEF DOSING VALVE CIRCUITS FOR SHORT

Check the continuity between DEF dosing valve circuits and ground at ECM harness connector.

ECM		Ground	Continuity
Connector	Terminal		
E93	73	—	No
	74		

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness connector.

8.CHECK DEF DOSING VALVE CIRCUIT CONNECTOR FOR SHORT

Check the continuity between DEF dosing valve power circuit and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	74	All others	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair short circuit in harness connector.

9.CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

Is P2048 DTC current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

Component Inspection

INFOID:0000000014420552

1.CHECK THE DEF DOSING VALVE RESISTANCE

Measure the resistance between the DEF dosing valve pins at the DEF dosing valve.

Is the resistance between 11 and 18 ohms?

YES >> GO TO 2.
NO >> Replace the DEF dosing valve. Refer to EX-64, "Exploded View".

2.CHECK DEF DOSING VALVE FOR A SHORT TO GROUND

Measure the resistance between the aftertreatment DEF dosing valve SIGNAL (pin 1) and the metal case of the aftertreatment DEF dosing valve.

Is the resistance above 100 Kohms?

YES >> Inspection End.
NO >> Replace the DEF dosing valve. Refer to EX-64, "Exploded View".

P204A REDUCTANT PRESSURE SENSOR CIRCUIT

DTC Description

INFOID:0000000014420553

NOTE:
If DTC P204A is displayed with the following DTC, first perform the trouble diagnosis for other DTC:
• P203F. Refer to EC-838, "DTC Index".

The SCR dosing system is an In-tank system with a DEF supply pump assembly that controls the dosing pump and monitors DEF heating, level, quality, pressure and temperature. This Dosing system is powered by battery voltage. The DEF supply pump assembly activates priming, dosing, heating and purging of DEF using data provided by the Engine Control module (ECM) via CAN lines. The DEF supply pump assembly performs its own diagnostics and reports malfunctions back to the ECM. The ECM then decodes the error and converts it to a Diagnostic Trouble Code.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected that the DEF supply pump assembly pump is stuck.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P204A	DEF PUMP STATUS	Diagnosis condition	Immediately after turning the ignition ON and continues until DEF dosing unit attempts to prime
		Signal (terminal)	DEF dosing pump
		Threshold	DEF dosing unit was unable to maintain the commanded DEF pressure.
		Diagnosis delay time	—

POSSIBLE CAUSE

• DEF supply pump assembly.
• Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate ″DEF System Leak Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P204A DTC current?

YES >> Go to EC-1653, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420554

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P204A current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR ANOTHER CURRENT DTC

1. Make sure the aftertreatment DEF tank is **not** empty and the tank level gauge is accurate.
2. Using CONSULT check for other ENGINE diagnostic trouble codes.

Is P203F DTC current?

YES >> Fill the DEF tank.
NO >> GO TO 3.

3.CHECK THE DEF TANK

1. Turn ignition switch OFF.
2. Check the DEF tank for debris or foreign particles.
3. Check the DEF tank vent for crystallization buildup and clogging.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Clean the DEF tank thoroughly and fill with certified DEF.

4.CHECK FOR OTHER CURRENT DTCS

1. Turn ignition switch ON.
2. Using CONSULT check for the following “ENGINE” diagnostic trouble codes:

- P204C
- P204D
- P20E8
- P20E9

Are any of the above DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.INSPECT DEF DOSING UNIT LINES AND FITTINGS

1. Turn ignition switch OFF.
2. Inspect the DEF line on the selective catalytic reduction (SCR) dosing system.
3. Inspect dosing valve supply line between the dosing unit and dosing valve (pressure line).
4. Inspect the DEF line and associated fittings or connectors:

- Check the DEF tank connections for cracks and pitting.
- Check the dosing unit connections and fittings for loose, leaking, or damaged connections.
- Disconnect the pressure line dosing unit connectors and look for signs of buildup or blockage.
- Verify proper sealing at all connection points, including DEF tank, dosing unit, and dosing valve.

Any damaged, leaking, or restricted connections found?

YES >> Repair or replace the leaking DEF line or fitting, or replace the DEF dosing unit as necessary.
NO >> GO TO 6.

6.CHECK FOR AIR IN THE DEF

1. Turn ignition switch ON.
2. Connect CONSULT.
3. Check for air in the DEF.

Is air found in the DEF?

YES >> Check the DEF dosing unit fittings, pressure line fittings, tank fittings and repair as necessary.
NO >> GO TO 7.

7.INSPECT THE DEF TANK FILTER FOR BLOCKAGE

1. Turn ignition switch OFF.
2. Remove the tank level and temperature sensor from the DEF tank.
3. Inspect the aftertreatment DEF tank filter for signs of blockage or buildup.

Is the DEF tank filter blocked?

YES >> Drain, clean, and refill the DEF tank.
NO >> GO TO 8.

8.CHECK DEF DOSING UNIT FOR PROPER OPERATION

1. Connect all harness connectors.
2. Remove the aftertreatment DEF dosing valve from the decomposition tube.
3. Place the DEF dosing valve in a measuring container having greater than a 1.5 liter [50 oz] capacity.
4. Turn ignition switch ON.
5. Using CONSULT, access “ENGINE” and select ″DEF Dosing Unit Override Test″ active test.

Did the DEF dosing unit operate according to specifications?

YES >> GO TO 9.
NO >> Replace the DEF supply pump assembly. Refer to EX-64, "Exploded View".

9.ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and clear DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC" found in the DTC description of this diagnosis procedure.

Is P204A DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1653, "DTC Description".
NO >> Repair complete.

P204C REDUCTANT PRESSURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420555

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1496, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply and a ground to the aftertreatment diesel exhaust fluid pressure sensor. The pressure sensor provides a signal to the ECM on the sensor signal circuit. This sensor signal voltage changes, based on the aftertreatment diesel exhaust fluid pressure supplied by the dosing unit. The ECM will detect a low signal voltage at low diesel exhaust fluid pressures, and a high signal voltage at high diesel exhaust fluid pressures. Possible reduced engine performance.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid tank temperature signal voltage was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P204C	DEF LINE PRESS	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	DEF pressure sensor signal.
		Threshold	DEF pressure sensor signal voltage is less than 0.5 volt for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- DEF pressure sensor.
- DEF control module.
- DEF supply pump assembly.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P204C current on the CONSULT screen.

Is P204C DTC current?

YES >> Go to EC-1656, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420556

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1756, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF PRESSURE SENSOR DTC

Check for DTC P204C current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK DEF PRESSURE SENSOR POWER SUPPLY CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DEF supply pump assembly connector sensor supply voltage and return circuit terminals.

DEF supply pump assembly			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C204	13	11	Approx. 5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between DEF supply pump assembly 5V supply terminal 13 and signal circuit terminal 12.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P204D become current and P204C become past?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the DEF supply pump assembly connector.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P203C DTC become current?

YES >> A damaged tank level sensor has been detected. Replace the aftertreatment DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> The removal and installation of the connector corrected the issue. Repair complete.

7. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Disconnect the DEF control module.
2. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK TANK PRESSURE SENSOR POWER CIRCUIT FOR OPEN

Check the 5 volt power circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	27	C204	13	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9. CHECK TANK PRESSURE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	25	C204	12	Yes

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair open circuit in harness or connectors.

10. CHECK TANK PRESSURE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank pressure sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	25	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair short circuit in harness or connectors.

11. CHECK TANK PRESSURE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DEF tank pressure sensor signal circuit and ground.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	25	—	No

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair or replace harness for a short to ground.

12.CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P204C DTC current?

YES >> Replace DEF control module. Refer to EC-1999, "Exploded View".
NO >> The removal and installation of the connector corrected the issue.

P204D REDUCTANT PRESSURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420557

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1756, "DTC Description".

The Diesel Exhaust Fluid (DEF) Pressure Sensor is a three wire sensor, integrated into the DEF Supply Pump assembly and is not serviceable separate. The DEF Pressure Sensor monitors supply pressure to the DEF Injector. The Diesel Exhaust Fluid (DEF) Dosing Control Unit provides a 5V Supply and a ground to the DEF Pressure Sensor. The sensor provides a signal to the DEF Dosing Control Unit on the DEF Pressure sensor signal circuit. This DEF Pressure Sensor Signal voltage changes, based on the diesel exhaust fluid pressure supplied by the DEF Supply Pump.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the DEF supply pump assembly Diesel Exhaust Fluid (DEF) tank pressure sensor voltage is in excess of an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P204C	DEF LINE PRESS	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF pressure sensor signal
		Threshold	DEF pressure sensor signal voltage is greater than 4.5 volt for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- DEF pressure sensor.
- DEF control module.
- DEF supply pump assembly.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P204D being current on the CONSULT screen.

Is P204D DTC current?

YES >> Go to EC-1660, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420558

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1756, "DTC Description".
NO >> GO TO 2.

2. CHECK FOR CURRENT DEF PRESSURE SENSOR DTC

Check for DTC P204D current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Connect a jumper wire between DEF supply pump assembly 5 volt supply terminal 13 and signal circuit terminal 12.
3. Wait for 1 minute.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is DTC P204C current and P204D past?

YES >> GO TO 10.
NO >> GO TO 5.

5. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK TANK PRESSURE SENSOR GROUND CIRCUIT FOR OPEN

Check the ground circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	24	C204	11	Yes

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open circuit in harness or connectors.

7. CHECK TANK PRESSURE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank pressure sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	25	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness or connectors.

8. CHECK TANK PRESSURE SENSOR POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank pressure sensor 5V supply and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	27	All others	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace harness for a short circuit.

9. CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Reconnect all harness connectors.
2. Turn ignition switch ON and wait 30 seconds.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is P204D DTC current?

YES >> Replace DEF control module. Refer to EC-1999, "Exploded View".
NO >> The removal and installation of the connector corrected the issue.

10. CHECK FOR CURRENT DTC

1. Turn ignition OFF.
2. Remove the jumper wire.
3. Connect all components in the correct positions.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P204D DTC current?

YES >> Return to the diagnosis procedure steps. Refer to EC-1660, "DTC Description".
NO >> Repair complete.

P205C REDUCTANT TANK TEMPERATURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420559

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1496, "DTC Description".

The Diesel Exhaust Fluid (DEF) tank temperature sensor measures the temperature of the fluid inside the DEF tank. The DEF control module monitors the variation in voltage caused by changes in the sensor resistance to determine the fluid temperature. DEF tank temp sensor is integrated in the DEF supply pump assembly. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid tank temperature signal voltage was out of range low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P205C	UREA TANK TEMP	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF temperature sensor signal
		Threshold	DEF tank temperature sensor signal voltage is less than 0.17 volt (80°C) for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF temperature sensor
- DEF control module
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P205C current on the CONSULT screen.

Is P205C DTC current?

YES >> Go to EC-1663, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420560

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1756, "DTC Description".

NO >> GO TO 2.

2.CHECK FOR CURRENT DEF PRESSURE SENSOR DTC

Check for DTC P205C current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P205D become current and P205C become past?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P205C DTC current?

YES >> Replace the DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> The removal and installation of the connector corrected the issue.

6.INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.

NO >> Repair or replace error-detected parts.

7. CHECK TANK TEMPERATURE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check for continuity between DEF tank temperature sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	21	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness or connectors.

8. CHECK TANK TEMPERATURE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check for continuity between DEF tank temperature sensor signal circuit and ground.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	21	—	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace harness for a short to ground.

9. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.
4. Turn ignition switch ON.
5. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P205C DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1663, "DTC Description".
NO >> Repair complete.

P205D REDUCTANT TANK TEMPERATURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420561

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1496, "DTC Description".

The Diesel Exhaust Fluid (DEF) tank temperature sensor measures the temperature of the fluid inside the DEF tank. The DEF control module monitors the variation in voltage caused by changes in the sensor resistance to determine the fluid temperature. DEF tank temp sensor is integrated in the DEF supply pump assembly. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment diesel exhaust fluid tank temperature signal voltage was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P205D	UREA TANK TEMP	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF temperature sensor signal
		Threshold	DEF tank temperature sensor signal voltage is greater than 4.4 volt (40°C) for 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF temperature sensor.
- DEF control module.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P205D current on the CONSULT screen.

Is P205D DTC current?

YES >> Go to EC-1666, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420562

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1756, "DTC Description".

NO >> GO TO 2.

2. CHECK FOR CURRENT DEF TEMPERATURE SENSOR DTC

Check for DTC P205D current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the DEF supply pump assembly connector temperature SIGNAL terminal 9 and temperature ground terminal 10.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P205C become current and P205D become past?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Remove the jumper wire.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P205D become current?

YES >> Replace the DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> The removal and installation of the connector corrected the issue. Repair complete.

6. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.

- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK TANK TEMPERATRE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	21	C204	9	Yes

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair open circuit in harness or connectors.

8. CHECK TANK TEMPERATRE SENSOR GROUND CIRCUIT FOR OPEN

Check the ground circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	29	C204	10	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9. CHECK TANK TEMPERATURE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank temperature sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	21	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair short circuit in harness or connectors.

10. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.
4. Turn ignition switch ON.
5. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P205D DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1666, "DTC Description".
NO >> Repair complete.

P205E REDUCTANT TANK TEMPERATURE SENSOR CIRCUIT INTERMITTENT

DTC Description

INFOID:0000000014420563

NOTE:
If DTC P21CA is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CA present. Refer to EC-1496, "DTC Description".

The Diesel Exhaust Fluid (DEF) tank temperature sensor measures the temperature of the fluid inside the DEF tank. The DEF control module monitors the variation in voltage caused by changes in the sensor resistance to determine the DEF temperature. DEF tank temperature sensor is integrated in the DEF supply pump assembly. It must be replaced with the DEF Supply Pump assembly.

DTC DETECTION LOGIC

The aftertreatment diesel exhaust fluid controller (DCU) detected the diesel exhaust fluid tank temperature reading was higher or lower than other temperature sensors or no increase in DEF tank temperature during tank heating.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P205E	DEF QUALITY SENSOR TEMP UREA TANK TEMP COOLANT TEMP	Diagnosis condition	Engine OFF for 8 hours, start the engine and let it idle for 1 minute.
		Signal (terminal)	DEF temperature sensor signal
		Threshold	The difference in DEF temperature from start to 700 seconds later is less than 2°
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF temperature sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Allow the engine to stay OFF for 8 hours.
3. Start the engine and let it idle for 1 minute.
4. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P205E being current on the CONSULT screen.

Is P205E DTC current?

YES >> Go to EC-1669, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420564

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CA is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1756, "DTC Description".
NO >> GO TO 2.

2. CHECK FOR CURRENT DEF TEMPERATURE SENSOR DTC

Check for DTC P205E current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
   NOTE:
   Other diagnostic codes related to the DEF supply pump assembly will be set.

Did DTC P205D become current?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the DEF supply pump assembly connector temperature SIGNAL terminal 9 and temperature ground terminal 10.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Did DTC P205C become current and P205D become past?

YES >> Replace the DEF supply pump assembly. Refer to EX-73, "Exploded View".
NO >> GO TO 6.

6. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Remove the jumper wire.
2. Turn ignition switch OFF.
3. Disconnect the DEF control module.
4. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.

- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK TANK TEMPERATURE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank temperature sensor signal and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	21	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness or connectors.

8. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for Clearing the DTC".
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P205E DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1669, "DTC Description".
NO >> Repair complete.

P206B REDUCTANT QUALITY SENSOR CIRCUIT

DTC Description

INFOID:0000000014420565

NOTE:
If DTC U02A2 is displayed with this DTC, first perform the trouble diagnosis for other DTC.
• U02A2 present. Refer to EC-939, "DTC Description".

The aftertreatment diesel exhaust fluid quality sensor is a smart device that communicates to the ECM via CAN communication. The aftertreatment diesel exhaust fluid quality sensor performs its own internal diagnostics and reports malfunctions back to the engine control module via CAN communication. The aftertreatment diesel exhaust fluid quality sensor is used to measure the concentration of the aftertreatment diesel exhaust fluid in the tank.

DTC DETECTION LOGIC

The DEF quality sensor has reported an internal error. Engine power will be reduced.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P206B	DEF QLTY SENS	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF quality sensor signal
		Threshold	DEF tank concentration detection element signal is out of range, shorted low or shorted high for 5 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

• DEF tank quality sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P206B current on the CONSULT screen.

Is P206B DTC current?

YES >> Go to EC-1672, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420566

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC U02A2 is present, perform the confirmation procedure (diagnosis procedure) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-939, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF QUALITY SENSOR DTC

Check for DTC P206B current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.CHECK FOR CURRENT DTC

1. Using CONSULT erase “ENGINE” diagnostic trouble codes.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.
4. Turn ignition switch ON.
5. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P206B DTC current?

YES >> Replace the quality sensor. Refer to EX-73, "Exploded View".
NO >> Repair complete.

P206D REDUCTANT QUALITY SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420567

NOTE:
If DTC U02A2 is displayed with this DTC, first perform the trouble diagnosis for other DTC.
• U02A2 present. Refer to EC-939, "DTC Description".

The aftertreatment diesel exhaust fluid quality sensor is a smart device that communicates to the ECM via CAN communication. The aftertreatment diesel exhaust fluid quality sensor performs its own internal diagnostics and reports malfunctions back to the engine control module via CAN communication. The aftertreatment diesel exhaust fluid quality sensor is used to measure the concentration of the aftertreatment diesel exhaust fluid in the tank.

DTC DETECTION LOGIC

The DEF quality sensor has reported an internal error. Engine power will be reduced.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P206D	DEF QLTY SENS	Diagnosis condition	Ignition switch ON or the engine is running
		Signal (terminal)	DEF quality sensor signal
		Threshold	DEF tank concentration detection element signal is shorted to a high voltage source for 5 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

• DEF tank quality sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P206D current on the CONSULT screen.

Is P206D DTC current?

YES >> Go to EC-1674, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420568

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC U02A2 is present, perform the confirmation procedure (diagnosis procedure) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-939, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF QUALITY SENSOR DTC

Check for DTC P206D current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.CHECK FOR CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.
4. Turn ignition switch ON.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P206D DTC current?

YES >> Replace the DEF quality sensor. Refer to EX-75, "Exploded View".
NO >> Repair complete.

P207F REDUCTANT QUALITY PERFORMANCE

DTC Description

INFOID:0000000014420569

The aftertreatment diesel exhaust fluid quality sensor is a smart device that communicates to the ECM via CAN communication. The aftertreatment diesel exhaust fluid quality sensor performs its own internal diagnostics and reports malfunctions back to the engine control module via CAN communication. The aftertreatment diesel exhaust fluid quality sensor is used to measure the concentration of the aftertreatment diesel exhaust fluid in the tank. The concentration level is expected to be at 32.5 Â ±1.5%.

DTC DETECTION LOGIC

The DEF quality sensor has measured the concentration of DEF in the tank to be:
- Below the minimum concentration threshold.
- Above the maximum concentration threshold.
- Sensor is unable to generate a concentration estimate for longer than the maximum wait time threshold

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P207F	DEF QLTY SENS	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	DEF quality sensor signal.
		Threshold	DEF tank concentration detection element signal is out of range, shorted low or shorted high for 5 seconds. • DEF concentration level > 40%. • 22.5% < DEF concentration level < 15%. • DEF concentration level cannot be detected (frozen or not present).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Degraded, diluted, or incorrect DEF.
- CAN lines open or shorted.
- DEF quality sensor.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1676, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420570

1.CHECK AFTERTREATMENT DEF LEVEL

1. Turn ignition OFF.
2. Check the DEF fluid tank level.
   NOTE:
   Having low level DEF fluid in the tank can cause this DTC to set.

Is DEF fluid tank level less than 50%?

YES >> Fill tank completely with fresh DEF.
NO >> GO TO 2.

2.CHECK AFTERTREATMENT DEF CONCENTRATION

Using a refractometer [SST: J-54466] measure the concentration of the DEF in the tank.

Is DEF concentration within 32.5 Â± 1.5 %?

YES >> GO TO 3.
NO >> Drain the DEF fluid tank and fill with new DEF.

3.CHECK FOR CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for Clearing DTC".
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P207F DTC current?

YES >> Replace the Aftertreatment DEF quality sensor. Refer to EX-75, "Exploded View".
NO >> Repair complete.

P2080 EXHAUST GAS TEMPERATURE SENSOR 1

DTC Description

INFOID:0000000014420571

The aftertreatment Diesel Particulate Filter (DPF) temperature sensor module is a smart device that communicates with the Engine Control Module (ECM) via CAN communication lines. The aftertreatment DPF temperature sensor module performs its own internal diagnostics and reports malfunctions back to the ECM using CAN data lines. The aftertreatment DPF temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment DPF intake temperature, and aftertreatment DPF outlet temperature. The temperature probes are permanently attached to the aftertreatment DPF temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment DOC inlet gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2080	DOC INLET TEMP	Diagnosis condition	This diagnostic runs continuously when the engine is running and active regeneration of the aftertreatment diesel particulate filter is not occurring.
		Signal (terminal)	DOC inlet temperature sensor
		Threshold	ECM detected the temperature at the DOC intake was > 745°C [1373°F] for 65 seconds.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

NOTE:
This DTC will become history after the aftertreatment temperatures drop below the warning limit and a key cycle has occurred, and will likely be "past" at the time of diagnosis. For these reasons this diagnosis procedure must be used for both current and past DTCs.

POSSIBLE CAUSE

- Excessive engine oil being introduced into the exhaust system from the engine.
- A malfunctioning fuel injector causing unburned fuel to enter the exhaust system.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Bring the vehicle to a complete stop.
6. Repeat all of the above steps one more time.
7. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
8. Check for DTC P2080 being current on the CONSULT screen.

Is 1st trip DTC detected?

YES >> Proceed to EC-1678, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420572

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other current and past “ENGINE” diagnostic trouble codes.

NOTE:

The following current and past DTCs have priority over this DTC if any of them exists:
- U1611
- P1613
- P1614
- P1615
- P1623

Are there any current or past applicable DTCs?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Using CONSULT, select “ENGINE” and perform the ″Cylinder Cutout Test″ under ″active test″ to check for a cylinder misfire.

Was an engine misfire detected?

YES >>
- Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
- Inspect and repair the aftertreatment system for possible damage.

NO >> GO TO 3.

3.INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Was engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 4.

4.CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 5.

5.ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P2080 DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1678, "DTC Description".
NO >> Repair complete.

P208A REDUCTANT PUMP CONTROL CIRCUIT OPEN

DTC Description

INFOID:0000000014420573

The SCR dosing system is an in-tank system with a DEF supply pump assembly that controls the dosing pump and monitors Urea heating, level, quality, pressure and temperature. This dosing system is powered by battery voltage and an initialization signal from the DEF control module. The DEF supply pump assembly activates Priming, dosing, heating and purging of DEF using data provided by the Engine Control module (ECM) via CAN communication. The DEF supply pump assembly performs its own diagnostics and reports malfunctions back to the ECM. The ECM then decodes the error and converts it to a DTC.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected that any of the 3 brushless direct current motor phases, within the DEF supply pump assembly pump, has an open circuit condition.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P208A	DEF PUMP STATE DEF PUMP STATUS DEF PUMP TIME DEF DOSING VALVE POS CMP	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	DEF pump signal.
		Threshold	DEF control module detected there is an open circuit in one of the three DEF supply pump assembly unit motor phases.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- DEF control module.
- DEF supply pump assembly.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P208A current on the CONSULT screen.

Is P208A DTC current?

YES >> Go to EC-1680, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420574

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes for DTC P208A being current.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the DEF supply pump assembly connector pump motor A supply terminal 15 and motor B supply terminal 16 or motor C supply terminal 8.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P208D become current and P208A become past?

YES >> GO TO 4.
NO >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".

4.INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Disconnect the DEF control module.
4. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK DEF SUPPLY PUMP MOTOR A SUPPLY CIRCUIT FOR OPEN

Check the pump motor A supply circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	19	C204	15	Yes

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit in harness or connectors.

6.CHECK DEF SUPPLY PUMP MOTOR B SUPPLY CIRCUIT FOR OPEN

Check the pump motor B supply circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	18	C204	16	Yes

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open circuit in harness or connectors.

7. CHECK DEF SUPPLY PUMP MOTOR C SUPPLY CIRCUIT FOR OPEN

Check the pump motor C supply circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	17	C204	8	Yes

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair open circuit in harness or connectors.

8. CHECK DEF SUPPLY PUMP MOTOR GROUND CIRCUIT FOR OPEN

Check the pump motor ground circuit for continuity between the DEF control module and the DEF supply pump assembly.

DEF control module		DEF supply pump assembly		Continuity
Connector	Terminal	Connector	Terminal	
C205	7	C204	7	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9. ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for clearing the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P208A DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1680, "DTC Description".
NO >> Repair complete.

P208C REDUCTANT PUMP CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420575

The aftertreatment Diesel Exhaust Fluid (DEF) dosing control module performs many functions, one of which is to generate adequate diesel exhaust fluid pressure in the lines, using a pump, to allow for dosing. The ECM provides a battery voltage supply and a ground to the DEF supply pump assembly. The ECM also supplies a signal to the dosing unit to control the diesel exhaust fluid output. This signal changes, based on the diesel exhaust fluid pressure being commanded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected that any of the 3 brushless direct current motor phases, within the DEF supply pump assembly pump, has a voltage below an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P208C	DEF PUMP STATE DEF PUMP STATUS DEF PUMP TIME DEF DOSING VALVE POS CMP	Diagnosis condition	This diagnostic runs when the DEF supply pump assembly is in the priming or dosing state.
		Signal (terminal)	DEF pump signal
		Threshold	The DEF control module detected the dosing pump motor circuit is shorted to ground.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF supply pump assembly.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch ON.
2. Connect CONSULT, select ″ENGINE″ and perform ″DEF System Leak Test″ under ″Active test″.
3. Check for DTC P208C being current on the CONSULT screen.

Is DTC P208C current?

YES >> Proceed to EC-1683, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420576

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes for DTC P208C being current.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.

- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DEF SUPPLY PUMP MOTOR A SUPPLY CIRCUIT FOR SHORT TO GROUND

Check for continuity between the pump motor A supply circuit and ground at the DEF control module harness connector.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	19	—	No

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair short circuit in harness or connectors.

5. CHECK DEF SUPPLY PUMP MOTOR B SUPPLY CIRCUIT FOR SHORT TO GROUND

Check for continuity between the pump motor B supply circuit and ground at the DEF control module harness connector.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	18	—	No

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair short circuit in harness or connectors.

6. CHECK DEF SUPPLY PUMP MOTOR C SUPPLY CIRCUIT FOR SHORT TO GROUND

Check for continuity between the pump motor C supply circuit and ground at the DEF control module harness connector.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	17	—	No

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair short circuit in harness or connectors.

7.CHECK FOR CURRENT DTC

1. Connect DEF control module.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT check for “ENGINE” diagnostic trouble codes.
   NOTE:
   Other DTCs will be set.

Is P208A DTC current and P208C DTC past?

YES >> • Replace the DEF supply pump assembly. Refer to EX-73, "Removal and Installation".
• GO TO 8.
NO >> • Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
• GO TO 8.

8.ERASE CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for setting the DTC".
6. Check for “ENGINE” diagnostic trouble codes.

Is P208C DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1683, "DTC Description".
NO >> Repair complete.

P208D REDUCTANT PUMP CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420577

The aftertreatment Diesel Exhaust Fluid (DEF) dosing control module performs many functions, one of which is to generate adequate diesel exhaust fluid pressure in the lines, using a pump, to allow for dosing. The ECM provides a battery voltage supply and a ground to the DEF supply pump assembly. The ECM also supplies a signal to the dosing unit to control the diesel exhaust fluid output. This signal changes, based on the diesel exhaust fluid pressure being commanded.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected that any of the 3 brushless direct current motor phases, within the DEF supply pump assembly pump, has a voltage in excess of an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P208C	DEF PUMP STATE DEF PUMP STATUS DEF PUMP TIME DEF DOSING VALVE POS CMP	Diagnosis condition	This diagnostic runs when the DEF supply pump assembly is in the priming or dosing state.
		Signal (terminal)	DEF pump signal
		Threshold	The DEF control module detected the dosing pump motor circuit is shorted to high voltage.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF supply pump assembly.
- Harness and connectors.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch ON.
2. Connect CONSULT, select ″ENGINE″ and perform ″DEF System Leak Test″ under ″Active Test″.
3. Check for DTC P208D being current on the CONSULT screen.

Is DTC P208D current?

YES >> Proceed to EC-1686, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420578

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes for DTC P208D being current.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR OBSTRUCTED OR RESTRICTED AIR FLOW TO THE DEF CONTROL MODULE

Check the aftertreatment DEF control module mounting area for air flow obstructions. Restrictions or blockage ofthe air flow could cause the DEF control module to overheat. Check for the following:

1. Debris on or around the DEF control module.
2. Aftermarket shields, flaps, or brackets mounted too close to the DEF control module.
3. Exhaust leaks allowing exhaust to overheat the temperature sensor module.

Is the inspection result normal?

YES >> GO TO 3.
NO >> • Repair or replace the cause of the restricted air flow.
• Remove any debris accumulated near the DEF control module.
• Relocate any aftermarket accessories that might be restricting air flow.

- Repair any causes of excessive heat to the DEF control module.
- GO TO 9.

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK DEF SUPPLY PUMP MOTOR A SUPPLY CIRCUIT FOR SHORT TO ANOTHER CIRCUIT

1. Turn ignition switch ON.
2. Check for continuity between the pump motor A supply circuit and all other pins at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	19	All others	No

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair short circuit in harness or connectors.

6. CHECK DEF SUPPLY PUMP MOTOR B SUPPLY CIRCUIT FOR SHORT TO ANOTHER CIRCUIT

1. Turn ignition switch ON.
2. Check for continuity between the pump motor B supply circuit and all other pins at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	18	All others	No

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair short circuit in harness or connectors.

7. CHECK DEF SUPPLY PUMP MOTOR C SUPPLY CIRCUIT FOR SHORT TO ANOTHER CIRCUIT

1. Turn ignition switch ON.
2. Check for continuity between the pump motor C supply circuit and all other pins at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	17	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair short circuit in harness or connectors.

8. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Connect DEF control module.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT check for “ENGINE” diagnostic trouble codes.
   NOTE:
   Other DTCs will be set.

Is P208A DTC current and P208D DTC past?

YES >> • Replace the DEF supply pump assembly. Refer to EX-73, "Removal and Installation".
• GO TO 9.
NO >> • Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
• GO TO 9.

9. ERASE CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for setting the DTC".
6. Check for “ENGINE” diagnostic trouble codes.

Is P208D DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1686, "DTC Description".
NO >> Repair complete.

P209F REDUCTANT TANK HEATER CONTROL CIRCUIT PERFORMANCE

DTC Description

INFOID:0000000014420579

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- P202B present. Refer to EC-1620, "DTC Description".
- P202C present. Refer to EC-1623, "DTC Description".
- P205C present. Refer to EC-1663, "DTC Description".
- P205D present. Refer to EC-1666, "DTC Description".
- P205E present. Refer to EC-1669, "DTC Description".

The Diesel Exhaust Fluid (DEF) Tank has an internal heating coil to thaw frozen diesel exhaust fluid. The DEF control module monitors the temperature of the diesel exhaust fluid in the tank. The DEF control module activates the DEF tank heater, at freezing temperatures to warm the diesel exhaust fluid. The DEF tank heater is integrated into the DEF supply pump assembly. It must be replaced with the DEF supply pump assembly.

DTC DETECTION LOGIC

The monitor checks whether the DEF tank temperature has failed to reach a target threshold within a time window after the heating is commanded ON.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P209F	DEF HTR TEST TIME UREA TANK TEMP DEF TANK TEMP SENS V	Diagnosis condition	This diagnostic runs a calibrated amount of time after DEF tank heating is first commanded.
		Signal (terminal)	DEF tank heater signal
		Threshold	The DEF control module detected the DEF tank temperature did not reach dosing temperature (minimum of –6°C (21°F) in the required time, when the DEF tank heater was commanded ON.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF supply pump assembly (DEF tank heater).
- DEF supply pump assembly (DEF tank temperature sensor).
- Frozen DEF in the DEF tank.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P209F being current on the CONSULT screen.

Is P209F DTC current?

YES >> Go to EC-1689, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420580

1.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- P202B
- P202C
- P205C
- P205D
- P205E

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR LOW DEF TANK LEVEL

1. Make sure the DEF tank is **not** empty and the tank level gauge is accurate.
2. .Check for P203F being a current ENGINE diagnostic trouble code:

Is the above DTC detected?

YES >> Fill the DEF tank.
NO >> GO TO 3.

3.CHECK FOR CURRENT TANK HEATER DTC

Check for DTC P209F being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 4.
NO >> Refer to GI-47, "Intermittent Incident".

4.INSPECT DEF TANK HEATER SUPPLY CIRCUIT FOR OPEN

1. Turn ignition switch OFF.
2. Disconnect the DEF control module.
3. Disconnect the DEF supply pump assembly.
4. Check the DEF tank heater power supply circuit for continuity between the DEF supply pump assembly and the DEF control module.

DEF supply pump assembly		DEF control module		Continuity
Connector	Terminal	Connector	Terminal	
C204	1	C205	22	Yes

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open power supply circuit in harness or connectors.

5.INSPECT DEF TANK HEATER RETURN CIRCUIT FOR OPEN

Check the DEF tank heater return circuit for continuity between the DEF supply pump assembly and the DEF control module.

DEF supply pump assembly		DEF control module		Continuity
Connector	Terminal	Connector	Terminal	
C204	3	C205	23	Yes

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open return circuit in harness or connectors.

6.VERIFY PPROPER OPERATION OF THE DEF TANK HEATER

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Connect CONSULT and select “ENGINE” then perform the ″DEF Tank Heater Test″.
4. Using the CONSULT, monitor the DEF tank temperature ″ UREA TANK TEMP″.
5. Allow the DEF tank temperature 3 to 5 minutes to rise.

Did the DEF tank temperature rise?

YES >> GO TO 7.
NO >> Replace the DEF supply pump assembly. Refer to EX-73, "Removal and Installation".

7.ERASE CURRENT DTC

1. Using CONSULT erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Check for ENGINE diagnostic trouble codes.

Is P209F DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1689, "DTC Description".
NO >> Repair complete.

P20B7 REDUCTANT METERING UNIT HEATER CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420581

The aftertreatment diesel exhaust fluid dosing unit heater is used to defrost and/or prevent freezing of the diesel exhaust fluid dosing unit.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the heater input power source voltage to the DEF supply pump assembly is below an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20B7	DEF HTR TEST TIME DEF HTR TEST TIMER DEF HTR TEST COUNTS Def tank heater test status	Diagnosis condition	This diagnostic runs when the DEF supply pump assembly heater is commanded ON.
		Signal (terminal)	DEF tank heater signal
		Threshold	The heater input power source voltage to the DEF supply pump assembly < 8.99 V
		Diagnosis delay time	—

POSSIBLE CAUSE

- Urea heater relay.
- Wiring harness.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate "DEF Tank Heater Test".
3. The DTC will move to "Past" when the test runs and passes.

Is P20B7 DTC current?

YES >> Go to EC-1692, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420582

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing "ENGINE" diagnostic trouble codes.

If DTC P21CB or P21CC are present, perform the confirmation procedure (diagnosis procedure) for these other DTCs first.

Are any applicable DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF HEATER CIRCUIT DTC

Check for DTC P20B7 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT UREA HEATER RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the urea heater relay.
3. Inspect urea heater relay and connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.

- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK UREA HEATER RELAY CIRCUIT

1. Replace urea heater relay with a known good relay.
2. Turn ignition switch ON.
3. Connect CONSULT and erase DTCs.
4. Using CONSULT, activate ″DEF Tank Heater Test″.
5. The DTC will move to ″Past″ when the test runs and passes.

Is P20B7 DTC current?

YES >> GO TO 5.
NO >> Repair complete.

5. INSPECT DEF CONTROL MODULE AND VEHICLE HARNESS CONNECTOR PINS

1. Turn ignition OFF.
2. wait at least 90 seconds before proceeding to allow sufficient time for the DEF control module to completely power down.
3. Disconnect the DEF control module.
4. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK DEF TANK HEATER SUPPLY CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check for continuity between DEF tank heater supply circuit and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C35	1	All others	No

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair short circuit in harness or connectors.

7. CHECK TANK HEATER SUPPLY CIRCUIT FOR OPEN

Check the DEF tank heater supply circuit for continuity between the DEF control module connector C35 terminal 1 and the urea heater relay terminal 3.

DEF control module		Urea heater relay		Continuity
Connector	Terminal	Connector	Terminal	
C35	1	E90	3	Yes

Is the inspection result normal?

YES >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
NO >> Repair open circuit in harness or connectors.

P20B8 REDUCTANT METERING UNIT HEATER CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420583

The aftertreatment diesel exhaust fluid dosing unit heater is used to defrost and/or prevent freezing of the diesel exhaust fluid dosing unit.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the heater input power source voltage to the DEF supply pump assembly is in excess of an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20B7	DEF HTR TEST TIME DEF HTR TEST TIMER DEF HTR TEST COUNTS Def tank heater test status	Diagnosis condition	This diagnostic runs when the DEF supply pump assembly heater is commanded ON.
		Signal (terminal)	DEF tank heater signal.
		Threshold	ECM detects the DEF supply pump assembly heater temperature is rising when the heater was commanded OFF.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Urea heater relay.
- Wiring harness.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and activate ″DEF Tank Heater Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P20B8 DTC current?

YES >> Go to EC-1695, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420584

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CB or P21CC are present, perform the confirmation procedure (diagnosis procedure) for these other DTCs first.

Are any applicable DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF HEATER CIRCUIT DTC

Check for DTC P20B8 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT UREA HEATER RELAY AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the urea heater relay.
3. Inspect urea heater relay and connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.

- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK UREA HEATER RELAY CIRCUIT

1. Replace urea heater relay with a known good relay.
2. Turn ignition switch ON.
3. Connect CONSULT and erase DTCs.
4. Using CONSULT, activate ″DEF Tank Heater Test″.
5. The DTC will move to ″Past″ when the test runs and passes.

Is P20B8 DTC current?

YES >> GO TO 5.
NO >> Repair complete.

5. INSPECT DEF CONTROL MODULE AND VEHICLE HARNESS CONNECTOR PINS

1. Turn ignition OFF.
2. wait at least 90 seconds before proceeding to allow sufficient time for the DEF control module to completely power down.
3. Disconnect the DEF control module.
4. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK DEF TANK HEATER SUPPLY CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check for continuity between DEF tank heater supply circuit and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C35	1	All others	No

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair short circuit in harness or connectors.

7. CHECK THE UREA HEATER RELAY

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Connect CONSULT and erase all “ENGINE” diagnostic trouble codes.
4. Using CONSULT, activate ″DEF Tank Heater Test″.
5. The DTC will move to ″Past″ when the test runs and passes.

Is P20B8 DTC current?

YES >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
NO >> Inspection End.

P20B9 REDUCTANT HEATER CONTROL CIRCUIT OPEN

DTC Description

INFOID:0000000014420585

NOTE:
If the following DTC is displayed with P20B9, first perform the diagnosis procedure for other DTC.
- P21C4 present. Refer to EC-1754, "DTC Description".

The heater relay supplies power to the DEF supply pump assembly. The DEF Line heater power supply and ground circuits are controlled by the DEF Control module. Aftertreatment DEF Line heating is based on the input of the ambient temperature sensor. Heating of the line is initiated when the ambient temperature is below 0 degrees Celsius. The DEF supply pump assembly reports status back to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The DEF control module detected the DEF line heater has an open circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20B9	DEF LINE HTR TEST STATUS DEF LINE HTR TEST COUNTS DEF LINE HTR OP STATE	Diagnosis condition	This diagnostic runs when the key switch is ON and line heating is commanded ON.
		Signal (terminal)	DEF line heater signal
		Threshold	DEF supply pump assembly line heater current < 1 A
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF line heater.
- DEF control module.
- Urea heater relay.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate ″DEF Line Heater Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P20B9 DTC current?

YES >> Go to EC-1698, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420586

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21C4 is present, perform the confirmation procedure (diagnosis procedure) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1754, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT DEF LINE HEATER CIRCUIT DTC

Check for DTC P20B9 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT DEF CONTROL MODULE LINE HEATER AND CONNECTOR PINS

1. Turn ignition OFF.
2. Disconnect the DEF line heater from the harness.
3. Disconnect the DEF control module.
4. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK DEF LINE HEATER SUPPLY CIRCUIT FOR OPEN

Check the power supply circuit for continuity between the DEF control module and the DEF line heater.

DEF control module		DEF line heater		Continuity
Connector	Terminal	Connector	Terminal	
C205	15	C202	1	Yes

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open power supply circuit in harness or connectors.

5.CHECK DEF LINE HEATER GROUND CIRCUIT FOR OPEN

Check the ground supply circuit for continuity between the DEF control module and the DEF line heater.

DEF control module		DEF line heater		Continuity
Connector	Terminal	Connector	Terminal	
C205	30	C202	2	Yes

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open ground circuit in harness or connectors.

6.CHECK THE DEF LINE HEATER INTEGRITY

Check the DEF line heater resistance. Refer to EC-1700, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace the DEF line heater. Refer to EX-64, "Exploded View".

7.CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Connect CONSULT and erase ENGINE diagnostic trouble codes.
4. Using CONSULT, activate ″DEF Line Heater Test″.
5. The DTC will move to ″Past″ when the test runs and passes.

Is P20B9 DTC current?

YES >> Return to diagnostic procedure. Refer to EC-1698, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014420587

1.CHECK THE DEF LINE HEATER RESISTANCE

Measure the resistance between the DEF line heater pins at the DEF line heater.

Is the resistance between 4 and 10 ohms?

YES >> GO TO 2.
NO >> Replace the DEF line heater. Refer to EX-64, "Exploded View".

2.CHECK DEF LINE HEATER FOR A SHORT TO GROUND

Measure the resistance between the DEF line heater power supply (pin 1) and the metal case of the DEF line heater.

Is the resistance above 100 KΩ?

YES >> Inspection End.
NO >> Replace the DEF line heater. Refer to EX-64, "Exploded View".

P20BB REDUCTANT HEATER CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420588

The heater relay supplies power to the DEF supply pump assembly. The DEF Line heater power supply and ground circuits are controlled by the DEF control module. Aftertreatment DEF Line heating is based on the input of the ambient temperature sensor. Heating of the line is initiated when the ambient temperature is below 0 degrees Celsius. The DEF supply pump assembly reports status back to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The DEF control module detected the DEF line heater is shorted to ground.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20BB	DEF LINE HTR TEST STATUS DEF LINE HTR TEST COUNTS DEF LINE HTR OP STATE	Diagnosis condition	This diagnostic runs when the key switch is ON and line heating is commanded ON.
		Signal (terminal)	DEF line heater signal
		Threshold	DEF supply pump assembly line heater current > 15 A
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- DEF line heater.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate ″DEF Line Heater Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P20BB DTC current?

YES >> Go to EC-1701, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420589

1.CHECK FOR CURRENT DEF LINE HEATER CIRCUIT DTC

Check for DTC P20BB current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.

NO >> Repair or replace error-detected parts.

3.CHECK DEF LINE HEATER POWER CIRCUIT FOR SHORT TO GROUND

1. Disconnect the DEF line heater from the harness.
2. Check for continuity between DEF line heater power circuit at the DEF control module and ground.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	15	Ground	No

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair short circuit in harness connector.

4.CHECK DEF LINE HEATER GROUND CIRCUIT FOR SHORT TO GROUND

Check for continuity between DEF line heater ground circuit at the DEF control module and ground.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	30	Ground	No

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair short circuit in harness connector.

5.CHECK DEF LINE HEATER POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check for continuity between DEF line heater power circuit at the DEF control module and all other circuits.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	15	All others	No

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair short circuit in harness connector.

6.CHECK DEF LINE HEATER GROUND CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check for continuity between DEF line heater ground circuit at the DEF control module and all other circuits.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	30	All others	No

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair short circuit in harness connector.

7.CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Connect CONSULT and erase “ENGINE” diagnostic trouble codes.
4. Using CONSULT, activate ″DEF Line Heater Test″.
5. The DTC will move to ″Past″ when the test runs and passes.

Is P20BB DTC current?

YES >> A malfunctioning line heater has been detected. Replace the DEF line heater. Refer to EX-64, "Removal and Installation".

NO >> A malfunctioning DEF control module has been detected. Replace the DEF control module. Refer to EC-1999, "Removal and Installation".

P20BC REDUCTANT HEATER CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420590

The heater relay supplies power to the DEF supply pump assembly. The DEF Line heater power supply and ground circuits are controlled by the DEF Control module. Aftertreatment DEF Line heating is based on the input of the ambient temperature sensor. Heating of the line is initiated when the ambient temperature is below 0 degrees Celsius. The DEF supply pump assembly reports status back to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The DEF control module detected the DEF line heater is shorted to battery.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20BC	DEF LINE HTR TEST STATUS DEF LINE HTR TEST COUNTS DEF LINE HTR OP STATE	Diagnosis condition	This diagnostic runs when the key switch is ON and line heating is commanded ON.
		Signal (terminal)	DEF line heater signal
		Threshold	DEF supply pump assembly line heater current ≥ 4 A
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF line heater.
- DEF control module.
- Urea heater relay.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate "DEF Line Heater Test".
3. The DTC will move to "Past" when the test runs and passes.

Is P20BC DTC current?

YES >> Go to EC-1704, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420591

1.CHECK FOR CURRENT DEF LINE HEATER CIRCUIT DTC

Check for DTC P20BC current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT DEF CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK DEF LINE HEATER POWER CIRCUIT FOR SHORT TO GROUND

1. Disconnect the DEF line heater from the harness.
2. Check for continuity between DEF line heater power circuit at the DEF control module and all other circuits.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	15	All others	No

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair short circuit in harness connector.

4. CHECK DEF LINE HEATER GROUND CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check for continuity between DEF line heater ground circuit at the DEF control module and all other circuits.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	30	All others	No

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair short circuit in harness connector.

5. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, activate "DEF Line Heater Test".
4. The DTC will move to "Past" when the test runs and passes.

Is P20BC DTC current?

YES >> A malfunctioning line heater has been detected. Replace the DEF line heater. Refer to EX-64, "Removal and Installation".
NO >> A malfunctioning DEF control module has been detected. Replace the DEF control module. Refer to EC-1999, "Removal and Installation".

P20E8 REDUCTANT PRESSURE TOO LOW

DTC Description

INFOID:0000000014420592

NOTE:
If DTC P203F is displayed with this DTC, first perform the trouble diagnosis for the other DTC.

The Aftertreatment DEF control module activates priming, dosing and purging of the Diesel Exhaust Fluid (DEF). The DEF supply pump assembly is responsible for transporting diesel exhaust fluid between the dosing unit and the dosing valve. A restriction or damage to the pressure line or connections can cause DEF pressure to be erratic.

DTC DETECTION LOGIC

The DEF supply pump assembly was unable to successfully prime after multiple attempts.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20E8	DEF LINE PRESS DEF PUMP STATUS	Diagnosis condition	When the DEF supply pump assembly attempts to prime.
		Signal (terminal)	DEF dosing pump
		Threshold	The DEF supply pump assembly has detected the Diesel Exhaust Fluid (DEF) Pressure ≤ 450 kPa (65 psi).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Low DEF level in the tank.
- Frozen DEF in the line.
- DEF pressure line is kinked, broken, or disconnected.
- DEF supply pump assembly.
- Debris in the DEF tank.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate ″DEF System Leak Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P20E8 DTC current?

YES >> Go to EC-1706, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420593

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P20E8 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DEF TANK LEVEL

1. Make sure the aftertreatment DEF tank is **not** empty and the tank level gauge is accurate.
2. Using CONSULT check for other ENGINE diagnostic trouble codes.

Is P203F DTC current?

YES >> Fill the DEF tank.
NO >> GO TO 3.

3.CHECK FOR OTHER CURRENT DEF DOSING VALVE DTCS

1. Turn ignition switch ON.
2. Using CONSULT check for the following “ENGINE” diagnostic trouble codes:

- P2048
- P202E

Are any of the above DTCs current?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK THE DEF TANK

1. Turn ignition switch OFF.
2. Check the DEF tank for debris or foreign particles.
3. Check the DEF tank vent for crystallization buildup and clogging.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Clean the DEF tank thoroughly and fill with certified DEF.

5. CHECK FOR OTHER RELATED CURRENT DTCS

1. Turn ignition switch ON.
2. Using CONSULT check for the following “ENGINE” diagnostic trouble code:

- P20E9

Is the above DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 6.

6. INSPECT DEF SUPPLY PUMP ASSEMBLY, LINES AND FITTINGS

1. Connect CONSULT, select “ENGINE” and activate ″DEF System Leak Test″.
2. While the test is running, inspect all DEF lines, fittings, and connections for external leaks.

Any damaged, leaking, or restricted connections found?

YES >> Repair or replace the leaking DEF line, fitting, or DEF supply pump assembly.
NO >> GO TO 7.

7. CHECK FOR AIR IN THE DEF

1. Turn ignition switch ON.
2. Using CONSULT, check for air in the DEF.

Is air found in the DEF?

YES >> Check the DEF dosing unit fittings, pressure line fittings, tank fittings and repair as necessary.
NO >> GO TO 8.

8. INSPECT THE DEF TANK FILTER FOR BLOCKAGE

1. Turn ignition switch OFF.
2. Remove the tank level and temperature sensor from the DEF tank.
3. Inspect the aftertreatment DEF tank filter for signs of blockage or buildup.

Is the DEF tank filter blocked?

YES >> Clean the DEF tank or replace the DEF supply pump assembly. Drain, clean, and refill the DEF tank.
NO >> GO TO 9.

9. CHECK DEF DOSING UNIT FOR PROPER OPERATION

1. Connect all components and harness connectors.
2. Remove the aftertreatment DEF dosing valve from the decomposition tube.
3. Place the DEF dosing valve in a measuring container having greater than a 1.5 liter [50 oz] capacity.
4. Turn ignition switch ON.
5. Using CONSULT, access “ENGINE” and select ″DEF Dosing Unit Override Test″ active test.

Did the DEF dosing unit operate according to specifications?

YES >> GO TO 10.
NO >> Replace the DEF supply pump assembly. Refer to EX-64, "Exploded View".

10. ERASE DTCS

1. Using CONSULT, select “ENGINE” and erase DTCs.
2. Operate the engine within the "Conditions for Clearing the DTC".

Is P20E8 DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1706, "DTC Description".
NO >> Repair complete.

P20E9 REDUCTANT PRESSURE TOO HIGH

DTC Description

INFOID:0000000014420594

The Diesel Exhaust Fluid (DEF) Pressure Sensor is a three wire sensor, integrated into the DEF Supply Pump assembly and is not serviceable separate. The DEF Pressure Sensor monitors supply pressure to the DEF Injector. The Diesel Exhaust Fluid (DEF) control module provides a 5V Supply and a ground to the DEF Pressure Sensor. The sensor provides a signal to the DEF control module on the DEF Pressure Sensor Signal circuit. This DEF Pressure Sensor Signal voltage changes, based on the diesel exhaust fluid pressure supplied by the DEF supply pump.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected that the DEF supply pump assembly pressure control is too high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20E9	DEF LINE PRESS DEF PUMP STATUS	Diagnosis condition	When the key switch is ON or the engine is running.
		Signal (terminal)	DEF pressure sensor
		Threshold	The DEF control module has detected the Diesel Exhaust Fluid (DEF) Pressure ≤> 600 kPa (87 psi) for more than 20 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Blocked, restricted, or frozen DEF return line or return line fitting.
- DEF supply pump assembly.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate ″DEF System Leak Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P20E9 DTC current?

YES >> Go to EC-1709, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420595

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P20E9 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DEF TANK LEVEL

1. Make sure the aftertreatment DEF tank is **not** empty and the tank level gauge is accurate.
2. Using CONSULT check the DEF tank level and compare it to the gauge on the dash.

DEF tank empty?

YES >> Fill the DEF tank.
NO >> GO TO 3.

3.CHECK FOR OTHER CURRENT DEF QUALITY DTCS

Using CONSULT check ENGINE diagnostic trouble codes for DTCs related to DEF quality.

Are there any current DTCs related to DEF quality?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK FOR OTHER CURRENT DEF DOSING SYSTEM DTCS

Using CONSULT check ENGINE diagnostic trouble codes for DTCs related to DEF dosing system.

Are there any current DTCs related to DEF dosing system?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5. INSPECT DEF SUPPLY PUMP ASSEMBLY, LINES AND FITTINGS

1. Turn ignition switch OFF.
2. Disconnect the aftertreatment DEF dosing line from the dosing valve.
3. Disconnect the aftertreatment DEF dosing line from the DEF tank.
4. Check the aftertreatment DEF dosing line for blockage.
5. Check the dosing unit supply, dosing valve supply, return connectors, and fittings for loose or leaking connections.
6. Look at both ends of the line to check for signs of buildup or blockage.
7. Blow compressed shop air through the supply line to establish/confirm free flow.
8. Check the dosing line for signs of leakage or openings which would allow the dosing unit to suck in air with the DEF.

DEF dosing line or connections blocked, cracked, or restricted?

YES >> Repair or replace the dosing line or fittings.
NO >> GO TO 6.

6. PERFORM DEF DOSING UNIT OVERRIDE TEST

1. Connect all components and harness connectors.
2. Remove the aftertreatment DEF dosing valve from the decomposition tube.
3. Place the DEF dosing valve in a measuring container having greater than a 1.5 liter [50 oz] capacity.
4. Turn ignition switch ON.
5. Using CONSULT, access ’ENGINE” and select ″DEF Dosing Unit Override Test″ active test.

Did the DEF dosing unit operate according to specifications?

YES >> GO TO 7.
NO >> Replace the DEF supply pump assembly. Refer to EX-64, "Exploded View".

7. ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all components and harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P20E9 DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1709, "DTC Description".
NO >> Repair complete.

P20EE SCR NOX CATALYST EFFICIECY

DTC Description

INFOID:0000000014420596

The engine control module (ECM) monitors the NOx concentration in the engine's exhaust gases using an aftertreatment intake NOx sensor and an aftertreatment outlet NOx sensor. By comparing these two values, the ECM is able to determine the conversion efficiency of the SCR catalyst and dosing system.

DTC DETECTION LOGIC

The system has detected a decrease of the NOx converting catalyst's conversion capability resulting in tailpipe out NOx emissions exceeding the applicable threshold.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20EE	INTAKE NOX INTAKE NOX CORRCTD INTAKE NOX READING STBL OUTLET NOX OUTLET NOX CORRCTD OUTLET NOX READING STBL	Diagnosis condition	This diagnostic has to meet specific engine and after-treatment conditions to run and complete (pattern 3 four times).
		Signal (terminal)	NOx sensor signal.
		Threshold	Amplified catalyst in-efficiency (ACIE) Where: ACIE is the SCR catalyst inefficiency amplified using the ammonia to NOx ratio ≥ 40 (unitless).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning DEF supply pump assembly.
- Exhaust system leaks.
- Malfunctioning SCR catalyst
- Degraded, diluted, or incorrect DEF.
- DEF deposits in the decomposition tube.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 eleven more times.
6. Check 1st trip DTC.

Is P20EE DTC detected?

YES >> Proceed to EC-1711, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420597

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.
3. Check for DTC P20EE current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR OTHER PRIORITY DTCS

Using CONSULT, check ENGINE diagnostic trouble codes for the following higher priority DTCs:

- U029D
- U029E
- U059E
- U059F
- P1C55
- P2201
- P2202
- P2209
- P220A
- P220B
- P229E
- P229F
- P22A7

Are there any of the above DTCs current?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR CURRENT SCR TEMPERATURE SENSOR DTCS

Using CONSULT check ENGINE diagnostic trouble codes for DTCs related to SCR temperature sensor.

Are there any current DTCs related to SCR temperature sensor?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK FOR CURRENT DEF DOSING SYSTEM DTCS

Using CONSULT check ENGINE diagnostic trouble codes for DTCs related to DEF dosing system.

Are there any current DTCs related to DEF dosing system?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5. INSPECT THE EXHAUST SYSTEM FOR LEAKS

1. Start the engine.
2. Check the exhaust for leaks.
3. Inspect the entire exhaust system between the turbocharger outlet and the SCR outlet. Inspect for loose connections, leaking connections, and broken exhaust system components.

Exhaust system leaks found?

YES >> Repair or replace the damaged exhaust system component.
NO >> GO TO 6.

6. INSPECT THE DEF DOSING SYSTEM FOR EXTERNAL LEAKS

1. Turn ignition switch OFF.
2. Inspect all components of the aftertreatment DEF dosing system for signs of external leaks, including:

- Tank connectors.
- Dosing unit and dosing unit connectors.
- Lines.
- Dosing valve.
- DEF will form white deposits around leaky fittings.

DEF leaks detected in the system?

YES >> Repair the source of the external leak.
NO >> GO TO 7.

7. CHECK DEF QUALITY

1. Inspect the DEF in the tank for signs of debris or contamination.
2. Using a refractometer [SST: J-54466] measure the concentration of the DEF in the tank.

Is DEF concentration within 32.5 Â± 1.5 %?

YES >> GO TO 8.
NO >> Drain the DEF tank, rinse with water, and refill with pure DEF.

8. PERFORM DEF DOSING UNIT FOR PROPER OPERATION

1. Connect all components and harness connectors.
2. Remove the aftertreatment DEF dosing valve from the decomposition tube.
3. Place the DEF dosing valve in a measuring container having greater than a 1.5 liter [50 oz] capacity.
4. Turn ignition switch ON.
5. Using CONSULT, access ENGINE and select ″DEF Dosing Unit Override Test″ active test.

Did the DEF dosing unit operate according to specifications?

YES >> GO TO 9.
NO >> Replace the DEF supply pump assembly. Refer to EX-64, "Exploded View".

9.CHECK DEF DOSING VALVE FOR PROPER OPERATION

Using CONSULT, access ENGINE and select DEF Dosing Unit Leak Test active test.

DEF leaking from the DEF dosing valve during the system leak test?

YES >> A leaking aftertreatment DEF dosing valve has been detected. Replace the aftertreatment DEF dosing valve.
NO >> GO TO 10.

10.CHECK DEF DEPOSITS IN THE DECOMPOSITION TUBE

1. Turn ignition switch OFF (do not operate the engine).
2. Inspect the decomposition tube for deposits.
3. Remove the decomposition tube from the vehicle.
4. Inspect for excessive DEF deposits.

Excessive DEF deposits found inside the decomposition tube?

YES >>
- Clean and install the decomposition tube.
- GO TO 11.

NO >>
- A malfunctioning SCR catalyst has been detected. Replace the aftertreatment SCR catalyst. Refer to EX-36, "Removal and Installation".
- Replace the aftertreatment intake NOx sensor. Refer to EX-45, "Removal and Installation".
- Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
- GO TO 11.

11.ERASE DTCS

1. Using CONSULT, select ENGINE and erase DTCs.
2. Operate the engine within the "Conditions for Clearing the DTC".

Is P20EE DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1711, "DTC Description".
NO >> Repair complete.

P20FF REDUCTANT CONTROL MODULE PERFORMANCE

DTC Description

INFOID:0000000014420598

The Diesel Exhaust Fluid (DEF) control module is the central control for the Selective Catalytic Reduction (SCR) diesel exhaust fluid dosing system, and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The DEF control module communicates to the engine control module (ECM) via CAN communication.

DTC DETECTION LOGIC

An internal error has been detected in the DEF control module.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P20FF	Byte order	Diagnosis condition	When the key switch is ON or the engine is running.
		Signal (terminal)	DEF control module
		Threshold	Bad intelligent device or component was detected in the DEF control module, and has been communicated to the ECM via CAN communication.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF control module.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P20FF being current on the CONSULT screen.

Is P20FF DTC current?

YES >> Go to EC-1714, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420599

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P20FF current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.RESET DTCS

1. Using CONSULT, select “ENGINE” and erase DTCs.
2. Turn ignition switch OFF.
3. Wait 90 seconds.

4. Turn ignition switch ON.
5. Using CONSULT, check for existing “ENGINE” diagnostic trouble codes.

Is P20FF DTC current?

YES >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
NO >> GO TO 3.

3. PERFORM LEAK TEST

1. Using CONSULT, select “ENGINE” and perform the ″DEF System Leak Test″ active test.
2. Turn ignition switch OFF.
3. Wait 90 seconds.
4. Turn ignition switch ON.
5. Using CONSULT, check for existing “ENGINE” diagnostic trouble codes.

Is P20FF DTC current?

YES >> Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
NO >> GO TO 4.

4. ERASE DTCS

1. Using CONSULT, select “ENGINE” and erase DTCs.
2. Operate the engine within the "Conditions for Clearing the DTC".

Is P20FF DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1714, "DTC Description".
NO >> Repair complete.

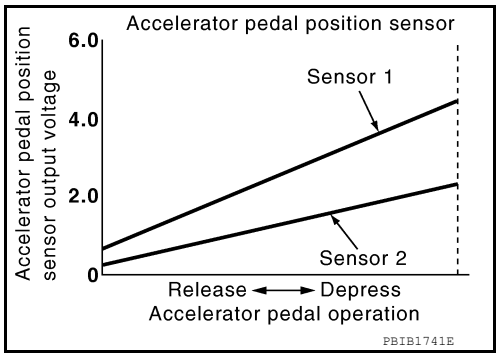
P2121 ACCELERATOR PEDAL POSITION SENSOR 1

DTC Description

INFOID:0000000014420600

NOTE:
If DTC P2121 is displayed with any of the following DTCs, first perform the trouble diagnosis for other DTC:
- P2122. Refer to EC-1720, "DTC Description".
- P2123. Refer to EC-1724, "DTC Description".
- P2127. Refer to EC-1728, "DTC Description".
- P2128. Refer to EC-1732, "DTC Description".

The accelerator pedal position sensor is a potentiometer type sensor attached to the accelerator pedal assembly. The accelerator position position sensor varies the signal voltage to the ECM as the accelerator pedal is depressed and released. Low signal voltage is received by the ECM when the accelerator pedal is at 0%. A high signal voltage is received by the ECM when the accelerator pedal is at 100%. The accelerator pedal position circuit contains an accelerator pedal position 5V supply, accelerator pedal return, and accelerator pedal position signal.



The accelerator pedal position sensor contains two sensors. These sensors are used to measure the throttle position. Both position sensors receive a 5 volt supply from the ECM. A corresponding signal voltage based on the position of the accelerator pedal is then received from the ECM. The signal voltage for accelerator position 1 is twice as much as the signal voltage from the accelerator position 2.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2121	ACC POS SENS V ACC POS SENS SPLY V	Diagnosis condition	When the key switch is ON or the engine is running.
		Signal (terminal)	Accelerator pedal position sensor signals
		Threshold	The difference between accelerator pedal position sensor 1 signal and accelerator pedal position sensor 2 signal differ by more than 10%.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Accelerator Pedal Position (APP) Sensor
- Harness or connectors

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is P2121 DTC detected?

YES >> Go to EC-1717, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420601

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following other existing “ENGINE” diagnostic trouble codes:

- P2122
- P2123
- P2127
- P2128

Are any of the above applicable DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT ACCELERATOR PEDAL POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor from engine harness connector.
3. Inspect the accelerator pedal position sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Are both P2122 and P2127 DTCs current?

YES >> GO TO 4.
NO >> • P2122 is not current. Refer to EC-1720, "DTC Description".
• P2127 is not current. Refer to EC-1728, "DTC Description".

4.CHECK ACCELERATOR PEDAL POSITION 1 SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor.
3. Turn ignition switch ON.
4. Check the voltage between accelerator pedal position sensor supply voltage and return circuit terminals.

Accelerator Pedal Position Sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E20	2	4	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> Low sensor supply voltage has been detected. Refer to EC-1720, "DTC Description".

5.CHECK ACCELERATOR PEDAL POSITION 2 SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor.
3. Turn ignition switch ON.

4. Check the voltage between accelerator pedal position sensor supply voltage and return circuit terminals.

Accelerator pedal position sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E20	1	5	5

Is the inspection result normal?

YES >> GO TO 6.
NO >> Low sensor supply voltage has been detected. Refer to EC-1728, "DTC Description".

6. CHECK FOR DTCS

1. Turn ignition switch OFF.
2. Reconnect the accelerator pedal position sensor connector.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P2121 DTC become ″past″?

YES >> The removal and installation of the connector corrected the issue.
NO >> GO TO 7.

7. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK ACCELERATOR PEDAL POSITION SENSOR 1 SIGNAL CIRCUIT CONNECTOR FOR SHORT

1. Disconnect the accelerator pedal position sensor.
2. Check the continuity between accelerator pedal position sensor 1 signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	79	All others	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair short circuit in harness connector.

9. CHECK ACCELERATOR PEDAL POSITION SENSOR 2 SIGNAL CIRCUIT CONNECTOR FOR SHORT

Check the continuity between Accelerator pedal position sensor 2 signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	78	All others	No

Is the inspection result normal?

YES >> • A damaged accelerator pedal has been detected. Replace the Accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".
• GO TO 10.

NO >> Repair short circuit in harness connector.

10. ERASE DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and erase DTCs.
5. Operate the engine within the "Conditions for Clearing the DTC".

Is P2121 DTC current?

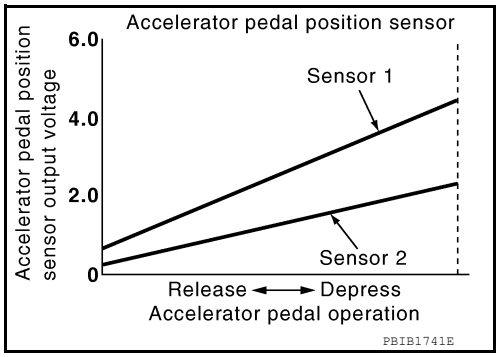
YES >> Diagnosis procedure needs to be repeated. Refer to EC-1716, "DTC Description".
NO >> Repair complete.

P2122 ACCELERATOR PEDAL POSITION SENSOR 1

DTC Description

INFOID:0000000014420602

NOTE:
If DTC P2122 is displayed with any of the following DTCs, first perform the trouble diagnosis for other DTC:
- P06A4. Refer to EC-838, "DTC Index".
- P06A5. Refer to EC-838, "DTC Index".



The accelerator pedal position sensor is a potentiometer type sensor attached to the accelerator pedal assembly. The accelerator position position sensor varies the signal voltage to the ECM as the accelerator pedal is depressed and released. Low signal voltage is received by the ECM when the accelerator pedal is at 0%. A high signal voltage is received by the ECM when the accelerator pedal is at 100%. The accelerator pedal position circuit contains an accelerator pedal position 5V supply, accelerator pedal return, and accelerator pedal position signal.
The accelerator pedal position sensor contains two sensors. These sensors are used to measure the throttle position. Both position sensors receive a 5V supply from the ECM. A corresponding signal voltage based on the position of the accelerator pedal is then received from the ECM. The signal voltage for accelerator position 1 is twice as much as the signal voltage from the accelerator position 2.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2122	THROTTLE/PDL POSITION SEN/SW D	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Accelerator pedal position sensor signal
		Threshold	• The accelerator pedal position sensor signal is not detected by the ECM during the first 0.8 second of engine cranking. • The proper accelerator pedal position sensor (POS) is not sent to ECM while the engine is running. • The accelerator pedal position sensor signal is not in the normal pattern during engine running. • The accelerator pedal position sensor 1 signal is < 0.293 volt (0%).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
- Sensor 5 volt supply circuit is open or shorted.
- Sensor return circuit is open or shorted.
- Sensor signal circuit is open or shorted.
- Accelerator Pedal Position (APP) Sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-1276, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420603

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P06A4 or P06A5 is present, perform the confirmation procedure (trouble diagnosis) for these other DTCs first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR ACTIVE ACCELERATOR PEDAL POSITION SENSOR DTC

Check for DTC P2122 being active on the CONSULT screen.

Is applicable DTC active?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ACCELERATOR PEDAL POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor from engine harness connector.
3. Inspect the accelerator pedal position sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between accelerator pedal position sensor supply voltage and return circuit terminals.

Accelerator pedal position sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E20	2	4	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.

2. Connect a jumper wire between accelerator pedal position sensor connector 5V supply terminal 2 and signal circuit terminal 3.
3. Turn key ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P2123 DTC become active and P2122 DTC become inactive?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the accelerator pedal position sensor connector.
4. Key ON. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P2122 DTC become active?

YES >> Replace the accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK ACCELERATOR PEDAL POSITION SENSOR CIRCUITS FOR OPEN

Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	2	E93	80	Yes
	3		79	

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9. CHECK ACCELERATOR PEDAL POSITION SENSOR SIGNAL CIRCUIT CONNECTOR FOR SHORT

Check the continuity between accelerator pedal position sensor signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	79	All others	No

Is the inspection result normal?

YES >> GO TO 10.

NO >> Repair short circuit in harness connector.

10. CHECK ACCELERATOR PEDAL POSITION SENSOR SIGNAL CIRCUIT FOR SHORT

Check the continuity between accelerator pedal position sensor harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	79	—	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair short circuit in harness or connectors.

11. CHECK FOR INACTIVE DTC

1. Connect all components in the correct positions.
2. Turn ignition switch ON.
3. Connect CONSULT and check for inactive “ENGINE” diagnostic trouble codes.

Is P2122 DTC inactive?

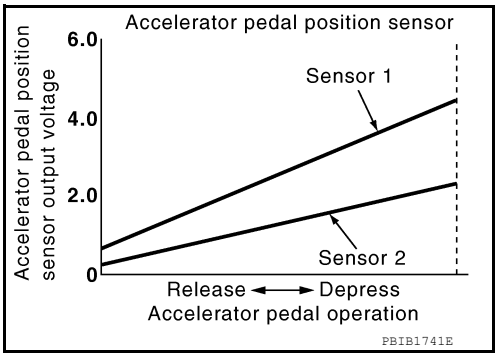
YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P2123 ACCELERATOR PEDAL POSITION SENSOR 1

DTC Description

INFOID:0000000014420604

NOTE:
If DTC P2123 is displayed with any of the following DTCs, first perform the trouble diagnosis for other DTC:
- P2122. Refer to EC-838, "DTC Index".
- P06A5. Refer to EC-838, "DTC Index".



The accelerator pedal position sensor is a potentiometer type sensor attached to the accelerator pedal assembly. The accelerator position position sensor varies the signal voltage to the ECM as the accelerator pedal is depressed and released. Low signal voltage is received by the ECM when the accelerator pedal is at 0%. A high signal voltage is received by the ECM when the accelerator pedal is at 100%. The accelerator pedal position circuit contains an accelerator pedal position 5V supply, accelerator pedal return, and accelerator pedal position signal.
The accelerator pedal position sensor contains two sensors. These sensors are used to measure the throttle position. Both position sensors receive a 5V supply from the ECM. A corresponding signal voltage based on the position of the accelerator pedal is then received from the ECM. The signal voltage for accelerator position 1 is twice as much as the signal voltage from the accelerator position 2.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2123	THROTTLE/PDL POSITION SEN/SW D	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Accelerator pedal position sensor signal
		Threshold	• The accelerator pedal position sensor signal is not detected by the ECM during the first 0.8 second of engine cranking. • The proper accelerator pedal position sensor (POS) is not sent to ECM while the engine is running. • The accelerator pedal position sensor signal is not in the normal pattern during engine running. • The accelerator pedal position sensor 1 signal voltage is > 4.692 volt (100%).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
- Sensor 5 volt supply circuit is shorted to battery.
- Sensor return circuit is open.
- Sensor signal circuit is shorted to battery or 5V supply.
- Accelerator Pedal Position (APP) Sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-1276, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420605

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P2122 or P06A5 is present, perform the confirmation procedure (trouble diagnosis) for these other DTCs first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR ACTIVE ACCELERATOR PEDAL POSITION SENSOR DTC

Check for DTC P2123 being active on the CONSULT screen.

Is applicable DTC active?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ACCELERATOR PEDAL POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor from engine harness connector.
3. Inspect the accelerator pedal position sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between accelerator pedal position sensor supply voltage and return circuit terminals.

Accelerator pedal position sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E20	2	4	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Insure ignition switch is still ON.
2. Wait 30 seconds.

3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P2122 DTC become active and P2123 DTC become inactive?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Reconnect the accelerator pedal position sensor connector.
3. Key ON. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P2123 DTC become active?

YES >> Replace the accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK ACCELERATOR PEDAL POSITION SENSOR RETURN CIRCUIT FOR OPEN

Check the return circuit for continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	4	E93	63	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit in harness or connectors.

9. CHECK ACCELERATOR PEDAL POSITION SENSOR SIGNAL CIRCUIT CONNECTOR FOR SHORT

Check the continuity between accelerator pedal position sensor signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	79	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair short circuit in harness connector.

10. CHECK FOR INACTIVE DTC

1. Connect all components in the correct positions.
2. Turn ignition switch ON.

3. Connect CONSULT and check for inactive “ENGINE” diagnostic trouble codes.

Is P2123 DTC inactive?

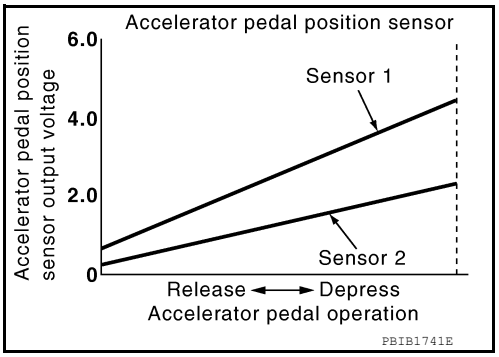
YES >> The removal and installation of the connector corrected the issue.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P2127 ACCELERATOR PEDAL POSITION SENSOR 2

DTC Description

INFOID:0000000014420606

NOTE:
If DTC P2127 is displayed with any of the following DTCs, first perform the trouble diagnosis for other DTC:
- P06D3. Refer to EC-838, "DTC Index".
- P06D4. Refer to EC-838, "DTC Index".



The accelerator pedal position sensor is a potentiometer type sensor attached to the accelerator pedal assembly. The accelerator position sensor varies the signal voltage to the ECM as the accelerator pedal is depressed and released. Low signal voltage is received by the ECM when the accelerator pedal is at 0%. A high signal voltage is received by the ECM when the accelerator pedal is at 100%. The accelerator pedal position circuit contains an accelerator pedal position 5V supply, accelerator pedal return, and accelerator pedal position signal.
The accelerator pedal position sensor contains two sensors. These sensors are used to measure the throttle position. Both position sensors receive a 5V supply from the ECM. A corresponding signal voltage based on the position of the accelerator pedal is then received from the ECM. The signal voltage for accelerator position 1 is twice as much as the signal voltage from the accelerator position 2.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2127	THROTTLE/PDL POSITION SEN/SW E	Diagnosis condition	Ignition switch ON
		Signal (terminal)	Accelerator pedal position sensor 2 signal
		Threshold	• The accelerator pedal position sensor signal is not detected by the ECM during the first 0.8 second of engine cranking. • The proper accelerator pedal position sensor (POS) is not sent to ECM while the engine is running. • The accelerator pedal position sensor signal is not in the normal pattern during engine running. • The accelerator pedal position sensor 2 signal voltage is < 0.4 volt for more than 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness or connectors
- Sensor 5 volt supply circuit is open or shorted.
- Sensor return circuit is open or shorted.
- Sensor signal circuit is open or shorted.
- Accelerator Pedal Position (APP) Sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-1276, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420607

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P06D3 is present, perform the confirmation procedure (diagnosis procedure) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1541, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR ACTIVE ACCELERATOR PEDAL POSITION SENSOR DTC

Check for DTC P2127 being active on the CONSULT screen.

Is applicable DTC active?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ACCELERATOR PEDAL POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor from engine harness connector.
3. Inspect the accelerator pedal position sensor connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY AND RETURN CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between accelerator pedal position sensor supply voltage and return circuit terminals.

Accelerator pedal position sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E20	1	5	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.

2. Connect a jumper wire between accelerator pedal position sensor connector 5V supply terminal 1 and signal circuit terminal 6.
3. Turn key ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P2128 DTC become active and P2127 DTC become inactive?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK THE DTC AND VERIFY ACCELERATOR PEDAL CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the accelerator pedal position sensor connector.
4. Turn ignition switch ON.
5. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P2127 DTC become active?

YES >> Replace the accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".
NO >> The removal and installation of the connector corrected the issue.

7. INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY CIRCUIT FOR OPEN

Check the power circuit for continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	1	E93	81	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open power supply circuit in harness or connectors.

9. CHECK ACCELERATOR PEDAL POSITION SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	6	E93	78	Yes

Is the inspection result normal?

YES >> GO TO 10.

NO >> Repair open signal circuit in harness or connectors.

10. CHECK FOR A PIN TO PIN SHORT IN SIGNAL CIRCUIT

Check for continuity between accelerator pedal position sensor signal circuit and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	78	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair short signal circuit in harness connector.

11. CHECK ACCELERATOR PEDAL POSITION SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check for continuity between accelerator pedal position sensor signal circuit and ground at ECM harness connector.

ECM		Ground	Continuity
Connector	Terminal		
E93	78	—	No

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair accelerator pedal position sensor signal circuit for a short to ground.

12. CHECK FOR CURRENT VS PAST DTC

1. Connect all components in the correct positions.
2. Turn ignition switch ON.
3. Connect CONSULT and check for ″past″ “ENGINE” diagnostic trouble codes.

Is P2127 DTC inactive?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 13.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

13. ERASE DTC

1. Using CONSULT, erase all DTCs.
2. Operate the engine within the conditions for setting the DTC.
3. Using CONSULT, check for existing “ENGINE” diagnostic trouble codes.

Is P2127 DTC current?

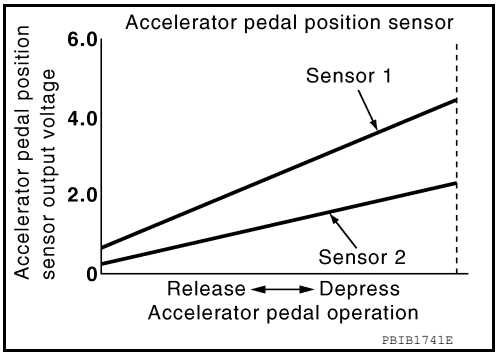
YES >> Troubleshooting procedure needs to be repeated. Go to EC-1728, "DTC Description".
NO >> Repair complete.

P2128 ACCELERATOR PEDAL POSITION SENSOR 2

DTC Description

INFOID:0000000014420608

NOTE:
If DTC P2128 is displayed with any of the following DTCs, first perform the trouble diagnosis for other DTC:
• P06D4. Refer to EC-838, "DTC Index".



The accelerator pedal position sensor is a potentiometer type sensor attached to the accelerator pedal assembly. The accelerator position sensor varies the signal voltage to the ECM as the accelerator pedal is depressed and released. Low signal voltage is received by the ECM when the accelerator pedal is at 0%. A high signal voltage is received by the ECM when the accelerator pedal is at 100%. The accelerator pedal position circuit contains an accelerator pedal position 5 volt supply, accelerator pedal return, and accelerator pedal position signal.
The accelerator pedal position sensor contains two sensors. These sensors are used to measure the throttle position. Both position sensors receive a 5 volt supply from the ECM. A corresponding signal voltage based on the position of the accelerator pedal is then received from the ECM. The signal voltage for accelerator position 1 is twice as much as the signal voltage from the accelerator position 2.

DTC DETECTION LOGIC

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2128	THROTTLE/PDL POSITION SEN/SW E	Diagnosis condition	Ignition switch ON.
		Signal (terminal)	Accelerator pedal position sensor 2 signal.
		Threshold	• The accelerator pedal position sensor signal is not detected by the ECM during the first 0.8 second of engine cranking. • The proper accelerator pedal position sensor (POS) is not sent to ECM while the engine is running. • The accelerator pedal position sensor signal is not in the normal pattern during engine running. • The accelerator pedal position sensor 2 signal voltage is > 2.4 volt for more than 1 second.
		Diagnosis delay time	—

POSSIBLE CAUSE

• Harness or connectors
- Sensor 5 volt supply circuit is shorted to battery.
- Sensor return circuit is open.
- Sensor signal circuit is shorted to battery or 5 volt supply.
• Accelerator Pedal Position (APP) Sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to EC-1276, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420609

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.

If DTC P06D4 is present, perform the confirmation procedure (diagnosis procedure) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1544, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR ACTIVE APPS DTC

Check for DTC P2128 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT ACCELERATOR PEDAL POSITION SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the accelerator pedal position sensor from engine harness connector.
3. Inspect the accelerator pedal position sensor connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY AND RETURN CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between accelerator pedal position sensor supply voltage and return circuit terminals.

APPS			Voltage (V)
Connector	Terminal (+)	Terminal (-)	
E20	1	5	Approx. 5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Insure ignition switch is still ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did P2127 DTC become current and P2128 DTC become past?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK DTC AND VERIFY ACCELERATOR PEDAL CONDITION

1. Turn ignition switch OFF.
2. Reconnect the accelerator pedal position sensor connector.
3. Turn ignition switch ON.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did P2123 DTC become current?

YES >> • Replace the accelerator pedal position sensor. Refer to ACC-3, "Removal and Installation".
• GO TO 11.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 11.

7.INSPECT ECM AND ENGINE HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM from engine harness connector.
3. Inspect the ECM connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8.CHECK APPS SENSOR RETURN CIRCUIT FOR OPEN

Check the return circuit for continuity between APPS sensor harness connector and ECM harness connector.

APPS		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E20	5	E93	62	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair return circuit for open in harness or connectors.

9.CHECK FOR PIN TO PIN SHORT WITH SENSOR SIGNAL CIRCUIT

Check the continuity between APPS sensor signal and all other circuits at ECM harness connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	78	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> Repair signal circuit for a short in harness connector.

10.CHECK FOR CURRENT VS PAST DTC

1. Connect all components in the correct positions.
2. Turn ignition switch ON.

3. Wait 30 seconds.
4. Using CONSULT, check for past ENGINE diagnostic trouble codes.

Is P2128 DTC past?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 11.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 11.

11. ERASE DTC

1. Using CONSULT, erase all DTCs.
2. Operate the engine within the conditions for setting the DTC.
3. Using CONSULT, check for existing ENGINE diagnostic trouble codes.

Is P2128 DTC current?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1732, "DTC Description".
NO >> Repair complete.

P2146 FUEL INJECTOR GROUP 1 POWER CIRCUIT

DTC Description

INFOID:0000000014420610

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2146	INJECTOR	Diagnosis condition	This diagnostic runs continuously when the engine is running.
		Signal (terminal)	Fuel injector signal.
		Threshold	The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- Fuel injector.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P2146 being current on the CONSULT screen.

Is P2146 DTC current?

YES >> Go to EC-1736, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420611

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.

Is P2146 DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel injectors 1, 4, 6, and 7.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE FUEL INJECTOR RESISTANCE

Check the resistance value across the two pins of each of the injectors 1, 4, 6, and 7. Refer to EC-1700, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace the malfunctioning fuel injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

4. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Disconnect the ECM.
2. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK INJECTOR 1 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 1 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	155	(+)	No
		(–)	
	176	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the engine harness.

6.CHECK INJECTOR 4 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 4 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	157	(+)	No
		(–)	
	178	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the engine harness.

7.CHECK INJECTOR 6 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 6 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	158	(+)	No
		(–)	
	179	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the engine harness.

8.CHECK INJECTOR 7 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 7 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	156	(+)	No
		(–)	
	177	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the engine harness.

9.PERFORM FUEL SYSTEM DIAGNOSTIC TEST

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Use SST J-54421 to perform the next step.
4. Using CONSULT, select ENGINE and perform the "Fuel Injector Drain Flow Test" on bank 1.

NOTE:
The purpose of this test is to check for excessive fuel drain from each injector.

- Disconnect the fuel drain lines from the bank of injectors being tested.
- Plug injector drain lines with the plug provided in the kit.
- Connect the piezo adapter line drain tool connection to each of the injectors.
- Start the engine until top mark is reached or crank for 30 seconds if the engine does not start.
- The maximum permissible drain is 3 times the lowest measured drain quantity.
- A failed injector will have a higher flow and exhibits 3 times the lowest measured drain quantity.

Filling quantity up to:	Engine cranks but does not start (small diameter)		Engine starts (large diameter)	
	ml	oz	ml	oz
1	1.8	0.06	6	0.2
2	2.4	0.08	13	0.44
3	3.2	0.11	21	0.71
4	4	0.14	29	0.98
5	—	—	37	1.25
6	—	—	45	1.52
7	—	—	53	1.79

Does each fuel injector meet the specification in injector drain flow test?

YES >> GO TO 10.
NO >> Replace the malfunctioning injector(s). Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

10. CHECK FOR CURRENT DTC

1. Start the engine.
2. Wait 30 seconds.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Is P2146 DTC current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> GO TO 11.

11. ERASE DTCS

1. Connect CONSULT and erase ENGINE diagnostic trouble codes.
2. Operate the engine within the "Conditions for Clearing the DTC".
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2146 DTC current?

YES >> Return to diagnostic procedure. Refer to EC-1736, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014420612

1. CHECK THE INJECTOR INTERNAL RESISTANCE

Measure the resistance between the two injector pins.

Is the resistance below 150 KΩ?

YES >> Replace the injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 2.

2. CHECK INJECTOR COIL FOR A SHORT TO GROUND

Measure the resistance between each of the injector pins and the metal case of the injector.

Is the resistance below 150 KΩ?

YES >> Replace the injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> Inspection End.

P2149 FUEL INJECTOR GROUP 2 POWER CIRCUIT

DTC Description

INFOID:0000000014420613

The Fuel Injectors' timing and quantity is controlled by the Engine Control Module (ECM). The ECM provides current to energize the actuator (Piezo) in the Fuel Injector. This causes the needle valve to rise and flow fuel into the combustion chamber. The ECM has an internal injector driver for each group of injectors. Each injector circuit has a dedicated low-side switch that completes the circuit path to ground inside the ECM. Electrically, fuel injectors 1, 4, 6, and 7 make-up group 1. Fuel injectors 2, 3, 5, and 8 make-up group 2.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2149	INJECTOR	Diagnosis condition	This diagnostic runs continuously when the engine is running.
		Signal (terminal)	Fuel injector signal.
		Threshold	The Engine Control Module (ECM) detected the injector is shorted to a voltage source, shorted to a battery source, or low injector solenoid resistance.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- Fuel injector.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P2149 being current on the CONSULT screen.

Is P2149 DTC current?

YES >> Go to EC-1740, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420614

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing "ENGINE" diagnostic trouble codes.

Is P2149 DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT FUEL INJECTOR CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect fuel injectors 2, 3, 5, and 8.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE FUEL INJECTOR RESISTANCE

Check the resistance value across the two pins of each of the injectors 2, 3, 5, and 8. Refer to EC-1700, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace the malfunctioning fuel injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

4. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Disconnect the ECM.
2. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK INJECTOR 2 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 2 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	113	(+)	No
		(–)	
	92	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace the engine harness.

6.CHECK INJECTOR 3 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 3 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	116	(+)	No
		(–)	
	95	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace the engine harness.

7.CHECK INJECTOR 5 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 5 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	115	(+)	No
		(–)	
	94	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace the engine harness.

8.CHECK INJECTOR 8 SIGNAL AND DRIVER CIRCUITS FOR SHORT

Check injector 8 signal and driver circuits for continuity between the ECM connector and battery post.

ECM		Battery post	Continuity
Connector	Terminal		
F101	114	(+)	No
		(–)	
	93	(+)	
		(–)	

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace the engine harness.

9.PERFORM FUEL SYSTEM DIAGNOSTIC TEST

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Use SST J-54421 to perform the next step.
4. Using CONSULT, select “ENGINE” and perform the ″Fuel Injector Drain Flow Test″ on bank 2.

NOTE:
The purpose of this test is to check for excessive fuel drain from each injector.

- Disconnect the fuel drain lines from the bank of injectors being tested.
- Plug injector drain lines with the plug provided in the kit.
- Connect the piezo adapter line drain tool connection to each of the injectors.
- Start the engine until top mark is reached or crank for 30 seconds if the engine does not start.
- The maximum permissible drain is 3 times the lowest measured drain quantity.
- A failed injector will have a higher flow and exhibits 3 times the lowest measured drain quantity.

Filling quantity up to:	Engine cranks but does not start (small diameter)		Engine starts (large diameter)	
	ml	oz	ml	oz
1	1.8	0.06	6	0.2
2	2.4	0.08	13	0.44
3	3.2	0.11	21	0.71
4	4	0.14	29	0.98
5	—	—	37	1.25
6	—	—	45	1.52
7	—	—	53	1.79

Does each fuel injector meet the specification in injector drain flow test?

YES >> GO TO 10.
NO >> Replace the malfunctioning injector(s). Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".

10. CHECK FOR CURRENT DTC

1. Start the engine.
2. Wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P2149 DTC current?

YES >> Replace ECM. Refer to EC-1994, "Removal and Installation".
NO >> GO TO 11.

11. ERASE DTCS

1. Connect CONSULT and erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for Clearing the DTC".
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2149 DTC current?

YES >> Return to diagnostic procedure. Refer to EC-1740, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014420615

1. CHECK THE INJECTOR INTERNAL RESISTANCE

Measure the resistance between the two injector pins.

Is the resistance below 150 KΩ?

YES >> Replace the injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 2.

2. CHECK INJECTOR COIL FOR A SHORT TO GROUND

Measure the resistance between each of the injector pins and the metal case of the injector.

Is the resistance below 150 KΩ?

YES >> Replace the injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> Inspection End.

P214A SCR NOX CATALYST INLET TEMPERATURE TOO HIGH

DTC Description

INFOID:0000000014420616

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U1612 present. Refer to EC-971, "DTC Description".
- P1624 present. Refer to EC-1586, "DTC Description".
- P1625 present. Refer to EC-1588, "DTC Description".
- P1626 present. Refer to EC-1591, "DTC Description".
- P1628 present. Refer to EC-1596, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment SCR inlet gas temperature is above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P214A	DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	SCR inlet temperature sensor signal.
		Threshold	SCR Inlet Temperature > 650°C (1202°F).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning fuel injector.
- Malfunctioning SCR intermediate temperature sensor.
- Contaminated DEF.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip P214A DTC detected?

YES >> Proceed to EC-1744, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420617

1.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1624
- P1625
- P1626
- P1628

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR DEF QUALITY RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check ENGINE for any current DEF quality related diagnostic trouble codes:

Any DEF quality related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Using CONSULT, select “ENGINE” and perform the ″Cylinder Cutout Test″ active test to check for a cylinder misfire.

Was an engine misfire detected?

YES >> Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4. INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Was engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 5.

5. CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50% of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 6.

6. ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P214A DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1744, "DTC Description".
NO >> Repair complete.

P214B SCR NOX CATALYST INLET TEMPERATURE TOO HIGH DURING REGEN

DTC Description

INFOID:0000000014420618

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U1612 present. Refer to EC-971, "DTC Description".
- P1624 present. Refer to EC-1586, "DTC Description".
- P1625 present. Refer to EC-1588, "DTC Description".
- P1626 present. Refer to EC-1591, "DTC Description".
- P1628 present. Refer to EC-1596, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment SCR inlet gas temperature is above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P214B	DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	SCR inlet temperature sensor signal.
		Threshold	SCR Inlet Temperature > 700°C (1292°F) for 60 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning fuel injector.
- Malfunctioning SCR intermediate temperature sensor.
- Contaminated DEF.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip P214B DTC detected?

YES >> Proceed to EC-1746, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420619

1.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.

2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:
- U1612
- P1624
- P1625
- P1626
- P1628

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR DEF QUALITY RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check “ENGINE” for any current DEF related diagnostic trouble codes:

Any DEF quality related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Using CONSULT, select “ENGINE” and perform the ″Cylinder Cutout Test″ active test to check for a cylinder misfire.

Was an engine misfire detected?

YES >> Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4. INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Was engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 5.

5. CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 6.

6. ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P214B DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1746, "DTC Description".
NO >> Repair complete.

P214C SCR NOX CATALYST OUTLET TEMPERATURE TOO HIGH

DTC Description

INFOID:0000000014420620

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment SCR outlet gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P214C	DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	This diagnostic runs continuously when the engine is running and active regeneration of the DPF is not occurring.
		Signal (terminal)	SCR outlet temperature sensor signal.
		Threshold	SCR outlet Temperature > 650°C (1202°F).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning SCR catalyst.
- Degraded, diluted, or incorrect DEF.
- Malfunctioning SCR outlet temperature sensor.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip P214C DTC detected?

YES >> Proceed to EC-1748, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420621

1.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1624
- P1625
- P1626
- P1628

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR DEF QUALITY RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check “ENGINE” for any current DEF quality related diagnostic trouble codes:

Any DEF quality related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Using CONSULT, select “ENGINE” and perform the ″Cylinder Cutout Test″ active test to check for a cylinder misfire.

Was an engine misfire detected?

YES >> Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4. INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Was engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 5.

5. CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50% of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 6.

6. ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC found in the DTC description.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P214C DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1744, "DTC Description".
NO >> Repair complete.

P214D SCR NOX CATALYST OUTLET TEMPERATURE TOO HIGH DURING REGEN

DTC Description

INFOID:0000000014420622

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment SCR outlet gas temperature is continuously above a severe, high threshold for a calibrated period of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P214D	DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	This diagnostic runs continuously when the engine is running.
		Signal (terminal)	SCR outlet temperature sensor signal
		Threshold	SCR outlet Temperature > 800°C (1472°F).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning SCR catalyst.
- Degraded, diluted, or incorrect DEF.
- Malfunctioning SCR outlet temperature sensor.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip P214D DTC detected?

YES >> Proceed to EC-1750, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420623

1.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1624
- P1625
- P1626
- P1628

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR DEF QUALITY RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check “ENGINE” for any current DEF related diagnostic trouble codes:

Any DEF quality related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Using CONSULT, select “ENGINE” and perform the ″Cylinder Cutout Test″ active test to check for a cylinder misfire.

Was an engine misfire detected?

YES >> Replace malfunctioning injector. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
NO >> GO TO 4.

4. INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Was engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >> Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
NO >> GO TO 5.

5. CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Is more than 50 % of the cells on the intake face completely blocked by soot?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 6.

6. INSPECT AFTERTREATMENT DIESEL OXIDATION CATALYST FOR CRACKS IN THE CELL WALL

Visually inspect the DOC cell walls for cracks.

Any cracks found in the cell walls?

YES >> Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
NO >> GO TO 7.

7. ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P214D DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1750, "DTC Description".
NO >> Repair complete.

P218F REDUCTANT NO FLOW DETECTED

DTC Description

INFOID:0000000014420624

The DEF supply pump assembly precisely measures the amount of aftertreatment diesel exhaust fluid to be injected into the aftertreatment system. The DEF supply pump assembly has three primary cycles. A priming cycle makes sure that aftertreatment diesel exhaust fluid is available at the DEF supply pump assembly. During the dosing cycle, aftertreatment diesel exhaust fluid is being delivered to the aftertreatment dosing valve. A purge cycle occurs when the engine is turned OFF. The purge cycle makes sure that all the aftertreatment diesel exhaust fluid is removed from the diesel exhaust fluid lines and dosing valve.

DTC DETECTION LOGIC

To determine degraded doser performance based on accumulated nominal error between commanded and estimated DEF flow.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P218F	DEF DOSING VALVE POS CMD DPF PUMP DOSING RATE DEF PUMP STATUS DEF TANK LEVEL	Diagnosis condition	diagnostic runs when the DEF dosing valve is commanded ON.
		Signal (terminal)	Dosing valve signal
		Threshold	The ECM detected the DEF dosing performance is low.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF supply pump assembly.
- DEF dosing valve.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch ON.
2. Connect CONSULT and perform ″DEF Dosing Unit Override Test″ active test.
3. Check 1st trip DTC.

Is P218F DTC detected?

YES >> Proceed to EC-1752, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420625

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes for DTC P218F being current.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DEF QUALITY

1. Using CONSULT erase “ENGINE” diagnostic trouble codes.
2. Inspect the DEF in the tank for signs of debris or contamination.
3. Using a refractometer [SST: J-54466] measure the concentration of the DEF in the tank.

Is DEF concentration within 32.5 Â± 1.5 %?

YES >> GO TO 3.
NO >> Drain the DEF tank, rinse with water, and refill with pure DEF.

3.PERFORM DEF DOSING UNIT OVERRIDE TEST

1. Turn ignition switch OFF.
2. Remove the aftertreatment DEF dosing valve from the decomposition tube.

3. Place the DEF dosing valve in a measuring container having greater than a 1.5 liter [50 oz] capacity.
4. Turn ignition switch ON.
5. Using CONSULT, access “ENGINE” and select ″DEF Dosing Unit Override Test″ active test.

Did the DEF dosing unit operate according to specifications?

YES >> GO TO 4.
NO >> Replace the DEF supply pump assembly. Refer to EX-64, "Exploded View".

4. ERASE DTC.

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC.
4. Check for existing “ENGINE” diagnostic trouble codes.

Did the P218F DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1752, "DTC Description".
NO >> Repair complete.

P21C4 REDUCTANT HEATER RELAY CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420626

Urea heater relay supplies heating power for the DEF Dosing Control Unit. The DEF Line Heater supply and ground circuits are controlled by the DEF control module. Aftertreatment DEF Line heating is based on the input of the ambient temperature sensor. Heating of the line is initiated when the ambient temperature is below 0 degrees Celsius. The DEF control module reports status and issues back to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the aftertreatment DEF line heater relay driver signal was shorted to high source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P21C4	DEF HTR TEST TIME DEF HTR TEST TIMER DEF HTR TEST COUNTS Def tank heater test status	Diagnosis condition	This diagnostic runs when the ignition key switch is ON and line heating is commanded ON.
		Signal (terminal)	DEF line heater relay signal.
		Threshold	Urea heater relay driver signal is shorted to battery.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Short to battery in the urea heater relay driver
- Urea heater relay
- Wiring harness

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and activate ″DEF Line Heater Test″.
3. The DTC will move to ″Past″ when the test runs and passes.

Is P21C4 DTC current?

YES >> Go to EC-1754, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420627

1.CHECK FOR CURRENT UREA HEATER RELAY CIRCUIT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is DTC P21C4 current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK UREA HEATER RELAY CIRCUIT

1. Using CONSULT, erase existing “ENGINE” diagnostic trouble codes.
2. Turn ignition switch OFF.
3. Replace urea heater relay with a known good relay.
4. Turn ignition switch ON.
5. Using CONSULT, activate ″DEF Tank Heater Test″ and the ″DEF Line Heater Test″.
6. Using CONSULT, check “ENGINE” diagnostic trouble codes.

Is P21C4 DTC current?

YES >> GO TO 3.
NO >> Relay was malfunctioning. Repair complete.

3.INSPECT DEF CONTROL MODULE AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DEF control module.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DEF HEATER SUPPLY CIRCUIT FOR SHORT TO OTHER CIRCUITS

1. Disconnect urea heater relay.
2. Check resistance between DEF tank heater supply circuit and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C35	1	All others	No

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair short circuit in harness or connectors.

5. CHECK DEF HEATER SUPPLY CIRCUIT FOR SHORT TO VOLTAGE

Measure the voltage between the DEF heater supply circuit at the relay connector and ground.

Urea heater relay		Terminal (–)	Voltage (Approx.)
Connector	Terminal (+)		
E90	3	Ground	0

Was any voltage measured?

YES >> • Repair or replace the harness for a short to voltage source.
• GO TO 6.
NO >> • Replace the DEF control module. Refer to EC-1999, "Removal and Installation".
• GO TO 6.

6. ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT erase ENGINE diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P21C4 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1683, "DTC Description".
NO >> Repair complete.

P21CA REDUCTANT SUPPLY VOLTAGE INTERMITTENT

DTC Description

INFOID:0000000014420628

NOTE:
If any of the following DTCs is displayed with this DTC, first perform the trouble diagnosis for other DTC.
- P21CB present. Refer to EC-1759, "DTC Description".
- P21CC present. Refer to EC-1762, "DTC Description".

The DEF control module is the central control for the selective catalytic reduction (SCR) diesel exhaust fluid dosing system, and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The DEF control module communicates to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the DEF supply pump assembly internal sensor power supply ground is in excess of an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P21CA	DEF TANK LEVEL	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	DEF tank level sensor signal
		Threshold	DEF Tank Level Sensor voltage supply circuit is > 5.1V or < 4.8V.
		Diagnosis delay time	—

POSSIBLE CAUSE

- DEF control module
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P21CA being current on the CONSULT screen.

Is P21CA DTC current?

YES >> Go to EC-1756, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420629

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P21CB or P21CC is present, perform the confirmation procedure (diagnosis procedure) for the other DTC first.

Any of the two applicable DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR CURRENT DTC

Check for DTC P21CA being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT DEF SUPPLY PUMP ASSEMBLY AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the DEF supply pump assembly.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE DOSING UNIT SENSOR SUPPLY

1. Turn ignition ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P21CA DTC current?

YES >> GO TO 5.
NO >> Replace DEF supply pump assembly. Refer to EX-73, "Exploded View".

5. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition OFF.
2. Disconnect the DEF control module.
3. Inspect both connectors and pins for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK TANK LEVEL SENSOR POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank level sensor 5V supply and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	28	All others	No

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace harness for a short circuit.

7. CHECK TANK PRESSURE SENSOR POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DEF tank pressure sensor 5V supply and all other circuits at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C205	27	All others	No

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace harness for a short circuit.

8. CHECK TANK PRESSURE SENSOR SUPPLY CIRCUIT FOR SHORT TO GROUND

Check the continuity between DEF tank pressure sensor supply circuit and ground.

DEF control module		Ground	Continuity
Connector	Terminal		
C205	27	—	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace harness for a short to ground.

9. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON and wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P21CA DTC current?

YES >> • Replace the DEF supply pump assembly. Refer to EX-73, "Removal and Installation".
• GO TO 10.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 10.

10. ERASE THE DIAGNOSTIC TROUBLE CODES

1. Using CONSULT, erase ENGINE DTCs.
2. Operate the engine within the "Conditions for Clearing the DTC".
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P21CA DTC current?

YES >> Return to diagnostic procedure. Refer to EC-1756, "DTC Description".
NO >> Repair complete.

P21CB REDUCTANT SUPPLY VOLTAGE LOW

DTC Description

INFOID:0000000014420630

NOTE:
If the following DTC is displayed with P21CB, first perform the trouble diagnosis for other DTC.
• P0562 present. Refer to EC-1386, "DTC Description".

The aftertreatment diesel exhaust fluid controller is the central control for the Selective Catalytic Reduction (SCR) diesel exhaust fluid dosing system, and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The diesel exhaust fluid control module communicates to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the input power source voltage to the DEF supply pump assembly is below an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P21CB	DEF TANK VOLTAGE SEN SUPPLY VOL	Diagnosis condition	When the engine is running
		Signal (terminal)	DEF tank voltage supply signal
		Threshold	The DEF control module detected the battery supply voltage is less than 9V.
		Diagnosis delay time	—

POSSIBLE CAUSE

• Damaged generator causing low voltage.
• Weak or damaged battery.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.
1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P21CB being current on the CONSULT screen.

Is P21CB DTC detected?

YES >> Proceed to EC-1759, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420631

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P21CB being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. If DTC P0562 is present, perform the confirmation procedure (diagnosis procedure) for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1386, "DTC Description".
NO >> GO TO 3.

3. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Wait 1 minute to allow sufficient time for the DEF control module to completely power down.
3. Disconnect the DEF control module.
4. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DEF CONTROL MODULE POWER AND GROUND SUPPLY CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DEF control module connector battery power and ground circuit terminals.

Condition	DEF control module			Voltage (V) (Approx.)
	Connector	Terminal (+)	Terminal (-)	
Key ON	C35	1	7	Battery voltage
Cranking		3		
Engine idling		4		

Are the measured voltages within 1 volt of battery voltage?

YES >> • Replace DEF control module. Refer to EC-1999, "Removal and Installation".
• GO TO 11.
NO >> GO TO 5.

5. CHECK BATTERY CONNECTIONS

1. Turn ignition switch ON.
2. Check battery voltage.
3. Check the battery terminal connections on both positive (+) and negative (-) terminals.

Are the connections tight and corrosion-free?

YES >> GO TO 6.
NO >> • Tighten the loose connections, and clean the terminals.
• GO TO 11.

6. VERIFY THE FUSES ARE INSTALLED CORRECTLY

1. Turn ignition switch OFF.
2. Verify the supply fuses in the IPDM E/R are not blown.

- Maxi fuse Y (30A)
- Fuse #55 (15A)
- Fuse #69 (5A)
- Fuse #72 (10A)

3. Inspect the fuses for correct installation.

Fuses are good and installed correctly?

YES >> GO TO 7.
NO >> • Replace the fuse or correct the fuse installation as necessary.
• GO TO 11.

7. CHECK BATTERY SUPPLY CIRCUIT FOR OPEN

Check the signal circuit for continuity between the battery post and the DEF control module.

Battery post	DEF control module		Continuity
Terminal	Connector	Terminal	
(+)	C35	3	Yes
(–)		7	

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair open circuit in harness or connectors.
• GO TO 11.

8.CHECK FOR A SHORT CIRCUIT IN THE POWER HARNESS

Check for continuity between the battery and ground supply terminals at the DEF control module harness connector.

DEF control module			Continuity
Connector	Terminal	Terminal	
C35	3	7	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair short circuit in harness or connectors.
• GO TO 11.

9.CHECK FOR A SHORT CIRCUIT IN THE POWER HARNESS

Check for continuity between the battery supply terminal at the DEF control module harness connector and engine block ground.

DEF control module		Ground	Continuity
Connector	Terminal		
C35	3	Engine block ground	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair short circuit in harness or connectors.
• GO TO 11.

10.CHECK THE CHARGING SYSTEM

Check the charging system for proper operation. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or STR-27, "Work Flow (Without GR8-1200 NI)".

Is generator charging within specification?

YES >> • Replace DEF control module. Refer to EC-1999, "Removal and Installation".
• GO TO 11.
NO >> • Replace the generator. Refer to CHG-46, "Removal and Installation: VK56VD".
• GO TO 11.

11.ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Check for “ENGINE” diagnostic trouble codes.

Is P21CB DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1759, "DTC Description".
NO >> Repair complete.

P21CC REDUCTANT SUPPLY VOLTAGE HIGH

DTC Description

INFOID:0000000014420632

NOTE:
If the following DTC is displayed with P21CC, first perform the trouble diagnosis for other DTC.
- P0563 present. Refer to EC-1389, "DTC Description".

The aftertreatment diesel exhaust fluid controller is the central control for the Selective Catalytic Reduction (SCR) diesel exhaust fluid dosing system, and handles the dosing activity, tank level sensing, tank temperature sensing, line heating, and tank heating. The diesel exhaust fluid control module communicates to the Engine Control Module (ECM) via CAN communication.

DTC DETECTION LOGIC

The Engine Control Module (ECM) has detected the input power source voltage to the DEF supply pump assembly is in excess of an allowable value.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P21CC	DEF TANK VOLTAGE SEN SUPPLY VOL	Diagnosis condition	When the engine is running.
		Signal (terminal)	DEF tank voltage supply signal
		Threshold	The DEF control module detected the battery supply voltage is greater than 16V.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Damaged generator causing high voltage
- Weak or damaged battery
- Improperly connected batteries

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
3. Check for DTC P21CC being current on the CONSULT screen.

Is P21CC DTC detected?

YES >> Proceed to EC-1762, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420633

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P21CC being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. If DTC P0563 is present, perform the confirmation procedure “diagnosis procedure” for this other DTC first.

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-1389, "DTC Description".

NO >> GO TO 3.

3. INSPECT DEF CONTROL MODULE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Wait 1 minute to allow sufficient time for the DEF control module to completely power down.
3. Disconnect the DEF control module.
4. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK DEF CONTROL MODULE POWER AND GROUND SUPPLY CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DEF control module connector battery power and ground circuit terminals.

Condition	DEF control module			Voltage (V) (Approx.)
	Connector	Terminal (+)	Terminal (-)	
Key ON	C35	1	7	Battery voltage
Cranking		3		
Engine idling		4		

Do all the measured voltages read less than 18V?

YES >> • Replace DEF control module. Refer to EC-1999, "Removal and Installation".
• GO TO 6.
NO >> GO TO 5.

5. CHECK THE CHARGING SYSTEM

Check the charging system for proper operation. Refer to CHG-25, "Work Flow (With EXP-800 NI or GR8-1200 NI) (with Cummins 5.0L)" or STR-27, "Work Flow (Without GR8-1200 NI)".

Is generator charging within specification?

YES >> GO TO 6.
NO >> • Replace the generator. Refer to CHG-46, "Removal and Installation: VK56VD".
• GO TO 6.

6. ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Check for “ENGINE” diagnostic trouble codes.

Is P21CC DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1762, "DTC Description".
NO >> Repair complete.

P2201 NOX SENSOR 1

DTC Description

INFOID:0000000014420634

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029D present. Refer to EC-931, "DTC Description".
- P2202 present. Refer to EC-1766, "DTC Description".
- P2209 present. Refer to EC-1770, "DTC Description".
- P220A present. Refer to EC-1773, "DTC Description".

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN communication. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

Engine Out NOx sensor reading is stuck in range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2201	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the DOC intake temperature is above 150°C [302°F], and the engine is in a motoring condition.
		Signal (terminal)	NOx sensor signal
		Threshold	Change of Engine Out NOx Sensor value over the monitoring period < 150 ppm
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning intake NOx sensor
- Improperly installed intake NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Check 1st trip DTC.

Is P2201 DTC detected?

YES >> Proceed to EC-1764, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420635

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P2201 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.

NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- U029D
- P2202
- P2209
- P220A

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >>
- Verify intake NOx sensor is present and installed properly. Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".
- GO TO 3.

3.ERASE CURRENT DTC

1. Using CONSULT erase ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Check for “ENGINE” diagnostic trouble codes.

Is P2201 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1764, "DTC Description".
NO >> Repair complete.

P2202 NOX SENSOR 1

DTC Description

INFOID:0000000014420636

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029D present. Refer to EC-931, "DTC Description".
- P220A present. Refer to EC-1773, "DTC Description".

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN communication. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

Engine Out NOx sensor reading is stuck in range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2202	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the DOC intake temperature sensor has been above 150° C (302°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal
		Threshold	Intake NOx sensor circuit voltage below normal or shorted to low source. An internal circuit error has been detected by the NOx control module.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning intake NOx sensor
- Intake NOx sensor internal heater failure
- Incorrect NOx sensor installed

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1766, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420637

1.CHECK FOR PRIORITY DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P2201 being current on the CONSULT screen.

4. Check If any of the following DTCs are present:
- U029D
- P220A

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2202 DTC current?

YES >> An internal error has been detected in the aftertreatment intake NOx sensor. Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".
NO >> GO TO 3.

3.ERASE CURRENT DTC

1. Using CONSULT erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Check for “ENGINE” diagnostic trouble codes.

Is P2202 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1766, "DTC Description".
NO >> Repair complete.

P2204 NOX SENSOR 1

DTC Description

INFOID:0000000014698699

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029D present. Refer to EC-931, "DTC Description".
- P2202 present. Refer to EC-1766, "DTC Description".
- P2209 present. Refer to EC-1770, "DTC Description".
- P220A present. Refer to EC-1773, "DTC Description".

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The engine outlet NOx sensor reading is stuck in range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2204	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the DOC intake temperature is above 150°C (302°F), and the engine is in motoring condition (pattern 4).
		Signal (terminal)	NOx sensor signal.
		Threshold	Change of engine outlet NOx sensor value over the monitoring period < 150 ppm.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning intake NOx sensor
- Improperly installed intake NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Check 1st trip DTC.

Is P2201 DTC detected?

YES >> Proceed to EC-1815, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014698700

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2204 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.

NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- U029D
- P2202
- P2209
- P220A

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >>
- Verify intake NOx sensor is present and installed properly. Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".
- GO TO 3.

3.ERASE CURRENT DTC

1. Using CONSULT erase ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Check for “ENGINE” diagnostic trouble codes.

Is P2204 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1768, "DTC Description".
NO >> Repair complete.

P2209 NOX SENSOR HEATER SENSE CIRCUIT 1/1

DTC Description

INFOID:0000000014420638

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029D present. Refer to EC-931, "DTC Description".
- P2202 present. Refer to EC-1766, "DTC Description".
- P220A present. Refer to EC-1773, "DTC Description".

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN communication. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

Amount of time that heater reaches working temperature > 30 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2209	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the DOC intake temperature sensor has been above 150°C (302°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal
		Threshold	Percentage of time spent heating ≥ 5% of a 60 second diagnostic window.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning intake NOx sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1770, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420639

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P2209 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> GO TO 8.

2.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- U029D
- P2202
- P220A

Is applicable DTC current?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR OTHER CURRENT DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- P0544
- P0545
- P0546

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.INSPECT THE INTAKE NOX SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the intake NOx sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK THE VOLTAGE TO THE INTAKE NOX SENSOR

1. Turn ignition switch ON.
2. Measure the voltage between the voltage supply circuit and the ground circuit at the intake NOx sensor harness connector.

Intake NOx Sensor			Voltage (Approx.)
Connector	Terminal (+)	Terminal (–)	
C31	4	3	Battery voltage

Is the reading within 1 volt of battery voltage?

YES >> • A damaged aftertreatment intake NOx sensor heater has been detected. Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".
• GO TO 8.
NO >> GO TO 6.

6.CHECK THE BATTERY CONNECTION

1. Turn ignition switch OFF.
2. Check the battery terminals and connections.

Is the battery connection tight and corrosion-free?

YES >> GO TO 7.
NO >> • Tighten any loose connections and clean the terminals.
• GO TO 8.

7. CHECK INTAKE NOX SENSOR VOLTAGE SUPPLY CIRCUIT FOR OPEN

1. Turn ignition switch ON.
2. Measure the voltage between the voltage supply circuit at the intake NOx sensor harness connector and engine block ground.

Intake NOx sensor			Voltage (Approx.)
Connector	Terminal (+)	Terminal (–)	
C31	4	Engine block	Battery voltage

Is the reading within 1 volt of battery voltage?

YES >> • Repair the ground circuit to the intake NOx sensor for open.
• GO TO 8.
NO >> • Repair the power supply to the intake NOx sensor for open.
• GO TO 8.

8. ERASE CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT erase ENGINE diagnostic trouble codes.
5. Operate the engine within the "Conditions for setting the DTC".
6. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2209 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1770, "DTC Description".
NO >> Repair complete.

P220A NOX SENSOR 1

DTC Description

INFOID:0000000014420640

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- P0562 present. Refer to EC-1386, "DTC Description".
- P0563 present. Refer to EC-1389, "DTC Description".

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN communication. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

The engine out NOx sensor circuitry has detected an intermittent power supply voltage drop that results in a reset internal to the sensor.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P220A	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the DOC intake temperature sensor has been above 150°C (302°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal
		Threshold	The Engine Control Module (ECM) detected the NOx sensor supply voltage is greater than 16.5V or less than 10.8V for 10 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- System voltage too low or too high.
- Malfunctioning intake NOx sensor.
- Incorrect intake NOx sensor installed.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1773, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420641

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.

2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P220A being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- P0562
- P0563

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT THE INTAKE NOX SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the intake NOx sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE VOLTAGE TO THE INTAKE NOX SENSOR

1. Turn ignition switch ON.
2. Measure the voltage between the voltage supply circuit and the ground circuit at the intake NOx sensor harness connector.

Intake NOx Sensor			Voltage (Approx.)
Connector	Terminal (+)	Terminal (–)	
C31	4	3	Battery voltage

Is the reading within 1 volt of battery voltage?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK FOR CORRECT INTAKE NOX SENSOR

1. Remove aftertreatment intake NOx sensor.
2. Verify intake NOx sensor is the correct sensor for this engine.

NOTE:
The aftertreatment intake NOx sensor is available in 12V or 24V versions.

Is this intake NOx sensor the correct sensor for this engine?

YES >> GO TO 6.
NO >> • Replace the aftertreatment intake NOx sensor. Refer to EX-45, "Removal and Installation".
• GO TO 9.

6.CHECK CONDITION OF THE INTAKE NOX SENSOR

1. Turn ignition switch OFF.

2. Reinstall the intake NOx sensor and connect all harness connectors.
3. Start the engine.
4. Operate the engine until the diesel oxidation catalyst intake temperature is above 150°C (302°F).
   NOTE:
   The exhaust gas temperature at the aftertreatment intake NOx sensor **must** be above 150°C (302°F) before the sensor can perform its internal diagnostics.
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P220A DTC current?

YES >> • Verify the integrity of the intake NOx sensor. Refer to EX-48, "Removal and Installation".
• Replace the intake NOx sensor if necessary.Refer to EX-45, "Removal and Installation".
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 9.

7.CHECK THE BATTERY CONNECTION

1. Turn ignition switch OFF.
2. Check the battery terminals and connections.

Is the battery connection tight and corrosion-free?

YES >> GO TO 8.
NO >> • Tighten any loose connections and clean the terminals.
• GO TO 9.

8.CHECK INTAKE NOX SENSOR VOLTAGE SUPPLY CIRCUIT FOR OPEN

1. Disconnect the intake NOx sensor.
2. Turn ignition switch ON.
3. Measure the voltage between the voltage supply circuit at the intake NOx sensor harness connector and engine block ground.

Intake NOx sensor			Voltage (Approx.)
Connector	Terminal (+)	Terminal (–)	
C31	4	Engine block	Battery voltage

Is the reading within 1 volt of battery voltage?

YES >> • Repair the ground circuit to the intake NOx sensor for open.
• GO TO 9.
NO >> • Repair the power supply to the intake NOx sensor for open.
• GO TO 9.

9.ERASE CURRENT DTC

1. Insure the ignition switch is OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for setting the DTC".
6. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P220A DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1773, "DTC Description".
NO >> Repair complete.

P220B NOX SENSOR 2

DTC Description

INFOID:0000000014420642

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- P0562 present. Refer to EC-1386, "DTC Description".
- P0563 present. Refer to EC-1389, "DTC Description".

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN communication. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The engine out NOx sensor circuitry has detected an intermittent power supply voltage drop that results in a reset internal to the sensor.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P220B	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the SCR outlet temperature sensor has been above 150°C (302°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal
		Threshold	The Engine Control Module (ECM) detected the NOx sensor supply voltage is greater than 16.5V or less than 10.8V for 10 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors.
- System voltage too low or too high.
- Malfunctioning outlet NOx sensor.
- Incorrect outlet NOx sensor installed.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1776, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420643

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.

2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P220B being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- P0562
- P0563

Is applicable DTC current?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT THE OUTLET NOX SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the outlet NOx sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE VOLTAGE TO THE OUTLET NOX SENSOR

1. Turn ignition switch ON.
2. Measure the voltage between the voltage supply circuit and the ground circuit at the outlet NOx sensor harness connector.

outlet NOx Sensor			Voltage (Approx.)
Connector	Terminal (+)	Terminal (–)	
C33	4	3	Battery voltage

Is the reading within 1 volt of battery voltage?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK FOR CORRECT OUTLET NOX SENSOR

1. Remove aftertreatment outlet NOx sensor.
2. Verify outlet NOx sensor is the correct sensor for this engine.

NOTE:
The aftertreatment outlet NOx sensor is available in 12V or 24V versions.

Is this outlet NOx sensor the correct sensor for this engine?

YES >> GO TO 6.
NO >> • Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• GO TO 9.

6.CHECK CONDITION OF THE OUTLET NOX SENSOR

1. Turn ignition switch OFF.

2. Reinstall the outlet NOx sensor and connect all harness connectors.
3. Start the engine.
4. Operate the engine until the SCR outlet temperature is above 150°C (302°F).
   NOTE:
   The exhaust gas temperature at the aftertreatment outlet NOx sensor **must** be above 150°C (302°F) before the sensor can perform its internal diagnostics.
5. Using CONSULT, check for ENGINE diagnostic trouble codes.

Is P220A DTC current?

YES >> • Verify the integrity of the outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• Replace the outlet NOx sensor if necessary. Refer to EX-48, "Removal and Installation".
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 9.

7. CHECK THE BATTERY CONNECTION

1. Turn ignition switch OFF.
2. Check the battery terminals and connections.

Is the battery connection tight and corrosion-free?

YES >> GO TO 8.
NO >> • Tighten any loose connections and clean the terminals.
• GO TO 9.

8. CHECK OUTLET NOX SENSOR VOLTAGE SUPPLY CIRCUIT FOR OPEN

1. Disconnect the outlet NOx sensor.
2. Turn ignition switch ON.
3. Measure the voltage between the voltage supply circuit at the outlet NOx sensor harness connector and engine block ground.

Outlet NOx sensor			Voltage (Approx.)
Connector	Terminal (+)	Terminal (–)	
C33	4	Engine block	Battery voltage

Is the reading within 1 volt of battery voltage?

YES >> • Repair the ground circuit to the outlet NOx sensor for open.
• GO TO 9.
NO >> • Repair the power supply to the outlet NOx sensor for open.
• GO TO 9.

9. ERASE CURRENT DTC

1. Insure the ignition switch is OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for setting the DTC".
6. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P220A DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1773, "DTC Description".
NO >> Repair complete.

P221A NOX SENSOR 1/2 CORRELATION BANK 1

DTC Description

INFOID:0000000014420644

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- P0562 present. Refer to EC-1386, "DTC Description".
- P0563 present. Refer to EC-1389, "DTC Description".

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN communication. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The system has detected aftertreatment outlet NOx sensor oxygen reading within range but reading inappropriately high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P221A	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the SCR outlet temperature sensor has been above 150°C (302°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal
		Threshold	The Engine Control Module (ECM) detected the Oxygen readings of the Inlet and Outlet NOx sensor did not match.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning outlet NOx sensor.
- DEF crystallization or deposits.
- Incorrect outlet NOx sensor installed.
- Exhaust system leaks.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 eleven more times.
6. Check 1st trip DTC.

Is P221A DTC detected?

YES >> Proceed to EC-1779, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420645

1.CHECK FOR CURRENT RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following ″current″ “ENGINE” diagnostic trouble codes:

- P0102
- P0103
- P0106
- P0107
- P0108
- P012B
- P012C
- P012D
- P0237
- P0299

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR NOX CURRENT RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for the following NOx "current" "ENGINE" diagnostic trouble codes:

- U029D
- U029E
- P2201
- P2202
- P2209
- P220A
- P220B
- P229E
- P229F
- P22A7
- P2BAD
- P2BAF

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR CURRENT AND PAST FUEL SYSTEM RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for any fuel system related "current" or "past" "ENGINE" diagnostic trouble codes.

Any fuel pump or fuel injectors related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK FOR CURRENT AND PAST EGR RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for any EGR related "current" or "past" "ENGINE" diagnostic trouble codes.

Any EGR related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5. CHECK THE AIR OR EXHAUST SYSTEM FOR LEAKS

1. Start the engine and let it idle.
2. Check the charge air cooler and charge air plumbing for leaks:

- Check the charge-air cooler connections for leaks between the turbocharger compressor outlet and the charge-air cooler.
- Check the charge-air cooler connections between the charge-air cooler and the intake manifold.
- Inspect the intake manifold gasket for leaks.
- Inspect the charge-air cooler hoses for leaks or loose connections.
- Inspect the charge-air cooler clamps to make sure they are tight.
- Inspect the charge-air plumbing for cracks.

Air leaks present in the charge air system?

YES >> • Repair or replace the leaking component.
• GO TO 7.
NO >> GO TO 6.

6. CHECK THE EXHAUST SYSTEM FOR LEAKS

1. Turn ignition switch OFF.
2. Check the exhaust system plumbing for leaks:

- Check the exhaust transfer tubes for leaks.
- Check the exhaust bypass tubes for leaks.
- Inspect the EGR valve for leaks.
- Leaks can be easily noted by traces of soot.
- Inspect the charge-air cooler clamps to make sure they are tight.
- Inspect the charge-air plumbing for cracks.

Leaks or restrictions present in the exhaust system?

YES >> • Repair or replace the leaking component.
• GO TO 7.
NO >> • Malfunctioning aftertreatment NOx sensors have been detected.
• Replace the aftertreatment intake NOx sensor. Refer to EX-45, "Removal and Installation".
• Replace the outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• GO TO 7.

7. ERASE DTC.

1. Connect all components.
2. Turn ignition switch ON.
3. With CONSULT, erase all DTCs.
4. Operate the engine within the conditions for setting DTC found in the DTC description.
5. Check for existing “ENGINE” diagnostic trouble codes.

Did the P221A DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1779, "DTC Description".
NO >> Repair complete.

P225C AFTERTREATMENT INTAKE OXYGEN SENSOR HIGH

DTC Description

INFOID:0000000014699083

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a mismatch between the aftertreatment intake and outlet NOx sensor readings.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P225C	NOx Sensor Bank 1 Sensor 1 Sensor Circuit Drifted High. INTAKE NOX INTAKE NOX CORRCTD INTAKE NOX READING STBL OUTLET NOX OUTLET NOX CORRCTD OUTLET NOX READING STBL	Diagnosis condition	Continuously while the ignition is ON or when the engine is running
		Signal (terminal)	—
		Threshold	The absolute difference between the inlet and outlet NOx sensors was greater than a calibrated threshold
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Malfunctioning aftertreatment intake NOx sensor.
- Diesel exhaust fluid crystallization or deposits
- Improperly installed aftertreatment intake NOx sensor
- Exhaust system leaks

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Go to EC-1782, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014699084

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.
3. Check for DTC P225C current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2. CHECK FOR CURRENT NOX SENSOR DTCS

Using CONSULT check for the following ENGINE diagnostic trouble codes related to NOx sensor:
- U029D
- P2201
- P2202
- P2209
- P220A

Are there any of the above current DTCs related to NOx sensor?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR OTHER CURRENT PRIORITY DTCS

Using CONSULT, check ENGINE diagnostic trouble codes for the following current higher priority DTC:
- P0127

Is the above DTC current?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK FOR CURRENT TURBOCHARGER OR EGR RELATED DTCS

Using CONSULT check ENGINE diagnostic trouble codes for the following DTCs related to the turbocharger or EGR:
- P0049
- P0127
- P0405
- P046C
- P2263
- P2413
- P2457
- P2580

Are there any of the above current DTCs related to turbocharger or EGR valve?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5. INSPECT THE AFTERTREATMENT INTAKE NOX SENSOR INSTALLATION

1. Turn ignition switch OFF.
2. Inspect the aftertreatment intake NOx sensor for proper installation.

Sensor properly installed?

YES >> GO TO 6.
NO >> Properly install the aftertreatment intake NOx sensor.

6. ERASE DTCS

1. Turn ignition switch ON.
2. Using CONSULT, select ENGINE and erase DTCs.
3. Operate the engine within the "Conditions for Clearing the DTC".

Is P225C DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1782, "DTC Description".
NO >> Repair complete.

P225D AFTERTREATMENT INTAKE OXYGEN SENSOR LOW

DTC Description

INFOID:0000000014709618

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a mismatch between the aftertreatment intake and outlet NOx sensor readings.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P225D	NOx Sensor Bank 1 Sensor 1 Sensor Circuit Drifted Low. INTAKE NOX INTAKE NOX CORRCTD INTAKE NOX READING STBL OUTLET NOX OUTLET NOX CORRCTD OUTLET NOX READING STBL	Diagnosis condition	Continuously while the ignition is ON or when the engine is running
		Signal (terminal)	—
		Threshold	The absolute difference between the inlet and outlet NOx sensors was greater than a calibrated threshold
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Malfunctioning aftertreatment intake NOx sensor.
- Diesel exhaust fluid crystallization or deposits
- Improperly installed aftertreatment intake NOx sensor
- Exhaust system leaks

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Go to EC-1784, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014709619

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.
3. Check for DTC P225D current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CURRENT NOX SENSOR DTCS

Using CONSULT check for the following ENGINE diagnostic trouble codes related to NOx sensor:
- U029D
- P2201
- P2202
- P2209
- P220A

Are there any of the above current DTCs related to NOx sensor?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR OTHER CURRENT PRIORITY DTCS

Using CONSULT, check ENGINE diagnostic trouble codes for the following current higher priority DTC:
- P0127

Is the above DTC current?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK FOR CURRENT TURBOCHARGER OR EGR RELATED DTCS

Using CONSULT check ENGINE diagnostic trouble codes for the following DTCs related to the turbocharger or EGR:
- P0049
- P0127
- P0405
- P046C
- P2263
- P2413
- P2457
- P2580

Are there any of the above current DTCs related to turbocharger or EGR valve?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.INSPECT THE AFTERTREATMENT INTAKE NOX SENSOR INSTALLATION

1. Turn ignition switch OFF.
2. Inspect the aftertreatment intake NOx sensor for proper installation.

Sensor properly installed?

YES >> GO TO 6.
NO >> Properly install the aftertreatment intake NOx sensor.

6.ERASE DTCS

1. Turn ignition switch ON.
2. Using CONSULT, select ENGINE and erase DTCs.
3. Operate the engine within the "Conditions for Clearing the DTC".

Is P225D DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1784, "DTC Description".
NO >> Repair complete.

P225E AFTERTREATMENT OUTLET OXYGEN SENSOR HIGH

DTC Description

INFOID:0000000014709620

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a mismatch between the aftertreatment intake and outlet NOx sensor readings.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P225E	NOx Sensor Bank 1 Sensor 2 Sensor Circuit Drifted High. INTAKE NOX INTAKE NOX CORRCTD INTAKE NOX READING STBL OUTLET NOX OUTLET NOX CORRCTD OUTLET NOX READING STBL	Diagnosis condition	Continuously while the ignition is ON or when the engine is running
		Signal (terminal)	—
		Threshold	The absolute difference between the inlet and outlet NOx sensors was greater than a calibrated threshold
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Malfunctioning aftertreatment outlet NOx sensor.
- Diesel exhaust fluid crystallization or deposits
- Improperly installed aftertreatment outlet NOx sensor
- Exhaust system leaks

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Go to EC-1786, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014709621

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.
3. Check for DTC P225E current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CURRENT NOX SENSOR DTCS

Using CONSULT check for the following ENGINE diagnostic trouble codes related to NOx sensor:
- U029D
- P2201
- P2202
- P2209
- P220A

Are there any of the above current DTCs related to NOx sensor?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR OTHER CURRENT PRIORITY DTCS

Using CONSULT, check ENGINE diagnostic trouble codes for the following current higher priority DTC:
- P0127

Is the above DTC current?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK FOR CURRENT TURBOCHARGER OR EGR RELATED DTCS

Using CONSULT check ENGINE diagnostic trouble codes for the following DTCs related to the turbocharger or EGR:
- P0049
- P0127
- P0405
- P046C
- P2263
- P2413
- P2457
- P2580

Are there any of the above current DTCs related to turbocharger or EGR valve?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.INSPECT THE AFTERTREATMENT OUTLET NOX SENSOR INSTALLATION

1. Turn ignition switch OFF.
2. Inspect the aftertreatment outlet NOx sensor for proper installation.

Sensor properly installed?

YES >> GO TO 6.
NO >> Properly install the aftertreatment outlet NOx sensor.

6.ERASE DTCS

1. Turn ignition switch ON.
2. Using CONSULT, select ENGINE and erase DTCs.
3. Operate the engine within the "Conditions for Clearing the DTC".

Is P225E DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1786, "DTC Description".
NO >> Repair complete.

P225F AFTERTREATMENT OUTLET OXYGEN SENSOR LOW

DTC Description

INFOID:0000000014709622

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a mismatch between the aftertreatment intake and outlet NOx sensor readings.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P225F	NOx Sensor Bank 1 Sensor 2 Sensor Circuit Drifted Low. INTAKE NOX INTAKE NOX CORRCTD INTAKE NOX READING STBL OUTLET NOX OUTLET NOX CORRCTD OUTLET NOX READING STBL	Diagnosis condition	Continuously while the ignition is ON or when the engine is running
		Signal (terminal)	—
		Threshold	The absolute difference between the inlet and outlet NOx sensors was greater than a calibrated threshold
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Malfunctioning aftertreatment outlet NOx sensor.
- Diesel exhaust fluid crystallization or deposits
- Improperly installed aftertreatment outlet NOx sensor
- Exhaust system leaks

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Go to EC-1788, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014709623

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.
3. Check for DTC P225F current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR CURRENT NOX SENSOR DTCS

Using CONSULT check for the following ENGINE diagnostic trouble codes related to NOx sensor:
- U029D
- P2201
- P2202
- P2209
- P220A

Are there any of the above current DTCs related to NOx sensor?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR OTHER CURRENT PRIORITY DTCS

Using CONSULT, check ENGINE diagnostic trouble codes for the following current higher priority DTC:
- P0127

Is the above DTC current?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK FOR CURRENT TURBOCHARGER OR EGR RELATED DTCS

Using CONSULT check ENGINE diagnostic trouble codes for the following DTCs related to the turbocharger or EGR:
- P0049
- P0127
- P0405
- P046C
- P2263
- P2413
- P2457
- P2580

Are there any of the above current DTCs related to turbocharger or EGR valve?

YES >> Go to the appropriate diagnosis procedure. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.INSPECT THE AFTERTREATMENT OUTLET NOX SENSOR INSTALLATION

1. Turn ignition switch OFF.
2. Inspect the aftertreatment outlet NOx sensor for proper installation.

Sensor properly installed?

YES >> GO TO 6.
NO >> Properly install the aftertreatment outlet NOx sensor.

6.ERASE DTCS

1. Turn ignition switch ON.
2. Using CONSULT, select ENGINE and erase DTCs.
3. Operate the engine within the "Conditions for Clearing the DTC".

Is P225F DTC current?

YES >> Diagnosis procedure needs to be repeated. Refer to EC-1788, "DTC Description".
NO >> Repair complete.

P2262 TC BOOST PRESSURE NOT DETECTED

DTC Description

INFOID:0000000014420646

The Dual stage turbocharger is electronically activated by the Rotary Turbine Control (RTC) actuator. The actuator is powered by the battery via the smart power relay. The RTC actuator is a smart device and receives information by CAN communication from the primary engine control module (ECM). The RTC actuator performs its own diagnostics and reports malfunctions back to the primary engine ECM, using CAN communication. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The turbine bypass valve smart device actuator has determined itself to be incapable of meeting its desired position. This is communicated to the ECM via a number of status codes.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2262	RTCV ACTUATOR POS RTCV ACTUATOR POS CMD	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position.
		Signal (terminal)	Rotary Turbine Control Valve Actuator.
		Threshold	The Rotary Turbine Control (RTC) actuator position could not meet the commanded position for greater than 10 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning Rotary Turbine Control Valve Actuator.
- Harness and connectors.
- Malfunctioning Rotary Turbine Control Valve.
- Loose or damaged linkage.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1790, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420647

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P2262 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK THE TURBOCHARGER ROTARY TURBINE CONTROL VALVE ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the turbine bypass actuator.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> • Repair or replace error-detected parts.
• Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".

3.RUN THE TURBINE BYPASS VALVE ACTUATOR HYSTERESIS TEST

1. Turn ignition switch ON.
2. Check the turbine bypass valve actuator operation.
3. Using CONSULT, connect to ENGINE and perform the ″RTCV Hysteresis Test″ active test.

Did the turbine bypass valve actuator Hysteresis test pass?

YES >> GO TO 5.
NO >> GO TO 4.

4.INSPECT THE TURBINE BYPASS VALVE ACTUATOR LINKAGE

1. Disconnect the turbine bypass valve actuator linkage.
2. Inspect the turbine bypass valve actuator linkage.

Is the linkage bent, broken, or damaged?

YES >> Replace the turbocharger turbine actuator linkage. Refer to EM-398, "Exploded View".
NO >> GO TO 5.

5.RUN THE TURBINE BYPASS VALVE ACTUATOR HYSTERESIS TEST WITH LINKAGE REMOVED

Using CONSULT, connect to ENGINE and perform the ″RTCV Hysteresis Test″ Active Test.

Did the turbine bypass valve actuator Hysteresis test pass?

YES >> GO TO 6.
NO >> Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".

6.RUN THE TURBINE BYPASS VALVE ACTUATOR CALIBRATION

Using CONSULT, connect to “ENGINE” and perform the ″RTCV actuator calibrate″ under Work Support.

RTCV actuator calibration process completed successfully?

YES >> GO TO 7.
NO >> Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".

7.TEST DRIVE THE VEHICLE

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT erase “ENGINE” diagnostic trouble codes.
5. Start the engine and operate under normal driving conditions for at least 15 minutes.
6. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2262 DTC current?

YES >> A turbocharger mechanical malfunction has been detected. Replace the turbocharger assembly. Refer to EM-399, "Removal and Installation".

NO >> GO TO 8.

8. CHECK FOR PROGRESSIVE DAMAGE TO THE TREATMENT SYSTEM

Perform the following snap acceleration test:
1. Engage the parking brakes
2. Place the shift lever in neutral.
3. start the engine and let it idle to reach normal operating temperature.
4. Rapidly depress the accelerator pedal from 0 to 100% multiple times.
5. Check for black smoke exiting the exhaust as the engine accelerated from low to high idle.

NOTE:
If there is a heavy build up of exhaust residue, and a snap acceleration does not reveal the condition outlined, perform a brief acceleration under partial or full load. White smoke due to condensation in the exhaust system is permissible.

Was visible black or grey smoke seen from the exhaust?

YES >> Replace the damaged aftertreatment system. Refer to EX-42, "Removal and Installation".
NO >> GO TO 9.

9. ERASE CURRENT DTC

1. Turn ignition switch ON (engine OFF).
2. Using CONSULT erase “ENGINE” diagnostic trouble codes.
3. Operate the engine within the "Conditions for setting the DTC".
4. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2262 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1790, "DTC Description".
NO >> Repair complete.

P2263 TC BOOST CONTROL SYSTEM

DTC Description

INFOID:0000000014420648

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- P0101 present. Refer to EC-1020, "DTC Description".
- P0102 present. Refer to EC-1024, "DTC Description".
- P0103 present. Refer to EC-1028, "DTC Description".
- P0106 present. Refer to EC-1031, "DTC Description".
- P0107 present. Refer to EC-1036, "DTC Description".
- P0108 present. Refer to EC-1040, "DTC Description".
- P0111 present. Refer to EC-1044, "DTC Description".
- P0112 present. Refer to EC-1047, "DTC Description".
- P0113 present. Refer to EC-1050, "DTC Description".
- P012B present. Refer to EC-1066, "DTC Description".
- P012C present. Refer to EC-1069, "DTC Description".
- P012D present. Refer to EC-1073, "DTC Description".
- P0299 present. Refer to EC-1230, "DTC Description".
- P2580 present. Refer to EC-1961, "DTC Description".

The Engine Control Module (ECM) monitors pressure sensors within the air handling system. Under load, the ECM will adjust engine actuators to meet commanded air and exhaust flow. If adjustment can be no longer made to meet target flows, a fault will be set.

DTC DETECTION LOGIC

EGR flow higher or lower than EGR flow target when EGR flow controller used up all adjustment allowed.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2263	INTAKE MANIFOLD TEMP TURBO PRESS SENSOR	Diagnosis condition	This diagnostic runs continuously when the engine is running.
		Signal (terminal)	Ambient air temperature.
		Threshold	The Engine Control Module (ECM) detected the EGR flow, charge pressure, or exhaust pressure was unable to meet the target pressure commanded by the ECM.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Leak or restriction in charge air plumbing.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to park, and idle for 40 seconds.
5. Repeat steps 2 through 4 two more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P2263 being current on the CONSULT screen.

Is P2263 DTC current?

YES >> Go to EC-1794, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420649

1. CHECK FOR CURRENT AND PAST RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following "current" and "past" "ENGINE" diagnostic trouble codes:

- P0106
- P0107
- P0108
- P0299

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR OTHER CURRENT AND PAST RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for the following "current" and "past" "ENGINE" diagnostic trouble codes:

- P0101
- P0102
- P0103
- P0111
- P0112
- P0113
- P012B
- P012C
- P012D
- P2280
- P2580

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. CHECK FOR MORE CURRENT AND PAST RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for the following "current" and "past" "ENGINE" diagnostic trouble codes:

- P0471
- P0472
- P0473

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4. CHECK FOR EGR RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for any EGR related "current" or "past" "ENGINE" diagnostic trouble codes.

Any EGR related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5. CHECK FOR TURBOCHARGER RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for any turbocharger related "current" or "past" "ENGINE" diagnostic trouble codes.

Any turbocharger related DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 6.

6. INSPECT THE TURBINE BYPASS VALVE ACTUATOR LINKAGE

1. Turn the ignition switch OFF.
2. Inspect the turbine bypass valve actuator linkage.

Is the linkage missing, bent, broken, or damaged?

YES >> • Replace the turbocharger turbine actuator linkage. Refer to EM-419, "Exploded View".
• GO TO 7.

NO >> GO TO 7.

7. CHECK THE CHARGE AIR COOLER AND CHARGE AIR PLUMBING FOR LEAKS

1. Start the engine and let it idle.
2. Check the charge air cooler and charge air plumbing for leaks:

- Check the charge-air cooler connections for leaks between the turbocharger compressor outlet and the charge-air cooler.
- Check the charge-air cooler connections between the charge-air cooler and the intake manifold.
- Inspect the intake manifold gasket for leaks.
- Inspect the charge-air cooler hoses for leaks or loose connections.
- Inspect the charge-air cooler clamps to make sure they are tight.
- Inspect the charge-air plumbing for cracks.

Air leaks present in the charge air system?

YES >> • Repair or replace the leaking component.
• GO TO 10.
NO >> GO TO 8.

8. INSPECT FOR LEAKS AND RESTRICTIONS IN THE AIR INTAKE MANIFOLD AND EXHAUST SYSTEM

1. Turn ignition switch OFF.
2. Check for leaks in the Air Intake and Exhaust Systems. Refer to EX-19, "Checking Exhaust System".
3. Check the Air Intake for restriction. Refer to EM-229, "Exploded View".

Air leaks present in the charge air system?

YES >> • Repair or replace the leaking component.
• GO TO 10.
NO >> GO TO 9.

9. CHECK THE EGR SYSTEM FOR LEAKS AND RESTRICTIONS

1. Turn ignition switch OFF.
2. Check the EGR system plumbing for leaks and restrictions:

- Check the exhaust transfer tubes for leaks and restrictions.
- Check the exhaust bypass tubes for leaks and restrictions.
- Inspect the EGR valve for restrictions.
- Leaks can be easily noted by traces of soot.
- Inspect the charge-air cooler clamps to make sure they are tight.
- Inspect the charge-air plumbing for cracks.

Leaks or restrictions present in the EGR system?

YES >> • Repair or replace the malfunctioning component.
• GO TO 10.
NO >> GO TO 10.

10. VERIFY THE COMPRESSOR BYPASS VALVE ACTUATOR

1. Turn ignition switch ON.
2. Verify compressor bypass valve actuator:

- Use a hand pump to provide vacuum to the actuator.
- Verify that the compressor bypass valve moves to both linkage stops. Refer to EM-422, "Exploded View".

Compressor bypass valve linkage moves from stop to stop?

YES >> • Inspect the compressor bypass valve for proper operation. If the compressor bypass valve functions properly, replace the compressor bypass valve actuator. Refer to EM-425, "Removal and Installation".
• GO TO 11.
NO >> GO TO 11.

11. ERASE DTC.

1. Connect all components.
2. Turn ignition switch ON.
3. With CONSULT, erase all DTCs.
4. Operate the engine within the conditions for setting DTC found in the DTC description.
5. Check for existing “ENGINE” diagnostic trouble codes.

Did the P2263 DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1793, "DTC Description".
NO >> Repair complete.

P2267 WATER IN FUEL SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420650

The water in fuel sensor is in the fuel filter. The Engine Control Module (ECM) provides a 5V reference signal to the water in fuel sensor. When the water collected in the fuel filter covers the sensor probes, the water-in-fuel sensor pulls the 5V reference voltage down, indicating high water accumulation in the fuel filter.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the water in fuel sensor signal voltage was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2267	WATER IN FUEL WATER IN FUEL V	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	Water in fuel sensor signal
		Threshold	Filtered output value of the water in fuel sensor > 4.912 V
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness and connectors
- Water in fuel sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2267 being current on the CONSULT screen.

Is P2267 DTC current?

YES >> Go to EC-1797, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420651

1.CHECK FOR A CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.
3. Check for DTC P2267 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT THE WATER-IN-FUEL SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the water-in-fuel sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. INSPECT THE WATER-IN-FUEL SENSOR RESISTANCE

Test the water-in-fuel sensor resistance. Refer to EC-1799, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Replace the water-in-fuel sensor. Refer to FL-52, "Removal and Installation".
• GO TO 10.

4. CHECK THE CIRCUIT RESPONSE

1. Reconnect the water-in-fuel sensor.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2267 DTC current?

YES >> GO TO 5.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 10.

5. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> • Repair or replace error-detected parts.
• GO TO 10.

6. CHECK WATER IN FUEL SENSOR RETURN CIRCUIT FOR OPEN

1. Disconnect the water in fuel sensor.
2. Check water-in-fuel sensor return circuit for continuity between ECM and water-in-fuel sensor connectors.

ECM		Water in fuel sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	41	F225	2	Yes

Is the inspection result normal?

YES >> GO TO 7.
NO >> • Repair open circuit in harness or connectors.
• GO TO 10.

7.CHECK WATER-IN-FUEL SENSOR SIGNAL CIRCUIT FOR OPEN

Check water in fuel sensor signal circuit for continuity between ECM and water in fuel sensor connectors.

ECM		Water in fuel sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	77	F225	1	Yes

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair open circuit in harness or connectors.
• GO TO 10.

8.CHECK WATER-IN-FUEL SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check water-in-fuel sensor signal circuit for continuity between ECM connector terminal 77 and all other terminals.

ECM			Continuity
Connector	Terminal	Terminal	
E93	77	All others	No

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair or replace harness for a short circuit.
• GO TO 10.

9.CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2267 DTC current?

YES >> • Diagnosis procedure needs to be repeated. Go to EC-1797, "DTC Description".
• GO TO 10.
NO >> The removal and installation of the connector corrected the issue.

10.ERASE CURRENT DTCS

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for Clearing the DTC".
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2267 DTC current?

YES >> Diagnosis procedure needs to be repeated. Go to EC-1797, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014420652

1.CHECK THE WATER IN FUEL SENSOR INTERNAL RESISTANCE

Measure the resistance between the two sensor pins without the presence of water.

NOTE:

Water-in-fuel sensor resistance without the presence of water is normally between 78.9 KΩ and 86.1 KΩ.

Is the resistance between 78.9 KΩ and 86.1 KΩ without the presence of water?

YES >> Inspection End.
NO >> Replace the water in fuel sensor. Refer to FL-52, "Removal and Installation".

P2269 WATER IN FUEL CONDITION

DTC Description

INFOID:0000000014420653

NOTE:
If DTC P2267 is displayed with this DTC, first perform the trouble diagnosis for other DTC.
• P2267 present. Refer to EC-1797, "DTC Description".

The water in fuel sensor is in the fuel filter. The Engine Control Module (ECM) provides a 5V reference signal to the water-in fuel sensor. When the water collected in the fuel filter covers the sensor probes, the water in fuel sensor pulls the 5V reference voltage down, indicating high water accumulation in the fuel filter.

DTC DETECTION LOGIC

Water has been detected in the fuel filter.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2269	WATER IN FUEL WATER IN FUEL V	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	Water in fuel sensor signal.
		Threshold	Filtered output value of the water in fuel sensor ≤ 2.891V
		Diagnosis delay time	—

POSSIBLE CAUSE

• Open return or signal circuit
• Signal circuit is shorted to a voltage source

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2269 being current on the CONSULT screen.

Is P2269 DTC current?

YES >> Go to EC-1800, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420654

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other current “ENGINE” diagnostic trouble codes.

NOTE:
The following current DTC has priority over this DTC if it exists.
• P2267

Is P2267 DTC current?

YES >> Refer to EC-1797, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT AND PAST DTCS

1. Using CONSULT, check for current and past “ENGINE” diagnostic trouble codes.
2. Check for DTC P2269 being current or past on the CONSULT screen.

Is applicable DTC present?

YES >> • Drain the water from the fuel filter.
NOTE:
If DTC P2269 remains present, a malfunction in the sensor and/or connector may have occurred. Repair or replace the sensor and/or connector as necessary.
• GO TO 3.
NO >> GO TO 3.

3.INSPECT THE WATER-IN-FUEL SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the water-in-fuel sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.INSPECT THE WATER-IN-FUEL SENSOR RESISTANCE

Test the water-in-fuel sensor resistance. Refer to EC-1803, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Replace the water-in-fuel sensor. Refer to FL-52, "Removal and Installation".
• GO TO 10.

5.CHECK THE CIRCUIT RESPONSE

1. Reconnect the water-in-fuel sensor.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2269 DTC current?

YES >> GO TO 6.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 10.

6.INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.

- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> • Repair or replace error-detected parts.
• GO TO 10.

7.CHECK WATER IN FUEL SENSOR RETURN CIRCUIT FOR OPEN

1. Disconnect the water in fuel sensor.
2. Check water-in-fuel sensor return circuit for continuity between ECM and water-in-fuel sensor connectors.

ECM		Water in fuel sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	41	F225	2	Yes

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair open circuit in harness or connectors.
• GO TO 10.

8.CHECK WATER-IN-FUEL SENSOR SIGNAL CIRCUIT FOR OPEN

Check water in fuel sensor signal circuit for continuity between ECM and water in fuel sensor connectors.

ECM		Water in fuel sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	77	F225	1	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 10.

9.CHECK WATER-IN-FUEL SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check water-in-fuel sensor signal circuit for continuity between ECM connector terminal 77 and all other terminals.

ECM			Continuity
Connector	Terminal	Terminal	
E93	77	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair or replace harness for a short circuit.
• GO TO 10.

10.ERASE CURRENT DTCS

1. Reconnect all previously disconnected components.
2. Turn ignition switch ON.
3. Using CONSULT, erase ENGINE diagnostic trouble codes.
4. Operate the engine within the "Conditions for Clearing the DTC".
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2269 DTC current?

YES >> Diagnosis procedure needs to be repeated. Go to EC-1800, "DTC Description".
NO >> Repair complete.

Component Inspection

INFOID:0000000014735334

1. CHECK THE WATER IN FUEL SENSOR INTERNAL RESISTANCE

Measure the resistance between the two sensor pins without the presence of water.

NOTE:

Water-in-fuel sensor resistance without the presence of water is normally between 78.9 KΩ and 86.1 KΩ.

Is the resistance between 78.9 KΩ and 86.1 KΩ without the presence of water?

YES >> Inspection End.

NO >> Replace the water in fuel sensor. Refer to FL-52, "Removal and Installation".

P226C TC BOOST CONTROL SLOW RESPONSE

DTC Description

INFOID:0000000014420655

The Dual stage turbocharger is electronically activated by the Rotary Turbine Control (RTC) actuator. The actuator is powered by the battery via the smart power relay. The RTC actuator is a smart device and receives information by CAN2 communication from the primary Engine Control Module (ECM). The RTC actuator performs its own diagnostics and reports malfunctions back to the primary ECM, using the CAN2 communication. The ECM then decodes the error message and converts it to a DTC.

DTC DETECTION LOGIC

The turbocharger turbine bypass actuator position feedback is failed in range, but not clearly "in range high" or "in range low."

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P226C	RTCV ACTUATOR POS RTCV ACTUATOR POS CMD RTV INSTALL/CALIB STATUS RTCV HYSTERESIS STATUS	Diagnosis condition	When the key switch is in the ON position.
		Signal (terminal)	Rotary Turbine Control Valve Actuator signal.
		Threshold	The Engine Control Module (ECM) detected the difference between actual and commanded turbocharger position is too large.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning Rotary Turbine Control Valve Actuator
- Malfunctioning compressor bypass valve
- Loose or damaged linkage

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CHECK

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P226C being current on the CONSULT screen.

Is P226C DTC current?

YES >> Go to EC-1804, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420656

1.CHECK FOR A CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for current and past “ENGINE” diagnostic trouble codes.
3. Check for DTC P226C ″current″ or ″past″ on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT THE ROTARY TURBINE CONTROL VALVE ACTUATOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the rotary turbine control valve actuator.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.

- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK ROTARY TURBINE CONTROL VALVE ACTUATOR POWER AND GROUND CIRCUITS

1. Start the engine.
2. Measure the voltage at the rotary turbine control valve actuator between power terminal 4 and ground terminal 1.

Rotary turbine control valve actuator			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (–)	
F146	4	1	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace harness for an open circuit.
• GO TO 7.

4.RUN ROTARY TURBINE CONTROL VALVE ACTUATOR HYSTERESIS TEST

1. Turn ignition switch OFF.
2. Reconnect the rotary turbine control valve actuator.
3. Turn ignition switch ON.
4. Using CONSULT, select ENGINE and perform the ″RTCV Hysteresis Test″ under ″Active Test″.

Did RTCV Hysteresis Test pass?

YES >> GO TO 6.
NO >> GO TO 5.

5.RUN ROTARY TURBINE CONTROL VALVE ACTUATOR HYSTERESIS TEST WITH LINKAGE REMOVED

1. Disconnect the rotary turbine control valve actuator linkage.
2. Using CONSULT, select ENGINE and perform the ″RTCV Hysteresis Test″ under ″Active Test″.

Did RTCV Hysteresis Test pass?

YES >> GO TO 6.
NO >> • Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".
• GO TO 9.

6.CHECK THE ROTARY TURBINE CONTROL VALVE ACTUATOR LINKAGE

Inspect the rotary turbine control valve actuator linkage.

Is the linkage broken or damaged?

YES >> • Replace the rotary turbine control valve actuator linkage. Refer to EM-420, "Removal and Installation".
• GO TO 7.
NO >> GO TO 8.

7.RUN ROTARY TURBINE CONTROL VALVE ACTUATOR CALIBRATION

1. Connect all components and harness connectors.
2. Using CONSULT, select “ENGINE” and perform the ″RTCV actuator calibrate″ under ″Work Support″.

Did RTCV actuator calibration test pass?

YES >> GO TO 8.
NO >> • Replace the rotary turbine control valve actuator. Refer to EM-418, "Removal and Installation".
• GO TO 9.

8.COMPLETE THE VEHICLE TEST

1. Connect all components and harness connectors.
2. Using CONSULT, erase ENGINE diagnostic trouble codes.

3. Start the engine and operate under normal driving conditions for at least 15 minutes.
4. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P226C DTC current?

YES >> • A turbocharger mechanical malfunction has been detected. Replace the turbocharger assembly. Refer to EM-399, "Removal and Installation".
• GO TO 9.
NO >> GO TO 9.

9. CHECK FOR PROGRESSIVE DAMAGE TO THE AFTERTREATMENT SYSTEM

Perform the following snap acceleration test:
1. Connect all components and harness connectors.
2. Engage the parking brakes
3. Place the shift lever in (N) neutral.
4. start the engine and let it idle to reach normal operating temperature.
5. Rapidly depress the accelerator pedal from 0 to 100% multiple times.
6. Check for black smoke exiting the exhaust as the engine accelerated from low to high idle.

NOTE:
If there is a heavy buildup of exhaust residue and a snap acceleration does not reveal the condition outlined, perform a brief acceleration under partial or full load. White smoke due to condensation in the exhaust system is permissible.

Was visible black or gray smoke seen from the exhaust?

YES >> • Replace the damaged aftertreatment system. Refer to EX-42, "Removal and Installation".
• GO TO 10.
NO >> GO TO 10.

10. ERASE CURRENT DTCS

1. Turn the engine OFF.
2. Turn ignition switch ON.
3. Using CONSULT, erase ENGINE diagnostic trouble codes.
4. Operate the engine within the "Conditions for Clearing the DTC".
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P226C DTC current?

YES >> Diagnosis procedure needs to be repeated. Go to EC-1804, "DTC Description".
NO >> Repair complete.

P2280 INTAKE AIR SYSTEM

DTC Description

INFOID:0000000014420657

This monitor determines when the air filter has become too restrictive by calculating the air pressure change in the air filter box. The mass air flow and turbocharger compressor inlet pressure sensors are used to calculate pressure drop across the air box. When the air pressure drops faster than a threshold after multiple drive cycles, a DTC is set.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected a rapid decrease in pressure from the inlet air pressure.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2280	MASS AIR FLOW TURBO COMP INLET PRESS	Diagnosis condition	This diagnostic runs continuously when the engine is running.
		Signal (terminal)	Engine air filter differential pressure
		Threshold	When the filtered ambient air pressure rate of change is less than a preset value
		Diagnosis delay time	—

POSSIBLE CAUSE

- Restricted air filter

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Go to EC-1807, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420658

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2280 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT AIR FILTER

1. Remove the air filter.
2. Inspect the air filter for any damage or restriction.

Is the air filter damaged or restricted?

YES >> • Replace the damaged or restricted air filter. Refer to EM-221, "Removal and Installation".
• GO TO 3.
NO >> GO TO 3.

3.ERASE CURRENT DTC

1. Connect all components.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2280 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1807, "DTC Description".
NO >> Repair complete.

P2299 ACCELERATOR/BRAKE PEDAL POSITION INCONSISTENCY

DTC Description

INFOID:0000000014420659

This diagnostic tests for a stuck throttle or throttle position sensor. The algorithm only runs when the throttle is pressed and the brake pedal is pushed during that time. This DTC will not occur if the brake pedal is applied first and then the throttle pedal is engaged.

DTC DETECTION LOGIC

This DTC is intended to detect conditions where both the accelerator pedal and brake pedal were depressed at the same time. When this condition occurs, the accelerator pedal position is defaults to idle. If the DTC occurs when both pedals are NOT depressed, this may indicate that either the accelerator pedal position or brake pedal position are NOT returning to 0%.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2299	ACCEL PEDAL POS BRAKE SWITCH	Diagnosis condition	This diagnostic runs when the vehicle is in motion.
		Signal (terminal)	Accelerator Pedal Position Sensor and Brake Pedal Position Sensor.
		Threshold	ECM detected the brake pedal is depressed when the throttle position sensor > 8% with < 2% deviation for 2 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Misadjusted brake pedal position switch
- Accelerator pedal not fully returning to rest

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1809, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420660

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.
3. If there are any ABS related DTCs, perform the confirmation procedure (trouble diagnosis) for these other DTCs first.

Is any applicable ABS related DTC detected?

YES >> Refer to BRC-55, "DTC Index".
NO >> GO TO 2.

2.VERIFY DTC CAUSE

NOTE:

This DTC can trip if the customer is a two-footed driver (customer rests a foot on the brake pedal while using the accelerator pedal).
Determine whether the brake pedal has been depressed while the vehicle is moving and the throttle position is greater than 8% for 2 seconds.

Is the driver a two-footed driver?

YES >> Explain the diagnostic operation to the customer. Repair complete.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P229E NOX SENSOR 2

DTC Description

INFOID:0000000014420661

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029E present. Refer to EC-935, "DTC Description".
- P220B present. Refer to EC-1776, "DTC Description".

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN2 communication. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN2 communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The NOx sensor circuitry has detected a failure affecting the aftertreatment outlet NOx sensor heater circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P229E	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the SCR outlet temperature sensor has been above 200°C (392°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal.
		Threshold	Outlet NOx sensor circuit voltage below normal or shorted to low source. An internal circuit error has been detected by the outlet NOx sensor.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning outlet NOx sensor
- Malfunctioning outlet NOx sensor heater
- Incorrect outlet NOx sensor installed

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1811, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420662

1.CHECK FOR PRIORITY DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other “ENGINE” diagnostic trouble codes.
3. Check If any of the following DTCs are present:

- P0562
- P0563

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

1. Using CONSULT, check “ENGINE“ diagnostic trouble codes.
2. Check for DTC P229E being current on the CONSULT screen.

Is applicable DTC current?

YES >> • Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• GO TO 3.
NO >> GO TO 3.

3.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P229E DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1773, "DTC Description".
NO >> Repair complete.

P229F NOX SENSOR 2

DTC Description

INFOID:0000000014420663

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029E present. Refer to EC-935, "DTC Description".
- P220B present. Refer to EC-1776, "DTC Description".
- P229E present. Refer to EC-1811, "DTC Description".
- P22A7 present. Refer to EC-1817, "DTC Description".

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN2 communication. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN2 communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

Aftertreatment outlet NOx sensor in-range but reading inappropriately high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P229F	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the SCR outlet temperature is above 200°C (392°F), and the engine is in a motoring (non-fueling) condition.
		Signal (terminal)	NOx sensor signal
		Threshold	The ECM detected the outlet NOx sensor was not reading zero while in a motoring (non-fueling) condition.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning outlet NOx sensor
- Diesel exhaust fluid crystallization or deposits
- Incorrect outlet NOx sensor installed

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:
1. Start engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to (P) park, and idle for 40 seconds.
5. Repeat steps 2 through 4 eleven more times.
6. Check 1st trip DTC.

Is P229F DTC detected?

YES >> Proceed to EC-1813, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420664

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.

3. Check for DTC P229F being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> GO TO 5.

2. CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check if any of the following DTCs are present:

- U029E
- P220B
- P229E
- P22A7

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. VERIFY PROPER INSTALLATION OF THE OUTLET NOX SENSOR

1. Turn ignition switch OFF.
2. Verify proper installation of the aftertreatment outlet NOx sensor.
3. Verify the correct aftertreatment outlet NOx sensor is installed.

Is the correct outlet NOx sensor properly installed?

YES >> GO TO 4.
NO >> Properly install the correct outlet NOx sensor.

4. VERIFY PROPER INSTALLATION OF THE OUTLET NOX SENSOR

1. Disconnect the aftertreatment diesel exhaust fluid decomposition tube.
2. Check for diesel exhaust fluid crystallization.
3. Inspect the decomposition tube for crystallization.

Is there crystallization buildup in the decomposition tube?

YES >> • Remove the crystallization buildup.
• GO TO 5.
NO >> • A damaged aftertreatment outlet NOx sensor has been detected. Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• GO TO 5.

5. ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P229F DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1813, "DTC Description".
NO >> Repair complete.

P22A2 AFTERTREATMENT 1 INTAKE NOX OUT OF CALIBRATION

DTC Description

INFOID:0000000014698703

NOTE:
If any of the following DTCs are displayed with this DTC, first perform the trouble diagnosis for other DTCs:
- U029E present. Refer to EC-935, "DTC Description".
- P220B present. Refer to EC-1776, "DTC Description".
- P229E present. Refer to EC-1811, "DTC Description".
- P22A7 present. Refer to EC-1817, "DTC Description".

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device that communicates with the ECM via the CAN 2 communication lines. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the ECM using the CAN 2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

Aftertreatment outlet NOx sensor in-range but reading inappropriately high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P22A2	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the SCR outlet temperature is above 200°C (392°F), and the engine is in a motoring (non-fueling) condition.
		Signal (terminal)	NOx sensor signal
		Threshold	The ECM detected the outlet NOx sensor was not reading zero while in a motoring (non-fueling) condition.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning outlet NOx sensor
- Diesel exhaust fluid crystallization or deposits
- Incorrect outlet NOx sensor installed

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to (P) park, and idle for 40 seconds.
5. Repeat steps 2 through 4 eleven more times.
6. Check 1st trip DTC.

Is P22A2 DTC detected?

YES >> Proceed to EC-1815, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014698704

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

3. Check for DTC P22A2 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> GO TO 5.

2. CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check If any of the following DTCs are present:

- U029D
- P220B
- P229E
- P22A7

Is any of the applicable DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. VERIFY PROPER INSTALLATION OF THE OUTLET NOX SENSOR

1. Turn ignition switch OFF.
2. Verify proper installation of the aftertreatment outlet NOx sensor.
3. Verify the correct aftertreatment outlet NOx sensor is installed.

Is the correct outlet NOx sensor properly installed?

YES >> GO TO 4.
NO >> Properly install the correct outlet NOx sensor.

4. VERIFY PROPER INSTALLATION OF THE OUTLET NOX SENSOR

1. Disconnect the aftertreatment diesel exhaust fluid composition tube.
2. Check for diesel exhaust fluid crystallization.
3. Inspect the decomposition tube for crystallization.

Is there crystallization buildup in the decomposition tube?

YES >> • Remove the crystallization buildup.
• GO TO 5.
NO >> • A damaged aftertreatment outlet NOx sensor has been detected. Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• GO TO 5.

5. ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P22A2 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1815, "DTC Description".
NO >> Repair complete.

P22A7 NOX SENSOR HEATER SENSE CIRCUIT 1/2

DTC Description

INFOID:0000000014420665

NOTE:

1. If any of the following "current" or "past" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- U029E present. Refer to EC-935, "DTC Description".
- P220B present. Refer to EC-1776, "DTC Description".
- P229E present. Refer to EC-1811, "DTC Description".

2. If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- P2481 present. Refer to EC-1908, "DTC Description".
- P2482 present. Refer to EC-1910, "DTC Description".
- P2483 present. Refer to EC-1912, "DTC Description".

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via CAN2 communication. The aftertreatment outlet NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using CAN2 communication. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

Aftertreatment outlet NOx sensor heater malfunction

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P22A7	OUTLET NOX INLET NOX	Diagnosis condition	This diagnostic runs when the SCR outlet temperature sensor has been above 200°C (392°F) for 5 seconds while the engine is running.
		Signal (terminal)	NOx sensor signal
		Threshold	The ECM detected the NOx sensor heater was unable to maintain its normal operating temperature.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning outlet NOx sensor
- Intermittent power connection to the outlet NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1818, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420666

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for DTC P22A7 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> GO TO 8.

2.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check if any of the following DTCs are ″current″ or ″past″:

- U029E
- P220B
- P229E

Is applicable DTC current or past?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR PRIORITY DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Check if any of the following DTCs are ″current″:

- P2481
- P2482
- P2483

Is applicable DTC current?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

4.INSPECT THE OUTLET NOX SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the outlet NOx sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Repair or replace error-detected parts.
• GO TO 8.

5.CHECK THE VOLTAGE TO THE OUTLET NOX SENSOR

1. Turn ignition switch ON.
2. Measure the voltage between the voltage supply circuit and the ground circuit at the outlet NOx sensor harness connector.

Outlet NOx sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (–)	
C33	4	3	Battery voltage

Is the reading within 1V of battery voltage?

YES >> • A damaged aftertreatment outlet NOx sensor heater has been detected. Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
• GO TO 8.
NO >> GO TO 6.

6.CHECK THE BATTERY CONNECTION

1. Turn ignition switch OFF.
2. Check the battery terminals and connections.

Is the battery connection tight and corrosion-free?

YES >> GO TO 7.
NO >> • Tighten any loose connections and clean the terminals.
• GO TO 8.

7.CHECK OUTLET NOX SENSOR VOLTAGE SUPPLY CIRCUIT FOR OPEN

Measure the voltage between the voltage supply circuit at the outlet NOx sensor harness connector and engine block ground.

Outlet NOx sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (–)	
C33	4	Engine block	Battery voltage

Is the reading within 1V of battery voltage?

YES >> • Repair the ground circuit to the outlet NOx sensor for open.
• GO TO 8.
NO >> • Repair the power supply to the outlet NOx sensor for open.
• GO TO 8.

8.ERASE CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for setting the DTC".
6. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P22A7 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1818, "Diagnosis Procedure".
NO >> Repair complete.

P22CB TC OUTLET SWITCHING VALVE CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420667

The compressor bypass solenoid allows the vacuum produced by the belt driven vacuum pump to pass through to compressor bypass actuator when the ECM applies a Pulse Width Modulation (PWM) duty cycle to the compressor bypass solenoid. The ECM commands a duty cycle of 100% to the compressor bypass solenoid when the engine speed and load is such that is required for the compressor bypass valve to open. This allows vacuum to pass through to actuate compressor bypass valve.

DTC DETECTION LOGIC

This monitor detects if the compressor bypass valve discrete output actuator device command line is shorted low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P22CB	COMPRESSOR BYPASS VALVE	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	Compressor Bypass Valve Actuator
		Threshold	The ECM detected the Compressor bypass actuator circuit is shorted low.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness shorted to ground.
- Malfunctioning compressor bypass valve solenoid.
- ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P22CB current on the CONSULT screen.

Is P22CB DTC current?

YES >> Go to EC-1820, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420668

1.CHECK FOR DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for ″current″ “ENGINE” diagnostic trouble codes.
3. Check for current DTC P22CB on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT COMPRESSOR BYPASS VALVE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.

2. Disconnect the compressor bypass actuator connector.
3. Inspect connector for the following:
- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P22CC become current and P22CB become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK DTC AND VERIFY VALVE CONDITION

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON and wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P22CB DTC current?

YES >> • Replace the compressor bypass valve. Refer to EM-423, "Removal and Installation".
• GO TO 8.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 8.

5. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Inspect the connector for the following:
- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> • Repair or replace error-detected parts.
• GO TO 8.

6. CHECK THE ECM RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P22CC become current and P22CB become past?

YES >> GO TO 7.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 8.

7. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P22CB DTC current?

YES >> • Repair or replace the engine harness for a short.
• GO TO 8.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 8.

8. ERASE CURRENT DTCS

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for Clearing DTC".
3. Using CONSULT, check for current ENGINE” diagnostic trouble codes.

Is P22CB DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1820, "DTC Description".
NO >> Repair complete.

P22CC TC OUTLET SWITCHING VALVE CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420669

The compressor bypass solenoid allows the vacuum produced by the belt driven vacuum pump to pass through to compressor bypass actuator when the ECM applies a pulse width modulation (PWM) duty cycle to the compressor bypass solenoid. The ECM commands a duty cycle of 100% to the compressor bypass solenoid when the engine speed and load is such that is required for the compressor bypass valve to open. This allows vacuum to pass through to actuate compressor bypass valve.

DTC DETECTION LOGIC

This monitor detects if the compressor bypass valve discrete output actuator device command line is shorted high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P22CC	COMPRESSOR BYPASS VALVE	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	Compressor Bypass Valve Actuator
		Threshold	The ECM detected the Compressor bypass actuator circuit is shorted high or open.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Harness shorted to battery.
- Compressor bypass valve solenoid.
- Harness open circuit.

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P22CC being current on the CONSULT screen.

Is P22CC DTC current?

YES >> Go to EC-1823, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420670

1.CHECK FOR DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for ″current″ “ENGINE” diagnostic trouble codes.
3. Check for current DTC P22CC being on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT COMPRESSOR BYPASS VALVE AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.

2. Disconnect the compressor bypass actuator connector.
3. Inspect connector for the following:
- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the signal and return circuits at the compressor bypass valve connector.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P22CB become current and P22CC become past?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK DTC AND VERIFY VALVE CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON and wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P22CC DTC current?

YES >> • Replace the compressor bypass valve. Refer to EM-423, "Removal and Installation".
• GO TO 8.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 8.

5. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the ECM engine side connector F101.
3. Inspect the connector for the following:
- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> • Repair or replace error-detected parts.
• GO TO 8.

6. CHECK THE ECM RESPONSE

CAUTION:

Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
- **Not to bend and damage pins and terminals.**
- **Not to probe or short unintended circuits and potentially damaging the control unit.**

1. Connect a jumper wire between ECM connector F101 pins 137 and 139.
2. Turn ignition switch ON.
3. Wait for 30 seconds.
4. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P22CB become current and DTC P22CC become past?

YES >> GO TO 7.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 8.

7. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Wait 30 seconds.
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P22CC become current?

YES >> • Repair or replace the engine harness for open.
• GO TO 8.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 8.

8. ERASE CURRENT DTCS

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for Clearing DTC".
3. Using CONSULT check for current ENGINE diagnostic trouble codes.

Is P22CC DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1823, "DTC Description".
NO >> Repair complete.

P22CD TC OUTLET SWITCHING VALVE STUCK OPEN

DTC Description

INFOID:0000000014420671

NOTE:

1. If any of the following "current" or "past" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- P0237 present. Refer to EC-1143, "DTC Description".
- P0238 present. Refer to EC-1147, "DTC Description".
- P1191 present. Refer to EC-1559, "DTC Description".
- P1192 present. Refer to EC-1562, "DTC Description".
- P1193 present. Refer to EC-1565, "DTC Description".
- P22CB present. Refer to EC-1820, "DTC Description".
- P22CC present. Refer to EC-1823, "DTC Description".

2. If there are any additional "current" turbocharger related DTCs displayed with this DTC, first perform the diagnosis procedure for the turbocharger related DTC.

The compressor bypass solenoid allows the vacuum produced by the belt driven vacuum pump to pass through to compressor bypass actuator when the ECM applies a pulse width modulation (PWM) duty cycle to the compressor bypass solenoid. The ECM commands a duty cycle of 100% to the compressor bypass solenoid when the engine speed and load is such that is required for the compressor bypass valve to open. This allows vacuum to pass through to actuate compressor bypass valve.

DTC DETECTION LOGIC

Detects when the air flow fails to pass through the compressor when the compressor bypass valve commanded position is "default" or "closed".

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P22CD	Compressor bypass valve	Diagnosis condition	This diagnostic runs when the ignition switch is ON or when the engine is running.
		Signal (terminal)	Compressor bypass valve
		Threshold	Maximum pressure ratio observed across the high pressure compressor after the enable conditions are true for 500 msec is < 1.1 (ratio).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning compressor bypass valve
- Malfunctioning compressor bypass solenoid

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:

- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1827, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420672

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check If any of the following DTCs are ″current″ or ″past″:

- P0237
- P0238
- P1191
- P1192
- P1193
- P22CB
- P22CC

Is applicable DTC current or past?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR TURBOCHARGER RELATED DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for ″current″″

Any applicable DTC current or past?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.VERIFY VACUUM PUMP OUTPUT

1. Start the engine.
2. Connect a hand pump or a vacuum gauge to the vacuum pump inlet.
3. Verify the vacuum pump output is sufficient:

Minimum required vacuum	
mm	inch
40	5.8

Is the vacuum supply sufficient?

YES >> GO TO 4.
NO >> • Refer to EM-486, "Removal and Installation".
• GO TO 6.

4.VERIFY THE COMPRESSOR BYPASS VALVE ACTUATOR

1. Stop the engine.
2. Turn ignition switch ON.
3. Using CONSULT, monitor the compressor bypass valve actuator.
4. Use a hand pump to provide vacuum to the compressor bypass valve actuator.
5. Verify that the compressor bypass valve moves to both linkage stops.

Compressor bypass valve linkage moves from stop to stop?

YES >> GO TO 5.
NO >> • Refer to EM-423, "Removal and Installation".
• GO TO 6.

5.VERIFY LOW PRESSURE TURBOCHARGER BOOST PRESSURE SENSOR ACCURACY

1. Verify the low-pressure turbocharger boost speed sensor.
2. Using CONSULT, monitor and log the following:

- Engine speed.
- Low-pressure turbocharger boost pressure.
- Charge-air cooler outlet pressure.
- Compressor bypass valve.

3. Start the engine.
4. Override compressor bypass valve to OPEN.

5. Use the accelerator pedal to raise the engine speed to 2,000 rpm and hold for 20 seconds.
6. Return the engine speed to idle.
7. Repeat above steps with compressor bypass valve override set to CLOSED.
8. Compare low-pressure turbocharger boost pressure values at 2,000 rpm with valve OPEN vs. CLOSED.

From open to closed valve, turbocharger boost pressure increased by 5 kPa (0.73 psi) or more at 2,000 RPM?

YES >> GO TO 6.
NO >> • Replace the low-pressure turbocharger boost pressure sensor. Refer to EM-253, "Removal and Installation".
• GO TO 6.

6. ERASE CURRENT DTC

1. Stop the engine.
2. Connect all components.
3. Turn ignition switch ON
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes
5. Operate the engine within the "Conditions for setting the DTC"
6. Using CONSULT, check for “ENGINE” diagnostic trouble codes

Is P22CD DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1826, "DTC Description".
NO >> Repair complete.

P22CE TC OUTLET SWITCHING VALVE STUCK CLOSED

DTC Description

INFOID:0000000014420673

NOTE:

1. If any of the following "current" or "past" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- P007B present. Refer to EC-988, "DTC Description".
- P0107 present. Refer to EC-1036, "DTC Description".
- P0108 present. Refer to EC-1040, "DTC Description".
- P0237 present. Refer to EC-1143, "DTC Description".
- P0238 present. Refer to EC-1147, "DTC Description".
- P1191 present. Refer to EC-1559, "DTC Description".
- P1192 present. Refer to EC-1562, "DTC Description".
- P1193 present. Refer to EC-1565, "DTC Description".

2. If there are any additional "current" turbocharger related DTCs displayed with this DTC, first perform the diagnosis procedure for the turbocharger related DTC.

The compressor bypass solenoid allows the vacuum produced by the belt driven vacuum pump to pass through to compressor bypass actuator when the ECM applies a Pulse Width Modulation (PWM) duty cycle to the compressor bypass solenoid. The ECM commands a duty cycle of 100% to the compressor bypass solenoid when the engine speed and load is such that is required for the compressor bypass valve to open. This allows vacuum to pass through to actuate compressor bypass valve.

DTC DETECTION LOGIC

Detects when the air flow fails to pass through the compressor when the compressor bypass valve commanded position is "default" or "closed".

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P22CE	TURBO COMP INLET PRESS TURBO COMP INLET PRESS V	Diagnosis condition	This diagnostic runs when the ignition switch is ON or when the engine is running.
		Signal (terminal)	Compressor bypass valve
		Threshold	Maximum pressure ratio observed across the high pressure compressor after the enable conditions are true for 500 msec is 0.85 (ratio) ≥ value ≥ 1.3 (ratio).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning compressor bypass valve
- Malfunctioning compressor bypass solenoid

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Check 1st trip DTC.

Is P22CE DTC detected?

YES >> Proceed to EC-1830, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420674

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check if any of the following DTCs are ″current″ or ″past″:

- P007B
- P0107
- P0108
- P0237
- P0238
- P1191
- P1192
- P1193

Is applicable DTC current or past?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR TURBOCHARGER RELATED DTC

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for ″current″ DTCs related to turbocharger.

Is any applicable current DTC?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.VERIFY THE BAROMETRIC PRESSURE SENSOR ACCURACY

1. Using CONSULT, access “ENGINE” and check ″TURBO COMP INLET PRESS″ under ″Data Monitor″.
2. Compare turbocharger compressor intake pressure to the local barometric pressure.

Is measured reading within ± 2 kPa (0.3 psi) of local barometric pressure reading?

YES >> GO TO 4.
NO >> • Replace the turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".
• GO TO 18.

4.VERIFY VACUUM PUMP OUTPUT

1. Start the engine.
2. Connect a hand pump or a vacuum gauge to the vacuum pump inlet.
3. Verify the vacuum pump output is sufficient:

Minimum required vacuum	
mm	inch
40	5.8

Is the vacuum supply sufficient?

YES >> GO TO 5.
NO >> • Replace the vacuum pump. Refer to EM-486, "Removal and Installation".
• GO TO 18.

5.VERIFY THE COMPRESSOR BYPASS VALVE ACTUATOR

1. Stop the engine.
2. Turn ignition switch ON.
3. Using CONSULT, monitor the compressor bypass valve actuator.
4. Use a hand pump to provide vacuum to the compressor bypass valve actuator.
5. Verify that the compressor bypass valve moves to both linkage stops.

Does the compressor bypass valve linkage move from stop to stop?

YES >> GO TO 6.

NO >> • Remove the obstruction or replace the compressor bypass valve. Refer to EM-423, "Removal and Installation".
• GO TO 18.

6. VERIFY CHARGE-AIR COOLER OUTLET PRESSURE DURING ENGINE OPERATION

1. Verify the charge-air cooler outlet pressure.
2. Using CONSULT, monitor and log the following:
- Engine speed
- Charge-air cooler outlet pressure
- Compressor bypass valve
3. Start the engine
4. Override compressor bypass valve to OPEN.
5. Use the accelerator pedal to raise the engine speed to 2,000 rpm and hold for 20 seconds.
6. Return the engine speed to idle.
7. Repeat above steps with compressor bypass valve override set to CLOSED.
8. Compare charge-air cooler outlet pressure values at 2,000 rpm with valve OPEN vs. CLOSED.

Charge-air cooler outlet pressure increased by 50 kPa (7.25 psi) or more at 2,000 RPM?

YES >> GO TO 7.
NO >> GO TO 9.

7. VERIFY THE TURBOCHARGER SPEED SENSOR ACCURACY

1. Verify the turbocharger speed sensor.
2. Using CONSULT, monitor and log the following:
- Engine speed.
- Turbocharger speed.
- Compressor bypass valve.
3. Start the engine.
4. Override compressor bypass valve to OPEN.
5. Use the accelerator pedal to raise the engine speed to 2,000 rpm and hold for 20 seconds.
6. Return the engine speed to idle.
7. Repeat above steps with compressor bypass valve override set to CLOSED.
8. Compare turbocharger speed at 2,000 rpm with valve OPEN vs. CLOSED.

Turbocharger speed increased from less than 130,000 rpm to between 140,000 and 160,000 rpm?

YES >> GO TO 8.
NO >> • Replace the malfunctioning turbocharger speed sensor. Refer to EM-407, "Removal and Installation".
• GO TO 18.

8. VERIFY LOW PRESSURE TURBOCHARGER BOOST PRESSURE SENSOR ACCURACY

1. Verify the low-pressure turbocharger boost speed sensor.
2. Using CONSULT, monitor and log the following:
- Engine speed.
- Low-pressure turbocharger boost pressure.
- Charge-air cooler outlet pressure.
- Compressor bypass valve.
3. Start the engine.
4. Override compressor bypass valve to OPEN.
5. Use the accelerator pedal to raise the engine speed to 2,000 rpm and hold for 20 seconds.
6. Return the engine speed to idle.
7. Repeat above steps with compressor bypass valve override set to CLOSED.
8. Compare low-pressure turbocharger boost pressure values at 2,000 rpm with valve OPEN vs. CLOSED.

From open to closed valve, does turbocharger boost pressure increased by 5 kPa (0.73 psi) or more at 2,000 RPM?

YES >> GO TO 9.
NO >> • Replace the Low-Pressure Turbocharger Boost Pressure Sensor. Refer to EM-253, "Removal and Installation".
• GO TO 18.

9. INSPECT THE ENGINE CHARGE-AIR COOLER OUTLET PRESSURE/TEMPERATURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the engine charge-air cooler outlet pressure/temperature sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair or replace error-detected parts.
• GO TO 18.

10. VERIFY THE CHARGE-AIR COOLER OUTLET PRESSURE SENSOR ACCURACY AT KEY ON

1. Reconnect the charge-air cooler outlet pressure/temperature sensor.
2. Verify the charge-air cooler outlet pressure sensor accuracy.
3. Turn ignition switch ON.
4. Using CONSULT, select “ENGINE” and read the “Data Monitor” of the charge-air cooler outlet pressure.

Using CONSULT is charge-air cooler outlet pressure 0±10.3 kPa (0±1.5 psi)?

YES >> GO TO 16.
NO >> GO TO 11.

11. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the engine charge-air cooler outlet pressure/temperature sensor.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P0107 DTC current?

YES >> GO TO 12.
NO >> GO TO 13.

12. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between the engine charge air cooler outlet pressure/temperature sensor connector F140 pressure signal circuit terminal 1 and power circuit terminal 2.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P0108 DTC current?

YES >> • Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
• GO TO 18.
NO >> GO TO 13.

13. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.

- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 14.
NO >> • Repair or replace error-detected parts.
• GO TO 18.

14. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P0107 DTC current?

YES >> GO TO 15.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 18.

15. CHECK THE CIRCUIT RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Turn ignition switch OFF.
2. Connect a jumper wire between ECM connector F101 pins 1 and 2.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P0108 DTC current?

YES >> • Repair or replace the engine harness for high resistance or short circuit.
• GO TO 18.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 18.

16. CHECK THE AIR INTAKE FOR LEAKS

1. Remove the jumper wire.
2. Connect all harness connectors.
3. Start the engine.
4. Check for air leaks in connections and hoses between the turbocharger outlet and charge-air cooler inlet.

Is air leak present?

YES >> • Repair or replace the leaking component.
• GO TO 18.
NO >> GO TO 17.

17. CHECK THE INTAKE AND EXHAUST FOR RESTRICTIONS

Inspect the intake and the exhaust system for restrictions.

Is exhaust or intake restriction found?

YES >> • Repair or replace the restricted component.
• GO TO 18.
NO >> • An in-range malfunction of the charge-air cooler outlet pressure/temperature sensor has been detected. Replace the engine charge air cooler outlet pressure/temperature sensor. Refer to EM-233, "Removal and Installation".
• GO TO 18.

18. ERASE CURRENT DTCS

1. Turn ignition switch ON (engine OFF).
2. Using CONSULT, erase ENGINE diagnostic trouble codes.

3. Operate the engine within the "Conditions for Clearing DTC".
4. Using CONSULT check for current ENGINE diagnostic trouble codes.

Is P22CE DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1830, "Diagnosis Procedure".
NO >> Repair complete.

P2413 EGR SYSTEM

DTC Description

INFOID:0000000014420675

NOTE:
If any other "current" DTC is displayed with this DTC, first perform the trouble diagnosis for all other DTCs.

The Exhaust Gas Recirculation (EGR) temperature sensor is a variable resistor sensor and is used to measure the temperature of the EGR gas flow after it exits the EGR cooler. The engine control module (ECM) supplies 5V to the EGR temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the EGR flow temperature.

DTC DETECTION LOGIC

EGR Orifice Temperature above normal engine operating range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2413	EGR ORIFICE TEMP	Diagnosis condition	This diagnostic runs when the ignition switch is ON or the engine is running.
		Signal (terminal)	EGR temperature sensor signal
		Threshold	The Engine Control Module (ECM) detected the EGR temperature was greater than 250°C (482°F) for more than 5 seconds.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning EGR valve
- Low reading for the EGR valve position sensor
- High exhaust temperature
- Low coolant level
- High coolant temperature
- Incorrect coolant/water mixture
- Fouled EGR cooler

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1835, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420676

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for other current DTCs on the CONSULT screen.

Are there any other current DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK THE EGR TEMPERATURE SENSOR ACCURACY

1. Turn ignition switch OFF.
2. Remove the EGR temperature sensor from the EGR plumbing.
3. Turn ignition switch ON.
4. Using CONSULT, select ”ENGINE” and check “Data Monitor” of “EGR ORIFICE TEMP”.
5. Compare the EGR temperature sensor reading to ambient air temperature.

NOTE:
Allow the EGR temperature sensor enough time to cool down to ambient temperature before comparing the reading.

Is EGR temperature within 10°C (18°F) of ambient air temperature?

YES >> GO TO 3.
NO >>
- Malfunctioning EGR temperature sensor has been detected. Replace the EGR temperature sensor. Refer to EM-236, "Removal and Installation".
- GO TO 6.

3. CHECK THE ENGINE COOLANT MIXTURE

1. Turn ignition switch OFF.
2. Check the engine coolant mixture.
3. Check the freeze point of the engine coolant to be sure of a proper mixture.

NOTE:
Incorrect coolant mixture will cause high EGR temperatures due to inefficient cooling.

Engine coolant is proper mixture?

YES >> GO TO 4.
NO >>
- Drain the coolant and fill the cooling system with the proper mixture. Refer to CO-47, "Changing Engine Coolant".
- GO TO 6.

4. CHECK THE ENGINE COOLANT LEVEL

Check for proper engine coolant level.

NOTE:
Low engine coolant level can cause erratic coolant flow through the engine and EGR cooler, in turn, causing the EGR temperatures to rise.

Is engine coolant level is at proper level?

YES >> GO TO 5.
NO >>
- Replenish the cooling system and troubleshoot for loss of coolant, if necessary.
- GO TO 6.

5. CHECK THE EGR COOLER FOR LEAKS OR FOULING

1. Remove the EGR cooler.
2. Inspect and pressure test the EGR cooler.

Is EGR cooler pressure check within specification?

YES >>
- Clean the EGR cooler.
- GO TO 6.

NO >>
- Replace the EGR cooler. Refer to EM-276, "Removal and Installation".
- GO TO 6.

6. ERASE CURRENT DTC

1. Connect all harness components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2413 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1835, "DTC Description".

NO >> Repair complete.

P242B EGT SENSOR 3

DTC Description

INFOID:0000000014420677

NOTE:

1. If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- U1611 present. Refer to EC-967, "DTC Description".
- P1614 present. Refer to EC-1575, "DTC Description".
- P1615 present. Refer to EC-1578, "DTC Description".
- P1616 present. Refer to EC-1581, "DTC Description".
- P1623 present. Refer to EC-1583, "DTC Description".

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment DPF outlet gas temperature is in-range but not rational.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P242B	DOC INLET TEMP DPF INLET TEMP DPF OUTLET TEMP	Diagnosis condition	This diagnostic runs when the ignition is ON and the engine is running.
		Signal (terminal)	DOC and DPF temperature sensor signals.
		Threshold	-85°C (-121°F) < Average temperature drop across PDF<°C (185°F).
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning DPF intake temperature sensor.
- A malfunctioning DPF outlet temperature sensor.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Check 1st trip DTC.

Is P242B DTC detected?

YES >> Proceed to EC-1838, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420678

1.CHECK FOR PRIORITY DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other ENGINE diagnostic trouble codes.
3. Check If any of the following DTCs are "current":

- U1611

- P1614
- P1615
- P1616
- P1623

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> • A malfunctioning aftertreatment Diesel Particulate Filter (DPF) temperature sensor module has been detected. Replace the aftertreatment DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
• GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P242B DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1838, "DTC Description".
NO >> Repair complete.

P242C EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW 1/3

DTC Description

INFOID:0000000014420679

NOTE:

1. If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- U1611 present. Refer to EC-967, "DTC Description".
- P1614 present. Refer to EC-1575, "DTC Description".
- P1615 present. Refer to EC-1578, "DTC Description".
- P1616 present. Refer to EC-1581, "DTC Description".
- P1623 present. Refer to EC-1583, "DTC Description".

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The Smart Exhaust Gas Temperature Module has detected a sensor short to ground that causes too low of an input voltage condition in the outlet DPF thermocouple sensor circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P242C	DPF OUTLET TEMP	Diagnosis condition	This diagnostic runs when the ignition is ON and the engine is running.
		Signal (terminal)	DPF outlet temperature sensor signal
		Threshold	Aftertreatment outlet DPF gas temperature sensor input voltage ≤ 1 V [-40°C (-40°F)]
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning DPF outlet temperature sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P242C being current on the CONSULT screen.

Is P242C DTC current?

YES >> Go to EC-1841, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420680

1.CHECK FOR PRIORITY DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other “ENGINE” diagnostic trouble codes.
3. Check If any of the following DTCs are ″current″:

- U1611
- P1614
- P1615
- P1616
- P1623

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".

NO >>
- A malfunctioning aftertreatment Diesel Particulate Filter (DPF) temperature sensor module has been detected. Replace the aftertreatment DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
- GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P242C DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1840, "DTC Description".

NO >> Repair complete.

P242D EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH 1/3

DTC Description

INFOID:0000000014420681

NOTE:

1. If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:

- U1611 present. Refer to EC-967, "DTC Description".
- P1614 present. Refer to EC-1575, "DTC Description".
- P1615 present. Refer to EC-1578, "DTC Description".
- P1616 present. Refer to EC-1581, "DTC Description".
- P1623 present. Refer to EC-1583, "DTC Description".

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The smart exhaust gas temperature module has detected a sensor short to ground that causes too low of an input voltage condition in the outlet DPF thermocouple sensor circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P242D	DPF OUTLET TEMP	Diagnosis condition	This diagnostic runs when the ignition is ON and the engine is running.
		Signal (terminal)	DPF outlet temperature sensor signal
		Threshold	The aftertreatment temperature sensor module has detected a sensor short to battery or open circuit condition that causes a high input voltage.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning DPF outlet temperature sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P242D being current on the CONSULT screen.

Is P242D DTC current?

YES >> Go to EC-1843, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420682

1.CHECK FOR PRIORITY DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for other “ENGINE” diagnostic trouble codes.
3. Check If any of the following DTCs are ″current″:

- U1611
- P1614
- P1615
- P1616
- P1623

Is applicable DTC detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".

NO >>
- A malfunctioning aftertreatment Diesel Particulate Filter (DPF) temperature sensor module has been detected. Replace the aftertreatment DPF temperature sensor module. Refer to EX-52, "Removal and Installation".
- GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P242D DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1842, "DTC Description".

NO >> Repair complete.

P242F DIESEL PARTICULATE FILTER

DTC Description

INFOID:0000000014420683

The engine aftertreatment system monitors the soot load in the aftertreatment diesel particulate filter. Under normal operating conditions, the aftertreatment diesel particulate filter is self cleaning, where soot is converted to carbon dioxide, nitrogen, and water. Under light load operating conditions, it can be necessary to perform a stationary regeneration of the aftertreatment diesel particulate filter. The soot load in the aftertreatment diesel particulate filter is estimated, using the aftertreatment differential pressure sensor and the calculated soot output of the engine.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the soot load of the aftertreatment diesel particulate filter had exceeded the maximum operating limits.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P242F	(Aftertreatment Diesel Particulate Filter Differential Pressure - Data Valid But Above Normal Operating Range - Most Severe Level)	Diagnosis condition	Engine is running.
		Signal (terminal)	—
		Threshold	Soot load estimate > 10 g/L
		Diagnosis delay time	Diagnostic runs continuously when the engine is running.

POSSIBLE CAUSE

- Harness or connector.
- Engine has been operating in a light load condition that prevents exhaust temperatures from being high enough to actively regenerate the aftertreatment diesel particulate filter.
- Base engine malfunction that causes excessive black soot to be generated.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine.
2. Using CONSULT perform Aftertreatment Diesel Particulate Filter Regeneration Test.
3. Check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P242F being current on the CONSULT screen.

Is DTC P242F current?

YES >> Go to EC-1024, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420684

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

Is DTC P242F current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2459 or P242A being current on the CONSULT screen.

Is applicable DTC detected as current?

YES >> Refer to EC-838, "DTC Index".

NO >> GO TO 3.

3. CHECK THE AFTERTREATMENT DUTY CYCLE

1. Turn ignition switch ON.
2. Using CONSULT, monitor “DEF PUMP DUTY CYCLE” in “Data Monitor” of “ENGINE”.
3. Determine if the duty cycle of the application needs to change in order to increase the temperature of the exhaust gases entering the aftertreatment system.

Duty cycle of the application needs to be increased?

YES >> Change the duty cycle of the application to increase the temperature of the exhaust gases entering the aftertreatment system.
NO >> GO TO 4.

4. PERFORM AFTERTREATMENT DPF PROCEDURE

1. Turn ignition switch ON.
2. Using CONSULT, perform “AFT maintenance” in “” of “ENGINE”.
   NOTE:
   After clicking the reset button, it can take several minutes for DTC P242F to go past and DTC P2463 to go current.

NOTE:
- DTC P242F must be current before the aftertreatment maintenance reset procedure can be performed.
- DTC P242F will go past and DTC P2463 will become current after completing this procedure.

Aftertreatment maintenance reset procedure completed?

YES >> GO TO 5.
NO >> GO TO 4.

5. PERFORM STATIONARY REGENERATION PROCEDURE

1. Turn ignition switch ON.
2. Start and idle engine.
3. Using CONSULT, perform “DPF Regeneration” in “Active Test” of “ENGINE”.

NOTE:
- If stationary regeneration will not activate, see Stationary Regeneration - Will Not Activate troubleshooting.
- DTC P1451 will become current during the regeneration procedure. This is normal operation as the soot is removed from the aftertreatment DPF.

Is DTC P242F current after stationary regeneration completed?

YES >> GO TO 6.
NO >> GO TO 7.

6. INSPECT AFTERTREATMENT DPF

Inspect the aftertreatment DPF.

NOTE:
If the aftertreatment DPF required replacement for excessive ash and had not reached the normal ash cleaning interval, further troubleshooting is required. Check for lubricating oil consumption, coolant consumption, or previous repairs that may have corrected an issue resulting in lubricating oil or coolant consumption

Aftertreatment DPF meet reuse guidelines?

YES >> Clean the aftertreatment DPF.
NO >> Replace the aftertreatment DPF. Refer to EX-41, "Exploded View".

7. INPECT EXHAUST FOR EXCESSIVE BLACK SMOKE

1. Disconnect exhaust pipe from aftertreatment inlet.
2. Start the engine.
3. Perform the Snap Acceleration - Aftertreatment Disconnected procedure to check for excessive black smoke.

Is the inspection result normal?

YES >> Inspection End.
NO >> Refer to appropriate engine performance symptom table.

P244A DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE

DTC Description

INFOID:0000000014420685

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U1611 present. Refer to EC-967, "DTC Description".
- P0544 present. Refer to EC-1378, "DTC Description".
- P0545 present. Refer to EC-1380, "DTC Description".
- P0546 present. Refer to EC-1381, "DTC Description".
- P1613 present. Refer to EC-1573, "DTC Description".
- P1614 present. Refer to EC-1575, "DTC Description".
- P1615 present. Refer to EC-1578, "DTC Description".
- P1616 present. Refer to EC-1581, "DTC Description".
- P1623 present. Refer to EC-1583, "DTC Description".
- P2031 present. Refer to EC-1628, "DTC Description".
- P2032 present. Refer to EC-1630, "DTC Description".
- P2033 present. Refer to EC-1583, "DTC Description".

The engine aftertreatment system monitors the soot load in the aftertreatment diesel particulate filter. Under normal operating conditions, the aftertreatment diesel particulate filter is self cleaning, where soot is converted to carbon dioxide, nitrogen, and water. Under light load operating conditions, it can be necessary to perform a stationary regeneration of the aftertreatment diesel particulate filter. The soot load in the aftertreatment diesel particulate filter is estimated, using the aftertreatment differential pressure sensor and the calculated soot output of the engine.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor key OFF check indicates signal in-range but not rational.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P244A	DPF OUTLET PRESS DPF DELTA PRESS DPF SOOT LOAD	Diagnosis condition	This diagnostic runs when the engine is running and exhaust flow is above a minimum level.
		Signal (terminal)	DPF pressure sensor signals
		Threshold	Absolute value of averaged DPF delta pressure measured by the delta P sensor > 1.5 kPa (gauge)
		Diagnosis delay time	—

POSSIBLE CAUSE

- The DPF has been removed from the vehicle.
- The DPF is cracked or broken.
- The DPF differential tubes are installed incorrectly, broken, loose, or have been tampered with.
- The DPF differential tubes are installed backward.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1847, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420686

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check If any of the following DTCs are ″current″:

- U1611
- P0544
- P0545
- P0546
- P1613
- P1614
- P1615
- P1616
- P1623
- P2031
- P2032
- P2033

Is applicable DTC current?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR THE PRESENCE OF DOC

1. Turn ignition switch OFF.
2. Check for the presence of the DOC/DPF assembly.

Is DOC/DPF assembly present?

YES >> GO TO 3.
NO >> • Properly install the DOC/DPF assembly.
• GO TO 3.

3.ERASE CURRENT DTC

1. Turn ignition switch ON.
2. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
3. Operate the engine within the "Conditions for setting the DTC".
4. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P244A DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1846, "DTC Description".
NO >> Repair complete.

P244D EXHAUST TEMPERATURE TOO HIGH FOR PF REGENERATION

DTC Description

INFOID:0000000014420687

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U1611 present. Refer to EC-967, "DTC Description".
- P1613 present. Refer to EC-1573, "DTC Description".
- P1614 present. Refer to EC-1575, "DTC Description".
- P1623 present. Refer to EC-1583, "DTC Description".

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN2 communication. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Persistent temperature overshoots the aftertreatment DPF outlet gas temperature during active regeneration of the DPF.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P244D	DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	This diagnostic runs continuously when the ignition switch is in the ON position and the engine is running.
		Signal (terminal)	SCR outlet temperature sensor signal
		Threshold	The DPF outlet temperature sensor was greater than 650°C (1202°F) for 5 seconds on five separate occasions.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Excessive engine oil or diesel fuel being introduced into the exhaust system from the engine
- A damaged fuel injector causing unburned diesel fuel to enter the exhaust system
- A face plugged aftertreatment diesel oxidation catalyst

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Start the engine and let it idle.
2. Connect CONSULT, select "ENGINE" and perform the "DPF Regeneration" in the "Active Test" menu.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current "ENGINE" diagnostic trouble codes.
4. Check for DTC P244D being current on the CONSULT screen.

Is P244D DTC current?

YES >> Go to EC-1849, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420688

1. CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current ENGINE diagnostic trouble codes:

- U1611
- P1613
- P1614
- P1623

Are any of the above DTCs current?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR INJECTOR MISFIRE

1. Start the engine and run it at low idle.
2. Determine if a cylinder misfire is noticed when the engine is running at low idle.
3. Using CONSULT, select “ENGINE” and perform the ″Cylinder Cutout Test″ Active Test to check for a cylinder misfire.

Was an engine misfire detected?

YES >>
- Replace malfunctioning injector if necessary. Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
- Inspect the aftertreatment system for possible damage, and repair if necessary.
- GO TO 5.

NO >> GO TO 3.

3. INSPECT TURBOCHARGER EXHAUST OUTLET FOR OIL OR FUEL

1. Turn ignition switch OFF.
2. Remove the exhaust plumbing from the turbocharger outlet.
3. Look for signs of moisture in the turbocharger exhaust outlet.
4. Inspect the turbocharger exhaust outlet for signs of oil or fuel being introduced into the aftertreatment system from the engine.

Was engine oil or fuel contamination found in the turbocharger exhaust outlet?

YES >>
- Locate the cause of possible diesel fuel or engine oil being carried from the engine into the aftertreatment system and repair or replace any components that caused the engine oil or diesel fuel contamination. Inspect the aftertreatment system for possible damage.
- GO TO 5.

NO >> GO TO 4.

4. CHECK AFTERTREATMENT DIESEL OXIDATION CATALYST FOR SOOT ACCUMULATION

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Are more than 50% of the cells on the intake face completely blocked by soot?

YES >>
- Replace the DOC and DPF assembly. Refer to EX-36, "Removal and Installation".
- GO TO 5.

NO >> GO TO 5.

5. ERASE DTC

1. Connect all components.
2. With CONSULT, erase all DTCs.
3. Operate the engine within the conditions for setting DTC.
4. Check for current ENGINE diagnostic trouble codes.

Did the P244D DTC return?

YES >> Troubleshooting procedure needs to be repeated. Go to EC-1848, "DTC Description".
NO >> Repair complete.

P2453 PARTICULATE FILTER PRESSURE SENSOR A RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420689

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P2454 present. Refer to EC-1854, "DTC Description".
- P2455 present. Refer to EC-1858, "DTC Description".

The engine control module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter outlet pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter outlet pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter outlet pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the outlet of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF outlet pressure sensor signal stuck in-range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2453	DPF OUTLET PRESS	Diagnosis condition	• Part 1: Runs 1 minute after key OFF, and DPF temperature sensors are still > 200°C (392°F). • Part 2: Runs when the engine is operating.
		Signal (terminal)	DPF outlet pressure sensor
		Threshold	Range of DPF outlet pressure since last decision in current key cycle until the enable conditions are met < 0.1 kPa
		Diagnosis delay time	—

POSSIBLE CAUSE

- Stuck in-range aftertreatment diesel particulate filter outlet pressure sensor reading
- High resistance in the aftertreatment diesel particulate filter outlet pressure sensor signal or return wires
- Higher than expected diesel particulate filter outlet pressure
- Excessive diesel exhaust fluid (DEF) deposits in the aftertreatment decomposition tube.
- Plugged outlet pressure sensor ports could cause this DTCs if pressure is held in the port after the engine is turned OFF.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1851, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420690

1. CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- P2454
- P2455

Are any of the above DTCs detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR TUBES FOR BLOCKAGE

1. Turn ignition switch OFF.
2. Disconnect the aftertreatment DPF differential pressure sensor tubes.
3. Inspect the aftertreatment DPF differential pressure sensor tubes for blockage.

Differential pressure sensor tubes blocked?

YES >> • Repair or replace the aftertreatment DPF differential pressure sensor tubes.
• GO TO 14.
NO >> GO TO 3.

3. MONITOR THE DPF OUTLET PRESSURE SENSOR WITH CONSULT

1. Connect all components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, select ENGINE and check Data Monitor of the DPF outlet pressure sensor.

NOTE:
An exhaust ventilation system connected to the exhaust can cause the outlet pressure sensor to read incorrectly. Be sure to remove any ventilation or vacuum equipment from the exhaust before reading the outlet pressure sensor value.

Does DPF outlet pressure sensor read 0± 3 kPa?

YES >> GO TO 4.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 14.

4. CHECK THE DEPOSITS IN THE DECOMPOSITION TUBE

1. Turn ignition switch OFF.
2. Remove the aftertreatment decomposition tube from the vehicle.
3. Inspect the tube for excessive DEF deposits.

Are excessive DEF deposits found inside the decomposition tube?

YES >> • Clean and install the decomposition tube.
• GO TO 14.
NO >> GO TO 5.

5. INSPECT THE DPF OUTLET PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF outlet pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> • Repair or replace error-detected parts.
• GO TO 14.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

NOTE:
DTC P2460 will also be current.

Is P2454 DTC current?

YES >> GO TO 7.
NO >> GO TO 8.

7.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Connect a jumper wire between the DPF differential pressure sensor connector C28 power terminal 4 and signal terminal 2.
4. Turn ignition switch ON.
5. Wait 30 seconds.

NOTE:
DTC P2460 will also be current.

Is P2455 DTC current?

YES >> GO TO 13.
NO >> GO TO 8.

8.INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair or replace error-detected parts.
• GO TO 14.

9.CHECK THE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	7	C28	2	Yes

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair open circuit in harness or connectors.
• GO TO 14.

10. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DPF differential pressure sensor signal circuit and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	7	—	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair or replace harness for a short to ground.
• GO TO 14.

11. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 12.
NO >> • Repair short circuit in harness or connectors.
• GO TO 14.

12. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR VOLTAGE VALUE

1. Connect all harness connectors.
2. Start the engine.
3. Using CONSULT, select “ENGINE” and check “Data Monitor” of the ″DPF OUTLET PRESS SENS V″.
4. Perform a “Snap Acceleration Test” while looking for a change in voltage value.

Did the value changed?

YES >> GO TO 13.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 14.

13. CHECK EXHAUST SYSTEM FOR RESTRICTIONS

Inspect the exhaust system for restrictions.

Is exhaust restriction found?

YES >> • Repair or replace the restricted component.
• GO TO 14.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 14.

14. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2453 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1850, "DTC Description".
NO >> Repair complete.

P2454 DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR

DTC Description

INFOID:0000000014420691

NOTE:
If the following "current" DTC is displayed with this DTC, first perform the trouble diagnosis for this other DTC:
• P06D3 present. Refer to EC-1541, "DTC Description".

The engine control module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter differential pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter differential pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter differential pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the differential of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor reading less than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2454	DPF OUTLET PRESS	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	DPF differential pressure sensor
		Threshold	Aftertreatment DPF differential pressure sensor value < 0.25 V (-6.245 kPa)
		Diagnosis delay time	—

POSSIBLE CAUSE

• Signal circuit open or shorted to ground in the engine harness or sensor
• Supply wire open or shorted to ground

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2454 being current on the CONSULT screen.

Is P2454 DTC current?

YES >> Go to EC-1854, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420692

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P06D3 is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Refer to EC-1541, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT SENSOR DTC

Check for DTC P2454 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

4.CHECK THE PRESSURE SENSOR POWER SUPPLY AND GROUND CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DPF differential pressure sensor supply voltage and return circuit terminals.

DPF differential pressure sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C28	4	1	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between DPF differential pressure sensor connector C28 power supply terminal 4 and signal circuit terminal 2.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P2455 become current?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the DPF differential pressure sensor.
4. Turn ignition switch ON and wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did P2454 DTC become current?

YES >> • A damaged sensor has been detected. Replace the aftertreatment diesel particulate filter differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 13.

NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.

NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE SENSOR POWER CIRCUIT FOR OPEN

Check the power circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	32	C28	4	Yes

Is the inspection result normal?

YES >> GO TO 9.

NO >> • Repair open circuit in harness or connectors.
• GO TO 13.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	7	C28	2	Yes

Is the inspection result normal?

YES >> GO TO 10.

NO >> • Repair open circuit in harness or connectors.
• GO TO 13.

10. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair short circuit in harness or connectors.
• GO TO 13.

11. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DPF differential pressure sensor signal circuit and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	7	—	No

Is the inspection result normal?

YES >> GO TO 12.
NO >> • Repair or replace harness for a short to ground.
• GO TO 13.

12. CHECK FOR PAST DTCS

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P2454 DTC past?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 13.
NO >> Return to Diagnosis Procedure. Refer to EC-1854, "DTC Description".

13. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2454 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1854, "DTC Description".
NO >> Repair complete.

P2455 DIESEL PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR

DTC Description

INFOID:0000000014420693

NOTE:
If the following "current" DTC is displayed with this DTC, first perform the trouble diagnosis for this other DTC:
• P06D4 present. Refer to EC-1544, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter differential pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter differential pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter differential pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the outlet of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor reading is greater than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2455	DPF OUTLET PRESS	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	DPF differential pressure sensor
		Threshold	Aftertreatment DPF differential pressure sensor value > 4.75 V (36.733 kPa)
		Diagnosis delay time	—

POSSIBLE CAUSE

• Sensor ground circuit open in the engine harness or sensor
• Sensor signal circuit shorted to power circuit or battery supply

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2455 being current on the CONSULT screen.

Is P2455 DTC current?

YES >> Go to EC-1858, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420694

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If DTC P06D4 is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Refer to EC-1544, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT SENSOR DTC

Check for DTC P2455 current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P2454 become current?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE PRESSURE SENSOR POWER SUPPLY AND GROUND CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DPF differential pressure sensor supply voltage and return circuit terminals.

DPF differential pressure sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C28	4	1	5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Reconnect the DPF differential pressure sensor.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2455 DTC current?

YES >> • A damaged sensor has been detected. Replace the aftertreatment diesel particulate filter differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 12.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 12.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

8. CHECK THE SENSOR GROUND CIRCUIT FOR OPEN

Check the sensor ground circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	15	C28	1	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 12.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair short circuit in harness or connectors.
• GO TO 12.

10. CHECK THE SENSOR POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor power and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	32	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair short circuit in harness or connectors.
• GO TO 12.

11. CHECK FOR PAST DTCS

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2455 DTC past?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 12.
NO >> Refer to EC-1858, "DTC Description".

12. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase ENGINE diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2455 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1858, "DTC Description".
NO >> Repair complete.

P2456 PARTICULATE FILTER PRESSURE SENSOR A INTERMITTENT

DTC Description

INFOID:0000000014420695

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P2454 present. Refer to EC-1854, "DTC Description".
- P2455 present. Refer to EC-1858, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter differential pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter differential pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter differential pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the outlet of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor signal is in-range but reading is not rational or inappropriately high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2456	DPF OUTLET PRESS	Diagnosis condition	• Part 1: Runs 1 minute after key OFF, and DPF temperature sensors are still > 200°C (392°F). • Part 2: Runs when the engine is operating.
		Signal (terminal)	DPF differential pressure sensor.
		Threshold	Range of DPF differential pressure since last decision in current key cycle until the enable conditions are met < 0.1 kPa.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Stuck in-range aftertreatment diesel particulate filter differential pressure sensor reading.
- High resistance in the aftertreatment diesel particulate filter differential pressure sensor signal or return wires.
- Higher than expected diesel particulate filter differential pressure.
- Excessive Diesel Exhaust Fluid (DEF) deposits in the aftertreatment decomposition tube.
- Plugged differential pressure sensor ports could cause this DTC if pressure is held in the port after the engine is turned OFF.

NOTE:
It is possible to set this DTC in a shop environment by performing a key cycle with the tailpipe connected to an exhaust ventilation system.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1863, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420696

1. CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current ENGINE diagnostic trouble codes:

- P2454
- P2455

Are any of the above DTCs detected?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR TUBES FOR BLOCKAGE

1. Turn ignition switch OFF.
2. Disconnect the aftertreatment DPF differential pressure sensor tubes.
3. Inspect the aftertreatment DPF differential pressure sensor tubes for blockage.

Differential pressure sensor tubes blocked?

YES >>
- Repair or replace the aftertreatment DPF differential pressure sensor tubes. Refer to EM-301, "Removal and Installation".
- GO TO 14.

NO >> GO TO 3.

3. MONITOR THE DPF DIFFERENTIAL PRESSURE SENSOR WITH CONSULT

1. Connect all components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, select ENGINE and check Data Monitor of the DPF differential pressure sensor.

NOTE:
An exhaust ventilation system connected to the exhaust can cause the differential pressure sensor to read incorrectly. Be sure to remove any ventilation or vacuum equipment from the exhaust before reading the differential pressure sensor value.

DPF differential pressure sensor reads 0± 1.5 kPa (0± 0.44 in Hg)?

YES >> GO TO 4.
NO >>
- Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
- GO TO 14.

4. INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >>
- Repair or replace error-detected parts.
- GO TO 14.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

NOTE:
DTC P2460 will also be current.

Is P2454 DTC current?

YES >> GO TO 6.
NO >> GO TO 7.

6. INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Connect a jumper wire between the DPF differential pressure sensor connector C28 power terminal 32 and signal terminal 24.
4. Turn ignition switch ON.
5. Wait 30 seconds.

NOTE:
DTC P2460 will also be current.

Is P2455 DTC current?

YES >> GO TO 12.
NO >> GO TO 7.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Disconnect the ECM.
4. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 14.

8. CHECK THE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	24	C28	3	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 14.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DPF differential pressure sensor signal circuit and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	24	—	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair or replace harness for a short to ground.
• GO TO 14.

10. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	24	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair short circuit in harness or connectors.
• GO TO 14.

11. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the DPF differential pressure sensor.
4. Turn ignition switch ON and wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did P2456 DTC become current?

YES >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 14.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 14.

12. CHECK THE DEPOSITS IN THE DECOMPOSITION TUBE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Remove the aftertreatment decomposition tube from the vehicle.
4. Inspect the tube for excessive DEF deposits.

Were excessive DEF deposits found inside the decomposition tube?

YES >> • Clean and install the decomposition tube.
• GO TO 14.
NO >> GO TO 13.

13. CHECK EXHAUST SYSTEM FOR RESTRICTIONS

Inspect the exhaust system for restrictions.

Is exhaust restriction found?

YES >> • Repair or replace the restricted component.
• GO TO 14.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 14.

14. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.

4. Using CONSULT, erase ENGINE diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2456 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1862, "DTC Description".
NO >> Repair complete.

P2457 EGR COOLER

DTC Description

INFOID:0000000014420697

The Exhaust Gas Recirculation (EGR) temperature sensor is a variable resistor sensor and is used to measure the temperature of the EGR gas flow after it exits the EGR cooler. The Engine Control Module (ECM) supplies 5V to the EGR temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the EGR flow temperature.

DTC DETECTION LOGIC

EGR orifice temperature above normal engine operating range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2457	EGR ORIFICE TEMP	Diagnosis condition	This diagnostic runs when the engine is running.
		Signal (terminal)	EGR temperature sensor signal
		Threshold	The Engine Control Module (ECM) detected the EGR temperature was greater than 260°C (500°F).
		Diagnosis delay time	—

POSSIBLE CAUSE

- Malfunctioning EGR temperature sensor
- Malfunctioning EGR cooler

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CHECK

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2457 being current on the CONSULT screen.

Is P2457 DTC current?

YES >> Go to EC-1867, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420698

1.CHECK FOR OTHER CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check “ENGINE” diagnostic trouble codes.
3. Check for other current DTCs on the CONSULT screen.

Are there any other current DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

1. Using CONSULT, check for “ENGINE” diagnostic trouble codes.
2. Check for P2457 being current DTCs on the CONSULT screen.

Is P2457 current DTC detected?

YES >> GO TO 3.

NO >> Refer to GI-47, "Intermittent Incident".

3. CHECK THE ENGINE COOLANT MIXTURE

1. Turn ignition switch OFF.
2. Check the engine coolant mixture.
3. Check the freeze point of the engine coolant to be sure of a proper mixture.

NOTE:
Incorrect coolant mixture will cause high EGR temperatures due to inefficient cooling.

Is engine coolant mixed correctly?

YES >> GO TO 4.
NO >> • Drain the coolant and fill the cooling system with the proper mixture. Refer to CO-47, "Changing Engine Coolant".
• GO TO 13.

4. CHECK THE ENGINE COOLANT LEVEL

Check for proper engine coolant level.

NOTE:
Low engine coolant level can cause erratic coolant flow through the engine and EGR cooler, in turn, causing the EGR temperatures to rise.

Is Engine coolant level at proper level?

YES >> GO TO 5.
NO >> • Replenish the cooling system and troubleshoot for loss of coolant if necessary.
• GO TO 13.

5. CHECK THE EGR TEMPERATURE SENSOR ACCURACY

1. Remove the EGR temperature sensor from the EGR plumbing.
2. Turn ignition switch ON.
3. Using CONSULT, select ENGINE and check Data Monitor of EGR ORIFICE TEMP.
4. Compare the EGR temperature sensor reading to ambient air temperature.

NOTE:
Allow the EGR temperature sensor enough time to cool down to ambient temperature before comparing the reading.

Is EGR temperature within 10°C (18°F) of ambient air temperature?

YES >> GO TO 6.
NO >> GO TO 7.

6. CHECK THE EGR COOLER FOR LEAKS OR FOULING

1. Turn ignition switch OFF.
2. Remove the EGR cooler.
3. Inspect and pressure test the EGR cooler.

Is EGR cooler pressure check within specification?

YES >> • Clean the EGR cooler.
• GO TO 13.
NO >> • Replace the EGR cooler. Refer to EM-276, "Removal and Installation".
• GO TO 13.

7. INSPECT THE EGR TEMPERATURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the EGR temperature sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.

- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P040D DTC current?

YES >> GO TO 9.
NO >> GO TO 10.

9. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between the EGR temperature sensor connector F142 signal terminal 154 and return terminal 170.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P040C DTC current?

YES >> • A malfunctioning EGR temperature sensor has been detected. Replace the EGR temperature sensor. Refer to EM-236, "Removal and Installation".
• GO TO 13.
NO >> GO TO 10.

10. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Disconnect the ECM connector F101.
4. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

11. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P040D DTC current?

YES >> GO TO 12.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

12. CHECK THE ECM RESPONSE

CAUTION:

Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
- **Not to bend and damage pins and terminals.**
- **Not to probe or short unintended circuits and potentially damaging the control unit.**

1. Turn ignition switch OFF.
2. Connect a jumper wire between ECM connector F101 pins 154 and 170.
3. Turn ignition switch ON.
4. Wait for 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P040C DTC current?

YES >> GO TO 13.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

13. ERASE CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect jumper wire.
3. Connect all harness components and connectors.
4. Turn ignition switch ON.
5. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
6. Operate the engine within the "Conditions for setting the DTC".
7. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2457 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1867, "DTC Description".
NO >> Repair complete.

P2459 REGENERATION FREQUENCY OF DIESEL PARTICULATE FILTER

DTC Description

INFOID:0000000014420699

NOTE:
If any of the following ″current″ DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P0101 present. Refer to EC-1020, "DTC Description".
- P0106 present. Refer to EC-1031, "DTC Description".
- P0299 present. Refer to EC-1230, "DTC Description".
- P2263 present. Refer to EC-1793, "DTC Description".
- P2454 present. Refer to EC-1854, "DTC Description".
- P2455 present. Refer to EC-1858, "DTC Description".
- P2456 present. Refer to EC-1862, "DTC Description".
- P2460 present. Refer to EC-1885, "DTC Description".
- P2461 present. Refer to EC-1889, "DTC Description".
- P2462 present. Refer to EC-1893, "DTC Description".

The ECM records the time from the completion of an active regeneration of the aftertreatment diesel particulate filter until the ECM requests another active regeneration of the diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF system active regeneration is occurring more frequently than intended.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2459	DPF OUTLET PRESS DPF DELTA PRESS DPF DELTA PRESS SENS V DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	This diagnostic only runs after successful completion of an active regeneration of the aftertreatment diesel particulate filter
		Signal (terminal)	Outlet pressure and temperature sensor signals.
		Threshold	The system detects that the DPF is no longer new, or "green". New DPF temporarily exhibits high back pressure during their first hours of use which can lead to a false high estimation of soot load.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning fuel injector causing unburned diesel fuel to enter the exhaust system
- A face plugged aftertreatment diesel oxidation catalyst
- A malfunctioning aftertreatment diesel particulate filter differential pressure sensor
- An engine malfunction resulting in high engine out soot

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CHECK

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2459 being current on the CONSULT screen.

Is P2459 DTC current?

YES >> Go to EC-1871, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420700

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is P2459 DTC current?

YES >> GO TO 2.

NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Using CONSULT, check for the following current or past ENGINE diagnostic trouble codes:

- P0101
- P0106
- P0299
- P2263
- P2454
- P2455
- P2456
- P2460
- P2461
- P2462

Are any of the above current or past DTCs present?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR CURRENT OR PAST FUEL SYSTEM RELATED DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for fuel system related DTCs.

Any applicable DTC current or past?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK FOR CURRENT OR PAST AIR HANDLING SYSTEM RELATED DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for air handling system DTCs.

Is any of P0101, P0106, P0299 or P2263 DTCs current or past?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.CHECK FOR CURRENT OR PAST EGR OR TURBOCHARGER SYSTEM RELATED DTCS

1. Using CONSULT, check for other ENGINE diagnostic trouble codes.
2. Look for EGR and turbocharger system related DTCs.

Are any applicable current or past DTCs?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 6.

6.CHECK FOR CURRENT OR PAST AFTERTREATMENT SYSTEM RELATED DTCS

1. Using CONSULT, check for other ENGINE diagnostic trouble codes.
2. Look for aftertreatment system related DTCs.

Is P0420, P0421, P0544, P2031, P242B or P24A0 DTCs current or past?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 7.

7.CHECK FOR CURRENT OR PAST AFTERTREATMENT DPF SYSTEM RELATED DTCS

1. Using CONSULT, check for other ENGINE diagnostic trouble codes.
2. Look for air handling system DTCs.

Is P1451, P242F or P2463 DTCs current or past?

YES >> • Without the presence of DTC P24A2: Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
• With DTC P24A2 present: GO TO 9.

NO >> GO TO 8.

8. CHECK FOR DEBRIS IN THE FUEL TANK

1. Turn ignition switch OFF.
2. Remove the fuel tank filter cap.
3. Check for debris in the fuel tank.

Is any debris found in the tank?

YES >> • Remove the debris from the tank.
• GO TO 9.
NO >> GO TO 9.

9. MONITOR AFTERTREATMENT DPF DIFFERENTIAL PRESSURE SENSOR WITH CONSULT

1. Turn ignition switch ON.
2. Using CONSULT, select ENGINE, Data Monitor and verify the "DPF DELTA PRESS SENS V".
3. Expected voltage reading is 0.69V ± 0.1V at ≤ 25°C (77°) or 0.69V± 0.06V at ≥ 26°C (78°F).

Is DPF differential pressure sensor voltage reading within specification?

YES >> GO TO 10.
NO >> • An issue with the DPF differential pressure sensor or associated wiring has been found:
- Check for a short between the signal pin and other pins at the sensor harness.
- Check for high resistance in the return pin circuit of the sensor harness.
- Replace the DPF differential pressure sensor if the wiring checks OK. Refer to EX-58, "Removal and Installation".
• GO TO 10.

10. CHECK AFTERTREATMENT DPF DIFFERENTIAL PRESSURE SENSOR TUBES FOR BLOCKAGE

1. Turn ignition switch OFF.
2. Inspect the DPF differential pressure sensor tubes for blockage, kinking or leaking.

Is any blockage, kinking or leaking found?

YES >> • Clean, repair or replace the DPF differential pressure sensor tubes as necessary.
• GO TO 11.
NO >> GO TO 11.

11. CHECK THE CIRCUIT RESPONSE

1. Disconnect the DPF differential pressure sensor.
2. Turn ignition switch ON.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Are both P2454 and P2460 DTCs current?

YES >> GO TO 12.
NO >> • An issue with the DPF differential pressure sensor or associated wiring has been found. Check harness for proper location between the ECM and the sensor.
• GO TO 12.

12. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR WIRING

1. Turn ignition switch OFF.
2. Connect a jumper wire between DPF differential pressure sensor connector C28 power supply terminal 4 and delta pressure signal circuit terminal 2.
3. Turn ignition switch ON.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Are both P2455 and P2461 DTCs current?

YES >> GO TO 13.
NO >> • An issue with the DPF differential pressure sensor or associated wiring has been found. Check harness for proper location between the ECM and the sensor.
• GO TO 13.

13. INSPECT THE HIGH PRESSURE FUEL SYSTEM FOR LEAKS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Inspect for fuel leaks:

- Fuel supply line from the Stage 2 fuel filter and high-pressure fuel pump

- Fuel rail supply lines
- Injector supply lines

Is a leak detected?

YES >> • Repair or replace the leaky component.
• GO TO 17.
NO >> GO TO 14.

14. CHECK FUEL PUMP ACTUATOR AND FUEL PRESSURE RELIEF VALVE

1. Turn ignition switch ON.
2. Using CONSULT, select “ENGINE”, perform the “HPCR Fuel Act Override“/” “Active Test”.

Are actuators within specifications?

YES >> GO TO 15.
NO >> • If the fuel pump actuator is **not** within specifications, replace the fuel pump actuator. Refer to EM-484, "Removal and Installation".
• If the pressure relief valve is **not** within specifications, replace the fuel rail pressure relief valve. Refer to EM-482, "Removal and Installation".
• GO TO 17.

15. CHECK FUEL INJECTOR RETURN FLOW

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Use SST J-54421 to perform the next step.
4. Using CONSULT, select “ENGINE” and perform the ″Fuel Injector Drain Flow Test″ on bank 2.

NOTE:
The purpose of this test is to check for excessive fuel drain from each injector.

- Disconnect the fuel drain lines from the bank of injectors being tested.
- Plug injector drain lines with the plug provided in the kit.
- Connect the piezo adapter line drain tool connection to each of the injectors.
- Start the engine until top mark is reached or crank for 30 seconds if the engine does not start.
- The maximum permissible drain is 3 times the lowest measured drain quantity.
- A failed injector will have a higher flow and exhibit 3 times the lowest measured drain quantity.

Filling quantity up to:	Engine cranks but does not start (small diameter)		Engine starts (large diameter)	
	ml	oz	ml	oz
1	1.8	0.06	6	0.2
2	2.4	0.08	13	0.44
3	3.2	0.11	21	0.71
4	4	0.14	29	0.98
5	—	—	37	1.25
6	—	—	45	1.52
7	—	—	53	1.79

Does each fuel injector meet the specification in injector drain flow test?

YES >> GO TO 16.
NO >> • Replace the malfunctioning injector(s). Refer to (cylinder 1 or 3) EM-436, "Removal and Installation (CYLINDER 1 and CYLINDER 3)", (cylinder 2 or 4) EM-439, "Removal and Installation (CYLINDER 2 and CYLINDER 4)", (cylinder 5 or 7) EM-442, "Removal and Installation (CYLINDER 5 and CYLINDER 7)", (cylinder 6 or 8) EM-446, "Removal and Installation (CYLINDER 6 and CYLINDER 8)".
• GO TO 17.

16. CHECK THE EXHAUST FOR EXCESSIVE SMOKE

1. Disconnect the exhaust from the aftertreatment inlet.
2. Start the engine.
3. Perform two “Snap Acceleration Test” from low to high idle. Hold the engine at high idle for 5 seconds.

NOTE:
A small puff of black smoke upon acceleration that clears at a steady high idle speed is normal.

Excessive black smoke during acceleration or constant black smoke at high idle?

YES >> Refer to the appropriate diagnosis procedure to correct the cause of excessive smoke.
NO >>
- Replace the DOC/DPF assembly. Refer to EX-42, "Removal and Installation".
- If the aftertreatment DPF requires replacement for excessive ash and has **not** reached the normal ash cleaning interval, further troubleshooting is required.
- Check for lubricating oil consumption, coolant consumption, or previous repairs that may have corrected an issue resulting in lubricating oil or coolant consumption.
- GO TO 17.

17. ERASE CURRENT DTC

1. Connect all harness components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2459 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1871, "DTC Description".
NO >> Repair complete.

P245C EGR COOLER BYPASS CONTROL CIRCUIT LOW

DTC Description

INFOID:0000000014420701

The Exhaust Gas Recirculation Cooler Bypass Valve (EBV) is used to redirect the EGR gases around the cooler when the engine is under certain operating conditions. The Engine Control Module (ECM) opens and close the EBV based on engine conditions. The EBV sends the valve position status back to the ECM.

DTC DETECTION LOGIC

The ECM has detected that EGR Bypass Valve (EBV) driver is short to low source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P245C	EGR BYPASS VLV POS V EGR BYPASS VLV CMD	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	EGR bypass valve position sensor signal
		Threshold	The ECM detected the EGR cooler bypass actuator circuit is shorted to ground.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Short to ground in the wiring harness
- Malfunctioning EGR bypass valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P245C being current on the CONSULT screen.

Is P245C DTC current?

YES >> Go to EC-1876, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420702

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is P245C DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT EGR BYPASS VALVE ACTUATOR AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the EGR bypass valve actuator connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.

- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> • Repair or replace error-detected parts.
• GO TO 8.

3. CHECK EGR BYPASS MOTOR RETURN CIRCUIT FOR SHORT TO GROUND

1. Disconnect the ECM.
2. Check for continuity between EGR bypass valve connector F145 motor return circuit signal terminal 5 and ground.

EGR bypass valve		Ground	Continuity
Connector	Terminal		
F145	5	—	No

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace harness for a short to ground.
• GO TO 8.

4. CHECK THE EGR BYPASS MOTOR RETURN CIRCUIT FOR OPEN OR HIGH RESISTANCE

Check the return circuit for continuity between the ECM connector and the EGR bypass valve connector.

ECM		EGR bypass valve		Continuity
Connector	Terminal	Connector	Terminal	
F101	159	F145	5	Yes

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Repair open circuit in harness or connectors.
• GO TO 8.

5. CHECK EGR BYPASS MOTOR POWER CIRCUIT FOR SHORT TO GROUND

Check for continuity between EGR bypass valve connector F145 motor power circuit terminal 1 and ground.

EGR bypass valve		Ground	Continuity
Connector	Terminal		
F145	1	—	No

Is the inspection result normal?

YES >> GO TO 6.
NO >> • Repair or replace harness for a short to ground.
• GO TO 8.

6. CHECK THE EGR BYPASS MOTOR POWER CIRCUIT FOR OPEN OR HIGH RESISTANCE

Check the power circuit for continuity between the ECM connector and the EGR bypass valve connector.

ECM		EGR bypass valve		Continuity
Connector	Terminal	Connector	Terminal	
F101	180	F145	1	Yes

Is the inspection result normal?

YES >> • Replace EGR bypass valve. Refer to EM-290, "Removal and Installation".
• GO TO 7.
NO >> • Repair open circuit in harness or connectors.
• GO TO 8.

7. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P245C DTC current?

YES >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 8.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 8.

8. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase ENGINE diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P245C DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1876, "DTC Description".
NO >> Repair complete.

P245D EGR COOLER BYPASS CONTROL CIRCUIT HIGH

DTC Description

INFOID:0000000014420703

The Exhaust Gas Recirculation Cooler Bypass Valve (EBV) is used to redirect the EGR gases around the cooler when the engine is under certain operating conditions. The Engine Control Module (ECM) opens and closes the EBV based on engine conditions. The EBV sends the valve position status back to the ECM.

DTC DETECTION LOGIC

The ECM has detected that EGR Bypass Valve (EBV) driver has an open circuit or shorted to a voltage source.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P245D	EGR BYPASS VLV POS V EGR BYPASS VLV CMD	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	EGR bypass valve position sensor signal.
		Threshold	The ECM detected the EGR cooler bypass actuator circuit is shorted to battery.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Short to voltage in the wiring harness
- Malfunctioning EGR bypass valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P245D being current on the CONSULT screen.

Is P245D DTC current?

YES >> Go to EC-1879, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420704

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is P245D DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT EGR BYPASS VALVE ACTUATOR AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the EGR bypass valve actuator connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.

- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 3.
NO >> • Repair or replace error-detected parts.
• GO TO 5.

3. CHECK THE EGR BYPASS MOTOR RETURN CIRCUIT FOR A SHORT TO VOLTAGE

1. Disconnect the ECM.
2. Check the voltage between EGR bypass motor return circuit and ground at the EGR bypass valve connector.

EGR bypass valve		Terminal (-)	Voltage (V) (Approx.)
Connector	Terminal (+)		
F145	5	Ground	0

Is the inspection result normal?

YES >> • A damaged EGR bypass valve has been detected. Replace the EGR bypass valve.
• GO TO 5.
NO >> • Repair or replace harness for a short to a voltage source.
• GO TO 5.

4. CHECK FOR CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P245D DTC current?

YES >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 5.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 5.

5. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT check for current “ENGINE” diagnostic trouble codes.

Is P245D DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1879, "DTC Description".
NO >> Repair complete.

P245F PARTICULATE FILTER PRESSURE SENSOR B RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420705

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P2460 present. Refer to EC-1885, "DTC Description".
- P2461 present. Refer to EC-1889, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter differential pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter differential pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter differential pressure sensor signal circuit. This sensor signal voltage changes based on the differential pressure across the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor signal is stuck in-range.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P245F	DPF OUTLET PRESS	Diagnosis condition	• Part 1: Runs 1 minute after key OFF, and DPF temperature sensors are still > 200°C (392°F). • Part 2: Runs when the engine is operating.
		Signal (terminal)	DPF differential/outlet pressure sensor
		Threshold	ECM detected the DPF differential pressure was greater than 1.5 kpa (0.44 in HG) at key OFF, or is not changing with engine conditions
		Diagnosis delay time	—

POSSIBLE CAUSE

- Stuck in-range aftertreatment diesel particulate filter outlet pressure sensor reading
- High resistance in the aftertreatment diesel particulate filter differential pressure sensor signal or return wires.
- Disconnected or damaged diesel exhaust fluid (DEF) differential pressure sensor tubes
- Plugged differential pressure sensor ports could cause this DTC if pressure is held in the port after the engine is turned OFF.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1882, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420706

1. CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current ENGINE diagnostic trouble codes:

- P2460
- P2461

Are any of the above DTCs detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR TUBES

1. Turn ignition switch OFF.
2. Inspect the aftertreatment DPF differential pressure sensor tubes.
3. Make sure the tubes are installed correctly (**not** reversed).
4. Make sure both ends of the tubes are securely connected.
5. Inspect the tubes for leaks or damage.
6. Inspect the tubes for blockage.

Are DPF differential pressure sensor tubes damaged, disconnected or blocked?

YES >> • Repair or replace the aftertreatment DPF differential pressure sensor tubes.
• GO TO 12.
NO >> GO TO 3.

3. MONITOR THE DPF DIFFERENTIAL PRESSURE SENSOR WITH CONSULT

1. Connect all components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, select ENGINE and check Data Monitor of the DPF differential pressure sensor.

NOTE:
An exhaust ventilation system connected to the exhaust can cause the outlet pressure sensor to read incorrectly. Be sure to remove any ventilation or vacuum equipment from the exhaust before reading the outlet pressure sensor value.

Does DPF outlet pressure sensor read 0± 3 kPa?

YES >> GO TO 4.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 12.

4. INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

5. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.

2. Wait 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2460 DTC current?

YES >> GO TO 6.
NO >> GO TO 7.

6. INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Connect a jumper wire between the DPF differential pressure sensor connector C28 power terminal 4 and signal terminal 3.
3. Turn ignition switch ON.
4. Wait 30 seconds.

Is P2461 DTC current?

YES >> GO TO 12.
NO >> GO TO 7.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

8. CHECK THE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	7	C28	2	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 12.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DPF differential pressure sensor signal circuit and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	7	—	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair or replace harness for a short to ground.

• GO TO 12.

10. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair short circuit in harness or connectors.
• GO TO 12.

11. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR VOLTAGE VALUE

1. Connect all harness connectors.
2. Start the engine.
3. Using CONSULT, select “ENGINE” and check Data Monitor of the ″DPF OUTLET PRESS SENS V″.
4. Perform a “Snap Acceleration Test” while looking for a change in voltage value.

Did the value change?

YES >> GO TO 12.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 12.

12. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase ENGINE diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P245F DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1881, "DTC Description".
NO >> Repair complete.

P2460 PARTICULATE FILTER PRESSURE SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420707

NOTE:
If the following ″current″ DTC is displayed with this DTC, first perform the trouble diagnosis for this other DTC:
• P06D3 present. Refer to EC-1541, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter differential pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter differential pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter differential pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the outlet of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor reading is less than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2460	DPF OUTLET PRESS	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	DPF differential pressure sensor
		Threshold	Aftertreatment DPF differential pressure sensor value < 0.25 V (-6.245 kPa)
		Diagnosis delay time	—

POSSIBLE CAUSE

• Signal circuit open or shorted to ground in the engine harness or sensor
• Supply wire open or shorted to ground

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2460 current on the CONSULT screen.

Is P2460 DTC current?

YES >> Go to EC-1885, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420708

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE diagnostic trouble codes.

If DTC P06D3 is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Refer to EC-1541, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT SENSOR DTC

Check for DTC P2460 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

4.CHECK THE PRESSURE SENSOR POWER SUPPLY AND GROUND CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DPF differential pressure sensor supply voltage and return circuit terminals.

DPF differential pressure sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C28	4	1	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between DPF differential pressure sensor connector C28 power supply terminal 4 and signal circuit terminal 2.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P2461 become current?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the DPF differential pressure sensor.
4. Turn ignition switch ON and wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did P2460 DTC become current?

YES >> • A damaged sensor has been detected. Replace the aftertreatment diesel particulate filter differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE SENSOR POWER CIRCUIT FOR OPEN

Check the power circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	32	C28	4	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 13.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	7	C28	2	Yes

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair open circuit in harness or connectors.
• GO TO 13.

10. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair short circuit in harness or connectors.
• GO TO 13.

11. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DPF differential pressure sensor signal circuit and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	7	—	No

Is the inspection result normal?

YES >> GO TO 12.
NO >> • Repair or replace harness for a short to ground.
• GO TO 13.

12. CHECK FOR PAST DTCS

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2460 DTC past?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 13.
NO >> Return to Diagnosis Procedure. Refer to EC-1885, "DTC Description".

13. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase ENGINE diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2460 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1885, "DTC Description".
NO >> Repair complete.

P2461 PARTICULATE FILTER PRESSURE SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420709

NOTE:
If the following ″current″ DTC is displayed with this DTC, first perform the trouble diagnosis for this other DTC:
• P06D4 present. Refer to EC-1544, "DTC Description".

The engine control module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter differential pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter differential pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter differential pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the outlet of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF differential pressure sensor reading is greater than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2461	DPF OUTLET PRESS	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	DPF differential and differential pressure sensor
		Threshold	Aftertreatment DPF differential pressure sensor value > 4.75 V (36.733 kPa)
		Diagnosis delay time	—

POSSIBLE CAUSE

• Sensor ground circuit open in the engine harness or sensor
• Sensor signal circuit shorted to power circuit or battery supply

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2461 current on the CONSULT screen.

Is P2461 DTC current?

YES >> Go to EC-1889, "DTC Description".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420710

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing ENGINE diagnostic trouble codes.

If DTC P06D4 is present, perform the confirmation procedure (trouble diagnosis) for this other DTC first.

Is applicable DTC detected?

YES >> Refer to EC-1544, "DTC Description".
NO >> GO TO 2.

2.CHECK FOR CURRENT SENSOR DTC

Check for DTC P2461 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.

Did DTC P2460 become current?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR POWER SUPPLY AND GROUND CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between DPF differential pressure sensor supply voltage and return circuit terminals.

DPF differential pressure sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
C28	4	1	5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Reconnect the DPF differential pressure sensor.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2461 DTC current?

YES >> • A damaged sensor has been detected. Replace the aftertreatment diesel particulate filter differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 12.

NO >> • The removal and installation of the connector corrected the issue.
• GO TO 12.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

8. CHECK THE SENSOR GROUND CIRCUIT FOR OPEN

Check the sensor ground circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	15	C28	1	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 12.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair short circuit in harness or connectors.
• GO TO 12.

10. CHECK THE SENSOR POWER CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor power and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	32	All others	No

Is the inspection result normal?

YES >> GO TO 11.

NO >> • Repair short circuit in harness or connectors.
• GO TO 12.

11. CHECK FOR PAST DTCS

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2461 DTC past?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 12.
NO >> Return to Diagnosis Procedure. Refer to EC-1889, "DTC Description".

12. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2461 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1889, "DTC Description".
NO >> Repair complete.

P2462 PARTICULATE FILTER PRESSURE SENSOR CIRCUIT INTERMITTENT

DTC Description

INFOID:0000000014420711

NOTE:
If the following "current" DTC is displayed with this DTC, first perform the trouble diagnosis for this other DTC:
- P2460 present. Refer to EC-1885, "DTC Description".
- P2461 present. Refer to EC-1889, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply to the aftertreatment diesel particulate filter outlet pressure sensor on the sensor supply circuit. The ECM also provides a ground on the sensor return circuit. The aftertreatment diesel particulate filter outlet pressure sensor provides a signal to the ECM on the aftertreatment diesel particulate filter outlet pressure sensor signal circuit. This sensor signal voltage changes based on the pressure at the outlet of the aftertreatment diesel particulate filter.

DTC DETECTION LOGIC

Aftertreatment DPF Outlet pressure sensor reading less than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2462	DPF OUTLET PRESS DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	Part 1: One minute after key OFF and DPF temperature sensor > 200°C (392°F). Part 2: Continuously while the engine is running.
		Signal (terminal)	DPF differential pressure sensor
		Threshold	Aftertreatment DPF differential pressure sensor value > 1.5 kPa (0.44 in Hg) at key OFF or not changing with engine condition.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Stuck in-range aftertreatment diesel particulate filter differential pressure sensor reading
- High resistance in the aftertreatment diesel particulate filter differential pressure sensor signal or return wires
- Disconnected or damaged aftertreatment diesel particulate filter differential pressure sensor tubes
- Plugged aftertreatment differential pressure sensor ports could cause this DTC if pressure is held in the port after the engine is turned OFF

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it reach normal operating temperature.
3. Turn ignition switch OFF.
4. Keep the ignition switch OFF for 1 minute.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P2462 current on the CONSULT screen.

Is P2462 DTC current?

YES >> Go to EC-1894, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420712

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for other existing “ENGINE” diagnostic trouble codes.

If either DTC P2460 or P2461 is present, perform the confirmation procedure (trouble diagnosis) for these other DTCs first.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR TUBES

1. Turn ignition switch OFF.
2. Inspect the aftertreatment DPF differential pressure sensor tubes.
3. Make sure the tubes are installed correctly (**not** reversed).
4. Make sure both ends of the tubes are securely connected.
5. Inspect the tubes for leaks or damage.
6. Inspect the tubes for blockage.

Are DPF differential pressure sensor tubes damaged, disconnected or blocked?

YES >> • Repair or replace the aftertreatment DPF differential pressure sensor tubes.
• GO TO 12.
NO >> GO TO 3.

3.MONITOR THE DPF DIFFERENTIAL PRESSURE SENSOR WITH CONSULT

1. Connect all components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, select ENGINE and check Data Monitor of the DPF differential pressure sensor.

NOTE:
An exhaust ventilation system connected to the exhaust can cause the outlet pressure sensor to read incorrectly. Be sure to remove any ventilation or vacuum equipment from the exhaust before reading the outlet pressure sensor value.

Does DPF outlet pressure sensor read 0± 3 kPa?

YES >> GO TO 4.
NO >> • Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
• GO TO 12.

4.INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.

2. Wait 30 seconds.
3. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2460 DTC current?

YES >> GO TO 6.
NO >> GO TO 7.

6. INSPECT THE DPF DIFFERENTIAL PRESSURE SENSOR AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Connect a jumper wire between the DPF differential pressure sensor connector C28 power terminal 4 and signal terminal 3.
3. Turn ignition switch ON.
4. Wait 30 seconds.

Is P2461 DTC current?

YES >> GO TO 12.
NO >> GO TO 7.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

8. CHECK THE SENSOR SIGNAL CIRCUIT FOR OPEN

Check the signal circuit for continuity between the ECM connector and the DPF differential pressure sensor connector.

ECM		DPF differential pressure sensor		Continuity
Connector	Terminal	Connector	Terminal	
E93	7	C28	2	Yes

Is the inspection result normal?

YES >> GO TO 9.
NO >> • Repair open circuit in harness or connectors.
• GO TO 12.

9. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO GROUND

Check the continuity between DPF differential pressure sensor signal circuit and ground.

ECM		Ground	Continuity
Connector	Terminal		
E93	7	—	No

Is the inspection result normal?

YES >> GO TO 10.
NO >> • Repair or replace harness for a short to ground.

- GO TO 12.

10. CHECK THE SENSOR SIGNAL CIRCUIT FOR SHORT TO OTHER CIRCUITS

Check the continuity between DPF differential pressure sensor signal and all other circuits at the ECM connector.

ECM			Continuity
Connector	Terminal	Terminal	
E93	7	All others	No

Is the inspection result normal?

YES >> GO TO 11.
NO >>
- Repair short circuit in harness or connectors.
- GO TO 12.

11. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR VOLTAGE VALUE

1. Connect all harness connectors.
2. Start the engine.
3. Using CONSULT, select “ENGINE” and check “Data Monitor” of the ″DPF OUTLET PRESS SENS V″ sensor.
4. Perform a “Snap Acceleration Test” while looking for a change in voltage value.

Does this value change?

YES >> GO TO 12.
NO >>
- Replace the aftertreatment DPF differential pressure sensor. Refer to EX-58, "Removal and Installation".
- GO TO 12.

12. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2462 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1893, "DTC Description".
NO >> Repair complete.

P2463 DIESEL PARTICULATE FILTER

DTC Description

INFOID:0000000014420713

NOTE:
If the following ″current″ DTC is displayed with this DTC, first perform the trouble diagnosis for this other DTC:
• P06D3 present. Refer to EC-1541, "DTC Description".

The engine aftertreatment system monitors the soot load in the aftertreatment diesel particulate filter. Under normal operating conditions, the aftertreatment diesel particulate filter is self-cleaning, where soot is converted to carbon dioxide, nitrogen, and water. Under light load operating conditions, it can be necessary to perform a stationary regeneration of the aftertreatment diesel particulate filter. The soot load in the aftertreatment diesel particulate filter is estimated using the aftertreatment differential pressure sensor and the calculated soot output of the engine.

DTC DETECTION LOGIC

Aftertreatment DPF soot load estimate has increased above the moderate severe level.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2463	DPF OUTLET PRESS	Diagnosis condition	This diagnostic runs continuously when the engine is running.
		Signal (terminal)	DPF differential pressure sensor
		Threshold	Soot load estimate > 9 g/L
		Diagnosis delay time	—

POSSIBLE CAUSE

• The engine has been operating in a light load condition that prevents exhaust temperatures from being high enough to actively regenerate the aftertreatment diesel particulate filter.
• Possible engine damage that causes excessive black soot to be generated

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.
1. Start the engine.
2. Connect CONSULT, select “ENGINE” and perform the ″Stationary Regeneration″ Active Test.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2463 being current on the CONSULT screen.

Is P2463 DTC current?

YES >> Go to EC-1897, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420714

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is P2463 DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK THE AFTERTREATMENT DUTY CYCLE

1. Interview the driver to determine if the driving duty cycle is enough to raise exhaust temperatures.
2. Determine if the duty cycle of the application needs to change in order to increase the exhaust temperatures entering the aftertreatment system.

Does the duty cycle of the application need to be increased?

YES >> Change the duty cycle of the application in order to increase the exhaust temperatures entering the aftertreatment system.
NO >> GO TO 3.

3. ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2463 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1897, "DTC Description".
NO >> Repair complete.

P2470 EXHAUST GAS TEMPERATURE SENSOR 4

DTC Description

INFOID:0000000014420715

NOTE:
If any of the following ″current″ DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U4152 present. Refer to EC-1020, "DTC Description".
- P1625 present. Refer to EC-1031, "DTC Description".
- P1626 present. Refer to EC-1230, "DTC Description".
- P1627 present. Refer to EC-1793, "DTC Description".
- P1628 present. Refer to EC-1854, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN2 communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The SCR temperature sensor module has detected a sensor short to ground condition that causes too low of an input voltage condition in the intake/mid-bed SCR thermocouple sensor circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2470	SCR INLET TEMP SCR OUTLET TEMP DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	SCR pressure and temperature sensor signals
		Threshold	Aftertreatment intake/mid-bed SCR gas temperature sensor input voltage ≤ 1 V (-40°C)
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment SCR intermediate temperature sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2470 being current on the CONSULT screen.

Is P2470 DTC current?

YES >> Go to EC-1900, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420716

1.CHECK FOR RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1625
- P1626
- P1627
- P1628

Are any of the above DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> • A malfunctioning aftertreatment selective catalytic reduction temperature sensor module has been detected. Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
• GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2470 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1899, "DTC Description".
NO >> Repair complete.

P2471 EXHAUST GAS TEMPERATURE SENSOR 4

DTC Description

INFOID:0000000014420717

NOTE:
If any of the following ″current″ DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U4152 present. Refer to EC-1020, "DTC Description".
- P1625 present. Refer to EC-1031, "DTC Description".
- P1626 present. Refer to EC-1230, "DTC Description".
- P1627 present. Refer to EC-1793, "DTC Description".
- P1628 present. Refer to EC-1854, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The aftertreatment SCR temperature sensor module reported the aftertreatment SCR intermediate temperature signal was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2471	SCR INLET TEMP SCR OUTLET TEMP DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	SCR pressure and temperature sensor signals
		Threshold	Aftertreatment intake/mid-bed SCR gas temperature sensor input voltage out of range high.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment SCR intermediate temperature sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2471 being current on the CONSULT screen.

Is P2471 DTC current?

YES >> Go to EC-1902, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420718

1.CHECK FOR RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1625
- P1626
- P1627
- P1628

Are any of the above DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> • A malfunctioning aftertreatment selective catalytic reduction temperature sensor module has been detected. Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
• GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2471 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1901, "DTC Description".
NO >> Repair complete.

P2472 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT INTERMITTENT 1/4

DTC Description

INFOID:0000000014420719

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U4152 present. Refer to EC-1020, "DTC Description".
- P1625 present. Refer to EC-1031, "DTC Description".
- P1626 present. Refer to EC-1230, "DTC Description".
- P1627 present. Refer to EC-1793, "DTC Description".
- P1628 present. Refer to EC-1854, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN2 communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment SCR catalyst gas temperature measurement is in-range but not rational.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2472	SCR INLET TEMP SCR OUTLET TEMP DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	This diagnostic runs when the engine is running and exhaust flow is above a minimum level.
		Signal (terminal)	SCR pressure and temperature sensor signals
		Threshold	The Engine Control Module (ECM) detected the aftertreatment SCR intermediate temperature sensor signal was irrational for more than 5 minutes.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment SCR intermediate temperature sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:
1. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Check 1st trip DTC.

Is P2472 DTC detected?

YES >> Proceed to EC-1903, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420720

1.CHECK FOR RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current ENGINE diagnostic trouble codes:

- U1612
- P1625
- P1626
- P1627
- P1628

Are any of the above DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> • A malfunctioning aftertreatment selective catalytic reduction temperature sensor module has been detected. Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
• GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2472 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1903, "DTC Description".
NO >> Repair complete.

P1191 TC INLET AIR TEMPERATURE SENSOR PERFORMANCE

DTC Description

INFOID:0000000014699081

The turbocharger compressor intake temperature sensor is a variable resistor sensor and is used to measure the temperature of the air entering the compressor intake of the turbocharger.The Engine Control Module (ECM) supplies 5V to the compressor intake temperature signal circuit. The ECM monitors the change in voltage caused by changes in the resistance of the sensor to determine the air temperature.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the Compressor Intake Temperature reading was higher or lower than other temperature sensors after 8 hours (engine off), or the sensor reading is erratic when engine running.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P1191	(Inlet Air Temperature Sensor Performance/Rationality)	1	Diagnosis condition	Engine running 2 minutes or more
			Signal (terminal)	(–)
			Threshold	Cumulative sum of error in 150 seconds is > 1,500°C, which is ≥ 2°C. Where tolerance is defined as 68.5°C.
			Diagnosis delay time	Diagnostic runs continuously when the engine is running
		2	Diagnosis condition	• 8 hour cold soak • Engine running.
			Signal (terminal)	(–)
			Threshold	Turbocharger compressor intake pressure/temperature sensor is 40°C > the tolerance of the second most accurate sensor of the remaining sensors
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger compressor intake pressure/temperature sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

NOTE:

If the DTC does not go past, it may be necessary to perform an 8 hour cold soak with the ignition switch OFF.

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P1191 being current on the CONSULT screen.

Is DTC P1191 current?

YES >> Go to EC-1906, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014699082

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P1191 being current on the CONSULT screen.

Is DTC P1191 detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen:

- P1192
- P1193

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.INSPECT TURBOCHARGER COMPRESSOR INTAKE PRESSURE/TEMPERATURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Inspect the harness connector and turbocharger compressor intake pressure/temperature sensor pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Disconnect turbocharger compressor intake pressure/temperature sensor harness connector F105.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1193 DTC become current?

YES >> GO TO 5.
NO >> GO TO 6.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between turbocharger compressor intake pressure/temperature sensor harness connector F105 terminal 3 and 4.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1192 DTC become current?

YES >> Replace turbocharger compressor intake pressure/temperature sensor. Refer to EM-222, "Removal and Installation".

NO >> GO TO 6.

6. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector E93.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1193 DTC become current?

YES >> GO TO 8.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

8. CHECK THE ECM RESPONSE

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Connect a jumper wire between ECM harness connector F101 terminal 109 and 127.
4. Turn ignition switch ON and wait 30 seconds.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did P1192 DTC become current?

YES >> Repair or replace engine harness.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P2481 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW 1/5

DTC Description

INFOID:0000000014420721

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U4152 present. Refer to EC-1020, "DTC Description".
- P1625 present. Refer to EC-1031, "DTC Description".
- P1626 present. Refer to EC-1230, "DTC Description".
- P1627 present. Refer to EC-1793, "DTC Description".
- P1628 present. Refer to EC-1854, "DTC Description".

The aftertreatment selective catalytic reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN2 communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The SCR temperature sensor module has detected a sensor short to ground condition that causes too low of an input voltage condition in the outlet SCR thermocouple sensor circuit.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2470	SCR INLET TEMP SCR OUTLET TEMP DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running.
		Signal (terminal)	SCR pressure and temperature sensor signals
		Threshold	Aftertreatment outlet SCR gas temperature sensor input voltage ≤ 1 V (-40°C)
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment SCR outlet temperature sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2470 being current on the CONSULT screen.

Is P2481 DTC current?

YES >> Go to EC-1909, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420722

1.CHECK FOR RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1625
- P1626
- P1627
- P1628

Are any of the above DTCs current?

YES >> Perform diagnosis of applicable DTC. Refer to EC-838, "DTC Index".
NO >>
- A malfunctioning aftertreatment selective catalytic reduction temperature sensor module has been detected. Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
- GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2481 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1908, "DTC Description".
NO >> Repair complete.

P2482 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH 1/5

DTC Description

INFOID:0000000014420723

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U4152 present. Refer to EC-1020, "DTC Description".
- P1625 present. Refer to EC-1031, "DTC Description".
- P1626 present. Refer to EC-1230, "DTC Description".
- P1627 present. Refer to EC-1793, "DTC Description".
- P1628 present. Refer to EC-1854, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN2 communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The aftertreatment SCR temperature sensor module reported the aftertreatment SCR outlet temperature signal was out of range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2482	SCR INLET TEMP SCR OUTLET TEMP DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	This diagnostic runs continuously when the key switch is in the ON position or when the engine is running
		Signal (terminal)	SCR pressure and temperature sensor signals
		Threshold	Aftertreatment outlet SCR gas temperature sensor input voltage is out of range (high)
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment SCR outlet temperature sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2482 being current on the CONSULT screen.

Is P2482 DTC current?

YES >> Go to EC-1911, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420724

1.CHECK FOR RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1625
- P1626
- P1627
- P1628

Are any of the above DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >>
- A malfunctioning aftertreatment selective catalytic reduction temperature sensor module has been detected. Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
- GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2482 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1910, "DTC Description".
NO >> Repair complete.

P2483 EXHAUST GAS TEMPERATURE SENSOR CIRCUIT INTERMITTENT 1/5

DTC Description

INFOID:0000000014420725

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- U4152 present. Refer to EC-1020, "DTC Description".
- P1625 present. Refer to EC-1031, "DTC Description".
- P1626 present. Refer to EC-1230, "DTC Description".
- P1627 present. Refer to EC-1793, "DTC Description".
- P1628 present. Refer to EC-1854, "DTC Description".

The aftertreatment Selective Catalytic Reduction (SCR) temperature sensor module is a smart device that communicates with the engine control module via CAN2 communication. The aftertreatment SCR temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using CAN2 communication. The aftertreatment SCR temperature sensor module is used to measure the aftertreatment SCR intermediate temperature and aftertreatment SCR outlet temperature. The temperature probes are permanently attached to the aftertreatment SCR temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

Aftertreatment SCR catalyst gas temperature measurement is in-range but not rational.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2483	SCR INLET TEMP SCR OUTLET TEMP DPF DELTA PRESS DPF DELTA PRESS SENS V	Diagnosis condition	This diagnostic runs when the engine is running and exhaust flow is above a minimum level
		Signal (terminal)	SCR pressure and temperature sensor signals.
		Threshold	The Engine Control Module (ECM) detected the aftertreatment SCR outlet temperature sensor signal was irrational for more than 5 minutes.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment SCR outlet temperature sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:
1. Start vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Perform coast down event from 88 km/h (55 MPH) to 72 km/h (45 MPH) for 2 minutes.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Check 1st trip DTC.

Is P2483 DTC detected?

YES >> Proceed to EC-1912, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420726

1.CHECK FOR RELATED DIAGNOSTIC TROUBLE CODES

1. Turn ignition switch ON.
2. Connect CONSULT and check for the following current “ENGINE” diagnostic trouble codes:

- U1612
- P1625
- P1626
- P1627
- P1628

Are any of the above DTCs current?

YES >> Refer to EC-838, "DTC Index".
NO >> • A malfunctioning aftertreatment selective catalytic reduction temperature sensor module has been detected. Replace the SCR temperature sensor module. Refer to EX-55, "Removal and Installation".
• GO TO 2.

2.ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P2483 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1912, "DTC Description".
NO >> Repair complete.

P2493 EGR COOLER BYPASS POSITION SENSOR INTERMITTENT

DTC Description

INFOID:0000000014420727

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P0652 present. Refer to EC-1437, "DTC Description".
- P0653 present. Refer to EC-1445, "DTC Description".
- P245C present. Refer to EC-1876, "DTC Description".
- P245D present. Refer to EC-1879, "DTC Description".
- P2494 present. Refer to EC-1918, "DTC Description".
- P2495 present. Refer to EC-1922, "DTC Description".

The Exhaust Gas Recirculation Cooler Bypass Valve (EBV) is used to redirect the EGR gases around the cooler when the engine is under certain operating conditions. The Engine Control Module (ECM) opens and closes the EBV based on engine conditions. The EBV sends the valve position status back to the ECM.

DTC DETECTION LOGIC

The EGR bypass valve position feedback value is in range high.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2493	EGR BYPASS VLV POS V EGR BYPASS VLV CMD	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	EGR bypass valve position sensor signal.
		Threshold	The ECM detected the EGR bypass valve is stuck or not meeting commanded position.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Engine harness high resistance
- Malfunctioning EGR bypass valve

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release the accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.

NOTE:
- Checking the vehicle speed with GST is advised.
- When steady-state driving is performed again even after it is interrupted, each diagnosis can be conducted. In this case, the time required for diagnosis may be extended.

Is 1st trip DTC detected?

YES >> Proceed to EC-1914, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420728

1.CHECK DTC PRIORITY

1. Start the engine and let it idle for 1 minute.
2. Turn engine OFF.
3. Turn ignition switch ON.
4. Connect CONSULT and check for existing ENGINE diagnostic trouble codes:

- P0652

- P0653
- P245C
- P245D
- P2494
- P2495

Are any of the above current DTCs present?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. INSPECT EGR BYPASS VALVE ACTUATOR AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the EGR bypass valve actuator connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> • Repair or replace error-detected parts.
• GO TO 10.

3. CHECK THE EGR BYPASS SENSOR SUPPLY AND RETURN CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between EGR bypass actuator position sensor supply and return circuits at the EGR bypass valve connector.

EGR bypass valve			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F145	2	3	5

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 6.

4. CHECK THE CIRCUIT RESPONSE

1. Wait 30 seconds.
2. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2495 DTC current?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the EGR bypass actuator position sensor RETURN circuit terminal 3 and the SIGNAL circuit terminal 4 at the EGR bypass actuator connector.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2494 DTC current?

YES >> • A malfunctioning EGR bypass valve actuator position sensor has been detected. Replace the EGR bypass valve actuator. Refer to EM-290, "Removal and Installation".
• GO TO 10.
NO >> GO TO 6.

6. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Disconnect the ECM F101 connector.
4. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 7.
NO >> • Repair or replace error-detected parts.
• GO TO 10.

7. CHECK THE ECM RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2495 DTC current?

YES >> GO TO 8.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 10.

8. CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Connect a jumper wire between ECM connector F101 return circuit pin 127 and signal circuit pin 172.
2. Turn ignition switch ON.
3. Wait for 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P2494 become current?

YES >> GO TO 9.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 10.

9. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Start the engine and let it idle for 1 minute.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P2493 become current?

YES >> • High resistance has been detected in the engine harness. Repair or replace the engine harness.
• GO TO 10.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 10.

10. ERASE CURRENT DTCS

1. Turn ignition switch OFF.

2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Operate the engine within the "Conditions for Clearing DTC".
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2493 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1914, "DTC Description".
NO >> Repair complete.

P2494 EGR COOLER BYPASS POSITION SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420729

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P0652 present. Refer to EC-1437, "DTC Description".
- P0653 present. Refer to EC-1445, "DTC Description".

The Exhaust Gas Recirculation Cooler Bypass Valve (EBV) is used to redirect the EGR gases around the cooler when the engine is under certain operating conditions. The Engine Control Module (ECM) opens and closes the EBV based on engine conditions. The EBV sends the valve position status back to the ECM.

DTC DETECTION LOGIC

EGR bypass valve position is less than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2494	EGR BYPASS VLV POS V EGR BYPASS VLV CMD	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	EGR bypass valve position sensor signal
		Threshold	The ECM detected the EGR bypass valve position signal voltage is less than 0.3V.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Signal circuit shorted to ground in the harness
- Malfunctioning EGR bypass valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P2494 current on the CONSULT screen.

Is P2494 DTC current?

YES >> Go to EC-1918, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420730

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes:

- P0652
- P0653

Are any of the above current DTCs present?

YES >> Refer to EC-838, "DTC Index".

NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

1. Start the engine and let it idle for 1 minute.
2. Turn engine OFF.
3. Turn ignition switch ON.
4. Using CONSULT, check for existing “ENGINE” diagnostic trouble codes.

Is P2494 DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT EGR COOLER BYPASS VALVE ACTUATOR AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the EGR cooler bypass valve actuator connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

4.CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the EGR cooler bypass actuator position sensor POWER circuit terminal 2 and the SIGNAL circuit terminal 4 at the EGR bypass actuator connector.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2495 DTC current and P2494 DTC past?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE EGR BYPASS SENSOR POWER SUPPLY AND RETURN CIRCUITS

1. Disconnect the jumper wire.
2. Check the voltage between EGR bypass actuator position sensor supply and return circuits at the EGR bypass valve connector.

EGR bypass valve			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F145	2	3	5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6.CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2494 DTC current?

YES >> • Replace the EGR cooler bypass valve actuator. Refer to EM-290, "Removal and Installation".
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

7. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Disconnect the ECM F101 connector.
4. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Connect a jumper wire between ECM connector F101 return circuit pin 127 and signal circuit pin 172.
2. Turn ignition switch ON.
3. Wait for 30 seconds.
4. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P2494 become current and DTC P2495 past?

YES >> GO TO 9.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

9. CHECK FOR PAST DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Wait 30 seconds.
6. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2494 DTC current?

YES >> • A pin-to-pin short circuit has been detected on the SIGNAL wire of the engine harness. Repair or replace the engine harness.
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

10. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the ECM F101 connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

11. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUITS

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Turn ignition switch ON.
2. Check the voltage between EGR bypass actuator position sensor supply pin 106 and return circuit pin 127 at the ECM.

Is the voltage approximately 5V?

YES >> GO TO 12.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

12. CHECK FOR PAST DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2494 DTC current?

YES >> • An open return circuit has been detected in the engine harness. Repair or replace the engine harness.
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

13. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
6. Operate the engine within the "Conditions for Clearing DTC".
7. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2494 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1918, "DTC Description".
NO >> Repair complete.

P2495 EGR COOLER BYPASS POSITION SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420731

NOTE:
If any of the following "current" DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P0652 present. Refer to EC-1437, "DTC Description".
- P0653 present. Refer to EC-1445, "DTC Description".

The Exhaust Gas Recirculation Cooler Bypass Valve (EBV) is used to redirect the EGR gases around the cooler when the engine is under certain operating conditions. The Engine Control Module (ECM) open and close the EBV based on engine conditions. The EBV sends the valve position status back to the ECM.

DTC DETECTION LOGIC

EGR bypass valve position greater than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2495	EGR BYPASS VLV POS V EGR BYPASS VLV CMD	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	EGR bypass valve position sensor signal
		Threshold	The ECM detected the EGR bypass valve position signal voltage is greater than 4.7V.
		Diagnosis delay time	—

POSSIBLE CAUSE

- A short circuit to voltage source in the engine harness
- An open circuit in the engine harness
- Malfunctioning EGR bypass valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2495 being current on the CONSULT screen.

Is P2495 DTC current?

YES >> Go to EC-1922, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420732

1.CHECK DTC PRIORITY

1. Start the engine and let it idle for 1 minute.
2. Turn engine OFF.
3. Turn ignition switch ON.
4. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes:

- P0652
- P0653

Are any of the above current DTCs present?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2. CHECK FOR CURRENT DTC

Using CONSULT, check for existing “ENGINE” diagnostic trouble codes.

Is P2495 DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT EGR COOLER BYPASS VALVE ACTUATOR AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the EGR cooler bypass valve actuator connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

4. CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the EGR cooler bypass actuator position sensor RETURN circuit terminal 3 and the SIGNAL circuit terminal 4 at the EGR bypass actuator connector.
2. Turn ignition switch ON.
3. Wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2494 DTC current and P2495 DTC past?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK THE EGR BYPASS SENSOR POWER SUPPLY AND RETURN CIRCUITS

1. Disconnect the jumper wire.
2. Check the voltage between EGR bypass actuator position sensor supply and return circuits at the EGR bypass valve connector.

EGR bypass valve			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F145	2	3	5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6. CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2495 DTC current?

YES >> • Replace the EGR cooler bypass valve actuator. Refer to EM-290, "Removal and Installation".
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

7. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Disconnect the ECM F101 connector.
4. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Connect a jumper wire between ECM connector F101 return circuit pin 127 and signal circuit pin 172.
2. Turn ignition switch ON.
3. Wait for 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did DTC P2494 become current and DTC P2495 past?

YES >> GO TO 9.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

9. CHECK FOR PAST DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Wait 30 seconds.
6. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2495 DTC current?

YES >> • A pin-to-pin short circuit has been detected on the SIGNAL wire of the engine harness. Repair or replace the engine harness.
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

10. INSPECT ECM AND ELECTRICAL CONNECTIONS

1. Turn ignition switch OFF.
2. Disconnect the ECM F101 connector.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

11. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUITS

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Turn ignition switch ON.
2. Check the voltage between EGR bypass actuator position sensor power supply pin 106 and return circuit pin 127 at the ECM.

Is the voltage approximately 5V?

YES >> GO TO 12.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

12. CHECK FOR PAST DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2495 DTC current?

YES >> • An open return circuit has been detected in the engine harness. Repair or replace the engine harness.
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

13. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
6. Operate the engine within the "Conditions for Clearing DTC".
7. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Is P2495 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1922, "DTC Description".
NO >> Repair complete.

P249E CLOSED LOOP REDUCTANT INJECTION FLOW TOO HIGH

DTC Description

INFOID:0000000014420733

The SCR dosing system is an in-tank system with a DEF control module that controls the dosing pump and monitors Urea heating, level, quality, pressure and temperature. This dosing system is powered by battery voltage and an initialization signal from the Urea heater relay. The DEF control module activates priming, dosing, heating and purging of Urea using data provided by the Engine Control Module (ECM) via CAN communication. The DEF control module performs its own diagnostics and reports malfunctions back to the ECM. The ECM then decodes the error and converts it to a DTC.

DTC DETECTION LOGIC

Aftertreatment SCR feedback control status - Mechanical system not responding or out of adjustment. The maximum dosing adjustment has been reached.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P249E	DEF PUMP DOSING RATE DEF PUMP DOSING VOLUME DEF PUMP STATUS DEF PUMP TIME DEF LINE PRESS DEF DOSING VALVE POS CMD	Diagnosis condition	This diagnostic has to meet specific engine and aftertreatment conditions to run and complete.
		Signal (terminal)	DEF pump dosing command signal
		Threshold	The ECM detected the adjusted aftertreatment DEF dosing command has reached a maximum limit.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Damaged generator causing low voltage
- Weak or damaged battery

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CHECK

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P249E being current on the CONSULT screen.

Is P249E DTC current?

YES >> Go to EC-1926, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420734

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Using CONSULT, check for other “ENGINE“ diagnostic trouble codes.
3. Look for DEF dosing, NOx sensor, SCR temperature, or EGR related DTCs, and perform the confirmation procedure (diagnosis procedure) for these other DTCs first.

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DEF QUALITY

1. Turn ignition switch OFF.
2. Check the DEF quality by visually inspecting the DEF in the tank for signs of debris or contamination.
3. Using a refractometer [SST: J-54466], measure the concentration of the DEF in the tank.

Is DEF free from contamination and concentration within 32.5 Â± 1.5 %?

YES >> GO TO 3.
NO >> Drain the DEF tank, rinse with water, and refill with pure DEF.

3. PERFORM DEF DOSING UNIT OVERRIDE TEST

1. Remove the aftertreatment DEF dosing valve from the decomposition tube.
2. Place the DEF dosing valve in a measuring container having greater than a 1.5 liter [50 oz] capacity.
3. Turn ignition switch ON.
4. Using CONSULT, access “ENGINE” and select ″DEF Dosing Unit Override Test″ active test.

Did the DEF dosing unit operate according to specifications?

YES >> GO TO 4.
NO >>
- Replace the DEF supply pump assembly. Refer to EX-64, "Exploded View".
- GO TO 4.

4. PERFORM SCR PERFORMANCE TEST

1. Connect all components and harness connectors.
2. Start the engine.
3. Using CONSULT, access “ENGINE” and select ″SCR Performance Test″ active test.

Did the SCR performance test complete?

YES >> GO TO 6.
NO >> GO TO 5.

5. CHECK DEF DEPOSITS IN THE DECOMPOSITION TUBE

1. Turn ignition switch OFF (do not operate the engine).
2. Inspect the decomposition tube for deposits.
3. Remove the decomposition tube from the vehicle.
4. Inspect for excessive DEF deposits.

Are excessive DEF deposits found inside the decomposition tube?

YES >>
- Clean and install the decomposition tube.
- GO TO 6.

NO >>
- Repeat the SCR Performance Test again.
- GO TO 6.

6. CHECK THE STATUS OF THE SCR CATALYST OUTLET NOX SENSOR TEST

1. Stop the engine.
2. Turn ignition switch ON.
3. With CONSULT, check the results of the SCR Performance Test.
4. Check the status of the SCR Catalyst Outlet NOx Sensor Test portion of the SCR Performance Test.

Did SCR catalyst outlet NOx sensor test pass?

YES >> GO TO 7.
NO >>
- An in-range malfunction has been detected in the aftertreatment outlet NOx sensor. Replace the aftertreatment outlet NOx sensor. Refer to EX-48, "Removal and Installation".
- GO TO 8.

7. CHECK THE STATUS OF THE SCR CATALYST TEST

1. With CONSULT, check the results of the SCR Performance Test.
2. Check the result of the SCR Performance Test.

Did SCR catalyst test pass?

YES >> GO TO 8.
NO >>
- A malfunctioning SCR catalyst has been detected. Replace the aftertreatment SCR catalyst. Refer to EX-42, "Removal and Installation".
- GO TO 8.

8. ERASE CURRENT DTC

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Check for ENGINE diagnostic trouble codes.

Is P249E DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1926, "DTC Description".

NO >> Repair complete.

P24A0 DPF REGENERATION TEMPERATURE TOO LOW

DTC Description

INFOID:0000000014420735

The aftertreatment diesel particulate filter temperature sensor module is a smart device that communicates with the engine control module via CAN communication. The aftertreatment diesel particulate filter temperature sensor module performs its own internal diagnostics and reports malfunctions back to the engine control module using the CAN communication. The aftertreatment diesel particulate filter temperature sensor module is used to measure the aftertreatment diesel oxidation catalyst intake temperature, aftertreatment diesel particulate filter intake temperature, and aftertreatment diesel particulate filter outlet temperature. The temperature probes are permanently attached to the aftertreatment diesel particulate filter temperature sensor module and cannot be replaced individually.

DTC DETECTION LOGIC

The engine control module is unable to begin closed loop control of active regeneration of DPF due to low DOC temperature.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P24A0	DOC INLET TEMP DPF INLET TEMP DPF OUTLET TEMP CAC OUT TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	This diagnostic runs continuously when the engine is running and the ECM is requesting active regeneration of the aftertreatment diesel particulate filter.
		Signal (terminal)	DPF aftertreatment temperature sensors
		Threshold	DOC Bed Temperature < 280°C (536°F)
		Diagnosis delay time	—

POSSIBLE CAUSE

- DOC temperature not warm enough to inject fuel for active regeneration of the diesel particulate filter

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test.

1. Start the engine.
2. Connect CONSULT, select “ENGINE” and perform the ″Stationary Regeneration″ Active Test.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P24A0 being current on the CONSULT screen.

Is P24A0 DTC current?

YES >> Go to EC-1929, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420736

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is P24A0 DTC current?

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK THE AFTERTREATMENT DUTY CYCLE

1. Start the engine and allow it to idle.
2. Using CONSULT, select ENGINE, and perform “DPF Regeneration” under “Active Test”.
3. If new DTCs become current during the regeneration test, abort the procedure and diagnose the new DTCs.

Is DTC P24A0 is current or the regeneration did not complete?

YES >> • P24A0 is current: GO TO 3.
• Other DTCs are current: Refer to EC-838, "DTC Index".

NO >> GO TO 3.

3. ERASE CURRENT DTC

1. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
2. Operate the engine within the "Conditions for setting the DTC".
3. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P24A0 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1929, "DTC Description".
NO >> Repair complete.

P24A2 PARTICULATE FILTER REGENERATION INCOMPLETE

DTC Description

INFOID:0000000014420737

NOTE:
If any of the following ″current″ DTCs are displayed with this DTC, first perform the trouble diagnosis for these other DTCs:
- P2454 present. Refer to EC-1854, "DTC Description".
- P2455 present. Refer to EC-1858, "DTC Description".
- P2456 present. Refer to EC-1862, "DTC Description".
- P2460 present. Refer to EC-1885, "DTC Description".
- P2461 present. Refer to EC-1889, "DTC Description".
- P2462 present. Refer to EC-1893, "DTC Description".

The engine aftertreatment system monitors the soot load in the aftertreatment diesel particulate filter. Under normal operating conditions, the aftertreatment diesel particulate filter is self cleaning, where soot is converted to carbon dioxide, nitrogen, and water. Under light load operating conditions, it can be necessary to perform a stationary regeneration of the aftertreatment diesel particulate filter. The soot load in the aftertreatment diesel particulate filter is estimated using the aftertreatment differential pressure sensor and the calculated soot output of the engine.

DTC DETECTION LOGIC

Aftertreatment Diesel Particulate Filter Incomplete Regeneration - Condition Exists. The system has detected that the aftertreatment diesel particulate filter differential pressure is too high following an active regeneration.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P24A2	DPF OUTLET PRESS DPF DELTA PRESS DPF DELTA PRESS SENS V DPF INLET TEMP DPF OUTLET TEMP SCR INLET TEMP SCR OUTLET TEMP	Diagnosis condition	This diagnostic only runs after successful completion of an active regeneration of the aftertreatment diesel particulate filter
		Signal (terminal)	Outlet pressure and temperature sensor signals
		Threshold	The Engine Control Module (ECM) detected the DPF differential pressure is higher than expected after regeneration
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning aftertreatment temperature sensors
- A face plugged aftertreatment diesel oxidation catalyst
- A malfunctioning aftertreatment diesel particulate filter differential pressure sensor
- An engine malfunction resulting in high engine out soot
- A damaged or malfunctioning OEM wiring harness to the differential pressure sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CHECK

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P24A2 being current on the CONSULT screen.

Is P24A2 DTC current?

YES >> Go to EC-1931, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420738

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing ENGINE diagnostic trouble codes.

Is P24A2 DTC current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK FOR OTHER RELATED DIAGNOSTIC TROUBLE CODES

Using CONSULT, check for the following current or past ENGINE diagnostic trouble codes:
- P2454
- P2455
- P2456
- P2460
- P2461
- P2462

Are any of the above current or past DTCs present?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK FOR CURRENT OR PAST FUEL SYSTEM RELATED DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for fuel system related DTCs.

Is any applicable DTC current or past?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 4.

4.CHECK FOR CURRENT OR PAST AIR HANDLING SYSTEM RELATED DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for air handling system DTCs.

Is any of P0106 or P0299 DTCs current or past?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 5.

5.CHECK FOR CURRENT OR PAST EGR OR TURBOCHARGER SYSTEM RELATED DTCS

1. Using CONSULT, check for other ENGINE diagnostic trouble codes.
2. Look for EGR and turbocharger system related DTCs.

Are any applicable current or past DTCs?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 6.

6.CHECK FOR CURRENT OR PAST AFTERTREATMENT SYSTEM RELATED DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for aftertreatment system related DTCs.

Any of P0420, P0544, P2031 or P242B DTCs current or past?

YES >> Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
NO >> GO TO 7.

7.CHECK FOR CURRENT OR PAST AFTERTREATMENT DPF SYSTEM RELATED DTCS

1. Using CONSULT, check for other “ENGINE” diagnostic trouble codes.
2. Look for aftertreatment system related DTCs.

Are any of P1451, P242F or P2463 DTCs current or past?

YES >>
- Without the presence of DTC P24A2: Perform diagnosis of applicable DTCs first, then return to this DTC. Refer to EC-838, "DTC Index".
- With DTC P24A2 present: GO TO 8.

NO >> GO TO 8.

8.MONITOR AFTERTREATMENT DPF DIFFERENTIAL PRESSURE SENSOR WITH CONSULT

1. Using CONSULT, select ENGINE, Data Monitor and verify the "DPF DELTA PRESS SENS V".

2. Expected voltage reading is 0.69V ± 0.1V at ≤ 25°C (77°) or 0.69V± 0.06V at ≥ 26°C (78°F).

Is DPF differential pressure sensor voltage reading within specification?

YES >> GO TO 9.
NO >> • An issue with the DPF differential pressure sensor or associated wiring has been found:
- Check for a short between the SIGNAL pin and other pins at the sensor harness.
- Check for high resistance in the RETURN pin circuit of the sensor harness.
- Replace the DPF differential pressure sensor if the wiring checks OK. Refer to EX-58, "Removal and Installation".
• GO TO 9.

9. CHECK AFTERTREATMENT DPF DIFFERENTIAL PRESSURE SENSOR TUBES FOR BLOCKAGE

1. Turn ignition switch OFF.
2. Inspect the DPF differential pressure sensor tubes for blockage, kinking or leaking.

Are any blockage, kinking or leaking found?

YES >> • Clean, repair or replace the DPF differential pressure sensor tubes as necessary. Refer to EX-36, "Removal and Installation".
• GO TO 10.
NO >> GO TO 10.

10. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect the DPF differential pressure sensor.
3. Turn ignition switch ON.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Are both P2454 and P2460 DTCs current?

YES >> GO TO 11.
NO >> • An issue with the DPF differential pressure sensor or associated wiring has been found. Check harness for proper location between the ECM and the sensor.
• GO TO 11.

11. CHECK THE DPF DIFFERENTIAL PRESSURE SENSOR WIRING

1. Turn ignition switch OFF.
2. Connect a jumper wire between DPF differential pressure sensor connector C28 power supply terminal 4 and delta pressure signal circuit terminal 2.
3. Turn ignition switch ON.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Are both P2455 and P2461 DTCs current?

YES >> GO TO 12.
NO >> • An issue with the DPF differential pressure sensor or associated wiring has been found. Check harness for proper pin to pin location between the ECM and the sensor.
• GO TO 12.

12. CHECK FOR DEBRIS IN THE FUEL TANK

1. Turn ignition switch OFF.
2. Remove the jumper wire.
3. Remove the fuel tank filter cap.
4. Check for debris in the fuel tank.

Are any debris found in the tank?

YES >> • Remove the debris from the tank.
• GO TO 13.
NO >> GO TO 13.

13. INSPECT THE AFTERTREATMENT DPF

1. Remove the aftertreatment Diesel Oxidation Catalyst (DOC) and Diesel Particulate Filter (DPF) assembly.
2. Inspect the aftertreatment DOC.
3. Check the intake face of the aftertreatment DOC for damage, soot accumulation and/or face plugging.

Are more than 50% of the cells on the intake face completely blocked by soot?

YES >> • If the aftertreatment DPF required replacement for excessive ash and has **not** reached the normal ash cleaning interval, further troubleshooting is required. Check for lubricating oil consumption, coolant consumption, or previous repairs that may have corrected an issue resulting in lubricating oil or coolant consumption.
• Replace the DOC and DPF assembly. Refer to EX-42, "Removal and Installation".
• GO TO 14.

NO >> GO TO 14.

14. INSPECT THE EXHAUST FOR EXCESSIVE SMOKE

1. Disconnect the exhaust from the aftertreatment inlet.
2. Start the engine.
3. Perform two “Snap Acceleration Tests” from low to high idle. Hold the engine at high idle for 5 seconds.

NOTE:
A small puff of black smoke upon acceleration that clears at a steady high idle speed is normal.

Is Excessive black smoke during acceleration or constant black smoke at high idle?

YES >> Refer to the appropriate diagnosis procedure to correct the cause of excessive smoke. Refer to EC-1986, "Symptom Table".

NO >> • Replace the DOC/DPF assembly. Refer to EX-42, "Removal and Installation".
• If the aftertreatment DPF requires replacement for excessive ash and has not reached the normal ash cleaning interval, further troubleshooting is required.
• Check for lubricating oil consumption, coolant consumption, or previous repairs that may have corrected an issue resulting in lubricating oil or coolant consumption.
• GO TO 15.

15. ERASE CURRENT DTC

1. Connect all harness components and connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
4. Operate the engine within the "Conditions for setting the DTC".
5. Using CONSULT, check for “ENGINE” diagnostic trouble codes.

Is P24A2 DTC current?

YES >> Return to Diagnosis Procedure. Refer to EC-1931, "DTC Description".

NO >> Repair complete.

P2509 ECM POWER INPUT SIGNAL INTERMITTENT

DTC Description

INFOID:0000000014420739

The Engine Control Module (ECM) receives constant voltage from the batteries through the unswitched battery wires that are connected directly to the positive (+) battery post. The ECM receives switched battery input through the ignition switch wire when the ignition switch is turned ON. At ignition switch OFF, the Engine Control Module (ECM) stays powered for a short period of time. During this time, the ECM will begin to save important data into memory. If the ECM is wired improperly, maintenance and DTC data could be corrupted or inaccurate.

DTC DETECTION LOGIC

RAM image storage has not completed for every time that it has started.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2509	BATTERY VOLTAGE ACC POS SENS V ACC POS SENS 2 V	Diagnosis condition	Ignition switch ON or the engine is running.
		Signal (terminal)	Supply voltage to the ECM signal
		Threshold	ECM detected the ECM power supply was removed before power-down parameters could be saved. The DTC will be active when the ignition switch is turned ON following the incomplete power-down event.
		Diagnosis delay time	—

POSSIBLE CAUSE

- Loose battery connection
- High resistance in harness or connectors

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2509 being current on the CONSULT screen.

Is P2509 DTC current?

YES >> Go to EC-1935, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420740

1.CHECK FOR CURRENT DTC

1. Turn ignition switch ON.
2. Connect CONSULT and check for existing “ENGINE” diagnostic trouble codes.

Is DTC P2509 current?

YES >> GO TO 2.
NO >> • If past DTC P2509 is found in the ECM, check the battery disconnect devices in the vehicle. If ignition switch and ECM power are disconnected at the same time, DTC P2509 will be logged.
• GO TO 12.

2.CHECK BATTERIES AND POWER CONNECTOR

1. Turn ignition switch OFF.
2. Check battery connections.
3. Check battery terminal connections.

Are connections tight and corrosion-free?

YES >> GO TO 3.
NO >> • Tighten the loose connections, and clean the terminals.
• GO TO 12.

3.CHECK BATTERY VOLTAGE

1. Turn ignition switch ON.
2. Check battery voltage.
3. Place the positive (+) probe of the multimeter on the positive battery terminal and touch the negative (-) probe to the negative battery terminal while trying to start the engine.

Does the normal condition exists of approximately battery voltage and > 6.2V during cranking?

YES >> GO TO 4.
NO >> • Charge or replace the battery.
• GO TO 12.

4.INSPECT THE HARNESS AND ECM CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM.
3. Inspect connector for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Repair or replace error-detected parts.
• GO TO 12.

5.CHECK FOR AN OPEN CIRCUIT IN THE BATTERY POWER CIRCUIT

Using a multimeter, measure the voltage between the ECM battery supply and engine block ground.

ECM			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
E93	83	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 6.

6.VERIFY THE FUSE IS INSTALLED CORRECTLY

1. Turn ignition switch OFF.
2. Inspect fuse #68 (5A) for correct installation.

Is the fuse installed correctly?

YES >> GO TO 7.
NO >> • Install the fuse correctly.
• GO TO 12.

7.CHECK FOR A BLOWN FUSE

1. Turn ignition switch OFF.
2. Check the ECM battery fuse #68 for open.

Is the fuse open?

YES >> • Locate and repair short in the harness.
• Replace the blown fuse.
• GO TO 12.
NO >> GO TO 8.

8.CHECK ADD-ON ACCESSORY WIRING AT BOTH BATTERY POSITIVE TERMINALS

1. Check for add-on or the accessory wiring at the (+) terminal of the batteries.
2. Examine wiring for damaged insulation or an installation error that can cause the supply wire to be shorted to the engine block.

Are there any damaged wires?

YES >> • Locate and repair the damaged wiring.
• GO TO 12.
NO >> • Repair or replace the wiring harness between the ECM and the battery.
• GO TO 12.

9.CHECK THE RESISTANCE OF THE BATTERY SUPPLY CIRCUIT

1. Disconnect the positive terminals from both batteries.
2. Use a digital multimeter, set it to low resistance mode and calibrate it to zero.
3. Measure the resistance between the ECM battery SUPPLY (+) terminal 83 and the positive battery connector.
4. Measure the resistance between the ECM battery SUPPLY (-) terminals 1, 2, 4 and the negative battery connector.

ECM		Battery post cable	Continuity
Connector	Terminal		
E93	83	Positive battery terminal	< 1.0 Ω
	1	Positive negative terminal	
	2		
	4		

Is the resistance less than 1.0 ohm?

YES >> GO TO 10.
NO >> • Repair or replace the wiring harness for high resistance.
• GO TO 12.

10.CHECK THE IGNITION SWITCH CIRCUIT TO THE ECM FOR RESISTANCE

Measure the resistance of the ignition circuit between the ECM terminal 65 and the IPDM E/R fuse #40 (15A).

ECM		IPDM E/R	Continuity
Connector	Terminal	Terminal	
E93	65	Fuse #40	< 5.0 Ω

Is the resistance less than 5.0 ohms?

YES >> GO TO 11.
NO >> • Repair or replace the wiring harness for high resistance.
• GO TO 12.

11.CHECK THE IGNITION SWITCH INPUT CIRCUIT FOR RESISTANCE

Measure the resistance of the power circuit between the battery positive terminal and the IPDM E/R.

Battery post cable	IPDM E/R	Continuity
Positive battery terminal	Battery supply	< 5.0 Ω

Is the resistance less than 5.0 ohms?

YES >> GO TO 12.
NO >> • Repair or replace the wiring harness for high resistance.
• GO TO 12.

12. ERASE THE DIAGNOSTIC TROUBLE CODES

1. Connect all harness connectors.
2. Turn ignition switch ON.
3. Using CONSULT, erase “ENGINE” DTCs.
4. Operate the engine within the "Conditions for Clearing the DTC".
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2509 DTC current?

YES >> Return to diagnostic procedure. Refer to EC-1935, "DTC Description".
NO >> Repair complete.

P2540 LOW FUEL PRESSURE SENSOR

DTC Description

INFOID:0000000014420741

NOTE:
If any of the following DTCs is displayed with this DTC, first perform the trouble diagnosis for other DTC:
- P008A present. Refer to EC-1002, "DTC Description".
- P0252 present. Refer to EC-1151, "DTC Description".
- P0253 present. Refer to EC-1154, "DTC Description".
- P0254 present. Refer to EC-1157, "DTC Description".
- P2541 present. Refer to EC-1943, "DTC Description".
- P2542 present. Refer to EC-1947, "DTC Description".

The Engine Control Module (ECM) provides a 5V supply and ground to the fuel pressure sensor on the sensor supply circuit.The fuel pressure sensor provides a signal to the ECM on the fuel pressure sensor signal circuit. This sensor monitors the fuel pressure from the low fuel pressure system (lift pump to the Stage 2 filter).

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the fuel pressure is greater than or equal to 7 bar.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2540	FUEL SPLY PRESS FUEL SPLY PRESS V TURBO COMP INLET PRESS TURBO COMP INLET PRESS V	Diagnosis condition	Continuously when the engine is running
		Signal (terminal)	Stage 1 fuel pressure sensor signal
		Threshold	Fuel Pump Inlet Pressure ≥ 7 bar for 1 second at the expiration of a sensor rationality check delay time of 10 seconds
		Diagnosis delay time	—

POSSIBLE CAUSE

- A malfunctioning fuel lift pump
- A malfunctioning fuel pressure sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:
1. Turn ignition switch OFF.
2. Turn ignition switch ON and wait 2 minutes.
3. Start the engine and let it idle for 1 minute.
4. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2540 being current on the CONSULT screen.

Is P2540 DTC current?

YES >> Go to EC-1939, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420742

1.CHECK DTC PRIORITY

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

3. Are any of the following displayed as current or do they have high past counts on the CONSULT screen:
- P008A
- P0252
- P0253
- P0254
- P2541
- P2542

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

Check for DTC P2540 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.MONITOR THE FUEL PRESSURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect the lift pump (Stage 1 fuel pump).
3. Turn ignition switch ON and wait 30 seconds.
4. Using CONSULT, select “ENGINE” and check the ″FUEL SPLY PRESS″ and ″TURBO COMP INLET PRESS″.

Is the fuel pressure sensor reading within ±0.5 bar of the compressor intake pressure?

YES >> GO TO 4.
NO >> • Replace the fuel pressure sensor. Refer to FL-56, "Removal and Installation".
• GO TO 10.

4.INSPECT FUEL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the fuel pressure sensor.
3. Inspect the harness connector for the following:
- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 5.
NO >> • Repair or replace error-detected parts.
• GO TO 10.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is DTC P2541 current?

YES >> GO TO 6.
NO >> GO TO 7.

6.CHECK THE CIRCUIT RESPONSE

1. Connect a jumper wire between the fuel pressure sensor SIGNAL terminal 3 and POWER terminal 1 of the fuel pressure sensor connector F197.
2. Wait 30 seconds.

3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is DTC P2542 current?

YES >> • Replace the fuel pressure sensor. Refer to FL-56, "Removal and Installation".
• GO TO 10.
NO >> GO TO 7.

7. INSPECT ECM AND HARNESS CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM harness connector F101.
3. Inspect the ECM connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 10.

8. CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is DTC P2541 current?

YES >> GO TO 9.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 10.

9. CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Connect a jumper wire between ECM pins 127 and 130 at the ECM.
2. Wait for 30 seconds.
3. With CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2542 DTC current?

YES >> • High resistance or short circuit has been detected in the engine harness. Repair or replace the engine harness.
• GO TO 10.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 10.

10. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON.
5. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
6. Operate the engine within the ″Conditions for clearing the DTC″.
7. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Is P2540 DTC current?

YES >> Troubleshooting procedure need to be repeated. Go to EC-1939, "DTC Description".
NO >> The removal and installation of the connector corrected the issue. Repair complete.

P2541 FUEL PRESSURE SENSOR

DTC Description

INFOID:0000000014420743

NOTE:
Repair any existing DTCs related to power sensor supply circuit before performing diagnosis procedure for this DTC.

The Engine Control Module (ECM) provides a 5V supply and ground to the fuel pressure sensor on the sensor supply circuit.The fuel pressure sensor provides a signal to the ECM on the fuel pressure sensor signal circuit. This sensor monitors the fuel pressure from the low fuel pressure system (lift pump to the Stage 2 filter).

DTC DETECTION LOGIC

Fuel supply pressure sensor reading is less than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2541	FUEL SPLY PRESS FUEL SPLY PRESS V	Diagnosis condition	Continuously when the ignition switch is in the ON position
		Signal (terminal)	Stage 1 fuel pressure sensor signal
		Threshold	The ECM detected the fuel pressure signal voltage is less than 0.2 V for 3 seconds
		Diagnosis delay time	—

POSSIBLE CAUSE

- Signal circuit open or shorted to ground in the engine harness or sensor
- A malfunctioning fuel pressure sensor
- A malfunctioning ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2541 being current on the CONSULT screen.

Is P2541 DTC current?

YES >> Go to EC-1943, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420744

1.CHECK DTC PRIORITY

1. Repair DTCs related to power sensor supply circuit before performing diagnosis procedure for this DTC.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

Are any power sensor supply related DTCs detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

Check for DTC P2541 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT FUEL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the fuel pressure sensor.
3. Inspect the harness connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

4.CHECK THE PRESSURE SENSOR POWER SUPPLY AND GROUND CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between fuel pressure sensor supply voltage and return circuit terminals.

Fuel pressure sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F197	1	2	5

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch OFF.
2. Connect a jumper wire between the fuel pressure sensor connector F197 power supply terminal 1 and signal circuit terminal 3.
3. Turn ignition switch ON and wait 30 seconds.
4. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.

Did DTC P2542 become current and DTC P2541 past?

YES >> GO TO 6.
NO >> GO TO 10.

6.CHECK THE DTC AND VERIFY FUEL PRESSURE SENSOR CONDITION

1. Turn ignition switch OFF.
2. Disconnect the jumper wire.
3. Reconnect the fuel pressure sensor.
4. Turn ignition switch ON and wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did P2541 DTC become current?

YES >> • A damaged sensor has been detected. Replace the fuel pressure sensor. Refer to FL-56, "Removal and Installation".
• GO TO 13.

NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Turn ignition switch ON.
2. Measure the voltage between ECM pins 106 (-) and 127 (+) at the ECM.

Is the voltage reading approximately 5V?

YES >> GO TO 9.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

9. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON and wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did P2541 DTC become past?

YES >> • The removal and installation of the connector corrected the issue. Repair complete.
• GO TO 13.
NO >> • An open or shorted fuel pressure sensor 5V supply circuit has been detected in the engine harness. Isolate all harnesses connected in series to determine which contains the open or pin-to-pin short. Repair as necessary.
• GO TO 13.

10. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.

- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

11. CHECK THE ECM RESPONSE

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Connect a jumper wire between ECM pins 106 and 130 at the ECM.
2. Wait for 30 seconds.
3. With CONSULT, check for current ENGINE diagnostic trouble codes.

Did DTC P2542 become current and DTC P2541 past?

YES >> GO TO 12.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

12. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Disconnect jumper wire.
3. Connect all harness connectors.
4. Turn ignition switch ON and wait 30 seconds.
5. Using CONSULT, check for current ENGINE diagnostic trouble codes.

Did P2541 DTC become past?

YES >> • An open or shorted fuel pressure sensor 5V supply circuit has been detected in the engine harness. Isolate all harnesses connected in series to determine which contains the open or pin-to-pin short. Repair as necessary.
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue. Repair complete.
• GO TO 13.

13. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2541 DTC past?

YES >> GO TO 14.
NO >> Return to Diagnosis Procedure. Refer to EC-1943, "DTC Description".

14. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did all DTCs get erased with none remaining?

YES >> Repair complete.
NO >> Go to the appropriate Diagnosis Procedure. Refer to EC-838, "DTC Index".

P2542 FUEL PRESSURE SENSOR

DTC Description

INFOID:0000000014420745

NOTE:
Repair any existing DTCs related to power sensor supply circuit before performing diagnosis procedure for this DTC.

The engine control module (ECM) provides a 5V supply and ground to the fuel pressure sensor on the sensor supply circuit.The fuel pressure sensor provides a signal to the ECM on the fuel pressure sensor signal circuit. This sensor monitors the fuel pressure from the low fuel pressure system (lift pump to the stage 2 filter).

DTC DETECTION LOGIC

Fuel supply pressure sensor reading is greater than specified operating range for a calibrated amount of time.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2542	FUEL SPLY PRESS FUEL SPLY PRESS V	Diagnosis condition	Continuously when the ignition switch is in the ON position.
		Signal (terminal)	Stage 1 fuel pressure sensor signal
		Threshold	The ECM detected the fuel pressure signal voltage is greater than 4.8 V for 3 seconds
		Diagnosis delay time	—

POSSIBLE CAUSE

- Signal circuit shorted to voltage source
- Open return circuit in the engine harness, connector, or sensor
- A malfunctioning fuel pressure sensor
- A malfunctioning ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch OFF.
2. Start the engine and let it idle for 1 minute.
3. Turn ignition switch OFF.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Check 1st trip DTC.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2542 being current on the CONSULT screen.

Is P2542 DTC current?

YES >> Go to EC-1947, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420746

1.CHECK DTC PRIORITY

1. Repair DTCs related to power sensor supply circuit before performing diagnosis procedure for this DTC.
2. Turn ignition switch ON.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

Are there any power sensor supply related DTCs detected?

YES >> Refer to EC-838, "DTC Index".

NO >> GO TO 2.

2.CHECK FOR CURRENT DTC

Check for DTC P2542 being current on the CONSULT screen.

Is applicable DTC current?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3.INSPECT FUEL PRESSURE SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the fuel pressure sensor.
3. Inspect the harness connector for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

4.CHECK THE CIRCUIT RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is DTC P2541 current and DTC P2542 past?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK THE PRESSURE SENSOR POWER SUPPLY AND GROUND CIRCUITS

1. Turn ignition switch ON.
2. Check the voltage between fuel pressure sensor supply voltage and return circuit terminals.

Fuel pressure sensor			Voltage (V) (Approx.)
Connector	Terminal (+)	Terminal (-)	
F197	1	2	5

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 10.

6.CHECK THE DTC AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Wait 30 seconds.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is DTC P2542 current?

YES >> • A damaged sensor has been detected. Replace the fuel pressure sensor. Refer to FL-56, "Removal and Installation".
• GO TO 13.
NO >> GO TO 13.

7. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 8.
NO >> • Repair or replace error-detected parts.
• GO TO 13.

8. CHECK THE ECM RESPONSE

1. Turn ignition switch ON.
2. Wait 30 seconds.
3. With CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is DTC P2541 current and DTC P2542 past?

YES >> GO TO 9.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

9. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON and wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2542 DTC current?

YES >> • A pin-to-pin short circuit has been detected on the SIGNAL wire of the engine harness. Isolate all harnesses connected in series to determine which contains the open or pin-to-pin short. Repair as necessary.
• GO TO 13.
NO >> • The removal and installation of the connector corrected the issue.
• GO TO 13.

10. INSPECT ECM AND ELECTRICAL CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect the ECM connector F101.
3. Inspect connectors for the following:

- Loose connector.
- Corroded pins.
- Bent or broken pins.
- Pushed back or expanded pins.
- Moisture in or on the connector.
- Missing or damaged connector seals.
- Dirt or debris on or in the connector pins.
- Connector shell broken.
- Wire insulation damage.
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 11.
NO >> • Repair or replace error-detected parts.

• GO TO 13.

11. CHECK THE ECM SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

CAUTION:
Never bend pins or terminals. Extreme care should be taken when using a probe or a jumper into the pin side of a connector for the following reasons:
• Not to bend and damage pins and terminals.
• Not to probe or short unintended circuits and potentially damaging the control unit.

1. Turn ignition switch ON.
2. Measure the voltage between ECM pins 106 and 127 at the ECM.

Is the voltage reading approximately 5V?

YES >> GO TO 12.
NO >> • Replace the ECM. Refer to EC-1994, "Removal and Installation".
• GO TO 13.

12. CHECK FOR CURRENT DTC

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON and wait 30 seconds.
4. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did P2542 DTC become past?

YES >> • The removal and installation of the connector corrected the issue.
• GO TO 13.
NO >> • An open fuel pressure sensor RETURN circuit has been detected in the engine harness. Repair as necessary.
• GO TO 13.

13. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Is P2542 DTC past?

YES >> GO TO 14.
NO >> Return to Diagnosis Procedure. Refer to EC-1947, "DTC Description".

14. ERASE CURRENT DTCS

1. Turn ignition switch OFF.
2. Connect all harness connectors.
3. Turn ignition switch ON.
4. Using CONSULT, erase “ENGINE” diagnostic trouble codes.
5. Using CONSULT, check for current “ENGINE” diagnostic trouble codes.

Did all DTCs get erased with none remaining?

YES >> Repair complete.
NO >> Go to the appropriate Diagnosis Procedure. Refer to EC-838, "DTC Index".

P2558 ENGINE COOLANT LEVEL SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420747

The coolant level sensor is a switch and is used to measure the level of the engine coolant in the radiator top tank. The coolant level sensor is immersed in the coolant and returns a different signal voltage when immersed in coolant verses being out of coolant. The Engine Control Module (ECM) monitors the change in the signal voltage to determine the level of the engine coolant.

DTC DETECTION LOGIC

The ECM detected the coolant level sensor signal voltage was less than 0.58 V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P2558	Engine Coolant Level Sensor/ Switch Circuit Low (Coolant level sensor 1 circuit - voltage below normal or shorted to low source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant level sensor value < 0.371 V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Coolant level sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2558 being current on the CONSULT screen.

Is DTC P2558 current?

YES >> Go to EC-1951, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420748

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2558 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT COOLANT LEVEL SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect coolant level sensor connector E91.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3.CHECK CIRCUIT RESPONSE

1. Coolant level sensor connector E91 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P2559 being current and P2558 being past on the CONSULT screen after 1 minute.

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 5.

4.CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect coolant level sensor connector E91.
3. Turn ignition switch ON.
4. Check for DTC P2558 being current on the CONSULT screen after 30 seconds.

Is the inspection result normal?

YES >> Replace the engine coolant level sensor. Refer to CO-52, "Exploded View".
NO >> The removal and installation of the connector corrected the fault.

5.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector E93.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6.CHECK FOR AN OPEN SIGNAL CIRCUIT

1. Disconnect ECM connector E93 and coolant level sensor connector E91.
2. Check resistance between ECM connector E93 and coolant level sensor connector E91.

ECM		Coolant level sensor		Resistance
Connector	Terminal	Connector	Terminal	
E93	75	E91	2	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

7.CHECK FOR AN OPEN RETURN CIRCUIT

1. Disconnect ECM connector E93 and coolant level sensor connector E91.
2. Check resistance between ECM connector E93 and coolant level sensor connector E91.

ECM		Coolant level sensor		Resistance
Connector	Terminal	Connector	Terminal	
E93	41	E91	1	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

8.CHECK FOR A PIN TO PIN SHORT CIRCUIT

Check resistance between the terminals of ECM connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	75	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> A pin to pin short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

9.CHECK FOR A SHORT CIRCUIT TO GROUND

Check resistance between ECM connector E93 and ground.

ECM		Ground	Resistance
Connector	Terminal		
E93	75	—	> 100k Ω

Is the inspection result normal?

YES >> GO TO 10.
NO >> A short to ground on the signal circuit has been detected in the engine harness. Repair or replace the engine harness.

10.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect all components.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P2558 being past on the CONSULT screen after 30 seconds.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the fault.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P2559 ENGINE COOLANT LEVEL SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014420749

The coolant level sensor is a switch and is used to measure the level of the engine coolant in the radiator top tank. The coolant level sensor is immersed in the coolant and returns a different signal voltage when immersed in coolant verses being out of coolant. The Engine Control Module (ECM) monitors the change in the signal voltage to determine the level of the engine coolant.

DTC DETECTION LOGIC

The ECM detected the coolant level sensor signal voltage was greater than 4.4 V for more than 10 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P2559	Engine Coolant Level Sensor/ Switch Circuit High (Coolant level sensor 1 circuit - voltage above normal or shorted to high source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant level sensor value > 4.629 V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Coolant level sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2559 being current on the CONSULT screen.

Is DTC P2559 current?

YES >> Go to EC-1954, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420750

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2559 being current on the CONSULT screen.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT COOLANT LEVEL SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect coolant level sensor connector E91.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken

- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK CIRCUIT RESPONSE

1. Coolant level sensor connector E91 remains disconnected.
2. Connect a jumper wire between terminals 1 and 2 of the coolant level sensor connector E91.
3. Turn ignition switch ON.
4. Check for DTC P2559 being current and P2558 being past on the CONSULT screen after 30 seconds.

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 5.

4. CHECK DTCS AND VERIFY SENSOR CONDITION

1. Turn ignition switch OFF.
2. Connect coolant level sensor connector E91.
3. Turn ignition switch ON.
4. Check for DTC P2559 being current on the CONSULT screen after 30 seconds.

Is the inspection result normal?

YES >> Replace the engine coolant level sensor. Refer to EM-347, "Removal and Installation".
NO >> The removal and installation of the connector corrected the fault.

5. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector E93.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace error-detected parts.

6. CHECK FOR AN OPEN RETURN CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect jumper wire between terminals 1 and 2 of the coolant level sensor connector E91.
3. Check resistance between ECM connector E93 and coolant level sensor connector E91.

ECM		Coolant level sensor		Resistance
Connector	Terminal	Connector	Terminal	
E93	41	E91	1	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.
NO >> An open return circuit has been detected in the engine harness. Repair or replace the engine harness.

7. CHECK FOR AN OPEN SIGNAL CIRCUIT

1. Disconnect ECM connector E93 and coolant level sensor connector E91.

2. Check resistance between ECM connector E93 and coolant level sensor connector E91.

ECM		Coolant level sensor		Resistance
Connector	Terminal	Connector	Terminal	
E93	75	E91	2	< 10 Ω

Is the inspection result normal?

YES >> GO TO 8.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

8. CHECK FOR A SHORT CIRCUIT

Check resistance between the terminals of ECM connector E93.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
E93	75	E93	All	> 100k Ω

Is the inspection result normal?

YES >> GO TO 9.
NO >> A short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

9. CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect all components.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P2559 being past on the CONSULT screen after 30 seconds.

Is the inspection result normal?

YES >> The removal and installation of the connector corrected the fault.
NO >> Replace ECM. Refer to EC-1994, "Removal and Installation".

P2560 ENGINE COOLANT LEVEL LOW

DTC Description

INFOID:0000000014420751

The coolant level sensor is a switch and is used to measure the level of the engine coolant in the radiator top tank. The coolant level sensor is immersed in the coolant and returns a different signal voltage when immersed in coolant verses being out of coolant. The Engine Control Module (ECM) monitors the change in the signal voltage to determine the level of the engine coolant.

DTC DETECTION LOGIC

- The ECM detected the coolant level sensor signal voltage is between 1.75 V and 3.0 V for more than 30 seconds.
- The ECM detected the coolant level sensor signal voltage was higher than 3.0 V for more than 30 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P2560	Engine Coolant Level Low (Coolant level - data valid but below normal operating range - least severe level)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	Coolant level sensor voltage: • ≥ 2.953 V • < 3.75 V • ≥ 3.75 V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Low coolant level
- Coolant level sensor
- Harness and connectors

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2560 being current on the CONSULT screen.

Is DTC P2560 current?

YES >> Go to EC-1957, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420752

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2560 being current or past on the CONSULT screen.

Is applicable DTC detected?

YES >> Check coolant level and add coolant if necessary. If DTC P2560 is current and coolant level is not low, replace coolant level sensor. Refer to CO-52, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P2579 TC SPEED SENSOR CIRCUIT RANGE/PERFORMANCE

DTC Description

INFOID:0000000014420753

The turbocharger speed sensor is a hall effect type sensor. The Engine Control Module (ECM) provides a 5V supply to the position sensor and a return circuit. As the blades of the turbocharger spin past the speed sensor, a signal is generated on the position sensor signal circuit. The ECM interprets this signal and converts it to a turbo speed.

DTC DETECTION LOGIC

The ECM detected the turbocharger shaft is stuck.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2579	Turbocharger Speed Sensor “A” Circuit Range/Performance (Turbocharger 1 speed - mechanical system not responding or out of adjustment)	Diagnosis condition	Diagnostic runs continuously when the engine is running
		Signal (terminal)	—
		Threshold	Cumulative sum of error (15k rpm turbo speed) in a 30 second period is > 4k rpm, which is equivalent to average of error ≥ 13.333k rpm
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger speed sensor
- Turbocharger

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady state driving is performed again even after it is interrupted, each diagnosis can be conducted.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P2579 being current on the CONSULT screen.

Is DTC P2579 current?

YES >> Proceed to EC-1958, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420754

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTCs P00AF, P1A62, P2262, P226C or P2580 being current on the CONSULT screen.

Are applicable DTCs detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.

2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTCs P0103, P0107, P0108, P012B, P0652, P1191, P22CD or P22CE being current on the CONSULT screen.

Are applicable DTCs detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Drive the vehicle or interview the customer.
3. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
4. Check for DTC P2579 being current on the CONSULT screen.

Is applicable DTC detected with engine symptoms?

YES >> Replace the turbocharger assembly. Refer to EM-399, "Removal and Installation".
NO >> GO TO 4.

4.INSPECT TURBOCHARGER SPEED SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger speed sensor connector F126.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5.CHECK SENSOR SUPPLY VOLTAGE

1. Turbocharger speed sensor connector F126 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the turbocharger speed sensor connector F126.

Turbocharger speed sensor connector F126		Condition	Voltage (Approx.)
Terminal	Terminal		
1	2	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 8.

6.CHECK FOR AN OPEN SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Check resistance between ECM connector F101 and turbocharger speed sensor connector F126.

ECM		Turbocharger speed sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	188	F126	3	< 10 Ω

Is the inspection result normal?

YES >> GO TO 7.

NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

7.CHECK FOR A SHORT CIRCUIT

Check resistance between the terminals of ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	188	F101	All	> 100k Ω

Is the inspection result normal?

YES >> Replace the turbocharger speed sensor. Refer to EM-407, "Removal and Installation".
NO >> A short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

8.INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace error-detected parts.

9.CHECK SENSOR SUPPLY VOLTAGE

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the ECM connector F101.

ECM connector F101		Condition	Voltage (Approx.)
Terminal	Terminal		
106	127	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> An open circuit has been detected in the engine harness. Repair or replace the engine harness.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P2580 TC SPEED SENSOR CIRCUIT LOW

DTC Description

INFOID:0000000014420755

The turbocharger speed sensor is a hall effect type sensor. The Engine Control Module (ECM) provides a 5V supply to the position sensor and a return circuit. As the blades of the turbocharger spin past the speed sensor, a signal is generated on the position sensor signal circuit. The ECM interprets this signal and converts it to a turbo speed.

DTC DETECTION LOGIC

The ECM detected the turbocharger speed was less than 15,000 rpm for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2580	Turbocharger Speed Sensor “A” Circuit Low (Turbocharger 1 speed - data valid but below normal operating range - moderately severe level)	Diagnosis condition	Diagnostic runs continuously when the engine is running
		Signal (terminal)	—
		Threshold	Raw turbo speed < 250 Hz (10k rpm) for 5 seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Turbocharger speed sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady state driving is performed again even after it is interrupted, each diagnosis can be conducted.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P2580 being current on the CONSULT screen.

Is DTC P2580 current?

YES >> Proceed to EC-1961, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420756

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs P0103, P0107, P0108, P012C, P012D, P0652, P1192, P1193, P22CD or P22CE being current on the CONSULT screen.

Are applicable DTCs detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK DTC PRIORITY

1. Erase DTCs.

2. Start the engine.
3. Accelerate the engine speed to 1,500 rpm and hold for at least 20 seconds.
4. Return engine speed to idle.
5. Check for ENGINE diagnostic trouble codes.
6. Check for DTC P2580 being current on the CONSULT screen.

Does DTC P2580 become current during engine operation?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT TURBOCHARGER SPEED SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger speed sensor connector F126.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK SENSOR SUPPLY VOLTAGE

1. Turbocharger speed sensor connector F126 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the turbocharger speed sensor connector F126.

Turbocharger speed sensor connector F126		Condition	Voltage (Approx.)
Terminal	Terminal		
1	2	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5. CHECK FOR AN OPEN SIGNAL CIRCUIT

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Check resistance between ECM connector F101 and turbocharger speed sensor connector F126.

ECM		Turbocharger speed sensor		Resistance
Connector	Terminal	Connector	Terminal	
F101	188	F126	3	< 10 Ω

Is the inspection result normal?

YES >> GO TO 6.
NO >> An open signal circuit has been detected in the engine harness. Repair or replace the engine harness.

6. CHECK FOR A SHORT CIRCUIT

Check resistance between the terminals of ECM connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	188	F101	All	> 100k Ω

Is the inspection result normal?

YES >> Replace the turbocharger speed sensor. Refer to EM-407, "Removal and Installation".
NO >> A short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

7. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace error-detected parts.

8. CHECK SENSOR SUPPLY VOLTAGE

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the ECM connector F101.

ECM connector F101		Condition	Voltage (Approx.)
Terminal	Terminal		
106	127	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> An open circuit has been detected in the engine harness. Repair or replace the engine harness.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P2581 TURBOCHARGER SPEED SENSOR CIRCUIT HIGH

DTC Description

INFOID:0000000014698693

The turbocharger speed sensor is a hall effect type sensor. The Engine Control Module (ECM) provides a 5V supply to the position sensor and a return circuit. As the blades of the turbocharger spin past the speed sensor, a signal is generated on the position sensor signal circuit. The ECM interprets this signal and converts it to a turbo speed.

DTC DETECTION LOGIC

The ECM detected the turbocharger speed was less than 333,000 rpm for more than 5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2581	(Turbocharger/Supercharger Turbine Overspeed)	Diagnosis condition	Diagnostic runs continuously when the engine is running
		Signal (terminal)	—
		Threshold	Raw turbo speed > 5,500 Hz (220k rpm) for 5 seconds
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Turbocharger speed sensor
- Harness and connectors
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC CONFIRMATION PROCEDURE has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 90 km/h (56 MPH), then release accelerator pedal and keep it released for more than 10 seconds.
   CAUTION:
   Always drive vehicle at safe speed.
2. Depress the accelerator pedal until vehicle speed is 90 km/h (56 MPH) again.
   NOTE:
   - Checking the vehicle speed with GST is advised.
   - When steady state driving is performed again even after it is interrupted, each diagnosis can be conducted.
3. Connect CONSULT and check for current ENGINE diagnostic trouble codes.
4. Check for DTC P2581 being current on the CONSULT screen.

Is DTC P2581 current?

YES >> Proceed to EC-1964, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014698694

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for ENGINE diagnostic trouble codes.
3. Check for DTCs P0103, P0107, P0108, P012C, P012D, P0652, P1192, P1193, P22CD or P22CE being current on the CONSULT screen.

Is any applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 2.

2.CHECK FOR INTERMITTENT DTC

1. Turn ignition switch ON.

2. Connect CONSULT and clear past "ENGINE" diagnostic trouble codes.
3. Start the engine.
4. Using accelerator pedal, increase engine speed to 1,500 rpm and hold for at least 20 seconds.
5. Return engine speed to idle.
6. Using CONSULT, check for ENGINE diagnostic trouble codes.
7. Check for DTC P2581 being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 3.
NO >> Refer to GI-47, "Intermittent Incident".

3. INSPECT TURBOCHARGER SPEED SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect turbocharger speed sensor connector F126.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace error-detected parts.

4. CHECK THE SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. Turbocharger speed sensor connector F126 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the turbocharger speed sensor connector F126.

Turbocharger speed sensor connector F126		Condition	Voltage (Approx.)
Terminal	Terminal		
1	2	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 6.

5. CHECK FOR A PIN TO PIN SHORT CIRCUIT IN THE HARNESS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Check resistance between the ECM harness connector F101 terminal 188 and all other terminals in the ECM harness connector F101.

ECM		ECM		Resistance
Connector	Terminal	Connector	Terminal	
F101	188	F101	All	> 100k Ω

Is the inspection result normal?

YES >> Replace the turbocharger speed sensor. Refer to EM-407, "Removal and Installation".
NO >> A short circuit has been detected on the signal circuit in the engine harness. Repair or replace the engine harness.

6. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.

2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab.

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace error-detected parts.

7. CHECK SENSOR SUPPLY VOLTAGE AND RETURN CIRCUIT

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check voltage between the terminals of the ECM connector F101.

ECM connector F101		Condition	Voltage (Approx.)
Terminal	Terminal		
106	127	Ignition switch ON	4.75 – 5.25 V

Is the inspection result normal?

YES >> An open circuit has been detected in the engine harness. Repair or replace the engine harness.
NO >> Replace the ECM. Refer to EC-1994, "Removal and Installation".

P262A FUEL INJECTOR - PILOT INJECTION NOT LEARNED

DTC Description

INFOID:0000000014420757

The Engine Control Module (ECM) can detect when inaccurate fuel injection occurs by monitoring fuel rail pressure and engine speed. During certain engine conditions, the ECM looks at injection on time and engine speed to determine if the injector is meeting the proper fuel quantity. If the fuel quantity is outside the set limits, a DTC will be set.

DTC DETECTION LOGIC

The ECM has diagnosed that the closed loop fueling control has reached the limit of adjustment within the calibration.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P262A	Fuel Injector - Pilot Injection Not Learned (Engine emissions closed loop fueling adjustment - data erratic, intermittent, or incorrect)	1	Diagnosis condition	Ignition is ON or engine is running
			Signal (terminal)	—
			Threshold	—
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Fuel injector

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 20 seconds.
2. Accelerate lightly and drive at 40 km/h (25 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at a safe speed.
3. Accelerate lightly and drive at 88 km/h (55 MPH) for 4 minutes.
4. Decelerate using as little braking as possible, return to "P" park, and idle for 40 seconds.
5. Repeat steps 2 through 4 eleven more times.
6. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
7. Check for DTC P262A being current on the CONSULT screen.

Is DTC P262A current?

YES >> Go to EC-1967, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420758

1.CHECK DTC PRIORITY

1. Start and idle the engine.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P262A being current on the CONSULT screen.

Is applicable DTC detected?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Refer to GI-47, "Intermittent Incident".

P262D SENSOR REFERENCE VOLTAGE CIRCUIT LOW

DTC Description

INFOID:0000000014420759

The mass air flow sensor is a frequency based device. A constant voltage is applied to a heated wire. This wire is positioned in the air stream and is heated by the electrical current that the voltage produces. As air flows across it, it cools down. The heated wire is a Positive Temperature Coefficient (PTC) resistor. This means that the resistance drops when the temperature drops. The drop in resistance allows more current to flow through it in order to maintain the programmed temperature. This current is changed to a frequency which is sent to the ECM and interpreted as air flow. Adjustments for air temperature and humidity are taken into consideration since they also affect the temperature of the heated wire. The mass air flow sensor receives a 12V power supply from the ECM.

DTC DETECTION LOGIC

The ECM detected the mass air flow sensor supply was shorted to ground for 0.5 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition		
P262D	Sensor Reference Voltage “G” Circuit Low (Switched output #1 - voltage below normal or shorted to low source)	1	Diagnosis condition	Continuously when key is ON, or engine is running
			Signal (terminal)	—
			Threshold	The power supply < 8 V
			Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness or connectors
- Mass air flow sensor
- ECM

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn the ignition switch ON.
2. Start the engine and let it idle for 1 minute.
3. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
4. Check for DTC P262D being current on the CONSULT screen.

Is DTC P262D current?

YES >> Go to EC-1968, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420760

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P262D being current on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.INSPECT MASS AIR FLOW SENSOR AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect mass air flow sensor connector F104.
3. Inspect the harness and sensor connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins

- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace error-detected parts.

3. CHECK DTC PRIORITY

1. Mass air flow sensor connector F104 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P262D being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> GO TO 4.
NO >> Replace the mass air flow sensor. Refer to EM-224, "Removal and Installation".

4. INSPECT ECM AND CONNECTOR PINS

1. Turn ignition switch OFF.
2. Disconnect ECM connector F101.
3. Inspect the harness and module connector pins for the following:

- Loose connector
- Corroded pins
- Bent or broken pins
- Pushed back or expanded pins
- Moisture in or on the connector
- Missing or damaged connector seals
- Dirt or debris on or in the connector pins
- Connector shell broken
- Wire insulation damage
- Damaged connector locking tab

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair or replace error-detected parts.

5. CHECK DTC PRIORITY

1. ECM connector F101 remains disconnected.
2. Turn ignition switch ON.
3. Check for DTC P262D being current on the CONSULT screen after 30 seconds.

Is applicable DTC detected?

YES >> Replace the ECM. Refer to EC-1994, "Removal and Installation".
NO >> Repair or replace error-detected parts.

P263E GLOW PLUG CONTROL MODULE OVER TEMPERATURE

DTC Description

INFOID:0000000014420761

The glow plug control module controls the timing and intensity of the glow plug outputs on the engine using data provided by the ECM through the CAN2 communication lines. The glow plug control module will not activate the glow plugs if the glow plug module reads a temperature greater than a calibrated amount. The glow plug control module receives fused power directly from the battery and switches power through the smart power relay.

DTC DETECTION LOGIC

This DTC is triggered when the glow plug control module internal temperature is greater than 125°C for more than 3 seconds.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P263E	(Glow Plug Control Module 1 Over Temperature)	Diagnosis condition	Ignition switch is ON or engine is running
		Signal (terminal)	—
		Threshold	• Glow plug control module ASIC temperature > 150°C for 2 seconds. OR • Glow plug control module PCB temperature > 125°C for 2.5 seconds.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

- Harness and connectors
- Glow plug control module
- Dirt and debris that could lead to overheating

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P263E being current on the CONSULT screen.

Is DTC P263E current?

YES >> Go to EC-1970, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420762

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P263E being current or more than 3 past counts on the CONSULT screen.

Is applicable DTC detected?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK THE GLOW PLUG CONTROL MODULE INSTALLATION

1. Turn ignition switch OFF.
2. Verify that the glow plug control module is properly mounted. Refer to EC-1996, "Removal and Installation".

Is the inspection result normal?

YES >> GO TO 3.

NO >> Properly install the glow plug control module. Refer to EC-1996, "Exploded View".

3. CHECK FOR OBSTRUCTED OR RESTRICTED AIR FLOW TO THE GLOW PLUG CONTROL MODULE

Check the glow plug control module mounting area for air flow obstructions:
- Debris on or around the temperature sensor module.
- Aftermarket shields, flaps, or brackets mounted too close to the module.
- Exhaust leaks allowing exhaust to overheat the temperature sensor module.

Is the inspection result normal?

YES >> Replace the glow plug control module. Refer to EC-1996, "Removal and Installation".
NO >> Check the following:
- Remove any debris accumulated near the glow plug control module
- Relocate any aftermarket accessories that might be restricting air flow
- Repair any causes of excessive heat to the temperature sensor module

P268C FUEL INJECTOR 1 INJECTION QUANTITY ADJUSTMENT VALUE

DTC Description

INFOID:0000000014420763

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 1 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P268C	(Cylinder 1 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P268C being current on the CONSULT screen.

Is DTC P268C current?

YES >> Go to EC-1972, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420764

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P268C being current on the CONSULT screen.

Is DTC P268C detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P268D FUEL INJECTOR 2 INJECTION QUANTITY ADJUSTMENT VALUE

DTC Description

INFOID:0000000014420765

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 2 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P268D	(Cylinder 2 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P268D being current on the CONSULT screen.

Is DTC P268D current?

YES >> Go to EC-1973, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420766

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P268D being current on the CONSULT screen.

Is DTC P268D detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P268E FUEL INJECTOR 3 INJECTION QUANTITY ADJUSTMENT VALUE

DTC Description

INFOID:0000000014420767

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 3 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P268E	(Cylinder 3 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P268E being current on the CONSULT screen.

Is DTC P268E current?

YES >> Go to EC-1974, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420768

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P268E being current on the CONSULT screen.

Is DTC P268E detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P268F FUEL INJECTOR 4 INJECTION QUANTITY ADJUSTMENT VALUE

DTC Description

INFOID:0000000014420769

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 4 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P268F	(Cylinder 4 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P268F being current on the CONSULT screen.

Is DTC P268F current?

YES >> Go to EC-1975, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420770

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P268F being current on the CONSULT screen.

Is DTC P268F detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P2690 INJECTOR SOLENOID DRIVER CYLINDER 5

DTC Description

INFOID:0000000014420771

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 5 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2690	(Cylinder 5 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2690 being current on the CONSULT screen.

Is DTC P2690 current?

YES >> Go to EC-1976, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420772

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2690 being current on the CONSULT screen.

Is DTC P2690 detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P2691 INJECTOR SOLENOID DRIVER CYLINDER 6

DTC Description

INFOID:0000000014420773

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 6 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2691	(Cylinder 6 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2691 being current on the CONSULT screen.

Is DTC P2691 current?

YES >> Go to EC-1977, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420774

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2691 being current on the CONSULT screen.

Is DTC P2691 detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P2692 INJECTOR SOLENOID DRIVER CYLINDER 7

DTC Description

INFOID:0000000014420775

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 7 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2692	(Cylinder 7 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2692 being current on the CONSULT screen.

Is DTC P2692 current?

YES >> Go to EC-1978, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420776

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2692 being current on the CONSULT screen.

Is DTC P2692 detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P2693 INJECTOR SOLENOID DRIVER CYLINDER 8

DTC Description

INFOID:0000000014420777

Each fuel injector has a specific barcode. This barcode data contains information specific to each individual injector. The ECM uses this information to adjust fueling and allow the engine to run more smoothly

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the injector barcode value for cylinder 8 has not been entered correctly into the ECM.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2693	(Cylinder 8 Injector Data Incompatible)	Diagnosis condition	Ignition is ON.
		Signal (terminal)	(-)
		Threshold	Invalid injector barcode information has been entered or has not been entered at all.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Invalid injector barcode information

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2693 being current on the CONSULT screen.

Is DTC P2693 current?

YES >> Go to EC-1979, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420778

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2693 being current on the CONSULT screen.

Is DTC P2693 detected as current?

YES >> Using CONSULT, perform “ENTER INJECTOR CODES” in “Work support” of “ENGINE”.
NO >> Inspection End.

P2BA7 UREA TANK LEVEL

DTC Description

INFOID:0000000014420779

The Diesel Exhaust Fluid (DEF) tank level sensor measures the level of the fluid inside the DEF Tank. The DEF controller unit provides a 5V source and monitors the voltage that determines the fluid level in the tank. DEF Tank Level Sensor is integrated in the DEF dosing unit. It must be replaced with the DEF supply pump assembly.

DTC DETECTION LOGIC

The diesel exhaust fluid tank was critically low.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2BA7	NOx Exceedence - Empty Reagent Tank (Aftertreatment Diesel Exhaust Fluid Tank Empty - Condition Exists)	Diagnosis condition	Ignition is ON or engine is running
		Signal (terminal)	(-)
		Threshold	DTCs P203B, P203C, P203D, P203F and U010E all current.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

Diesel Exhaust Fluid (DEF) level is critically low.

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Turn ignition switch ON.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BA7 being current on the CONSULT screen.

Is DTC P2BA7 current?

YES >> Go to EC-1980, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420780

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BA7 being current on the CONSULT screen.

Is DTC P2BA7 detected as current?

YES >> Add Diesel Exhaust Fluid (DEF) to the DEF tank.
NO >> Inspection End.

P2BAC NOX CONCENTRATION

DTC Description

INFOID:0000000014420781

The Engine Control Module (ECM) monitors the engine operation for critical current DTCs. If the DTCs are current for an extended period of time and no repair action has been taken, the ECM will limit the engine torque. This DTC indicates engine torque has been reduced.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected certain critical DTCs related to engine operation were current and the engine continued to operate.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2BAC	NOX EXCEEDENCE	Diagnosis condition	Engine is running
		Signal (terminal)	(-)
		Threshold	One or more conditions exist requiring moderate driver inducement.
		Diagnosis delay time	Diagnostic runs continuously when the engine is running

POSSIBLE CAUSE

—

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the engine and let it idle for 1 minute.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BAC being current on the CONSULT screen.

Is DTC P2BAC current?

YES >> Go to EC-1981, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420782

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BAC being current on the CONSULT screen.

Is DTC P2BAC detected as current?

YES >> This is an information only DTC. Troubleshoot all other current DTCs. Refer to EC-838, "DTC Index".
NO >> Inspection End.

P2BAD NOX CONCENTRATION EXCEEDED

DTC Description

INFOID:0000000014420783

The aftertreatment intake NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via the CAN2 communication lines. The aftertreatment intake NOx sensor performs internal diagnostics and reports malfunctions back to the primary ECM using the CAN2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment intake NOx sensor is used to measure the NOx emissions at the intake of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the NOx reading was higher or lower than what was expected for the engine operating conditions.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2BAD	NOx Exceedence - Root Cause Unknown (Aftertreatment 1 Intake NOx Sensor - Root Cause Not Known)	Diagnosis condition	Engine is running and aftertreatment diesel oxidation catalyst intake temperature sensor has been above 150° C (302°F) for 5 seconds.
		Signal (terminal)	(–)
		Threshold	NOx reading was higher or lower than what was expected
		Diagnosis delay time	Diagnostic has to meet specific engine and aftertreatment conditions to run and complete

POSSIBLE CAUSE

Intake NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

If DTC Confirmation Procedure has been previously conducted, always perform the following procedure before conducting the next test:

1. Start the vehicle and accelerate to 88 km/h (55 MPH) for 2 minutes.
   CAUTION:
   Always drive vehicle at safe speed.
2. Decelerate to 73 km/h (45 MPH) by releasing the accelerator pedal completely.
3. Accelerate to 88 km/h (55 MPH) for 20 seconds.
4. Repeat steps 2 and 3 for 21 times.
5. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
6. Check for DTC P021A being current on the CONSULT screen.

Is DTC P2BAD current?

YES >> Go to EC-1982, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420784

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BAD being current on the CONSULT screen.

Is DTC P2BAD detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.

3. Are any of the following displayed as current on the CONSULT screen:
- P2201
- P2202
- P2209
- P220A
- U029D

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. INSPECT INTAKE NOX SENSOR

1. Turn ignition switch OFF.
2. Inspect the intake NOx sensor installation.

Is the inspection result normal?

YES >> GO TO 4.
NO >> Properly install the intake NOx sensor. Refer to EX-45, "Removal and Installation".

4. CHECK EXHAUST SYSTEM FOR LEAKS

1. Turn ignition switch OFF.
2. Inspect the exhaust system for the following:
- Loose connections.
- Leaking connections and broken exhaust system component.

Is the inspection result normal?

YES >> Replace the intake NOx sensor. Refer to EX-45, "Removal and Installation".
NO >> Repair or replace error-detected parts.

P2BAF NOX SYSTEM DRIVER INDUCEMENT ACTIVE

DTC Description

INFOID:0000000014420785

The aftertreatment outlet NOx (nitrogen oxides) sensor is a smart device and communicates with the Engine Control Module (ECM) via the CAN2 communication lines. The aftertreatment outlet NOx sensor performs its own internal diagnostics and reports malfunctions back to the primary ECM using the CAN2 communication lines. The NOx sensor is permanently attached to the NOx control module. They are serviced as a single component and cannot be replaced individually. The aftertreatment outlet NOx sensor is used to measure the NOx emissions at the outlet of the aftertreatment system.

DTC DETECTION LOGIC

The Engine Control Module (ECM) detected the power supply to the outlet NOx sensor was above or below a calibrated threshold.

DTC	CONSULT screen terms (Trouble diagnosis content)	DTC detection condition	
P2BAF	NOx System Driver Inducement Active (Aftertreatment 1 Outlet NOx Sensor - Root Cause Not Known)	Diagnosis condition	Engine is running and aftertreatment SCR outlet temperature has been above 200° C (392°F) for calibrated period of time.
		Signal (terminal)	(–)
		Threshold	NOx reading was higher or lower than what was expected
		Diagnosis delay time	Diagnostic runs continuously when engine is running.

POSSIBLE CAUSE

- Harness and connectors
- Outlet NOx sensor

DTC CONFIRMATION PROCEDURE

1.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Connect CONSULT and check for current “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BAF being current on the CONSULT screen.

Is DTC P2BAF current?

YES >> Go to EC-1984, "Diagnosis Procedure".
NO >> Inspection End.

Diagnosis Procedure

INFOID:0000000014420786

1.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Check for DTC P2BAF being current on the CONSULT screen.

Is DTC P2BAF detected as current?

YES >> GO TO 2.
NO >> Refer to GI-47, "Intermittent Incident".

2.CHECK DTC PRIORITY

1. Turn ignition switch ON.
2. Connect CONSULT and check for “ENGINE” diagnostic trouble codes.
3. Are any of the following displayed as current on the CONSULT screen.

- P220B
- P229E
- P229F
- P22A7
- U029E

Is applicable DTC detected?

YES >> Refer to EC-838, "DTC Index".
NO >> GO TO 3.

3. INSPECT OUTLET NOX SENSOR

1. Turn ignition switch OFF.
2. Inspect the outlet NOx sensor installation. Refer to EX-48, "Exploded View".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Properly install the outlet NOx sensor. Refer to EX-48, "Removal and Installation".

4. CHECK EXHAUST SYSTEM FOR LEAKS

1. Turn ignition switch OFF.
2. Inspect the exhaust system for the following:

- Loose connections.
- Leaking connections and broken exhaust system component.

Is the inspection result normal?

YES >> Replace the outlet NOx sensor. Refer to EX-48, "Removal and Installation".
NO >> Repair or replace error-detected parts.

SYMPTOM DIAGNOSIS

ENGINE CONTROL SYSTEM SYMPTOMS

Symptom Table

INFOID:0000000014420787

SYSTEM — BASIC ENGINE CONTROL SYSTEM

	SYMPTOM																					
	HARD/NO START/RESTART				ENGINE STALL															ABNORMAL SMOKE COLOR		
	NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BLACK SMOKE	WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)
Lift pump circuit	4	4	4	4	4	4	4	4		4	4		4	4	4	4		4				
Fuel injector circuit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1	
Mass air flow sensor circuit								1		1	1									1		
Coolant temperature sensor circuit			1		1		1			1			1	1	1		1			1		
Accelerator pedal position sensor circuit								1		1	1					1						
Fuel rail pressure sensor circuit	1	1	1	1						1				1						1		
Crankshaft position sensor circuit		1	1	1	1	1	1	1	1	1	1			1	1							
Camshaft position sensor circuit			3	3						3												
Start signal circuit	1	1	1	1	1		1	1		1	1											
Ignition switch circuit		1			1	1	1															
Power supply for ECM circuit		1			1	1	1															
Glow plug control circuit	1	1	1	1																	1	
Intake manifold temperature sensor circuit																						

	SYMPTOM																						
	HARD/NO START/RESTART				ENGINE STALL																ABNORMAL SMOKE COLOR		
	NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	BLACK SMOKE	WHITE SMOKE	DEAD BATTERY (UNDER CHARGE)
Exhaust gas pressure sensor circuit																							
Refrigerant pressure sensor circuit					2	2	2					3	3			3		4					
ECM relay circuit		1				1	1	1															
ECM	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

1 – 5: The numbers refer to the order of inspection.

SYSTEM — ENGINE MECHANICAL & OTHER

	SYMPTOM																			
	HARD/NO START/RESTART				ENGINE STALL														ABNORMAL SMOKE COLOR	
	NO START (with first firing)	NO START (without first firing)	HARD TO START WHEN ENGINE IS COLD	HARD TO START WHEN ENGINE IS HOT	AT IDLE	DURING DRIVING	WHEN DECELERATING	HESITATION/SURGING/FLAT SPOT	KNOCK/DETONATION	LACK OF POWER	POOR ACCELERATION	HI IDLE	LOW IDLE	ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	EXCESSIVE FUEL CONSUMPTION	BLACK SMOKE	WHITE SMOKE
Lift pump	4	4	4	4	4	4	4	4		4	4		4	4	4	4	4	4	
Fuel filter	1	1	1	1						1								1	
Fuel injector	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	3	2	2
Glow plug control system	1	1	1	1					1										1
EGR system										2	2							2	
Air cleaner and duct										2	2							2	
Fuel pressure relief valve	2	2	2	2	2	2	2	2		2	2		2	2	2	2	2	2	
NATS (Nissan Anti-theft System)		1																	

1 – 4: The numbers refer to the order of inspection.

PERIODIC MAINTENANCE

IDLE SPEED

Inspection

INFOID:0000000014420788

1.CHECK IDLE SPEED

With CONSULT
Check “CKPS·RPM (TDC)” in “DATA MONITOR” mode with CONSULT.
With GST
Check idle speed with Service $01 of GST.

>> INSPECTION END

EXHAUST SYSTEM

Exhaust System Diagnostics

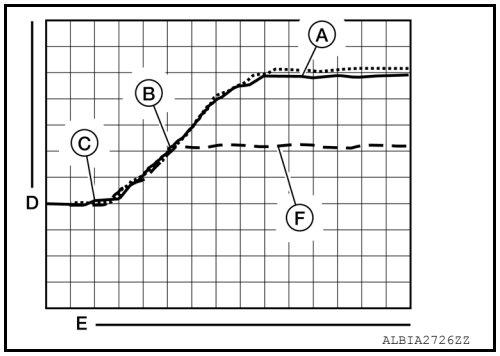
INFOID:0000000014420789

General Information

- The following procedure contains troubleshooting steps and information regarding the aftertreatment system.
- Leaks in the exhaust system can cause exhaust odor or white smoke.
- Inspect the exhaust piping for leaks, cracks, and loose connections. Refer to EX-25, "Removal and Installation"
- Tighten the clamps, if necessary. Refer to EX-24, "Exploded View".
- It may be necessary to perform a stationary (parked) regeneration to locate exhaust leaks. Refer to "DPF REGENERATION TEST"
- The ambient temperature affects the length of time it will take to perform a stationary (parked) regeneration, because the engine must work harder to increase the exhaust temperatures to the appropriate levels in cold ambient temperatures.
- In cold ambient temperatures (approximately -18°C [0°F] or colder), stationary (parked) regeneration may take longer to complete. In extremely cold ambient temperatures, stationary (parked) regeneration may **not** complete.
- In these cases, it may be necessary to warm the engine to operating temperature before starting the stationary (parked) regeneration, or to move the vehicle to a location with higher ambient temperatures.

Stationary Regeneration (Parked)

- When performing a stationary (parked) regeneration, monitor the exhaust temperatures in the aftertreatment system to determine why a stationary (parked) regeneration will **not** complete.
- Possible causes for stationary (parked) regenerations that will **not** complete include:
- Mis-assembled aftertreatment wiring harness.
- Aftertreatment exhaust gas temperature sensors installed in the wrong locations.
- Plugged diesel oxidation catalyst (DOC).
- Malfunctioning turbocharger.
- Exhaust leaks between the engine and the aftertreatment.
- Very low ambient temperatures (less than -18°C [0°F]).
- A normal stationary (parked) regeneration will follow the pattern shown.

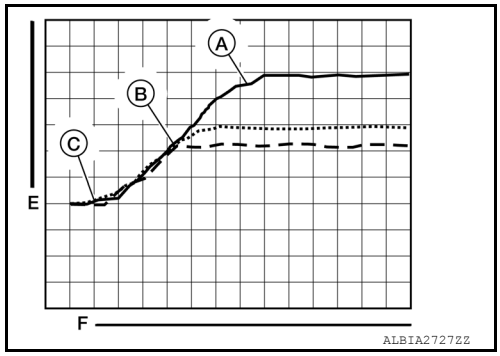


(D) : Temperature
(E) : Time

- The dashed line is for the DOC inlet temperature sensor (F).
- The dotted line is for the diesel particulate filter (DPF) inlet temperature sensor (B).
- The solid line is for the DPF outlet temperature sensor (A).
- When the stationary (parked) regeneration begins (C), all three temperatures should be approximately the same, and should increase at the same rate.
- The wiring to the aftertreatment temperature sensors appears to be correct in this example, because they all read approximately the same temperature at the beginning of the stationary (parked) regeneration and increase at the same rate.
- The DPF inlet and outlet temperatures will increase over approximately 10 minutes to 482 to 649°C [900 to 1200°F]. The temperatures may vary during the stationary (parked) regeneration, as the amount of fuel injected during aftertreatment injection is changed to maintain a constant temperature.
- The DPF inlet and outlet temperatures will remain at this temperature for the duration of the stationary (parked) regeneration.

Stationary Regeneration (DOC and DPF Assembly Blocked)

- This graph illustrates a stationary (parked) regeneration where the inlet of the DOC is blocked.

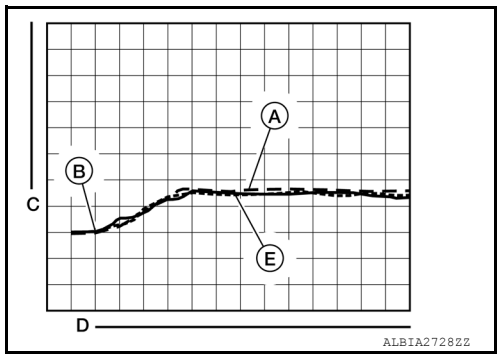


(E) : Temperature
(F) : Time

- The dashed line is for the DOC inlet temperature sensor (B).
- The dotted line is for the DPF inlet temperature sensor (C).
- The solid line is for the DPF outlet temperature sensor (A).
- In this condition, the engine speed will increase to the stationary (parked) regeneration speed of 1000 to 1100 rpm.
- The wiring to the aftertreatment temperature sensors appears to be correct in this example, because they all read approximately the same temperature at the beginning of the stationary (parked) regeneration and they increase at the same rate.
- The possible cause of this condition is a plugged DOC. Use the following procedure to inspect the DOC. Inspect the exhaust and aftertreatment system for leaks. Tighten clamps as necessary. Reference the appropriate procedure for torque specifications.

Stationary Regeneration (Cold Engine)

- This graph illustrates a stationary (parked) regeneration where the engine can **not** build enough heat to start aftertreatment injection.

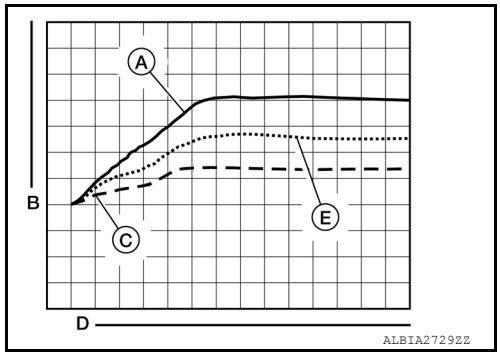


(C) : Temperature
(D) : Time

- The dashed line is for the DOC inlet temperature sensor (A).
- The dotted line is for the DPF inlet temperature sensor (E).
- The solid line is for the DPF outlet temperature sensor (B).
- The engine speed will likely increase to the stationary (parked) regeneration speed of 1000 to 1100 rpm, but because the aftertreatment temperatures do **not** increase enough to start aftertreatment injection, the stationary (parked) regeneration will **not** complete.
- The wiring to the aftertreatment temperature sensor appears to be correct in this example, because they all read approximately the same temperature for the same conditions.
- Possible causes of this issue include:
- A malfunctioning turbocharger.
- Low ambient temperatures. Move the vehicle to a location with higher ambient temperatures.

Stationary Regeneration (Incorrect Wire Routing)

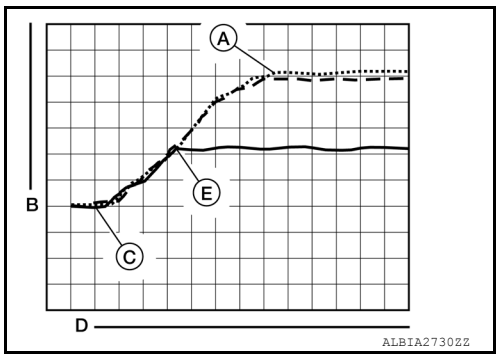
- This graph illustrates a stationary (parked) regeneration where the wiring to the aftertreatment temperature sensors is incorrect.



(B) : Temperature
(D) : Time

- The dashed line is for the DOC inlet temperature sensor (C).
- The dotted line is for the DPF inlet temperature sensor (E).
- The solid line is for the DPF outlet temperature sensor (A).
- In this condition, the engine speed will increase to the stationary (parked) regeneration speed of 1000 to 1100 rpm.
- Aftertreatment injection will **not** occur in this condition because the DOC inlet temperature does **not** reach the required temperature. Because aftertreatment injection is **not** occurring, the aftertreatment temperatures should **not** read differently.
- The possible cause of this condition is an incorrectly assembled aftertreatment wiring harness. See the aftertreatment exhaust gas temperature sensor wiring information in this procedure.

- This graph illustrates a stationary (parked) regeneration where the connectors to the DOC inlet temperature sensor and the DPF outlet temperature sensor are reversed.



(B) : Temperature
(D) : Time

- The dashed line is for the DOC inlet temperature sensor (C).
- The dotted line is for the DPF inlet temperature sensor (A).
- The solid line is for the DPF outlet temperature sensor (E).
- In this condition, the engine speed will increase to the stationary (parked) regeneration speed of 1000 to 1100 rpm.
- Aftertreatment injection may occur in this condition. However, the DOC inlet temperature increases after aftertreatment injection begins, while the DPF outlet temperature remains constant.
- The possible cause of this condition is that the connectors to the DOC inlet temperature sensor and the DPF outlet temperature sensor are reversed. See the aftertreatment exhaust gas temperature sensor wiring information in this procedure.

TEST

CAUTION:
It is unlawful to tamper with or remove any component of the aftertreatment system. It is also unlawful to use a diesel exhaust fluid (DEF) that does not meet the specifications provided or to operate the vehicle/equipment without DEF.

CAUTION:
Never add water or any other fluid besides what is specified to the DEF tank. The aftertreatment system may be damaged.

CAUTION:
Having the correct concentration of DEF is critical to the engine and aftertreatment system performing correctly.

CAUTION:
Cummins Inc. is not responsible for malfunctions or damage resulting from what Cummins Inc. determines to be abuse or neglect, including, but not limited to: operation without correctly specified diesel exhaust fluid, lack of maintenance of the aftertreatment system, improper storage or shutdown practices, or unauthorized modifications of the engine and aftertreatment system. Cummins Inc. is also not responsible for malfunctions caused by incorrect diesel exhaust fluid, water, dirt, or other contaminants in the diesel exhaust fluid. Follow the instructions provided with the service tool.

- To test the concentration of the DEF, use tool.

Tool number : — (J-54466)

NOTE:
The concentration of the DEF **must** be 32.5 ± 0.7 percent by weight. When measuring concentration with tool, the acceptable DEF measurement specification is 32.5 ± 1.5 percent. This specification takes into consideration the tool tolerances, variability and calibration when measuring DEF concentration.

- If the DEF concentration is found to be outside of this specification, drain the DEF tank, flush with distilled water, and fill with new and/or known good DEF. Check the DEF concentration.
- Concentration of the DEF should be checked when:
- The vehicle has been stored for an extended period of time.
- It is suspected that water has been added to the DEF tank.

CONTAMINATION/INCORRECT FLUID

1. DEF can become contaminated by the following situations:
   - The DEF tank cap is missing/damaged, or the tank vent malfunctions.
   - Filling the DEF tank with the incorrect fluid.

   In the event that the DEF becomes contaminated, inspect the DEF to determine the most likely source. Obtain a sample from the DEF tank and pour the sample into an appropriate container. Make sure to get a sample from the highest fluid level.
2. Inspect for petroleum base liquids, such as, but **not** limited to:
   - Diesel fuel.
   - Hydraulic fluid.
   - Brake fluid.

DEF is comprised largely of water. Petroleum based liquids will separate from the DEF and rise to the top. Check for separation of the fluids, as well as their characteristics.
If contaminated, reference the steps detailed later in this procedure.

3. Inspect for non-petroleum base liquids, such as, but **not** limited to:
   - Water.
   - Coolant.
   - Windshield washer fluid.

   If water has been added, the DEF will remain clear. As a result, the DEF will become diluted, reducing the concentration level.
   NOTE:
   If **only** water has been added to the DEF tank, drain the DEF tank, flush with distilled water, and fill the tank with new and/or known good DEF. Check the DEF concentration after completing the refill. Reference the Test Section of this procedure.
   For other non-petroleum based liquids that may have been added to the DEF, typically those fluids have coloring and will mix with DEF. If the DEF has a color tint to it, look for other fluids used on the vehicle that may match, such as coolant or windshield washer fluid.
   If contaminated, reference the steps detailed later in this procedure.
4. If the DEF has been contaminated, remove the DEF dosing pump module. Inspect the filter for signs that the contaminated fluid went through the dosing system. If the DEF has been contaminated, replace the aftertreatment DEF dosing pump module.Refer to EX-73, "Removal and Installation".
   After the DEF tank has been cleaned, fill the tank with new and/or known good DEF. Check the DEF concentration after completing the refill. Reference the Test section of this procedure.
   NOTE:
   Make sure to view and troubleshoot any fault codes that occur during the following steps with CONSULT. Reference the appropriate fault code troubleshooting manual.
5. If the contaminated fluid passed through the dosing system:
   NOTE:
   Any discarded contaminated fluids and/or parts **must** be disposed of according to local area ordinances.
   - Drain the DEF tank, flush with several fills of water until it is clean and clear of contamination. Replace the DEF dosing pump. Refer to EX-75, "Removal and Installation".
   - Fill the DEF tank with distilled water.
   - Perform CONSULT DEF Dosing Unit Override Test. Repeat the test until the distilled water runs clear. Use tool to check the concentration of the distilled water after being sprayed out of the dosing system. If the system is free of contaminants, distilled water will register zero percent concentration. Refer to EX-68, "DEF Dosing Unit Override Test".

     Tool number : — (J-54466)

   - Drain the distilled water from the DEF tank and fill with new and/or known good DEF. Check the DEF concentration after completing the refill, reference the Test section of this procedure.
   - Use the following procedure to test the performance and spray pattern of the DEF dosing valve and perform CONSULT DEF Dosing Unit Override Test. Residual water in the dosing system can possibly lower the DEF concentration being sprayed. Continue to run the DEF Dosing Unit Override Test until DEF is sprayed out of the dosing system. Use tool to check for proper concentration of the DEF. Refer to EX-68, "DEF Dosing Unit Override Test"

     Tool number : — (J-54466)

   - Road test the vehicle for 30 minutes to verify system operation.

REMOVAL AND INSTALLATION

ECM

Removal and Installation

INFOID:0000000014420790

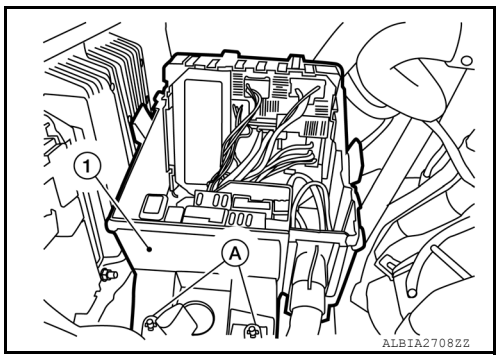
INSPECTION BEFORE REMOVAL

- Turn the ignition switch to the ON position while monitoring the malfunction indicator lamps (MIL). The malfunction indicator lamps (MIL) must illuminate for 2 to 3 seconds.
  NOTE:
  If the lamps do not illuminate, check for burned out bulbs.
- Before removing the Engine Control Module (ECM) from the vehicle, note the injector trim codes and match them to the correct cylinder number. Failure to do so could result in DTCs or could negatively affect engine performance. Refer to the following procedure to identify the cylinder number for each bank. Refer to EC-894, "Work Procedure".
  CAUTION:
  Make sure the injector trim codes match the correct cylinder number. Failure to do so could result in DTCs or could negatively affect engine performance.
- Press the keyswitch button to the OFF position.
- Connect CONSULT to the vehicle data link.
- Turn the ignition switch to the ON position.
- Select the monitor mode on CONSULT. The electronic service tool must be able to communicate with the ECM.
- Record the engine serial number and the injector trim codes before removing the ECM. The engine serial number is located on the engine dataplate on the front of the intake manifold.
- The injector trim codes are a 7-digit alphanumeric code that can be found printed on the injector head or can be accessed with the electronic service tool under "High Pressure Common Rail Injector Setup".

REMOVAL

CAUTION:
Perform ADDITIONAL SERVICE WHEN REPLACING ECM. Refer to EC-886, "Work Procedure".

1. After keying the engine OFF, wait for 1 minute to allow the ECM to completely power down before disconnecting the batteries.
2. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
   WARNING:
   Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;
   - **Wear appropriate goggles and protective clothing.**
   - **Always properly ventilate the area where the service is being performed.**
   - **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
   - **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
   - **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**
3. Release harness clips (A) from studs, then remove nuts and reposition the Intelligent Power Distribution Module [IPDM E/R (1)].



4. Disconnect the harness connectors from the ECM.
5. Remove the bolts that secure ECM to vehicle body.
6. Remove the ECM.

INSPECTION AFTER REMOVAL

- Inspect the engine harness connector for the following:
  - Cracked or broken connector shell
  - Missing or damaged connector seals
  - Dirt, debris, or moisture in or on the connector pins
  - Corroded, bent, broken, pushed back, or expanded pins
- Repair or replace parts as necessary.

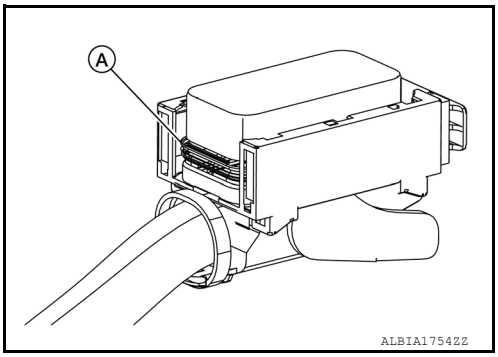
INSTALLATION

1. Install the new ECM to the ECM bracket on the vehicle body, then tighten bolts.
   CAUTION:
   Make sure no grease or dirt is between the ECM and the mounting plate.
   NOTE:
   Make sure **all** four bolts are installed. These ground the ECM body/casing.

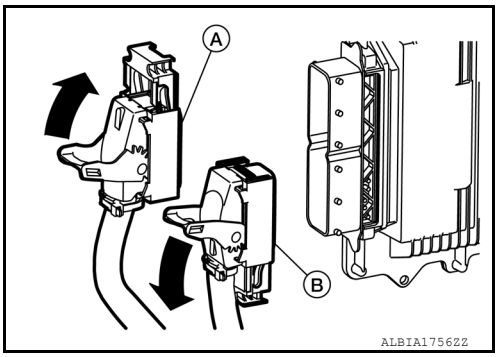
   ECM bolts : 11 N·m (1.1 kg-m, 8 ft-lb)

2. Use a suitable tool to remove all dirt and moisture from the ECM connector ports and the harness connectors.
   CAUTION:
   Do not blow compressed air into the ECM ports or connectors. Compressed air can contain moisture due to condensation.

3. Make sure the orange seal (A) in the ECM connectors is properly seated in its cavity. Otherwise, water intrusion to the electrical connectors could occur, which could cause shorts or intermittent connections.



4. Connect the harness connectors (A/B) to the ECM by placing the harness connectors into the ECM header and pulling back on the locking lever until the connectors are fully seated and the lever locking tab is engaged.

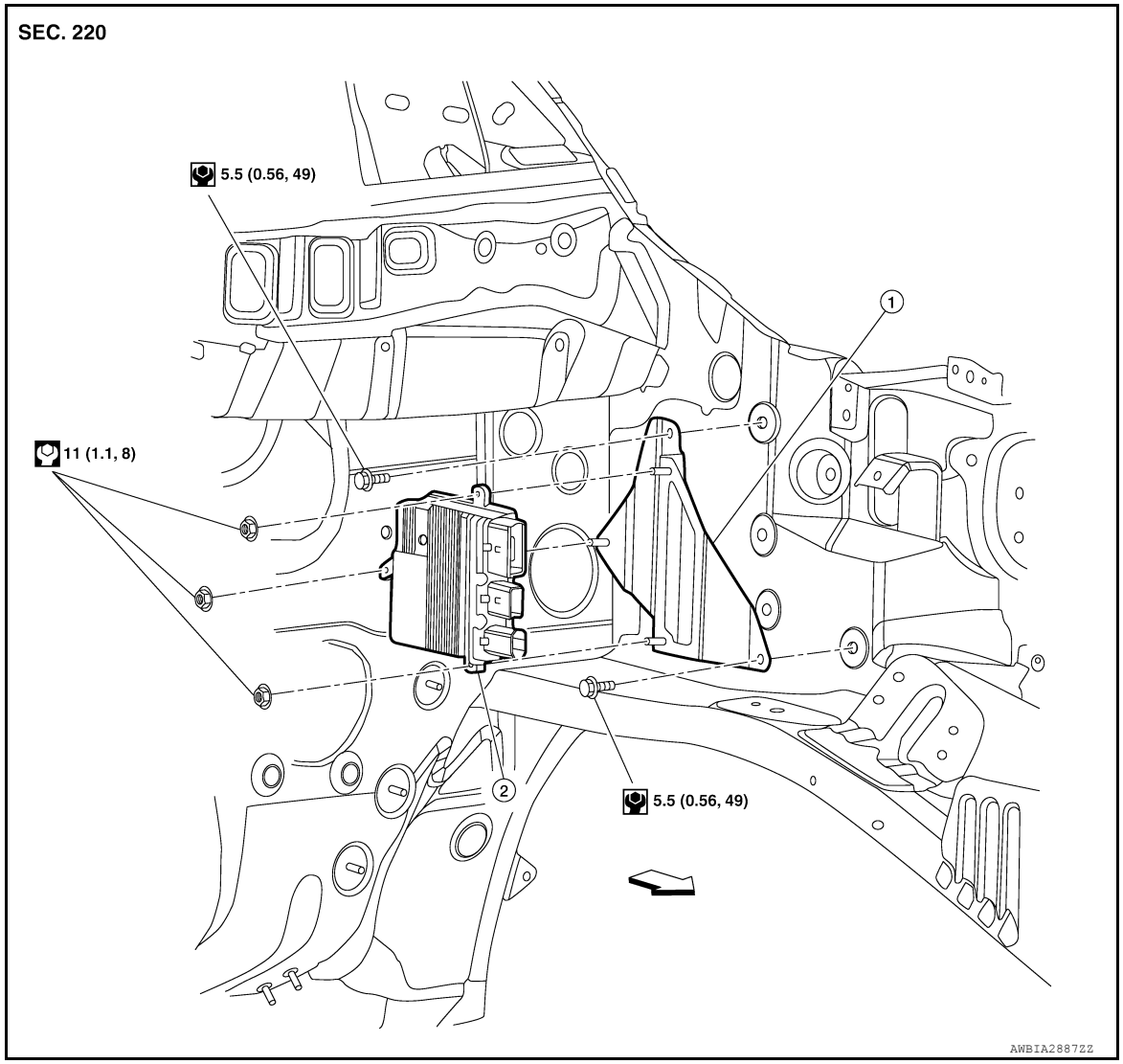


5. When the ECM is replaced, the new ECM must be calibrated. Refer to EC-886, "Work Procedure".
6. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".
   WARNING:
   Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
   - **Wear appropriate goggles and protective clothing.**
   - **Always properly ventilate the area where the service is being performed.**
   - **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
   - **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
   - **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**
7. Operate the engine and check for loose components.

GLOW CONTROL UNIT

Exploded View

INFOID:0000000014420791



1. Glow control unit bracket
2. Glow control unit
⇦ Front

Removal and Installation

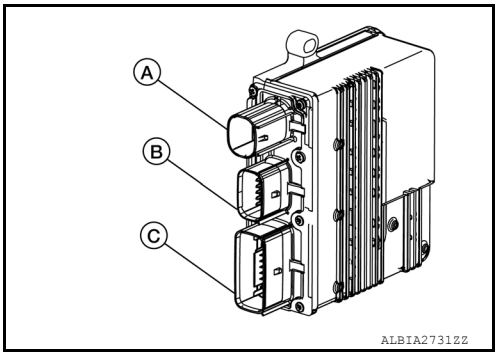
INFOID:0000000014420792

GENERAL INFORMATION

- The glow plug control unit is mounted on the driver side of the engine compartment close to the air filter box. The glow plug control unit communicates to the Engine Control Unit (ECM) via a J1939 (250k baud) data link. The glow timing and intensity are calculated inside the glow plug control unit on the basis of controller area network signals provided by the ECM (engine speed, engine torque, engine coolant temperature, intake air temperature, air pressure, keyswitch, and engine state).

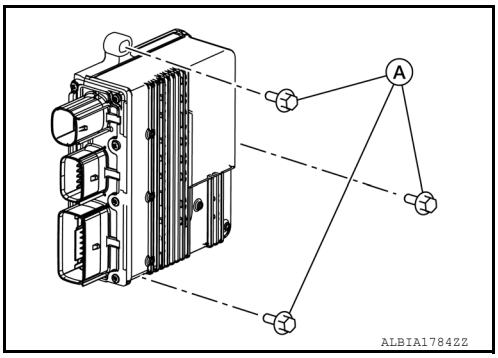
- The glow plug control unit has three connections:

(A) : J1939 data link, ground and smart power connector
(B) : Glow plug current supply connector
(C) : Constant battery power connector



REMOVAL

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".
   WARNING:
   Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
   - **Wear appropriate goggles and protective clothing.**
   - **Always properly ventilate the area where the service is being performed.**
   - **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
   - **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
   - **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**
2. Remove air cleaner and air duct assembly. Refer to EM-221, "Removal and Installation".
3. Disconnect the connectors from the glow plug control unit by pressing the connector latch and pulling outward.
4. Remove the bolts (A) that secure the glow plug control unit to the vehicle chassis.
   Remove the glow plug control unit.

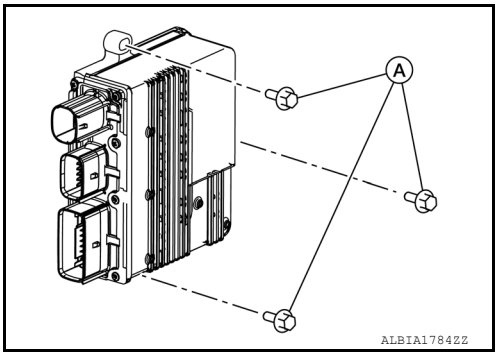


INSPECTION AFTER REMOVAL

- Inspect the glow plug control unit connectors for the following:
- Cracked or broken connector shells
- Missing or damaged connector seals
- Dirt, debris, or moisture in or on the connector pins
- Corroded, bent, broken, pushed back, or expanded pins
- Repair or replace parts as necessary.

INSTALLATION

1. Install the new glow plug control unit to the vehicle chassis.
   CAUTION:
   - **Make sure no grease or dirt is between the glow plug control unit and the mounting plate.**
   - **Over-tightening the bolts will result in damaging the glow plug control unit.**
2. Tighten the bolts (A).



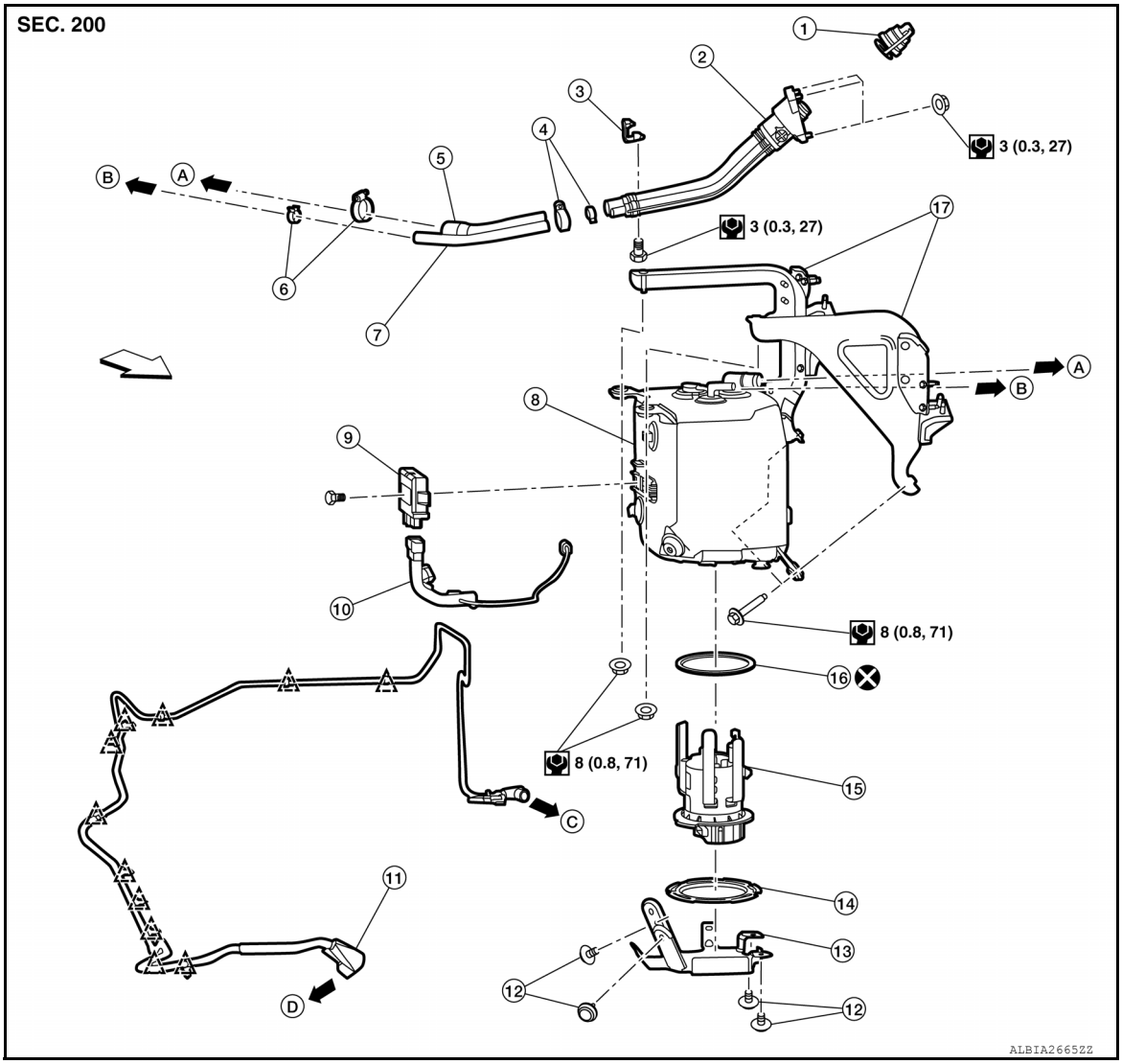
3. Use a suitable tool to remove all dirt and moisture from the glow plug control unit connector ports and the harness connectors.
4. Connect the harness connectors to glow plug control unit by pushing them into their corresponding connector cavities.
   NOTE:
   An audible click should be heard when the connection is made.
5. Install the air cleaner and air duct assembly. Refer to EM-221, "Removal and Installation".
6. Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".

   WARNING:
   Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury;
   - **Wear appropriate goggles and protective clothing.**
   - **Always properly ventilate the area where the service is being performed.**
   - **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**
   - **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
   - **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**
7. Operate the engine and check for loose components.

SCR CONTROL UNIT

Exploded View

INFOID:0000000014420793



1. DEF filler cap
2. DEF filler neck
3. Filler neck support bracket
4. Clamp
5. DEF filler hose
6. Clamp
7. DEF breather hose
8. DEF tank
9. SCR control unit
10. Harness
11. DEF supply line
12. Clip
13. DEF pump shield
14. Lock ring
15. DEF pump
16. O-ring
17. DEF tank brackets
A. To DEF tank
B. To DEF tank
C. To DEF pump
D. To DEF dosing valve

⇦ Front

Removal and Installation

INFOID:0000000014420794

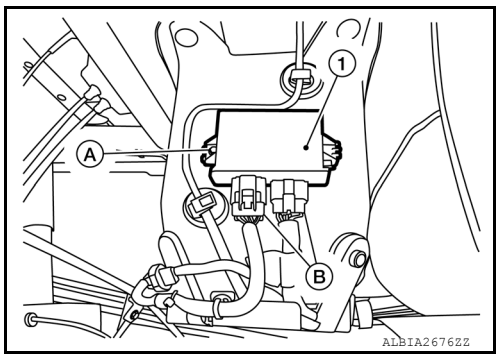
REMOVAL

1. Disconnect the battery or batteries. Refer to PG-185, "Battery Disconnect".

WARNING:
Battery acid and battery acid fumes are extremely dangerous and can cause severe burns and explosion. To help reduce the risk of personal injury:
- **Wear appropriate goggles and protective clothing.**
- **Always properly ventilate the area where the service is being performed.**
- **Never allow battery fluid to come in contact with skin, eyes, fabrics or painted surfaces.**

- **To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.**
- **If acid contacts eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.**

2. Disconnect the SCR control unit harness connectors (B) and remove the bolt (A) from the SCR control unit (1).



3. Remove the SCR control unit.

INSTALLATION

Installation is in the reverse order of removal.

- Connect the battery or batteries. Refer to PG-185, "Battery Disconnect".

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Fuel Pressure

INFOID:0000000014420795

Fuel pressure at idling kPa (kg/cm^2, psi)	Approximately 350 (3.57, 51)

Fuel Rail Pressure

INFOID:0000000014420796

Operating Range kPa (kg/cm^2, psi)	Minimum	: 25,000 (255, 3625)
	Maximum	: 200,000 (2,040, 29,000)

Engine Coolant Temperature Sensor

INFOID:0000000014420797

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.00
90 (194)	0.236 - 0.260

Crankshaft Position Sensor

INFOID:0000000014420798

Refer to EC-1279, "Component Inspection".

Camshaft Position Sensor

INFOID:0000000014420799

Refer to EC-743, "Camshaft Position Sensor".

Exhaust Restriction

INFOID:0000000014420800

Maximum Restriction kPa (kg/m^2, psi)	Clean	: 26.0 (0.27, 3.8)
	Dirty	: 40.7 (0.415, 5.9)

DEF

INFOID:0000000014420801

Fluid capacity	17.65L (4-5/8 US gal, 3-7/8 Imp gal)
Urea concentration	32.5 ± 1.5%

*: Only use Diesel Exhaust Fluid meeting ISO 22241-1 standard..

1. P2128-SE1378: Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Above Normal or Shorted to High Source

Secondary Accelerator Pedal Position Out-of-Range High

Monitor Operation:	
DTC	P2128-SE1378
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.8 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P2127-SE1379
P06D4-SE1893
P06D3-SE1894

Pause Conditions (any active):
P2127-SE1379
P06D4-SE1893
P06D3-SE1894

Malfunction Thresholds (all active):
Secondary Accelerator Pedal Position Sensor Value > 4.399 V (100 %)

2. P2127-SE1379: Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Below Normal or Shorted to Low Source

Secondary Accelerator Pedal Position Out-of-Range Low

Monitor Operation:	
DTC	P2127-SE1379
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.8 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P06D4-SE1893
P06D3-SE1894

Pause Conditions (any active):
P06D4-SE1893
P06D3-SE1894

Malfunction Thresholds (all active):
Secondary Accelerator Pedal Position Sensor Value < 0.147 V (0 %)

3. P0533-SE1806: Refrigerant High Pressure Switch Circuit - Voltage Above Normal or Shorted to High Source

Detect an in-range High Error with the Air Conditioner (AC) Pressure Sensor.

Monitor Operation:	
DTC	P0533-SE1806
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
AC Pressure Sensor Value > 4.924V(3,140kPa(absolute))

4. P0532-SE1807: Refrigerant High Pressure Switch Circuit - Voltage Below Normal or Shorted to Low Source

Detect an in-range Low Error with the Air Conditioner (AC) Pressure Sensor.

Monitor Operation:	
DTC	P0532-SE1807
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
AC Pressure Sensor Value < 0.05V(0kPa(absolute))

5. P221A-SE10826: Aftertreatment Intake and Outlet Oxygen Concentration Mismatch - Condition Exists

The system has detected aftertreatment outlet NOx sensor O2 reading within range but reading inappropriately high.

Monitor Operation:	
DTC	P221A-SE10826
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1C56-SE7613
P229F-SE5978
P229F-SE5976
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P2201-SE5366
P2201-SE5365
P2BAD-SE5369
P1C55-SE5368
Rate of change of Net brake torque < 200 N-m/sec
Rate of change of Engine speed < 200 RPM/sec
5 % < SCR inlet O2 < 13 %
Rate of change of SCR inlet O2 < 8 %/sec
25 mg/stroke < Torque fuel < 200 mg/stroke
Aftertreatment Outlet NOx sensor O2 reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0001.)
Intake O2 reading status valid.
The above Enable Conditions must be true for at least 3 seconds
DPF regeneration is inactive.
Ambient air pressure ≥ 75 kPa(absolute)
Ambient air temperature ≥ -6.7 °C
Key switch is turned ON.

Abort Conditions (any active):
P1C56-SE7613
P229F-SE5978
P229F-SE5976
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486

P2201-SE5366
P2201-SE5365
P2BAD-SE5369
P1C55-SE5368
DPF regeneration is active.
Key switch is turned OFF.
Ambient air pressure < 75 kPa(absolute)
Ambient air temperature < -6.7 °C

Pause Conditions (any active):
Rate of change of Net brake torque ≥ 200 N-m/sec
Rate of change of Engine speed ≥ 200 RPM/sec
5 % >= SCR inlet O2 >= 13 %
Rate of change of SCR inlet O2 ≥ 8 %/sec
25 mg/stroke >= Torque fuel >= 200 mg/stroke
Not Aftertreatment Outlet NOx sensor O2 reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0001.)
Intake O2 reading status is not valid.

Malfunction Thresholds (all active):
The average cumulative sum of error ((SCR out O2 - SCR In O2) / SCR In O2) over a 60 sec period is ever > 70 % , which is equivalent to [Average of Error - Tolerance] > 0.233 % Where diagnostic tolerance is defined as: 0 %

6. P221A-SE10827: Aftertreatment Intake and Outlet Oxygen Concentration Mismatch - Condition Exists

The system has detected aftertreatment outlet NOx sensor O2 reading within range but reading inappropriately low.

Monitor Operation:	
DTC	P221A-SE10827
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1C56-SE7613
P229F-SE5978
P229F-SE5976
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P2201-SE5366
Aftertreatment Outlet NOx sensor O2 reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0001.)
Rate of change of Net brake torque < 200 N-m/sec
Rate of change of Engine speed < 200 RPM/sec
5 % < SCR inlet O2 < 18 %
Rate of change of SCR inlet O2 < 8 %/sec
25 mg/stroke < Torque fuel < 200 mg/stroke
Intake O2 reading status valid.
The above Enable Conditions must be true for at least 3 seconds.
DPF regeneration is inactive.
Key switch is turned ON.
Ambient air pressure ≥ 75 kPa(absolute)
Ambient air temperature ≥ -6.7 °C

Abort Conditions (any active):
P1C56-SE7613
P229F-SE5978
P229F-SE5976
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P2201-SE5366
DPF regeneration is active
Key switch is turned OFF

Ambient air pressure < 75 kPa(absolute)
Ambient air temperature < -6.7 °C

Pause Conditions (any active):
Rate of change of Net brake torque ≥ 200 N-m/sec
Rate of change of Engine speed ≥ 200 RPM/sec
5 % > SCR inlet O2 > 18 %
Rate of change of SCR inlet O2 ≥ 8 %/sec
25 mg/stroke >= Torque fuel >= 200 mg/stroke
Not Aftertreatment Outlet NOx sensor O2 reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0001.)
Intake O2 reading status is not valid.

Malfunction Thresholds (all active):
The average cumulative sum of error ((SCR In O2 - SCR out O2) / SCR In O2) over a 60 sec period is ever > 70 , which is equivalent to [Average of Error - Tolerance] > 0.233 % Where diagnostic tolerance is defined as: 0 %

7. P2280-SE5447: Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

This monitor determines when the air filter has become too restrictive by calculating the air pressure change in the air filter box. When the filtered air pressure drops faster than a calibratable threshold a counter is updated for that drive cycle. Once the counter equals the calibrated limit for a period of time, the error is set.

Monitor Operation:	
DTC	P2280-SE5447
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.5 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206
Engine Speed ≥ 500 RPM
Key Switch ON time > 2 sec

Pause Conditions (any active):
Turbo charger surge margin < 0 %

Malfunction Thresholds (all active):
When the Filtered Ambient Air Pressure rate of change is less than RefTable2

8. P2509-SE215: Power Supply Lost With Ignition On - Data Erratic, Intermittent, or Incorrect

Powerdown block checksum does not match selected block checksum for either powerdown block.

Monitor Operation:	
DTC	P2509-SE215
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0 sec
MIL Activation Criteria	OBD No MIL

Malfunction Thresholds (all active):
At powerup, neither powerdown block checksums match the selected block checksum.

9. P0591-SE11096: Cruise Control System Command State - Mechanical System Not Responding or Out of Adjustment

The analog cruise switch input gets stuck for longer than calibrated time.

Monitor Operation:	
DTC	P0591-SE11096
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
When the Cruise switch input is sending an active signal continuously longer than 120 seconds

10. P0581-SE1898: Cruise Control (Resistive) Signal Circuit - Voltage Above Normal or Shorted to High Source

The cruise control switch 1 output value is above the operational limit.

Monitor Operation:	
DTC	P0581-SE1898
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	20 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Cruise Control Switch value > 4.888 V

11. P0579-SE6019: Cruise Control Enable Switch - Data Erratic, Intermittent, or Incorrect

The analog cruise switch input voltage is not within one of the expected values.

Monitor Operation:	
DTC	P0579-SE6019
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
When the cruise control switch value is not in boundary defined by
(Switch Value > 0.005 V AND
Switch Value < 0.196 V) OR
(Switch Value > 0.43 V AND
Switch Value < 0.645 V) OR
(Switch Value > 1.007 V AND
Switch Value < 1.413 V) OR
(Switch Value > 1.808 V AND
Switch Value < 2.346 V) OR
(Switch Value > 3.011 V AND
Switch Value < 3.514 V)

12. P0513-SE2329: Antitheft Password Valid Indicator - Data Erratic, Intermittent, or Incorrect

Invalid Key is used to start the vehicle.

Monitor Operation:	
DTC	P0513-SE2329
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Driver used wrong Key

13. P0563-SE297: Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level

Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level

Monitor Operation:	
DTC	P0563-SE297
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Engine Is Running

Pause Conditions (any active):
Engine Is Not Running

Malfunction Thresholds (all active):
Battery Voltage > 17.766 V

14. P0562-SE296: Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level

Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level

Monitor Operation:	
DTC	P0562-SE296
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Engine Is Running

Pause Conditions (any active):
Engine Is Not Running

Malfunction Thresholds (all active):
Battery Voltage < 8.128 V

15. P051B-SE2086: Crankcase Pressure - Data Erratic, Intermittent, or Incorrect

Crankcase Pressure is either In range High or In Range Low

Monitor Operation:	
DTC	P051B-SE2086
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.02 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P051C-SE1424, P051D-SE1422
Engine RPM ≤ 0 RPM
[Coolant Temperature is > 71.109 deg C for 300 seconds]
Crankcase Pressure delta ≤ 0.02 kPa(gauge)

Abort Conditions (any active):
P051C-SE1424, P051D-SE1422

Pause Conditions (any active):
Engine Speed > 0 RPM
[Coolant Temperature has not been > 71.109 deg C for 300 seconds]
Crankcase Pressure delta > 0.02 kPa(gauge)

Malfunction Thresholds (all active):
Crankcase Pressure > 0.5 kPa(gauge)
OR
Crankcase Pressure < - 0.5 kPa(gauge)

16. P007B-SE4129: Engine Charge Air Cooler Outlet Temperature - Data Erratic, Intermittent, or Incorrect

Charge Air Cooler Outlet Temperature reading is In Range Low

Monitor Operation:	
DTC	P007B-SE4129
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P007B-SE3870
P007C-SE2873, P007D-SE2872
P0501-SE130, P0501-SE4361
P0049-SE3641, P0102-SE3207, P0103-SE3206, P0111-SE4067, P0111-SE4070, P0501-SE130, P0501-SE4361, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
Remote Throttle is active
Ambient Air Temperature ≤ -6.67 °C
Fresh Air Flow ≤ 8 kg/min
Vehicle speed < 37.282 mph
The time, after vehicle speed is >= 37.282 (mph), is less than a calibrated Diagnostic Delay RefTable3. The Low Vehicle Speed time input to the table is determined by logging the time below a calibrated vehicle speed, 18.641 (mph) while the engine is running.
|Compressor Inlet Temperature - Ambient Air Temperature| > 12 °C
Compressor Inlet Temperature ≥ 50 °C
Compressor Outlet Temperature - Compressor Inlet Temperature < 40 °C
Engine is not in run state OR has been in run state for < 120 sec

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Value - Measured Value) in 90 seconds is ever > 54,000 Deg C, which is equivalent to [Average of Error - Tolerance] >= 24 Deg C. Where Tolerance is defined as: 0 Deg C.

17. P007B-SE3870: Engine Charge Air Cooler Outlet Temperature - Data Erratic, Intermittent, or Incorrect

Charge Air Cooler Outlet Temperature sensor reading is erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P007B-SE3870
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine off time ≥ 480 min
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

Abort Conditions (any active):
P007C-SE2873, P007D-SE2872
U3017-SE4759
U3017-SE4760

Malfunction Thresholds (all active):
| Charge Air Cooler Outlet Temperature sensor - the most accurate sensor from the remaining temperature sensors | > (13 + the tolerance of the most accurate sensor from the remaining temperature sensors) °C
| Charge Air Cooler Outlet Temperature sensor - the second most accurate sensor from the remaining temperature sensors | > (13 + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
| the most accurate sensor from the remaining temperature sensors - the second most accurate sensor from the remaining temperature sensors | < (the tolerance of the most accurate sensor from the remaining temperature sensors + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
The tolerance of the remaining temperature sensors are:
Compressor Inlet Temperature sensor tolerance = 40 °C
Charge Temperature sensor tolerance = 25 °C
Coolant Temperature sensor tolerance = 20 °C
ECM Internal Temperature sensor tolerance = 35 °C
EGR Orifice Temperature sensor tolerance = 25 °C

18. P007D-SE2872: Engine Charge Air Cooler Outlet Temperature - Voltage Above Normal or Shorted to High Source

Charge Air Cooler Outlet Temperature sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P007D-SE2872
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Charge Air Cooler Outlet Temperature sensor value > 4.737V (< -40 degC)

19. P007C-SE2873: Engine Charge Air Cooler Outlet Temperature - Voltage Below Normal or Shorted to Low Source

Charge Air Cooler Outlet Temperature sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P007C-SE2873
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Charge Air Cooler Outlet Temperature sensor voltage < 0.057V (> 130 degC)

20. P026A-SE3562: Engine Charge Air Cooler Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level

Charge Air Cooler failed to provide enough cooling

Monitor Operation:	
DTC	P026A-SE3562
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine has been in Run state for >= 360 s

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0472-SE494, P0473-SE493
Fresh Air Flow < 3.5 kg/min
Ambient Air Temperature < -6.67 °C
Compressor Outlet Temperature - Compressor Inlet Temperature < 28 °C
The time, after vehicle speed is >= 24.855 (mph), is less than a calibrated Diagnostic Delay RefTable4. The Low Vehicle Speed time input to the table is determined by logging the time below a calibrated vehicle speed, 24.233 (mph) while the engine is running
Total Fueling < 10 mg/stroke
Total Fueling > 1,000 mg/stroke
Absolute value of (Compressor Inlet Temperature - Ambient Air Temperature) > 12 °C

Malfunction Thresholds (all active):
Cumulative sum of error (Charge Air Cooler [CAC] Outlet Temperature - RefTable5) in a 50 second period is ever > 600 Deg C, which is equivalent to [Average of Error - Tolerance] >= 12 Deg C, where Tolerance is defined as: 0 Deg C

21. P0340-SE4499: Engine Camshaft Speed/Position Sensor - Data Erratic, Intermittent, or Incorrect

This diagnostic sets an error when there is a valid crankshaft signal without a corresponding camshaft signal.

Monitor Operation:	
DTC	P0340-SE4499
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0335-SE4372, P0335-SE6886
P0016-SE5202
P0652-SE225, P0653-SE243
Crankshaft tonewheel gap is detected.

Abort Conditions (any active):
P0335-SE4372, P0335-SE6886
P0016-SE5202
P0652-SE225, P0653-SE243
Crankshaft tonewheel gap is NOT detected.

Malfunction Thresholds (all active):
No camshaft signal is present

22. P0016-SE5202: Engine Speed/Position Camshaft and Crankshaft Misalignment - Mechanical System Not Responding or Out of Adjustment

The camshaft timing is incorrect relative to crankshaft timing.

Monitor Operation:	
DTC	P0016-SE5202
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 rev
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0335-SE4372, P0335-SE6886, P0340-SE3392, P0340-SE4499

Abort Conditions (any active):
P0335-SE4372, P0335-SE6886, P0340-SE3392, P0340-SE4499

Malfunction Thresholds (all active):
Camshaft tonewheel tooth angle offset from radial > 5.56 deg
OR Camshaft tonewheel tooth angle offset from radial < -10.11 deg

23. P0340-SE3392: Engine Camshaft Speed/Position Sensor - Data Erratic, Intermittent, or Incorrect

Incorrect or displaced camshaft signal pulses are detected when the camshaft signal pulse count in the ECU reaches a calibrated threshold.

Monitor Operation:	
DTC	P0340-SE3392
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	6 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0335-SE4372, P0335-SE6886
P0016-SE5202
P0652-SE225, P0653-SE243
This indicates that a crankshaft signal is present.

Abort Conditions (any active):
P0335-SE4372, P0335-SE6886
P0016-SE5202
P0652-SE225, P0653-SE243
Crankshaft tonewheel gap is NOT detected.

Malfunction Thresholds (all active):
The number of camshaft pulse counts != 9
OR the camshaft pulses are not syncronized with the crankshaft pulses.

24. U0002-SE3232: J1939 Network #1 - Data Erratic, Intermittent, or Incorrect

Set error when CAN module ceases communications.

Monitor Operation:	
DTC	U0002-SE3232
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 msec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Bus Off interupt triggered by CAN hardware.

25. U1000-SE5599: Forward Collision Warning - Abnormal Update Rate

The Engine Control Module did not receive Airbag Control Unit Status message on the datalink.

Monitor Operation:	
DTC	U1000-SE5599
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	510 msec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT [Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Airbag Control Unit.

26. U0101-SE8016: Transmission ECU to ECM Communication - Abnormal Update Rate

The Engine Control Module did not receive message from Automatic Transmission Electronic Control Unit on the datalink.

Monitor Operation:	
DTC	U0101-SE8016
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Automatic Transmission Electronic Control Unit.

27. U0101-SE4922: Transmission ECU to ECM Communication - Abnormal Update Rate

The Engine Control Module did not receive message from Automatic Transmission Electronic Control Unit on the datalink.

Monitor Operation:	
DTC	U0101-SE4922
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Automatic Transmission Electronic Control Unit.

28. U0101-SE4918: Transmission ECU to ECM Communication - Abnormal Update Rate

The Engine Control Module did not receive message from Automatic Transmission Electronic Control Unit on the datalink.

Monitor Operation:	
DTC	U0101-SE4918
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Automatic Transmission Electronic Control Unit.

29. U0402-SE4919: Transmission ECU to ECM Communication - Received Network Data in Error

Determine if Torque Control RN1 message data from the Automatic Transmission Electronic Control Unit has been updated.

Monitor Operation:	
DTC	U0402-SE4919
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Heartbeat counter value from Automatic Transmission Electronic Control Unit to is not incrementing.

30. U0101-SE4920: Transmission ECU to ECM Communication - Abnormal Update Rate

The Engine Control Module did not receive message from Automatic Transmission Electronic Control Unit on the datalink.

Monitor Operation:	
DTC	U0101-SE4920
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Automatic Transmission Electronic Control Unit.

31. U0402-SE4921: Transmission ECU to ECM Communication - Received Network Data in Error

Determine if Torque Control RN2 message data from the Automatic Transmission Electronic Control Unit has been updated.

Monitor Operation:	
DTC	U0402-SE4921
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Heartbeat counter value from Automatic Transmission Electronic Control Unit to is not incrementing.

32. U1000-SE11622: Body Control Module - Abnormal Update Rate

The Engine Control Module did not receive message from Body Control Module on the datalink.

Monitor Operation:	
DTC	U1000-SE11622
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Body Control Module.

33. U1000-SE4929: Body Control Module - Abnormal Update Rate

The Engine Control Module did not receive message from Body Control Module on the datalink.

Monitor Operation:	
DTC	U1000-SE4929
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Body Control Module.

34. U1000-SE4928: Lost Communication with ABS Control Module - Condition Exists

The Engine Control Module did not receive message from Brake Controller on the datalink.

Monitor Operation:	
DTC	U1000-SE4928
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	210 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Brake Controller.

35. U0415-SE5061: Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Condition Exists

Determine if Stability Control RN1 message torque data from the Brake Controller is within torque limits

Monitor Operation:	
DTC	U0415-SE5061
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Torque control values from the Brake Controller exceed maximum torque values.

36. U1000-SE4924: Lost Communication with ABS Control Module - Condition Exists

The Engine Control Module did not receive message from Brake Controller on the datalink.

Monitor Operation:	
DTC	U1000-SE4924
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	110 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Brake Controller.

37. U0415-SE4925: Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Condition Exists

Determine if Stability Control RN1 message data from the Brake Controller has been updated.

Monitor Operation:	
DTC	U0415-SE4925
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Heartbeat counter value from Brake Controller is not incrementing.

38. U1000-SE11575: Cab HVAC System Controller - Abnormal Update Rate

The Engine Control Module did not receive message from Body Control Module on the datalink.

Monitor Operation:	
DTC	U1000-SE11575
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	510 msec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Body Control Module.

39. U1000-SE4926: Instrument Cluster Control Module - Abnormal Update Rate

The Engine Control Module did not receive message from Instrument Cluster Electronic Control Panel on the datalink.

Monitor Operation:	
DTC	U1000-SE4926
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	110 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Message not received from Instrument Cluster Electronic Control Unit.

40. U0426-SE10862: Immobilizer ID Invalid - Condition Exists

Determine when there are communication errors between ECM and immobilizer

Monitor Operation:	
DTC	U0426-SE10862
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	250 msec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
ECM can't receive feedback message from immobilizer within expected period of time. Or ECM receives feedback from immobilizer, but the message content is indicating there is communication error between the antenna interfacing with immobilizer controller.

41. U0426-SE10863: Immobilizer Lock Mode Error - Condition Exists

Determine when engine is locked because of 5 consecutive ignition on requests have failed.

Monitor Operation:	
DTC	U0426-SE10863
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
If the ECM finds out the verification process at the end of the ignition on communication fails on 5 consecutive occasions or if the ECM finds out the ignition on communication fails to complete on 5 successive occasions

42. U0426-SE10860: Immobilizer Key Code Error - Condition Exists

Determine when the key code pragrammed in the transponder interfacing with immobilizer controller is not right

Monitor Operation:	
DTC	U0426-SE10860
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
ECM receives message from immobilizer which indicates that the key programmed in tranponder interfacing with this immobilizer carries wrong key code

43. U0426-SE10861: Immobilizer No Key Error - Condition Exists

Determine when there is no key code programmed in the transponder interfacing with immobilizer controller.

Monitor Operation:	
DTC	U0426-SE10861
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
ECM receives message from immobilizer which indicates that there is no key code programmed in the transponder which is interfacing with the immobilizer

44. P1A78-SE9985: Engine Fuel Shutoff 1 Control - Special Instructions

Airbag Control Unit is sending Airbag Crash Order value of 0x54AB to ECM to stop vehicle fueling.

Monitor Operation:	
DTC	P1A78-SE9985
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 msec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Nissan Airbag Crash indicator = 0x54AB

45. P0700-SE8015: Transmission Requested Malfunction Indicator Lamp - Condition Exists

Automatic Transmission Electronic Control Unit is sending request to ECM to turn on OBD Malfunction Indicator Lamp.

Monitor Operation:	
DTC	P0700-SE8015
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fault Inhibit Time has elapsed (See RefCond0003.)

Abort Conditions (any active):
NOT[Fault Inhibit Time has elapsed (See RefCond0003.)]

Malfunction Thresholds (all active):
Nissan OBD MIL Requested

46. P22CC-SE7828: Engine Turbocharger Compressor Bypass Actuator Control Command Circuit - Voltage Above Normal or Shorted to High Source

This monitor detects if the Compressor Bypass Valve Discrete Output actuator device command line is shorted high

Monitor Operation:	
DTC	P22CC-SE7828
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.02 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The diagnostic will continue to detect and reset the fault for 5 times within the current drive cycle.

Malfunction Thresholds (all active):
The low level output line is commanded to have a PWM waveform, but has a voltage of ≥ 16.25 V.
OR
The low level output line is commanded to have a voltage of ≤ 0 V, but has a voltage of ≥ 16.25 V.

47. P22CB-SE7829: Engine Turbocharger Compressor Bypass Actuator Control Command Circuit - Voltage Below Normal or Shorted to Low Source

This monitor detects if the Compressor Bypass Valve Discrete Output actuator device command line is shorted low.

Monitor Operation:	
DTC	P22CB-SE7829
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.02 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The low level output line is commanded to have a PWM waveform, but has a voltage of ≤ 1.5 V.
OR
The low level output line is commanded to have a voltage of ≥ 13.2 V, but has a voltage of ≤ 1.5 V.

48. P22CE-SE8242: Engine Turbocharger Compressor Bypass Actuator 1 Position - Data Valid But Below Normal Operating Range - Moderately Severe Level

Detects when the air flow fails to pass through the Compressor Bypass loop when the Compressor Bypass Valve commanded position is "bypass" or "open", i.e. the flow should be passing exclusively through the bypass loop.

Monitor Operation:	
DTC	P22CE-SE8242
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.51 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0237-SE2976, P0238-SE2977
P0049-SE3641, P2580-SE3642
The Compressor Bypass Valve is commanded open.
Engine Speed > 1,800 RPM
Engine Speed < 4,200 RPM
Turbo Speed < 190 KRPM
(Ambient air temperature >= -6.7 Deg C OR Charge air cooler outlet temperature >= 12 Deg C)
All of the above enable conditions must be met for >= 500 msec

Malfunction Thresholds (all active):
Within a time window of 0.51 sec, the Minimum Pressure Ratio across the High Pressure Compressor falls below or is equal to 0.85 (ratio).
OR
Within a time window of 0.51 sec, the Maximum Pressure Ratio across the High Pressure Compressor rises above or is equal to 1.3 (ratio).

49. P22CD-SE8243: Engine Turbocharger Compressor Bypass Actuator 1 Position - Data Valid But Above Normal Operating Range - Moderately Severe Level

Detects when the air flow fails to pass through the Compressor when the Compressor Bypass Valve commanded position is "default" or "closed", i.e. the flow should be passing exclusively through the Compressor.

Monitor Operation:	
DTC	P22CD-SE8243
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.01 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0237-SE2976, P0238-SE2977
P0049-SE3641, P2580-SE3642
The Compressor Bypass Valve is commanded closed.
Engine Speed > 1,000 RPM
Engine Speed < 1,800 RPM
Turbo Speed > 100 KRPM
All of the above enable conditions must be met for >= 500 msec

Malfunction Thresholds (all active):
Within a time window of 10.01 sec, the Maximum Pressure Ratio across the High Pressure Compressor never rises above nor is equal to 1.1 (ratio).

50. P051B-SE3665: Crankcase Pressure - Data Erratic, Intermittent, or Incorrect

Crankcase Pressure (CCP) sensor is stuck in range.

Monitor Operation:	
DTC	P051B-SE3665
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	50 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P051B-SE2086
P051C-SE1424, P051D-SE1422
Engine RPM > 0 RPM
The engine has operated both under High Power and Low Power conditions.
High Power Condition:[Engine Torque (Nm) >= 250 Nm and Engine Speed (RPM) >= 1,600 RPM and Boost Pressure (kPa (Gauge)) >=50 kPa (Gauge) for 5 sec] This condition should occur at least 5 times.
Low Power Condition:[Engine Torque (Nm) <= 180 Nm and Engine Speed (RPM) <= 1,200 RPM and Boost Pressure (kPa (Gauge)) <=20 kPa (Gauge) for atleast 5 (sec)] This condition should occur at least 5 times.
Coolant Temperature is > 71.109 deg C for 300 seconds.

Abort Conditions (any active):
P051C-SE1424, P051D-SE1422
P051B-SE2086
Engine RPM = 0 RPM

Pause Conditions (any active):
Coolant Temperature is < 71.109 deg C .

Malfunction Thresholds (all active):
Difference between observed minimum and maximum Crankcase Pressure values is less than 0.1 kPa(gauge) at least 5 (counts) number of times.

51. P2457-SE3565: Engine Exhaust Gas Recirculation Cooler Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level

EGR cooler failed to provide enough cooling

Monitor Operation:	
DTC	P2457-SE3565
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0472-SE494, P0473-SE493
P0106-SE3651, P0106-SE3652, P0107-SE490, P0108-SE489, P0112-SE488, P0113-SE487, P0471-SE3922, P0471-SE3924, P0472-SE494, P0473-SE493
P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878
P0116-SE3669, P0117-SE76, P0118-SE75
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
EGR flow < 0.6 kg/min
Exhaust temperature minus coolant temperature < 100 °C
Aftertreatment operation mode is in a mode other than NORMAL

Malfunction Thresholds (all active):
Cumulative sum of error (EGR Orifice Temperature - RefTable6) in a 60 second period is ever > 400 Deg C, which is equivalent to [Average of Error - Tolerance] >= 6.667 Deg C, where Tolerance is defined as: 0 Deg C

52. P0106-SE3651: Engine Charge Air Cooler Outlet Pressure - Data Erratic, Intermittent, or Incorrect

Charge Pressure Sensor reading is In Range High.

Monitor Operation:	
DTC	P0106-SE3651
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	1 trip

Abort Conditions (any active):
EGR Off Engine Protection is active and Number of OBD Operating Cycle Increases
Key Switch Detect Increase

Pause Conditions (any active):
P0107-SE490, P0108-SE489
P0106-SE4439
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
Engine is not in Run State.
EGR Off Engine Protection is active

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - Estimated Value) in 45 seconds is ever > 270,000 kPa, which is equivalent to [Average of Error - Tolerance] >= 60 kPa.
Where Tolerance is defined as: RefTable8 kPa.

53. P0106-SE3652: Engine Charge Air Cooler Outlet Pressure - Data Erratic, Intermittent, or Incorrect

Charge Pressure Sensor reading is In Range Low.

Monitor Operation:	
DTC	P0106-SE3652
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	1 trip

Abort Conditions (any active):
EGR Off Engine Protection is active and Number of OBD Operating Cycle Increases
Key Switch Detect Increase

Pause Conditions (any active):
P0106-SE4439
P0107-SE490, P0108-SE489
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
Engine is not in Run State.
EGR Off Engine Protection is active

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Value - Measured Value) in 45 seconds is ever > 270,000 kPa, which is equivalent to [Average of Error - Tolerance] >= 60 kPa.
Where Tolerance is defined as: RefTable8 kPa.

54. P0106-SE4439: Engine Charge Air Cooler Outlet Pressure - Data Erratic, Intermittent, or Incorrect

Charge Pressure Sensor reading is erratic, intermittent or incorrect at keyoff.

Monitor Operation:	
DTC	P0106-SE4439
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine is in stopped state
The time since Key Switch is turned OFF ≥ 30 sec

Abort Conditions (any active):
P0107-SE490, P0108-SE489
Coolant Temperature ≤ 70 °C

Malfunction Thresholds (all active):
Charge Pressure Sensor reading < 18 kPa(absolute)
OR
Charge Pressure Sensor reading > 144.31 kPa(absolute)
OR
|Charge Pressure - the most accurate pressure sensor from the remaining pressure sensor| > (11.84 + the tolerance of the most accurate pressure sensor from the remaining pressure sensors) kPa(absolute)
|Charge Pressure - the second most accurate pressure sensor from the remaining pressure sensor| > (11.84 + the tolerance of the second most accurate pressure sensor from the remaining pressure sensors) kPa(absolute)
| the most accurate sensor from the remaining pressure sensors - the second most accurate sensor from the remaining pressure sensors | < (the tolerance of the most accurate sensor from the remaining pressure sensors + the tolerance of the second most accurate sensor from the remaining pressure sensors) kPa(absolute)
The tolerance of the remaining pressure sensors are:
Exhaust Pressure sensor tolerance = 39.59 kPa(absolute)
Compressor Inlet Pressure sensor tolerance = 3.19 kPa(absolute)

55. P0108-SE489: Engine Charge Air Cooler Outlet Pressure - Voltage Above Normal or Shorted to High Source

Charge Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0108-SE489
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Charge Pressure sensor value > 4.8V (350 kPa(absolute))

56. P0107-SE490: Engine Charge Air Cooler Outlet Pressure - Voltage Below Normal or Shorted to Low Source

Charge Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0107-SE490
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Charge Pressure sensor value < 0.2V (44.81 kPa(absolute))

57. P0111-SE4067: Intake Manifold 1 Temperature - Data Erratic, Intermittent, or Incorrect

Charge Temperature reading is In Range High.

Monitor Operation:	
DTC	P0111-SE4067
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0112-SE488, P0113-SE487
P0111-SE3793
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P0049-SE3641, P0102-SE3207, P0103-SE3206, P0111-SE4067, P0111-SE4070, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0501-SE130, P0501-SE4361
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Fresh Air Flow ≤ 8 kg/min
Ambient Air Temperature ≤ -6.67 °C
Compressor Inlet Temperature ≥ 50 °C
Compressor Outlet Temperature - Compressor Inlet Temperature < 40 °C
Vehicle speed < 37.282 mph
The time, after vehicle speed is >= 37.282 (mph), is less than a calibrated Diagnostic Delay RefTable3. The Low Vehicle Speed time input to the table is determined by logging the time below a calibrated vehicle speed, 18.641 (mph) while the engine is running.
|Compressor Inlet Temperature - Ambient Air Temperature| > 12 °C
Remote Throttle is active
EGR Off Engine Protection is active
Engine is not in Run state OR has been in Run state for < 120 s

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - Estimated Value) in 60 seconds is ever > 216,000 Deg C, which is equivalent to [Average of Error - Tolerance] >= 36 Deg C.
Tolerance is defined as: 0 Deg C

58. P0111-SE4070: Intake Manifold 1 Temperature - Data Erratic, Intermittent, or Incorrect

Charge Temperature reading is In Range Low.

Monitor Operation:	
DTC	P0111-SE4070
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0112-SE488, P0113-SE487
P0111-SE3793
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P0049-SE3641, P0102-SE3207, P0103-SE3206, P0111-SE4067, P0111-SE4070, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0501-SE130, P0501-SE4361
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Fresh Air Flow ≤ 8 kg/min
Ambient Air Temperature ≤ -6.67 °C
Compressor Inlet Temperature ≥ 50 °C
Compressor Outlet Temperature - Compressor Inlet Temperature < 40 °C
Vehicle speed < 37.282 mph
The time, after vehicle speed is >= 37.282 (mph), is less than a calibrated Diagnostic Delay RefTable3. The Low Vehicle Speed time input to the table is determined by logging the time below a calibrated vehicle speed, 18.641 (mph) while the engine is running.
|Compressor Inlet Temperature - Ambient Air Temperature| > 12 °C
Remote Throttle is active
EGR Off Engine Protection from aftertreatment component is active.
EGR Off Engine Protection from air handling component is active.
Engine is not in Run state OR has been in Run state for < 120 s

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Value - Measured Value) in 60 seconds is ever > 216,000 Deg C, which is equivalent to [Average of Error - Tolerance] >= 36 Deg C. Where
Tolerance is defined as: 0 Deg C

59. P0111-SE3793: Intake Manifold 1 Temperature - Data Erratic, Intermittent, or Incorrect

Charge Temperature sensor reading is erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P0111-SE3793
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine off time ≥ 480 min
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

Abort Conditions (any active):
P0112-SE488, P0113-SE487
U3017-SE4759
U3017-SE4760

Malfunction Thresholds (all active):
| Charge Temperature sensor - the most accurate sensor from the remaining temperature sensors | > (25 + the tolerance of the most accurate sensor from the remaining temperature sensors) °C
| Charge Temperature sensor - the second most accurate sensor from the remaining temperature sensors | > (25 + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
| the most accurate sensor from the remaining temperature sensors - the second most accurate sensor from the remaining temperature sensors | < (the tolerance of the most accurate sensor from the remaining temperature sensors + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
The tolerance of the remaining temperature sensors are:
Compressor Inlet Temperature sensor tolerance = 40 °C
Charge Air Cooler Outlet Temperature sensor tolerance = 13 °C
Coolant Temperature sensor tolerance = 20 °C
ECM Internal Temperature sensor tolerance = 35 °C
EGR Orifice Temperature sensor tolerance = 25 °C

60. P0113-SE487: Intake Manifold 1 Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

Charge Temperature sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0113-SE487
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Charge Temperature sensor value > 4.738V (< -40 degC)

61. P0112-SE488: Intake Manifold 1 Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

Charge Temperature sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0112-SE488
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Charge Temperature sensor value < 0.067V (> 250 degC)

62. P0606-SE6842: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

There is a short circuit in the injector current charging and discharging switch for injector bank number 1.

Monitor Operation:	
DTC	P0606-SE6842
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
During Initialization with no injection; Actuator Charge-up Voltage [uChrgUp] > 210 V
OR
Main injection is active AND all of the following:
Actuator charging time [tiChrg] for the cylinder being fired < 5 µsecs
Actuator Discharge time [tiDisch] for the cylinder being fired ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for the cylinder being fired > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A
Actuator charging time [tiChrg] for all cylinders in injector bank number 1 < 5 µsecs
Actuator Discharge time [tiDisch] for all cylinders in injector bank number 1 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for all cylinders in injector bank number 1 > Injector charge voltage set-point+80 V

63. P0606-SE6843: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

There is a short circuit in the injector current charging and discharging switch for injector bank number 2.

Monitor Operation:	
DTC	P0606-SE6843
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
During Initialization with no injection; Actuator Charge-up Voltage [uChrgUp] > 210 V
OR
Main injection is active AND all of the following:
Actuator charging time [tiChrg] for the cylinder being fired < 5 µsecs
Actuator Discharge time [tiDisch] for the cylinder being fired ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for the cylinder being fired > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Actuator charging time [tiChrg] for all cylinders in injector bank number 2 < 5 µsecs
Actuator Discharge time [tiDisch] for all cylinders in injector bank number 2 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for all cylinders in injector bank number 2 > Injector charge voltage set-point+80 V
Injector buffer current during voltage discharging ≤ 9.6 A

64. P0088-SE10028: Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

The measured fuel rail pressure is above the setpoint by more than a calibratable amount, regardless of the control mode.

Monitor Operation:	
DTC	P0088-SE10028
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec OR 10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Pressure control is by Pressure Control Valve [PCV] OR Volume Control Valve [VCV] OR by combined pressure control mode [CPC]

Malfunction Thresholds (all active):
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure < RefTable9 bar
High Pressure Pump Delivery Volume Set Point ≤ -0 m3/sec
OR
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure < -200 bar
Pressure Control Valve [PCV] setpoint value < 10 bar

65. P0087-SE10027: Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

The measured fuel rail pressure falls below the setpoint by more than a calibratable amount, regardless of the control mode.

Monitor Operation:	
DTC	P0087-SE10027
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec OR 10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Pressure Control Valve [PCV] OR Fuel Inlet Metering Valve [VCV] OR by comined pressure control mode [CPC]
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure > RefTable10 bar
High Pressure Pump Delivery Volume Set Point ≥ 0 m3/sec
OR
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure > RefTable10 bar

66. P012B-SE8698: Turbocharger 1 Compressor Intake Pressure - Data Erratic, Intermittent, or Incorrect

Compressor Inlet Pressure reading is In Range High

Monitor Operation:	
DTC	P012B-SE8698
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P012B-SE8802
P012C-SE8366, P012D-SE8365
Engine is not in Run State.

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - Estimated Value) in 30 seconds is ever > 15 kPa, which is equivalent to [Average of Error - Tolerance] >= 0.1 kPa. Where Tolerance is defined as: 28.74 kPa.

67. P012B-SE8699: Turbocharger 1 Compressor Intake Pressure - Data Erratic, Intermittent, or Incorrect

Compressor Inlet Pressure reading is In Range Low

Monitor Operation:	
DTC	P012B-SE8699
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P012B-SE8802
P012C-SE8366, P012D-SE8365
Engine is not in Run State.

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Value - Measured Value) in 30 seconds is ever > 15 kPa, which is equivalent to [Average of Error - Tolerance] >= 0.1 kPa. Where Tolerance is defined as: 28.74 kPa.

68. P012B-SE8802: Turbocharger 1 Compressor Intake Pressure - Data Erratic, Intermittent, or Incorrect

Compressor Inlet Pressure Sensor reading is erratic, intermittent or incorrect at keyoff.

Monitor Operation:	
DTC	P012B-SE8802
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in stopped state
The time since Key Switch is turned OFF ≥ 30 sec

Abort Conditions (any active):
P012C-SE8366, P012D-SE8365
Coolant Temperature ≤ 70 °C

Malfunction Thresholds (all active):
Compressor Inlet Pressure Sensor reading < 18 kPa(absolute)
OR
Compressor Inlet Pressure Sensor reading > 144.31 kPa(absolute)
OR
(|Compressor Inlet Pressure - the most accurate pressure sensor from the remaining pressure sensor| > 3.19 + the tolerance of the most accurate pressure sensor from the remaining pressure sensors kPa(absolute)
|Compressor Inlet Pressure - the second most accurate pressure sensor from the remaining pressure sensor| > 3.19 + the tolerance of the second most accurate pressure sensor from the remaining pressure sensors kPa(absolute)
| the most accurate sensor from the remaining pressure sensors - the second most accurate sensor from the remaining pressure sensors | < the tolerance of the most accurate sensor from the remaining pressure sensors + the tolerance of the second most accurate sensor from the remaining pressure sensors) kPa(absolute)
The tolerance of the remaining pressure sensors are:
Exhaust Pressure sensor tolerance = 39.59 kPa(absolute)
Charge Pressure sensor tolerance = 11.84 kPa(absolute)

69. P012D-SE8365: Turbocharger 1 Compressor Intake Pressure Circuit - Voltage Above Normal or Shorted to High Source

Compressor Inlet Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P012D-SE8365
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Compressor Inlet Pressure sensor value > 4.8 V (110.32 kPa (absolute))

70. P012C-SE8366: Turbocharger 1 Compressor Intake Pressure Circuit - Voltage Below Normal or Shorted to Low Source

Compressor Inlet Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P012C-SE8366
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Compressor Inlet Pressure sensor value < 0.2 V (44.82 kPa (absolute))

71. P0238-SE2977: Interstage Air Pressure 1 Circuit - Voltage Above Normal or Shorted to High Source

Compressor Interstage Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0238-SE2977
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Compressor Interstage Pressure sensor value > 4.8V (620.53 (kPa (absolute)))

72. P0237-SE2976: Interstage Air Pressure 1 Circuit - Voltage Below Normal or Shorted to Low Source

Compressor Interstage Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0237-SE2976
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Compressor Interstage Pressure sensor value < 0.2V (44.81 (kPa (absolute)))

73. P1191-SE4190: Turbocharger 1 Compressor Intake Temperature - Data Erratic, Intermittent, or Incorrect

Compressor Inlet Temperature reading is In Range High

Monitor Operation:	
DTC	P1191-SE4190
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine has been in Run state for >= 120 s

Pause Conditions (any active):
P1191-SE4746
P1192-SE484, P1193-SE486

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - Estimated Value) in 150 seconds is ever > 1,500 Deg C, which is equivalent to [Average of Error - Tolerance] >= 2 Deg C. Where Tolerance is defined as: 68.5 Deg C.

74. P1191-SE4746: Turbocharger 1 Compressor Intake Temperature - Data Erratic, Intermittent, or Incorrect

Compressor Inlet Temperature sensor reading is erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P1191-SE4746
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine off time ≥ 480 min
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

Abort Conditions (any active):
P1192-SE484, P1193-SE486
U3017-SE4759
U3017-SE4760

Malfunction Thresholds (all active):
| Compressor Inlet Temperature sensor - the most accurate sensor from the remaining temperature sensors | > (40 + the tolerance of the most accurate sensor from the remaining temperature sensors) °C
| Compressor Inlet Temperature sensor - the second most accurate sensor from the remaining temperature sensors | > (40 + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
| the most accurate sensor from the remaining temperature sensors - the second most accurate sensor from the remaining temperature sensors | < (the tolerance of the most accurate sensor from the remaining temperature sensors + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
The tolerance of the remaining temperature sensors are:
Charge Temperature sensor tolerance = 25 °C
Charge Air Cooler Outlet Temperature sensor tolerance = 13 °C
Coolant Temperature sensor tolerance = 20 °C
ECM Internal Temperature sensor tolerance = 35 °C
EGR Orifice Temperature sensor tolerance = 25 °C

75. P1193-SE486: Turbocharger 1 Compressor Intake Temperature Circuit - Voltage Above Normal or Shorted to High Source

Compressor Inlet Temperature sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P1193-SE486
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Compressor Inlet Temperature sensor value > 4.737V (< -40 degC)

76. P1192-SE484: Turbocharger 1 Compressor Intake Temperature Circuit - Voltage Below Normal or Shorted to Low Source

Compressor Inlet Temperature sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P1192-SE484
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Compressor Inlet Temperature sensor value < 0.096V (> 119.885 degC)

77. P2559-SE572: Coolant Level Sensor 1 Circuit - Voltage Above Normal or Shorted to High Source

Coolant Level Sensor Circuit has its voltage above normal, or shorted to a high source

Monitor Operation:	
DTC	P2559-SE572
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Coolant Level Sensor Value > 4.629 V

78. P2558-SE283: Coolant Level Sensor 1 Circuit - Voltage Below Normal or Shorted to Low Source

Coolant Level Sensor Circuit has its voltage below normal, or is shorted to a low source.

Monitor Operation:	
DTC	P2558-SE283
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Coolant Level Sensor Value < 0.371 V

79. P2560-SE1909: Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level

Data from the 'Coolant Level sensor' is valid but below normal operating range; level being the 'Least Severe'.

Monitor Operation:	
DTC	P2560-SE1909
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	90 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
P2558-SE283, P2559-SE572

Malfunction Thresholds (all active):
Coolant Level Sensor Voltage ≥ 2.953 V
Coolant Level Sensor Voltage < 3.75 V

80. P0118-SE75: Engine Coolant Temperature 1 Sensor Circuit - Voltage Above Normal or Shorted to High Source

Coolant Temperature sensor circuit has its voltage above normal, or shorted to a high source

Monitor Operation:	
DTC	P0118-SE75
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.96 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):	
Coolant Temperature Sensor Value > 4.966 V	(<-40 Deg C)

81. P0117-SE76: Engine Coolant Temperature 1 Sensor Circuit - Voltage Below Normal or Shorted to Low Source

Coolant Temperature Circuit has its voltage below normal, or is shorted to a low source.

Monitor Operation:	
DTC	P0117-SE76
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.96 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):	
Coolant Temperature Sensor Value < 0.108 V	(>150 Deg C)

82. P0116-SE3669: Engine Coolant Temperature - Data Erratic, Intermittent, or Incorrect

Coolant Temperature Stuck In Range Error

Monitor Operation:	
DTC	P0116-SE3669
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine Is Running

Pause Conditions (any active):
P0117-SE76
P0118-SE75
P0116-SE3805

Malfunction Thresholds (all active):
(Maximum Coolant Temperature – Minimum Coolant Temperature) < 0.5 DegC for 300 counts. Where: Counts increment according to High Counts and Low Counts: 'High Counts' increment when: Net Engine Torque > 300 Nm OR (Coolant Temperature Sensor < 71.094 degC AND Net Engine Torque > 300 Nm) 'Low counts' increment when: Net Engine Torque < 170 Nm OR (Coolant Temperature Sensor < 71.094 degC AND Net Engine Torque < 170 Nm)

83. P0116-SE3805: Engine Coolant Temperature - Data Erratic, Intermittent, or Incorrect

Coolant Temperature sensor reading is erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P0116-SE3805
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine off time ≥ 480 min
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

Abort Conditions (any active):
P0117-SE76, P0118-SE75
U3017-SE4759
U3017-SE4760

Malfunction Thresholds (all active):
| Coolant Temperature sensor - the most accurate sensor from the remaining temperature sensors | > (20 + the tolerance of the most accurate sensor from the remaining temperature sensors) °C
| Coolant Temperature sensor - the second most accurate sensor from the remaining temperature sensors | > (20 + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
| the most accurate sensor from the remaining temperature sensors - the second most accurate sensor from the remaining temperature sensors | < (the tolerance of the most accurate sensor from the remaining temperature sensors + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
The tolerance of the remaining temperature sensors are:
Compressor Inlet Temperature sensor tolerance = 40 °C
Charge Temperature sensor tolerance = 25 °C
Charge Air Cooler Outlet Temperature sensor tolerance = 13 °C
ECM Internal Temperature sensor tolerance = 35 °C
EGR Orifice Temperature sensor tolerance = 25 °C

84. P0128-SE3190: Engine Cooling System Monitor - Data Valid But Below Normal Operating Range - Moderately Severe Level

Engine not warming up

Monitor Operation:	
DTC	P0128-SE3190
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Variable based on Operating Conditions, but not more than RefTable11 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine RPM > 300 RPM
Coolant Temperature at engine startup < 51.594 °C
Time Elapsed Since Engine Start ≥ 10 sec

Abort Conditions (any active):
P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75
Engine RPM < 300 RPM
Elapsed Time that this monitor has been running ≥ RefTable11 sec
Coolant Temperature ≤ -6.695 °C

Pause Conditions (any active):
Percentage of time at engine idle > 50 %

Malfunction Thresholds (all active):
Predicted Coolant Temperature ≥ 71.094 °C
Coolant Temperature < 71.094 °C

85. P0128-SE8351: Engine Cooling System Monitor - Data Valid But Below Normal Operating Range - Moderately Severe Level

Coolant Temperture drops after engine has warmed up

Monitor Operation:	
DTC	P0128-SE8351
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	20 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0128-SE3190
Maximum Coolant Temperature this trip ≥ 71.094 °C
Engine Is Running

Abort Conditions (any active):
P0117-SE76
P0118-SE75
P0116-SE3805
P0116-SE3669
Ambient Air Temperature ≤ -6.695 °C

Malfunction Thresholds (all active):
Coolant Temperature < 71.094 °C
Net Engine Torque > 200 Nm
Coolant Temperature <= previous Coolant Temperature

86. P0087-SE6787: Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Fuel Rail Pressure falls below a calibratable minimum threshold [based on engine speed] while running in the Combined Pressure Control Mode.

Monitor Operation:	
DTC	P0087-SE6787
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is by both Volume Control Valve [VCV] AND Pressure Control Valve [PCV] in closed loop [Coupled Pressure Control, in closed loop]

Malfunction Thresholds (all active):
Fuel Rail Pressure < RefTable12 bar

87. P053E-SE2020: Crankcase Pressure - Data Valid But Above Normal Operating Range - Most Severe Level

Crankcase Pressure - High (critical severity)

Monitor Operation:	
DTC	P053E-SE2020
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
P051C-SE1424, P051D-SE1422
P051B-SE2086, P051B-SE3665
Engine RPM ≥ 400 RPM
(coolant temperature > 71.109 degC for 300 sec AND P0118-SE75 is inactive AND P0117-SE76 is inactive) OR (engine RPM > 0 RPM for 1,200 sec).

Abort Conditions (any active):
P051C-SE1424, P051D-SE1422
P051B-SE2086, P051B-SE3665
Engine RPM < 400 RPM

Pause Conditions (any active):
Any Active Air Temperature System Errors (See RefCond0005.) AND (coolant temperature ≤ 71.109 degC OR P0118-SE75 is active OR P0117-SE76 is active) AND (engine RPM > 0 RPM for less than 1,200 sec)

Malfunction Thresholds (all active):
Crankcase Pressure ≥ RefTable13 kPa(gauge)

88. P051D-SE1422: Crankcase Pressure Circuit - Voltage Above Normal or Shorted to High Source

Crankcase Pressure Out Of Range High

Monitor Operation:	
DTC	P051D-SE1422
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Crankcase Pressure Sensor Value > 4.746 V (6.89 kPa (gauge))

89. P051C-SE1424: Crankcase Pressure Circuit - Voltage Below Normal or Shorted to Low Source

Crankcase Pressure Out Of Range Low

Monitor Operation:	
DTC	P051C-SE1424
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Crankcase Pressure Sensor Value < 0.254 V (-2.49 kPa (gauge))

90. P0335-SE4372: Engine Crankshaft Speed/Position - Data Erratic, Intermittent, or Incorrect

Crankshaft tonewheel pulses are monitored for “disturbances” due to missing pulses or pulses in wrong locations. The error is set if an incorrect signal is received for a calibratable number of engine revolutions.

Monitor Operation:	
DTC	P0335-SE4372
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0335-SE6886, P0501-SE130, P0501-SE4361, P0698-SE816, P0699-SE814
Crankshaft signal profile with tonewheel gap effect is detected.
0.621 mph > Vehicle Speed > 15.534 mph OR Engine Speed > 400 rpm
Engine Speed ≥ 550 RPM

Abort Conditions (any active):
P0335-SE6886, P0501-SE130, P0501-SE4361, P0698-SE816, P0699-SE814
Crankshaft signal profile with tonewheel gap effect is NOT detected.
Vehicle Speed ≤ 15.534 mph AND Engine Speed ≤ 400 rpm
Vehicle Speed ≥ 0.621 mph AND Engine Speed ≤ 400 rpm
Engine Speed < 550 RPM

Malfunction Thresholds (all active):
Crankshaft tone wheel pulses are intermittently missing.

91. P0335-SE6886: Engine Crankshaft Speed/Position - Data Erratic, Intermittent, or Incorrect

This diagnostic sets an error when there is a valid camshaft signal without a corresponding crankshaft signal.

Monitor Operation:	
DTC	P0335-SE6886
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0501-SE130, P0501-SE4361
P0698-SE816, P0699-SE814
Engine Speed ≥ 550 RPM
To prevent false errors due to tow start, vehicle speed is outside a calibratable range as follows: 0.621 mph > Vehicle Speed > 15.534 mph for an Engine Speed ≤400 RPM

Abort Conditions (any active):
P0501-SE130, P0501-SE4361
P0698-SE816, P0699-SE814
Engine Speed < 550 RPM
Vehicle Speed ≤ 15.534 mph
Vehicle Speed ≥ 0.621 mph

Malfunction Thresholds (all active):
No Crankshaft signal is present.

92. P0301-SE7393: Engine Misfire Cylinder 1 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 1 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0301-SE7393
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 1 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 1 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

93. P02EE-SE6854: Injector Solenoid Driver Cylinder 1 - Voltage Above Normal or Shorted to High Source

Injector number 1 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02EE-SE6854
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 1 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

94. P0261-SE6892: Injector Solenoid Driver Cylinder 1 - Voltage Below Normal or Shorted to Low Source

Injector number 1 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 1 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0261-SE6892
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 1 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 1 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 1 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V

Actuator Charge-up voltage [uChrgUp] for cylinder number 1 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 1 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 1 < Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
Injector buffer current during voltage discharging ≤ 9.6 A

95. P0302-SE7394: Engine Misfire Cylinder 2 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 2 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0302-SE7394
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 2 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 2 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

96. P02EF-SE6855: Injector Solenoid Driver Cylinder 2 - Voltage Above Normal or Shorted to High Source

Injector number 2 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02EF-SE6855
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 2 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

97. P0264-SE6893: Injector Solenoid Driver Cylinder 2 - Voltage Below Normal or Shorted to Low Source

Injector number 2 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 2 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0264-SE6893
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 2 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 2 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 2 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V

Actuator Charge-up voltage [uChrgUp] for cylinder number 2 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 2 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 2 < Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
Injector buffer current during voltage discharging ≤ 9.6 A

98. P0303-SE7399: Engine Misfire Cylinder 3 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 3 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0303-SE7399
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 3 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 3 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

99. P02F0-SE6861: Injector Solenoid Driver Cylinder 3 - Voltage Above Normal or Shorted to High Source

Injector number 3 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02F0-SE6861
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 3 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

100. P0267-SE6899: Injector Solenoid Driver Cylinder 3 - Voltage Below Normal or Shorted to Low Source

Injector number 3 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 3 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0267-SE6899
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 3 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 3 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 3 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V

Actuator Charge-up voltage [uChrgUp] for cylinder number 3 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 3 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 3 < Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

101. P0304-SE7396: Engine Misfire Cylinder 4 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 4 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0304-SE7396
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 4 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 4 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

102. P02F1-SE6858: Injector Solenoid Driver Cylinder 4 - Voltage Above Normal or Shorted to High Source

Injector number 4 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02F1-SE6858
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for for cylinder number 4 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

103. P0270-SE6896: Injector Solenoid Driver Cylinder 4 - Voltage Below Normal or Shorted to Low Source

Injector number 4 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 4 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0270-SE6896
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 4 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 4 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 4 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V

Actuator Charge-up voltage [uChrgUp] for cylinder number 4 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 4 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 4 < Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

104. P0305-SE7397: Engine Misfire Cylinder 5 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 5 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0305-SE7397
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 5 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 5 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

105. P02F2-SE6859: Injector Solenoid Driver Cylinder 5 - Voltage Above Normal or Shorted to High Source

Injector number 5 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02F2-SE6859
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 5 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

106. P0273-SE6897: Injector Solenoid Driver Cylinder 5 - Voltage Below Normal or Shorted to Low Source

Injector number 5 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 5 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0273-SE6897
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 5 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 5 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 5 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V

Actuator Charge-up voltage [uChrgUp] for cylinder number 5 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 5 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 5 < Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

107. P0306-SE7398: Engine Misfire Cylinder 6 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 6 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0306-SE7398
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 6 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 6 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

108. P02F3-SE6860: Injector Solenoid Driver Cylinder 6 - Voltage Above Normal or Shorted to High Source

Injector number 6 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02F3-SE6860
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 6 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

109. P0276-SE6898: Injector Solenoid Driver Cylinder 6 - Voltage Below Normal or Shorted to Low Source

Injector number 6 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 6 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0276-SE6898
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 6 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 6 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 6 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V

Actuator Charge-up voltage [uChrgUp] for cylinder number 6 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 6 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 6 < Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

110. P0307-SE7395: Engine Misfire Cylinder 7 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 7 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0307-SE7395
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 7 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 7 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

111. P02F4-SE6856: Injector Solenoid Driver Cylinder 7 - Voltage Above Normal or Shorted to High Source

Injector number 7 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02F4-SE6856
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 7 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

112. P0279-SE6894: Injector Solenoid Driver Cylinder 7 - Voltage Below Normal or Shorted to Low Source

Injector number 8 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 8 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0279-SE6894
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 7 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 7 ≥ 5 µsecs

Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 < Injector charge voltage set-point*0.55 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 ≥ Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

113. P0308-SE7454: Engine Misfire Cylinder 8 - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. Cylinder number 8 misfire error is set when excessive misfires are detected.

Monitor Operation:	
DTC	P0308-SE7454
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Only 1 cylinder is detected misfiring and flagged by software.
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on Cylinder number 8 were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after cylinder number 8 injection is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

114. P02F5-SE6857: Injector Solenoid Driver Cylinder 8 - Voltage Above Normal or Shorted to High Source

Injector number 8 low side or negative terminal is short-circuited to battery.

Monitor Operation:	
DTC	P02F5-SE6857
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 8 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

115. P0282-SE6895: Injector Solenoid Driver Cylinder 8 - Voltage Below Normal or Shorted to Low Source

Injector number 8 driver high side is short-circuited to the injector driver low side of another injector on the same bank with a high resistance.
OR
Injector number 8 driver low side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0282-SE6895
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 8 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 < Injector charge voltage set-point*0.7 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 8 ≥ 5 µsecs

Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge voltage [uUp] < Injector charge voltage set-point*0.55 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 ≤ Injector charge voltage set-point+80 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 < Injector charge voltage set-point*0.7 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 < Injector charge voltage set-point*0.55 V
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 ≥ Injector charge voltage set-point*0.55 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

116. P0606-SE6881: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

The DCDC Converter controls and monitors the charging of the Buffer Capacitors of the Charge Switches in the injector driver circuit. This system error is set If the DCDC Converter fails to be started.

Monitor Operation:	
DTC	P0606-SE6881
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0606-SE6842
The injector driver ASIC successfully initialized.

Malfunction Thresholds (all active):
A SPI command from the microcontroller to the injector driver ASIC to START the DCDC converter of injector bank number 1 was unsuccessful.
OR
The Buffer Capacitor voltage of the Charging Switch for injector bank number 1 has not reached 250 V after a calibratable time of 1,100 msec

117. P0606-SE6862: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

The DCDC Converter controls and monitors the charging of the Buffer Capacitors of the Charge Switches in the injector driver circuit. This system error is set if the DCDC Converter cannot be turned off.

Monitor Operation:	
DTC	P0606-SE6862
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0606-SE6842
The DCDC Converter for injector bank number 1 was successfully started.

Malfunction Thresholds (all active):
A SPI command from the microcontroller to the injector driver ASIC to STOP the DCDC converter of injector bank number 1 was unsuccessful.

118. P0606-SE6882: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

The DCDC Converter controls and monitors the charging of the Buffer Capacitors of the Charge Switches in the injector driver circuit. This system error is set If the DCDC Converter fails to be started.

Monitor Operation:	
DTC	P0606-SE6882
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0606-SE6843
The injector driver ASIC successfully initialized.

Malfunction Thresholds (all active):
A SPI command from the microcontroller to the injector driver ASIC to START the DCDC converter of injector bank number 2 was unsuccessful.
OR
The Buffer Capacitor voltage of the Charging Switch for injector bank number 2 has not reached 250 V after a calibratable time of 1,100 msec

119. P0606-SE6863: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

The DCDC Converter controls and monitors the charging of the Buffer Capacitors of the Charge Switches in the injector driver circuit. This system error is set if the DCDC Converter cannot be turned off.

Monitor Operation:	
DTC	P0606-SE6863
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0606-SE6843
The DCDC Converter for injector bank number 2 was successfully started.

Malfunction Thresholds (all active):
A SPI command from the microcontroller to the injector driver ASIC to STOP the DCDC converter of injector bank number 2 was unsuccessful.

120. P218F-SE8289: Aftertreatment 1 Diesel Exhaust Fluid Actual Dosing Quantity - Data Valid But Below Normal Operating Range - Moderately Severe Level

To determine degraded doser performance based on accumulated nominal error between commanded and estimated DEF flow.

Monitor Operation:	
DTC	P218F-SE8289
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P208C-SE7126
P208A-SE7127
P204A-SE7128
P204A-SE7129
P204A-SE7130
U040F-SE7149
U040F-SE7150
P20E8-SE7969
P20E9-SE7966
U11C1-SE7156
P208D-SE7604
P21CC-SE7074
P21CB-SE7098
P21CA-SE7104
P21CA-SE7106
P208D-SE7598
P208D-SE7599
P204D-SE7115
P204C-SE7118
P20E9-SE7120
P20E8-SE7121
P208D-SE7125
P2048-SE5102
P20E8-SE6980
U11C1-SE8706
P0563-SE297
P0562-SE296
Key Switch is ON.

The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.) OR The in-tank mounted measurement of the DEF tank temperature is suspect (See RefCond0007.)
NOT[Reset for Urea Delivery Monitor Diagnostic Cumulative Sum (CUSUM) calculation. (See RefCond0008.)].
Urea Delivery Monitor Key Switch/Operation Cycle Enable. (See RefCond0009.)
Urea Delivery Monitor Cusum Enable. (See RefCond0010.)

Abort Conditions (any active):
P0563-SE297
P0562-SE296
P208C-SE7126
P208A-SE7127
P204A-SE7128
P204A-SE7129
P204A-SE7130
U040F-SE7149
U040F-SE7150
P20E8-SE7969
P20E9-SE7966
U11C1-SE7156
P208D-SE7604
P21CC-SE7074
P21CB-SE7098
P21CA-SE7102
P21CA-SE7104
P21CA-SE7106
P208D-SE7598
P208D-SE7599
P204D-SE7115
P204C-SE7118
P20E9-SE7120
P20E8-SE7121
P208D-SE7125
P2048-SE5102
P20E8-SE6980
U11C1-SE8706
Key Switch is OFF.
NOT[The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.)] and NOT [The in-tank mounted measurement of the DEF tank temperature is suspect (See RefCond0007.)]
Reset for Urea Delivery Monitor Diagnostic Cumulative Sum (CUSUM) calculation. (See RefCond0008.)

Malfunction Thresholds (all active):

Cumulative sum of error (((Commanded DEF flow - Estimated DEF flow)/Commanded DEF flow) - Tolerance) over a 120 second period is ever ≥ 300 unitless, which is equivalent to [Average of Error - Tolerance] >= 0.5 unitless. Where: Tolerance is defined as 0 unitless.

121. P0611-SE7410: Injector Power Supply - Bad Intelligent Device or Component

Plausibility diagnosis of Engine speed offset between Engine Speed calculated at 10 ms interval and Engine Speed calculated at 40 ms interval.

Monitor Operation:	
DTC	P0611-SE7410
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.32 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM

Malfunction Thresholds (all active):
|Engine speed calculated at 10 ms interval - Engine speed calculated at 40 ms interval| > 400 RPM

122. P0611-SE7416: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of the Post Fuel Injection 2 shut-off.

Monitor Operation:	
DTC	P0611-SE7416
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM
Post Fuel Injection 2 quantity > 5 mg

Malfunction Thresholds (all active):
Post Fuel Injection 2 quantity > 25 mg OR Start of Energizing angle for Post Fuel Injection 2 quantity is greater than Permissible Start of Energizing angle OR RefTable14 > Post Fuel Injection 2 Efficiency factor OR RefTable15 < Post Fuel Injection 2 Efficiency factor

123. P0611-SE7417: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of Post Fuel Injection 3 efficiency plausibility.

Monitor Operation:	
DTC	P0611-SE7417
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM
Post Fuel Injection 3 quantity > 5 mg

Malfunction Thresholds (all active):
-0.102 (unitless) > Post Fuel Injection 3 efficiency factor OR 1.102 (unitless) < Post Fuel Injection 3 efficiency factor

124. P062B-SE7419: Fuel System Shutdown Failure - Condition Exists

Plausibility diagnosis of the fuel injection correction components of Pilot, Main and Post fuel injections

Monitor Operation:	
DTC	P062B-SE7419
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM

Malfunction Thresholds (all active):
|Actual fuel injection correction component for Main Fuel Injection 1 - Requested fuel injection correction component for Main Fuel Injection 1| >= 9.5 mg OR |Actual fuel injection correction component for Pilot Fuel Injection 1 - Requested fuel injection correction component for Pilot Fuel Injection 1| >= 9.5 mg OR |Actual fuel injection correction component for Post Fuel Injection 2 - Requested fuel injection correction component for Post Fuel Injection 2| >= 9.5 mg OR |Actual fuel injection correction component for Post Fuel Injection 3 - Requested fuel injection correction component for Post Fuel Injection 3| >= 9.5 mg

125. P062B-SE7481: Fuel System Shutdown Failure - Condition Exists

Monitoring of the vehicle brake pedal switch signal status plausibility.

Monitor Operation:	
DTC	P062B-SE7481
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Brake Status indication = Complement of Brake Status indication

126. P062B-SE7414: Fuel System Shutdown Failure - Condition Exists

Diagnosis of the energizing time correction values plausibility for Zero Fuel quantity Calibration (ZFC) or Zero Fuel quantity Calibration at Low Idle (ZFL) as applicable

Monitor Operation:	
DTC	P062B-SE7414
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM

Malfunction Thresholds (all active):
RefTable16 > Energizing time correction value for ZFC/ZFL for Pilot Injection 1 OR RefTable17 < Energizing time correction value for ZFC/ZFL for Pilot Injection 1 OR RefTable16 > Energizing time correction value for ZFC/ZFL for Pilot Injection 2 OR RefTable17 < Energizing time correction value for ZFC/ZFL for Pilot Injection 2 OR RefTable16 > Energizing time correction value for ZFC/ZFL for Pilot Injection 3 OR RefTable17 < Energizing time correction value for ZFC/ZFL for Pilot Injection 3 ZFC - Zero Fuel quantity Calibration ZFL - Zero Fuel quantity Calibration at Low Idle

127. P0611-SE7482: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of plausibility of current energizing time with maximum permitted energizing time.

Monitor Operation:	
DTC	P0611-SE7482
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Commanded injection quantity is zero for minimum 100 ms

Malfunction Thresholds (all active):
Averaged energizing time per cylinder > RefTable18

128. P0611-SE7411: Injector Power Supply - Bad Intelligent Device or Component

Plausibility diagnosis of Energizing time for Pilot, Main and Post Fuel Injection quantity.

Monitor Operation:	
DTC	P0611-SE7411
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM

Malfunction Thresholds (all active):
Measured energizing time (µs) - Requested energizing time (µs) > 70 µs

129. P0611-SE7412: Injector Power Supply - Bad Intelligent Device or Component

Plausibility diagnosis of Start of Energizing angle for Pilot, Main and Post Fuel Injection quantity.

Monitor Operation:	
DTC	P0611-SE7412
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM
Fuel Injection energizing time (µs) is non-zero.

Malfunction Thresholds (all active):
-23.01 ° > Start of energizing angle for Pilot Fuel Injection 3 OR 123.76 ° < Start of energizing angle for Pilot Fuel Injection 3 OR -23.01 ° > Start of energizing angle for Main Fuel Injection 1 OR 33 ° < Start of energizing angle for Main Fuel Injection 1 OR -92.99 ° > Start of energizing angle for Post Fuel Injection 3 OR 13.01 ° < Start of energizing angle for Post Fuel Injection 3 OR -92.99 ° > Start of energizing angle for Post Fuel Injection 2 OR -2 ° < Start of energizing angle for Post Fuel Injection 2 OR -360 ° > Start of energizing angle for Post Fuel Injection 1 OR -36.98 ° < Start of energizing angle for Post Fuel Injection 1 OR -360 ° > Start of energizing angle for Post Fuel Injection 0 OR -36.98 ° < Start of energizing angle for Post Fuel Injection 0 (The unit of Start of energizing angle is Crankshaft angle in degrees (°CrS))

130. P0611-SE7413: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of Fuel Injection quantity RAM data values update.

Monitor Operation:	
DTC	P0611-SE7413
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM

Malfunction Thresholds (all active):
Fuel injection quantity values are not updated in to RAM buffer.

131. P0611-SE7420: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of fuel rail pressure plausibility.

Monitor Operation:	
DTC	P0611-SE7420
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.12 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine speed > 1,200 RPM

Malfunction Thresholds (all active):
7,200 kPa (absolute) > Fuel Rail Pressure OR 203,200 kPa (absolute) < Fuel Rail Pressure

132. P0611-SE7418: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of calculated actual torque-relevant fuel injection quantity plausibility.

Monitor Operation:	
DTC	P0611-SE7418
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.52 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Calculated actual torque-relevant fuel injection quantity > Permissible torque-relevant fuel injection quantity

133. P200E-SE3070: Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment DOC delta gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P200E-SE3070
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	55 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
Elapsed time since last active regeneration > 540 sec
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.2 g/sec

Abort Conditions (any active):
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
Rate of active/intrusive injection of hydrocarbons in exhaust > 0.2 g/sec

Malfunction Thresholds (all active):
DPF inlet temperature - DOC inlet temperature > 400 °C

134. P0544-SE2858: Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data Erratic, Intermittent, or Incorrect

Aftertreatment DOC intake gas temperature is in-range but not rational.

Monitor Operation:	
DTC	P0544-SE2858
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	500 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Engine is running
Elapsed time since last active regeneration > 120 sec
Exhaust flow > 25 g/sec
215 degC < (DOC intake or DPF intake or DPF outlet) gas temperature < 600 degC
(300 seconds have elapsed since OEM datalink requested Engine intrusive diagnostics was active)
NOT [DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0013.)]
NOT [DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0014.)]
NOT [DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0015.)]

Abort Conditions (any active):
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872,

P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Elapsed time since last active regeneration < 120 sec

Pause Conditions (any active):
Engine is not running
Exhaust flow < 25 g/sec
(DOC Intake Temperature or DPF Intake Temperature or DPF Outlet Temperature) <215 degC OR (DOC Intake Temperature or DPF Intake Temperature or DPF Outlet Temperature) gas temperature > 600 degC
OEM datalink requested Engine intrusive diagnostics is active
DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0013.)
DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0014.)
DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0015.)

Malfunction Thresholds (all active):
(Average temperature drop across DOC > 85 degC) OR (average temperature drop across DOC < -85 degC)
-85 degC < average temperature drop across DPF < 85 degC

135. P2080-SE3068: Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment DOC inlet gas temperature is above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P2080-SE3068
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	65 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
Elapsed time since last active regeneration > 540 sec
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.2 g/sec

Abort Conditions (any active):
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
Rate of active/intrusive injection of hydrocarbons in exhaust ≥ 0.2 g/sec

Malfunction Thresholds (all active):
DOC inlet temperature > 745 °C

136. P0420-SE4719: Aftertreatment 1 Diesel Oxidation Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level

Decrease in the NMHC conversion capability of the DOC that would cause tailpipe out NMHC emissions to exceed the applicable OBD threshold.

Monitor Operation:	
DTC	P0420-SE4719
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	375 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Conditions that enable the calculation of conversion efficiency of an oxidation catalyst. (See RefCond0016.)

Abort Conditions (any active):
System errors that could abort the calculation of conversion efficiency of an oxidation catalyst. (See RefCond0017.)

Pause Conditions (any active):
Conditions that pause the calculation of conversion efficiency of an oxidation catalyst. (See RefCond0018.)

Malfunction Thresholds (all active):
Filtered value of Hydrocarbon dosing efficiency < 58 %, where Hydrocarbon dosing efficiency is defined as DOC Heat / DOC Dosing Heat

137. P2031-SE2844: Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Erratic, Intermittent, or Incorrect

Aftertreatment DPF intake gas temperature is in-range but not rational.

Monitor Operation:	
DTC	P2031-SE2844
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	500 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Engine is running
Elapsed time since last active regeneration > 120 sec
Exhaust flow > 25 g/sec
215 degC < (DOC intake or DPF intake or DPF outlet) gas temperature < 600 degC
(300 seconds have elapsed since OEM datalink requested Engine intrusive diagnostics was active)
NOT [DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0013.)].
NOT [DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0014.)]
NOT [DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0015.)]

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736

P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
Elapsed time since last active regeneration < 120 sec

Pause Conditions (any active):
Engine is not running
Exhaust flow < 25 g/sec
(DOC Intake Temperature or DPF Intake Temperature or DPF Outlet Temperature) < 215 degC OR (DOC Intake Temperature or DPF Intake Temperature or DPF Outlet Temperature) > 600 degC
OEM datalink requested Engine intrusive diagnostics is active
DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0013.)
DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0014.)
DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0015.)

Malfunction Thresholds (all active):
(Average temperature drop across DOC > 85 degC) OR (average temperature drop across DOC < -85 degC)
(Average temperature drop across DPF > 85 degC) OR (average temperature drop across DPF < -85 degC)

138. P200E-SE3069: Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment DPF inlet gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P200E-SE3069
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	100 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
Elapsed time since last active regeneration > 540 sec
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.2 g/sec

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
Rate of active/intrusive injection of hydrocarbons in exhaust ≥ 0.2 g/sec

Malfunction Thresholds (all active):
DPF inlet temperature > 735 °C

139. P1484-SE1759: Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Valid But Above Normal Operating Range - Least Severe Level

Persistent temperature overshoots of the aftertreatment DPF inlet gas temperature during active regeneration of the DPF

Monitor Operation:	
DTC	P1484-SE1759
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 unique occurrences of temperature overshoots persisting for a minimum of 5 seconds each .
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
DPF Regeneration is Active

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736

Malfunction Thresholds (all active):
DPF Inlet temperature > 650 °C

140. P1484-SE3591: Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Valid But Above Normal Operating Range - Most Severe Level

(Aftertreatment DPF inlet gas temperature) OR (Aftertreatment DOC delta gas temperature) continuously above a severe, high threshold for a calibrated period of time

Monitor Operation:	
DTC	P1484-SE3591
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Case A: 30 seconds OR Case B: 90 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168

Malfunction Thresholds (all active):
Case A: DPF inlet temperature > 800 °C
OR
Case B: DPF inlet temperature - DOC inlet temperature > 540 °C

141. P24A0-SE7455: Aftertreatment Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration - Condition Exists

The engine control module is unable to begin closed loop control of active regeneration of DPF due to low DOC temperature.

Monitor Operation:	
DTC	P24A0-SE7455
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	115 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine Speed > 400 RPM for 450 seconds
Ambient Air Pressure ≥ 75 kPa(absolute)
Ambient Air Temperature ≥ -6.7 °C
Active regeneration of DPF has been requested more than 450 sec

Abort Conditions (any active):
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
Engine Speed ≤ 1,125 RPM for 60 seconds.
Engine Fueling ≤ 15 mg/stroke for 60 seconds.

Pause Conditions (any active):
Engine Speed ≤ 1,125 RPM
Engine Fueling ≤ 15 mg/stroke
The above two Pause Conditions turns from true to false for less than 3 seconds.

Malfunction Thresholds (all active):
DOC Bed Temperature < 250 °C

142. P245F-SE2851: Aftertreatment 1 Diesel Particulate Filter Differential Pressure - Abnormal Rate of Change

Aftertreatment DPF differential pressure sensor signal stuck in-range.

Monitor Operation:	
DTC	P245F-SE2851
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2460-SE2857, P2461-SE2849
Range of exhaust volumetric flow since last decision > 0.14 m3/sec
DPF differential pressure sensor signal not saturated at high exhaust flow: (DPF differential pressure <= 35 kPa) OR (Exhaust flow <= 2 m3/sec)
Engine is Running.

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2460-SE2857, P2461-SE2849
Range of exhaust volumetric flow since last decision ≤ 0.14 m3/sec
DPF differential pressure sensor signal saturated at high exhaust flow: (DPF differential pressure > 35 kPa) AND (Exhaust flow > 2 m3/sec)
Engine is Not Running.

Malfunction Thresholds (all active):
Range of DPF differential pressure < 0.1 kPa

143. P2462-SE7316: Aftertreatment Diesel Particulate Filter Differential Pressure - Data Erratic, Intermittent, or Incorrect

Aftertreatment DPF differential pressure sensor key-off check indicates signal in-range but not rational.

Monitor Operation:	
DTC	P2462-SE7316
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
P2460-SE2857, P2461-SE2849
Key Switch is OFF AND Engine Speed is 0 rpm for 54 seconds
Before Key Switch turns Off, DPF Outlet Temperature is >= 200 deg C AND Engine is Running AND the above two conditions are true for 100 seconds.

Abort Conditions (any active):
P2460-SE2857, P2461-SE2849
Key Switch is ON OR Engine Speed is not 0 rpm

Malfunction Thresholds (all active):
Absolute value of averaged DPF delta pressure measured by the delta P sensor > 1.5 kPa(gauge)

144. P2461-SE2849: Aftertreatment Diesel Particulate Filter Differential Pressure Sensor Circuit - Voltage Above Normal or Shorted to High Source

Aftertreatment DPF Delta Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2461-SE2849
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Aftertreatment DPF Delta Pressure sensor value > 4.75 V (36.733 kPa)

145. P2460-SE2857: Aftertreatment Diesel Particulate Filter Differential Pressure Sensor Circuit - Voltage Below Normal or Shorted to Low Source

Aftertreatment DPF Delta Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2460-SE2857
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Aftertreatment DPF Delta Pressure sensor value < 0.25 V (-3.983 kPa)

146. P200C-SE3072: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment DPF delta gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P200C-SE3072
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	140 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
Elapsed time since last active regeneration > 700 sec
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.2 g/sec

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
Rate of active/intrusive injection of hydrocarbons in exhaust ≥ 0.2 g/sec

Malfunction Thresholds (all active):
DPF outlet temperature - DPF inlet temperature > 400 °C

147. P24A2-SE3036: Aftertreatment Diesel Particulate Filter Incomplete Regeneration - Condition Exists

System has detected incomplete regeneration of aftertreatment DPF. This diagnostic feature is essentially a rationality check between the model-based and sensor-based soot load estimate. The OBD system shall detect an incomplete regeneration when the model has predicted that regeneration has completed but more direct indicators (such as pressure signature) indicates the regeneration has not been completed properly. This could be caused by soot failed to be removed under conditions where it is expected to be removed. Or it can be caused by high ash loading that is holding DPF back pressure high even with insignificant amount of soot in the filter

Monitor Operation:	
DTC	P24A2-SE3036
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P245F-SE2851, P2460-SE2857, P2461-SE2849
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
the system detects that the DPF is no longer new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load. (See RefCond0021.)
Time in active regeneration >= 300 seconds, AND percentage of time during the active regeneration when the DPF inlet temperature within 100 degC of target temperature >= 40 %

The time period during active regeneration that DPF volumetric flow rate is > 0.08 m3/sec is > 180 seconds.
At the end of the active regeneration, the Diagnostic Model Based Soot Load Estimate <= 3 g/L.
%O2 reading of Exhaust Air (See RefCond0022.)

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P245F-SE2851, P2460-SE2857, P2461-SE2849
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
the system considers that the DPF is new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load. (See RefCond0023.)
Time in active regeneration < 300 seconds.
Percentage of time during the active regeneration when the DPF inlet temperature is within 100 degC, < 40 %
The time period during active regeneration that DPF volumetric flow rate is < 0.08 m3/sec is > 120 seconds.
At the end of the active regeneration, the Diagnostic Model Based Soot Load Estimate > 3 g/L.
NOT [%O2 reading of Exhaust Air (See RefCond0022.)].

Malfunction Thresholds (all active):
DPF differential pressure based soot load estimate > RefTable19
Immediately after the end of active DPF regeneration in which no abort conditions occurred

148. P244A-SE1752: Aftertreatment 1 Diesel Particulate Filter Missing - Condition Exists

Detection of aftertreatment DPF malfunction.

Monitor Operation:	
DTC	P244A-SE1752
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P245F-SE2851, P2460-SE2857, P2461-SE2849
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
0.08 m3/sec ≤ Exhaust flow ≤ 0.9 m3/sec

Abort Conditions (any active):
P245F-SE2851, P2460-SE2857, P2461-SE2849
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Exhaust flow < 0.08 m3/sec OR Exhaust flow > 0.9 m3/sec

Pause Conditions (any active):

Malfunction Thresholds (all active):
Exhaust flow resistance (DPF differential pressure / volumetric exhaust flow) < RefTable20

149. P2453-SE2983: Aftertreatment 1 Diesel Particulate Filter Outlet Pressure - Abnormal Rate of Change

Aftertreatment DPF outlet pressure sensor signal stuck in-range.

Monitor Operation:	
DTC	P2453-SE2983
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2454-SE2883, P2455-SE2882
Range of exhaust volumetric flow since last decision > 0.15 m3/sec
DPF outlet pressure sensor signal not saturated at high exhaust flow: (DPF outlet pressure <= 20 kPa(gauge)) OR (Exhaust flow <= 2 m3/sec)
Engine is Running.

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2454-SE2883, P2455-SE2882
DPF outlet pressure sensor signal saturated at high exhaust flow: (DPF outlet pressure > 20 kPa(gauge)) AND (exhaust flow > 2 m3/sec)
Engine is Not Running.

Malfunction Thresholds (all active):
Range of DPF outlet pressure since last decision in current key cycle until the enable conditions are met < 0.1 kPa

150. P2456-SE3284: Aftertreatment 1 Diesel Particulate Filter Outlet Pressure - Data Erratic, Intermittent, or Incorrect

Aftertreatment DPF outlet pressure sensor signal in-range but reading inappropriately high.

Monitor Operation:	
DTC	P2456-SE3284
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2454-SE2883, P2455-SE2882
(Exhaust flow > 0.1 m3/sec) OR (Exhaust flow >= 0.08 m3/sec and derivative of Exhaust flow > 0 m3/s^2.)

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2454-SE2883, P2455-SE2882
DPF outlet pressure is above the malfunction criteria for 15 seconds which can trigger AECD 10-1 for active/intrusive injection of hydrocarbons to elevate the temperature of the aftertreatment system with the objective of mitigating the adverse effects of a suspected DEF deposit.

Pause Conditions (any active):
Exhaust flow < 0.08 m3/sec

Malfunction Thresholds (all active):
DPF outlet pressure > RefTable21

151. P2456-SE7317: Aftertreatment 1 Diesel Particulate Filter Outlet Pressure - Data Erratic, Intermittent, or Incorrect

Aftertreatment DPF Outlet pressure sensor key-off check indicates signal in-range but not rational.

Monitor Operation:	
DTC	P2456-SE7317
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
P2454-SE2883, P2455-SE2882
Key Switch is OFF AND Engine Speed is 0 rpm for 54 seconds
Before Key Switch turns Off, DPF Outlet Temperature is >= 200 deg C AND Engine is Running AND The above two conditions are true for 100 seconds.

Abort Conditions (any active):
P2454-SE2883, P2455-SE2882
Key Switch is ON OR Engine Speed is not 0 rpm.

Malfunction Thresholds (all active):
Absolute value of averaged DPF Outlet pressure. > 1.5 kPa(gauge)

152. P2455-SE2882: Aftertreatment 1 Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage Above Normal or Shorted to High Source

Aftertreatment DPF Outlet pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2455-SE2882
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Aftertreatment DPF Outlet pressure sensor value > 4.75 V (36.733 kPa(gauge))

153. P2454-SE2883: Aftertreatment 1 Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage Below Normal or Shorted to Low Source

Aftertreatment DPF Outlet pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2454-SE2883
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Aftertreatment DPF outlet pressure sensor value < 0.25 V (-6.245 kPa(gauge))

154. P242B-SE2852: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Erratic, Intermittent, or Incorrect

Aftertreatment DPF Outlet Gas Temperature is in-range but not rational.

Monitor Operation:	
DTC	P242B-SE2852
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	500 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
Engine is running
Elapsed time since last active regeneration > 120 sec
Exhaust flow > 25 g/sec
215 degC < (DOC intake or DPF intake or DPF outlet) gas temperature < 600 degC
(300 seconds have elapsed since OEM datalink requested Engine intrusive diagnostics was active)
NOT [DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0013.)]
NOT [DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0014.)]
NOT [DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0015.)]

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2032-SE6732, P2033-SE6731, P2033-SE6736

P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
Elapsed time since last active regeneration < 120 sec

Pause Conditions (any active):
Engine is not running
Exhaust flow < 25 g/sec
(DOC Intake Temperature or DPF Intake Temperature or DPF Outlet Temperature) < 215 degC OR (DOC Intake Temperature or DPF Intake Temperature or DPF Outlet Temperature) > 600 degC
OEM datalink requested Engine intrusive diagnostics is active
DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0013.)
DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0014.)
DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0015.)

Malfunction Thresholds (all active):
-85 degC < average temperature drop across DOC < 85 degC
(Average temperature drop across DPF > 85 degC) OR (average temperature drop across DPF < -85 degC)

155. P200C-SE3071: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment DPF outlet gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P200C-SE3071
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	145 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
Elapsed time since last active regeneration > 700 sec
Rate of active/intrusive injection of HC's in exhaust < 0.2 g/sec

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
Rate of active/intrusive injection of HC's in exhaust ≥ 0.2 g/sec

Malfunction Thresholds (all active):
DPF Outlet Temperature > 735 °C

156. P244D-SE1754: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range - Least Severe Level

Persistent temperature overshoots of the Aftertreatment DPF outlet gas temperature during active regeneration of the DPF.

Monitor Operation:	
DTC	P244D-SE1754
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 unique occurrences of temperature overshoots persisting for a minimum of 10 seconds each.
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
DPF Regeneration is Active

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737

Malfunction Thresholds (all active):
DPF outlet temperature > 650 °C

157. P200C-SE3592: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range - Most Severe Level

Aftertreatment DPF outlet gas temperature continuously above a severe, high threshold for a calibrated period of time.

Monitor Operation:	
DTC	P200C-SE3592
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	35 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737

Abort Conditions (any active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737

Malfunction Thresholds (all active):
DPF outlet temperature > 810 °C

158. P2463-SE1887: Aftertreatment Diesel Particulate Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment DPF Soot Load Estimate has increased above the Moderate Severe Level

Monitor Operation:	
DTC	P2463-SE1887
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Soot Load Estimate > 13 g/L

159. P1451-SE2096: Aftertreatment Diesel Particulate Filter Differential Pressure - Data Valid But Above Normal Operating Range - Least Severe Level

Aftertreatment DPF Soot Load Estimate has increased above the Least Severe Level

Monitor Operation:	
DTC	P1451-SE2096
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Soot Load Estimate > 11 g/L

160. P242F-SE2097: Aftertreatment Diesel Particulate Filter Differential Pressure - Data Valid But Above Normal Operating Range - Most Severe Level

Aftertreatment DPF Soot Load Estimate has increased above the Most Severe Level

Monitor Operation:	
DTC	P242F-SE2097
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Soot Load Estimate > 14.9 g/L

161. P2459-SE3590: Aftertreatment Diesel Particulate Filter Regeneration too Frequent - Condition Exists

Aftertreatment DPF system active regeneration occurring more frequently than intended.

Monitor Operation:	
DTC	P2459-SE3590
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0420-SE4719
P1484-SE1759
P1484-SE3591
P2080-SE3068
P200E-SE3069
P200E-SE3070
P0421-SE3545
P200C-SE3592
P244D-SE1754
P200C-SE3071
P200C-SE3072
P242F-SE2097
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872,

P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P245F-SE2851, P2460-SE2857, P2461-SE2849
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2509-SE294
%O2 reading of Exhaust Air (See RefCond0022.)
Engine speed > 50 RPM
Active regeneration of DPF not disabled due to Active errors within the SCR system that will disable active/intrusive injection of HC's into the exhaust in order to protect the SCR system (See RefCond0025.)
the system detects that the DPF is no longer new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load. (See RefCond0021.)

Abort Conditions (any active):
P0420-SE4719
P1484-SE1759
P1484-SE3591
P2080-SE3068
P200E-SE3069
P200E-SE3070
P0421-SE3545
P200C-SE3592
P244D-SE1754
P200C-SE3071
P200C-SE3072
P242F-SE2097
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493

P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P245F-SE2851, P2460-SE2857, P2461-SE2849
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2509-SE294
Not [%O2 reading of Exhaust Air (See RefCond0022.)]
Active errors within the SCR system that will disable active/intrusive injection of HC's into the exhaust in order to protect the SCR system (See RefCond0025.)
the system considers that the DPF is new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load. (See RefCond0023.)
NOT [%O2 reading of Exhaust Air (See RefCond0022.)].

Pause Conditions (any active):
Engine speed < 50 RPM

Malfunction Thresholds (all active):
Time since the last active regeneration of the DPF completed till new active regeneration is requested < RefTable22 hr
Number of failed decisions out of 3 updates made >=3 counts.

162. P2121-SE1380: Accelerator Pedal or Lever Position Sensor 1 - Data Erratic, Intermittent, or Incorrect

Dual Potentiometer Accelerator Rationality Check

Monitor Operation:	
DTC	P2121-SE1380
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Dual Potentiometer Accelerator = Enabled
P2128-SE1378
P2127-SE1379
P2123-SE63
P2122-SE64
P06A5-SE817
P06A4-SE815
P06D4-SE1893
P06D3-SE1894

Pause Conditions (any active):
P2128-SE1378
P2127-SE1379
P2123-SE63
P2122-SE64
P06A5-SE817
P06A4-SE815
P06D4-SE1893
P06D3-SE1894

Malfunction Thresholds (all active):
(Primary Accelerator Pedal Position > (Secondary Accelerator Pedal Position + 10.551%)) OR (Primary Accelerator Pedal Position < (Secondary Accelerator Pedal Position - 10.551%))

163. P245D-SE2766: EGR Cooler Bypass Actuator Circuit - Voltage Above Normal or Shorted to High Source

The ECM has detected that EGR Bypass Valve (EBV) driver is short to high source.

Monitor Operation:	
DTC	P245D-SE2766
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The diagnostic will continue to detect the condition for 5 times.

Malfunction Thresholds (all active):
The current rises above the low-side shutdown threshold of 12.6 A during PWM On-state.

164. P245C-SE2767: EGR Cooler Bypass Actuator Circuit - Voltage Below Normal or Shorted to Low Source

The ECM has detected that EGR Bypass Valve (EBV) driver is short to low source.

Monitor Operation:	
DTC	P245C-SE2767
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The diagnostic will continue to detect the condition for 5 times.

Malfunction Thresholds (all active):
The current rises above the high-side shutdown threshold of 12.6 A when a high-side switch is turned on.

165. P245D-SE3563: EGR Cooler Bypass Actuator Circuit - Voltage Above Normal or Shorted to High Source

The ECM has detected that EGR Bypass Valve (EBV) driver has an open circuit.

Monitor Operation:	
DTC	P245D-SE3563
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.15 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The EGR Bypass valve motor is being driven by a zero PWM signal while the ECM is being powered up.
The diagnostic will continue to detect the condition for 5 times.

Malfunction Thresholds (all active):
The current through the low side transistor is lower than the referenced current (1.5 mA to 1 mA) during PWM Off-state.

166. P2493-SE4118: EGR Cooler Bypass Actuator Position - Data Erratic, Intermittent, or Incorrect

The EGR Bypass Valve position feedback value is In Range, High.

Monitor Operation:	
DTC	P2493-SE4118
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The total number of in range failures must be < 1. The total number of in range failures include the following:
The accumulated number of P2493-SE4119 Failures this OBD operation cycle.
The accumulated number of P2493-SE4118 Failures this OBD operation cycle.

Abort Conditions (any active):
A new OBD operation cycle is detected

Pause Conditions (any active):
EGR Bypass valve actuator is not in any of the following states: feedback control state, holding zero position state, or holding full position state.
EBV auto zero or span check is in progress
P245C-SE2767, P245D-SE2766, P245D-SE3563
EGR Bypass valve is cycling its position to break free from being stuck. (See RefCond0026.)

Malfunction Thresholds (all active):
Cumulative sum of error (Measured EBV Position Value - Commanded EBV Position Value) over a 30 second period is ever > 30,000%, which is equivalent to (Average of In Range High Error - Tolerance) > 20%, where Tolerance is defined as 0%.

167. P2493-SE4119: EGR Cooler Bypass Actuator Position - Data Erratic, Intermittent, or Incorrect

The EGR Bypass Valve position feedback value is In Range, Low.

Monitor Operation:	
DTC	P2493-SE4119
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The total number of in range failures must be < 1. The total number of in range failures include the following:
The accumulated number of P2493-SE4119 Failures this OBD operation cycle.
The accumulated number of P2493-SE4118 Failures this OBD operation cycle.

Abort Conditions (any active):
A new OBD operation cycle is detected

Pause Conditions (any active):
EGR Bypass valve actuator is not in any of the following states: feedback control state, holding zero position state, or holding full position state.
EBV auto zero or span check is in progress
P245C-SE2767, P245D-SE2766, P245D-SE3563
EGR Bypass valve is cycling its position to break free from being stuck. (See RefCond0026.)

Malfunction Thresholds (all active):
Cumulative sum of error (Commanded EBV Position Value - Measured EBV Position Value) over a 30 second period is ever > 30,000%, which is equivalent to (Average of In Range Low Error - Tolerance) > 20%, where Tolerance is defined as 0%.

168. P2495-SE3185: EGR Cooler Bypass Actuator Position Circuit - Voltage Above Normal or Shorted to High Source

EGR Bypass Valve Position greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2495-SE3185
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.508 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Measured EGR Bypass Valve Position > 4.801 V (105.329 %)

169. P2494-SE3184: EGR Cooler Bypass Actuator Position Circuit - Voltage Below Normal or Shorted to Low Source

EGR Bypass valve position less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2494-SE3184
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.508 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Measured EGR Bypass Valve Position < 0.2 V (-8.544%)

170. P0667-SE3806: Engine ECU Temperature - Data Erratic, Intermittent, or Incorrect

ECM Internal Temperature sensor reading is erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P0667-SE3806
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine off time ≥ 480 min
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

Abort Conditions (any active):
U3017-SE4759
U3017-SE4760

Malfunction Thresholds (all active):
| ECM Internal Temperature sensor - the most accurate sensor from the remaining temperature sensors | > (35 + the tolerance of the most accurate sensor from the remaining temperature sensors) °C
| ECM Internal Temperature sensor - the second most accurate sensor from the remaining temperature sensors | > (35 + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
| the most accurate sensor from the remaining temperature sensors - the second most accurate sensor from the remaining temperature sensors | < (the tolerance of the most accurate sensor from the remaining temperature sensors + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
The tolerance of the remaining temperature sensors are:
Compressor Inlet Temperature sensor tolerance = 40 °C
Charge Temperature sensor tolerance = 25 °C
Charge Air Cooler Outlet Temperature sensor tolerance = 13 °C
Coolant Temperature sensor tolerance = 20 °C
EGR Orifice Temperature sensor tolerance = 25 °C

171. P0667-SE10056: Engine ECU Temperature - Data Erratic, Intermittent, or Incorrect

The temperature delta between the ECM Internal Digital Sensor and the ECM Internal Analog Sensor exceeds a calibratable maximum threshold for a calibratable duration, OR the difference in temperature between both sensors is below a calibratable lower threshold for a calibratable duration.

Monitor Operation:	
DTC	P0667-SE10056
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0606-SE4500, P0606-SE4501
P0606-SE7489
P0667-SE3806
Engine Speed ≤ 3,000 RPM
Number of Injection Pulses per Camshaft Revolution ≤ 5 counts
Key off Time ≥ 600 sec

Abort Conditions (any active):
P0606-SE4500, P0606-SE4501
P0606-SE7489
P0667-SE3806
Engine Speed > 3,000 RPM
Number of Injection Pulses per Camshaft Revolution > 5 counts

Malfunction Thresholds (all active):
ECM Digital Sensor Temperature minus ECM Analog Sensor Temperature > 50 degC
OR
ECM Digital Sensor Temperature minus ECM Analog Sensor Temperature < -20 degC

172. P0605-SE216: Engine Control Module Calibration Memory (ROM) Corruption - Root Cause Not Known

Engine control module non-volatile (Flash) memory failure.

Monitor Operation:	
DTC	P0605-SE216
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Fail to save the data to the non-volatile memory.

173. P0606-SE4500: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

Internal ECM Analog Temperature sensor reading greater than specified threshold for a calibrated amount of time.

Monitor Operation:	
DTC	P0606-SE4500
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
ECM Internal Temperature sensor value > 3.666 V (149.96 °C)

174. P0606-SE4501: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

Internal ECM Analog Temperature sensor reading lower than specified threshold for a calibrated amount of time.

Monitor Operation:	
DTC	P0606-SE4501
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
ECM Internal Temperature sensor value < 0.491 V (-50.04 °C)

175. P0606-SE7489: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

The diagnostic function sets the error if either or both bits D0 and D1 is 0 in the bit coded value received from the Electronic Control Module's Internal Digital Temperature Sensor at continuous temperature conversion mode or the bit coded value received from the sensor during shutdown mode is not equal to the manufacturer's ID.

Monitor Operation:	
DTC	P0606-SE7489
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	7 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Either or both of bits D0 & D1 in the bit coded value received from the ECM internal digital temperature sensor is 0.
OR
The bit coded value received from the ECM internal digital temperature sensor during shutdown mode is not equal to the manuacturer's ID.

176. P0490-SE2797: EGR Valve Control Circuit - Voltage Above Normal or Shorted to High Source

The ECM monitors whether the H-Bridge circuit that drives an EGR actuator motor is shorted to a high voltage source.

Monitor Operation:	
DTC	P0490-SE2797
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Current through low-side switches of EGR H-Bridge circuit > 12.6 A

177. P0489-SE2798: EGR Valve Control Circuit - Voltage Below Normal or Shorted to Low Source

The ECM monitors whether the H-Bridge circuit that drives an EGR actuator motor is shorted to a low voltage source.

Monitor Operation:	
DTC	P0489-SE2798
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Current through high-side switches of EGR H-Bridge circuit > 12.6 A

178. P0490-SE3582: EGR Valve Control Circuit - Voltage Above Normal or Shorted to High Source

The ECM monitors whether the H-Bridge circuit that drives an EGR actuator motor has an open-load condition.

Monitor Operation:	
DTC	P0490-SE3582
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Current through low-side switches of EGR H-Bridge circuit < 1.5 mA while being driven by a zero PWM signal at ECM power up

179. P046C-SE3869: EGR Valve Position - Data Erratic, Intermittent, or Incorrect

The EGR valve position feedback is failed in range, but not clearly "in range high" or "in range low."

Monitor Operation:	
DTC	P046C-SE3869
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	≤ 60 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0490-SE2797
P0490-SE3582
P0489-SE2798
EGR actuator is in PWM-Off state.
Engine speed < 1,500 RPM.
Torque fueling < 4 mg/stroke.

Malfunction Thresholds (all active):
Average of (|Measured Value - Commanded Value| + |Commanded Value - Measured Value|) over a 60 second period is ever > 1.583 %. Where Diagnostic Tolerance is defined as 0 %.

180. P0406-SE3202: EGR Valve Position Circuit - Voltage Above Normal or Shorted to High Source

EGR valve position sensor reading is greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0406-SE3202
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Measured EGR H-Bridge valve position > 4.801 V (112.822 %)

181. P0405-SE3203: EGR Valve Position Circuit - Voltage Below Normal or Shorted to Low Source

EGR valve position sensor reading is less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0405-SE3203
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.5 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Measured EGR H-Bridge valve position < 0.2 V (-20.609 %)

182. P040B-SE3876: Exhaust Gas Recirculation Temperature - Data Erratic, Intermittent, or Incorrect

EGR Orifice Temperature reading is In Range High

Monitor Operation:	
DTC	P040B-SE3876
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine has been in Run state for >= 120 s

Pause Conditions (any active):
P040C-SE495, P040D-SE496
P040B-SE3872
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
EGR Cooler Bypass Valve Position > 0 %
Coolant Temperature < 60 °C
EGR Orifice Temperature < 250 DegC AND EGR Flow < 1.5 kg/min

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - Estimated Value) in 60 seconds is ever > 6,000 Deg C, which is equivalent to [Average of Error - Tolerance] >= 1 Deg C. where, Tolerance is defined as: 207.5 Deg C.

183. P040B-SE3877: Exhaust Gas Recirculation Temperature - Data Erratic, Intermittent, or Incorrect

EGR Orifice Temperature reading is In Range Low

Monitor Operation:	
DTC	P040B-SE3877
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine has been in Run state for >= 120 s

Pause Conditions (any active):
P040B-SE3872
P040C-SE495, P040D-SE496
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
EGR Cooler Bypass Valve Position > 0 %
EGR Flow < 1.5 kg/min
Coolant Temperature < 60 °C
EGR Orifice Temperature < 250 DegC AND EGR Flow < 1.5 kg/min

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Value - Measured Value) in 60 seconds is ever > 6,000 Deg C, which is equivalent to [Average of Error - Tolerance] >= 1 Deg C. where, Tolerance is defined as: 207.5 Deg C.

184. P040B-SE3878: Exhaust Gas Recirculation Temperature - Data Erratic, Intermittent, or Incorrect

EGR Orifice Temperature reading is In Range Stuck

Monitor Operation:	
DTC	P040B-SE3878
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine has been in Run state for >= 120 s

Pause Conditions (any active):
P040B-SE3872
P040C-SE495, P040D-SE496
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
Condition enters when |Engine speed - Filtered engine speed| < 80 RPM and condition exits when |Engine speed - Filtered engine speed| > 100 RPM
EGR Cooler Bypass Valve Position > 0 %
EGR Flow < 1.5 kg/min
Coolant Temperature < 60 °C
EGR Orifice Temperature < 250 DegC AND EGR Flow < 1.5 kg/min

Malfunction Thresholds (all active):
(Maximum sensor value - Minimum sensor value) at the end of 60 seconds is < 0.3 °C

185. P040B-SE3872: Exhaust Gas Recirculation Temperature - Data Erratic, Intermittent, or Incorrect

EGR Orifice Temperature sensor reading is erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P040B-SE3872
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine off time ≥ 480 min
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

Abort Conditions (any active):
P040C-SE495, P040D-SE496
U3017-SE4759
U3017-SE4760

Malfunction Thresholds (all active):
| EGR Orifice Temperature sensor - the most accurate sensor from the remaining temperature sensors | > (25 + the tolerance of the most accurate sensor from the remaining temperature sensors) °C
| EGR Orifice Temperature sensor - the second most accurate sensor from the remaining temperature sensors | > (25 + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
| the most accurate sensor from the remaining temperature sensors - the second most accurate sensor from the remaining temperature sensors | < (the tolerance of the most accurate sensor from the remaining temperature sensors + the tolerance of the second most accurate sensor from the remaining temperature sensors) °C
The tolerance of the remaining temperature sensors are:
Compressor Inlet Temperature sensor tolerance = 40 °C
Charge Temperature sensor tolerance = 25 °C
Charge Air Cooler Outlet Temperature sensor tolerance = 13 °C
Coolant Temperature sensor tolerance = 20 °C
ECM Internal Temperature sensor tolerance = 35 °C

186. P040D-SE496: Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

EGR Orifice Temperature Sensor reading is greater than specified operating range for calibrated amount of time.

Monitor Operation:	
DTC	P040D-SE496
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
EGR Orifice Temperature sensor value > 4.738V (< -40 degC)

187. P040C-SE495: Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

EGR Orifice Temperature Sensor reading is less than specified operating range for calibrated amount of time.

Monitor Operation:	
DTC	P040C-SE495
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	8 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
EGR Orifice Temperature sensor value < 0.067V (> 500degC)

188. P2457-SE869: Exhaust Gas Recirculation Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

EGR Orifice Temperature above allowed engine operating range.

Monitor Operation:	
DTC	P2457-SE869
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Engine Speed < 570 RPM
EGR Orifice Temperature Start Timer < 0 sec

Malfunction Thresholds (all active):
EGR Orifice Temperature > 260 °C

189. P2413-SE870: Exhaust Gas Recirculation Temperature - Data Valid But Above Normal Operating Range - Least Severe Level

EGR Orifice Temperature above normal engine operating range

Monitor Operation:	
DTC	P2413-SE870
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Engine Speed < 570 RPM
EGR Orifice Temperature Start Timer < 0 sec

Malfunction Thresholds (all active):
EGR Orifice Temperature > 250 °C

190. P0402-SE7295: Engine Exhaust Gas Recirculation (EGR) System - Data Valid But Above Normal Operating Range - Moderately Severe Level

EGR Flow higher than normal

Monitor Operation:	
DTC	P0402-SE7295
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in run state.
Ambient Air Temperature > -6.67 °C
Compressor Inlet Density > 0.5 kg/m3
Time which all Enable Conditions have been true ≥ 2 sec

Pause Conditions (any active):
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P012B-SE8698, P012B-SE8699, P012B-SE8802, P012C-SE8366, P012D-SE8365, P0237-SE2976, P0238-SE2977, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
The EGR H-bridge valve position is not known to be good. (See RefCond0029.)
Fresh Air Flow Command < 0 kg/min
Fresh Air Flow Command > 4 kg/min
EGR Valve Effective Flow Area < 0.01 cm2
EGR Valve Effective Flow Area > 1 cm2
EGR Off Engine Protection is active
Filtered (tau = 0.011 sec) Charge Temperature ≤ 15 °C
Filtered (tau = 0.011 sec) EGR Orifice Temperature ≤ 15 °C
EGR Delta P sensor autozero check is not complete
Engine Speed < 650 RPM
Engine Speed > 1,500 RPM

Total Fueling < 0 mg/stroke
Total Fueling > 40 mg/stroke
EGR Actuator Effective Flow Area is greater than 0 cm2 and EBV Actuator Effective Flow Area is greater than 0 cm2

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Flow - Estimated Flow) in 200 second period is ever > 950 kg/min, which is equivalent to [Average of Error - Tolerance] >= 0.475 kg/min, where Tolerance is defined as: RefTable23 kg/min

191. P0401-SE7296: Engine Exhaust Gas Recirculation (EGR) System - Data Valid But Below Normal Operating Range - Moderately Severe Level

EGR Flow lower than normal

Monitor Operation:	
DTC	P0401-SE7296
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in run state.
Ambient Air Temperature > -6.67 °C
Compressor Inlet Density > 0.5 kg/m3
Time which all Enable Conditions have been true ≥ 2 sec

Pause Conditions (any active):
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P012B-SE8698, P012B-SE8699, P012B-SE8802, P012C-SE8366, P012D-SE8365, P0237-SE2976, P0238-SE2977, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
The EGR H-bridge valve position is not known to be good. (See RefCond0029.)
Fresh Air Flow Command < 0.5 kg/min
Fresh Air Flow Command > 7.75 kg/min
VGT Actuator Effective Flow Area < 0.85 cm2
VGT Actuator Effective Flow Area > 10 cm2
EGR Off Engine Protection is active
Filtered (tau = 0.011 sec) Charge Temperature ≤ 15 °C
Filtered (tau = 0.011 sec) EGR Orifice Temperature ≤ 15 °C
EGR Delta P sensor autozero check is not complete
Engine Speed < 800 RPM
Engine Speed > 1,940 RPM
Total Fueling < 5 mg/stroke

Total Fueling > 50 mg/stroke
EGR Actuator Effective Flow Area is greater than 0 cm2 and EBV Actuator Effective Flow Area is greater than 0 cm2

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Flow - Measured Flow) over 600 second period is ever > 3,600 kg/min, which is equivalent to [Average of Error - Tolerance] >= 0.6 kg/min, where Tolerance is defined as: 0 kg/min

192. P0546-SE6729: Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to battery or open circuit condition that causes too high of an input voltage condition in the intake DOC thermocouple sensor circuit.

Monitor Operation:	
DTC	P0546-SE6729
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment intake DOC gas temperature sensor input voltage ≥ 5 V (240 DegC)
OR intake DOC gas temperature thermocouple impedance ≥ 10 Ohms

193. P0545-SE6730: Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to ground that causes too low of an input voltage condition in the intake DOC thermocouple sensor circuit.

Monitor Operation:	
DTC	P0545-SE6730
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment intake DOC gas temperature sensor input voltage ≤ 1 V (-40 DegC)

194. P2033-SE6731: Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to battery or open circuit condition that causes too high of an input voltage condition in the outlet DOC thermocouple sensor circuit.

Monitor Operation:	
DTC	P2033-SE6731
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment outlet DOC gas temperature sensor input voltage ≥ 5 V (240 DegC)
OR outlet DOC gas temperature thermocouple impedance ≥ 10 Ohms

195. P2032-SE6732: Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to ground that causes too low of an input voltage condition in the outlet DOC thermocouple sensor circuit.

Monitor Operation:	
DTC	P2032-SE6732
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment outlet DOC gas temperature sensor input voltage ≤ 1 V (-40 DegC)

196. P242D-SE6733: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to battery or open circuit condition that causes too high of an input voltage condition in the outlet DPF thermocouple sensor circuit.

Monitor Operation:	
DTC	P242D-SE6733
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment outlet DPF gas temperature sensor input voltage ≥ 5 V (240 DegC)
OR outlet DPF gas temperature thermocouple impedance ≥ 10 Ohms

197. P242C-SE6734: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to ground that causes too low of an input voltage condition in the outlet DPF thermocouple sensor circuit.

Monitor Operation:	
DTC	P242C-SE6734
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment outlet DPF gas temperature sensor input voltage ≤ 1 V (-40 DegC)

198. P1613-SE6722: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected an open circuit condition in the reference cold junction thermistor internal to the triple sensor module.

Monitor Operation:	
DTC	P1613-SE6722
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
EGTS Module Cold Junction Temperature < -55 °C

199. P1613-SE6724: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected an implausible temperature error condition in the reference cold junction thermistor internal to the triple sensor module.

Monitor Operation:	
DTC	P1613-SE6724
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
|EGTS Module Cold Junction Temperature - EGTS ECU Temperature| > 20 °C

200. P1613-SE6721: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected a short circuit condition in the reference cold junction thermistor internal to the triple sensor module.

Monitor Operation:	
DTC	P1613-SE6721
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
EGTS Module Cold Junction Temperature > 180 °C

201. P1613-SE6726: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected an ASIC memory corruption error condition in the internal triple sensor module circuitry.

Monitor Operation:	
DTC	P1613-SE6726
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Mismatched or invalid CRC of the Smart Exhaust Gas Temperature Module ASIC's internal memory at power up.

202. P1614-SE6727: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a too high of a voltage condition to the triple sensor control module.

Monitor Operation:	
DTC	P1614-SE6727
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
EGT module supply voltage > 16 V

203. P1615-SE6728: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a too low of a voltage condition to the triple sensor control module.

Monitor Operation:	
DTC	P1615-SE6728
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off
Engine is in cranking state.
Elapsed time since engine has exited the cranking state >= 2 seconds.

Malfunction Thresholds (all active):
EGT module supply voltage < 6 V

204. P1616-SE7167: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Smart Exhaust Gas Temperature Module has detetected an ECU temperature too high condition in the internal triple sensor module circuitry.

Monitor Operation:	
DTC	P1616-SE7167
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Smart Exhaust Gas Temperature Module internal circuit board temperature > 150 °C

205. P1613-SE6725: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected mismatched data in the two copies of microcontroller EEPROM in the triple sensor module circuitry.

Monitor Operation:	
DTC	P1613-SE6725
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
The Smart Exhaust Gas Temperature Module's parameter storage within nonvolatile memory does not match the corresponding parameters volatile storage at power up

206. P1623-SE7168: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Root Cause Not Known

The Smart Exhaust Gas Temperature Module has detetected an intermittent power supply voltage drop that results in a reset internal to the module.

Monitor Operation:	
DTC	P1623-SE7168
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Time delay after key-on ≥ 5 sec
Key switch is turned on

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
The number of EGT module power reset events within a 300 second window is ≥ 5 counts

207. P0546-SE6735: Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detected an ASIC communication error with the intake DOC thermocouple.

Monitor Operation:	
DTC	P0546-SE6735
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Within the Smart Exhaust Gas Temperature Module an ASIC communication error is causing no data transfer between intake DOC thermocouple and the internal ASIC.

208. P2033-SE6736: Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detected an ASIC communication error with the outlet DOC thermocouple.

Monitor Operation:	
DTC	P2033-SE6736
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Within the Smart Exhaust Gas Temperature Module an ASIC communication error is causing no data transfer between outlet DOC thermocouple and the internal ASIC.

209. P242D-SE6737: Aftertreatment 1 Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detected an ASIC communication error with the outlet DPF thermocouple.

Monitor Operation:	
DTC	P242D-SE6737
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1611-SE6686, U1611-SE6687
Key switch is turned off

Malfunction Thresholds (all active):
Within the Smart Exhaust Gas Temperature Module an ASIC communication error is causing no data transfer between outlet DPF thermocouple and the internal ASIC.

210. P1624-SE6753: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected an open circuit condition in the reference cold junction thermistor internal to the dual sensor module.

Monitor Operation:	
DTC	P1624-SE6753
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
EGTS Module Cold Junction Temperature < -55 °C

211. P1624-SE6755: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected an implausible temperature error condition in the reference cold junction thermistor internal to the dual sensor module.

Monitor Operation:	
DTC	P1624-SE6755
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
|EGTS Module Cold Junction Temperature - EGTS ECU Temperature| > 20 °C

212. P1624-SE6752: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected a short circuit condition in the reference cold junction thermistor internal to the dual sensor module.

Monitor Operation:	
DTC	P1624-SE6752
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
EGTS Module Cold Junction Temperature < 180 °C

213. P1624-SE6757: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected an ASIC memory corruption error condition in the internal dual sensor module circuitry.

Monitor Operation:	
DTC	P1624-SE6757
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Mismatched or invalid CRC of the Smart Exhaust Gas Temperature Module ASIC's internal memory at power up.

214. P1625-SE6758: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a too high of a voltage condition to the dual sensor control module.

Monitor Operation:	
DTC	P1625-SE6758
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
EGT module supply voltage > 16 V

215. P1626-SE6759: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a too low of a voltage condition to the dual sensor control module.

Monitor Operation:	
DTC	P1626-SE6759
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off
Engine is in cranking state.
Elapsed time since engine has exited cranking state >= 2 seconds

Malfunction Thresholds (all active):
EGT module supply voltage < 6 V

216. P1627-SE7179: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Smart Exhaust Gas Temperature Module has detetected an ECU temperature too high condition in the internal dual sensor module circuitry.

Monitor Operation:	
DTC	P1627-SE7179
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Smart Exhaust Gas Temperature Module internal circuit board temperature > 150 °C

217. P1624-SE6756: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Bad Intelligent Device or Component

The Smart Exhaust Gas Temperature Module has detetected mismatched data in the two copies of microcontroller EEPROM in the dual sensor module circuitry.

Monitor Operation:	
DTC	P1624-SE6756
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4.2 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
The Smart Exhaust Gas Temperature Module's parameter storage within nonvolatile memory does not match the corresponding parameters volatile storage at power up.

218. P2482-SE6762: Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to battery or open circuit condition that causes too high of an input voltage condition in the outlet SCR thermocouple sensor circuit.

Monitor Operation:	
DTC	P2482-SE6762
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment outlet SCR gas temperature sensor input voltage ≥ 5 V (240 DegC)
OR outlet SCR gas temperature thermocouple impedance ≥ 10 Ohms

219. P2481-SE6763: Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to ground condition that causes too low of an input voltage condition in the outlet SCR thermocouple sensor circuit.

Monitor Operation:	
DTC	P2481-SE6763
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment outlet SCR gas temperature sensor input voltage ≤ 1 V (-40 DegC)

220. P1628-SE7180: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Root Cause Not Known

The Smart Exhaust Gas Temperature Module has detetected an intermittent power supply voltage drop that results in a reset internal to the module.

Monitor Operation:	
DTC	P1628-SE7180
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Time delay after key-on ≥ 5 sec
Key switch is turned on

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
The number of EGT module power reset events within a 300 s window ≥ 5 counts

221. P2471-SE6760: Aftertreatment 1 SCR Intermediate Gas Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to battery or open circuit condition that causes too high of an input voltage condition in the intake/mid-bed SCR thermocouple sensor circuit.

Monitor Operation:	
DTC	P2471-SE6760
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment intake/mid-bed SCR gas temperature sensor input voltage ≥ 5 V (240 DegC)
OR intake/mid-bed SCR gas temperature thermocouple impedance ≥ 10 Ohms

222. P2470-SE6761: Aftertreatment 1 SCR Intermediate Gas Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Smart Exhaust Gas Temperature Module has detetected a sensor short to ground condition that causes too low of an input voltage condition in the intake/mid-bed SCR thermocouple sensor circuit.

Monitor Operation:	
DTC	P2470-SE6761
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Aftertreatment intake/mid-bed SCR gas temperature sensor input voltage ≤ 1 V (-40 DegC)

223. P2471-SE6764: Aftertreatment 1 SCR Intermediate Gas Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detected an ASIC communication error with the intake/mid-bed SCR thermocouple.

Monitor Operation:	
DTC	P2471-SE6764
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Within the Smart Exhaust Gas Temperature Module an ASIC communication error is causing no data transfer between intake/mid-bed SCR thermocouple and the internal ASIC.

224. P2482-SE6765: Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Smart Exhaust Gas Temperature Module has detected an ASIC communication error with the outlet SCR thermocouple.

Monitor Operation:	
DTC	P2482-SE6765
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3.8 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
U1612-SE6683, U1612-SE6685
Key switch is turned off

Malfunction Thresholds (all active):
Within the Smart Exhaust Gas Temperature Module an ASIC communication error is causing no data transfer between outlet SCR thermocouple and the internal ASIC.

225. P2560-SE657: Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level

Data read from the Coolant Level sensor is valid but is below normal operating range.

Monitor Operation:	
DTC	P2560-SE657
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	90 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
P2558-SE283, P2559-SE572

Malfunction Thresholds (all active):
Coolant Level Sensor Value ≥ 3.75 V

226. P0219-SE124: Engine Crankshaft Speed/Position - Data Valid But Above Normal Operating Range - Most Severe Level

Engine Speed too high

Monitor Operation:	
DTC	P0219-SE124
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.06 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Engine Speed > 4,650 RPM

227. P2202-SE5151: Aftertreatment 1 Intake NOx Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The NOx sensor circuitry has detected a failure affecting the engine outlet NOx sensor heater circuit. This monitor is used to provide fault isolation for particular circuit continuity failure modes. However, if the physical failure prevents reaching the enable conditions for this monitor, coverage is still provided via other diagnostics. For example, P2209-SE5245 doesn't require the sensor temperature to reach any threshold, and thus will provide coverage for heater performance failure modes.

Monitor Operation:	
DTC	P2202-SE5151
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds after sensor identifies any of the listed malfunction criteria.
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U029D-SE2487

Pause Conditions (any active):
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 160 seconds
Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)

Malfunction Thresholds (all active):
[Open H-] The resistance between the sensors heater connection to Ground and a 3rd heater electrode > 1,000,000 ohms for 10 seconds.
or
[Open H+] The resistance between the sensors heater supply and a 3rd heater electrode > 1,000,000 ohms for 10 seconds.
or
[H-/Tmp] The voltage between the 3rd electrode within the sensors internal heater and ground < 0.5 V for 10 seconds.
or
[M2/Tmp] The resistance between the sensors measuring electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[P-/Tmp] The resistance between the sensors pumping electrode in the 1st pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or

[M1/Tmp] The resistance between the sensors pumping electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Ref/Tmp] (The resistance between the sensors air reference electrode and the sensors 3rd electrode within its internal heater is < 0.5 ohms AND the voltage between reference line and ground < 1 V) for 40 seconds.
or
[H+/H-] The resistance between the sensors internal heater supply voltage line and sensor ground is < 0.5 ohms for 10 seconds.
or
[Vbatt/P-] The resistance between supply voltage and the sensors pumping electrode in the 1st pumping chamber is < 0.5 ohms for 10 seconds.
or
[Vbatt/P+] The resistance between supply voltage and the sensors top electrode (directly exposed to exhaust gas) is < 0.5 ohms for 10 seconds.
or
[Vbatt/M1] The resistance between supply voltage and the sensors pumping electrode in the 2nd pumping chamber is < 0.5 ohms for 10 seconds.
or
[H+/Tmp] (The voltage between the 3rd electrode within the internal heater and ground < 2.19 V AND the sensors internal heater resistance < 20.97 Ohms) for 40 seconds.
or
[Vbatt/M2] The resistance between supply voltage and the sensors measuring electrode in 2nd chamber is < 0.5 ohms for 10 seconds.
or
[P+/Tmp] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Vbatt/Ref] The resistance between supply voltage and the sensors air reference electrode is < 0.5 ohms for 10 seconds.
or
[Vbatt/H+] The resistance between supply voltage and the sensors heater supply is < 0.5 ohms for 10 seconds.
or
[Open Tmp] The resistance between the sensors 3rd electrode within its internal heater is > 1,000,000 ohms for 10 seconds.
or
[M1/M2] (5 mV < the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode < 500 mV AND the voltage between the pumping electrode in the 2nd chamber and the air reference electrode = the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode) for 40 seconds.
or
[Vbatt/Tmp] The voltage at the 3rd electrode within the sensors internal heater > 8 V for 10 seconds.
or
[Open M2] The resistance between the sensors measuring electrode in the 2nd chamber and ground > 0 ohms for 10 seconds.

228. P2209-SE5246: Aftertreatment 1 Intake NOx Sensor Heater - Abnormal Rate of Change

Engine Out NOx sensor heater failure.

Monitor Operation:	
DTC	P2209-SE5246
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Amount of time that heater reaches working temperature > 30 sec
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.).

Abort Conditions (any active):
P2202-SE5151
P2202-SE5153
U029D-SE2487
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
NOx sensor supply voltage > 16.5 V
NOx sensor supply voltage < 10.8 V
Exhaust gas velocity ≥ 50 m/sec

Malfunction Thresholds (all active):
Percentage of time spent heating >= 5% of a 60 second diagnostic window.
OR the number of transitions from maintain working temperature to heating >= 5 (counts) in a 60 second diagnostic window.

229. P2209-SE5245: Aftertreatment 1 Intake NOx Sensor Heater - Abnormal Rate of Change

Engine Out NOx Sensor Heater malfunction.

Monitor Operation:	
DTC	P2209-SE5245
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.).

Abort Conditions (any active):
P2202-SE5151
P2202-SE5153
U029D-SE2487
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
NOx sensor supply voltage > 16.5 V
NOx sensor supply voltage < 10.8 V
Exhaust gas velocity ≥ 50 m/sec

Malfunction Thresholds (all active):
Time for heater to reach working temperature of 800 Deg C after enable conditions are satisfied ≥ 120 sec

230. P220A-SE5829: Aftertreatment 1 Intake NOx Sensor Power Supply - Data Erratic, Intermittent, or Incorrect

The engine out NOx sensor circuitry has detected an intermittent power supply voltage drop that results in a reset internal to the sensor.

Monitor Operation:	
DTC	P220A-SE5829
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Pause Conditions (any active):
Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 1 seconds

Malfunction Thresholds (all active):
The number of filtered sensor reset events (sensor supply power < 6 V) is greater than 10 counts, within a diagnostic time window (300 sec) Sensor reset events are "filtered" by ignoring consecutive reset events occuring within (20 sec).

231. P220A-SE5152: Aftertreatment 1 Intake NOx Sensor Power Supply - Data Erratic, Intermittent, or Incorrect

The engine out NOx sensor circuitry has detected that its battery supply voltage is outside the desired range.

Monitor Operation:	
DTC	P220A-SE5152
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds after sensor identifies any of the listed malfunction criteria.
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U029D-SE2487

Pause Conditions (any active):
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 160 seconds
Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)

Malfunction Thresholds (all active):
NOx sensor supply voltage > 16.5 V for 10 seconds.
or NOx sensor supply voltage < 10.8 V for 10 seconds.

232. P2202-SE5153: Aftertreatment 1 Intake NOx Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The NOx sensor circuitry has detected a failure within the engine out NOx sensor's internal circuitry that causes the sensed NOx value to be suspect. This monitor is used to provide fault isolation for particular circuit continuity failure modes. However, if the physical failure prevents reaching the enable conditions for this monitor, coverage is still provided via other diagnostics. For example, P2209-SE5245 doesn't require the sensor temperature to reach any threshold, and thus will provide coverage for heater performance failure modes.

Monitor Operation:	
DTC	P2202-SE5153
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds after sensor identifies any of the listed malfunction criteria.
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U029D-SE2487

Pause Conditions (any active):
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 160 seconds
Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)

Malfunction Thresholds (all active):
[Open P+] The resistance between the electrode on the top of the sensor (directly exposed to exhaust gas) and ground > 1,000,000 ohms for 10 seconds.
or
[Open Ref] The resistance between the sensors air reference electrode and ground > 1,000,000 ohms for 10 seconds.
or
[Open M1] The resistance between the sensors pumping electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Open P-] The resistance between the sensors pumping electrode in 1st pumping chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Ref/M2] (The resistance between the sensors air reference electrode and the sensors measuring electrode in the 2nd chamber is < 0.5 ohms AND the voltage between the pumping electrode in the

2nd chamber and reference is within 20mV of a 420mV setpoint AND the voltage between the measuring electrode in the 2nd chamber and the reference < 15mV) for 40 seconds.
or
[P-/M2] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the measuring electrode in the 2nd chamber and reference) for 40 seconds.
or
[P+/M2] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the measuring electrode within the 2nd chamber is < 0.5 ohms AND the voltage between the measuring electrode in the 2nd chamber and reference < 120 mV) for 40 seconds.
or
[P-/M1] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the pumping electrode in the 2nd chamber and reference) for 40 seconds.
or
[Open M2] The resistance between the sensors measuring electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[H-/Tmp] The voltage between the 3rd electrode within the sensors internal heater and ground < 0.5 V for 10 seconds.
or
[H+/Tmp] (the voltage between the 3rd electrode within the internal heater and ground < 2.19 V AND the sensors internal heater resistance < 20.97 Ohms) for 40 seconds.
or
[Ref/H+] The resistance between the air reference electrode and the sensors internal heater supply < 0.5 ohms for 10 seconds.
or
[Vbatt/Tmp] The voltage at the 3rd electrode within the sensors internal heater > 8 for 10 seconds.
or
[Ref/H-] The resistance between the air reference electrode and ground < 0.5 ohms for 10 seconds.
or
[Ref/M1] The resistance between the sensors air reference electrode and the sensors pumping electrode in the 2nd chamber is < 0.5 ohms for 10 seconds.
or
[M1/H+] (The resistance between the pumping electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms AND the the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[P+/P-] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 1st chamber is < 0.5 ohms AND | the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) for 40 seconds.
or

[Ref/Tmp] (The resistance between the sensors air reference electrode and the sensors 3rd electrode within its internal heater is < 0.5 ohms AND the voltage between reference line and ground < 1 V) for 40 seconds.
or
[P-/H+] The resistance between the pumping electrode in the 1st chamber and the sensors internal heater supply is < 0.5 ohms for 10 seconds.
or
[M1/H-] The resistance between the pumping electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P+/Tmp] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[M2/H-] The resistance between the measuring electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P-/H-] The resistance between the pumping electrode in the 1st chamber and ground is < 0.5 ohms for 10 seconds.
or
[M2/H+] The resistance between the measuring electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms for 10 seconds.
or
[H+/H-] The resistance between the sensors internal heater supply voltage line and sensor ground is < 0.5 ohms for 10 seconds.
or
[M2/Tmp] The resistance between the sensors measuring electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Vbatt/M1] The resistance between supply voltage and the sensors pumping electrode in the 2nd pumping chamber is < 0.5 ohms for 10 seconds.
or
[P+/M1] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 2nd chamber is < 0.5 ohms AND the binary voltage between the sensors top electrode and reference < 200 mV AND ((| the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) OR (binary voltage between the sensors top electrode and reference = the voltage between the pumping electrode in the 2nd chamber and reference)) for 40 seconds.
or
[Vbatt/Ref] The resistance between supply voltage and the sensors air reference electrode is < 0.5 ohms for 10 seconds.
or
[Vbatt/M2] The resistance between supply voltage and the sensors measuring electrode in 2nd chamber is < 0.5 ohms for 10 seconds.
or
[P-/Tmp] The resistance between the sensors pumping electrode in the 1st pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.

or
[M1/Tmp] The resistance between the sensors pumping electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[P+/H-] The resistance between the electrode in on the top of the sensor (exposed to the exhaust gas) and ground is < 0.5 ohms for 10 seconds.
or
[Ref/P-] (The resistance between the air reference electrode and pumping electrode in the 1st chamber < 0.5 ohms AND the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[Vbatt/P-] The resistance between supply voltage and the sensors pumping electrode in the 1st pumping chamber is < 0.5 ohms for 10 seconds.
or
[Vbatt/P+] The resistance between supply voltage and the sensors top electrode (directly exposed to exhaust gas) is < 0.5 ohms for 10 seconds.
or
[Vbatt/H+] The resistance between supply voltage and the sensors heater supply is < 0.5 ohms for 10 seconds.
or
[M1/M2] (5 mV < the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode < 500 mV AND the voltage between the pumping electrode in the 2nd chamber and the air reference electrode = the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode) for 40 seconds.

233. P2202-SE7986: Aftertreatment 1 Intake NOx Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The NOx sensor circuitry has detected a failure within the engine out NOx sensor's internal circuitry that causes the sensed O2 value to be suspect. This monitor is used to provide fault isolation for particular circuit continuity failure modes. However, if the physical failure prevents reaching the enable conditions for this monitor, coverage is still provided via other diagnostics. For example, P2209-SE5245 doesn't require the sensor temperature to reach any threshold, and thus will provide coverage for heater performance failure modes.

Monitor Operation:	
DTC	P2202-SE7986
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds after sensor identifies any of the listed malfunction criteria.
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U029D-SE2487

Pause Conditions (any active):
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 160 seconds
Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)

Malfunction Thresholds (all active):
[Open P+] The resistance between the electrode on the top of the sensor (directly exposed to exhaust gas) and ground > 1,000,000 ohms for 10 seconds.
or
[Open Ref] The resistance between the sensors air reference electrode and ground > 1,000,000 ohms for 10 seconds.
or
[Open M1] The resistance between the sensors pumping electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Open P-] The resistance between the sensors pumping electrode in 1st pumping chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Ref/M2] (The resistance between the sensors air reference electrode and the sensors measuring electrode in the 2nd chamber is < 0.5 ohms AND the voltage between the pumping electrode in the

2nd chamber and reference is within 20mV of a 420mV setpoint AND the voltage between the measuring electrode in the 2nd chamber and the reference < 15mV) for 40 seconds.
or
[P-/M2] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the measuring electrode in the 2nd chamber and reference) for 40 seconds.
or
[P+/M2] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the measuring electrode within the 2nd chamber is < 0.5 ohms AND the voltage between the measuring electrode in the 2nd chamber and reference < 120 mV) for 40 seconds.
or
[P-/M1] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the pumping electrode in the 2nd chamber and reference) for 40 seconds.
or
[Open M2] The resistance between the sensors measuring electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[H-/Tmp] The voltage between the 3rd electrode within the sensors internal heater and ground < 0.5 V for 10 seconds.
or
[H+/Tmp] (the voltage between the 3rd electrode within the internal heater and ground < 2.19 V AND the sensors internal heater resistance < 20.97 Ohms) for 40 seconds.
or
[Ref/H+] The resistance between the air reference electrode and the sensors internal heater supply < 0.5 ohms for 10 seconds.
or
[Vbatt/Tmp] The voltage at the 3rd electrode within the sensors internal heater > 8 V for 10 seconds.
or
[Ref/H-] The resistance between the air reference electrode and ground < 0.5 ohms for 10 seconds.
or
[Ref/M1] The resistance between the sensors air reference electrode and the sensors pumping electrode in the 2nd chamber is < 0.5 ohms for 10 seconds.
or
[M1/H+] (The resistance between the pumping electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms AND the the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[P+/P-] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 1st chamber is < 0.5 ohms AND | the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) for 40 seconds.
or

[Ref/Tmp] (The resistance between the sensors air reference electrode and the sensors 3rd electrode within its internal heater is < 0.5 ohms AND the voltage between reference line and ground < 1 V) for 40 seconds.
or
[P-/H+] The resistance between the pumping electrode in the 1st chamber and the sensors internal heater supply is < 0.5 ohms for 10 seconds.
or
[M1/H-] The resistance between the pumping electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P+/Tmp] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[M2/H-] The resistance between the measuring electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P-/H-] The resistance between the pumping electrode in the 1st chamber and ground is < 0.5 ohms for 10 seconds.
or
[M2/H+] The resistance between the measuring electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms for 10 seconds.
or
[H+/H-] The resistance between the sensors internal heater supply voltage line and sensor ground is < 0.5 ohms for 10 seconds.
or
[M2/Tmp] The resistance between the sensors measuring electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Vbatt/M1] The resistance between supply voltage and the sensors pumping electrode in the 2nd pumping chamber is < 0.5 ohms for 10 seconds.
or
[P+/M1] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 2nd chamber is < 0.5 ohms AND the binary voltage between the sensors top electrode and reference < 200 mV AND ((| the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) OR (binary voltage between the sensors top electrode and reference = the voltage between the pumping electrode in the 2nd chamber and reference)) for 40 seconds.
or
[Vbatt/Ref] The resistance between supply voltage and the sensors air reference electrode is < 0.5 ohms for 10 seconds.
or
[Vbatt/M2] The resistance between supply voltage and the sensors measuring electrode in 2nd chamber is < 0.5 ohms for 10 seconds.
or
[P-/Tmp] The resistance between the sensors pumping electrode in the 1st pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.

or
[M1/Tmp] The resistance between the sensors pumping electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[P+/H-] The resistance between the electrode in on the top of the sensor (exposed to the exhaust gas) and ground is < 0.5 ohms for 10 seconds.
or
[Ref/P-] (The resistance between the air reference electrode and pumping electrode in the 1st chamber < 0.5 ohms AND the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[Vbatt/P-] The resistance between supply voltage and the sensors pumping electrode in the 1st pumping chamber is < 0.5 ohms for 10 seconds.
or
[Vbatt/P+] The resistance between supply voltage and the sensors top electrode (directly exposed to exhaust gas) is < 0.5 ohms for 10 seconds.
or
[Vbatt/H+] The resistance between supply voltage and the sensors heater supply is < 0.5 ohms for 10 seconds.
or
[M1/M2] (5 mV < the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode < 500 mV AND the voltage between the pumping electrode in the 2nd chamber and the air reference electrode = the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode) for 40 seconds.

234. P0471-SE3924: Exhaust Gas Pressure 1 - Data Erratic, Intermittent, or Incorrect

Exhaust Pressure Sensor reading is In Range High

Monitor Operation:	
DTC	P0471-SE3924
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Abort Conditions (any active):

Pause Conditions (any active):
P0471-SE4442
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0472-SE494, P0473-SE493
Engine is not in Run State.
VGT Position < 35 %
Fueling < 12 mg/stroke
EGR Off Engine Protection is active

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - Estimated Value) in 90 seconds is ever > 1,800,000 KPa, which is equivalent to [Average of Error - Tolerance] >= 100 KPa. Where Tolerance is defined as: 0 KPa.

235. P0471-SE3922: Exhaust Gas Pressure 1 - Data Erratic, Intermittent, or Incorrect

Exhaust Pressure Sensor reading is In Range Low

Monitor Operation:	
DTC	P0471-SE3922
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Abort Conditions (any active):

Pause Conditions (any active):
P0471-SE4442
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0472-SE494, P0473-SE493
Engine is not in Run State.
VGT Position < 35 %
Fueling < 12 mg/stroke
EGR Off Engine Protection is active

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Value - Measured Value) in 90 seconds is ever > 1,800,000 KPa, which is equivalent to [Average of Error - Tolerance] >= 100 KPa. Where Tolerance is defined as: 0 KPa.

236. P0471-SE4442: Exhaust Gas Pressure 1 - Data Erratic, Intermittent, or Incorrect

Exhaust Pressure Sensor reading is erratic, intermittent or incorrect at keyoff.

Monitor Operation:	
DTC	P0471-SE4442
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in stopped state
The time since Key Switch is turned OFF ≥ 30 sec

Abort Conditions (any active):
P0472-SE494, P0473-SE493
Coolant Temperature ≤ 70 °C

Malfunction Thresholds (all active):
Exhaust Pressure Sensor reading < 18 kPa(absolute)
OR
Exhaust Pressure Sensor reading > 144.31 kPa(absolute)
OR
|Exhaust Pressure - the most accurate pressure sensor from the remaining pressure sensor| > (39.59 + the tolerance of the most accurate pressure sensor from the remaining pressure sensors) kPa(absolute)
|Exhaust Pressure - the second most accurate pressure sensor from the remaining pressure sensor| > (39.59 + the tolerance of the second most accurate pressure sensor from the remaining pressure sensors) kPa(absolute)
| the most accurate sensor from the remaining pressure sensors - the second most accurate sensor from the remaining pressure sensors | < (the tolerance of the most accurate sensor from the remaining pressure sensors + the tolerance of the second most accurate sensor from the remaining pressure sensors) kPa(absolute)
The tolerance of the remaining pressure sensors are:
Charge Pressure sensor tolerance = 11.84 kPa(absolute)
Compressor Inlet Pressure sensor tolerance = 3.19 kPa(absolute)

237. P0473-SE493: Exhaust Gas Pressure Sensor 1 Circuit - Voltage Above Normal or Shorted to High Source

Exhaust Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0473-SE493
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Exhaust Pressure sensor value > 4.8V (620.53 kPa(absolute))

238. P0472-SE494: Exhaust Gas Pressure Sensor 1 Circuit - Voltage Below Normal or Shorted to Low Source

Exhaust Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0472-SE494
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Exhaust Pressure sensor value < 0.2V (44.82 kPa(absolute))

239. P0A0F-SE10214: Engine Failed Automatic Start - Condition Exists

Engine Camshaft to Crankshaft synchronization is not achieved within a calibratable window.

Monitor Operation:	
DTC	P0A0F-SE10214
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	7 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine Cranking Time > 0.25 sec
Engine Speed ≥ 70 RPM
Measured Fuel Rail Pressure > 120 bar
Measured Fuel Rail Pressure > RefTable24 bar

Malfunction Thresholds (all active):
Engine Synchronization Time > 5 sec

240. P00C6-SE10215: Engine Injector Metering Rail 1 Cranking Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Rail pressure is too low to start the engine, as the fuel rail pressure is less than the specified minimum injection pressure threshold during cranking.

Monitor Operation:	
DTC	P00C6-SE10215
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	40 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0192-SE1403, P0193-SE1402, P0335-SE4372, P0335-SE6886, P0340-SE3392, P0340-SE4499
Engine Speed ≥ 70 RPM
Battery Voltage during starting ≥ 8 V
Ambient Air Temperature ≥ -7 °C
Ambient Air Pressure ≥ 70 kPa(absolute)
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
Measured Fuel Rail Pressure ≤ 120 bar

241. P0691-SE1003: Fan Control Circuit - Voltage Below Normal or Shorted to Low Source

Fan Clutch driver voltage has its voltage below normal, or shorted to a low source

Monitor Operation:	
DTC	P0691-SE1003
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	400 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
The resistance between the Fan Clutch Driver and ground < 0.2 Ohms

242. P0692-SE1004: Fan Control Circuit - Voltage Above Normal or Shorted to High Source

Fan Clutch driver voltage is above voltage limit.

Monitor Operation:	
DTC	P0692-SE1004
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	400 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
The resistance between the Fan Clutch Driver and ground > 500,000 Ohms

243. P026B-SE7471: Engine Fuel Injection Quantity Error for Multiple Cylinders - Condition Exists

The Fuel quantity Balancing Control has failed to enter closed loop mode.

Monitor Operation:	
DTC	P026B-SE7471
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1,150 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0335-SE4372, P0335-SE6886, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
2 mg/stroke ≤ Fuel Injection Quantity ≤ RefTable25
The engine is not in Particulate Filter regeneration mode.
Engine is in running state for at least 30 seconds.
This monitor is not disabled by any gear dependent deactivation.
Air to fuel ratio divided by the Stoichiometric Air to fuel ratio > RefTable26+0 (ratio)

Abort Conditions (any active):
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0335-SE4372, P0335-SE6886, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Fuel Injection Quantity < 2 mg/strok OR Fuel Injection Quantity > RefTable25
The engine is in Particulate Filter regeneration mode.
This monitor is disabled by any gear dependent deactivation.
Air to fuel ratio divided by the Stoichiometric Air to fuel ratio ≤ RefTable26+0 (ratio)

Malfunction Thresholds (all active):
Fuel quantity Balancing Control is not in closed loop mode

244. P0263-SE7472: Engine Cylinder 1 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 1 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0263-SE7472
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 1 Fuel Balance Control Correction Quantity > RefTable27

245. P0266-SE7473: Engine Cylinder 2 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 2 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0266-SE7473
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 2 Fuel Balance Control Correction Quantity > RefTable27

246. P0269-SE7480: Engine Cylinder 3 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 3 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0269-SE7480
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 3 Fuel Balance Control Correction Quantity > RefTable27

247. P0272-SE7477: Engine Cylinder 4 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 4 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0272-SE7477
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 4 Fuel Balance Control Correction Quantity > RefTable27

248. P0275-SE7478: Engine Cylinder 5 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 5 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0275-SE7478
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 5 Fuel Balance Control Correction Quantity > RefTable27

249. P0278-SE7479: Engine Cylinder 6 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 6 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0278-SE7479
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 6 Fuel Balance Control Correction Quantity > RefTable27

250. P0281-SE7475: Engine Cylinder 7 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 7 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0281-SE7475
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 7 Fuel Balance Control Correction Quantity > RefTable27

251. P0284-SE7476: Engine Cylinder 8 Fuel Injection Quantity - Data Erratic, Intermittent, or Incorrect

The Fuel Balance Control correction quantity for cylinder number 8 is within a calibratable offset of its limit.

Monitor Operation:	
DTC	P0284-SE7476
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Fuel quantity Balancing Control is in a closed-loop operating mode.
The engine is not in Particulate Filter regeneration mode.
No cylinders have been switched off due to limp-home or engine shut-off.
Fuel Injection Quantity ≥ 3 mg/stroke
Engine Coolant Temperature > 30 °C
Ambient Air Pressure ≥ 75 kPa(absolute)

Abort Conditions (any active):
Fuel quantity Balancing Control is not in a closed-loop operating mode.
The engine is in Particulate Filter regeneration mode.
One or more cylinders have been switched off due to limp-home or engine shut-off
Fuel Injection Quantity < 3 mg/stroke
Engine Coolant Temperature ≤ 30 °C
Ambient Air Pressure < 75 kPa(absolute)

Malfunction Thresholds (all active):
Cylinder number 8 Fuel Balance Control Correction Quantity > RefTable27

252. U11C1-SE7156: Aftertreatment Diesel Exhaust Fluid Controller - Received Network Data in Error

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) has detected its Internal Dataset is Invalid.

Monitor Operation:	
DTC	U11C1-SE7156
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0 sec
MIL Activation Criteria	1 trip

Abort Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V during startup sequence.

Malfunction Thresholds (all active):
The Flange Controller (FCU) has detected that the Internal Dataset Checksum does not match the expected value

253. U040F-SE7150: Aftertreatment Diesel Exhaust Fluid Controller - Root Cause Not Known

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) has detected a requested operation state out of sequence, which is an Implausible State Request from the ECM.

Monitor Operation:	
DTC	U040F-SE7150
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) has detected an Engine Control Module (ECM) SAE Aftertreatment 1 SCR Dosing System Requests 1 (PGN 61476) message that is out of sequence.

254. U040F-SE7149: Aftertreatment Diesel Exhaust Fluid Controller - Root Cause Not Known

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) has detected missing control messages from the ECM.

Monitor Operation:	
DTC	U040F-SE7149
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Control Unit (FCU) has not received the SAE Aftertreatment 1 SCR Dosing System Requests 1 (PGN 61476) message from the Engine Control Module (ECM)
OR
The FCU has not received the SAE Aftertreatment 1 SCR Dosing System Requests 2 (PGN 64832) message from the Engine Control Module (ECM)
OR
The FCU has not received the SAE Ambient Conditions (PGN 65269) message from the Engine Control Module (ECM)
OR
The FCU has not received the Diagnostic Override (PGN 65353) message from the Engine Control Module (ECM)

255. P21C4-SE7891: Aftertreatment Diesel Exhaust Fluid Line Heater Relay - Voltage Above Normal or Shorted to High Source

Flange Control Unit (FCU) Heater power supply is open or shorted to high voltage source.

Monitor Operation:	
DTC	P21C4-SE7891
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Keyswitch has been Off for 10 seconds
The Flange Control Unit continues to communicate with the Engine Control Unit for 10 seconds after key off
This diagnostic has not previously completed during this key cycle

Abort Conditions (any active):
Keyswitch is ON

Malfunction Thresholds (all active):
the Flange Control Unit (FCU) Heater voltage is below operational range condition (See RefCond0033.) has not occurred

256. P20B8-SE7100: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit 1 Heater Circuit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Heater Input Power Source voltage to the Flange Controller Unit (FCU) is in excess of an allowable value.

Monitor Operation:	
DTC	P20B8-SE7100
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	32 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Keyswitch is ON.
The Engine is not in a Cranking mode.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Heater Input Power Source voltage to the Flange Controller Unit (FCU) ≥ 16 V

257. P20B7-SE7217: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit 1 Heater Circuit - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Heater Input Power Source Voltage to the Flange Controller Unit (FCU) is below an allowable value.

Monitor Operation:	
DTC	P20B7-SE7217
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	62 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Keyswitch is ON.
The Engine is not in a Cranking mode.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Heater Input Power Source Voltage to the Flange Controller Unit (FCU) < 8.99 V

258. P20BC-SE7145: Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater current is above an allowable limit.

Monitor Operation:	
DTC	P20BC-SE7145
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	16 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Line Heater is active.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater current ≥ 4 A

259. P20B9-SE7144: Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Current Below Normal or Open Circuit

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater current is below an allowable limit.

Monitor Operation:	
DTC	P20B9-SE7144
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	16 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Line Heater is active.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater current < 1 A
The DEF line heater current > 0 A

260. P20B9-SE7143: Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Current Below Normal or Open Circuit

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater has an open circuit.

Monitor Operation:	
DTC	P20B9-SE7143
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Diesel Exhaust Fluid (DEF) Line Heater is active and the Flange Control Unit (FCU) detects that the Line Heater current < 1 A
The DEF Line Heater becomes inactive and the FCU detects that the switching Line Heater High Side driver voltage > 70 % of the heater supply.
The DEF Line Heater is inactive and the FCU detects that the switching Line Heater Low Side driver voltage < 30% of the heater supply.

261. P20BC-SE7139: Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater has a short circuit between the positive and negative heater circuit.

Monitor Operation:	
DTC	P20BC-SE7139
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.9 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Line Heater is active.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Diesel Exhaust Fluid (DEF) Line Heating is active and the Flange Control Unit (FCU) detects the Line Heater Low Side Driver current > 55.2 A
OR
The DEF Line Heating is active and the Flange Control Unit (FCU) detects the Line Heater High Side Driver current > 12A)
AND
The DEF Line Heater becomes inactive and the Line Heater High Side Driver voltage < 70% of the switching heater supply voltage
AND
The DEF Line Heater becomes inactive and the Line Heater Low Side Driver voltage < 70% of the switching heater supply voltage
AND
The DEF Line Heating becomes inactive and the FCU detects the Line Heater High and Low Side Driver voltage > 30 % of the Switching Heater Supply voltage.

262. P20BC-SE7140: Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater has a short circuit to the battery.

Monitor Operation:	
DTC	P20BC-SE7140
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Diesel Exhaust Fluid (DEF) Line Heater is active and the Line Heater High Side Driver current > 12 A
OR
The DEF Line Heater is active and the Line Heater Low Side Driver current > 55.2 A
OR
The DEF Line Heater is active and the Line Heater Current is < 5A)
AND
(The DEF Line Heater becomes inactive and the Line Heater High Side Driver voltage > 70% of the switching heater supply voltage
OR
The DEF Line Heater becomes inactive and the Line Heater Low Side Driver voltage ≥ 70% of the switching heater supply voltage)

263. P20BB-SE7142: Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Line Heater has a short circuit to ground.

Monitor Operation:	
DTC	P20BB-SE7142
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Diesel Exhaust Fluid (DEF) Line Heating is active and the Flange Control Unit (FCU) detects the Line Heater current > 15 A
The DEF Line Heating becomes inactive and the FCU detects the Line Heater Low or High Side Driver voltage < 30 % of the Switching Heater Supply voltage.

264. P208D-SE7598: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless Direct Current (BLDC) Motor Driver temperature is above an allowable limit.

Monitor Operation:	
DTC	P208D-SE7598
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is On
OR
The FCU Diesel Exhaust Fluid Tank Heater is active, as disclosed in AECD 13-3.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless Direct Current (BLDC) Motor Driver temperature ≥ 130 °C
The FCU DEF Tank Heater Driver temperature - FCU Pump BLDC Motor Driver temperature ≤ 30 °C

265. P204A-SE7129: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Mechanical System Not Responding or Out of Adjustment

The Engine Control Module (ECM) has detected that the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump is stuck.

Monitor Operation:	
DTC	P204A-SE7129
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is commanded On.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Control Unit (FCU) has requested the Diesel Exhaust Fluid (DEF) Pump to rotate and has detected the pump motor will not rotate

266. P208A-SE7127: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Current Below Normal or Open Circuit

The Engine Control Module (ECM) has detected that any of the 3 Brushless Direct Current (DC) Motor phases, within the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) pump, has an open circuit condition.

Monitor Operation:	
DTC	P208A-SE7127
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	11 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless Direct Current (BLDC) Motor is turning forward or reverse
AND
Any of the DEF Pump BLDC Motor Driver phase current is ≤ 0.5 A
AND
The DEF Pump BLDC Motor is turning ≤ 500RPM)
OR
(The DEF Pump is in heating mode
AND
The DEF Pump BLDC Motor current is ≤ 1.5A)
OR
(The DEF Pump BLDC Motor is not active
AND
Any of the DEF Pump BLDC Motor Driver phase voltage is ≤ 7V)

267. P208D-SE7599: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless Direct Current (BLDC) Motor Driver current is above an allowable limit.

Monitor Operation:	
DTC	P208D-SE7599
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	13 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is commanded On.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless DC (BLDC) Motor is turning forward or reverse
AND
The DEF Pump BLDC Motor Driver current ≥ 3A)
OR
(The DEF Pump BLDC Motor is in heating mode
AND
The Pump BLDC Motor Driver current ≥ 10.6A)

268. P204A-SE7128: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Mechanical System Not Responding or Out of Adjustment

The Engine Control Module (ECM) has detected that there is a short circuit between any 2 of the 3 Brushless Direct Current (BLDC) Motor Phases, within the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump.

Monitor Operation:	
DTC	P204A-SE7128
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	11 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless Direct Current (BLDC) Motor is active turning forward or reverse
AND
One of the DEF Pump 3 BLDC Motor Driver Phase current is ≥ 13.6 A
AND
The DEF Pump BLDC Motor becomes inactive and voltage is applied to the suspected DEF Pump BLDC Motor phase high and low side driver
AND
The suspect DEF Pump BLDC Motor Driver current ≤ 13.6A)
OR
(The DEF pump is in heating mode
AND
One of the DEF pump 3 brushless DC driver phase is ≥ 13.6 A
AND
The pump heating is stopped and voltage is applied to the suspected DEF Pump BLDC Motor phase high and low side driver
AND
The suspect DEF Pump BLDC Motor Driver phase current is ≤ 13.6A)
OR
(The DEF pump brushless motor is not turning
AND
Any of the DEF pump 3 brushless DC driver phase is ≤ 7A)

269. P208D-SE7125: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected that any of the 3 Brushless Direct Current (BLDC) Motor Phases, within the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump, has a voltage in excess of an allowable value.

Monitor Operation:	
DTC	P208D-SE7125
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	11 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Brushless Direct Current (BLDC) Motor is turning forward or reverse
AND
Any of the DEF Pump BLDC Motor Driver Phase current is ≥ 13.6 A
AND
The DEF Pump BLDC Motor becomes inactive and voltage is applied to the suspected DEF Pump BLDC Motor phase high and low side driver
AND
The suspect DEF Pump BLDC Motor Driver current ≥ 13.6A)
OR
(The DEF Pump is in heating mode
AND
Any of the DEF Pump BLDC Motor Driver Phase current is ≥ 13.6A)
OR
(Any DEF Pump BLDC Motor phase is inactive
AND
Any of the DEF Pump BLDC Motor Driver Phase voltage is ≥ 6V)
OR
(The DEF pump brushless motor is off
AND
Any of the DEF Pump BLDC Motor Driver Phase voltage is ≥ 6V)

270. P208C-SE7126: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected that any of the 3 Brushless Direct Current (BLDC) Motor Phases, within the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump, has a voltage below an allowable value.

Monitor Operation:	
DTC	P208C-SE7126
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	11 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump is in heating mode
AND
Any of the DEF Pump Brushless Direct Current (BLDC) Motor High Side Driver Phase current is ≥ 13.6A)
OR
(The DEF Pump BLDC Motor is turning forward or reverse
AND
Any of the DEF Pump BLDC Motor High Side Driver Phase current is ≥ 13.6A)
OR
(Any DEF Pump BLDC Motor phase is inactive
AND
Any of the DEF Pump BLDC Motor Driver Phase voltage is < 1V)
OR
(The DEF Pump BLDC motor is not turning
AND
Any of the DEF Pump BLDC Motor Driver Phase voltage is ≤ 1V)

271. P204A-SE7130: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Mechanical System Not Responding or Out of Adjustment

The Engine Control Module (ECM) has detected that the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump cannot maintain the target pressure.

Monitor Operation:	
DTC	P204A-SE7130
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	25 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P20E9-SE7966
P20E8-SE7969
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is commanded On.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
P20E8-SE7969, P20E9-SE7966
AND
(The Flange Control Unit (FCU) has detected the Diesel Exhaust Fluid (DEF) Pressure ≥ 550kPa(gauge))
OR
(The FCU has detected the Diesel Exhaust Fluid (DEF) Pressure ≤ 450 kPa(gauge))

272. P208D-SE7604: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected that the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump is turning the wrong direction.

Monitor Operation:	
DTC	P208D-SE7604
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.4 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) pump is commanded in the reverse direction.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure ≥ 30 kPa(gauge)

273. P21CA-SE7106: Aftertreatment Diesel Exhaust Fluid Controller - Data Erratic, Intermittent, or Incorrect

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Internal Sensor Power Supply Ground is in excess of an allowable value.

Monitor Operation:	
DTC	P21CA-SE7106
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The ground of the Flange Controller Unit (FCU) Internal Sensor Power Supply voltage ≥ 0.2 V

274. P21CA-SE7102: Aftertreatment Diesel Exhaust Fluid Controller - Data Erratic, Intermittent, or Incorrect

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Internal Sensor Power Supply Unit (PSU) voltage is in excess of an allowable value.

Monitor Operation:	
DTC	P21CA-SE7102
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Internal Sensor Power Supply voltage ≥ 5.16 V

275. P21CA-SE7104: Aftertreatment Diesel Exhaust Fluid Controller - Data Erratic, Intermittent, or Incorrect

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Internal Sensor Power Supply Unit (PSU) voltage is below an allowable value.

Monitor Operation:	
DTC	P21CA-SE7104
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Internal Sensor Power Supply voltage < 4.83 V

276. P203B-SE7113: Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Data Erratic, Intermittent, or Incorrect

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) detection of an electrical fault with temperature compensation error with the Diesel Exhaust Fluid (DEF) Tank Level Sensor.

Monitor Operation:	
DTC	P203B-SE7113
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage > 4.37 V
The FCU DEF Tank Level Sensor voltage ≤ 4.63 V

277. P202C-SE7137: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater current is above an allowable limit.

Monitor Operation:	
DTC	P202C-SE7137
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	16 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Tank Heater is active, as disclosed in AECD 13-3.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater current ≥ 12.9 A

278. P202B-SE7136: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater current is below an allowable limit.

Monitor Operation:	
DTC	P202B-SE7136
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	16 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Tank Heater is active, as disclosed in AECD 13-3.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater current < 5.3 A
The DEF Tank Heater current > 0 A

279. P202B-SE7135: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater has an open circuit.

Monitor Operation:	
DTC	P202B-SE7135
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Diesel Exhaust Fluid (DEF) Tank Heater is active and the Flange Control Unit (FCU) detects that the Tank Heater current < 5 A
The DEF Tank Heater becomes inactive and the FCU detects that the Tank Heater High Side Driver voltage > 70 % of the heater supply voltage.
The DEF Tank Heater is inactive and the FCU detects that the Tank Heater Low Side Driver voltage < 30% of the heater supply voltage.

280. P202C-SE7131: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater has a short circuit between the positive and negative heater circuit.

Monitor Operation:	
DTC	P202C-SE7131
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.9 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Tank Heater is active, as disclosed in AECD 13-3.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Diesel Exhaust Fluid (DEF) tank heating is active and the Flange Control Unit (FCU) detects the tank heater low side driver current > 55.2 A
OR
The DEF tank heating is active and the FCU detects the tank heater high side driver current > 15A)
AND
The DEF Tank Heater becomes inactive and the Tank Heater High Side Driver voltage < 70% of the switching heater supply voltage
AND
The DEF Tank Heater becomes inactive and the Tank Heater Low Side Driver voltage < 70% of the switching heater supply voltage
AND
The DEF Tank Heating becomes inactive and the FCU detects the Tank Heater High and Low Side Driver voltage > 30 % of the switching heater supply voltage

281. P202C-SE7132: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater has a short circuit to the battery.

Monitor Operation:	
DTC	P202C-SE7132
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
(The Diesel Exhaust Fluid (DEF) Tank Heater is active and the Tank Heater High Side Driver current > 15 A
OR
The Diesel Exhaust Fluid (DEF) Tank Heater is active and the Tank Heater Low Side Driver current > 55.2 A
OR
The DEF Tank Heater is active and the Tank Heater Current is < 5A)
AND
(The DEF Tank Heater becomes inactive and the Tank Heater High Side Driver voltage > 70% of the switching heater supply voltage
OR
The DEF Tank Heater becomes inactive and the Tank Heater Low Side Driver voltage ≥ 70% of the switching heater supply voltage)

282. P202B-SE7134: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Heater has a short circuit to ground.

Monitor Operation:	
DTC	P202B-SE7134
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Diesel Exhaust Fluid (DEF) Tank Heating is active and the Flange Control Unit (FCU) detects the Tank Heater current > 15 A
The DEF Tank Heating becomes inactive and the FCU detects the Tank Heater High and Low Side Driver voltage < 30 % of the switching heater supply voltage.

283. P202C-SE7138: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Heater Driver temperature is above an allowable limit.

Monitor Operation:	
DTC	P202C-SE7138
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The FCU Diesel Exhaust Fluid Tank Heater is active, as disclosed in AECD 13-3.
OR
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is On

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Heater Driver temperature ≥ 130 °C
The FCU DEF Tank Heater Driver temperature - FCU Pump Motor Driver temperature ≤ 30 °C

284. P203B-SE7112: Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Data Erratic, Intermittent, or Incorrect

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) detection of an internal critical error with the Diesel Exhaust Fluid (DEF) Tank Level Sensor.

Monitor Operation:	
DTC	P203B-SE7112
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage ≤ 4.87 V
The FCU DEF Tank Level Sensor voltage > 4.62 V

285. P203D-SE7107: Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage is in excess of an allowable value.

Monitor Operation:	
DTC	P203D-SE7107
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage ≥ 4.87V (100% DEF tank level)

286. P203C-SE7110: Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Level Sensor voltage is below an allowable value.

Monitor Operation:	
DTC	P203C-SE7110
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) tank level sensor voltage < 0.32V (0% DEF tank level)

287. P20E9-SE7120: Aftertreatment 1 Diesel Exhaust Fluid Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure Sensor measures an in-range high pressure.

Monitor Operation:	
DTC	P20E9-SE7120
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The FCU Internal Pump Rotor stall test has passed.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump has intentionally stopped.
The DEF Pressure Sensor value ≥ 50 kPa(gauge)

288. P20E8-SE7121: Aftertreatment 1 Diesel Exhaust Fluid Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure Sensor measures an in-range low pressure.

Monitor Operation:	
DTC	P20E8-SE7121
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The FCU Internal Pump Rotor stall test has passed.

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump has intentionally stopped.
The DEF Pressure Sensor value ≤ -47.5 kPa(gauge)

289. P204D-SE7115: Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure sensor voltage is in excess of an allowable value.

Monitor Operation:	
DTC	P204D-SE7115
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure Sensor voltage ≥ 4.62V (900kPa(gauge))

290. P204C-SE7118: Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure Sensor voltage is below an allowable value.

Monitor Operation:	
DTC	P204C-SE7118
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.2 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pressure Sensor voltage < 0.45V (-50kPa(gauge))

291. P205D-SE7122: Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor - Voltage Above Normal or Shorted to High Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Temperature Sensor voltage is in excess of an allowable value.

Monitor Operation:	
DTC	P205D-SE7122
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Temperature Sensor voltage ≥ 4.4V (-40°C)

292. P205C-SE7124: Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor - Voltage Below Normal or Shorted to Low Source

The Engine Control Module (ECM) has detected the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Temperature Sensor voltage is below an allowable value.

Monitor Operation:	
DTC	P205C-SE7124
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10.3 sec
MIL Activation Criteria	2 trips

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Tank Temperature Sensor voltage < 0.17V (80°C)

293. P21CC-SE7074: Battery 2 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Engine Control Module (ECM) has detected the Input Power Source voltage to the Flange Controller Unit (FCU) is in excess of an allowable value.

Monitor Operation:	
DTC	P21CC-SE7074
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	32 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine has been running for > 270 sec this drive cycle.

Malfunction Thresholds (all active):
The Input Power Source voltage to the Flange Controller Unit (FCU) ≥ 16 V

294. P21CB-SE7098: Battery 2 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level

The Engine Control Module (ECM) has detected the Input Power Source voltage to the Flange Controller Unit (FCU) is below an allowable value.

Monitor Operation:	
DTC	P21CB-SE7098
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	32 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine has been running for > 270 sec this drive cycle.

Malfunction Thresholds (all active):
The Input Power Supply voltage to the Flange Controller Unit (FCU) < 8.99 V

295. P20E9-SE7966: Aftertreatment 1 Diesel Exhaust Fluid Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Engine Control Module (ECM) has detected that the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Pressure Control is too high.

Monitor Operation:	
DTC	P20E9-SE7966
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	12 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is On
AND
The DEF Pump Pressure >= 450 kPa (gauge) AND DEF Pump Pressure <= 550 kPa (gauge)

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Control Unit (FCU) has detected the Diesel Exhaust Fluid (DEF) Pressure ≥ 550 kPa(gauge)

296. P20E8-SE7969: Aftertreatment 1 Diesel Exhaust Fluid Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

The Engine Control Module (ECM) has detected that the Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Pressure Control is too low.

Monitor Operation:	
DTC	P20E8-SE7969
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	20 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Controller Unit (FCU) Diesel Exhaust Fluid (DEF) Pump Motor is On.
AND
The DEF Pump Pressure >= 450 kPa (gauge) AND DEF Pump Pressure <= 550 kPa (gauge)

Pause Conditions (any active):
The Flange Controller Unit (FCU) Battery input voltage < 6.5 V

Malfunction Thresholds (all active):
The Flange Control Unit (FCU) has detected the Diesel Exhaust Fluid (DEF) Pressure ≤ 450 kPa(gauge)

297. P0168-SE2351: Engine Fuel Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Fuel temperature value greater than a calibrated threshold for a calibrated amount of time.

Monitor Operation:	
DTC	P0168-SE2351
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Engine speed > 570 RPM

Malfunction Thresholds (all active):
Fuel Temperature > 80 °C

298. P0461-SE3948: Fuel Level (Main Tank) - Data Erratic, Intermittent, or Incorrect

The fuel level has been under the calibrated low threshold for a longer distance than possible.

Monitor Operation:	
DTC	P0461-SE3948
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
P0501-SE130, P0501-SE4361, U0402-SE4921, U1000-SE4924, U1000-SE4928

Abort Conditions (any active):
P0462-SE3947, P0463-SE3946, U0002-SE3232, U1000-SE4926, U1000-SE4929

Pause Conditions (any active):
P0501-SE130, P0501-SE4361, U0402-SE4921, U1000-SE4924, U1000-SE4928

Malfunction Thresholds (all active):
Vehicle has traveled for at least 192.625 miles while Fuel level < 14.898 %

299. P0463-SE3946: Fuel Level (Main Tank) Sensor Circuit - Voltage Above Normal or Shorted to High Source

The analog or the datalink fuel level sensor output signal voltage was higher than expected.

Monitor Operation:	
DTC	P0463-SE3946
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	70 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
U0002-SE3232, U1000-SE4926, U1000-SE4929

Abort Conditions (any active):
U0002-SE3232, U1000-SE4926, U1000-SE4929

Malfunction Thresholds (all active):
Fuel level sensor voltage > 4.302 V

300. P0462-SE3947: Fuel Level (Main Tank) Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The fuel level sensor output signal voltage was lower than expected

Monitor Operation:	
DTC	P0462-SE3947
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	70 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
U0002-SE3232, U1000-SE4926, U1000-SE4929

Abort Conditions (any active):
U0002-SE3232, U1000-SE4926, U1000-SE4929

Malfunction Thresholds (all active):
Fuel level sensor voltage < 0.122 V

301. P2540-SE10364: Fuel Delivery Pressure - Data Erratic, Intermittent, or Incorrect

The Fuel Pump Inlet Pressure is greater than or equal to a calibrated threshold for a calibrated amount of time at the expiration of a calibrated delay time.

Monitor Operation:	
DTC	P2540-SE10364
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
The Fuel Lift Pump is OFF

Abort Conditions (any active):
P2541-SE6554, P2542-SE6553

Malfunction Thresholds (all active):
Fuel Pump Inlet Pressure >= 7 bar for 1 secs at the expiration of a sensor rationality check delay time of 60 secs

302. P2540-SE10365: Fuel Delivery Pressure - Data Erratic, Intermittent, or Incorrect

The Fuel Pump Inlet Pressure is less than a calibrated threshold for a calibrated amount of time at the expiration of a calibrated delay time.

Monitor Operation:	
DTC	P2540-SE10365
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
The Fuel Lift Pump is OFF for the entire Sensor Rationality Check delay time of 60 secs

Abort Conditions (any active):
P2541-SE6554, P2542-SE6553

Malfunction Thresholds (all active):
Fuel Pump Inlet Pressure < 0.5 bar for 1 secs at the expiration of a sensor rationality check delay time of 60 secs

303. P008A-SE6552: Engine Fuel Delivery Pressure - Data Valid But Below Normal Operating Range - Least Severe Level

The integrated severity value of the Actual Fuel Pump Inlet Pressure minus the Fuel Pressure threshold reaches a severity threshold.

Monitor Operation:	
DTC	P008A-SE6552
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Fuel Level ≥ 14.898 %
AND
The Fuel Lift Pump has been running for at least a minimum calibratable time interpolated from RefTable29

Abort Conditions (any active):
P2541-SE6554, P2542-SE6553

Malfunction Thresholds (all active):
A severity value of Fuel Pump Inlet Pressure minus 4.5 bar is interpolated from RefTable31. The accumulated severity reaches 500 secs.

304. P2542-SE6553: Fuel Delivery Pressure Sensor Circuit - Voltage Above Normal or Shorted to High Source

Fuel Supply Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2542-SE6553
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Fuel Supply Pressure Sensor value > 4.835 V (24.13 bar Absolute)

305. P2541-SE6554: Fuel Delivery Pressure Sensor Circuit - Voltage Below Normal or Shorted to Low Source

Fuel Supply Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2541-SE6554
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	3 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Fuel Supply Pressure Sensor value < 0.155 V (0 bar Absolute)

306. P008A-SE8269: Engine Fuel Delivery Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

The integrated severity value of the Actual Fuel Pump Inlet Pressure minus the Fuel Pressure threshold has reached a severity threshold for a calibratable number of consecutive key cycles, severe torque derate will be performed.

Monitor Operation:	
DTC	P008A-SE8269
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
A severity value of Fuel Pump Inlet Pressure minus 4.5 bar is interpolated from RefTable31. The accumulated severity reaches 500 seconds on 5 consecutive key cycles.

307. P0193-SE1402: Injector Metering Rail 1 Pressure Sensor Circuit - Voltage Above Normal or Shorted to High Source

Fuel Rail Pressure sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0193-SE1402
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.4 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0652-SE225, P0653-SE243

Malfunction Thresholds (all active):
Fuel Rail Pressure Sensor Value > 4,810 mV (2,200 bar absolute

308. P0192-SE1403: Injector Metering Rail 1 Pressure Sensor Circuit - Voltage Below Normal or Shorted to Low Source

Fuel Rail Pressure sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0192-SE1403
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.4 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0652-SE225, P0653-SE243

Malfunction Thresholds (all active):
Fuel Rail Pressure Sensor Value < 189 mV (0 bar absolute

309. P0191-SE4713: Injector Metering Rail 1 Pressure - Data Erratic, Intermittent, or Incorrect

Fuel Rail Pressure sensor reading greater than specified operating range for a calibrated amount of time at Key-on OR at Key-off.

Monitor Operation:	
DTC	P0191-SE4713
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.03 sec at Key-on 0.1 sec at Key-off.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0016-SE5202, P009C-SE4715, P0117-SE76, P0118-SE75, P0192-SE1403, P0193-SE1402, P0335-SE4372, P0335-SE6886, P0340-SE3392, P0340-SE4499, P0606-SE7489, P0652-SE225, P0653-SE243
Engine shut-off timer at key on ≥ 3 sec
The engine has not yet moved at key on.
Engine Coolant temperature at Key On ≥ -7 °C
Engine speed reaches zero at key off.
Fuel temperature at key off > -7 °C
At key off, the engine has already run in the current driving cycle.
The Pressure Control Valve [PCV] is open at key off. This implies that the current flowing through the PCV ≤ 0.5 A
Delay Time for offset monitoring of rail pressure sensor at key off = RefTable32 , based on current rail pressure

Malfunction Thresholds (all active):
Rail Pressure Sensor value at Key-on > 0.609 V (59.965 bar(absolute))
OR
The delay time after all enable conditions are satisfied is greater than a calculated threshold at key off. This threshold is calculated from the delay time map for rail pressure sensor offset monitoring based on fuel rail pressure.
AND
Rail Pressure Sensor value at Key-off > 0.609 V (59.965 bar(absolute))

310. P0191-SE6941: Injector Metering Rail 1 Pressure - Data Erratic, Intermittent, or Incorrect

Fuel Rail Pressure sensor reading less than specified operating range for a calibrated amount of time at Key-on OR at Key-off.

Monitor Operation:	
DTC	P0191-SE6941
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.03 sec at Key-on OR 0.1 sec at Key-off
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0016-SE5202, P009C-SE4715, P0117-SE76, P0118-SE75, P0192-SE1403, P0193-SE1402, P0335-SE4372, P0335-SE6886, P0340-SE3392, P0340-SE4499, P0606-SE7489, P0652-SE225, P0653-SE243
Engine shut-off timer at key on ≥ 3 sec
Engine Coolant temperature at Key On ≥ -7 °C
The engine has not yet moved at key on.
Engine speed reaches zero at key off.
Fuel temperature at key off > -7 °C
At key off, the engine has already run in the current driving cycle.
The Pressure Control Valve [PCV] is open at key off. This implies that the current flowing through the PCV ≤ 0.5 A
Delay Time for offset monitoring of rail pressure sensor at key off = RefTable32 , based on current rail pressure

Malfunction Thresholds (all active):
Rail Pressure Sensor value at Key-on < 0.424 V (0 bar absolute
OR
The delay time after all enable conditions are satisfied is greater than a calculated threshold at key off. This threshold is calculated from the delay time map for rail pressure sensor offset monitoring based on fuel rail pressure.
AND
Rail Pressure Sensor value at Key-off < 0.424 V (0 bar absolute

311. P0181-SE10097: Engine Fuel Temperature - Data Erratic, Intermittent, or Incorrect

The difference between Fuel Temperature and Ambient Air Temperature sensor readings is greater than a calibrated threshold for a calibrated amount of time.

Monitor Operation:	
DTC	P0181-SE10097
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Vehicle Speed > 3.107 mph for 300 sec
If Fuel Level Sensor is present and not malfunctioning, Fuel Level >= 14.898 %.
Ambient Air Temperature ≥ -6.7 °C

Abort Conditions (any active):
P0182-SE1024, P0183-SE1023
P0501-SE130, P0501-SE4361
P1191-SE4190, P1192-SE484, P1193-SE486
P0102-SE3207, P0103-SE3206
Vehicle Speed ≤ 3.107 mph
If Fuel Level Sensor is present and not malfunctioning, Fuel Level < 14.898 %.
Ambient Air Temperature < -6.7 °C

Malfunction Thresholds (all active):
Fuel Temperature - Ambient Air Temperature > 45 °C

312. P0184-SE10098: Engine Fuel Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level

The difference between Fuel Temperature and Ambient Air Temperature sensor readings falls below a calibrated threshold for a calibrated amount of time

Monitor Operation:	
DTC	P0184-SE10098
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Vehicle Speed > 3.107 mph for 300 sec
If Fuel Level Sensor is present and not malfunctioning, Fuel Level >= 14.898 %.
Ambient Air Temperature ≥ -6.7 °C

Abort Conditions (any active):
P0182-SE1024, P0183-SE1023
P0501-SE130, P0501-SE4361
P1191-SE4190, P1192-SE484, P1193-SE486
P0102-SE3207, P0103-SE3206
Vehicle Speed ≤ 3.107 mph
If Fuel Level Sensor is present and not malfunctioning, Fuel Level < 14.898 %.
Ambient Air Temperature < -6.7 °C

Malfunction Thresholds (all active):
Fuel Temperature - Ambient Air Temperature < -38 °C

313. P0183-SE1023: Engine Fuel Temperature Sensor 1 Circuit - Voltage Above Normal or Shorted to High Source

Fuel Temperature sensor reading is greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0183-SE1023
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Fuel Temperature Sensor value > 4.979 V (< -40 degC)

314. P0182-SE1024: Engine Fuel Temperature Sensor 1 Circuit - Voltage Below Normal or Shorted to Low Source

Fuel Temperature sensor reading is lower than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0182-SE1024
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Fuel Temperature Sensor value < 0.089 V (> 150 degC)

315. P066A-SE4074: Glow Plug Heater Circuit #1 - Voltage Below Normal or Shorted to Low Source

Glow Plug 1 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P066A-SE4074
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

316. P066B-SE9446: Glow Plug Heater Circuit #1 - Voltage Above Normal or Shorted to High Source

Glow Plug 1 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P066B-SE9446
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

317. P0671-SE9437: Glow Plug Heater Circuit #1 - Current Below Normal or Open Circuit

Glow Plug 1 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0671-SE9437
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

318. P06E5-SE9455: Glow Plug Control Module - Root Cause Not Known

Glow Plug 1 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9455
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 1 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

319. P06B9-SE9472: Engine Glow Plug 1 - Data Erratic, Intermittent, or Incorrect

Glow Plug 1 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06B9-SE9472
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

320. P066C-SE4075: Glow Plug Heater Circuit #2 - Voltage Below Normal or Shorted to Low Source

Glow Plug 2 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P066C-SE4075
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

321. P066D-SE9447: Glow Plug Heater Circuit #2 - Voltage Above Normal or Shorted to High Source

Glow Plug 2 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P066D-SE9447
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

322. P0672-SE9439: Glow Plug Heater Circuit #2 - Current Below Normal or Open Circuit

Glow Plug 2 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0672-SE9439
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

323. P06E5-SE9456: Glow Plug Control Module - Root Cause Not Known

Glow Plug 2 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9456
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 2 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

324. P06BA-SE9473: Engine Glow Plug 2 - Data Erratic, Intermittent, or Incorrect

Glow Plug 2 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06BA-SE9473
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

325. P066E-SE4076: Glow Plug Heater Circuit #3 - Voltage Below Normal or Shorted to Low Source

Glow Plug 3 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P066E-SE4076
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

326. P066F-SE9449: Glow Plug Heater Circuit #3 - Voltage Above Normal or Shorted to High Source

Glow Plug 3 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P066F-SE9449
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

327. P0673-SE9440: Glow Plug Heater Circuit #3 - Current Below Normal or Open Circuit

Glow Plug 3 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0673-SE9440
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

328. P06E5-SE9457: Glow Plug Control Module - Root Cause Not Known

Glow Plug 3 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9457
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 3 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

329. P06BB-SE9474: Engine Glow Plug 3 - Data Erratic, Intermittent, or Incorrect

Glow Plug 3 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06BB-SE9474
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

330. P067A-SE4077: Glow Plug Heater Circuit #4 - Voltage Below Normal or Shorted to Low Source

Glow Plug 4 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P067A-SE4077
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

331. P067B-SE9450: Glow Plug Heater Circuit #4 - Voltage Above Normal or Shorted to High Source

Glow Plug 4 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P067B-SE9450
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

332. P0674-SE9441: Glow Plug Heater Circuit #4 - Current Below Normal or Open Circuit

Glow Plug 4 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0674-SE9441
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

333. P06E5-SE9458: Glow Plug Control Module - Root Cause Not Known

Glow Plug 4 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9458
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 4 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

334. P06BC-SE9476: Engine Glow Plug 4 - Data Erratic, Intermittent, or Incorrect

Glow Plug 4 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06BC-SE9476
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

335. P067C-SE4078: Glow Plug Heater Circuit #5 - Voltage Below Normal or Shorted to Low Source

Glow Plug 5 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P067C-SE4078
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

336. P067D-SE9451: Glow Plug Heater Circuit #5 - Voltage Above Normal or Shorted to High Source

Glow Plug 5 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P067D-SE9451
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

337. P0675-SE9442: Glow Plug Heater Circuit #5 - Current Below Normal or Open Circuit

Glow Plug 5 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0675-SE9442
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

338. P06E5-SE9459: Glow Plug Control Module - Root Cause Not Known

Glow Plug 5 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9459
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 5 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

339. P06BD-SE9477: Engine Glow Plug 5 - Data Erratic, Intermittent, or Incorrect

Glow Plug 5 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06BD-SE9477
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

340. P067E-SE4079: Glow Plug Heater Circuit #6 - Voltage Below Normal or Shorted to Low Source

Glow Plug 6 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P067E-SE4079
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

341. P067F-SE9452: Glow Plug Heater Circuit #6 - Voltage Above Normal or Shorted to High Source

Glow Plug 6 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P067F-SE9452
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

342. P0676-SE9443: Glow Plug Heater Circuit #6 - Current Below Normal or Open Circuit

Glow Plug 6 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0676-SE9443
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

343. P06E5-SE9460: Glow Plug Control Module - Root Cause Not Known

Glow Plug 6 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9460
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 6 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

344. P06BE-SE9478: Engine Glow Plug 6 - Data Erratic, Intermittent, or Incorrect

Glow Plug 6 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06BE-SE9478
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

345. P068C-SE4080: Glow Plug Heater Circuit #7 - Voltage Below Normal or Shorted to Low Source

Glow Plug 7 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P068C-SE4080
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

346. P068D-SE9453: Glow Plug Heater Circuit #7 - Voltage Above Normal or Shorted to High Source

Glow Plug 7 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P068D-SE9453
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

347. P0677-SE9444: Glow Plug Heater Circuit #7 - Current Below Normal or Open Circuit

Glow Plug 7 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0677-SE9444
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

348. P06E5-SE9461: Glow Plug Control Module - Root Cause Not Known

Glow Plug 7 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9461
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 7 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

349. P06BF-SE9479: Engine Glow Plug 7 - Data Erratic, Intermittent, or Incorrect

Glow Plug 7 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06BF-SE9479
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

350. P068E-SE4081: Glow Plug Heater Circuit #8 - Voltage Below Normal or Shorted to Low Source

Glow Plug 8 Circuit Voltage is Out of Range Low or Shorted to Ground Resulting in Too High of a Current.

Monitor Operation:	
DTC	P068E-SE4081
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.1 OR 0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current ≥ 41 A
OR
Current ≥ 90 A

351. P068F-SE9454: Glow Plug Heater Circuit #8 - Voltage Above Normal or Shorted to High Source

Glow Plug 8 Circuit Voltage is Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error has been detected.

Monitor Operation:	
DTC	P068F-SE9454
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
(Voltage > 0.6
* Vbatt
AND
MOSFET is Commanded Off)
OR
(Voltage < 0.6
* Vbatt
AND
MOSFET is Commanded On)

352. P0678-SE9445: Glow Plug Heater Circuit #8 - Current Below Normal or Open Circuit

Glow Plug 8 Circuit Current is Out of Range Low resulting from an Open Circuit

Monitor Operation:	
DTC	P0678-SE9445
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.6 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation

Malfunction Thresholds (all active):
Current < 1.374 A

353. P06E5-SE9462: Glow Plug Control Module - Root Cause Not Known

Glow Plug 8 circuit diagnostics have not made a decision

Monitor Operation:	
DTC	P06E5-SE9462
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostics on glow plug 8 circuit to detect the following: 1) Voltage Out of Range Low or Shorted to Ground Resulting in Too High of a Current 2) Voltage Out of Range High, Shorted to Battery, or an internal GPCM MOSFET error 3) Current Out of Range Low resulting from an Open Circuit has not completed.

354. P06C0-SE9480: Engine Glow Plug 8 - Data Erratic, Intermittent, or Incorrect

Glow Plug 8 circuit current is too low, but not low enough to be detected as an open circuit. Therefore the resistance of the glow plug has increased and is now outside of the acceptable range of resistance for a glow plug.

Monitor Operation:	
DTC	P06C0-SE9480
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.2
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Glow Plugs must be in Operation
Engine Speed < 850 RPM
Net Engine Torque < 80 Nm
Circuit Potential Change < 2.116 V/sec
Coolant Temperature > 5 °C

Malfunction Thresholds (all active):
Current > 1.374 A
&
Current < RefTable33 A

355. P064C-SE9492: Glow Plug Control Module - Bad Intelligent Device or Component

Glow Plug Control Module Stuck in After-Run Mode

Monitor Operation:	
DTC	P064C-SE9492
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module has not updated the status signal to indicate "No after-run delay requested."

356. P06E5-SE10508: Glow Plug Control Module - Root Cause Not Known

Glow Plug Control Module EEPROM diagnostic has not made a decision

Monitor Operation:	
DTC	P06E5-SE10508
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostic to detect a read/write error in the EEPROM has not made a decision.

357. P064C-SE9491: Glow Plug Control Module - Bad Intelligent Device or Component

Glow Plug Control Module EEPROM Read/Write Error

Monitor Operation:	
DTC	P064C-SE9491
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
A read/write error has been detected in the Glow Plug Control Module's EEPROM.

358. P064C-SE9488: Glow Plug Control Module - Bad Intelligent Device or Component

Glow Plug Control Module has an internal communication or charge-pump error

Monitor Operation:	
DTC	P064C-SE9488
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
Internal communication between the Glow Plug Control Module's microcontroller and ASIC has disturbed. OR A charge-pump error has been detected inside the Glow Plug Control Module's ASIC.

359. P06E5-SE9490: Glow Plug Control Module - Root Cause Not Known

Glow Plug Control Module internal communication and charge-pump diagnostic has not made a decision

Monitor Operation:	
DTC	P06E5-SE9490
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostic to detect an internal communication disturbance between microcontroller and ASIC and charge-pump errors in the ASIC has not made a decision.

360. P263E-SE9481: Glow Plug Control Module Internal Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Glow Plug Control Module Internal Temperature is Too High

Monitor Operation:	
DTC	P263E-SE9481
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
Glow Plug Control Module ASIC Temperature > 150 °C for 2 seconds
OR
Glow Plug Control Module PCB Temperature > 125 °C for 2.525 seconds

361. P06E5-SE9483: Glow Plug Control Module - Root Cause Not Known

Glow Plug Control Module overtemperature diagnostic has not made a decision

Monitor Operation:	
DTC	P06E5-SE9483
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostic to detect overtemperature on the PCB and ASIC has not made a decision.

362. P0384-SE9486: Glow Plug Control Module - Voltage Above Normal or Shorted to High Source

Glow Plug Control Module Supply Voltage is Out Of Range High

Monitor Operation:	
DTC	P0384-SE9486
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.175 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
Glow Plug Control Module Supply Voltage ≥ 16 V

363. P06E5-SE9487: Glow Plug Control Module - Root Cause Not Known

Glow Plug Control Module overvoltage diagnostic has not made a decision

Monitor Operation:	
DTC	P06E5-SE9487
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostic to detect a high voltage on its supply voltage input has not made a decision.

364. P0383-SE9484: Glow Plug Control Module - Voltage Below Normal or Shorted to Low Source

Glow Plug Control Module Supply Voltage is Out Of Range Low

Monitor Operation:	
DTC	P0383-SE9484
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2.175 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
Glow Plug Control Module Supply Voltage < 6 V

365. P06E5-SE9485: Glow Plug Control Module - Root Cause Not Known

Glow Plug Control Module undervoltage diagnostic has not made a decision

Monitor Operation:	
DTC	P06E5-SE9485
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
U0106-SE3031

Malfunction Thresholds (all active):
The Glow Plug Control Module's diagnostic to detect a low voltage on its supply voltage input has not made a decision.

366. P0217-SE2141: Engine Coolant Temperature - Condition Exists

High Coolant temperature.

Monitor Operation:	
DTC	P0217-SE2141
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Abort Conditions (any active):

Pause Conditions (any active):
Engine is not Running

Malfunction Thresholds (all active):
Coolant Temperature >= 118 Deg C

367. P1612-SE2330: Proprietary Datalink Error (OEM/Vehicle Datalink) - Abnormal Update Rate

Communication is lost between ECM and Immobilizer.

Monitor Operation:	
DTC	P1612-SE2330
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
No message is received from Immobilizer on datalink.

368. P054F-SE3782: Engine Idle Fuel Quantity - Data Valid But Above Normal Operating Range - Moderately Severe Level

Idle Fuel higher than the nominal fueling at idle.

Monitor Operation:	
DTC	P054F-SE3782
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine State is Run and not Stop/Crank/Brake/Shutdown
Idle Reference Speed ≤ 2,000 RPM
Vehicle Speed ≤ 0 mph
Fueling is controlled by a governor requesting a lower bound on Engine Speed
Current Idle Reference Speed (Target) is the same as previous Idle Reference (verifies reference speed is not changing).
RefTable34 seconds have passed since Key On.

Abort Conditions (any active):
P2121-SE1380, P2122-SE64, P2123-SE63, P2127-SE1379, P2128-SE1378
P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75
P0501-SE130, P0501-SE4361

Pause Conditions (any active):
Engine State is not Run
Idle Reference Speed > 2,000 RPM
Vehicle Speed > 0 mph
Fueling is controlled by a governor that does not request a lower bound on Engine Speed
Current Idle Reference Speed (Target Speed) is not the same as previous Idle Reference

Malfunction Thresholds (all active):
Idle Fuel > RefTable35 mg/stroke

369. P054E-SE3783: Engine Idle Fuel Quantity - Data Valid But Below Normal Operating Range - Moderately Severe Level

Idle Fuel lower than the nominal fueling at idle.

Monitor Operation:	
DTC	P054E-SE3783
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	15 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine State is Run and not Stop/Crank/Brake/Shutdown
Idle Reference Speed ≤ 2,000 RPM
Vehicle Speed ≤ 0 mph
Fueling is controlled by a governor requesting a lower bound on Engine Speed
Current Idle Reference Speed (Target) is the same as previous Idle Reference (verifies reference speed is not changing).

Abort Conditions (any active):
P2121-SE1380, P2122-SE64, P2123-SE63, P2127-SE1379, P2128-SE1378
P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75
P0501-SE130, P0501-SE4361

Pause Conditions (any active):
Engine State is not Run
Idle Reference Speed > 2,000 RPM
Vehicle Speed > 0 mph
Fueling is controlled by a governor that does not request a lower bound on Engine Speed
Current Idle Reference Speed (Target Speed) is not the same as previous Idle Reference

Malfunction Thresholds (all active):
Idle Fuel < 2 mg/stroke

370. P0507-SE3775: Engine Speed At Idle - Data Valid But Above Normal Operating Range - Moderately Severe Level

Engine Speed at Idle lies outside the acceptable boundary of nominal Idle speed and tends to run above nominal Idle speed.

Monitor Operation:	
DTC	P0507-SE3775
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine State is Run and not Stop/Crank/Brake/Shutdown
Idle Reference Speed ≤ 2,000 RPM
Vehicle Speed ≤ 0 mph
Fueling is controlled by a governor requesting a lower bound on Engine Speed
Current Idle Reference Speed (Target) is the same as previous Idle Reference (verifies reference speed is not changing).

Abort Conditions (any active):
P2121-SE1380, P2122-SE64, P2123-SE63, P2127-SE1379, P2128-SE1378
P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75
P0501-SE130, P0501-SE4361

Pause Conditions (any active):
Engine State is not Run
Idle Reference Speed > 2,000 RPM
Vehicle Speed > 0 mph
Fueling is controlled by a governor that does not request a lower bound on Engine Speed
Current Idle Reference Speed (Target Speed) is not the same as previous Idle Reference

Malfunction Thresholds (all active):
Engine Speed - Idle Reference Speed > 50 RPM, when the amount of time that engine speed is outside the idle reference speed band, by more than 50 RPM, is equal to 15 seconds.

371. P0506-SE3781: Engine Speed At Idle - Data Valid But Below Normal Operating Range - Moderately Severe Level

Engine Speed at Idle lies outside the acceptable boundary of nominal Idle speed and tends to run below nominal Idle speed.

Monitor Operation:	
DTC	P0506-SE3781
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine State is Run and not Stop/Crank/Brake/Shutdown
Idle Reference Speed ≤ 2,000 RPM
Vehicle Speed ≤ 0 mph
Fueling is controlled by a governor requesting a lower bound on Engine Speed
Current Idle Reference Speed (Target) is the same as previous Idle Reference (verifies reference speed is not changing).

Abort Conditions (any active):
P2121-SE1380, P2122-SE64, P2123-SE63, P2127-SE1379, P2128-SE1378
P0116-SE3669, P0116-SE3805, P0117-SE76, P0118-SE75
P0501-SE130, P0501-SE4361

Pause Conditions (any active):
Engine State is not Run
Idle Reference Speed > 2,000 RPM
Vehicle Speed > 0 mph
Fueling is controlled by a governor that does not request a lower bound on Engine Speed
Current Idle Reference Speed (Target Speed) is not the same as previous Idle Reference

Malfunction Thresholds (all active):
Idle Reference Speed - Engine Speed > 50 RPM, when the amount of time that engine speed is outside the idle reference speed band, by more than 50 RPM, is equal to 15 seconds.

372. P0127-SE649: Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Most Severe Level

intake Manifold Temperature above allowed engine operating range.

Monitor Operation:	
DTC	P0127-SE649
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Engine Speed ≥ 570 RPM
Intake Manifold Temperature Start Timer ≥ 10 sec

Pause Conditions (any active):
P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487
Engine Speed < 570 RPM

Malfunction Thresholds (all active):
Intake Manifold Temperature ≥ 132 °C

373. P0127-SE648: Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Least Severe Level

intake Manifold Temperature above normal engine operating range

Monitor Operation:	
DTC	P0127-SE648
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Engine Speed ≥ 570 RPM
Intake Manifold Temperature Start Timer ≥ 10 sec

Pause Conditions (any active):
P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487
Engine Speed < 570 RPM

Malfunction Thresholds (all active):
Intake Manifold Temperature ≥ 121 °C

374. P2BAC-SE5737: Engine Protection Torque Derate - Condition Exists

Active alternate Moderate Driver Inducement

Monitor Operation:	
DTC	P2BAC-SE5737
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Variable (see AECD document)
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
One or more conditions exist requiring Moderate Driver Inducement (see AECD Document section 7-1 and Appendix VI)

375. P2BAC-SE5408: Engine Protection Torque Derate - Condition Exists

Active Moderate Driver Inducement

Monitor Operation:	
DTC	P2BAC-SE5408
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Variable (see AECD document)
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
One or more conditions exist requiring Moderate Driver Inducement (see AECD Document section 7-1 and Appendix VI)

376. P020A-SE6791: Injector Solenoid Driver Cylinder 1 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 1 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P020A-SE6791
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 1 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 1 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 1 > 270 µsec for the Rail pressure set point of 1,200 bar

377. P020A-SE6799: Injector Solenoid Driver Cylinder 1 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 1 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P020A-SE6799
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 1 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 1 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 1 < 100 µsec for the Rail pressure set point of 1,200 bar

378. P268C-SE6865: Injector Solenoid Driver Cylinder 1 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P268C-SE6865
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 1.
OR
Injector number 1 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 1 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 1 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 1 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 1 unreadable due to faulty EEPROM access.

379. P0201-SE3357: Injector Solenoid Driver Cylinder 1 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 1.

Monitor Operation:	
DTC	P0201-SE3357
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 1 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 1 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 1 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 1 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 1 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 1 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

380. P0262-SE4673: Injector Solenoid Driver Cylinder 1 Circuit - Current Above Normal or Grounded Circuit

Injector number 1 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0262-SE4673
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 1 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

381. P020B-SE6792: Injector Solenoid Driver Cylinder 2 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 2 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P020B-SE6792
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 2 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 2 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 2 > 270 µsec for the Rail pressure set point of 1,200 bar

382. P020B-SE6800: Injector Solenoid Driver Cylinder 2 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 2 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P020B-SE6800
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 2 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 2 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 2 < 100 µsec for the Rail pressure set point of 1,200 bar

383. P268D-SE6866: Injector Solenoid Driver Cylinder 2 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P268D-SE6866
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 2.
OR
Injector number 2 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 2 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 2 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 2 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 2 unreadable due to faulty EEPROM access.

384. P0202-SE3358: Injector Solenoid Driver Cylinder 2 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 2.

Monitor Operation:	
DTC	P0202-SE3358
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 2 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 2 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 2 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 2 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 2 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 2 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

385. P0265-SE4674: Injector Solenoid Driver Cylinder 2 Circuit - Current Above Normal or Grounded Circuit

Injector number 2 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0265-SE4674
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 2 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

386. P020C-SE6798: Injector Solenoid Driver Cylinder 3 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 3 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P020C-SE6798
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 3 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 3 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 3 > 270 µsec for the Rail pressure set point of 1,200 bar

387. P020C-SE6806: Injector Solenoid Driver Cylinder 3 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 3 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P020C-SE6806
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 3 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 3 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 3 < 100 µsec for the Rail pressure set point of 1,200 bar

388. P268E-SE6872: Injector Solenoid Driver Cylinder 3 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P268E-SE6872
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 3.
OR
Injector number 3 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 3 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 3 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 3 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 3 unreadable due to faulty EEPROM access.

389. P0203-SE3359: Injector Solenoid Driver Cylinder 3 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 3.

Monitor Operation:	
DTC	P0203-SE3359
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 3 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 3 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 3 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 3 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 3 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 3 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

390. P0268-SE4680: Injector Solenoid Driver Cylinder 3 Circuit - Current Above Normal or Grounded Circuit

Injector number 3 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0268-SE4680
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 3 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

391. P020D-SE6795: Injector Solenoid Driver Cylinder 4 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 4 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P020D-SE6795
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 4 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 4 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 4 > 270 µsec for the Rail pressure set point of 1,200 bar

392. P020D-SE6803: Injector Solenoid Driver Cylinder 4 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 4 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P020D-SE6803
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 4 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 4 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 4 < 100 µsec for the Rail pressure set point of 1,200 bar

393. P268F-SE6869: Injector Solenoid Driver Cylinder 4 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P268F-SE6869
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 4.
OR
Injector number 4 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 4 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 4 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 4 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 4 unreadable due to faulty EEPROM access.

394. P0204-SE3360: Injector Solenoid Driver Cylinder 4 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 4.

Monitor Operation:	
DTC	P0204-SE3360
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 4 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 4 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 4 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 4 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 4 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 4 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

395. P0271-SE4677: Injector Solenoid Driver Cylinder 4 Circuit - Current Above Normal or Grounded Circuit

Injector number 4 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0271-SE4677
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 4 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

396. P020E-SE6796: Injector Solenoid Driver Cylinder 5 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 5 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P020E-SE6796
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 5 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 5 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 5 > 270 µsec for the Rail pressure set point of 1,200 bar

397. P020E-SE6804: Injector Solenoid Driver Cylinder 5 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 5 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P020E-SE6804
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 5 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 5 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 5 < 100 µsec for the Rail pressure set point of 1,200 bar

398. P2690-SE6870: Injector Solenoid Driver Cylinder 5 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P2690-SE6870
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 5.
OR
Injector number 5 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 5 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 5 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 5 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 5 unreadable due to faulty EEPROM access.

399. P0205-SE3361: Injector Solenoid Driver Cylinder 5 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 5.

Monitor Operation:	
DTC	P0205-SE3361
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 5 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 5 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 5 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 5 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 5 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 5 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

400. P0274-SE4678: Injector Solenoid Driver Cylinder 5 Circuit - Current Above Normal or Grounded Circuit

Injector number 5 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0274-SE4678
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 5 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

401. P020F-SE6797: Injector Solenoid Driver Cylinder 6 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 6 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P020F-SE6797
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 6 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 6 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 6 > 270 µsec for the Rail pressure set point of 1,200 bar

402. P020F-SE6805: Injector Solenoid Driver Cylinder 6 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 6 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P020F-SE6805
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 6 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 6 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 6 < 100 µsec for the Rail pressure set point of 1,200 bar

403. P2691-SE6871: Injector Solenoid Driver Cylinder 6 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P2691-SE6871
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 6.
OR
Injector number 6 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 6 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 6 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 6 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 6 unreadable due to faulty EEPROM access.

404. P0206-SE3362: Injector Solenoid Driver Cylinder 6 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 6.

Monitor Operation:	
DTC	P0206-SE3362
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 6 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 6 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 6 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 6 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 6 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 6 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

405. P0277-SE4679: Injector Solenoid Driver Cylinder 6 Circuit - Current Above Normal or Grounded Circuit

Injector number 6 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0277-SE4679
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 6 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

406. P021A-SE6793: Injector Solenoid Driver Cylinder 7 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 7 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P021A-SE6793
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 7 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 7 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 7 > 270 µsec for the Rail pressure set point of 1,200 bar

407. P021A-SE6801: Injector Solenoid Driver Cylinder 7 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 7 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P021A-SE6801
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 7 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 7 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 7 < 100 µsec for the Rail pressure set point of 1,200 bar

408. P2692-SE6867: Injector Solenoid Driver Cylinder 7 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P2692-SE6867
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 7.
OR
Injector number 7 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 7 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 7 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 7 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 7 unreadable due to faulty EEPROM access.

409. P0207-SE3363: Injector Solenoid Driver Cylinder 7 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 7.

Monitor Operation:	
DTC	P0207-SE3363
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 7 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 7 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 7 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 7 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 7 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

410. P0280-SE4675: Injector Solenoid Driver Cylinder 7 Circuit - Current Above Normal or Grounded Circuit

Injector number 7 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0280-SE4675
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 7 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

411. P021B-SE6794: Injector Solenoid Driver Cylinder 8 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 8 exceeds a calibratable maximum threshold.

Monitor Operation:	
DTC	P021B-SE6794
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 8 > 690 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 8 > 370 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 8 > 270 µsec for the Rail pressure set point of 1,200 bar

412. P021B-SE6802: Injector Solenoid Driver Cylinder 8 - Mechanical System Not Responding or Out of Adjustment

The corrected injector Energizing Time (ET) for at least one rail pressure point on injector number 8 falls below a calibratable minimum threshold.

Monitor Operation:	
DTC	P021B-SE6802
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	52 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature > -10 °C
15 °C ≤ Fuel temperature ≤ 90 °C
Engine Coolant temperature > 70 °C
Battery voltage > 10 V
The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
Boost pressure > 85 kPa(absolute)
Accelerator Pedal position ≤ 0 %
The OBD Arbitrator allows this diagnostic to run
Time since start of Motoring ≥ 0 msecs
The Vehicle is in an enabled gear and the Engine speed is within a calibratable range. (See RefCond0034.)
The clutch is engaged.
Vehicle speed > RefTable36
Rail pressure has stabilized: |Rail pressure set point - Rail Pressure| < RefTable37 for 0.2 sec

Abort Conditions (any active):

P0087-SE3236, P0087-SE3237, P0087-SE6787, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P009E-SE4482, P009E-SE4485, P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258, P0335-SE4372, P0335-SE6886, P0652-SE225, P0653-SE243, P0698-SE816, P0699-SE814
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882, P2146-SE6840, P2149-SE6841
Intake Air temperature ≤ -10 °C
Fuel temperature < 15 °C OR Fuel temperature > 90 °C
Engine Coolant temperature ≤ 70 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable38
Boost pressure ≤ 85 kPa(absolute)
Accelerator Pedal position > 0 %
The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range). (See RefCond0035.)
A gear change occurs in the Motoring event
The clutch is disengaged.
Vehicle speed ≤ RefTable36

Malfunction Thresholds (all active):
Corrected Energizing Time of injector number 8 < 100 µsec for the Rail pressure set point of 250 bar
OR
Corrected Energizing Time of injector number 8 < 90 µsec for the Rail pressure set point of 600 bar
OR
Corrected Energizing Time of injector number 8 < 100 µsec for the Rail pressure set point of 1,200 bar

413. P2693-SE6868: Injector Solenoid Driver Cylinder 8 - Out of Calibration

Injector Trim Codes consists of Injector Quantity Adjustment [IQA] and Injector Voltage Adjustment [IVA] values. The Trim Codes are programmed into the EEPROM of the Engine management Electronic Control Unit [ECU]. Monitoring is done to ensure the integrity of this data. Monitoring for this error is for both IQA and IVA and it is performed either at key-on or when triggered by a service tool or at cyclic update.

Monitor Operation:	
DTC	P2693-SE6868
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Incorrect checksum of injector adjustment code for Injector number 8.
OR
Injector number 8 manufacturing trim adjustment for Pilot Injection operation is outside of the range -1 mm3 to 1 mm3
OR
Injector number 8 manufacturing trim adjustment for High Load operation is outside of the range -4 mm3 to 4 mm3
OR
Injector number 8 manufacturing trim adjustment for Low Idle operation is outside of the range -1.1 mm3 to 1.1 mm3
OR
Injector number 8 manufacturing trim adjustment for Partial Load operation is outside of the range -2.1 mm3 to 2.1 mm3
OR
Injector Adjustment values for injector number 8 unreadable due to faulty EEPROM access.

414. P0208-SE3364: Injector Solenoid Driver Cylinder 8 Circuit - Current Below Normal or Open Circuit

No load due to open circuit as a result of defective cable connector or broken connection to actuator within injector number 8.

Monitor Operation:	
DTC	P0208-SE3364
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
Main injection is active with voltage and time measurements perfomed in the µ-controller within the ECM.
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for cylinder number 8 < 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 8 ≥ 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 ≤ Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
All of the following:
Actuator charging time [tiChrg] for cylinder number 8 ≥ 5 µsecs
Actuator Discharge time [tiDisch] for cylinder number 8 < 35.2 µsecs
Actuator Charge-up voltage [uChrgUp] for cylinder number 8 > Injector charge voltage set-point+80 V
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
The maximum injector current [ipiezo] ≤ 32 A

Injector buffer current during voltage discharging ≤ 9.6 A

415. P0283-SE4676: Injector Solenoid Driver Cylinder 8 Circuit - Current Above Normal or Grounded Circuit

Injector number 8 driver high side is short-circuited to the injector driver low side of another injector on the same bank.

Monitor Operation:	
DTC	P0283-SE4676
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P02EE-SE6854, P0606-SE6842, P0606-SE6844, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] >100 µsecs
Actuator charging time [tiChrg] for cylinder number 8 ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Actuator Discharge time [tiDisch] for cylinder number 8 ≥ 35.2 µsecs
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

416. P0606-SE6844: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

Communication error in the integrated circuit [IC] chip for injector bank number 1.

Monitor Operation:	
DTC	P0606-SE6844
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

417. P2146-SE6840: Engine Injector Group 1 Circuit - Current Above Normal or Grounded Circuit

Injector driver high side is short-circuted to ground within injector bank number 1, or Injector driver low side is short-circuited to ground within injector bank number 1, or Injector driver low side is short-circuited to battery within bank number 1.
OR
Injector driver high side is short-circuted to battery within bank number 1.

Monitor Operation:	
DTC	P2146-SE6840
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for the cylinder being fired ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis > 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for the cylinder being fired ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

418. P0606-SE6845: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

Communication error in the integrated circuit [IC] chip for injector bank number 2.

Monitor Operation:	
DTC	P0606-SE6845
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P2146-SE6840
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis ≤ 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

419. P2149-SE6841: Engine Injector Group 2 Circuit - Current Above Normal or Grounded Circuit

Injector driver high side is short-circuted to ground within injector bank number 2, or Injector driver low side is short-circuited to ground within injector bank number 2, or Injector driver low side is short-circuited to battery within bank number 2.
OR
Injector driver high side is short-circuted to battery within bank number 2.

Monitor Operation:	
DTC	P2149-SE6841
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0201-SE3357, P0261-SE6892, P0262-SE4673, P02EE-SE6854, P0606-SE6842, P0606-SE6844
The injector circuitry watchdog status signal is correctly formatted and present AND The injector circuitry watchdog status indicates that the injector circuitry µ-controller has not stopped working. The 500 ms detection threshold required for the watchdog to trigger injection deactivation is not attained due to the following: Read and write RAM errors are not present. OR Safety related software functions execute in the expected sequence. OR Safety related parameters match their complementary data values.

Malfunction Thresholds (all active):
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for the cylinder being fired ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis > 9.8 A
The maximum injector current [ipiezo] ≤ 32 A
Injector buffer current during voltage discharging ≤ 9.6 A
OR
Actuator charging time [tiChrg] ≤100 µsecs
Actuator charging time [tiChrg] for the cylinder being fired ≥ 5 µsecs
Differential current in the injector shunt [idiff_piezo] for current measurement and difference analysis ≤ 9.8 A
Differential current in the injector Buffer shunt [idiff_buffer] for current measurement and difference analysis > 9.8 A
Injector buffer current during voltage discharging ≤ 9.6 A

420. P0611-SE7392: Injector Power Supply - Bad Intelligent Device or Component

Diagnosis of Engine speed during injection cut-off request.

Monitor Operation:	
DTC	P0611-SE7392
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Injection cut-off request is active

Malfunction Thresholds (all active):
Engine speed in Standard Mode > 1,500 RPM
Engine speed in Comfort Mode > 1,500 RPM

421. U1612-SE6683: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Abnormal Update Rate

Determine when the J1939 proprietary EGTS-dual cold junction message is not received on the Datalink

Monitor Operation:	
DTC	U1612-SE6683
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2,510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
J1939 proprietary EGTS-dual cold junction Message not received

422. U1612-SE6685: Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Abnormal Update Rate

Determine when the J1939 proprietary EGTS Triple message is not received on the Datalink

Monitor Operation:	
DTC	U1612-SE6685
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2,510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
J1939 proprietary EGTS Triple Message not received

423. U1611-SE6686: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Abnormal Update Rate

Determine when the J1939 proprietary EGTS-triple cold junction message is not received on the Datalink

Monitor Operation:	
DTC	U1611-SE6686
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2,510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
J1939 proprietary EGTS-triple cold junction Message not received

424. U1611-SE6687: Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Abnormal Update Rate

Determine when the J1939 proprietary EGTS Triple message is not received on the Datalink

Monitor Operation:	
DTC	U1611-SE6687
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2,510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
J1939 proprietary EGTS Triple Message not received

425. U029D-SE2487: Aftertreatment 1 Intake NOx Sensor - Abnormal Update Rate

Determine when the AT1IG1 message is not received on the Datalink

Monitor Operation:	
DTC	U029D-SE2487
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2,010 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
Message not received

426. U029E-SE2488: Aftertreatment 1 Outlet NOx Sensor - Abnormal Update Rate

Determine when the AT1OG1 message is not received on the Datalink

Monitor Operation:	
DTC	U029E-SE2488
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2,010 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
Message not received

427. U0106-SE3031: Glow Plug Control Module - Abnormal Update Rate

The Engine Control Module did not receive Status message from Glow Plug Control Module on the datalink.

Monitor Operation:	
DTC	U0106-SE3031
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	510 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
NOTDatalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Malfunction Thresholds (all active):
Message not received from Glow Plug Control Module.

428. U0307-SE3030: Glow Plug Control Module - Out of Calibration

Determine if Software ID from Glow Plug Control Module matches the expected Software ID.

Monitor Operation:	
DTC	U0307-SE3030
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 msec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
NOTDatalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Malfunction Thresholds (all active):
Software ID from Glow Plug Control Module does not match Software ID stored in calibration parameter.

429. U0407-SE10384: Glow Plug Control Module - Data Erratic, Intermittent, or Incorrect

Determine if Status and Status 2 message data from Glow Plug Control Module is within limits.

Monitor Operation:	
DTC	U0407-SE10384
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
NOTDatalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Malfunction Thresholds (all active):
Status and Status 2 message data from Glow Plug Control Module is not within limits

430. U010C-SE8277: Engine Turbocharger Turbine Bypass Actuator - Abnormal Update Rate

Determine when the TBV (Turbo Bypass Valve) Status signal is not received over the datalink.

Monitor Operation:	
DTC	U010C-SE8277
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1,010 msec.
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
NOT [Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)].

Malfunction Thresholds (all active):
TBV Status ID Message not received

431. P20FF-SE2327: Aftertreatment Diesel Exhaust Fluid Controller - Bad Intelligent Device or Component

Determine if the correct Software ID has been received from the SCR smart device.

Monitor Operation:	
DTC	P20FF-SE2327
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 mSec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Software ID message has been received.

Abort Conditions (any active):
Whenever any enable condition is not met.

Malfunction Thresholds (all active):
Incorrect Software ID received

432. U010E-SE2290: Aftertreatment Diesel Exhaust Fluid Controller - Abnormal Update Rate

The ECM monitors SCR communications over the datalink and sets an error when they are not received.

Monitor Operation:	
DTC	U010E-SE2290
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30.010 sec to detect missing software ID message. 0.260 sec to detect missing status message.
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable condition is not met.

Malfunction Thresholds (all active):
Message not received

433. U02A2-SE6447: Aftertreatment Diesel Exhaust Fluid Quality - Abnormal Update Rate

Determine when the J1939 DEF quality message is not received on the Datalink

Monitor Operation:	
DTC	U02A2-SE6447
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5,010 msec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics. (See RefCond0036.)

Abort Conditions (any active):
Whenever any enable conditions is not met.

Malfunction Thresholds (all active):
Message not received

434. P0629-SE3950: Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Above Normal or Shorted to High Source

When the lift pump is "OFF", an open circuit or short circuit of the lift pump relay driver output to ground is detected if the measured voltage across the gates of the MOSFET of the driver ASIC is below a fixed threshold defined by the hardware.

Monitor Operation:	
DTC	P0629-SE3950
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
The Key-switch is ON.
The Lift Pump is turned OFF.

Pause Conditions (any active):
The Lift Pump is turned ON.

Malfunction Thresholds (all active):
Fuel Lift Pump driver voltage < 5 V

435. P0628-SE3951: Electric Lift Pump for Engine Fuel Supply Circuit - Voltage Below Normal or Shorted to Low Source

When the lift pump is "ON", a short circuit of the lift pump relay driver output to battery is detected if the measured current flowing through the gates of the MOSFET of the driver ASIC exceeds a fixed threshold defined by the hardware.

Monitor Operation:	
DTC	P0628-SE3951
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	4 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
The Key-switch is ON.
The Lift Pump is turned ON.

Pause Conditions (any active):
The Lift Pump is turned OFF.

Malfunction Thresholds (all active):
Fuel Lift Pump driver current > 4A

436. P0101-SE10395: Engine Intake Air Mass Flow - Data Erratic, Intermittent, or Incorrect

Mass Air Flow Correction is lower than calibrated limit for a calibrated amount of time

Monitor Operation:	
DTC	P0101-SE10395
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206

Malfunction Thresholds (all active):
Mass Air Flow Adjustment Minimum Factor ≤ 0.8

437. P0101-SE10396: Engine Intake Air Mass Flow - Data Erratic, Intermittent, or Incorrect

Mass Air Flow Correction is higher than calibrated limit for a calibrated amount of time

Monitor Operation:	
DTC	P0101-SE10396
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206

Malfunction Thresholds (all active):
Mass Air Flow Adjustment Maximum Factor ≥ 1.2

438. P0103-SE3206: Engine Intake Air Mass Flow Sensor Circuit - Voltage Above Normal or Shorted to High Source

Mass Air Flow sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0103-SE3206
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Mass Air Flow sensor value > 15,100 Hz (< 0 kg/min)

439. P0102-SE3207: Engine Intake Air Mass Flow Circuit - Voltage Below Normal or Shorted to Low Source

Mass Air Flow sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0102-SE3207
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Mass Air Flow sensor value < 1,000 Hz (> 29.72 kg/min)

440. P0299-SE7294: Engine Charge Air Cooler Outlet Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Charge Flow lower than normal

Monitor Operation:	
DTC	P0299-SE7294
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in run state.
Ambient Air Temperature > -6.67 °C
Compressor Inlet Density > 0.5 kg/m3
Time which all Enable Conditions have been true ≥ 2 sec

Pause Conditions (any active):
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P012B-SE8698, P012B-SE8699, P012B-SE8802, P012C-SE8366, P012D-SE8365, P0237-SE2976, P0238-SE2977, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
The EGR H-bridge valve position is not known to be good. (See RefCond0029.)
Charge Flow Command < 2 kg/min
Charge Flow Command > 9 kg/min
EGR Valve Effective Flow Area < 0.25 cm2
EGR Valve Effective Flow Area > 2 cm2
EGR Off Engine Protection is active
Filtered (tau = 0.011 sec) Charge Temperature ≤ 15 °C
Filtered (tau = 0.011 sec) EGR Orifice Temperature ≤ 15 °C
EGR Delta P sensor autozero check is not complete
Engine Speed < 800 RPM
Engine Speed > 1,800 RPM

Total Fueling < 5 mg/stroke
Total Fueling > 75 mg/stroke
EGR Actuator Effective Flow Area is greater than 0 cm2 and EBV Actuator Effective Flow Area is greater than 0 cm2

Malfunction Thresholds (all active):
Cumulative sum of error (Estimated Flow - Measured Flow) over 200 second period is ever > 1,720 kg/min, which is equivalent to [Average of Error - Tolerance] >= 0.86 kg/min, where Tolerance is defined as: 0 kg/min

441. P0087-SE6789: Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Fuel Rail Pressure falls below a calibratable minimum threshold [based on engine speed] while running in the Volume Control Mode.

Monitor Operation:	
DTC	P0087-SE6789
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is only by Volume Control Valve in closed loop.
Service procedure for high pressure test should not be running.
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
Fuel Rail Pressure < RefTable39 bar

442. P0300-SE7400: Engine Misfire for Multiple Cylinders - Condition Exists

A cylinder misfire event is recorded when the angular acceleration of the crankshaft is less than a minimum threshold within a calibratable number of engine revolutions. The Multiple Cylinder misfire error is set when excessive misfires were detected on at least two cylinders.

Monitor Operation:	
DTC	P0300-SE7400
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	484 rev
MIL Activation Criteria	2 trips

Entry Conditions (all active):
450 rpm ≤ Engine Speed ≤ 1,500 rpm
(Low Idle Speed Governor Set Point -450 rpm) ≤ Engine Speed ≤ (Low Idle Speed Governor Set Point + 450 rpm)
4 mg/stroke ≤ Injection Quantity ≤ 29 mg/stroke
Engine Coolant Temperature ≥ 30 °C
Vehicle Speed ≤ 1.864 mph
The engine is running.
Time since engine attained Normal Running Mode ≥ 5 sec

Malfunction Thresholds (all active):
At least 120 misfires on each of at least two cylinders were detected during 440 crankshaft revs
The Angular Acceleration of the crankshaft after the injection of each of at least two cylinders is below a minimum threshold that is dynamically calculated from current injection quantity and engine speed.

443. P2BAD-SE5369: Aftertreatment 1 Intake NOx Sensor - Root Cause Not Known

Engine Out NOx sensor reading is stuck in range

Monitor Operation:	
DTC	P2BAD-SE5369
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	40 seconds
MIL Activation Criteria	2 trips

Entry Conditions (all active):
| Estimated Engine Out NOx Concentration - filtered (tau = 13.133 sec) estimated Engine Out NOx Concentration | > 200 ppm.

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time. (See RefCond0037.)
| Estimated Engine Out NOx Concentration - filtered (tau = 13.133 sec) estimated Engine Out NOx Concentration | < 100 ppm. Where: to exit this Pause Condition the | Estimated Engine Out NOx Concentration - filtered (tau = 13.133 sec) estimated Engine Out NOx Concentration | > 200 ppm
| Engine speed - filtered (tau = 3.8 sec) Engine Speed | < 200 RPM
Engine is not in run state

Malfunction Thresholds (all active):
Change of Engine Out NOx Sensor value over the monitoring period < 200 ppm

444. P1C55-SE5368: Aftertreatment 1 Intake NOx Sensor - Data Erratic, Intermittent, or Incorrect

Engine out NOx sensor reading is in range high during non motoring conditions

Monitor Operation:	
DTC	P1C55-SE5368
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
Engine is in Protection state
Compressor Inlet Density ≤ 0.85 kg/m3
Compressor Inlet Density ≥ 1.5 kg/m3
Ambient Air Temperature ≤ -6.7 °C
Engine Speed ≥ 2,800 RPM
Engine Speed ≤ 900 RPM
Net Engine Torque > RefTable40
Net Engine Torque < RefTable41
Engine doesn't run in Alpha 1 control mode
EGR Fraction ≤ 0.01 (ratio)
EGR Fraction ≥ 0.8 (ratio)
Fueling change rate > 50 mg/stroke/sec
Duration for which the pause conditions are FALSE < 10 sec
Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage

is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time. (See RefCond0037.)

Malfunction Thresholds (all active):

Cumulative sum of the ratio of (Measured Value - Estimated Value) to a Threshold in 300 seconds is ever >= 3,000 ppm ratio, which is equivalent to [Average of ratio - Tolerance] >= 2 ppm ratio. Where, Tolerance is defined as: 0 ppm, Threshold is defined as: max (1ppm, 1 scalar * Estimated Value).

445. P2201-SE5365: Aftertreatment 1 Intake NOx Sensor - Data Not Rational - Drifted High

Engine out NOx sensor reading is in range high during motoring condition

Monitor Operation:	
DTC	P2201-SE5365
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Duration for having permission by OBD arbitrator < 6.8 sec
Fueling > 0.1 mg/stroke
Engine Speed < 600 RPM
Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time. (See RefCond0037.)

Malfunction Thresholds (all active):
Cumulative sum of error (Measured Value - 0 ppm) in 6 seconds is ever >= 2,950 ppm, which is equivalent to [Average of Error - Tolerance] >= 98.333 ppm. where, Tolerance is defined as: 0 ppm.

446. P2201-SE5366: Aftertreatment 1 Intake NOx Sensor - Data Not Rational - Drifted High

Engine out NOx sensor reading is in range low during motoring condition

Monitor Operation:	
DTC	P2201-SE5366
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Fueling > 0.1 mg/stroke
Engine Speed < 600 RPM
Duration for having permission by OBD arbitrator < 6.8 sec
Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time. (See RefCond0037.)

Malfunction Thresholds (all active):
Cumulative sum of error (0 ppm - Measured Value) in 6 seconds is ever > 1,200 ppm, which is equivalent to [Average of Error - Tolerance] >= 40 ppm. Where, Tolerance is defined as: 0 ppm.

447. U059E-SE5569: Aftertreatment 1 Intake NOx Sensor - Abnormal Rate of Change

Engine out NOx sensor signal is not valid for a persistent period of time.

Monitor Operation:	
DTC	U059E-SE5569
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	150 sec
MIL Activation Criteria	2 trips

Abort Conditions (any active):
U029D-SE2487
P2202-SE5151
P2202-SE5153
P220A-SE5152
NOx Sensor internal operating temperature < 800 degC
Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 150 seconds

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849
%O2 reading of Exhaust Air (See RefCond0022.)
The rate of change of estimated engine out O2 ≥ 7 %/s
The rate of change of estimated exhaust pressure ≥ 5 kPa(absolute)/s

Malfunction Thresholds (all active):
NOx sensor reading is not valid due to internal control loops within the sensor being unstable.. (See RefCond0038.)

448. P2201-SE5384: Aftertreatment 1 Intake NOx - Out of Calibration

The rated NOx sensor voltage is compared to the system supply voltage. Checking for appropriate part for the appropriate system

Monitor Operation:	
DTC	P2201-SE5384
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Pause Conditions (any active):
NOx sensor voltage parameter is not avaliable

Malfunction Thresholds (all active):
Rated NOx Sensor voltage does not match nominal system voltage

449. P229E-SE5990: Aftertreatment 1 Outlet NOx Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The NOx sensor circuitry has detected a failure affecting the aftertreatment outlet NOx sensor heater circuit.

Monitor Operation:	
DTC	P229E-SE5990
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Processing of fail messages from the sensor enabled 160 seconds after Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)

Abort Conditions (any active):
U029E-SE2488

Pause Conditions (any active):
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)

Malfunction Thresholds (all active):
[Open H-] The resistance between the sensors heater connection to Ground and a 3rd heater electrode > 1,000,000 ohms for 10 seconds.
or
[Open H+] The resistance between the sensors heater supply and a 3rd heater electrode > 1,000,000 ohms for 10 seconds.
or
[H-/Tmp] The voltage between the 3rd electrode within the sensors internal heater and ground < 0.5 V for 10 seconds.
or
[M2/Tmp] The resistance between the sensors measuring electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[P-/Tmp] The resistance between the sensors pumping electrode in the 1st pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or

[M1/Tmp] The resistance between the sensors pumping electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Ref/Tmp] (The resistance between the sensors air reference electrode and the sensors 3rd electrode within its internal heater is < 0.5 ohms AND the voltage between reference line and ground < 1 V) for 40 seconds.
or
[H+/H-] The resistance between the sensors internal heater supply voltage line and sensor ground is < 0.5 ohms for 10 seconds.
or
[Vbatt/P-] The resistance between supply voltage and the sensors pumping electrode in the 1st pumping chamber is < 0.5 ohms for 10 seconds.
or
[Vbatt/P+] The resistance between supply voltage and the sensors top electrode (directly exposed to exhaust gas) is < 0.5 ohms for 10 seconds.
or
[Vbatt/M1] The resistance between supply voltage and the sensors pumping electrode in the 2nd pumping chamber is < 0.5 ohms for 10 seconds.
or
[H+/Tmp] The voltage between the 3rd electrode within the internal heater and ground < 2.19 V AND the sensors internal heater resistance < 20.97 Ohms for 40 seconds.
or
[Vbatt/M2] The resistance between supply voltage and the sensors measuring electrode in 2nd chamber is < 0.5 ohms for 10 seconds.
or
[P+/Tmp] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Vbatt/Ref] The resistance between supply voltage and the sensors air reference electrode is < 0.5 ohms for 10 seconds.
or
[Vbatt/H+] The resistance between supply voltage and the sensors heater supply is < 0.5 ohms for 10 seconds.
or
[Open Tmp] The resistance between the sensors 3rd electrode within its internal heater is > 1,000,000 ohms for 10 seconds.
or
[M1/M2] 5 mV < the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode < 500 mV AND the voltage between the pumping electrode in the 2nd chamber and the air reference electrode = the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode for 40 seconds.
or
[Vbatt/Tmp] The voltage at the 3rd electrode within the sensors internal heater > 8 V for 10 seconds.
or
[Open M2] The resistance between the sensors measuring electrode in the 2nd chamber and ground > 0 ohms for 10 seconds.

450. P22A7-SE5051: Aftertreatment 1 Outlet NOx Sensor Heater - Abnormal Rate of Change

Aftertreatment outlet NOx sensor heater malfunction.

Monitor Operation:	
DTC	P22A7-SE5051
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
Exhaust gas velocity < 60 m/sec
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)
SCR outlet temperature < 800 °C
Nox sensor battery supply voltage is within the desired range of [10.8, 16.5] V for more than 0.2 seconds.
Key switch is turned ON
NOx Sensor status is not equal to data not available and NOx Sensor status is not equal to no value.

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
Exhaust gas velocity ≥ 60 m/sec
SCR outlet temperature ≥ 800 °C
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)
Nox sensor battery supply voltage is outside the desired range of [10.8, 16.5] V.
Key switch is turned OFF
NOx Sensor status is data not available or NOx Sensor status has no value.

Malfunction Thresholds (all active):
Time for NOx sensor heater to reach working temperature of 800 Deg C after enable conditions are satisfied ≥ 120 sec

451. P229F-SE5976: Aftertreatment 1 Outlet NOx Sensor - Data Not Rational - Drifted High

Aftertreatment outlet NOx sensor in-range but reading inappropriately high.

Monitor Operation:	
DTC	P229F-SE5976
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
P229F-SE5986
P22A7-SE5982
U059F-SE5989
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
Engine total fueling ≤ 0.01 mg/stroke
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.)
Engine is operating in base mode.
Exhaust Flow ≥ 10 g/sec
Commanded DEF injection rate < 0.01 ml/sec
The OBD arbitrator allows the Tail Pipe NOx Sensor gain diagnostics to run.
None of the Abort Conditions are satisfied
The OBD Arbitrator allows the diagnostic to run.

NOT [When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.)]
All the other enable conditions has to be true for 6 seconds.

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
P229F-SE5986
P22A7-SE5982
U059F-SE5989
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.)

Pause Conditions (any active):
Estimated SCR catalyst bed temperature rate of change is > RefTable42. Pause condition is exited if the estimated SCR catalyst bed temperature has decreased by at least 20 Deg C from its maximum temperature value for a minimum cumulative time of 30seconds. OR Pause condition is exited if the estimated SCR catalyst bed temperature rate of change is < RefTable43 for a minimum cumulative time of 300seconds.

Malfunction Thresholds (all active):
The EWMA filtered value of average NOx sensor offset measurement at the decision point > 100ppm

452. P229F-SE5978: Aftertreatment 1 Outlet NOx Sensor - Data Not Rational - Drifted High

Aftertreatment outlet NOx sensor in-range but reading inappropriately low.

Monitor Operation:	
DTC	P229F-SE5978
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
P229F-SE5986
P22A7-SE5982
U059F-SE5989
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
Engine total fueling ≤ 0.01 mg/stroke
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.)
Engine is operating in base mode.
Exhaust Flow ≥ 10 g/sec
Commanded DEF injection rate < 0.01 ml/sec
The OBD Arbitrator allows the Tail Pipe NOx Sensor gain diagnostics to run.
The OBD Arbitrator allows the diagnostic to run.

NOT [When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.)]
All the other enable conditions has to be true for 6 seconds.

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
P229F-SE5986
P22A7-SE5982
U059F-SE5989
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.)

Pause Conditions (any active):
Estimated SCR catalyst bed temperature rate of change is > RefTable44. Pause condition is exited if the estimated SCR catalyst bed temperature has decreased by at least 20 Deg C from its maximum temperature value for a minimum cumulative time of 30seconds. OR Pause condition is exited if the estimated SCR catalyst bed temperature rate of change is < RefTable46 for a minimum cumulative time of 300seconds.

Malfunction Thresholds (all active):
The EWMA filtered value of average NOx sensor offset measurement at the decision point < -40ppm

453. P229E-SE11104: Aftertreatment 1 Outlet NOx Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The NOx sensor circuitry has detected a failure within the aftertreatment outlet NOx sensor's internal O2 circuitry that causes the O2 value to be suspect.

Monitor Operation:	
DTC	P229E-SE11104
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Processing of fail messages from the sensor enabled 160 seconds after dewpoint reached. Dewpoint is defined as: Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)

Abort Conditions (any active):
U029E-SE2488

Pause Conditions (any active):
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)

Malfunction Thresholds (all active):
[Open P+] The resistance between the electrode on the top of the sensor (directly exposed to exhaust gas) and ground > 1,000,000 ohms for 10 seconds.
or
[Open Ref] The resistance between the sensors air reference electrode and ground > 1,000,000 ohms for 10 seconds.
or
[Open M1] The resistance between the sensors pumping electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Open P-] The resistance between the sensors pumping electrode in 1st pumping chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Ref/M2] (The resistance between the sensors air reference electrode and the sensors measuring electrode in the 2nd chamber is < 0.5 ohms AND the voltage between the pumping electrode in the 2nd chamber and reference is within 20mV of a 420mV setpoint AND the voltage between the measuring electrode in the 2nd chamber and the reference < 15mV) for 40 seconds.

or
[P-/M2] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the measuring electrode in the 2nd chamber and reference) for 40 seconds.
or
[P+/M2] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the measuring electrode within the 2nd chamber is < 0.5 ohms AND the voltage between the measuring electrode in the 2nd chamber and reference < 120 mV) for 40 seconds.
or
[P-/M1] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the pumping electrode in the 2nd chamber and reference) for 40 seconds.
or
[Open M2] The resistance between the sensors measuring electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[H-/Tmp] The voltage between the 3rd electrode within the sensors internal heater and ground < 0.5 V for 10 seconds.
or
[H+/Tmp] (the voltage between the 3rd electrode within the internal heater and ground < 2.19 V AND the sensors internal heater resistance < 20.97 Ohms) for 40 seconds.
or
[Ref/H+] The resistance between the air reference electrode and the sensors internal heater supply < 0.5 ohms for 10 seconds.
or
[Vbatt/Tmp] The voltage at the 3rd electrode within the sensors internal heater > 8 V for 10 seconds.
or
[Ref/H-] The resistance between the air reference electrode and ground < 0.5 ohms for 10 seconds.
or
[Ref/M1] The resistance between the sensors air reference electrode and the sensors pumping electrode in the 2nd chamber is < 0.5 ohms for 10 seconds.
or
[M1/H+] (The resistance between the pumping electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms AND the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[P+/P-] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 1st chamber is < 0.5 ohms AND | the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) for 40 seconds.
or
[Ref/Tmp] (The resistance between the sensors air reference electrode and the sensors 3rd electrode within its internal heater is < 0.5 ohms AND the voltage between reference line and ground < 1 V) for 40 seconds.

or
[P-/H+] The resistance between the pumping electrode in the 1st chamber and the sensors internal heater supply is < 0.5 ohms for 10 seconds.
or
[M1/H-] The resistance between the pumping electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P+/Tmp] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[M2/H-] The resistance between the measuring electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P-/H-] The resistance between the pumping electrode in the 1st chamber and ground is < 0.5 ohms for 10 seconds.
or
[M2/H+] The resistance between the measuring electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms for 10 seconds.
or
[H+/H-] The resistance between the sensors internal heater supply voltage line and sensor ground is < 0.5 ohms for 10 seconds.
or
[M2/Tmp] The resistance between the sensors measuring electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Vbatt/M1] The resistance between supply voltage and the sensors pumping electrode in the 2nd pumping chamber is < 0.5 ohms for 10 seconds.
or
[P+/M1] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 2nd chamber is < 0.5 ohms AND the binary voltage between the sensors top electrode and reference < 200 mV AND ((| the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) OR (binary voltage between the sensors top electrode and reference = the voltage between the pumping electrode in the 2nd chamber and reference)) for 40 seconds.
or
[Vbatt/Ref] The resistance between supply voltage and the sensors air reference electrode is < 0.5 ohms for 10 seconds.
or
[Vbatt/M2] The resistance between supply voltage and the sensors measuring electrode in 2nd chamber is < 0.5 ohms for 10 seconds.
or
[P-/Tmp] The resistance between the sensors pumping electrode in the 1st pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[M1/Tmp] The resistance between the sensors pumping electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.

or
[P+/H-] The resistance between the electrode in on the top of the sensor (exposed to the exhaust gas) and ground is < 0.5 ohms for 10 seconds.
or
[Ref/P-] (The resistance between the air reference electrode and pumping electrode in the 1st chamber < 0.5 ohms AND the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[Vbatt/P-] The resistance between supply voltage and the sensors pumping electrode in the 1st pumping chamber is < 0.5 ohms for 10 seconds.
or
[Vbatt/P+] The resistance between supply voltage and the sensors top electrode (directly exposed to exhaust gas) is < 0.5 ohms for 10 seconds.
or
[Vbatt/H+] The resistance between supply voltage and the sensors heater supply is < 0.5 ohms for 10 seconds.
or
[M1/M2] (5 mV < the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode < 500 mV AND the voltage between the pumping electrode in the 2nd chamber and the air reference electrode = the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode) for 40 seconds.

454. U059F-SE5989: Aftertreatment 1 Outlet NOx Sensor - Abnormal Rate of Change

Aftertreatment outlet NOx sensor status is not valid for a persistent period of time.

Monitor Operation:	
DTC	U059F-SE5989
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P220B-SE5988, P229E-SE5987, P229E-SE5990, U029E-SE2488
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
%O2 reading of Exhaust Air (See RefCond0022.)
Engine total fueling > 5 mg/stroke AND Rate of active/intrusive injection of HC's in exhaust < 0.2 g/sec for 30 seconds.
Internal NOx sensor temperature > 800 °C
The changing range of exhaust O2 concentration within a 12 second moving window <= 9.96 %
The changing range of exhaust O2 concentration within a 6 second moving window <= 5.43 %
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.) AND sensor supply power >= 6 V for 150 seconds

Abort Conditions (any active):
P220B-SE5988, P229E-SE5987, P229E-SE5990, U029E-SE2488
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Sensor operating temperature < 800 degC
The changing range of exhaust O2 concentration within a 12 second moving window > 9.96 %
The changing range of exhaust O2 concentration within a 6 second moving window > 5.43 %
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.) OR sensor supply power < 6 V
NOT [%O2 reading of Exhaust Air (See RefCond0022.)]

Pause Conditions (any active):
Engine total fueling ≤ 5 mg/stroke

Rate of active/intrusive injection of HC's in exhaust ≥ 0.2 g/sec

Malfunction Thresholds (all active):
Percent of time > 50 % when NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.) is invalid

455. P220B-SE5988: Aftertreatment 1 Outlet NOx Sensor Power Supply - Data Erratic, Intermittent, or Incorrect

The aftertreatment outlet NOx sensor circuitry has detected that its battery supply voltage is outside the desired range.

Monitor Operation:	
DTC	P220B-SE5988
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Processing of fail messages from the sensor enabled 160 seconds after dewpoint reached. Dewpoint is defined as: Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)

Abort Conditions (any active):
U029E-SE2488

Pause Conditions (any active):
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)

Malfunction Thresholds (all active):
NOx sensor supply voltage > 16.5 V for 10 seconds.
OR
NOx sensor supply voltage < 10.8 V for 10 seconds.

456. P220B-SE6021: Aftertreatment 1 Outlet NOx Sensor Power Supply - Data Erratic, Intermittent, or Incorrect

The system out NOx sensor circuitry has detected an intermittent power supply voltage drop that results in a reset internal to the system out NOx sensor.

Monitor Operation:	
DTC	P220B-SE6021
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.) for less than 5 seconds

Abort Conditions (any active):
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)

Malfunction Thresholds (all active):
The number of filtered sensor reset events (sensor supply power < 6 V) is greater than 12 counts, within a diagnostic time window (300 sec). Sensor reset events are "filtered" by ignoring consecutive reset events occuring within (20 sec).

457. P229E-SE5987: Aftertreatment 1 Outlet NOx Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The NOx sensor circuitry has detected a failure within the aftertreatment outlet NOx sensor's internal circuitry that causes the sensed NOx value to be suspect.

Monitor Operation:	
DTC	P229E-SE5987
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 seconds
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Processing of fail messages from the sensor enabled 160 seconds after dewpoint reached. Dewpoint is defined as: Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)

Abort Conditions (any active):
U029E-SE2488

Pause Conditions (any active):
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)

Malfunction Thresholds (all active):
[Open P+] The resistance between the electrode on the top of the sensor (directly exposed to exhaust gas) and ground > 1,000,000 ohms for 10 seconds.
or
[Open Ref] The resistance between the sensors air reference electrode and ground > 1,000,000 ohms for 10 seconds.
or
[Open M1] The resistance between the sensors pumping electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Open P-] The resistance between the sensors pumping electrode in 1st pumping chamber and ground > 1,000,000 ohms for 10 seconds.
or
[Ref/M2] (The resistance between the sensors air reference electrode and the sensors measuring electrode in the 2nd chamber is < 0.5 ohms AND the voltage between the pumping electrode in the 2nd chamber and reference is within 20mV of a 420mV setpoint AND the voltage between the measuring electrode in the 2nd chamber and the reference < 15mV) for 40 seconds.

or
[P-/M2] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the measuring electrode in the 2nd chamber and reference) for 40 seconds.
or
[P+/M2] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the measuring electrode within the 2nd chamber is < 0.5 ohms AND the voltage between the measuring electrode in the 2nd chamber and reference < 120 mV) for 40 seconds.
or
[P-/M1] (The binary voltage between the electrode on the top of the sensor (exposed to the exhaust gas) and the air reference electrode > 900 mV AND the voltage across the electrode in the 1st chamber and reference = the voltage across the pumping electrode in the 2nd chamber and reference) for 40 seconds.
or
[Open M2] The resistance between the sensors measuring electrode in the 2nd chamber and ground > 1,000,000 ohms for 10 seconds.
or
[H-/Tmp] The voltage between the 3rd electrode within the sensors internal heater and ground < 0.5 V for 10 seconds.
or
[H+/Tmp] (the voltage between the 3rd electrode within the internal heater and ground < 2.19 V AND the sensors internal heater resistance < 20.97 Ohms) for 40 seconds.
or
[Ref/H+] The resistance between the air reference electrode and the sensors internal heater supply < 0.5 ohms for 10 seconds.
or
[Vbatt/Tmp] The voltage at the 3rd electrode within the sensors internal heater > 8 V for 10 seconds.
or
[Ref/H-] The resistance between the air reference electrode and ground < 0.5 ohms for 10 seconds.
or
[Ref/M1] The resistance between the sensors air reference electrode and the sensors pumping electrode in the 2nd chamber is < 0.5 ohms for 10 seconds.
or
[M1/H+] (The resistance between the pumping electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms AND the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[P+/P-] (The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 1st chamber is < 0.5 ohms AND | the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) for 40 seconds.
or
[Ref/Tmp] (The resistance between the sensors air reference electrode and the sensors 3rd electrode within its internal heater is < 0.5 ohms AND the voltage between reference line and ground < 1 V) for 40 seconds.

or
[P-/H+] The resistance between the pumping electrode in the 1st chamber and the sensors internal heater supply is < 0.5 ohms for 10 seconds.
or
[M1/H-] The resistance between the pumping electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P+/Tmp] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[M2/H-] The resistance between the measuring electrode in the 2nd chamber and ground < 0.5 ohms for 10 seconds.
or
[P-/H-] The resistance between the pumping electrode in the 1st chamber and ground is < 0.5 ohms for 10 seconds.
or
[M2/H+] The resistance between the measuring electrode in the 2nd chamber and the supply voltage to the sensors internal heater < 0.5 ohms for 10 seconds.
or
[H+/H-] The resistance between the sensors internal heater supply voltage line and sensor ground is < 0.5 ohms for 10 seconds.
or
[M2/Tmp] The resistance between the sensors measuring electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[Vbatt/M1] The resistance between supply voltage and the sensors pumping electrode in the 2nd pumping chamber is < 0.5 ohms for 10 seconds.
or
[P+/M1] The resistance between the sensors top electrode (directly exposed to exhaust gas) and the pumping electrode within the 2nd chamber is < 0.5 ohms AND the binary voltage between the sensors top electrode and reference < 200 mV AND ((| the current entering the pumping electrode in the 2nd chamber | > -19.5 uA AND the voltage between the pumping electrode in the 2nd chamber and the reference < 100 mV) OR (binary voltage between the sensors top electrode and reference = the voltage between the pumping electrode in the 2nd chamber and reference)) for 40 seconds.
or
[Vbatt/Ref] The resistance between supply voltage and the sensors air reference electrode is < 0.5 ohms for 10 seconds.
or
[Vbatt/M2] The resistance between supply voltage and the sensors measuring electrode in 2nd chamber is < 0.5 ohms for 10 seconds.
or
[P-/Tmp] The resistance between the sensors pumping electrode in the 1st pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.
or
[M1/Tmp] The resistance between the sensors pumping electrode in the 2nd pumping chamber and the 3rd electrode within the sensors internal heater is < 0.5 ohms for 10 seconds.

or
[P+/H-] The resistance between the electrode in on the top of the sensor (exposed to the exhaust gas) and ground is < 0.5 ohms for 10 seconds.
or
[Ref/P-] (The resistance between the air reference electrode and pumping electrode in the 1st chamber < 0.5 ohms AND the voltage between the electrode in the 1st chamber and the air reference electrode < 25.6 mV) for 40 seconds.
or
[Vbatt/P-] The resistance between supply voltage and the sensors pumping electrode in the 1st pumping chamber is < 0.5 ohms for 10 seconds.
or
[Vbatt/P+] The resistance between supply voltage and the sensors top electrode (directly exposed to exhaust gas) is < 0.5 ohms for 10 seconds.
or
[Vbatt/H+] The resistance between supply voltage and the sensors heater supply is < 0.5 ohms for 10 seconds.
or
[M1/M2] (5 mV < the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode < 500 mV AND the voltage between the pumping electrode in the 2nd chamber and the air reference electrode = the voltage between the measuring electrode in the 2nd chamber with respect to the air reference electrode) for 40 seconds.

458. P2BAF-SE11496: Aftertreatment 1 Outlet NOx Sensor - Root Cause Not Known

The Diagnostics will detect when the SONOx Sensor is removed from the exhaust pipe.

Monitor Operation:	
DTC	P2BAF-SE11496
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine total fueling ≥ 18 mg/stroke
Exhaust flow > 35 g/sec
Virtual SCR Inlet O2% < 17 %

Abort Conditions (any active):
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
U059F-SE5989
P22A7-SE5982
Ambient air pressure < 75 kPa(absolute)
Ambient air temperature < -6.7 °C
Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met. (See RefCond0044.)

Malfunction Thresholds (all active):
The fail sample percentage is above 30 %. Where the fail sample percentage is calculated as: The number of fail samples that the SCR Outlet O2 is above 18 % / The total number of the samples (600 counts) * 100%
AND
The Min/Max Delta of the sampled SCR Outlet O2% during the sampling period is below 3 %. The sampling period starts when the diagnostic was enabled for 15 sec, and ends when the number of samples reached 600 counts.

459. P229F-SE5986: Aftertreatment 1 Outlet NOx Sensor - Out of Calibration

The rated NOx sensor voltage is compared to the nominal system voltage.

Monitor Operation:	
DTC	P229F-SE5986
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	1 trip

Pause Conditions (any active):
Aftertreatment outlet NOx Sensor Voltage status is not valid

Malfunction Thresholds (all active):
Rated NOx Sensor voltage does not match nominal system voltage

460. P1C56-SE7613: Aftertreatment 1 Outlet NOx Sensor - Data Erratic, Intermittent, or Incorrect

The system has detected that the aftertreatment outlet NOx sensor output is in-range, but not varying as expected (i.e. stuck-in-range)

Monitor Operation:	
DTC	P1C56-SE7613
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
P229F-SE5986
P22A7-SE5982
U059F-SE5989
SCR-inlet NOx flow rate > 0.1 g/sec
Rate of change of SCR-inlet NOx flow rate > 0.01 g/sec/sec
Exhaust mass flow rate > 120 g/sec
Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)
NOT[Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage

is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time. (See RefCond0037.)]
NOT [When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.)]

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P220B-SE6021
P229F-SE5986
P22A7-SE5982
U059F-SE5989
Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time. (See RefCond0037.)
When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.)

Malfunction Thresholds (all active):
The maximum NOx sensor output - minimum NOx sensor output < 2 ppm during 3 valid monitoring events

461. U3017-SE4760: Real Time Clock - Abnormal Rate of Change

Engine Off Timer Stuck

Monitor Operation:	
DTC	U3017-SE4760
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Coolant Temperature at the prior powerdown ≥ 70 °C
Powerdown Coolant Temperature - Startup Coolant Temperature ≥ 10 °C

Abort Conditions (any active):
P2509-SE294
Battery power to the ECM has been removed since the prior power down.

Malfunction Thresholds (all active):
Number of times that the engine off timer displays the same value ≥ 10 counts

462. U3017-SE4759: Real Time Clock - Abnormal Rate of Change

ECM real time clock data has an erratic update rate.

Monitor Operation:	
DTC	U3017-SE4759
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The diagnostic monitor run time ≥ 721 sec

Abort Conditions (any active):
P2509-SE294
Battery power to the ECM has been removed since the prior power down.

Malfunction Thresholds (all active):
| Real Time clock elapsed time - 721sec | > 120 sec

463. P0524-SE74: Engine Oil Rifle Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Engine Oil Rifle Pressure is valid but below normal operating range.

Monitor Operation:	
DTC	P0524-SE74
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Time after the engine has started ≥ 30 sec
Engine Speed ≥ 570 RPM

Pause Conditions (any active):
Engine Speed < 570 RPM

Malfunction Thresholds (all active):
Oil Pressure ≤ RefTable49

464. P0524-SE279: Engine Oil Rifle Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Engine Oil Rifle Pressure is valid but below normal operating range.

Monitor Operation:	
DTC	P0524-SE279
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Time after the engine has started ≥ 30 sec
Engine Speed ≥ 570 RPM

Pause Conditions (any active):
Engine Speed < 570 RPM

Malfunction Thresholds (all active):
Oil Pressure ≤ RefTable49

465. P0521-SE687: Engine Oil Rifle Pressure - Data Erratic, Intermittent, or Incorrect

Oil Rifle Pressure sensor is either erratic, intermittent or incorrect.

Monitor Operation:	
DTC	P0521-SE687
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):

Abort Conditions (any active):

Malfunction Thresholds (all active):
Oil Pressure > 0 kPa (Gauge) at key on with Engine Speed = 0 RPM
Number of times the Oil Pressure Switch sensor indicates positive Oil Pressure before engine start ≥ 5 counts

466. P0257-SE3258: Engine Fuel Pump Pressurizing Assembly 2 - Mechanical System Not Responding or Out of Adjustment

The temperature of the Pressure Control Valve [PCV] driver ASIC within the ECM exceeds the monitoring threshold.

Monitor Operation:	
DTC	P0257-SE3258
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.28 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):

Pause Conditions (any active):

Malfunction Thresholds (all active):
Pressure Control Valve [PCV] Driver ASIC Temperature ≥ 160 °C

467. P0252-SE3262: Engine Fuel Pump Pressurizing Assembly 1 - Mechanical System Not Responding or Out of Adjustment

The temperature of the Volume Control Valve [VCV] driver ASIC within the ECM exceeds the monitoring threshold.

Monitor Operation:	
DTC	P0252-SE3262
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.22 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):

Pause Conditions (any active):

Malfunction Thresholds (all active):
Volume Control Valve [VCV] Driver ASIC Temperature ≥ 165 °C

468. P009E-SE4482: High Pressure Common Rail Fuel Pressure Relief Valve - Out of Calibration

The Adaptation Factor is calculated from Pressure Control Valve [PCV] Set value minus the Measured rail pressure during rail pressure control by the PCV. If the adaptation factor exceeds a calibratable maximum threshold, a PCV Adaptation Limit High error will be set.

Monitor Operation:	
DTC	P009E-SE4482
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0087-SE6789, P0087-SE6790, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258
-7 °C ≤ Fuel Temperature ≤ 55 °C
The rate of change [gradient] of PCV set point rail pressure < 800 bar/sec
The rate of change [gradient] of PCV set point current < 300 mA/sec
Number of PCV adaptation cycles ≥ 5
The Pressure Control Valve [PCV] Adaptation Factor calculation has been completed.
The engine is running.
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
PCV Adaptation factor ≥ 1.3

469. P009E-SE4485: High Pressure Common Rail Fuel Pressure Relief Valve - Out of Calibration

The Adaptation Factor is calculated from Pressure Control Valve [PCV] Set value minus the Measured rail pressure during rail pressure control by the PCV. If the adaptation factor falls below a calibratable minimum threshold, a PCV Adaptation Limit Low error will be set.

Monitor Operation:	
DTC	P009E-SE4485
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0087-SE3236, P0087-SE3237, P0087-SE6787, P0087-SE6789, P0087-SE6790, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785, P009C-SE4715, P009D-SE3257, P009D-SE4714, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716, P0257-SE3258
-7 °C ≤ Fuel Temperature ≤ 55 °C
The rate of change [gradient] of PCV set point rail pressure < 800 bar/sec
The rate of change [gradient] of PCV set point current < 300 mA/sec
Number of PCV adaptation cycles ≥ 5
The Pressure Control Valve [PCV] Adaptation Factor calculation has been completed.
The engine is running.
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
PCV Adaptation factor ≤ 0.7

470. P0088-SE3238: Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Pressure Control Valve [PCV] high rail pressure error is set when the measured fuel rail pressure is above the setpoint by more than a calibratable amount AND the pressure command to the Pressure Control Valve [PCV] is less than a calibratable amount.

Monitor Operation:	
DTC	P0088-SE3238
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is by only Pressure Control Valve [PCV] in closed loop OR Fuel Rail Pressure control is by both Volume Control Valve [VCV] AND Pressure Control Valve [PCV] in closed loop [Coupled Pressure Control, in closed loop]

Malfunction Thresholds (all active):
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure < -200 bar
Pressure Control Valve [PCV] setpoint value < 10 bar

471. P0087-SE3236: Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

The Pressure Control Valve [PCV] low rail pressure error is set when the measured fuel rail pressure is below the setpoint by more than a calibratable amount [based on engine speed].

Monitor Operation:	
DTC	P0087-SE3236
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3237, P0087-SE6790, P0088-SE3239, P0088-SE6783, P0252-SE3262, P0253-SE4717, P0254-SE3261, P0254-SE4716
Fuel Rail Pressure control is by only Pressure Control Valve [PCV] in closed loop OR Fuel Rail Pressure control is by both Volume Control Valve [VCV] AND Pressure Control Valve [PCV] in closed loop [Coupled Pressure Control, in closed loop]
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure > RefTable10 bar

472. P0087-SE6790: Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

Fuel Rail Pressure falls below a calibratable minimum threshold (based on engine speed) while running in the Pressure Control Mode.

Monitor Operation:	
DTC	P0087-SE6790
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is only by Pressure Control Valve [PCV] in closed loop OR Fuel Rail Pressure control is by both Volume Control Valve [VCV] AND Pressure Control Valve [PCV] in closed loop [Coupled Pressure Control, in closed loop]
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
Fuel Rail Pressure < RefTable12 bar

473. P009D-SE3257: High Pressure Common Rail Fuel Pressure Relief Valve Circuit - Voltage Above Normal or Shorted to High Source

The Fuel Rail Pressure Control Valve (PCV) driver voltage is below a fixed threshold while the PWM driver is in the "OFF" state.

Monitor Operation:	
DTC	P009D-SE3257
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	280 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Pressure Control Valve [PCV] Pulse Width Modulated [PWM] signal is in the "OFF" state.

Pause Conditions (any active):

Malfunction Thresholds (all active):
3 V < PCV driver voltage < 5 V

474. P009D-SE4714: High Pressure Common Rail Fuel Pressure Relief Valve Circuit - Voltage Above Normal or Shorted to High Source

The Fuel Rail Pressure Control Valve (PCV) driver current exceeds a fixed threshold when the PWM driver is in the "ON" state.

Monitor Operation:	
DTC	P009D-SE4714
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	280 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Pressure Control Valve [PCV] Pulse Width Modulated [PWM] signal is in the "ON' state.

Pause Conditions (any active):

Malfunction Thresholds (all active):
PCV driver current > 10 A

475. P009C-SE4715: High Pressure Common Rail Fuel Pressure Relief Valve Circuit - Voltage Below Normal or Shorted to Low Source

The Fuel Rail Pressure Control Valve (PCV) driver voltage is below a fixed threshold while the PWM driver is in the "OFF" state.

Monitor Operation:	
DTC	P009C-SE4715
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	50 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Pressure Control Valve [PCV] Pulse Width Modulated [PWM] signal is in the "OFF" state.

Pause Conditions (any active):

Malfunction Thresholds (all active):
PCV driver voltage < 3 V

476. P2509-SE294: Power Supply Lost With Ignition On - Data Erratic, Intermittent, or Incorrect

RAM image storage has not completed for every time that it has started.

Monitor Operation:	
DTC	P2509-SE294
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	OBD No MIL

Malfunction Thresholds (all active):
At powerup, the number of times RAM image storage has started does not match the number of times RAM image storage has completed.

477. P0421-SE3545: Aftertreatment Diesel Oxidation Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Least Severe Level

Active regeneration of the DPF aborted due to the system detecting a malfunction with the closed loop temperatue controller using up all of the adjustment allowed.

Monitor Operation:	
DTC	P0421-SE3545
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate after malfunction criteria are met
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
Rate of active/intrusive injection of Hydrocarbons into exhaust > 0.2 g/sec
Ambient Air Temperature > -7 °C
Enable conditions for the algorithm that detects an ineffective regeneration of the DPF. (See RefCond0045.)
%O2 reading of Exhaust Air (See RefCond0022.)

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
Rate of active/intrusive injection of Hydrocarbons into exhaust ≤ 0.2 g/sec
Ambient Air Temperature ≤ -7 °C
Abort conditions for the algorithm that detects an ineffective regeneration of the DPF. (See RefCond0046.)
NOT [%O2 reading of Exhaust Air (See RefCond0022.)].

Pause Conditions (any active):
Pause conditions for the algorithm that detects an ineffective regeneration of the DPF. (See RefCond0047.)
Torque Fueling ≥ 0 mg/stroke

Malfunction Thresholds (all active):
Malfunction criteria has occured that aborts the current active regeneration of the DPF (Ineffective regeneration). (See RefCond0024.)
3 unique occurrences of the following conditions during an active regeneration of the DPF, with each occurrence persisting for a minimum of 60 seconds: (desired DOC outlet temperature - actual DOC outlet temperature > 15 degC) AND (allowed HC injection command {limited due to tailpipe HC slip concerns} - desired HC injection command estimated from feed forward control > 0 g/sec) AND [(total HC injection rate command - allowed HC injection rate > 0 g/sec) OR (HC injection rate before feedback adjustment - actual HC injection rate after feedback adjustment > 0 g/sec)]

478. P0607-SE217: Engine Control Module Warning Internal Hardware Failure - Bad Intelligent Device or Component

ECM does not power down when the ignition is off.

Monitor Operation:	
DTC	P0607-SE217
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The ECM stays powered on after the ignition is turned off.

479. P0088-SE6780: Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

Fuel Rail Pressure exceeds a calibratable maximum threshold during pressure control in Combined Pressure Control [CPC] mode.

Monitor Operation:	
DTC	P0088-SE6780
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is by both Volume Control Valve [VCV] AND Pressure Control Valve [PCV] in closed loop [Coupled Pressure Control, in closed loop]

Malfunction Thresholds (all active):
Fuel Rail Pressure > 2,150 bar

480. P0088-SE6783: Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

Fuel Rail Pressure exceeds a maximum calibratable threshold during pressure control in Volume Control Valve [VCV] mode.

Monitor Operation:	
DTC	P0088-SE6783
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is by only Volume Control Valve [Metering Unit] in closed loop.

Malfunction Thresholds (all active):
Fuel Rail Pressure > 2,150 bar

481. P0088-SE6785: Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

Fuel Rail pressure exceeds a maximum calibratable threshold during pressure control in Pressure Control Valve [PCV] mode.

Monitor Operation:	
DTC	P0088-SE6785
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.3 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Fuel Rail Pressure control is by only Pressure Control Valve [PCV] in closed loop OR Fuel Rail Pressure control is by both Volume Control Valve [VCV] AND Pressure Control Valve [PCV] in closed loop [Coupled Pressure Control, in closed loop]

Malfunction Thresholds (all active):
Fuel Rail Pressure > 2,150 bar

482. P0606-SE33: Engine Control Module Critical Internal Failure - Bad Intelligent Device or Component

The write to ECM RAM imaged data block has failed.

Monitor Operation:	
DTC	P0606-SE33
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.04 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The checksum of the flash data block does not equal to the checksum of its ram imaged data block on a separate occurrences.

483. P06B8-SE5340: Engine Control Module Calibration Memory - Bad Intelligent Device or Component

Data mismatch between non-volatile memory and its RAM image.

Monitor Operation:	
DTC	P06B8-SE5340
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Data in Flash memory does not match its image in RAM on 10 separate occurrences.

484. P2123-SE63: Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage Above Normal or Shorted to High Source

Primary Accelerator Pedal Position Out-of-Range High

Monitor Operation:	
DTC	P2123-SE63
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.8 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P2122-SE64
P06A5-SE817
P06A4-SE815

Pause Conditions (any active):
P2122-SE64
P06A5-SE817
P06A4-SE815

Malfunction Thresholds (all active):
Primary Accelerator Pedal Position Sensor Value > 4.692 V (100 %)

485. P2122-SE64: Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage Below Normal or Shorted to Low Source

Primary Accelerator Pedal Position Out-of-Range Low

Monitor Operation:	
DTC	P2122-SE64
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.8 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P06A5-SE817
P06A4-SE815

Pause Conditions (any active):
P06A5-SE817
P06A4-SE815

Malfunction Thresholds (all active):
Primary Accelerator Pedal Position Sensor Value < 0.293 V (0 %)

486. P214D-SE2889: Aftertreatment 1 SCR Outlet Temperature - Data Valid But Above Normal Operating Range - Most Severe Level

The SCR catalyst exhibits an exothermic behavior (i.e. there is a large temperature difference across the SCR catalyst) for a sustained period of time.

Monitor Operation:	
DTC	P214D-SE2889
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, P2472-SE2895, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
SCR outlet temperature ≥ 200 °C
SCR inlet temperature ≥ 200 °C

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, P2472-SE2895, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
SCR outlet temperature < 200 °C
SCR inlet temperature < 200 °C

Malfunction Thresholds (all active):

(Calculated mass flow rate of Oxidant reaching the SCR catalyst > 0.5 g/sec) AND (exhaust mass flow rate < 2,000 g/sec) for the period of 180 seconds.
OR
(Calculated mass flow rate of Oxidant reaching the SCR catalyst > 0.5 g/sec) AND (exhaust mass flow rate ≥ 2,000 g/sec) for the period of 540 seconds.

487. P1C54-SE10102: Aftertreatment 1 SCR Catalyst System Missing - Condition Exists

The system has detected that the NOx converting catalyst has no detectable amount of NOx conversion capability.

Monitor Operation:	
DTC	P1C54-SE10102
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	35 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-

SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P214D-SE2889
P214A-SE5294
P214C-SE5295
P214B-SE5292
P214D-SE5293
P1C56-SE7613
P229F-SE5978
P229F-SE5976
EGR Off Engine Protection is not active
40 g/s <= Exhaust flow rate <= 150 g/s
-1 g/sec/sec <= Rate of change of estimated exhaust mass flow <= 2 g/sec/sec
Aftertreatment inlet NOx <= 1,500 PPM
Rate of change of SCR NOx In ≤ 8 ppm/sec
Aftertreatment outlet NOx <= 1,500 PPM
Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)
75 kPa (absolute) <= Ambient Air pressure <= 121 kPa (absolute)
Ambient Air temperature ≥ -6.7 °C
220 degC <= estimated SCR catalyst bed temperature <= 365 degC
-0.5 degC/sec <= estimated rate of change of absolute SCR catalyst bed temperature <= 1.8 degC/sec
Ammonia to NOx Ratio (ANR) is >= 1.2 (unitless) for 150 sec. The timer to exit this enable condition is enabled if Ammonia to NOx Ratio (ANR) is less than 0.3 (unitless) for 180 sec consecutively
0.8(unitless) < Filtered Ammonia to NOx ratio < 2.5(unitless)
Deviation from mean of EONOx <= 15(unitless) for minimum RefTable50.
(ANR fraction > 0.7(unitless) AND SCR bed temperature > 150 degC AND SCR bed temperature < 400 degC AND SCR Bed temperature reset condition based on the module off time. (See RefCond0048.)) for 360 sec.
Urea injection command is > 0.02ml/sec for 150 sec. The timer to exit this condition is enabled in the event of a Key Switch OR if the Operation cycle is completed.
OR
Urea Doser Functional Response Monitor has reached the minimum number of decisions to make a pass or a fail decision AND the P202E-SE7927 is not active.
Filtered total fueling is >= 1 mg/stroke for 1 sec.

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P214D-SE2889
P214A-SE5294

P214C-SE5295
P214B-SE5292
P214D-SE5293
P1C56-SE7613
P229F-SE5978
P229F-SE5976
EGR Off Engine Protection is active
Aftertreatment state is not equal to Base mode (Normal mode)

Pause Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
Estimated SCR catalyst bed temperature < 220 degC OR estimated SCR catalyst bed temperature > 365 degC
Aftertreatment inlet NOx > 1,500 PPM
Aftertreatment outlet NOx > 1,500 PPM
Ambient air temperature < -6.7 °C
Exhaust flow rate < 40 g/s OR Exhaust flow rate > 150 g/s
Ambient Air pressure < 75 kPa (absolute) OR Ambient Air pressure > 121 kPa (absolute)
Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met. (See RefCond0049.)
SCR Bed temperature reset condition based on the module off time. (See RefCond0050.)
Rate of change of estimated SCR bed temperature > 1.8 °C/sec
Rate of change of estimated exhaust mass flow ≥ 2 g/sec/sec
Rate of change of SCR NOx In ≥ 8 ppm/sec
Exhaust Flow Rate is <= 35g/sec for a minimum cumulative time of 135 sec. The timer to exit this pause condition is enabled if the Ammonia to NOx Ratio (ANR) feedback is greater than 35g/sec for 360 sec
Estimated SCR catalyst bed temperature rate of change is > RefTable51. Pause condition is active for a minimum cumulative time of RefTable50.The timer to exit this pause condition is enabled if the estimated SCR catalyst bed temperature has decreased by at least 50 degC from its maximum temperature value.
Estimated SCR catalyst bed temperature rate of change is > RefTable51. Pause condition is active for a minimum cumulative time of RefTable52. The timer to exit this pause condition is enabled if the estimated SCR catalyst bed temperature rate of change is < RefTable53.
Filtered Ammonia to NOx ratio (ANR) < 0.8(unitless) OR Filtered Ammonia to NOx ratio (ANR) > 2.5(unitless)

Ammonia to NOx Ratio (ANR) Feedback is <= 0.3 (unitless) for 180 sec. The timer to exit this pause condition is enabled if Ammonia to NOx Ratio (ANR) is greater than 1.2 (unitless) for 150 sec consecutively
Urea injection command is <= 0.02ml/sec for 150 sec. The timer to exit this condition is enabled in the event of a Key Switch OR if the Operation cycle is completed.
Urea Doser Functional Response Monitor has NOT reached the minimum number of decisions to make a pass or a fail decision AND the P202E-SE7927 is active.
Filtered total fueling is <= 1 mg/stroke for 1 sec.

Malfunction Thresholds (all active):
Normalized DeNOx efficiency < -20 %

488. P249E-SE10852: Aftertreatment 1 SCR Feedback Control Status - Mechanical System Not Responding or Out of Adjustment

SCR inner control loop has used up all its adjustment allowed.

Monitor Operation:	
DTC	P249E-SE10852
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	150 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-

SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P1C56-SE7613
P220B-SE6021
P229F-SE5978
P229F-SE5976
P221A-SE10826
P221A-SE10827
P1C54-SE10102
P229E-SE11104
P2BAF-SE11496
Aftertreatment State is in Base mode
Engine is not in Power Take Off mode.
All common enable condition for control loop used up is active (See RefCond0051.)
SCR Inner loop used up enable conditions are true. (See RefCond0052.)
Engine out NOx > 100 ppm

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-

SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P22A7-SE5051
P220B-SE5988
P229E-SE5990
P229E-SE5987
P1C56-SE7613
P220B-SE6021
P229F-SE5978
P229F-SE5976
P221A-SE10826
P221A-SE10827
P1C54-SE10102
P229E-SE11104
P2BAF-SE11496
Aftreatment operation mode is not base mode
Engine is in Power Take Off mode.

Pause Conditions (any active):
NOT[All common enable condition for control loop used up is active (See RefCond0051.)].

NOT [SCR Inner loop used up enable conditions are true. (See RefCond0052.)].

Malfunction Thresholds (all active):
Percent of time SCR Inner Loop is used up / time all enable conditions are active > 80% Where: SCR Inner Loop is used up when: (SCR Conversion Efficiency Relay feedback mode is commanding very high ANR. (See RefCond0054.) OR SCR Conversion Efficiency Relay feedback mode is commanding high dosing for accelerated ammonia storage in SCR first brick (See RefCond0055.)) AND { (Target SCR Conversion Efficiency - Final estimate SCR Conversion Efficiency) > switching threshold * 5) AND SCR Conversion Efficiency Relay feedback mode is commanding high dosing for accelerated ammonia storage in SCR first brick (See RefCond0055.) OR Actual SCR Conversion Efficiency ≤ 0% }
Where
Switching threshold =RefTable56

489. P20EE-SE10910: Aftertreatment 1 SCR Conversion Efficiency - Condition Exists

The system has detected a decrease of the NOx converting catalyst's conversion capability resulting in tailpipe out NOx emissions exceeding the applicable threshold.

Monitor Operation:	
DTC	P20EE-SE10910
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P214D-SE2889
P214A-SE5294
P214C-SE5295
P214B-SE5292
P214D-SE5293

P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P1C56-SE7613
P229F-SE5978
P229F-SE5976
P218F-SE8289
23 g/s <= Mass flow rate <= 175 g/s.
-1.5 g/s2 <= Rate of change of filtered mass flow rate <= 3 g/s2.
Filtered mass flow rate is >= 30 g/s for 60 sec AND Mass flow rate is not <= 20 g/s.
Input NOx concentration to SCR is <= 1,500 ppm.
Rate of change of filtered input NOx concentration to SCR is <= 15 ppm/s.
Deviation of input NOx concentration to SCR from its moving mean is <= 2 (unitless) for RefTable57.
0.8 (unitless) <= Estimated filtered ammonia to NOx ratio <= 2 (unitless).
Estimated ammonia to NOx ratio is >= 1 (unitless) for 100 sec AND Estimated ammonia to NOx ratio is not <= 0.55 (unitless).
Estimated ammonia to NOx ratio is <= 1.8 (unitless) for 50 sec.
SCR out NOx concentration <= 1,500 ppm.
75kPa(absolute) <= Ambient air pressure <= 121 kPa(absolute).
Ambient air temperature ≥ -6.7 °C
Change of Engine speed (RPM) in 200 msec is > 1.3 RPM for 30 seconds AND Change of Engine exhaust flow rate (g/sec) in 200 msec is > 0.28 g/s for 30 seconds AND Rate of change of Engine fueling rate (L/hr) in 200 msec is > 0.02 L/hr for 30 sec AND Rate of change of Engine out NOx (ppm) in 200 msec is > 0 ppm for 30 sec.
OR
Urea Doser Functional Response Monitor is ready to update the fault. (See RefCond0056.) AND P202E-SE7927 is not active.
OR
DEF injection rate > 0.005 ml/sec for 300 seconds.
230 degC <= SCR Bed temperature <= 430 degC.
Rate of change of filtered SCR bed temperature is > RefTable58AND < 0.8 degC/sec.

(Estimated ammonia to Nox ratio is > 0.7 (unitless) AND SCR Bed temperature > 200 degC AND SCR Bed temperature < 400 degC AND SCR Bed temperature <= 450 degC AND Not [Engine control module off time is greater thean a calibrated threshold. (See RefCond0057.)]) for 300 seconds.
[Filtered rate of change of SCR bed temperature < (Estimated rate of change of temperature * 0.6 (unitless)) AND Actual rate of change of SCR bed temperature <= Estimated rate of change of temperature] for RefTable59. OR [Change in Bed temperature is > 50 degC AND Filtered rate of change of bed temperature <= Estimated rate of change of temperature] for RefTable60.
Not [DeNOx reference dip maneuver for limiting NH3 slip is active. (See RefCond0059.)] OR Target catalyst efficiency > 0 %.
EGR Off Engine Protection is not active
Key switch is turned ON.
Engine Out NOx status is valid.
Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)
Not [DeNOx reference dip maneuver for limiting NH3 slip is active. (See RefCond0059.)] for 30 seconds
0 g/sec < Filtered engine out NOx flow rate < 0.18 g/sec for 30 seconds
Rate of change of filtered SCR bed temperature is ≤ RefTable61.
Filtered total fueling is >= 12 mg/stroke for 0 sec.

Abort Conditions (any active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P1C55-SE5368, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736, P2201-SE5365, P2201-SE5366, P2202-SE5151, P2202-SE5153, P220A-SE5152, P2453-SE2983, P2454-SE2883, P2455-SE2882, P2456-SE3284, P245F-SE2851, P2460-SE2857, P2461-SE2849, P2BAD-SE5369, U029D-SE2487

P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P214D-SE2889
P214A-SE5294
P214C-SE5295
P214B-SE5292
P214D-SE5293
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P203B-SE7112, P203C-SE7110, P203D-SE7107, P203F-SE2906, P203F-SE2907, P2048-SE5102, P204A-SE7128, P204A-SE7129, P204A-SE7130, P204C-SE7118, P204D-SE7115, P207F-SE7282, P208A-SE7127, P208C-SE7126, P208D-SE7125, P208D-SE7598, P208D-SE7599, P208D-SE7604, P209F-SE2962, P20E8-SE7121, P20E8-SE7969, P20E9-SE7120, P20E9-SE7966, P21CA-SE7102, P21CA-SE7104, P21CA-SE7106, P21CB-SE7098, P21CC-SE7074, P2BA7-SE5279, U040F-SE7149
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
P1C56-SE7613
P229F-SE5978
P229F-SE5976
P218F-SE8289
EGR Off Engine Protection is active
Key switch is turned OFF.

Pause Conditions (any active):
Mass flow rate < 23 g/s OR Mass flow rate > 175 g/s.
Rate of change of mass flow rate < -1.5 g/s2 OR Rate of change of mass flow rate > 3 g/s2.
Filtered mass flow rate is < 30 g/s OR Mass flow rate is <= 20 g/s for 30 sec.
Input NOx concentration to SCR is > 1,500 ppm.
Rate of change of filtered input NOx concentration to SCR is > 15 ppm/s.
Deviation from moving mean of input NOx concentration to SCR is > 2 (unitless).
Estimated filtered ammonia to NOx ratio is < 0.8 (unitless) OR Estimated filtered ammonia to NOx ratio is > 2 (unitless).
Estimated ammonia to NOx ratio is < 1 (unitless) OR Estimated ammonia to NOx ratio is <= 0.55 (unitless) for 30 seconds.
Estimated ammonia to NOx ratio is >= 2.2 (unitless) for 100 seconds.
SCR out NOx concentration > 1,500 ppm.

Ambient air pressure is < 75 kPa(absolute) OR Ambient air pressure is > 121 kPa(absolute).
Ambient air temperature < -6.7 °C
Change of Engine speed (RPM) in 200 msec is <= 1.3 RPM for 5 sec OR Change of Engine exhaust flow rate (g/sec) in 200 msec is <= 0.28 g/sec for 15 sec OR Rate of change of Engine fueling rate (L/hr) in 200 msec is <= 0.02 L/hr for 15 sec OR Rate of change of Engine out NOx (ppm) in 200 msec is <= 0 ppm for 15 sec.
SCR Bed temperature is < 230 degC OR SCR Bed temperature is > 430 degC.
Rate of change of filtered bed temperature is <= RefTable58 OR >= 0.8 degC/s.
Estimated ammonia to Nox ratio is <= 0.7 (unitless) OR SCR Bed temperature <= 200 degC OR SCR Bed temperature >= 400 degC OR SCR Bed temperature > 450 degC OR [Engine control module off time is greater thean a calibrated threshold. (See RefCond0057.)] .
[Filtered rate of change of SCR bed temperature >= (Estimated rate of change of temperature * 0.6 (unitless)) AND [Change in SCR Bed temperature is <= 50 degC AND Filtered rate of change of SCR bed temperature > Estimated rate of change of temperature].
DeNOx reference dip maneuver for limiting NH3 slip is active. (See RefCond0059.) AND Target catalyst efficiency <= 0 %.
Not [Urea Doser Functional Response Monitor is ready to update the fault. (See RefCond0056.)] AND Dosing Not Allowed Flag indicating Dosing command is out of nominal range for Urea Doser Functional Monitor (See RefCond0012.) AND DEF injection rate <= 0.005 ml/sec AND (Operation cycle is complete OR Key switch is turned ON).
Engine Out NOx status is not valid.
NOT[Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)].
DeNOx reference dip maneuver for limiting NH3 slip is active. (See RefCond0059.) for 15 seconds
0 g/sec ≥ Filtered engine out NOx flow rate ≥ 0.18 g/sec for 0.5 seconds.
Rate of change of filtered SCR bed temperature is > RefTable62 for 0.2 seconds.
Filtered total fueling is <= 6 mg/stroke for 0.2 sec.

Malfunction Thresholds (all active):
Amplified catalyst Inefficiency (ACIE) Where: ACIE is the SCR catalyst Inefficiency amplified using the ammonia to NOx ratio ≥ 80 (unitless).

490. P214A-SE5294: Aftertreatment 1 SCR Intermediate Gas Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment SCR inlet gas temperature is above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P214A-SE5294
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, P2472-SE2895, U1611-SE6687, U1612-SE6685
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.2 g/sec
Elapsed time since last active regeneration > 540 sec

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, P2472-SE2895, U1611-SE6687, U1612-SE6685
Rate of active/intrusive injection of hydrocarbons in exhaust > 0.2 g/sec

Malfunction Thresholds (all active):
SCR Inlet/midbed Temperature > 650 °C

491. P214B-SE5292: Aftertreatment 1 SCR Intermediate Gas Temperature - Data Valid But Above Normal Operating Range - Most Severe Level

Aftertreatment SCR inlet temperature continuously above a severe, high threshold for a calibrated period of time

Monitor Operation:	
DTC	P214B-SE5292
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, P2472-SE2895, U1611-SE6687, U1612-SE6685

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, P2472-SE2895, U1611-SE6687, U1612-SE6685

Malfunction Thresholds (all active):
SCR inlet/midbed temperature > 700 °C

492. P2472-SE2895: Aftertreatment 1 SCR Intermediate Gas Temperature Sensor - Data Erratic, Intermittent, or Incorrect

Aftertreatment SCR catalyst gas temperature measurement is in-range but not rational.

Monitor Operation:	
DTC	P2472-SE2895
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	350 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
NOT[Fuel system failure is present (See RefCond0064.)]
25 g/sec < Exhaust flow
Engine Speed > 200 RPM
Elapsed time since last active regeneration > 120 sec
(100 degC < SCR inlet temperature < 400 degC) OR (100 degC < SCR outlet temperature < 400 degC)
300 seconds have elapsed since OEM datalink requested Engine intrusive diagnostics was active
NOT [First SCR Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0065.)]
NOT [SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0066.)]
Fuel system failure is present (See RefCond0064.)

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Fuel system failure is present (See RefCond0064.)

Elapsed time since last active regeneration < 120 sec
Fuel system failure is present (See RefCond0064.)

Pause Conditions (any active):
Exhaust flow < 25 g/sec
Engine Speed < 200 RPM
(SCR inlet temperature < 100 degC OR SCR inlet temperature > 400 degC) AND (SCR outlet temperature < 100 degC OR SCR outlet temperature > 400 degC)
OEM datalink requested Engine intrusive diagnostics is active
First SCR Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0065.)
SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0066.)

Malfunction Thresholds (all active):
(Average of the delta temperature between SCR Inlet/Midbed and SCR Outlet over a time window of 350 sec > 80 degC) OR (average of the delta temperature between SCR Inlet/Midbed and SCR Outlet over a time window of 350 sec < -70 degC)

493. P2472-SE7288: Aftertreatment 1 SCR Intermediate Gas Temperature Sensor - Data Erratic, Intermittent, or Incorrect

Aftertreatment SCR either Inlet or Outlet temperature sensor has been tampered with.

Monitor Operation:	
DTC	P2472-SE7288
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	600 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
Engine Speed > 600 RPM for 60 seconds
Ambient Air Pressure ≥ 75 kPa(absolute)
Ambient Air Temperature ≥ -6.7 °C
Exhaust flow > 0 g/sec for 5 seconds

Abort Conditions (any active):
Engine Speed ≤ 900 RPM for 90 seconds.
Engine Fueling ≤ 22 mg/stroke for 90 seconds.

Pause Conditions (any active):
Engine Speed ≤ 900 RPM
Engine Fueling ≤ 22 mg/stroke
Diagnostic will immediately pause if either Pause Condition occurs. Once paused, diagnostic will remain paused until both limits have been exceeded for 10 seconds.

Malfunction Thresholds (all active):
SCR Inlet/Midbed Temperature < 190 °C
OR
SCR Outlet temperature < 200 °C

494. P2483-SE3785: Aftertreatment 1 SCR Outlet Temperature Sensor - Data Erratic, Intermittent, or Incorrect

Aftertreatment SCR outlet gas temperature is in-range but not rational.

Monitor Operation:	
DTC	P2483-SE3785
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	350 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
NOT[Fuel system failure is present (See RefCond0064.)]
25 g/sec < Exhaust flow
Engine Speed > 200 RPM
Elapsed time since last active regeneration > 120 sec
(100 degC < SCR inlet temperature < 400 degC) OR (100 degC < SCR outlet temperature < 400 degC)
300 seconds have elapsed since OEM datalink requested Engine intrusive diagnostics was active
NOT [First SCR Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0065.)]
NOT [SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0066.)]
Fuel system failure is present (See RefCond0064.)

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
Fuel system failure is present (See RefCond0064.)

Elapsed time since last active regeneration < 120 sec
Fuel system failure is present (See RefCond0064.)

Pause Conditions (any active):
Engine Speed < 200 RPM
Exhaust flow < 25 g/sec
(SCR inlet temperature < 100 degC OR SCR inlet temperature > 400 degC) AND (SCR outlet temperature < 100 degC OR SCR outlet temperature > 400 degC)
OEM datalink requested Engine intrusive diagnostics is active
First SCR Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0065.)
SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0066.)

Malfunction Thresholds (all active):
(Average of the temperature drop across the SCR catalyst > 80 degC) OR (average of the temperature drop across the SCR catalyst < -70 degC)
-70 degC < average of (DPF outlet temperature - SCR inlet/midbed temperature) < 80 degC

495. P22A7-SE5982: Aftertreatment 1 Outlet NOx Sensor Heater - Abnormal Rate of Change

Aftertreatment outlet NOx sensor heater malfunction.

Monitor Operation:	
DTC	P22A7-SE5982
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
Time after the sensor has reached it working temperature and has entered automatic mode > 30 sec
Exhaust gas velocity < 60 m/sec
SCR outlet temperature < 800 °C
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)
Nox sensor battery supply voltage is within the desired range of [10.8, 16.5] V for more than 0.2 seconds.

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
Exhaust gas velocity ≥ 60 m/sec
SCR outlet temperature ≥ 800 °C
Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.)
Nox sensor battery supply voltage is outside the desired range of [10.8, 16.5] V.

Malfunction Thresholds (all active):
(The percentage of time spent with the sensor in a heating mode other than automatic mode > 5 % of the time that the monitor takes to make a decision) OR (Number of transitions from automatic mode to other states > 5 counts)

496. P214C-SE5295: Aftertreatment 1 SCR Outlet Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

Aftertreatment SCR outlet gas temperature is continuously above a high threshold for a calibrated period of time while active regeneration of the DPF is not occurring.

Monitor Operation:	
DTC	P214C-SE5295
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.2 g/sec
Elapsed time since last active regeneration > 540 sec

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
Rate of active/intrusive injection of hydrocarbons in exhaust > 0.2 g/sec

Malfunction Thresholds (all active):
SCR outlet temperature > 650 °C

497. P214D-SE5293: Aftertreatment 1 SCR Outlet Temperature - Data Valid But Above Normal Operating Range - Most Severe Level

Aftertreatment SCR outlet gas temperature continuously above a severe, high threshold for a calibrated period of time

Monitor Operation:	
DTC	P214D-SE5293
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	60 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685

Malfunction Thresholds (all active):
SCR outlet temperature > 700 °C

498. P2472-SE6545: Aftertreatment 1 SCR Intermediate Gas Temperature Sensor - Data Erratic, Intermittent, or Incorrect

Aftertreatment SCR catalyst inlet/midbed gas temperature reading is in-range but not rational.

Monitor Operation:	
DTC	P2472-SE6545
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	350 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
NOT[Fuel system failure is present (See RefCond0064.)]
25 g/sec < Exhaust flow
Engine Speed > 200 RPM for 500 seconds
Elapsed time since last active regeneration > 120 sec
(100 degC < SCR inlet/midbed temperature < 400 degC) OR (100 degC < SCR outlet temperature < 400 degC)
300 seconds have elapsed since OEM datalink requested Engine intrusive diagnostics was active
NOT [First SCR Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0065.)]
NOT [SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0066.)]
Fuel system failure is present (See RefCond0064.)

Abort Conditions (any active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2481-SE6763, P2482-SE6762, P2482-SE6765, U1611-SE6687, U1612-SE6685
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2470-SE6761, P2471-SE6760, P2471-SE6764, U1611-SE6687, U1612-SE6685
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872,

P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242C-SE6734, P242D-SE6733, P242D-SE6737
Fuel system failure is present (See RefCond0064.)
Regeneration is Active
Fuel system failure is present (See RefCond0064.)

Pause Conditions (any active):
Engine speed < 200 RPM
Exhaust flow < 25 g/sec
(SCR inlet/midbed temperature < 100 degC OR SCR inlet/midbed temperature > 400 degC) AND (SCR outlet temperature < 100 degC OR SCR outlet temperature > 400 degC)
OEM datalink requested Engine intrusive diagnostics is active
First SCR Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0065.)
SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty. (See RefCond0066.)

Malfunction Thresholds (all active):
(Average of the temperature drop across the SCR catalyst > 80 degC AND average of (DPF outlet - SCR inlet/midbed) < -70 degC) OR (Average of the temperature drop across the SCR catalyst < -70 degC AND average of (DPF outlet - SCR inlet/midbed) > 80 degC)

499. U11C1-SE8706: Aftertreatment Diesel Exhaust Fluid Controller - Received Network Data in Error

This diagnostic checks if the Variant Data Selection (VDS) message sent by the Flange Control Unit (FCU) matches with the VDS message commanded by the engine ECU (Electronic Control Unit) to the FCU. If a mismatch is detected, then an error is set provided the datalink timeout error is not active

Monitor Operation:	
DTC	U11C1-SE8706
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Time taken to successfully transmit the Vehicle Configuration Message from the ECU to the FCU < 21 sec.
A valid Vehicle Configuration Selection was received from the FCU

Malfunction Thresholds (all active):
Vehicle configuration selected by the Flange Control Unit does not match with the vehicle configuration commanded by the Engine ECM.

500. P0653-SE243: Sensor Supply 1 Circuit - Voltage Above Normal or Shorted to High Source

Sensor Supply 1 voltage reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0653-SE243
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Sensor Supply 1 Voltage > 5.356 V

501. P0652-SE225: Sensor Supply 1 Circuit - Voltage Below Normal or Shorted to Low Source

Sensor Supply 1 voltage reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0652-SE225
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Sensor Supply 1 Voltage < 4.644 V

502. P0699-SE814: Sensor Supply 3 Circuit - Voltage Above Normal or Shorted to High Source

Sensor Supply 3 voltage reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0699-SE814
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Sensor Supply 3 Voltage > 5.356 V

503. P0698-SE816: Sensor Supply 3 Circuit - Voltage Below Normal or Shorted to Low Source

Sensor Supply 3 voltage reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0698-SE816
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Sensor Supply 3 Voltage < 4.644 V

504. P06A5-SE817: Sensor Supply 4 Circuit - Voltage Above Normal or Shorted to High Source

Sensor Supply 4 voltage reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P06A5-SE817
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Sensor Supply 4 Voltage > 5.356 V

505. P06A4-SE815: Sensor Supply 4 Circuit - Voltage Below Normal or Shorted to Low Source

Sensor Supply 4 voltage reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P06A4-SE815
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Sensor Supply 4 Voltage < 4.644 V

506. P06D4-SE1893: Sensor Supply 5 Circuit - Voltage Above Normal or Shorted to High Source

Sensor Supply 5 voltage reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P06D4-SE1893
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Sensor Supply 5 Voltage > 5.356 V

507. P06D3-SE1894: Sensor Supply 5 Circuit - Voltage Below Normal or Shorted to Low Source

Sensor Supply 5 voltage reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P06D3-SE1894
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
Sensor Supply 5 Voltage < 4.644 V

508. P06D8-SE2030: Sensor Supply 6 Circuit - Voltage Above Normal or Shorted to High Source

Sensor Supply 6 voltage reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P06D8-SE2030
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Sensor Supply 6 Voltage > 5.356 V

509. P06D7-SE2031: Sensor Supply 6 Circuit - Voltage Below Normal or Shorted to Low Source

Sensor Supply 6 voltage reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P06D7-SE2031
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Sensor Supply 6 Voltage < 4.644 V

510. P057E-SE8109: Brake Pedal Position - Data Erratic, Intermittent, or Incorrect

Brake Switch 1 and Brake Switch 2 disagree.

Monitor Operation:	
DTC	P057E-SE8109
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 (counts)
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Key Switch is ON.

Abort Conditions (any active):
Key Switch is OFF.

Malfunction Thresholds (all active):
(Brake Switch 1 is On AND Brake Switch 2 is Off) OR (Brake Switch 1 is Off AND Brake Switch 2 is On) FOR 4 (seconds)

511. P1C70-SE5496: Aftertreatment SCR Operator Inducement - Data Valid But Above Normal Operating Range - Most Severe Level

Active Severe Driver Inducement

Monitor Operation:	
DTC	P1C70-SE5496
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	See AECD Document
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Key Switch is OFF
OR
Idle Shutdown has shutdown engine
OR
Amount of time at Idle > 3,600 seconds
OR
Fuel Level has increased > 15 percent since last Key On

Malfunction Thresholds (all active):
One or more conditions exist requiring Severe Driver Inducement

512. P262D-SE11550: Switched Output #1 - Voltage Below Normal or Shorted to Low Source

The ECM has detected the voltage to a relay is less than an allowable value.

Monitor Operation:	
DTC	P262D-SE11550
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.4
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
The power supply to a relay is < 8 V.

513. P0687-SE11618: Switched Output #2 - Voltage Above Normal or Shorted to High Source

The ECM has detected the voltage to a device is in excess of an allowable value.

Monitor Operation:	
DTC	P0687-SE11618
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
The power supply to a device is > 16 V.

514. P061C-SE5023: Engine Speed Calculation - Bad Intelligent Device or Component

Compares the difference between two distinct, independently calculated Engine Speed values against a calibrated maximum difference.

Monitor Operation:	
DTC	P061C-SE5023
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Absolute value of difference between Engine RPM and an independently calculated engine speed is greater than 500 RPM.

515. P062C-SE5030: Cruise Control Set Speed - Out of Calibration

The detection of operational errors in the main vehicle speed fueling control logic and systems. This is to meet X Wire diagnostic requirements.

Monitor Operation:	
DTC	P062C-SE5030
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
The Engine ECM Cruise Control is engaged.

Malfunction Thresholds (all active):
Independently of the main control algorithms, the inputs for cruise control switches, brake pedal, road speed, and selected transmission gear are read and evaluated and a determination is made based on these that cruise control should not be engaged.
OR
An independent reading of the cruise control switch inputs produces values that do not match the nominal cruise control switch inputs.
OR
(
Independently calculated Road Speed exceeds independently calculated Cruise Set Speed by 6.214 MPH
AND
P061A-SE5020 is active
)

516. P0601-SE5354: Engine Control Module Calibration Memory Checksum - Out of Calibration

Engine Control Module Calibration Memory Checksum does not match the expected reference value.

Monitor Operation:	
DTC	P0601-SE5354
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
CRC on Cummins calibrations and unchanging trims, Cummins code block, partner-supplied code block, or partner- supplied calibrations does not equal the expected values.

517. P060B-SE7369: Analog Data Processing Support Malfunction Detected - Condition Exists

The Direct Memory Access controller (DMA) has detected an attempt to read or write low level data that is not on a proper byte boundary or it has detected an attempt to access data from two or more channels simultaneously.

Monitor Operation:	
DTC	P060B-SE7369
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Data was written to or read from an address not on a 32 bit boundary.
OR
The low level software could not read from or write to the data bus.
OR
A conflict was detected when the low level software attempted to access a memory channel.

518. P0604-SE5345: Engine Control Module Calibration Program Memory (RAM) Corruption - Condition Exists

Read/write test of off-CPU RAM has failed.

Monitor Operation:	
DTC	P0604-SE5345
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
ECM in powering down state.

Abort Conditions (any active):
ECM not in powering down state.

Malfunction Thresholds (all active):
The value read from each location of RAM by the main engine ECM microprocessor does not match the value previously written to it.

519. P0611-SE10857: Injector Power Supply - Bad Intelligent Device or Component

The main fueling calculation is compared against a system theroretical maximum fueling value, and if the main fueling exceeds the system protection fueling value, the error is set.

Monitor Operation:	
DTC	P0611-SE10857
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The observed injector pulse duration is greater than the independently calculated theoretical injector pulse duration.

520. P061E-SE5024: Brake Inactivity - Condition Exists

Brake input inactive. This is to meet X Wire diagnostic requirements.

Monitor Operation:	
DTC	P061E-SE5024
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Independently calculated Engine Speed > 200 RPM

Abort Conditions (any active):
Independently calculated Engine Speed ≤ 200 RPM

Malfunction Thresholds (all active):
Vehicle speed and brake pedal position are read and determined independently of the normal control algorithm. The derived vehicle speed has been above 27.962 MPH for a total of 300 seconds, and decreased to less than 1.864 MPH. when this occurs 2 times with no change in the independently derived brake pedal position detected and key switch input has not been off for at least 20 seconds.

521. P062B-SE5026: Fuel System Shutdown Failure - Condition Exists

The torque converted fueling is compared against a pre-determined map of fueling value for torque, and if the observed fueling exceeds the theoretical torque map value, the error is set.

Monitor Operation:	
DTC	P062B-SE5026
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1.5 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The observed torque fuel quantity is greater than the independently calculated theoretical torque fuel quantity limit.

522. P062B-SE5027: Fuel System Shutdown Failure - Condition Exists

The detection of non-working operation feedback for the main injection control overrun system design. This is to meet X Wire diagnostic requirements.

Monitor Operation:	
DTC	P062B-SE5027
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Engine Shutdown event is commanded.
OR
The ECM has powered up, but the engine is cranking and the test begun during the last shutdown did not complete.

Pause Conditions (any active):
Independently calculated engine speed < 50 RPM

Malfunction Thresholds (all active):
The engine fuel delivery calculated independently of the main control algorithm > 100 mg/stroke
Commanded fueling calculated independently from the main control algorithm > 4 mg/stroke
Fuel Pressure calculated independently of the main control algorithm > 200 kPa(absolute)

523. P0601-SE5357: Engine Control Module Calibration Memory Checksum - Out of Calibration

Main engine ECM microprocessor Calibration Memory Checksum does not complete before ECM powerdown.

Monitor Operation:	
DTC	P0601-SE5357
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
CRC on Cummins calibrations and unchanging trims, Cummins code block, partner-supplied code block, or partner- supplied calibrations does not complete before powerdown.

524. P060A-SE7370: Internal Monitor Processor Performance - Monitor Support Malfunction Detected - Condition Exists

The main microprocessor tests that support for the monitor micro is actively being controlled by testing the monitor microprocessor response to an incorrect input.

Monitor Operation:	
DTC	P060A-SE7370
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
At power-up with key switch on and every 30 minutes while key is on.

Abort Conditions (any active):
Key switch is OFF

Malfunction Thresholds (all active):
A known incorrect answer is provided to the monitoring microprocessor. The feedback to the main engine ECM microprocessor from the monitoring microprocessor incorrectly indicates that the known wrong answer was correct.

525. P060C-SE5362: Number of ECM Resets - Data Valid But Above Normal Operating Range - Moderately Severe Level

The monitoring engine ECM microprocessor has been requested to reset an excessive number of times.

Monitor Operation:	
DTC	P060C-SE5362
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
The monitoring microprocessor reset has been commanded 7 times.
Ignition Key switch input is on.

526. P0607-SE7383: Engine Control Module Warning Internal Hardware Failure - Bad Intelligent Device or Component

The circuits for the torque actuators on the monitor microprocessor are checked to ensure the shutdown circuit is operational.

Monitor Operation:	
DTC	P0607-SE7383
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
No external watchdog or software resets are active.
Key switch is ON.
ECM in powerup state.

Abort Conditions (any active):
External watchdog or software reset occurs.
Key switch is OFF for four seconds.
ECM not in powerup state.

Pause Conditions (any active):
Key switch is OFF.

Malfunction Thresholds (all active):
The monitoring microprocessor commands the torque actuator circuits (typically injector drivers) to shutdown, but the torque actuator circuit feedbacks indicates the circuit is still active.

527. P060C-SE10696: Number of ECM Resets - Data Valid But Above Normal Operating Range - Moderately Severe Level

The main engine ECM microprocessor has detected a reset occurred while previous engine state was run.

Monitor Operation:	
DTC	P060C-SE10696
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
(First reported Engine Speed after ECM initialization > 300 RPM
AND
Time since ECM power up is less than 2 seconds)
OR
(Engine Speed > 50 RPM
AND
ECM reset occurs (software or monitor microprocessor caused))

528. P061B-SE7386: Torque Fueling Performance Beyond Design Limits - Condition Exists

The engine fueling is in excess of what is expected for the given operational conditions.

Monitor Operation:	
DTC	P061B-SE7386
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Commanded fueling, calculated independently of the main control algorithm > 100 mg/stroke
The independently calculated engine speed <= 4,900 RPM

529. P061A-SE5020: Governor Fueling Error - Condition Exists

The engine fueling is in excess of what is expected for the engine speed conditions.

Monitor Operation:	
DTC	P061A-SE5020
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
P2299-SE5025

Malfunction Thresholds (all active):
The engine speed is > 1,200 RPM
The accelerator pedal input is < historical accelerator pedal position auto zero offset threshold %
The observed fueling value exceeds 4 mg/stroke

530. P060C-SE5346: Number of ECM Resets - Data Valid But Above Normal Operating Range - Moderately Severe Level

The main microprocessor is detecting errant operating conditions and generating incorrect responses to the monitoring microprocessor.

Monitor Operation:	
DTC	P060C-SE5346
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Any of the conditions: (the run-time response indicates an incorrect process sequence or the monitor micro new question update is <= 40 msec or the instruction path test fails) consecuitively for >= 0.5 seconds.
OR
Any of the conditions: (the run-time response indicates an incorrect process sequence or the monitor micro new question update is <= 40 msec or the instruction path test fails) for a cumulatively period of time >= 4.8 seconds.

531. P0604-SE5375: Engine Control Module Calibration Program Memory (RAM) Corruption - Condition Exists

Read/write test of on-chip RAM fail. Memory is written to and then read. If the value read does not match the value written, the error is set.

Monitor Operation:	
DTC	P0604-SE5375
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
Key switch is ON.

Abort Conditions (any active):
Key switch is OFF.

Malfunction Thresholds (all active):
The contents of the RAM as read by the main engine ECM microprocessor do not match what was written to it.

532. P0605-SE5350: Engine Control Module Calibration Memory (ROM) Corruption - Root Cause Not Known

Checksums are calculated for Read Only Memory (ROM) at keyon and compared to stored values. If the calculated checksum value does not match the stored checksum value, the error is set.

Monitor Operation:	
DTC	P0605-SE5350
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Key switch is ON.

Abort Conditions (any active):
Key switch is OFF.

Malfunction Thresholds (all active):
The checksum for any block of ROM as calculated by the main engine ECM microprocessor does not match the stored checksum for that block.

533. P2299-SE5025: Brake Switch and Accelerator Pedal Position Incompatible - Condition Exists

Accelerator pedal is stuck. This is to meet X Wire diagnostic requirements.

Monitor Operation:	
DTC	P2299-SE5025
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	2 sec
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
(
Accelerator Pedal Position, derived independently of normal control algorithm value ≤ 3.926 %
OR
Accelerator Pedal Position, derived independently of normal control algorithm value ≥ 24.915 %
)
AND
Independently calculated Engine Speed > 200 RPM

Abort Conditions (any active):
(
Accelerator Pedal Position, derived independently of normal control algorithm value > 3.926 %
AND
Accelerator Pedal Position, derived independently of normal control algorithm value < 24.915 %
)
OR
Independently calculated Engine Speed ≤ 200 RPM

Malfunction Thresholds (all active):
The raw analog or muxed input value for Accelerator Pedal Position, derived independently of normal control algorithm value is constant.
Accelerator Pedal Position, derived independently of normal control algorithm value > 2.114 %
Brake Switch derived independently of normal control algorithm value transitions ON

534. P0607-SE10093: Engine Control Module Warning Internal Hardware Failure - Bad Intelligent Device or Component

The micro sub-processor has a fault condition detected for its process flow, its registers or its memory that differs from the nominal or expected value.

Monitor Operation:	
DTC	P0607-SE10093
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The checksum of the main engine ECM sub-processor memory does not equal the expected checksum
OR
The independent internal watchdog timer updated in conjunction with the subprocessors intended instructions indicates operation processing is lost > 500 microseconds.
OR
The register value of the sub-processor is not equal to the expected value in normal operation

535. P2262-SE3018: Engine Turbocharger Turbine Bypass Actuator - Mechanical System Not Responding or Out of Adjustment

The turbine bypass valve smart device actuator has determined itself to be incapable of meeting its desired position. This is communicated to the ECM via a number of status codes.

Monitor Operation:	
DTC	P2262-SE3018
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The ECM reads status codes from the turbine bypass valve smart device. Each status code has its own enable, which must be ENABLED in order for the ECM to apply the status code received from the turbine bypass valve smart device to the System Error. Only received status codes will cause this error to be set. This differs slightly from an overall algorithm enable.
As there may be a number of malfunction criteria that apply, the enable conditions may be matched to the corresponding malfunction criteria by the word or phrase at the beginning of the condition.
Slow Actuator Response: The engine conditions must be appropriate to avoid a false detect of a stuck actuator. (See RefCond0067.)

Malfunction Thresholds (all active):
If ANY of the following apply, the error will be set:
Slow Actuator Response: The TBV smart device has detected that it cannot meet its commanded position within an acceptable time. (See RefCond0068.)

536. P1A62-SE9725: Engine Turbocharger 1 Turbine Bypass Actuator 1 Position - Special Instructions

The turbine bypass valve smart device indicates it is in a condition without known calibration data.

Monitor Operation:	
DTC	P1A62-SE9725
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The TBV device reports that it is in a state with no known calibration data.
OR
The TBV device reports that it is in the process of doing an installation.

537. P0046-SE4169: Engine Turbocharger Turbine Bypass Actuator - Received Network Data in Error

The turbine bypass valve smart device actuator has not received a command message from the controlling ECM for a calibrated period.

Monitor Operation:	
DTC	P0046-SE4169
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The following conditions apply to the specific malfunction as indicated by the first words in the description.
Message Timeout: The turbine bypass valve smart device has received at least one command message from the ECM.

Pause Conditions (any active):
The turbine bypass valve smart device is performing a self calibration - checking for span and end points.

Malfunction Thresholds (all active):
Message Timeout: The TBV smart device has not received a position command message for greater than or equal to a calibrated time after previously having received a command message. (See RefCond0069.)

538. U040D-SE9715: Engine Turbocharger Turbine Bypass Actuator - Out of Calibration

The turbine bypass valve smart device is configured incorrectly.

Monitor Operation:	
DTC	U040D-SE9715
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The ECM has received the message(s) from the turbine bypass valve smart device.

Malfunction Thresholds (all active):
The Customer ID received from the turbine bypass valve smart device does not equate to "Cummins"
OR
The motor type received from the turbine bypass valve smart device does not equate to the expected motor type.

539. P00AF-SE4166: Engine Turbocharger Turbine Bypass Actuator - Bad Intelligent Device or Component

The turbine bypass valve smart device has detected an internal error which will prevent it from functioning normally.

Monitor Operation:	
DTC	P00AF-SE4166
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The TBV smart device has detected an internal error which will prevent it from functioning normally. (See RefCond0071.)

540. U040D-SE4172: Engine Turbocharger Turbine Bypass Actuator - Out of Calibration

The turbine bypass valve smart device is configured incorrectly.

Monitor Operation:	
DTC	U040D-SE4172
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The ECM has received the message(s) from the turbine bypass valve smart device.

Malfunction Thresholds (all active):
The Software ID received from the turbine bypass valve smart device does not equal 3032.

541. P0046-SE9724: Engine Turbocharger Turbine Bypass Actuator - Received Network Data in Error

The turbine bypass valve smart device actuator has never received a command message from the controlling ECM for a calibrated period.

Monitor Operation:	
DTC	P0046-SE9724
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The following conditions apply to the specific malfunction as indicated by the first words in the description.
Message Timeout: The turbine bypass valve smart device has nver received a command message from the ECM.

Pause Conditions (any active):
The turbine bypass valve smart device is performing a self calibration - checking for span and end points.

Malfunction Thresholds (all active):
No Source: The TBV smart device has not received a message from the ECM. (See RefCond0072.)

542. P004E-SE4165: Engine Turbocharger Turbine Bypass Actuator Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

The turbine bypass valve smart device has detected a temperature in excess of internal limits.

Monitor Operation:	
DTC	P004E-SE4165
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1,800 sec
MIL Activation Criteria	1 trip

Malfunction Thresholds (all active):
The TBV smart device has detected a warm temperature condition. (See RefCond0073.)

543. P226C-SE9721: Engine Turbocharger 1 Turbine Bypass Actuator 1 Position - Data Erratic, Intermittent, or Incorrect

The TBV position feedback is failed in range, but not clearly "in range high" or "in range low."

Monitor Operation:	
DTC	P226C-SE9721
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Number of in range turbine bypass valve failures this drive cycle < 1.
Turbine bypass valve not failed (except for in-range failures as described by other enable condition)
Turbine bypass valve smart device is in closed loop control state.
The engine is running.
Coolant Temperature * 0.8 + Charge Temperature * 0.2 > -10 deg C

Malfunction Thresholds (all active):
(Maximum value of TBV In Range High Error Cumulative Sum plus the maximum value of In Range Low Error Cumulative Sum) within a 75 second period is ever > 3,750%, which is equivalent to (Average of In Range High Error - Tolerance) + (Average of In Range Low Error – Tolerance) > 1% Where In Range High Error is defined as (Measured Value – Commanded Value), In Range Low Error is defined as (Commanded Value – Measured Value) and Tolerance is defined as 0%.

544. P0047-SE4170: Engine Turbocharger Turbine Bypass Actuator - Condition Exists

The turbine bypass valve smart device has detected a low voltage condition.

Monitor Operation:	
DTC	P0047-SE4170
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	30 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The turbine bypass valve smart device is operable and in communication with the ECM.
Engine Speed >= 575 RPM

Malfunction Thresholds (all active):
The voltage for the TBV smart device is less than a calibrated value. (See RefCond0074.)

545. P0630-SE7946: Vehicle Identification Number - Out of Calibration

The error is set when an unprogrammed VIN has been detected.

Monitor Operation:	
DTC	P0630-SE7946
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	0.02 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Time elapsed after power up ≥ 0 sec

Malfunction Thresholds (all active):
All the values in the VIN are ASCII 0 (HEX 30).

546. P2579-SE12073: Engine Turbocharger 1 Speed - Mechanical System Not Responding or Out of Adjustment

Turbo shaft is seized.Turbo Speed sensor value is zero when engine is running

Monitor Operation:	
DTC	P2579-SE12073
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	1 trip

Pause Conditions (any active):
P22CB-SE7829, P22CC-SE7828
Engine Speed ≤ 1,200 RPM
Total Torque Fueling is ≤ 0mg/stroke
Engine is not in run state.
Compressor bypass valve is open

Malfunction Thresholds (all active):
Cumulative sum of error (15 KRPM - Turbo Speed) in a 30 second period is ever > 4,000 KRPM, which is equivalent to Average of Error >= 13.333 KRPM.

547. P0049-SE3641: Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level

Turbo speed sensor reading greater than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P0049-SE3641
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	5 sec
MIL Activation Criteria	2 trips

Malfunction Thresholds (all active):
Raw Turbo Speed value > 5,500 Hz (220 KRPM)

548. P2580-SE3642: Turbocharger 1 Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level

Turbo speed sensor reading less than specified operating range for a calibrated amount of time.

Monitor Operation:	
DTC	P2580-SE3642
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Pause Conditions (any active):
P22CB-SE7829, P22CC-SE7828
P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489
TBV driver failure (See RefCond0075.)
Ratio of Charge Pressure and Ambient Air Pressure < 1.25 (ratio)
Filtered Engine Speed < 500 RPM
Turbine bypass valve command > 100 %
Bypass Compressor valve is on

Malfunction Thresholds (all active):
Raw Turbo Speed < 250 Hz (10 KRPM), for 5 seconds.

549. P0049-SE2023: Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Least Severe Level

Turbo Speed above normal engine operating range

Monitor Operation:	
DTC	P0049-SE2023
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	Non-OBD

Abort Conditions (any active):

Malfunction Thresholds (all active):
No Derate Torque > RefTable63 Nm for RefTable64 where No Derate Torque is maximum torque at which engine can run without any derate.

550. P206D-SE8691: Aftertreatment Diesel Exhaust Fluid Quality Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Urea Quality Sensor (UQS) concentration sensing element has been shorted to a high voltage source

Monitor Operation:	
DTC	P206D-SE8691
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the enable conditions for the diagnostic are specified as follows (See RefCond0077.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the disable conditions for the diagnostic are specified as follows (See RefCond0078.).

Pause Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: (UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) is not satisfied, AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) is satisfied).

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) is cumulatively satisfied for > 5 seconds, since the last time that (UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) is not satisfied, AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) is not satisfied).
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the WEMA sensors: UQS Concentration detection element voltage shorted out of range high. (See RefCond0082.) is cumulatively satisfied for > 5 seconds, since the last time that (UQS Concentration detection element voltage shorted out of range high. (See RefCond0082.) is not satisfied, AND UQS Concentration detection element voltage shorted out of range low. (See RefCond0083.) is not satisfied, and UQS sensor internal temperature is above the maximum operating range (See RefCond0084.) is not satisfied).

551. P206B-SE6996: Aftertreatment Diesel Exhaust Fluid Quality - Root Cause Not Known

The Urea Quality Sensor (UQS) concentration sensing element has been detected to have an unspecific error.

Monitor Operation:	
DTC	P206B-SE6996
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the enable conditions for the diagnostic are specified as follows (See RefCond0085.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the disable conditions for the diagnostic are specified as follows (See RefCond0086.).

Pause Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: (Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) is not satisfied, AND UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) is satisfied).

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) is cumulatively satisfied for > 5 seconds, since the last time that (UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) is not satisfied, AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) is not satisfied).

552. P207F-SE7282: Aftertreatment Diesel Exhaust Fluid Quality - Data Valid But Below Normal Operating Range - Moderately Severe Level

The Urea Quality Sensor (UQS) has measured the concentration of DEF in the tank to be below the minimum concentration threshold.

Monitor Operation:	
DTC	P207F-SE7282
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the enable conditions for the diagnostic are specified as follows (See RefCond0087.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the disable conditions for the diagnostic are specified as follows (See RefCond0088.).

Pause Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the pause conditions for the diagnostic are specified as follows (See RefCond0089.).

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and The DEF concentration ≤ 22.5 % for a percentage of time > 50 % within a monitoring time window. The monitoring time window is 300 seconds when the initial DEF Tank Temperature at keyon > 10 °C, and 300 seconds, otherwise.

553. P207F-SE7286: Aftertreatment Diesel Exhaust Fluid Quality - Abnormal Rate of Change

The Urea Quality Sensor (UQS) has been unable to generate a concentration estimate for longer than the maximum wait time threshold, due to unsuitable measurement conditions.

Monitor Operation:	
DTC	P207F-SE7286
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	300 seconds when the initial DEF Tank Temperature at keyon > 10 °C, otherwise 300 seconds
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then The enable conditions for the diagnostic are specified as follows (See RefCond0090.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then The disable conditions for the diagnostic are specified as follows (See RefCond0091.).

Pause Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then The pause conditions for the diagnostic are specified as follows (See RefCond0092.).

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: (The Urea Quality Sensor (UQS) smart device controller is in the process of initializing, OR the DEF fluid is frozen or not present).
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the WEMA sensors: (The Urea Quality Sensor (UQS) smart device controller is unable to detect the fluid type and concentration due to unsuitable operating conditions).

554. P2044-SE6981: Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 Sensor Circuit - Voltage Above Normal or Shorted to High Source

The Urea Quality Sensor (UQS) temperature sensing element has been shorted to a high voltage source

Monitor Operation:	
DTC	P2044-SE6981
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the enable conditions for the diagnostic are specified as follows (See RefCond0093.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the disable conditions for the diagnostic are specified as follows (See RefCond0094.).

Pause Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: (Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) is not satisfied) AND (Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) is satisfied OR Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) is satisfied)

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) is cumulatively satisfied for longer than 5 seconds, since the last time that (Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) is not satisfied, AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) is not satisfied).
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the WEMA sensors: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) is cumulatively satisfied for longer than 5 seconds, since the last time that (Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) is not satisfied, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) is not satisfied).

555. P2045-SE6982: Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 Sensor Circuit - Voltage Below Normal or Shorted to Low Source

The Urea Quality Sensor (UQS) temperature sensing element has been shorted to a low voltage source.

Monitor Operation:	
DTC	P2045-SE6982
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the enable conditions for the diagnostic are specified as follows (See RefCond0099.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the disable conditions for the diagnostic are specified as follows (See RefCond0100.).

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) is cumulatively satisfied for longer than 5 seconds, since the last time that (Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) is not satisfied, AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) is not satisfied).
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the WEMA sensors: Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) is cumulatively satisfied for longer than 5 seconds, since the last time that (Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) is not satisfied, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) is not satisfied).

556. P207F-SE8690: Aftertreatment 1 Diesel Exhaust Fluid Property - Root Cause Not Known

The Urea Quality Sensor (UQS) has determined that the fluid type in the DEF tank is something other than DEF.

Monitor Operation:	
DTC	P207F-SE8690
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the enable conditions for the diagnostic are specified as follows (See RefCond0101.).

Abort Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the disable conditions for the diagnostic are specified as follows (See RefCond0102.).

Pause Conditions (any active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) then the pause conditions for the diagnostic are specified as follows (See RefCond0103.).

Malfunction Thresholds (all active):
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the SSI sensors: The fluid type has been detected to be the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is not DEF (See RefCond0104.) for a percentage of time > 50 % for a monitoring time window. The monitoring time window is 300 seconds when the initial DEF Tank Temperature at keyon > 10 °C, and 300 seconds otherwise.
When The Urea Quality Sensor (UQS) is located in tank. (See RefCond0076.) and the OEM has installed the WEMA sensors: The fluid type has been detected to be The sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is not DEF. (See RefCond0105.) for a percentage of time > 50 % for a monitoring time window. The monitoring time window is 300 seconds when the initial DEF Tank Temperature at keyon > 10 °C, and 300 seconds otherwise.

557. P20E8-SE6980: Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Input Lines - Condition Exists

The diagnostic checks whether the Flange Control Unit (FCU) DEF dosing system fails to prime after a calibrated number of attempts.

Monitor Operation:	
DTC	P20E8-SE6980
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF (See RefCond0106.)

Abort Conditions (any active):
The Flange Control Unit (FCU) DEF Supply Module has aborted filling with DEF (See RefCond0107.)
Key switch is turned OFF
Engine is not running

Malfunction Thresholds (all active):
DEF supply pressure does not reach 500 kPa (gauge) within a time window of 20 sec from the time that The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF (See RefCond0106.) for a number of occurrences > 10 counts

558. P202E-SE7927: Aftertreatment 1 Diesel Exhaust Fluid Dosing Valve 1 - Mechanical System Not Responding or Out of Adjustment

The diagnostic checks whether the Flange Control Unit (FCU) DEF Dosing Module Injector valve is mechanically stuck closed or mechanically stuck open based on the minimum pressure variation observed during On/ Off cycle at each injection period.

Monitor Operation:	
DTC	P202E-SE7927
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediately
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P2048-SE5102
Exhaust temperature >= 200 °C for 10 seconds AND The Engine is in Derate and Urea Doser Functional Response Monitor fault is active (See RefCond0108.) is not active
Exhaust Mass flow rate > = 30 g/sec AND The Engine is in Derate and Urea Doser Functional Response Monitor fault is active (See RefCond0108.) is not active
The engine is running
Dosing Not Allowed Flag indicating Dosing command is out of nominal range for Urea Doser Functional Monitor (See RefCond0012.)
The Engine is in Derate and Urea Doser Functional Response Monitor fault is active (See RefCond0108.) is not active
The DEF Flange Control Unit (FCU) Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing (See RefCond0109.)
Supply Module Pressure ≥ 400 kPa(gauge)
The OBD arbitrator allows the diagnostic to run

Abort Conditions (any active):
P2048-SE5102
Exhaust Mass flow rate < 30 g/sec OR The Engine is in Derate and Urea Doser Functional Response Monitor fault is active (See RefCond0108.) is active
The engine is not running
Not [Dosing Not Allowed Flag indicating Dosing command is out of nominal range for Urea Doser Functional Monitor (See RefCond0012.)]
The Engine is in Derate and Urea Doser Functional Response Monitor fault is active (See RefCond0108.) is active
NOT [The DEF Flange Control Unit (FCU) Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing (See RefCond0109.)]
Supply Module Pressure < 400 kPa(gauge)
The OBD arbitrator does not allow the diagnostic to run

Malfunction Thresholds (all active):
When (Maximum DEF Supply Pressure - Minimum DEF Supply Pressure) within one injection cycle < 15 kPa(gauge) for ≥ 2 out of 3 times within each set of diagnostic tests. Diagnostic tests are performed 300 seconds apart. There is a delay between each set of 3 tests. When diagnostic test has run 3 times it will wait for the delay of ((4 hours) OR (120 seconds if (Urea doser functional response error is active. (See RefCond0011.)) is active)).

559. P2048-SE5102: Aftertreatment 1 Diesel Exhaust Fluid Dosing Valve 1 Circuit - Current Below Normal or Open Circuit

DEF Dosing Valve Driver Control Line is shorted to ground, shorted to high voltage or open circuit.

Monitor Operation:	
DTC	P2048-SE5102
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
For malfunction criteria #1, the DEF Dosing Valve command is OFF.
For malfunction criteria #4, the DEF Dosing Valve command is OFF.
For malfunction criteria #5, the DEF Dosing Valve command is OFF.
For malfunction criteria #6, the DEF Dosing Valve command is ON.

Abort Conditions (any active):
For malfunction criteria #1, #3, #4 and #5, the DEF Dosing Valve command is ON.
For malfunction criteria #6, the DEF Dosing Valve command is OFF.

Malfunction Thresholds (all active):
#2 - For shorted to ground detection on the high side, the resistance between DEF Dosing Valve Control High Side Driver Line and Ground < 0.2 Ohms
#5 - For shorted to ground detection on the low side, the resistance between DEF Dosing Valve Control Low Side Driver line and ground < 0.2 Ohms

560. P209F-SE2962: Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Data Valid But Below Normal Operating Range - Moderately Severe Level

The monitor checks whether the Flange Control Unit (FCU) DEF tank temperature has failed to reach a target threshold within a time window after the heating is commanded on.

Monitor Operation:	
DTC	P209F-SE2962
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P202B-SE7134, P202B-SE7135, P202B-SE7136, P202C-SE7131, P202C-SE7132, P202C-SE7137, P202C-SE7138
P20B7-SE7217, P20B8-SE7100
P205C-SE7124, P205D-SE7122, P205E-SE3650, U029D-SE2487
-30 °C < DEF initial tank temperature < -11 °C
Ambient air temperature > -20 °C
DEF tank heater is reported active, as disclosed in AECD 13-3.
The engine is running
Diagnostic has not already completed or aborted in this key cycle

Abort Conditions (any active):
P202B-SE7134, P202B-SE7135, P202B-SE7136, P202C-SE7131, P202C-SE7132, P202C-SE7137, P202C-SE7138
P20B7-SE7217, P20B8-SE7100
P205C-SE7124, P205D-SE7122, P205E-SE3650, U029D-SE2487

Pause Conditions (any active):
(DEF tank temperature ≤ -30 °C) OR (DEF tank temperature ≥ -11 °C)
Ambient air temperature ≤ -20 °C
DEF tank heater is not reported active, as disclosed in AECD 13-3.
The engine is not running

Malfunction Thresholds (all active):
(The DEF Tank Temperature remains < -6 °C AND The DEF Supply Module (SM) has completed pump pressure control and is ready to dose. (See RefCond0110.) is NOT active) after the Engine Control Module (ECM) has sent the SAE Aftertreatment 1 SCR Dosing System Requests 1 (PGN 61476)

message to the Flange Control Unit (FCU) < 20 seconds AND the DEF Tank Heating is commanded active for RefTable66 seconds

561. P2BA7-SE5279: Aftertreatment Diesel Exhaust Fluid Tank Empty - Condition Exists

The monitor checks whether the level of DEF in the tank is low and so inducement to refill the tank is applied

Monitor Operation:	
DTC	P2BA7-SE5279
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, P203F-SE4189, U010E-SE2290

562. P203F-SE2906: Aftertreatment 1 Diesel Exhaust Fluid Tank Level - Data Valid But Below Normal Operating Range - Most Severe Level

The monitor checks whether the DEF tank is empty

Monitor Operation:	
DTC	P203F-SE2906
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U010E-SE2290

Pause Conditions (any active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U010E-SE2290

Malfunction Thresholds (all active):
DEF tank level < 0 %

563. P203F-SE4189: Aftertreatment 1 Diesel Exhaust Fluid Tank Level - Data Valid But Below Normal Operating Range - Most Severe Level

The monitor checks whether there is insufficient DEF in the DEF tank

Monitor Operation:	
DTC	P203F-SE4189
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U010E-SE2290

Pause Conditions (any active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U010E-SE2290

Malfunction Thresholds (all active):
DEF tank level ≤ an OEM defined value which is confined to the range of [19,35]%

564. P203F-SE2907: Aftertreatment 1 Diesel Exhaust Fluid Tank Level - Data Valid But Below Normal Operating Range - Least Severe Level

The monitor checks whether the DEF tank is low

Monitor Operation:	
DTC	P203F-SE2907
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Entry Conditions (all active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U010E-SE2290
P203F-SE2906
P203F-SE4189

Abort Conditions (any active):
P203F-SE2906
P203F-SE4189

Pause Conditions (any active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U010E-SE2290

Malfunction Thresholds (all active):
DEF tank level <= an OEM defined value which is confined to the range of [22,65]%

565. P205E-SE3650: Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature - Data Erratic, Intermittent, or Incorrect

The monitor indicates whether the Flange Control Unit (FCU) DEF tank temperature signal is in-range but not rational

Monitor Operation:	
DTC	P205E-SE3650
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	2 trips

Entry Conditions (all active):
P205C-SE7124, P205D-SE7122, U029D-SE2487
P0117-SE76, P0118-SE75
P0111-SE3793, P0112-SE488, P0113-SE487
A block heater is not detected (See RefCond0111.)
The engine is cold soaked (See RefCond0112.)

Abort Conditions (any active):
P205C-SE7124, P205D-SE7122, U029D-SE2487
P0117-SE76, P0118-SE75
P0111-SE3793, P0112-SE488, P0113-SE487

Malfunction Thresholds (all active):
|DEF tank temperature - Charge temperature measured at keyon| > 30 °C
|DEF tank temperature - coolant temperature measured at keyon| > 30 °C

566. P2263-SE9751: Engine Intake Manifold Pressure System Monitor - Condition Exists

EGR Flow higher or lower than EGR flow target when EGR Flow Controller used up all adjustment allowed.

Monitor Operation:	
DTC	P2263-SE9751
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in run state.
Ambient Air Temperature > -6.67 °C
Ambient Air Pressure > 80 kPa(absolute)
Time which all Enable Conditions have been TRUE ≥ 60 sec

Pause Conditions (any active):
P22CB-SE7829, P22CC-SE7828
P245C-SE2767, P245D-SE2766, P245D-SE3563, P2493-SE4118, P2493-SE4119, P2494-SE3184, P2495-SE3185
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P012B-SE8698, P012B-SE8699, P012B-SE8802, P012C-SE8366, P012D-SE8365, P0237-SE2976, P0238-SE2977, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
The EGR Bypass Valve Position is not known to be good. (See RefCond0030.)
The EGR H-bridge valve position is not known to be good. (See RefCond0029.)
Filtered (tau = 0.011 sec) Charge Temperature ≤ 15 °C
Filtered (tau = 0.011 sec) EGR Orifice Temperature ≤ 15 °C
EGR Actuator Effective Flow Area is greater than 0 cm2 and EBV Actuator Effective Flow Area is greater than 0 cm2
EGR Off Engine Protection is active
EGR Delta P sensor autozero check is not complete

Engine Speed < 550 RPM
Engine Speed > 3,600 RPM
Total Fueling < 0 mg/stroke
Total Fueling > 1,000 mg/stroke
Fresh Air Flow Controller has not used up all adjustments allowed.
EGR valve controller commands it to be closed.

Malfunction Thresholds (all active):
Cumulative sum of absolute error (|Measured EGR Flow - EGR Flow Target|) over a 60 seconds period is ever > 1,350 kg/min, which is equivalent to [Average of absolute Error - Tolerance] >= 2.25 kg/min, where Tolerance is defined as: RefTable68

567. P2263-SE10661: Engine Intake Manifold Pressure System Monitor - Condition Exists

Exhaust pressure higher or lower than Exhaust Pressure target when Exhaust Pressure Controller used up all adjustment allowed.

Monitor Operation:	
DTC	P2263-SE10661
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in run state.
Ambient Air Temperature > -6.67 °C
Ambient Air Pressure > 80 kPa(absolute)
Time which all Enable Conditions have been TRUE ≥ 60 sec

Pause Conditions (any active):
P22CB-SE7829, P22CC-SE7828
P245C-SE2767, P245D-SE2766, P245D-SE3563, P2493-SE4118, P2493-SE4119, P2494-SE3184, P2495-SE3185
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P012B-SE8698, P012B-SE8699, P012B-SE8802, P012C-SE8366, P012D-SE8365, P0237-SE2976, P0238-SE2977, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
The EGR Bypass Valve Position is not known to be good. (See RefCond0030.)
The EGR H-bridge valve position is not known to be good. (See RefCond0029.)
Filtered (tau = 0.011 sec) Charge Temperature ≤ 15 °C
Filtered (tau = 0.011 sec) EGR Orifice Temperature ≤ 15 °C
EGR Actuator Effective Flow Area is greater than 0 cm2 and EBV Actuator Effective Flow Area is greater than 0 cm2
EGR Off Engine Protection is active
EGR Delta P sensor autozero check is not complete

Engine Speed < 550 RPM
Engine Speed > 3,600 RPM
Total Fueling < 0 mg/stroke
Total Fueling > 1,000 mg/stroke
Exhaust Pressure Controller has not used up all adjustments allowed.
Exhaust Pressure Control is active.

Malfunction Thresholds (all active):
Cumulative sum of absolute error (|Measured Exhaust Pressure - Exhaust Pressure Target|) over a 60 seconds period is ever > 65,000 kg/min, which is equivalent to [Average of absolute Error - Tolerance] >= 108.333 kPa, where Tolerance is defined as: RefTable69

568. P2263-SE9750: Engine Intake Manifold Pressure System Monitor - Condition Exists

Charge Flow higher or lower than charge flow target when Charge Flow Controller used up all adjustment allowed.

Monitor Operation:	
DTC	P2263-SE9750
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate.
MIL Activation Criteria	2 trips

Entry Conditions (all active):
Engine is in run state.
Ambient Air Temperature > -6.67 °C
Ambient Air Pressure > 80 kPa(absolute)
Time which all Enable Conditions have been TRUE ≥ 60 sec

Pause Conditions (any active):
P22CB-SE7829, P22CC-SE7828
P245C-SE2767, P245D-SE2766, P245D-SE3563, P2493-SE4118, P2493-SE4119, P2494-SE3184, P2495-SE3185
P0405-SE3203, P0406-SE3202, P046C-SE3869, P0489-SE2798, P0490-SE2797, P0490-SE3582
P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0049-SE3641, P007B-SE3870, P007B-SE4129, P007C-SE2873, P007D-SE2872, P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P012B-SE8698, P012B-SE8699, P012B-SE8802, P012C-SE8366, P012D-SE8365, P0237-SE2976, P0238-SE2977, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493, P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486, P2580-SE3642
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
The EGR Bypass Valve Position is not known to be good. (See RefCond0030.)
The EGR H-bridge valve position is not known to be good. (See RefCond0029.)
Filtered (tau = 0.011 sec) Charge Temperature ≤ 15 °C
Filtered (tau = 0.011 sec) EGR Orifice Temperature ≤ 15 °C
EGR Actuator Effective Flow Area is greater than 0 cm2 and EBV Actuator Effective Flow Area is greater than 0 cm2
EGR Off Engine Protection is active
EGR Delta P sensor autozero check is not complete

Engine Speed < 550 RPM
Engine Speed > 3,600 RPM
Total Fueling < 0 mg/stroke
Total Fueling > 1,000 mg/stroke
Charge Flow Controller has not used up all adjustments allowed.

Malfunction Thresholds (all active):
Cumulative sum of absolute error (|Measured Charge Flow - Charge Flow Target|) over a 60 seconds period is ever > 600 kg/min, which is equivalent to [Average of absolute Error - Tolerance] >= 1 kg/min, where Tolerance is defined as: RefTable70

569. P0088-SE3239: Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level

During Volume Control Valve [VCV] control mode, the VCV high rail pressure error is set when the measured fuel rail pressure exceeds the setpoint by more than a calibratable amount [based on Engine Speed] AND the setpoint value of fuel volume flow through the VCV is less than or equal to a calibratable value.

Monitor Operation:	
DTC	P0088-SE3239
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P009C-SE4715
P0182-SE1024, P0183-SE1023
Fuel Rail Pressure control is only by Volume Control Valve in closed loop.
Service procedure for high pressure test should not be running.
Fuel Temperature > 15 °C
Injection Quantity > 4 mg/stroke

Malfunction Thresholds (all active):
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure > RefTable9 bar
High Pressure Pump Delivery Volume Set Point ≤ -0 m3/sec

570. P0087-SE3237: Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

The Volume Control Valve [VCV] low rail pressure error is set when the measured fuel rail pressure is below the setpoint by more than a calibratable amount [based on engine speed] AND the setpoint value of fuel volume flow through the VCV exceeds a calibratable threshold during pressure control in VCV mode.

Monitor Operation:	
DTC	P0087-SE3237
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
P0087-SE3236, P0087-SE6789, P0088-SE3238, P0088-SE6785, P009C-SE4715
Fuel Rail Pressure control is only by Volume Control Valve in closed loop.
Service procedure for high pressure test should not be running.
Fuel Level > 14.898 %

Malfunction Thresholds (all active):
Commanded Fuel Rail Pressure - Actual Fuel Rail Pressure > RefTable10 bar
High Pressure Pump Delivery Volume Set Point ≥ 0 m3/sec

571. P0254-SE3261: Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage Above Normal or Shorted to High Source

The Fuel Rail Volume Control Valve (VCV) driver voltage is below a fixed threshold while the PWM driver is in the "OFF" state.

Monitor Operation:	
DTC	P0254-SE3261
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	220 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Volume Control Valve [PCV] Pulse Width Modulated [PWM] signal is in the "OFF" state.

Pause Conditions (any active):

Malfunction Thresholds (all active):
2.7 V < VCV driver voltage < 5 V

572. P0254-SE4716: Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage Above Normal or Shorted to High Source

The Fuel Rail Volume Control Valve (VCV) driver voltage is above a fixed threshold while the PWM driver is in the "ON" state.

Monitor Operation:	
DTC	P0254-SE4716
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	220 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Volume Control Valve [VCV] Pulse Width Modulated [PWM] signal is in the "ON" state.

Pause Conditions (any active):

Malfunction Thresholds (all active):
VCV driver voltage > 600 mV

573. P0253-SE4717: Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage Below Normal or Shorted to Low Source

The Fuel Rail Volume Control Valve (VCV) driver voltage is below a fixed threshold while the PWM driver is in the "OFF" state.

Monitor Operation:	
DTC	P0253-SE4717
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	280 msec
MIL Activation Criteria	2 trips

Entry Conditions (all active):
The Volume Control Valve [PCV] Pulse Width Modulated [PWM] signal is in the "OFF" state.

Pause Conditions (any active):

Malfunction Thresholds (all active):
VCV driver voltage < 2.7 V

574. P0501-SE4361: Wheel-Based Vehicle Speed - Data Erratic, Intermittent, or Incorrect

Vehicle Speed Sensor Stuck In Range Error.

Monitor Operation:	
DTC	P0501-SE4361
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	600 sec
MIL Activation Criteria	1 trip

Entry Conditions (all active):
Road speed governor is inactive
Cruise control is inactive
Remote accelerator is inactive
Vehicle Speed > 0 mph
Accelerator pedal position ≥ 10 %
Auxiliary device is not in control of the engine.
Vehicle Speed < 37.282 mph

Abort Conditions (any active):
P0501-SE130
Vehicle Speed = 0 mph
Road speed governor is active
Cruise control is active
Remote accelerator is active
Accelerator pedal position < 10 %
Auxiliary device is in control of the engine.
Vehicle Speed ≥ 37.282 mph

Malfunction Thresholds (all active):
Difference between min and max vehicle speeds attained within a time window is less than 0.621 mph, while pedal position has changed by 20 % atleast 50 number of times in the time window.

575. P0501-SE130: Wheel-Based Vehicle Speed - Data Erratic, Intermittent, or Incorrect

Vehicle Speed Signal is lost while vehicle is stationary or while vehicle is moving.

Monitor Operation:	
DTC	P0501-SE130
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	1 sec
MIL Activation Criteria	1 trip

Pause Conditions (any active):
Auxiliary device is in control of the engine.
Remote accelerator is active

Malfunction Thresholds (all active):
For Physical Sensors and Datalink sensors: Vehicle Speed = 0 mph
Engine Speed > 10 RPM
((Boost transition counter >= 60 counts) OR (Net Brake Torque > 150 Nm FOR ≥ 15 sec))
Idle Validation counter >= 10 counts
Where Idle Validation Counter is incremented on Idle transitions from idle to non-idle, and Boost transition counter is incremented when Boost goes above 20 kPa(gauge) FOR ≥ 5 sec.
Additional check for physical sensors: After the engine has been running for ≥ 300 sec, (Engine Torque > 116 Nm) AND (Unfiltered Vehicle Speed = 0 mph) AND (Filtered Vehicle Speed > 9.942 mph)

576. P2269-SE280: Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Least Severe Level

Water has been detected in the fuel filter

Monitor Operation:	
DTC	P2269-SE280
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	20 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Water In Fuel Sensor Voltage ≤ 2.891 V

577. P0169-SE1612: Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Moderately Severe Level

The Water In Fuel sensor indicates that water has been detected in the fuel filter for an extensive amount of time or distance traveled.

Monitor Operation:	
DTC	P0169-SE1612
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Distance Traveled with Water In Fuel Detected ≥ 500.203 miles

578. P2267-SE660: Water in Fuel Indicator Sensor Circuit - Voltage Above Normal or Shorted to High Source

Water In Fuel Out of Range Error High

Monitor Operation:	
DTC	P2267-SE660
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	10 sec
MIL Activation Criteria	Non-OBD

Malfunction Thresholds (all active):
Filtered output value of the Water in Fuel sensor > 4.912 V

579. P262A-SE7697: Engine Emissions Closed Loop Fueling Adjustment - Data Erratic, Intermittent, or Incorrect

The Zero Fuel Calibration [ZFC] function is not learning the injector deviation for a calibrated time duration.

Monitor Operation:	
DTC	P262A-SE7697
Monitor Execution	Continuous
Monitor Sequence	None
Sensors OK	None
Typical Monitoring Duration	Immediate
MIL Activation Criteria	1 trip

Entry Conditions (all active):
A-type: Engine Motoring time ≥ 0 sec
A-type: P262A-SE7697 has not made a decision at anytime during the driving cycle
A-type: Ambient Air pressure > 0 kPa(absolute)
A-type: Intake Air temperature > -10 °C
A-type: Battery voltage > 10 V
A-type: The combustion chamber is warm: The commanded injection quantity > 5 mg/stroke for 10 sec
B-type: (Rate of change of Engine speed) to (average Engine speed) ratio < 0.012 (ratio)
B-type: Duration after gear change ≥ 0 sec

Abort Conditions (any active):
P262A-SE7697 has made a decision at anytime during the driving cycle
Ambient Air pressure ≤ 0 kPa(absolute)
Intake Air temperature ≤ -10 °C
Battery voltage ≤ 10 V
The combustion chamber has cooled: The duration of Motoring ≥ RefTable71

Malfunction Thresholds (all active):
ZFC learning not happening for 120 sec (short timer) while all A-type and B-type enable conditions have been met

580. RefCond0001: Aftertreatment Outlet NOx sensor O2 reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off.

Aftertreatment Outlet NOx sensor O2 reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off.

Conditions (all active):
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
The aftertreatment outlet NOx sensor has reached its internal working temperature of 800 degC.
NOx sensor O2 reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0114.) for 0 seconds
(10.8 V < Aftertreatment outlet NOx sensor battery supply voltage is < 16.5 V) for 0.2 seconds.
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.) AND sensor supply power >= 6 V for 150 seconds

581. RefCond0002: Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off.

Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off.

Conditions (all active):
P220B-SE5988, P229E-SE5987, P229E-SE5990, P229F-SE5986, U029E-SE2488
The aftertreatment outlet NOx sensor has reached its internal working temperature of 800 degC.
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.) for 0.2 seconds
(10.8 V < Aftertreatment outlet NOx sensor battery supply voltage is < 16.5 V) for 0.2 seconds.
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.) AND sensor supply power >= 6 V for 150 seconds

582. RefCond0003: Fault Inhibit Time has elapsed

Fault Inhibit Time has elapsed

Conditions (all active):
Time since Key On > 2,000 msec

583. RefCond0005: Any Active Air Temperature System Errors

Any Active Air Temperature System Errors

Conditions (all active):
P1191-SE4190, P1192-SE484, P1193-SE486

584. RefCond0006: The in-tank mounted measurement of the DEF tank temperature is Data Valid.

The in-tank mounted measurement of the DEF tank temperature is Data Valid.

Conditions (all active):
P205C-SE7124, P205D-SE7122, P205E-SE3650, U029D-SE2487
Keyswitch is ON since 1 seconds.
1 seconds elapsed since datalink sensor starts communicating with DCU (Dosing Control Unit).

585. RefCond0007: The in-tank mounted measurement of the DEF tank temperature is suspect

The in-tank mounted measurement of the DEF tank temperature is suspect

Conditions (all active):
P205C-SE7124, P205D-SE7122, P205E-SE3650, U029D-SE2487
(Keyswitch is OFF OR Time elapsed since Keyswitch is ON < 1 seconds.)
1 seconds are not elapsed since datalink sensor starts communicating with Dosing Control Unit.
The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.) at previous sample.

586. RefCond0008: Reset for Urea Delivery Monitor Diagnostic Cumulative Sum (CUSUM) calculation.

Reset for Urea Delivery Monitor Diagnostic Cumulative Sum (CUSUM) calculation.

Conditions (all active):
(DEF dosing pump speed new Offset value - Adjusted Offset value) < -30 rpm.
Urea Delivery Monitor Pump Speed Offset Update. (See RefCond0115.)

587. RefCond0009: Urea Delivery Monitor Key Switch/Operation Cycle Enable.

Urea Delivery Monitor Key Switch/Operation Cycle Enable.

Conditions (all active):
Key Switch is triggered ON OR there is change in Operation Cycle.
P218F-SE8289 test not completed.

588. RefCond0010: Urea Delivery Monitor Cusum Enable.

Urea Delivery Monitor Cusum Enable.

Conditions (all active):
Urea Delivery Monitor Pre-Enable (Based on input sensor prerequisites and limit considerations). (See RefCond0116.)
Urea Delivery Monitor Pre-Enable (Based on input sensor prerequisites and limit considerations). (See RefCond0116.) for < 120 seconds OR Urea Delivery Monitor Pump Speed Offset Update. (See RefCond0115.) .
Number of prior occurrences of Urea Delivery Monitor Pump Speed Offset Update. (See RefCond0115.) event ≥ 1 count.

589. RefCond0011: Urea doser functional response error is active.

Urea doser functional response error is active.

Conditions (all active):
P202E-SE7927

590. RefCond0012: Dosing Not Allowed Flag indicating Dosing command is out of nominal range for Urea Doser Functional Monitor

Dosing Not Allowed Flag indicating Dosing command is out of nominal range for Urea Doser Functional Monitor

Conditions (all active):
The calculated intrusive dosing command injection period > 6 sec
OR
The calculated intrusive dosing command injection period < 1 sec

591. RefCond0013: DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty.

DOC Inlet Temperature sensor reading is suspected and not yet confirmed as faulty.

Conditions (all active):
DOC Inlet Temperature sensor signal contains invalid data.
DOC Inlet temperature sensor value is out of range.

592. RefCond0014: DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty.

DOC Outlet Temperature sensor reading is suspected and not yet confirmed as faulty.

Conditions (all active):
DOC Outlet Temperature sensor signal contains invalid data.
DOC Outlet temperature sensor value is out of range.

593. RefCond0015: DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty.

DPF Outlet Temperature sensor reading is suspected and not yet confirmed as faulty.

Conditions (all active):
DPF Outlet Temperature sensor signal contains invalid data.
DPF Outlet temperature sensor value is out of range.

594. RefCond0016: Conditions that enable the calculation of conversion efficiency of an oxidation catalyst.

Conditions that enable the calculation of conversion efficiency of an oxidation catalyst.

Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
DOC inlet temperature > 280 °C
Catalyst intake temperature 1 > 280 °C
Hydrocarbon Desorption (HCD) Mode is not requested
Exhaust flow < 250 g/sec
Rate of active/intrusive injection of hydrocarbons in exhaust > 0.26 g/sec
Active/intrusive injection of hydrocarbons in exhaust is > 0.26 g/s for at least 130 continuous sec, within the current drive cycle.
Exhaust flow > 50 g/sec
A new active regeneration of the DPF is initiated.

595. RefCond0017: System errors that could abort the calculation of conversion efficiency of an oxidation catalyst.

System errors that could abort the calculation of conversion efficiency of an oxidation catalyst.

Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P2031-SE2844, P2032-SE6732, P2033-SE6731, P2033-SE6736
NOT [%O2 reading of Exhaust Air (See RefCond0022.)].

596. RefCond0018: Conditions that pause the calculation of conversion efficiency of an oxidation catalyst.

Conditions that pause the calculation of conversion efficiency of an oxidation catalyst.

Conditions (all active):
Time, within a single regeneration event, after active/intrusive injection of hydrocarbons into exhaust is stopped is > 60 sec
OR
DOC inlet temperature ≤ 280 °C
OR
First Catalyst intake temperature ≤ 280 °C
OR
Exhaust flow ≥ 250 g/sec
OR
Rate of active/intrusive injection of hydrocarbons in exhaust ≤ 0.26 g/sec
OR
Time in which active/intrusive injection of hydrocarbons in exhaust is above 0.26 g/sec for < 130 sec
OR
Exhaust flow ≤ 50 g/sec
OR
(DOC out temperature - First Catalyst intake temperature) < 50 °C

597. RefCond0021: the system detects that the DPF is no longer new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load.

the system detects that the DPF is no longer new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load.

Conditions (all active):
Regeneration of DPF is completed at least once, OR engine speed is > 1,000 rpm for 60 seconds.

598. RefCond0022: %O2 reading of Exhaust Air

%O2 reading of Exhaust Air

Conditions (all active):
P0102-SE3207, P0103-SE3206, P0106-SE3651, P0106-SE3652, P0106-SE4439, P0107-SE490, P0108-SE489, P0111-SE3793, P0111-SE4067, P0111-SE4070, P0112-SE488, P0113-SE487, P040B-SE3872, P040B-SE3876, P040B-SE3877, P040B-SE3878, P0471-SE3922, P0471-SE3924, P0471-SE4442, P0472-SE494, P0473-SE493
OR Fuel system failure is present (See RefCond0064.)

599. RefCond0023: the system considers that the DPF is new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load.

the system considers that the DPF is new, or "green". New DPF temporarily exhibits high backpressure during their first hours of use which can lead to a false high estimation of soot load.

Conditions (all active):
Regeneration of DPF has not been completed over the life of the DPF.
Over the life of the DPF, engine speed has not been > 1,000 rpm for 60 seconds.

600. RefCond0024: Malfunction criteria has occured that aborts the current active regeneration of the DPF (Ineffective regeneration).

Malfunction criteria has occured that aborts the current active regeneration of the DPF (Ineffective regeneration).

Conditions (all active):
DPF inlet temperature < regeneration target temperature - 50 °C
Rate of active/intrusive injection of hydrocarbons in exhaust ≥ 0.3 g/sec
Sum of the calculated soot oxidation rate and calculated soot NOx-idation rate ≤ 54 g/hr. (NOx-idation refers to the oxidation of soot from nitric oxides (NO2), which generally occurs at temperatures between about 250 degC and 400 degC)
When the above conditions for an Ineffective regeneration exists for a persistence time, the regeneration is considered as ineffective. The persistence time to detect an ineffective DRP Regeneration is based on the type of Regeneration and takes one of the following value: 3,600 seconds for Timer based regeneration. 3,600 secondsfor DPF High Back Pressure based regeneration. 3,600 seconds for high Soot load based regeneration . 3,600 seconds for Deep Clean based regeneration. 3,600 seconds for Special Non-Mission Regeneration. 3,600 seconds is the default time. 6,000 seconds for DRP Regeneration. 3,000 seconds for DOC Regeneration. If more than 1 trigger is active, duration time is the maximum of the respective regeneration time.

601. RefCond0025: Active errors within the SCR system that will disable active/intrusive injection of HC's into the exhaust in order to protect the SCR system

Active errors within the SCR system that will disable active/intrusive injection of HC's into the exhaust in order to protect the SCR system

Conditions (all active):
P214D-SE2889
OR
P214B-SE5292
OR
P214D-SE5293

602. RefCond0026: EGR Bypass valve is cycling its position to break free from being stuck.

EGR Bypass valve is cycling its position to break free from being stuck.

Conditions (all active):
When EGR Bypass Valve gets stuck and the target position is not reached, the valve is cycled away from the blockage and toward the target position for 3 times. If the EGR bypass valve feedback position meets the target position or whenever the EGR bypass valve command changes, commmand >= feedback position to command < feedback position or commmand < feedback position to command >= feedback position, the valve cycling is discontinued.

603. RefCond0029: The EGR H-bridge valve position is not known to be good.

The EGR H-bridge valve position is not known to be good.

Conditions (all active):
P0405-SE3203, P0406-SE3202

604. RefCond0030: The EGR Bypass Valve Position is not known to be good.

The EGR Bypass Valve Position is not known to be good.

Conditions (all active):
P2494-SE3184, P2495-SE3185

605. RefCond0031: Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element.

Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element.

Conditions (all active):
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
The exhaust temperature as measured by the sensor closest to the Aftertreatment Inlet NOx sensor > 150 degC for Indicates the time duration at which the inlet temperature must be above the high hysteresis threshold before dew point is exceeded. (See RefCond0117.) seconds.
Engine is runing OR Engine is not running for < 15 sec

606. RefCond0032: Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached.

Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached.

Conditions (all active):
P0544-SE2858, P0545-SE6730, P0546-SE6729, P0546-SE6735, P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168
OR the exhaust temperature as measured by the sensor closest to the Aftertreatment Inlet NOx Sensor < 140 degC
OR The exhaust temperature as measured by the sensor closest to the Aftertreatment Inlet NOx Sensor > 150 degC for less than Indicates the time duration at which the inlet temperature must be above the high hysteresis threshold before dew point is exceeded. (See RefCond0117.) seconds
OR Engine is not running for > 15 sec

607. RefCond0033: the Flange Control Unit (FCU) Heater voltage is below operational range condition

the Flange Control Unit (FCU) Heater voltage is below operational range condition

Conditions (all active):
FCU Heater supply voltage < 8.99 V for longer than 2 seconds

608. RefCond0034: The Vehicle is in an enabled gear and the Engine speed is within a calibratable range.

The Vehicle is in an enabled gear and the Engine speed is within a calibratable range.

Conditions (all active):
The Vehicle is in 6th gear AND Engine speed is within the desired range of [1,150 , 2,250] rpm OR
The Vehicle is in 5th gear AND Engine speed is within the desired range of [1,150 , 2,250] rpm OR
The Vehicle is in 4th gear AND Engine speed is within the desired range of [1,150 , 2,250] rpm

609. RefCond0035: The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range).

The Vehicle is not in an enabled gear OR (the Vehicle is in an enabled gear AND the Engine speed is outside of a calibratable range).

Conditions (all active):
(The Vehicle is in 6th gear AND Engine speed is outside the desired range of [1,150 , 2,250] rpm
OR
The Vehicle is in 5th gear AND Engine speed is outside the desired range of [1,150 , 2,250] rpm
OR
The Vehicle is in 4th gear AND Engine speed is outside the desired range of [1,150 , 2,250] rpm
OR
The Vehicle is in 3rd gear
OR
The Vehicle is in 2nd gear
OR
The Vehicle is in 1st gear
OR
The Vehicle is in Neutral.)

610. RefCond0036: Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics.

Datalinks-related faults are inhibited for a calibratable amount of time following a key-on event, a low battery voltage event, an engine cranking event, and a stop/suspend broadcast event. This is to allow reasonable time for datalink devices to power up and begin periodic broadcasts before the ECM performs time-out diagnostics.

Conditions (all active):
((Engine Position Sensor has determined that the engine has transitioned from stopped to a non-stopped state. AND Engine Speed > (Idle reference speed - 100) rpm.) AND Battery Voltage > 9 Volts. AND J1939 DM13 stop broadcast message has not been active. AND Key Switch is ON) for at least 30,000 msec.

611. RefCond0037: Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time.

Aftertreatment Inlet NOx sensor reading is not valid due to the internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature has not been met or dewpoint temperature has been meet for less than a light off time.

Conditions (all active):
P2202-SE5151, P2202-SE5153, P220A-SE5152, U029D-SE2487
OR Exhaust gas temperature is below a threshold or above a threshold for insufficient time representing that dew point is not reached. (See RefCond0032.)
OR Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0031.) for less than 150 seconds
OR NOx sensor reading is not valid due to internal control loops within the sensor being unstable.. (See RefCond0038.)
OR Aftertreatment inlet NOx sensor has not reached its internal working temperature of 800 °C.
OR Aftertreatment Inlet NOx sensor supply voltage > 16.5 V or Aftertreatment Inlet NOx sensor supply voltage < 10.8 V

612. RefCond0038: NOx sensor reading is not valid due to internal control loops within the sensor being unstable..

NOx sensor reading is not valid due to internal control loops within the sensor being unstable..

Conditions (all active):
[Ref/M2] The voltage between the sensor measuring electrode in the 2nd pumping chamber and the air reference electrode is not within 40 mV of its setpoint for over 0.2 seconds.
OR [P+/M2] The rate of change in current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode(directly exposed to exhaust gas) is not within 42.6 nA/msec for over 20 ms.
OR [M1/P+] The current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas) is larger than 19 uA or less than -40 uA for over 0.2 seconds.
OR [M1/P+] The current from the sensor pumping electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas) is not within 2.4 uA of its setpoint for over 2 seconds.

613. RefCond0039: Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element.

Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element.

Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
The SCR Out temperature as measured by the sensor closest to the SONOx sensor is above a processed threshold for a calculated period of time. (See RefCond0118.)
Engine is not running for time period < 0.2 sec
NOT [NOx Outlet sensor SCR hot start delay logic is allowed to run. (See RefCond0119.)]

614. RefCond0040: Exhaust gas temperature is below a threshold representing that dew point is not reached

Exhaust gas temperature is below a threshold representing that dew point is not reached

Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685
OR
The SCR Out temperature as measured by the thermistor closest to the SONOx sensor < 150 degC.
OR
Engine is not running for > 0.2 sec
OR
NOx Outlet sensor SCR hot start delay logic is allowed to run. (See RefCond0119.)

615. RefCond0041: NOx sensor reading is valid since the internal control loops within the sensor have stabilized.

NOx sensor reading is valid since the internal control loops within the sensor have stabilized.

Conditions (all active):
[Ref/M2] The voltage between the sensor measuring electrode in the 2nd pumping chamber and the air reference electrode is within 40 mV of its setpoint for over 0.2 seconds.
OR [P+/M2] The rate of change in current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode(directly exposed to exhaust gas) is within 42.6 nA/msec for over 20 ms.
OR [M1/P+] The current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas) < 19 uA OR [M1/P+] The current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas)> -40 uA for over 0.2 seconds.
OR [M1/P+] The current from the sensor pumping electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas) is within 2.4 uA of its setpoint for over 2 seconds.

616. RefCond0043: When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency.

When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency.

Conditions (all active):
Target SCR conversion efficiency correction is started when NH3 Slip Detection module to detect if NH3 slip is causing a drop in SCR conversion efficiency (See RefCond0123.) is active. Target SCR conversion efficiency correction ends: (When Rate of change of Filtered SCR Conversion Efficiency >1%/sec AND Filtered SCR Conversion Efficiency>92%) OR Actual SCR Conversion Efficiency >= Target SCR Conversion Efficiency OR Filtered SCR conversion efficiency correction timer >= 60sec.

617. RefCond0044: Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met.

Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met.

Conditions (all active):
The aftertreatment outlet NOx sensor has not reached its internal working temperature of 800 degC.
OR
150 sec has not expired after Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.) reached
OR
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.) for < 0.2 seconds
OR
(Aftertreatment outlet NOx sensor battery supply voltage is < 10.8 V) OR (Aftertreatment outlet NOx sensor battery supply voltage is > 16.5 V)
OR U029E-SE2488

618. RefCond0045: Enable conditions for the algorithm that detects an ineffective regeneration of the DPF.

Enable conditions for the algorithm that detects an ineffective regeneration of the DPF.

Conditions (all active):
Active regeneration of the DPF is occurring.

619. RefCond0046: Abort conditions for the algorithm that detects an ineffective regeneration of the DPF.

Abort conditions for the algorithm that detects an ineffective regeneration of the DPF.

Conditions (all active):
Active regeneration of the diesel particulate filter is not occurring.

620. RefCond0047: Pause conditions for the algorithm that detects an ineffective regeneration of the DPF.

Pause conditions for the algorithm that detects an ineffective regeneration of the DPF.

Conditions (all active):
DPF inlet temperature ≥ regeneration target temperature -50 °C
OR
Rate of active/intrusive injection of hydrocarbons in exhaust < 0.3 g/sec
OR
Sum of calculated soot oxidation rate and calculated soot NOx-idation rate > 54 g/hr (NOx-idation is oxidation of soot from nitric oxides (NO2) which generally occurs at temperatures between about 250 degC and 400 degC.)

621. RefCond0048: SCR Bed temperature reset condition based on the module off time.

SCR Bed temperature reset condition based on the module off time.

Conditions (all active):
SCR bed temperature <= 425 degC OR SCR bed temperature < 400 degC
Module off time status is not valid OR Module off time <= 86,400 sec.

622. RefCond0049: Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met.

Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met.

Conditions (all active):
The aftertreatment outlet NOx sensor has not reached its internal working temperature of 800 degC.
OR
P220B-SE5988
OR
P229E-SE5990
OR
P229E-SE5987
OR P229F-SE5986
OR U029E-SE2488
OR
NOx sensor reading is not valid due to internal control loops within the sensor being unstable.. (See RefCond0038.)
OR
(Aftertreatment outlet NOx sensor battery supply voltage is < 10.8 V) OR (Aftertreatment outlet NOx sensor battery supply voltage is > 16.5 V)
OR
Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.)
OR U059F-SE5989
OR
P22A7-SE5051
OR
P22A7-SE5982
OR
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.)
OR
150 sec has expired after Exhaust gas temperature is above a threshold representing the point at which there is no longer a concern of condensation on the NOx sensor element. (See RefCond0039.) reached

623. RefCond0050: SCR Bed temperature reset condition based on the module off time.

SCR Bed temperature reset condition based on the module off time.

Conditions (all active):
SCR bed temperature > 425 degC OR SCR bed temperature >= 400 degC
OR
Module off time status is valid AND Module off time > 86,400 sec.

624. RefCond0051: All common enable condition for control loop used up is active

All common enable condition for control loop used up is active

Conditions (all active):
Ambient Air Density ≥ 0.933 kg/m3
Ambient Air Temperature ≥ -6.7 °C
Ambient Air Pressure ≥ 75 kPa(absolute)
Ammonia Storage Timer > Threshold for ammonia storage timer based on ANR compensation in feedback control (See RefCond0125.) Where: Ammonia Storage Timer resets to zero when estimated SCR Catalyst Bed temperature > 450 degC. Ammonia Storage Timer resets to 60 sec or remains at the current value, whichever is lower, when Engine stops OR estimated SCR Catalyst Bed temperature <= 110 degC OR any of the Abort Conditions change from Inactive to Active OR NH3 storage used up counter is reset (See RefCond0127.) changes from Inctive to Active. Ammonia Storage Timer increments when Exhaust gas mass flow rate >= 25 g/sec AND (DEF dosing command > 0.005 ml/sec OR (Closed loop control of DEF dosing is allowed (See RefCond0128.) is active AND Commanded Ammonia to NOx Ratio at SCR Inlet <= 0 unitless)) AND all of the Abort Conditions are Inactive. Ammonia Storage Timer decrements when Ammonia storage counter decrement enable condition (See RefCond0129.) is met. Ammonia Storage Timer Increments and Decrements in intervals of 0.2 seconds.
20 g/sec <=Exhaust gas mass flow rate <= 150 g/sec for 5 seconds.
Injection rate command >= 0.02 ml/s for 5 seconds.
SCR Catalyst Bed Temperature > 170 °C
SCR Catalyst Bed temperature rate change is <= RefTable76 OR (SCR Catalyst Bed temperature rate of change is < RefTable77 for a minimum cumulative time of RefTable78. OR (Maximum SCR Catalyst Bed temperature - Estimated SCR Catalyst Bed temperature) > 120 Deg C for RefTable79.)
Intake NOx reading status is Data Valid.
Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)
Closed loop control of DEF dosing is allowed (See RefCond0128.)

625. RefCond0052: SCR Inner loop used up enable conditions are true.

SCR Inner loop used up enable conditions are true.

Conditions (all active):
(
SCR Conversion Efficiency Relay feedback mode is commanding high dosing for accelerated ammonia storage in SCR first brick (See RefCond0055.)
OR
Target SCR conversion efficiency > switching threshold * 5 scalar
Where
switching threshold =RefTable56
)
All common enable condition for control loop used up is active (See RefCond0051.)

626. RefCond0054: SCR Conversion Efficiency Relay feedback mode is commanding very high ANR.

SCR Conversion Efficiency Relay feedback mode is commanding very high ANR.

Conditions (all active):
(Target SCR Conversion Efficiency - Actual SCR Conversion Efficiency) > RefTable56

627. RefCond0055: SCR Conversion Efficiency Relay feedback mode is commanding high dosing for accelerated ammonia storage in SCR first brick

SCR Conversion Efficiency Relay feedback mode is commanding high dosing for accelerated ammonia storage in SCR first brick

Conditions (all active):
Actual SCR Conversion Efficiency ≤ 0% AND Target SCR Conversion Efficiency ≥ 100% AND SCR In temperature ≤ 260°C AND Estimated SCR Catalyst Bed temperature ≤ 250°C
OR
Regen is not active AND SCR In temperature ≤ 260°C AND Estimated SCR Catalyst Bed temperature <= 250°C AND Ambient air temperature >= 0°C AND Ammonia Storage Accumulation Timer < 50ml. Where: Ammonia Storage Accumulation Timer resets to zero when Auto non mission regen is active. Ammonia Storage Timer increments when estimated SCR Catalyst Bed temperature <= 300 °C Ammonia Storage Accum Timer Increments when (Actual dosing command - stoichiometric dosing command) is in the intervals of 0.2 seconds.

628. RefCond0056: Urea Doser Functional Response Monitor is ready to update the fault.

Urea Doser Functional Response Monitor is ready to update the fault.

Conditions (all active):
Urea Doser Functional Response Monitor has reached the minimum number of 3 (unitless) decisions to make a pass or a fail decision.

629. RefCond0057: Engine control module off time is greater thean a calibrated threshold.

Engine control module off time is greater thean a calibrated threshold.

Conditions (all active):
Engine control Module Off Time > 864,000 sec

630. RefCond0059: DeNOx reference dip maneuver for limiting NH3 slip is active.

DeNOx reference dip maneuver for limiting NH3 slip is active.

Conditions (all active):
NH3 slip is detected.
Control catalyst efficiency is < Target catalyst efficiency for more than 0.2 seconds.

631. RefCond0064: Fuel system failure is present

Fuel system failure is present

Conditions (all active):
P0087-SE10027, P0087-SE3236, P0087-SE3237, P0087-SE6787, P0087-SE6789, P0087-SE6790, P0088-SE10028, P0088-SE3238, P0088-SE3239, P0088-SE6780, P0088-SE6783, P0088-SE6785
P020A-SE6791, P020A-SE6799, P020B-SE6792, P020B-SE6800, P020C-SE6798, P020C-SE6806, P020D-SE6795, P020D-SE6803, P020E-SE6796, P020E-SE6804, P020F-SE6797, P020F-SE6805, P021A-SE6793, P021A-SE6801, P021B-SE6794, P021B-SE6802
P0263-SE7472, P0266-SE7473, P0269-SE7480, P026B-SE7471, P0272-SE7477, P0275-SE7478, P0278-SE7479, P0281-SE7475, P0284-SE7476
P0191-SE4713, P0191-SE6941, P0192-SE1403, P0193-SE1402
P0606-SE6844, P0606-SE6845, P0606-SE6862, P0606-SE6863, P0606-SE6881, P0606-SE6882
P0201-SE3357, P0202-SE3358, P0203-SE3359, P0204-SE3360, P0205-SE3361, P0206-SE3362, P0207-SE3363, P0208-SE3364, P0261-SE6892, P0262-SE4673, P0264-SE6893, P0265-SE4674, P0267-SE6899, P0268-SE4680, P0270-SE6896, P0271-SE4677, P0273-SE6897, P0274-SE4678, P0276-SE6898, P0277-SE4679, P0279-SE6894, P0280-SE4675, P0282-SE6895, P0283-SE4676, P02EE-SE6854, P02EF-SE6855, P02F0-SE6861, P02F1-SE6858, P02F2-SE6859, P02F3-SE6860, P02F4-SE6856, P02F5-SE6857, P0606-SE6842, P0606-SE6843, P2146-SE6840, P2149-SE6841
P0300-SE7400, P0301-SE7393, P0302-SE7394, P0303-SE7399, P0304-SE7396, P0305-SE7397, P0306-SE7398, P0307-SE7395, P0308-SE7454
P0335-SE4372, P0335-SE6886

632. RefCond0065: First SCR Temperature sensor reading is suspected and not yet confirmed as faulty.

First SCR Temperature sensor reading is suspected and not yet confirmed as faulty.

Conditions (all active):
First SCR Temperature sensor signal contains invalid data.
First SCR temperature sensor value is out of range.

633. RefCond0066: SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty.

SCR Outlet Temperature sensor reading is suspected and not yet confirmed as faulty.

Conditions (all active):
SCR Outlet Temperature sensor signal contains invalid data.
SCR Outlet temperature sensor value is out of range.

634. RefCond0067: Slow Actuator Response: The engine conditions must be appropriate to avoid a false detect of a stuck actuator.

Slow Actuator Response: The engine conditions must be appropriate to avoid a false detect of a stuck actuator.

Conditions (all active):
The Engine is Running.

635. RefCond0068: Slow Actuator Response: The TBV smart device has detected that it cannot meet its commanded position within an acceptable time.

Slow Actuator Response: The TBV smart device has detected that it cannot meet its commanded position within an acceptable time.

Conditions (all active):
(The difference between the TBV smart device's received commanded position and its internally measured position is greater than 9.3 %) AND (the TBV smart device's motor effort is greater than 0 % Motor Effort (at standard voltage for the application)) for 1.5 seconds.

636. RefCond0069: Message Timeout: The TBV smart device has not received a position command message for greater than or equal to a calibrated time after previously having received a command message.

Message Timeout: The TBV smart device has not received a position command message for greater than or equal to a calibrated time after previously having received a command message.

Conditions (all active):
Message Timeout: The TBV smart device actuator has not received a command message from the controlling ECM for 4.075 seconds after previously having received a command message.

637. RefCond0071: The TBV smart device has detected an internal error which will prevent it from functioning normally.

The TBV smart device has detected an internal error which will prevent it from functioning normally.

Conditions (all active):
The TBV smart device detects any of the conditions:
Invalid Hall Effect sensor state or sequence. Three Hall Effect sensors are used, and are expected to move within a known series of valid sequences. Valid Hall Effect sensors may not report HHH or LLL (all high or all low). If either the state or the sequence is invalid, the error condition is active
OR
The measured motor current indicates a short circuit condition within driver circuit.
OR
Invalid position calibration data detected during the turbocharger smart device initialization.
OR
Microprocessor internal error - the TBV smart device has detected an internal error such as an invalid ROM checksum, Watchdog Reset, or other similar error relating to a failed CPU or module.
OR
Severe over-temperature indicated within the TBV smart device Motor Driver Circuit. The TBV smart device has been disabled for a condition representing eminent hardware physical shutdown.

638. RefCond0072: No Source: The TBV smart device has not received a message from the ECM.

No Source: The TBV smart device has not received a message from the ECM.

Conditions (all active):
No Source: The TBV smart device has never received a message from the ECM for > 12 seconds.

639. RefCond0073: The TBV smart device has detected a warm temperature condition.

The TBV smart device has detected a warm temperature condition.

Conditions (all active):
The TBV smart device actuator has detected a temperature in excess of 150 deg C.

640. RefCond0074: The voltage for the TBV smart device is less than a calibrated value.

The voltage for the TBV smart device is less than a calibrated value.

Conditions (all active):
The TBV smart device voltage is < 9 V for > 10 seconds.

641. RefCond0075: TBV driver failure

TBV driver failure

Conditions (all active):
P0046-SE4169, P0046-SE9724, P00AF-SE4166, P1A62-SE9725, P2262-SE3018, U040D-SE4172, U040D-SE9715
P226C-SE9721

642. RefCond0076: The Urea Quality Sensor (UQS) is located in tank.

The Urea Quality Sensor (UQS) is located in tank.

Conditions (all active):
A Urea Quality Sensor (UQS) DEF concentration update has not been received from the sensor within 0 mSec after key-on.

643. RefCond0077: the enable conditions for the diagnostic are specified as follows

the enable conditions for the diagnostic are specified as follows

Conditions (all active):
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true

644. RefCond0078: the disable conditions for the diagnostic are specified as follows

the disable conditions for the diagnostic are specified as follows

Conditions (all active):
NOT [The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.)]

645. RefCond0079: UQS Concentration detection element voltage shorted out of range high.

UQS Concentration detection element voltage shorted out of range high.

Conditions (all active):
The voltage measured across the concentration detection element at the diagnostic charge voltage < 0.15 volts for > 4 update counts.

646. RefCond0080: Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low.

Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low.

Conditions (all active):
The voltage measured across the concentration detection element charge pump < 7.5 volts for > 8 update counts.

647. RefCond0082: UQS Concentration detection element voltage shorted out of range high.

UQS Concentration detection element voltage shorted out of range high.

Conditions (all active):
The voltage measured at the UQS concentration sensing element > 1.195 volts for > 5 seconds.

648. RefCond0083: UQS Concentration detection element voltage shorted out of range low.

UQS Concentration detection element voltage shorted out of range low.

Conditions (all active):
The voltage measured at the UQS concentration sensing element < 0.047 volts for > 5 seconds.

649. RefCond0084: UQS sensor internal temperature is above the maximum operating range

UQS sensor internal temperature is above the maximum operating range

Conditions (all active):
(The internal temperature of the UQS > 100 °C) for > 5 seconds.

650. RefCond0085: the enable conditions for the diagnostic are specified as follows

the enable conditions for the diagnostic are specified as follows

Conditions (all active):
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true

651. RefCond0086: the disable conditions for the diagnostic are specified as follows

the disable conditions for the diagnostic are specified as follows

Conditions (all active):
NOT [The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.)]

652. RefCond0087: the enable conditions for the diagnostic are specified as follows

the enable conditions for the diagnostic are specified as follows

Conditions (all active):
P207F-SE7286, P207F-SE8690, P20E8-SE6980
Keyswitch transitions to ON
The in-tank mounted measurement of DEF concentration quality is Data Valid. (See RefCond0138.)
Urea Tank Level status is Valid (See RefCond0139.)
The temperature of the fluid in the DEF tank is within the proper operational range. (See RefCond0140.)
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true
Longer than 300 seconds have elapsed, with keyswitch ON, since the last keyon, or since System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving. (See RefCond0141.).
The diagnostic has already updated once within the current key-cycle, subsequently System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving. (See RefCond0141.).
there are no DEF low level faults active (See RefCond0142.)
5 seconds have elapsed since P207F-SE7282 diagnostics failed.

653. RefCond0088: the disable conditions for the diagnostic are specified as follows

the disable conditions for the diagnostic are specified as follows

Conditions (all active):
P207F-SE7286, P207F-SE8690, P20E8-SE6980
NOT [The in-tank mounted measurement of DEF concentration quality is suspect. (See RefCond0143.)]
NOT [Urea Tank Level status is Valid (See RefCond0139.)]
System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving. (See RefCond0141.)
The diagnostic has already updated once within the current key-cycle
NOT [there are no DEF low level faults active (See RefCond0142.)]
The temperature of the fluid in the DEF tank is not within the proper operational range (See RefCond0144.)
NOT [Urea Tank Level status is suspect (See RefCond0145.)]
NOT [The in-tank mounted measurement of DEF concentration quality is Data Valid. (See RefCond0138.)]

654. RefCond0089: the pause conditions for the diagnostic are specified as follows

the pause conditions for the diagnostic are specified as follows

Conditions (all active):
Keyswitch transitions to OFF
The in-tank mounted measurement of DEF concentration quality is suspect. (See RefCond0143.)
Urea Tank Level status is suspect (See RefCond0145.)
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is false
The temperature of the fluid in the DEF tank is suspected. (See RefCond0146.)

655. RefCond0090: The enable conditions for the diagnostic are specified as follows

The enable conditions for the diagnostic are specified as follows

Conditions (all active):
P207F-SE8690
The in-tank mounted measurement of DEF concentration quality is Data Valid. (See RefCond0138.)
The temperature of the fluid in the DEF tank is within the proper operational range. (See RefCond0140.)
DEF tank level > 79 %
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true

656. RefCond0091: The disable conditions for the diagnostic are specified as follows

The disable conditions for the diagnostic are specified as follows

Conditions (all active):
P207F-SE8690
NOT [The in-tank mounted measurement of DEF concentration quality is suspect. (See RefCond0143.)]
The temperature of the fluid in the DEF tank is not within the proper operational range (See RefCond0144.)
DEF tank level ≤ 79 %
NOT [there are no DEF low level faults active (See RefCond0142.)]
NOT[The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.)]
NOT [The in-tank mounted measurement of DEF concentration quality is Data Valid. (See RefCond0138.)]

657. RefCond0092: The pause conditions for the diagnostic are specified as follows

The pause conditions for the diagnostic are specified as follows

Conditions (all active):
The DEF tank temperature or DEF internal temperature <=-4 °C OR The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is suspect. (See RefCond0147.)
The in-tank mounted measurement of DEF concentration quality is suspect. (See RefCond0143.)
The enable conditions for the diagnostic are specified as follows (See RefCond0090.) is false
The disable conditions for the diagnostic are specified as follows (See RefCond0091.) is false
The Urea Quality Sensor (UQS) indicates that the fluid type cannot be determined (See RefCond0148.)

658. RefCond0093: the enable conditions for the diagnostic are specified as follows

the enable conditions for the diagnostic are specified as follows

Conditions (all active):
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true

659. RefCond0094: the disable conditions for the diagnostic are specified as follows

the disable conditions for the diagnostic are specified as follows

Conditions (all active):
NOT [The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.)]

660. RefCond0095: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source.

Urea Quality Sensor (UQS) temperature sensor element shorted to a high source.

Conditions (all active):
(The voltage measured at the UQS temperature sensing element > 4.88 volts OR the temperature measured at the UQS temperature sensing element > 126 °C) for > 9 update counts.

661. RefCond0096: Urea Quality Sensor (UQS) temperature sensing element shorted to a low source.

Urea Quality Sensor (UQS) temperature sensing element shorted to a low source.

Conditions (all active):
(The voltage measured at the UQS temperature sensing element < 0.1 volts OR the temperature measured at the UQS temperature sensing element < -40 °C) for > 9 update counts.

662. RefCond0097: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source.

Urea Quality Sensor (UQS) temperature sensor element shorted to a high source.

Conditions (all active):
(The voltage measured at the UQS temperature sensing element > 1.195 volts OR the temperature measured at the UQS temperature sensing element < -55 °C) for > 5 seconds.

663. RefCond0098: Urea Quality Sensor (UQS) temperature sensor element shorted to a low source.

Urea Quality Sensor (UQS) temperature sensor element shorted to a low source.

Conditions (all active):
(The voltage measured at the UQS temperature sensing element < 0.047 volts OR the temperature measured at the UQS temperature sensing element > 115 °C) for > 5 seconds.

664. RefCond0099: the enable conditions for the diagnostic are specified as follows

the enable conditions for the diagnostic are specified as follows

Conditions (all active):
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true

665. RefCond0100: the disable conditions for the diagnostic are specified as follows

the disable conditions for the diagnostic are specified as follows

Conditions (all active):
NOT [The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.)]

666. RefCond0101: the enable conditions for the diagnostic are specified as follows

the enable conditions for the diagnostic are specified as follows

Conditions (all active):
P20E8-SE6980
Keyswitch transitions to ON
The in-tank mounted measurement of DEF fluid type is Data Valid. (See RefCond0149.)
Urea Tank Level status is Valid (See RefCond0139.)
The temperature of the fluid in the DEF tank is within the proper operational range. (See RefCond0140.)
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is true
Longer than 300 seconds have elapsed, with keyswitch ON, since the last keyon, or since System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving. (See RefCond0141.).
The diagnostic has already updated once within the current key-cycle, subsequently System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving. (See RefCond0141.).
there are no DEF low level faults active (See RefCond0142.)
5 seconds have elapsed since P207F-SE8690 diagnostics failed.

667. RefCond0102: the disable conditions for the diagnostic are specified as follows

the disable conditions for the diagnostic are specified as follows

Conditions (all active):
P20E8-SE6980
NOT [The in-tank mounted measurement of DEF fluid type is Data Valid. (See RefCond0149.)]
NOT[Urea Tank Level status is Valid (See RefCond0139.)]
System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving. (See RefCond0141.)
The diagnostic has already updated once within the current key-cycle
NOT [there are no DEF low level faults active (See RefCond0142.)]
The temperature of the fluid in the DEF tank is not within the proper operational range (See RefCond0144.)
NOT [Urea Tank Level status is suspect (See RefCond0145.)]
NOT [The in-tank mounted measurement of DEF fluid type is suspect. (See RefCond0150.)]

668. RefCond0103: the pause conditions for the diagnostic are specified as follows

the pause conditions for the diagnostic are specified as follows

Conditions (all active):
Keyswitch transitions to OFF
The in-tank mounted measurement of DEF fluid type is suspect. (See RefCond0150.)
Urea Tank Level status is suspect (See RefCond0145.)
The in-tank mounted Urea Quality Sensor (UQS) detected as active. (See RefCond0137.) is false
The temperature of the fluid in the DEF tank is suspected. (See RefCond0146.)

669. RefCond0104: the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is not DEF

the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is not DEF

Conditions (all active):
The concentration type determination is based on measuring the speed of sound in the liquid by generating an ultrasonic signal that reflects from a fixed reference distance from the sensor. The sensor has completed the DEF type detection process and has determined that the fluid in the DEF tank is not DEF.

670. RefCond0105: The sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is not DEF.

The sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is not DEF.

Conditions (all active):
On completion of DEF type detection process, sensor has determined that the fluid in the DEF tank is other than DEF.

671. RefCond0106: The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF

The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF

Conditions (all active):
P2048-SE5102
The DEF tank has been defrosted (See RefCond0151.)
Flange Control Unit (FCU) DEF Supply Module Pump Motor is enabled (See RefCond0152.)
The Flange Control Unit (FCU) DEF tank requirements for dosing are satisfied (See RefCond0153.)
(
Ambient Air status is Data Valid. (See RefCond0120.)
OR
Ambient Air Temperature ≥ -20 °C OR (Ambient Air Temperature < -20 °C) for < 300 sec
)
Selective Catalyst Reductant (SCR) catalyst bed temperature (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR inlet temperatures) ≥ 150 °C OR (10 sec has expired since the engine was started).
Key switch is turned ON.
Engine is running.

672. RefCond0107: The Flange Control Unit (FCU) DEF Supply Module has aborted filling with DEF

The Flange Control Unit (FCU) DEF Supply Module has aborted filling with DEF

Conditions (all active):
P2048-SE5102
NOT [Flange Control Unit (FCU) DEF Supply Module Pump Motor is enabled (See RefCond0152.)] OR NOT [The Flange Control Unit (FCU) DEF tank requirements for dosing are satisfied (See RefCond0153.)]

673. RefCond0108: The Engine is in Derate and Urea Doser Functional Response Monitor fault is active

The Engine is in Derate and Urea Doser Functional Response Monitor fault is active

Conditions (all active):
P202E-SE7927
Engine is in Derate

674. RefCond0109: The DEF Flange Control Unit (FCU) Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing

The DEF Flange Control Unit (FCU) Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing

Conditions (all active):
The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF (See RefCond0106.)
DEF supply pressure > 500 kPa (gauge) within a time window of 50 sec from the time that The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF (See RefCond0106.) is entered.

675. RefCond0110: The DEF Supply Module (SM) has completed pump pressure control and is ready to dose.

The DEF Supply Module (SM) has completed pump pressure control and is ready to dose.

Conditions (all active):
After the system enters The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF (See RefCond0106.), DEF supply pressure is > 50 kPa (gauge) for a time > 75 seconds
Engine is running

676. RefCond0111: A block heater is not detected

A block heater is not detected

Conditions (all active):
The temperature drop detected on Coolant Temperature Sensor ≤ 1 °C for a time period of 30 seconds after the engine is started up.

677. RefCond0112: The engine is cold soaked

The engine is cold soaked

Conditions (all active):
Engine off time ≥ 480 min

678. RefCond0114: NOx sensor O2 reading is valid since the internal control loops within the sensor have stabilized.

NOx sensor O2 reading is valid since the internal control loops within the sensor have stabilized.

Conditions (all active):
[Ref/M2] The absolute difference of the voltage between the sensor measuring electrode in the 2nd pumping chamber and the air reference electrode is < 40 mV of its setpoint for over 0.2 seconds.
OR [P+/M2] The rate of change in current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode(directly exposed to exhaust gas) is within 42.6 nA/msec for over 20 ms.
OR [M1/P+] The current from the sensor measuring electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas) is less than 19 uA or greater than -40 uA for over 0.2 seconds.
OR [M1/P+] The current from the sensor pumping electrode in the 2nd pumping chamber to the sensor top electrode (directly exposed to exhaust gas) is within 2.4 uA of its setpoint for over 2 seconds.

679. RefCond0115: Urea Delivery Monitor Pump Speed Offset Update.

Urea Delivery Monitor Pump Speed Offset Update.

Conditions (all active):
(Maximum DEF pump speed - Minimum DEF pump speed) <= 40 rpm.
DEF dosing command exceeds minimum DEF calibratable value or minimum time has elapsed. (See RefCond0154.)

680. RefCond0116: Urea Delivery Monitor Pre-Enable (Based on input sensor prerequisites and limit considerations).

Urea Delivery Monitor Pre-Enable (Based on input sensor prerequisites and limit considerations).

Conditions (all active):
DEF Dosing command >= 0.1 ml/sec AND DEF Dosing command <= 0.7 ml/sec.
Rate of change of DEF dosing command <= 1.75ml/sec/sec for 2seconds.
Exhaust temperature >= 190 °C for 10 seconds.
Engine is running.
The DEF Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing. (See RefCond0155.) for 300 seconds.
5 seconds elapsed after Key-On.
P202E-SE7927 test is not active.
DEF tank temperature >= -5 °C AND DEF tank temperature <= 60 °C.
Ambient Air pressure >= 75 kPa(absolute) AND Ambient Air pressure <= 160 kPa(absolute).

681. RefCond0117: Indicates the time duration at which the inlet temperature must be above the high hysteresis threshold before dew point is exceeded.

Indicates the time duration at which the inlet temperature must be above the high hysteresis threshold before dew point is exceeded.

Conditions (all active):
5 seconds

682. RefCond0118: The SCR Out temperature as measured by the sensor closest to the SONOx sensor is above a processed threshold for a calculated period of time.

The SCR Out temperature as measured by the sensor closest to the SONOx sensor is above a processed threshold for a calculated period of time.

Conditions (all active):
The SCR Out temperature as measured by the thermistor closest to the SONOx sensor > 200 deg C for RefTable83. Where processed ambient air temperature is calculated as: Ambient air temperature sensor value when Ambient Air status is Data Valid. (See RefCond0120.) else -10 deg C. Where processed SCR out temperature is calculated as: The minimum SCR out temperature captured after the rising event of (Exhaust gas temperature is below a threshold representing that dew point is not reached (See RefCond0040.) AND Engine is running AND SCR out temperature status valid. (See RefCond0157.))

683. RefCond0119: NOx Outlet sensor SCR hot start delay logic is allowed to run.

NOx Outlet sensor SCR hot start delay logic is allowed to run.

Conditions (all active):
SCR Out temperature as measured by the thermistor closest to the SONOx sensor ≥ 200 °C
SCR out temperature status valid. (See RefCond0157.)
Engine just started running
Hot start slope calculation of the SCR Outlet temperature has not been completed

684. RefCond0120: Ambient Air status is Data Valid.

Ambient Air status is Data Valid.

Conditions (all active):
P1191-SE4190, P1191-SE4746, P1192-SE484, P1193-SE486

685. RefCond0123: NH3 Slip Detection module to detect if NH3 slip is causing a drop in SCR conversion efficiency

NH3 Slip Detection module to detect if NH3 slip is causing a drop in SCR conversion efficiency

Conditions (all active):
Conditions are met for SCR dosing (See RefCond0158.)
Estimated SCR Catalyst bed temperature > 210 °C
Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.)
Exhaust gas mass flow rate > 25 g/sec

686. RefCond0125: Threshold for ammonia storage timer based on ANR compensation in feedback control

Threshold for ammonia storage timer based on ANR compensation in feedback control

Conditions (all active):
800 seconds when SCR Conversion Efficiency Relay feedback mode is commanding high dosing for accelerated ammonia storage in SCR first brick (See RefCond0055.) else 150 seconds when (SCR Conversion Efficiency Relay feedback mode is commanding high ANR. (See RefCond0159.) OR SCR Conversion Efficiency Relay feedback mode is commanding very high ANR. (See RefCond0054.)). else 150 seconds.

687. RefCond0127: NH3 storage used up counter is reset

NH3 storage used up counter is reset

Conditions (all active):
NOT [NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.)]
OR
Aftertreatment Outlet NOx sensor reading is not valid due to internal control loops within the sensor being unstable, or active faults detected by the sensor, or the sensor's battery supply voltage is outside the desired range or dewpoint temperature not met. (See RefCond0049.)
OR
NOT[Conditions are met for SCR dosing (See RefCond0158.)]
OR
Estimated SCR Catalyst bed temperature < 180 °C

688. RefCond0128: Closed loop control of DEF dosing is allowed

Closed loop control of DEF dosing is allowed

Conditions (all active):
Conditions are met for SCR dosing (See RefCond0158.)
Estimated SCR Catalyst bed temperature ≥ 180 °C
Aftertreatment Outlet NOx sensor reading is valid since the internal control loops within the sensor are stable, and no active faults detected by the sensor, and the sensor's battery supply voltage is within the desired range and dewpoint temperature has been met for a sufficient time to allow the sensor to light off. (See RefCond0002.)
NOx sensor reading is valid since the internal control loops within the sensor have stabilized. (See RefCond0041.)
When NH3 slip is detected, corrective action is taken. Commanded ANR is decreased by temporarily stepping down the target SCR conversion efficiency. (See RefCond0043.) is not active

689. RefCond0129: Ammonia storage counter decrement enable condition

Ammonia storage counter decrement enable condition

Conditions (all active):
DEF dosing command <= 0.005 ml/sec AND (Closed loop control of DEF dosing is allowed (See RefCond0128.) is not active OR Commanded Ammonia NOx Ratio > 0 (unitless))

690. RefCond0137: The in-tank mounted Urea Quality Sensor (UQS) detected as active.

The in-tank mounted Urea Quality Sensor (UQS) detected as active.

Conditions (all active):
U02A2-SE6447
30 seconds has elapsed since the last keyon and the time since engine cranking ended.

691. RefCond0138: The in-tank mounted measurement of DEF concentration quality is Data Valid.

The in-tank mounted measurement of DEF concentration quality is Data Valid.

Conditions (all active):
U02A2-SE6447
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
Keyswitch is ON
Engine is not cranking
When the SSI DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) has not occurred during the previous 5 seconds, AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) has not occurred during the previous 5 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) has not occurred during the previous 5 seconds, AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) has not occurred during the previous 5 seconds.
When the WEMA DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0082.) has not occurred during the previous 5 seconds, AND UQS Concentration detection element voltage shorted out of range low. (See RefCond0083.) has not occurred during the previous 10 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) has not occurred during the previous 5 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) has not occurred during the previous 5 seconds.

692. RefCond0139: Urea Tank Level status is Valid

Urea Tank Level status is Valid

Conditions (all active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U029D-SE2487
Keyswitch is ON for 6 seconds.
The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.)
Urea Tank temperature is ≥ -10 °C
0% ≤ Urea Tank Level reading ≤100%

693. RefCond0140: The temperature of the fluid in the DEF tank is within the proper operational range.

The temperature of the fluid in the DEF tank is within the proper operational range.

Conditions (all active):
When The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.) then the temperature of the DEF tank is considered within the proper operational range when the DEF tank temperature > -4 °C, otherwise (if it is not true that The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.) and it is not true that The in-tank mounted measurement of the DEF tank temperature is suspect (See RefCond0007.), and The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is Data Valid. (See RefCond0164.) then the temperature of the DEF tank is considered within the proper operational range when the Urea Quality Sensor (UQS) Temperature > -4 °C).

694. RefCond0141: System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving.

System has determined that the DEF tank has been refilled. Detection can occur across key-cycles or with the engine running and vehicle not moving.

Conditions (all active):
Refill is detected once at key-on if the (current tank level percentage) - (tank level percentage stored at the last key-off) > 10 % OR (With engine running, after the DEF tank level % has been stable for 5 seconds, refill is detected if the (maximum tank level %) - (minimum tank level % since key-on) > 10 %) for 3 seconds.

695. RefCond0142: there are no DEF low level faults active

there are no DEF low level faults active

Conditions (all active):
P203F-SE2907
P203F-SE4189

696. RefCond0143: The in-tank mounted measurement of DEF concentration quality is suspect.

The in-tank mounted measurement of DEF concentration quality is suspect.

Conditions (all active):
U02A2-SE6447
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
Keyswitch is ON
Engine is not cranking
When the SSI DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) has occurred for < 5 seconds, AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) has occurred for < 5 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) has occurred for < 5 seconds, AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) has occurred for < 5 seconds.
When the WEMA DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0082.) has occurred for < 5 seconds, AND UQS Concentration detection element voltage shorted out of range low. (See RefCond0083.) has occurred for < 10 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) has occurred for < 5 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) has occurred for < 5 seconds.

697. RefCond0144: The temperature of the fluid in the DEF tank is not within the proper operational range

The temperature of the fluid in the DEF tank is not within the proper operational range

Conditions (all active):
(If NOT [The in-tank mounted measurement of the DEF tank temperature is suspect (See RefCond0007.)] AND NOT [The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.)] AND NOT[The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is suspect. (See RefCond0147.)] AND NOT [The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is Data Valid. (See RefCond0164.)] then the temperatureof the DEF tank is considered outside of the proper operational range) otherwise (If The in-tank mounted measurement of the DEF tank temperature is suspect (See RefCond0007.) OR if The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.) then the temperature of the DEF tank is considered outside of the proper operational range when the DEF tank temperature < -3.9 °C OR the DEF tank temperature > 65 °C) otherwise (if The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is suspect. (See RefCond0147.) OR if The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is Data Valid. (See RefCond0164.) then the temperature of the DEF tank is considered outside of the proper operational range when the Quality Sensor (UQS) Temperature < -3.9 °C OR the Quality Sensor (UQS) Temperature > 65 °C)

698. RefCond0145: Urea Tank Level status is suspect

Urea Tank Level status is suspect

Conditions (all active):
P203B-SE7112, P203B-SE7113, P203C-SE7110, P203D-SE7107, U029D-SE2487
Urea Tank Level status is Valid (See RefCond0139.) at previous sample.
(
Key Switch is OFF
OR
6 seconds are not elapsed since datalink sensor starts communicating with Flange Control Unit.
OR
(The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.)) is not active OR Urea Tank temperature is ≤ -10 °C
)

699. RefCond0146: The temperature of the fluid in the DEF tank is suspected.

The temperature of the fluid in the DEF tank is suspected.

Conditions (all active):
(if it is not true that The in-tank mounted measurement of the DEF tank temperature is Data Valid. (See RefCond0006.) and if The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is suspect. (See RefCond0147.), then the temperature of the DEF tank is suspected to not be within the proper operational range), otherwise If The in-tank mounted measurement of the DEF tank temperature is suspect (See RefCond0007.) then the temperature of the DEF tank is suspected to not be within the proper operational range.
DEF Temperature < -4 °C
DEF Temperature > -3.9 °C

700. RefCond0147: The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is suspect.

The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is suspect.

Conditions (all active):
U02A2-SE6447
P2044-SE6981, P2045-SE6982
P2044-SE6981, P2045-SE6982
Keyswitch is ON
Engine is not cranking
When the SSI DEF concentration and level sensor has been installed by the OEM, then: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) has occurred for < 5 seconds, AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) has occurred for < 5 seconds.
When the WEMA DEF concentration and level sensor has been installed by the OEM, then: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) has occurred for < 5 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) has occurred for < 5 seconds.

701. RefCond0148: The Urea Quality Sensor (UQS) indicates that the fluid type cannot be determined

The Urea Quality Sensor (UQS) indicates that the fluid type cannot be determined

Conditions (all active):
The UQS performs an initial frequency sweep over a large frequency band, and if the measured transport characteristics are inconsistent with diesel fluid, then a wide band frequency sweep is performed. If the resulting fluid characteristics are inconsistent with DEF, then the fluid type detected is unknown

702. RefCond0149: The in-tank mounted measurement of DEF fluid type is Data Valid.

The in-tank mounted measurement of DEF fluid type is Data Valid.

Conditions (all active):
U02A2-SE6447
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
Keyswitch is ON
Engine is not cranking
the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is DEF (See RefCond0165.)
When the SSI DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) has not occurred during the previous 5 seconds AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) has not occurred during the previous 5 seconds AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) has not occurred during the previous 5 seconds AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) has not occurred during the previous 5 seconds.
When the WEMA DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0082.) has not occurred during the previous 5 seconds AND UQS Concentration detection element voltage shorted out of range low. (See RefCond0083.) has not occurred during the previous 10 seconds AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) has not occurred during the previous 5 seconds AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) has not occurred during the previous 5 seconds.

703. RefCond0150: The in-tank mounted measurement of DEF fluid type is suspect.

The in-tank mounted measurement of DEF fluid type is suspect.

Conditions (all active):
U02A2-SE6447
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
P2044-SE6981, P2045-SE6982, P206B-SE6996, P206D-SE8691
Keyswitch is ON
Engine is not cranking
the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is DEF (See RefCond0165.)
When the SSI DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0079.) has occurred for < 5 seconds AND Unknown failure of the UQS concentration detection element, or UQS Concentration detection element voltage shorted out of range low. (See RefCond0080.) has occurred for < 5 seconds AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) has occurred for < 5 seconds AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) has occurred for < 5 seconds.
When the WEMA DEF concentration and level sensor has been installed by the OEM, then: UQS Concentration detection element voltage shorted out of range high. (See RefCond0082.) has occurred for < 5 seconds AND UQS Concentration detection element voltage shorted out of range low. (See RefCond0083.) has occurred for < 10 seconds AND Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) has occurred for < 5 seconds AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) has occurred for < 5 seconds.

704. RefCond0151: The DEF tank has been defrosted

The DEF tank has been defrosted

Conditions (all active):
DEF tank temperature > 0 °C for longer than 1 sec.

705. RefCond0152: Flange Control Unit (FCU) DEF Supply Module Pump Motor is enabled

Flange Control Unit (FCU) DEF Supply Module Pump Motor is enabled

Conditions (all active):
P21CC-SE7074
P21CB-SE7098
P21CA-SE7106
P20E9-SE7120
P20E8-SE7121
P208D-SE7125
P208C-SE7126
P208A-SE7127
P204A-SE7128
U040F-SE7149
U040F-SE7150
U11C1-SE7156

706. RefCond0153: The Flange Control Unit (FCU) DEF tank requirements for dosing are satisfied

The Flange Control Unit (FCU) DEF tank requirements for dosing are satisfied

Conditions (all active):
P203F-SE2906
(
there are no Flange Control Unit (FCU) DEF line heater errors active (See RefCond0167.)
OR
Ambient Air Temperature > 4 °C
)

707. RefCond0154: DEF dosing command exceeds minimum DEF calibratable value or minimum time has elapsed.

DEF dosing command exceeds minimum DEF calibratable value or minimum time has elapsed.

Conditions (all active):
DEF dosing command >0.01 ml/sec OR 100 seconds have passed since Key On.
Offset time elapsed since Key On >= 4 seconds.

708. RefCond0155: The DEF Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing.

The DEF Supply Module (SM) has completed priming and is actively maintaining the target DEF pressure for dosing.

Conditions (all active):
After the system enters The Flange Control Unit (FCU) DEF Supply Module has begun filling with DEF (See RefCond0106.), DEF supply pressure is > 50 kPa (gauge) for a time > 75 seconds
Engine is running

709. RefCond0157: SCR out temperature status valid.

SCR out temperature status valid.

Conditions (all active):
P1624-SE6752, P1624-SE6753, P1624-SE6755, P1624-SE6756, P1624-SE6757, P1625-SE6758, P1626-SE6759, P1628-SE7180, P2472-SE2895, P2481-SE6763, P2482-SE6762, P2482-SE6765, P2483-SE3785, U1611-SE6687, U1612-SE6685

710. RefCond0158: Conditions are met for SCR dosing

Conditions are met for SCR dosing

Conditions (all active):
Calculated (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR Bed temperature) SCR control temperature conditions are met for SCR dosing. (See RefCond0168.)
OR
DPF Outlet Temperature conditions are met for SCR dosing. (See RefCond0169.)
OR
SCR Inlet Temperature conditions are met for SCR dosing. (See RefCond0170.)

711. RefCond0159: SCR Conversion Efficiency Relay feedback mode is commanding high ANR.

SCR Conversion Efficiency Relay feedback mode is commanding high ANR.

Conditions (all active):
(Target SCR Conversion Efficiency - Actual SCR Conversion Efficiency) > RefTable90

712. RefCond0164: The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is Data Valid.

The in-tank mounted measurement of Urea Quality Sensor (UQS) temperature is Data Valid.

Conditions (all active):
U02A2-SE6447
P2044-SE6981, P2045-SE6982
P2044-SE6981, P2045-SE6982
Keyswitch is ON
Engine is not cranking
When the SSI DEF concentration and level sensor has been installed by the OEM, then: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0095.) has not occurred during the previous 5 seconds, AND Urea Quality Sensor (UQS) temperature sensing element shorted to a low source. (See RefCond0096.) has not occurred during the previous 5 seconds
When the WEMA DEF concentration and level sensor has been installed by the OEM, then: Urea Quality Sensor (UQS) temperature sensor element shorted to a high source. (See RefCond0097.) has not occurred during the previous 5 seconds, AND Urea Quality Sensor (UQS) temperature sensor element shorted to a low source. (See RefCond0098.) has not occurred during the previous 5 seconds

713. RefCond0165: the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is DEF

the sensor has completed the DEF type detection process, and has determined that the fluid in the DEF tank is DEF

Conditions (all active):
The concentration type determination is based on measuring the speed of sound in the liquid by generating an ultrasonic signal that reflects from a fixed reference distance from the sensor. The sensor has completed the DEF type detection process and has determined that the fluid in the DEF tank is DEF.

714. RefCond0167: there are no Flange Control Unit (FCU) DEF line heater errors active

there are no Flange Control Unit (FCU) DEF line heater errors active

Conditions (all active):
P20B7-SE7217
P20B8-SE7100
P202C-SE7131
P202C-SE7132
P202B-SE7134
P202B-SE7135
P202B-SE7136
P202C-SE7137
P202C-SE7138
P20BC-SE7139
P20BC-SE7140
P20BB-SE7142
P20B9-SE7143
P20B9-SE7144
P20BC-SE7145

715. RefCond0168: Calculated (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR Bed temperature) SCR control temperature conditions are met for SCR dosing.

Calculated (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR Bed temperature) SCR control temperature conditions are met for SCR dosing.

Conditions (all active):
SCR In temperature has risen at certain rate for calibratable amount of time, DPF Out temperature has risen at certain rate for calibrated amount of time and SCR In temperature is greater than SCR Out temperature then SCR bed temperature flag is updated based on whether SCR bed temperature is within a desired range. (See RefCond0172.)
Calculated (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR Bed temperature) SCR control temperature status is valid. (See RefCond0173.)
Exhaust mass flow >= 0 g/sec.

716. RefCond0169: DPF Outlet Temperature conditions are met for SCR dosing.

DPF Outlet Temperature conditions are met for SCR dosing.

Conditions (all active):
SCR In temperature has risen at certain rate for calibratable amount of time, DPF Out temperature has risen at certain rate for calibrated amount of time and SCR In temperature is greater than SCR Out temperature then SCR bed temperature flag is updated based on whether SCR bed temperature is within a desired range. (See RefCond0172.)
(DPF Out temperature > 180 °C AND DPF Out temperature <= 700 °C) OR (DPF Out temperature > 190 °C AND DPF Out temperature <= 700 °C)
Exhaust mass flow >= 0 g/sec.

717. RefCond0170: SCR Inlet Temperature conditions are met for SCR dosing.

SCR Inlet Temperature conditions are met for SCR dosing.

Conditions (all active):
SCR In temperature has risen at certain rate for calibratable amount of time, DPF Out temperature has risen at certain rate for calibrated amount of time and SCR In temperature is greater than SCR Out temperature then SCR bed temperature flag is updated based on whether SCR bed temperature is within a desired range. (See RefCond0172.)
Exhaust mass flow >= 0 g/sec.

718. RefCond0172: SCR In temperature has risen at certain rate for calibratable amount of time, DPF Out temperature has risen at certain rate for calibrated amount of time and SCR In temperature is greater than SCR Out temperature then SCR bed temperature flag is updated based on whether SCR bed temperature is within a desired range.

SCR In temperature has risen at certain rate for calibratable amount of time, DPF Out temperature has risen at certain rate for calibrated amount of time and SCR In temperature is greater than SCR Out temperature then SCR bed temperature flag is updated based on whether SCR bed temperature is within a desired range.

Conditions (all active):
(700 °C >= SCR Bed temperature >= 110 °C) OR (700 °C >= SCR Bed temperature >= 190 °C)

719. RefCond0173: Calculated (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR Bed temperature) SCR control temperature status is valid.

Calculated (calculated as a weighted average of Diesel Particulate Filter (DPF) outlet and SCR Bed temperature) SCR control temperature status is valid.

Conditions (all active):
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737
P1613-SE6721, P1613-SE6722, P1613-SE6724, P1613-SE6725, P1613-SE6726, P1614-SE6727, P1615-SE6728, P1623-SE7168, P242B-SE2852, P242C-SE6734, P242D-SE6733, P242D-SE6737