SECTION ECR

ENGINE CONTROL SYSTEM (M9R)

CONTENTS

M9R

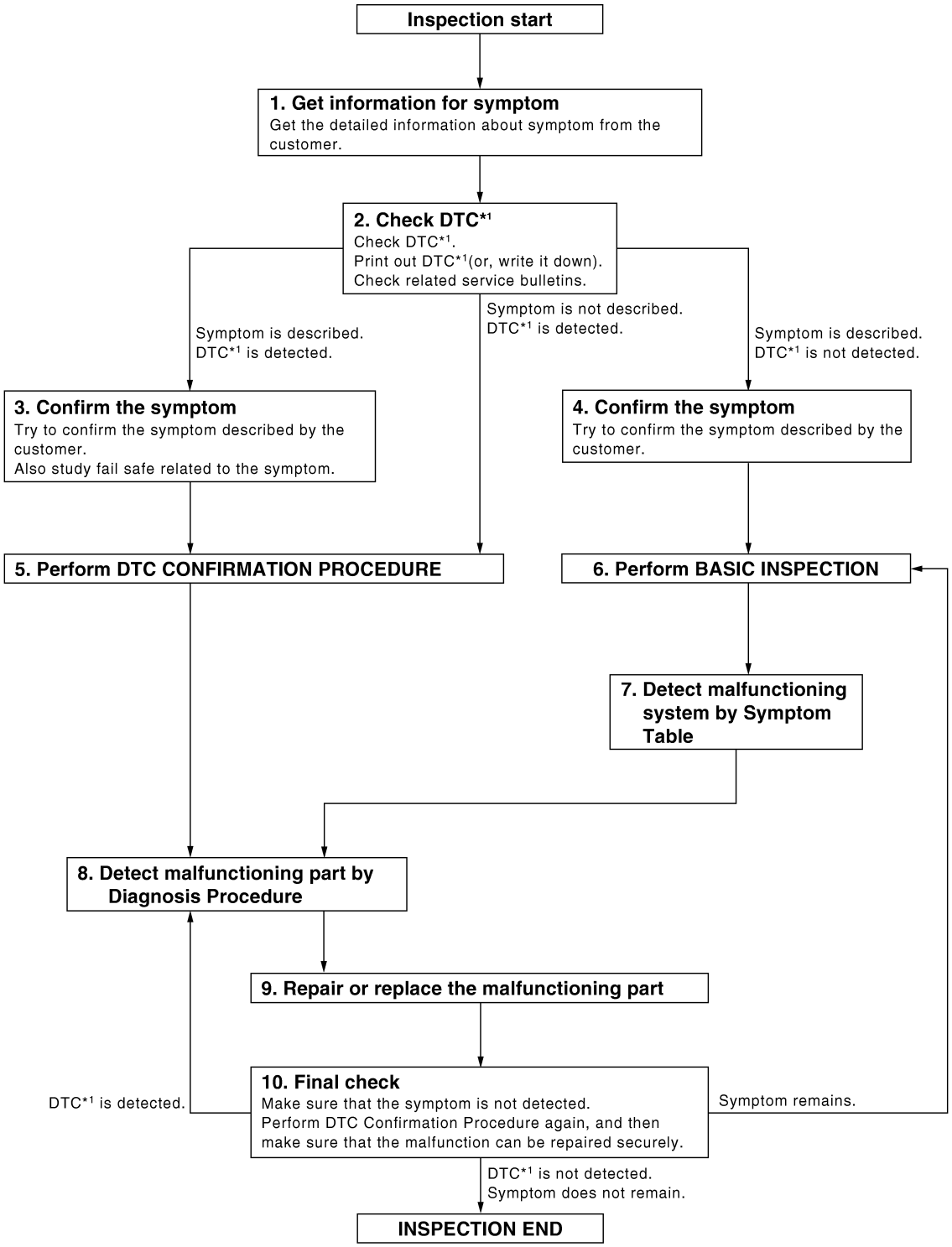
BASIC INSPECTION

DIAGNOSIS AND REPAIR WORKFLOW

Work Flow

INFOID:0000000001551214

OVERALL SEQUENCE



*1: Include 1st trip DTC.

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DETAILED FLOW

1.GET INFORMATION FOR SYMPTOM

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 ECR-9, "Diagnostic Work Sheet".)

>> GO TO 2.

2.CHECK DTC

1. Check DTC.
2. Perform the following procedure if DTC is displayed.

- Record DTC. (Print them out with CONSULT-III or GST.)
- Erase DTC. (Refer to ECR-97, "Diagnosis Description".)
- Study the relationship between the cause detected by DTC and the symptom described by the customer. (Symptom Table is useful. Refer to ECR-321, "Symptom Table".)

3. Check related service bulletins for information.

Is any symptom described and is any DTC 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 MI ON).
Also study the fail safe related to the symptom. Refer to ECR-316, "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.
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 1st trip DTC is detected again.
If two or more 1st trip DTCs are detected, refer to ECR-317, "DTC Inspection Priority Chart" and determine trouble diagnosis order.

NOTE:
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 8.
NO >> Check according to GI-39, "Intermittent Incident".

6.PERFORM BASIC INSPECTION

Perform ECR-11, "BASIC INSPECTION : Special Repair Requirement".

>> GO TO 7.

7.DETECT MALFUNCTIONING SYSTEM BY SYMPTOM TABLE

Detect malfunctioning system according to ECR-321, "Symptom Table" based on the confirmed symptom in step 4, and determine the trouble diagnosis order based on possible causes and symptom.

>> 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 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-41, "Circuit Inspection".

Is malfunctioning part detected?

YES >> GO TO 9.

NO >> Monitor input data from related sensors or check voltage of related ECM terminals using CONSULT-III. Refer to ECR-289, "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 1st trip DTC. If 1st trip DTC is displayed, erase it. Refer to ECR-97, "Diagnosis Description".

>> GO TO 10.

10. 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 repaired securely.

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 8.

YES-2 >> Symptom remains: GO TO 6.

NO >> Before returning the vehicle to the customer, make sure to erase unnecessary DTC in ECM.

Diagnostic Work Sheet

INFOID:0000000001551215

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 a incident. It is important to fully understand the symptoms or conditions for a customer complaint.

Utilize a diagnostic worksheet like the one on the next page in order to organize all the information for troubleshooting.

Some conditions may cause the MIL to come on steady 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

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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	

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INSPECTION AND ADJUSTMENT
BASIC INSPECTION

BASIC INSPECTION : Special Repair Requirement

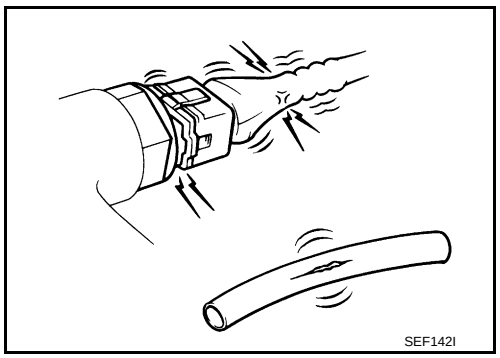
INFOID:0000000001530531

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 MA-7, "Periodic Maintenance".
3. Open engine 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. 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 ECR-13, "IDLE SPEED : Special Repair Requirement".
For specification, refer to ECR-333, "Idle Speed".

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.CHECK FOR INTAKE AIR LEAK

1. Stop engine.
2. 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.

4.BLEED AIR FROM FUEL SYSTEM

Use priming pump to bleed air from fuel system. Refer to FL-17, "Air Bleeding".

>> GO TO 5.

5.CHECK IDLE SPEED AGAIN

Check idle speed.
For procedure, refer to ECR-13, "IDLE SPEED : Special Repair Requirement".
For specification, refer to ECR-333, "Idle Speed".

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-17, "Water Draining".

>> GO TO 7.

7.CHECK IDLE SPEED AGAIN

Check idle speed.
For procedure, refer to ECR-13, "IDLE SPEED : Special Repair Requirement".
For specification, refer to ECR-333, "Idle Speed".

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-5, "Work Flow".

Is the inspection result normal?

YES >> Check charging system. Refer to CHG-3, "Work Flow".
NO >> Repair or replace.

11.CHECK COMPRESSION PRESSURE

Check compression pressure. Refer to EM-260, "Inspection".

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 ECR-13, "IDLE SPEED : Special Repair Requirement".
For specification, refer to ECR-333, "Idle Speed".

Is the inspection result normal?

YES >> INSPECTION END
NO >> 1. Replace fuel injector.
2. Perform ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".
3. Perform ECR-14, "ZFC VALUE RESET : Special Repair Requirement".
4. GO TO 2.

ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT

ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Description

INFOID:0000000001307408

When replacing ECM, this procedure must be performed.

ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Re-

quirement

INFOID:0000000001307409

1.PERFORM INJECTOR ADJUSTMENT VALUE REGISTRATION

Perform ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".

>> GO TO 2.

2.PERFORM ZFC VALVE RESET

Perform ECR-14, "ZFC VALUE RESET : Special Repair Requirement".

>> GO TO 3.

3.PERFORM EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING

Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Special Repair Requirement".

>> GO TO 4.

4.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Perform ECR-16, "THROTTLE VALVE CLOSED POSITION LEARNING : Special Repair Requirement".

>> GO TO 5.

5.PERFORM DPF DATA CLEAR

Perform ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

>> GO TO 6.

6.PERFORM AIR FUEL RATIO LEARNING VALVE CLEAR

Perform ECR-18, "AIR FUEL RATIO SENSOR LEARNING VALUE CLEAR : Special Repair Requirement".

>> END

IDLE SPEED

IDLE SPEED : Description

INFOID:0000000001559468

This describes how to check the idle speed. For the actual procedure, follow the instructions in “BASIC INSPECTION”.

IDLE SPEED : Special Repair Requirement

INFOID:0000000001559469

1.CHECK IDLE SPEED

With CONSULT-III
Check idle speed in “DATA MONITOR” mode with CONSULT-III.
With GST
Check idle speed with Service $01 of GST.

>> INSPECTION END

ZFC VALUE RESET

ZFC VALUE RESET : Description

INFOID:0000000001530732

Wear of injector opening portion (blocking or enlargement of the hall) due to secular change causes error of injected amount of fuel resulting in smoke or large noise.
To prevent these conditions, it is necessary to reset ZFC (Zero Fuel Calibration) and NVC (Nominal Voltage Calibration).

The calibration shall be performed after the following operation.
- ECM replacement or reprogramming
- Injector replacement

ZFC VALUE RESET : Special Repair Requirement

INFOID:0000000001530733

1.START

1. Turn ignition switch ON.
2. Perform “ZFC VALUE RESET ” in WORK SUPPORT mode with CONSULT-III.
3. Wait at least 10 seconds.

>> END

INJECTOR ADJUSTMENT VALUE REGISTRATION

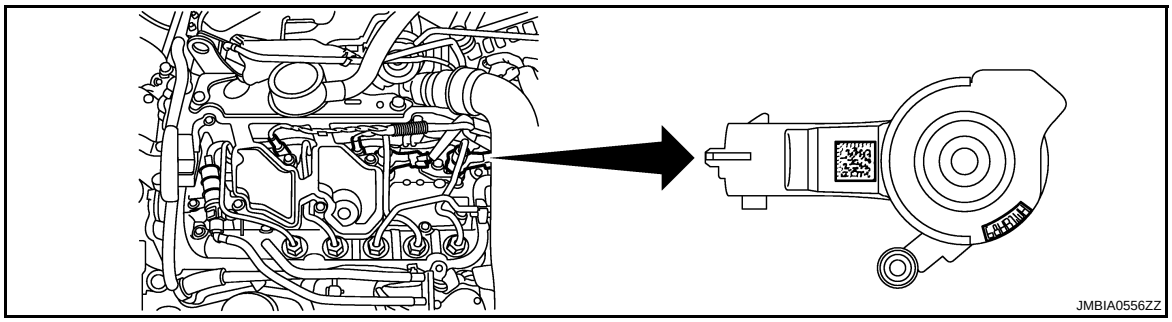
INJECTOR ADJUSTMENT VALUE REGISTRATION : Description

INFOID:0000000001307410

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 a drivability may effect 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.
- ECM is replaced.

For the first case, Injector Adjustment Value Registration for the replaced fuel injector must be performed. And for the second case, Injector Adjustment Value Registration for all the fuel injectors must be performed.



Example: Injector adjustment value = 68HBLWH

INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement

INFOID:0000000001307411

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 “INJ ADJ VAL REGIST” in “WORK SUPPORT” mode with CONSULT-III.
3. Touch “START”.
   NOTE:
   When touching “START”, CONSULT-III 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, and touch “ENTER”.
   NOTE:
   Input injector adjustment value is stored in CONSULT-III.
6. Repeat step 4 - 5 till there is no cylinder which needs Injector Adjustment Value Registration, and touch “START”.
   NOTE:

When touching “START”, injector adjustment values stored in CONSULT-III are written onto ECM memory.

7. After “CMND FINISHED” is displayed, make sure 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-III screen.

NOTE:

- In this step, CONSULT-III reads injector adjustment values stored in ECM and displays the values on the CONSULT-III 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.

>> END

EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR

EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR : Description

INFOID:0000000001530724

EGR volume control valve closed position learning value should be cleared under the following cases.

- EGR volume control valve is removed.
- EGR volume control valve is replaced.

EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement

INFOID:0000000001530725

1.START

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 30 seconds.
3. Turn ignition switch ON.
4. Select “EGR/V LEARN CLR” in “WORK SUPPORT” mode with CONSULT-III.
5. Touch “CLEAR” and wait a few seconds.
6. Make sure the “CMPLT” is displayed on CONSULT-III screen.

>> END

EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING

EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Description

INFOID:0000000001530734

EGR Volume Control Valve Closed Position Learning is an operation to learn the fully closed position of the EGR volume control valve by monitoring the EGR volume control valve control position sensor output signal. It must be performed under any of the following conditions:

- EGR volume control valve is removed.
- EGR volume control valve is replaced.
- ECM is replaced.

EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Special Repair Requirement

INFOID:0000000001530735

1.START

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 10 seconds.
   Make sure that EGR volume control valve moves during above 10 seconds by confirming the operating sound.

>> END

THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR

THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR : Description

INFOID:0000000001530738

Throttle valve closed position learning value should be cleared under the following cases.
- Electric throttle control actuator is removed.
- Electric throttle control actuator is replaced.

THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement

INFOID:0000000001530739

1.START

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 30 seconds.
3. Turn ignition switch ON.
4. Select “TP POS LEARN CLR” in “WORK SUPPORT” mode with CONSULT-III.
5. Touch “CLEAR” and wait a few seconds.
6. Make sure the “CMPLT” is displayed on CONSULT-III screen.

>> END

THROTTLE VALVE CLOSED POSITION LEARNING

THROTTLE VALVE CLOSED POSITION LEARNING : Description

INFOID:0000000001530736

Throttle Valve Closed Position Learning is an operation to learn the fully closed position of the throttle valve by monitoring the throttle position sensor output signal. It must be performed each time harness connector of electric throttle control actuator or ECM is disconnected.
- Electric throttle control actuator is removed.
- Electric throttle control actuator is replaced.
- ECM is replaced.

THROTTLE VALVE CLOSED POSITION LEARNING : Special Repair Requirement

INFOID:0000000001530737

1.START

1. Make sure that accelerator pedal is fully released.
2. Turn ignition switch ON.
3. Turn ignition switch OFF and wait at least 10 seconds.
   Make sure that throttle valve moves during above 10 seconds by confirming the operating sound.

>> END

SERVICE REGENERATION

SERVICE REGENERATION : Description

INFOID:0000000001530744

Service Regeneration is performed with CONSULT-III to reduce particulate matter in DPF. Service Regeneration should be performed in the following cases.
- ECM enters fail-safe mode because the amount of particulate matter in DPF reaches the specified level.
  NOTE:
  When ECM enters fail-safe mode because the amount of particulate matter in DPF reaches the specified level, check whether or not DTC is stored in ECM. In the case of DTC stored, perform the Diagnostic Procedure for the DTC.
- ECM is replaced.
  NOTE:
  Based on the signal from sensors ECM measures the amount of particulate matter in DPF and stores the value in EEPROM (Electrically Erasable Programmable Read Only Memory). When ECM is replaced as new one, there is a difference between the actual amount of particulate matter and the value stored in new ECM, because the value stored in new ECM is initialized one. In the case above, ECM can not perform

regeneration control correctly. So, perform service regeneration to make the amount of particulate matter in DPF zero.
- Component Inspection for DPF is performed.

CAUTION:
Always replace engine oil and engine oil filter after service regeneration. Fuel mixes with engine oil during service regeneration. The mixture does not occur during the regeneration which is automatically performed under normal operation.

SERVICE REGENERATION : Special Repair Requirement

INFOID:0000000001530745

1.START

1. Turn ignition switch ON.
2. Select “SERVC REGENERATION” in “WORK SUPPORT” mode with CONSULT-III.
3. Touch “START”.
4. Wait until “CMPT” is displayed.
   NOTE:
   - Make sure that accelerator pedal is fully released during service regeneration, or service regeneration is canceled. When service regeneration is canceled, retry from step1.
   - It will take approximately 40 minutes until “CMPLT” is displayed.
5. Turn ignition switch OFF.
6. Replace engine oil and engine oil filter.

>> END

DPF DATA CLEAR

DPF DATA CLEAR : Description

INFOID:0000000001530740

Perform “DPF DATA CLEAR” in “WORK SUPPORT” mode with CONSULT-III when oxidation catalyst with DPF is replaced as new one. Based on the signal from sensors ECM estimates the amount of particulate matter in DPF and stores the value in EEPROM as DPF data. When oxidation catalyst with DPF is replaced as new one, there is a difference between DPF data stored in ECM and the actual amount of particulate matter in DPF, because no particulate matter is trapped in new DPF. In this case, ECM can not perform regeneration control correctly. So perform “DPF DATA CLEAR” in “WORK SUPPORT” mode with CONSULT-III to clear DPF data stored in ECM.

CAUTION:
Never perform “DPF DATA CLEAR” in “WORK SUPPORT” mode with CONSULT-III when oxidation catalyst with DPF is not replaced as new one. DPF may be damaged because regeneration is not performed at appropriate timing.

DPF DATA CLEAR : Special Repair Requirement

INFOID:0000000001530741

1.START

1. Turn ignition switch ON.
2. Select “DPF DATA CLEAR” in “WORK SUPPORT” mode with CONSULT-III.
3. Touch “CLEAR” and wait a few seconds.
4. Make sure that “CMPLT” is displayed on CONSULT-III screen.

>> END

AIR FUEL RATIO SENSOR LEARNING VALUE CLEAR

AIR FUEL RATIO SENSOR LEARNING VALUE CLEAR : Description

INFOID:0000000001530742

ECM learns the output characteristic of A/F sensor 1 to perform the control of DPF regeneration precisely. A/F sensor learning value should be cleared under the following conditions.
- A/F sensor 1 is changed.
- ECM is replaced with used one which stores the A/F Sensor Learning Value of another A/F sensor 1.

AIR FUEL RATIO SENSOR LEARNING VALUE CLEAR : Special Repair Requirement

INFOID:0000000001530743

1.START

1. Turn ignition switch ON.
2. Select “A/F SEN LEAN CLR” in “WORK SUPPORT” mode with CONSULT-III.
3. Touch “CLEAR” and wait a few seconds.
4. Make sure that “CMPLT” is displayed on CONSULT-III screen.

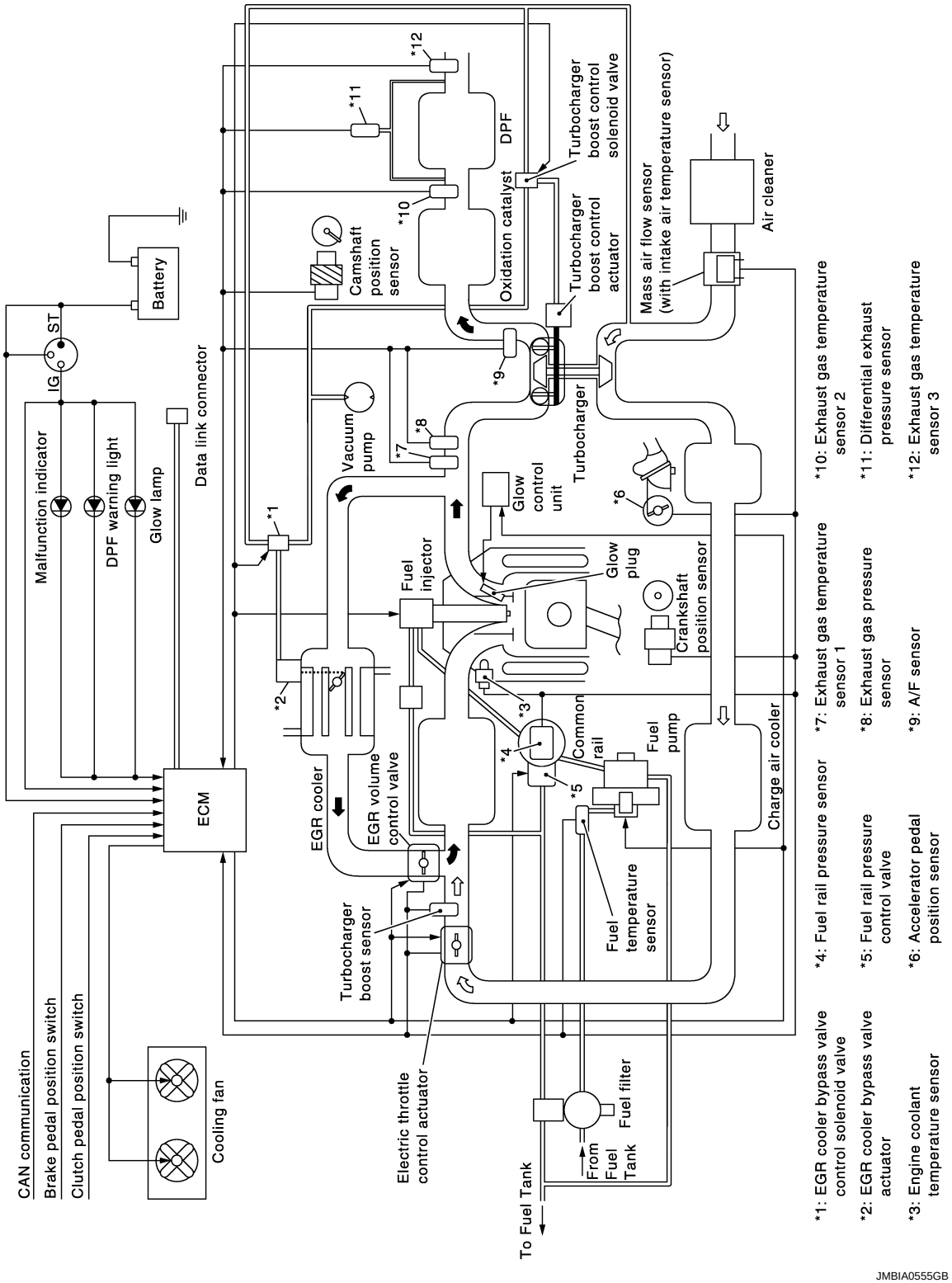
>> END

FUNCTION DIAGNOSIS

ENGINE CONTROL SYSTEM

System Diagram

INFOID:0000000001307412



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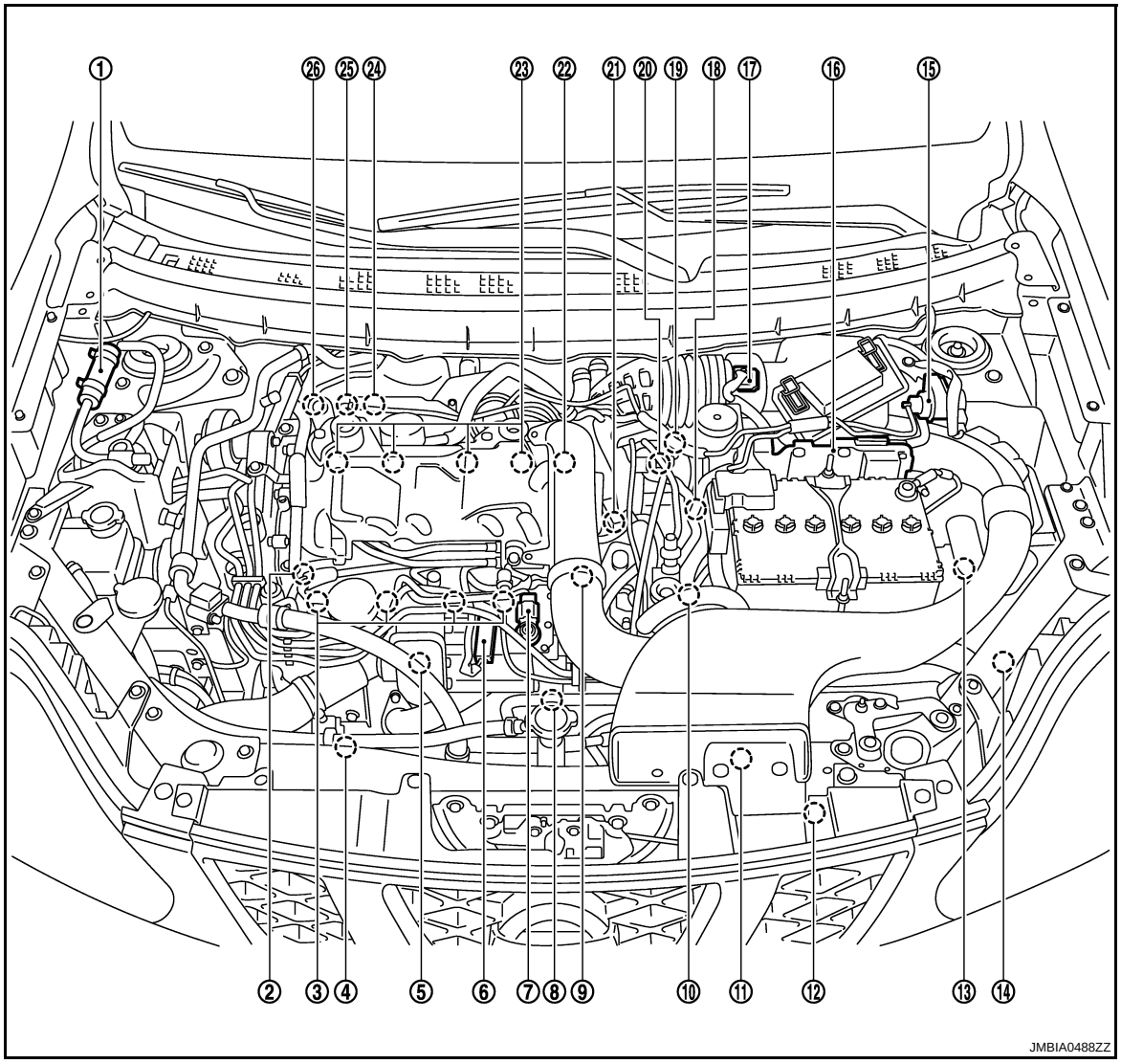
System Description

INFOID:0000000001307413

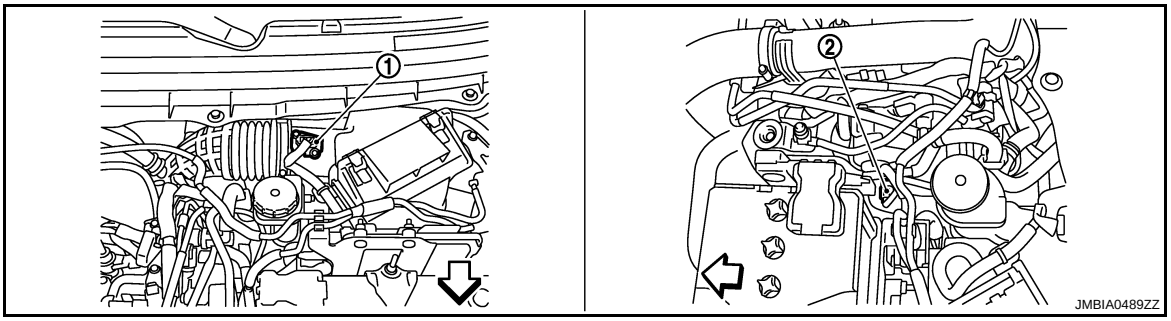
ECM performs various controls such as fuel injection control and furl pressure control.

Component Parts Location

INFOID:0000000001307414

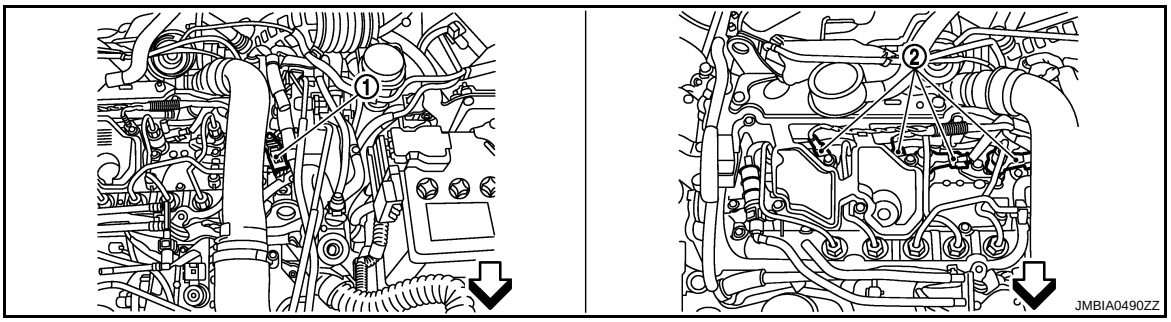


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



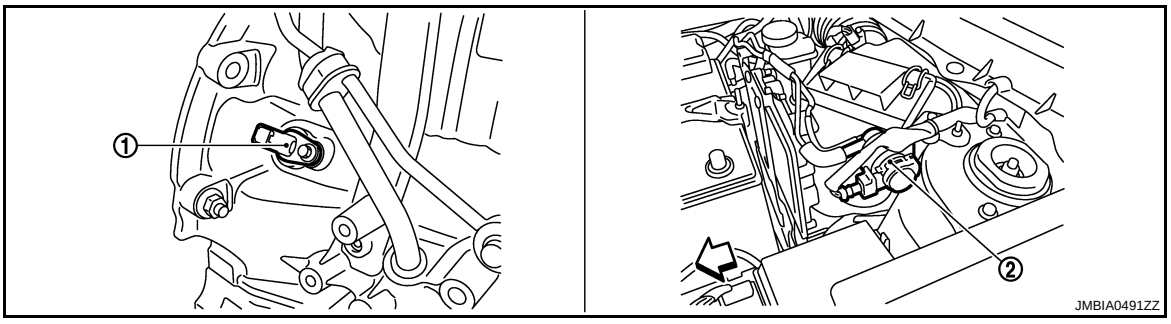
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



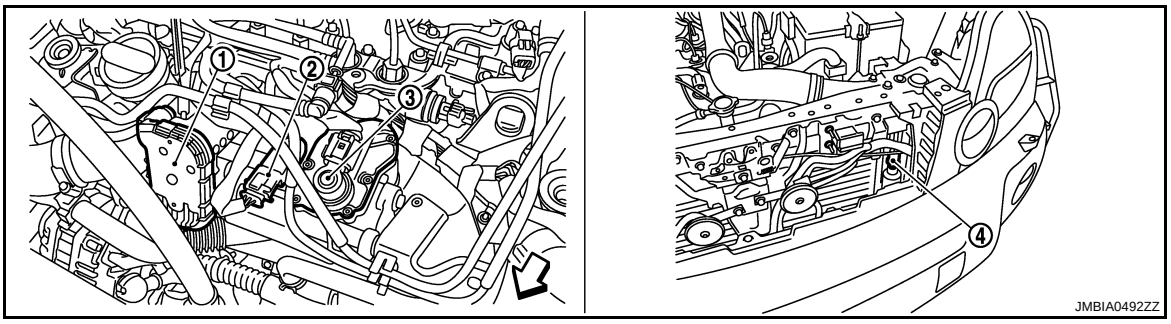
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



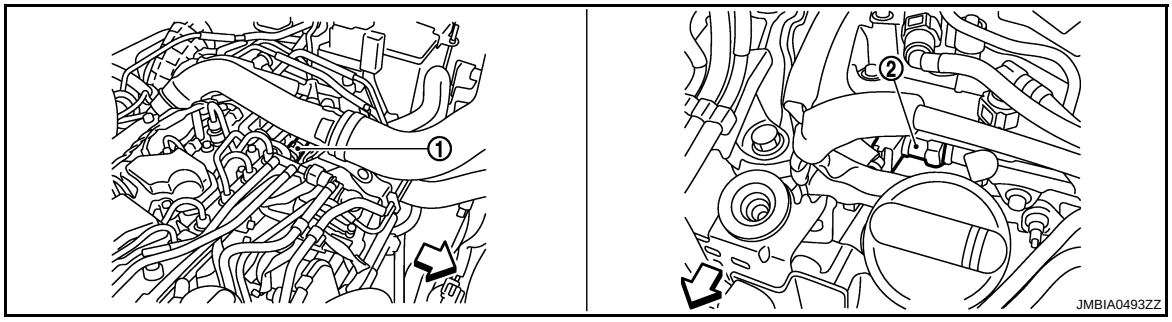
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



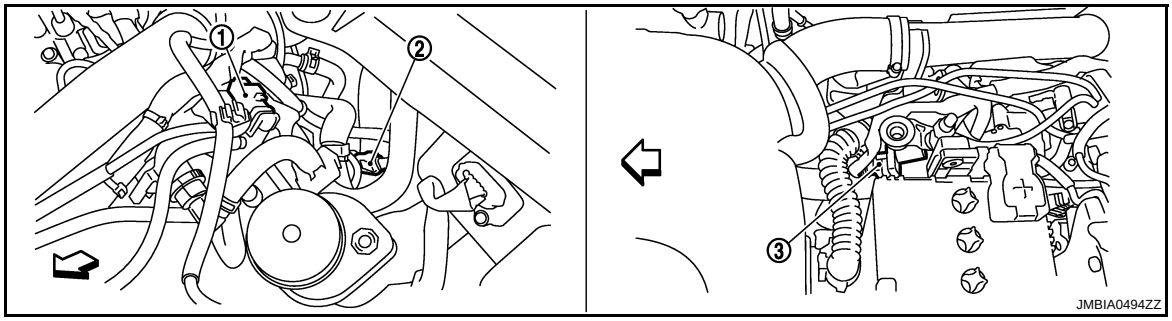
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



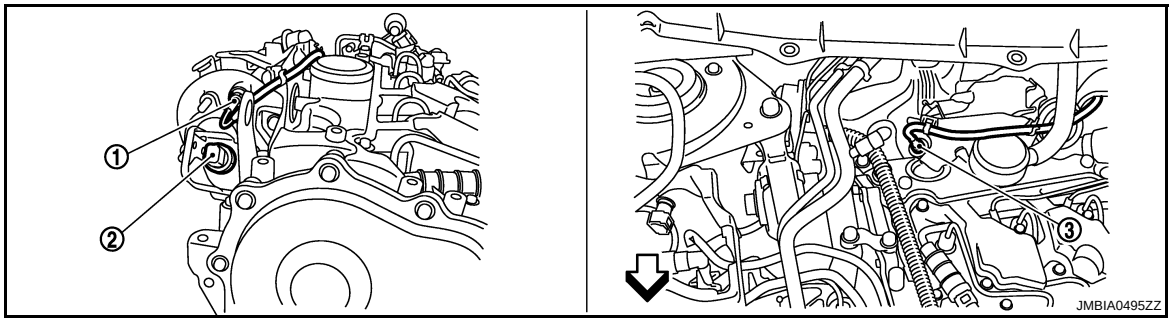
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



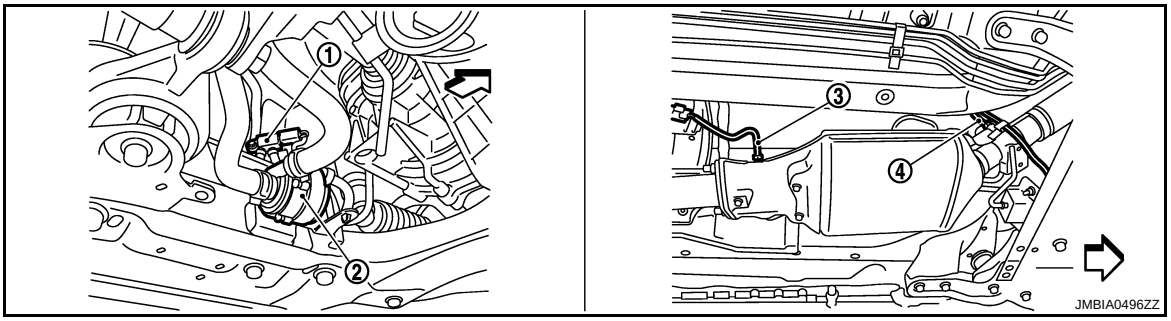
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



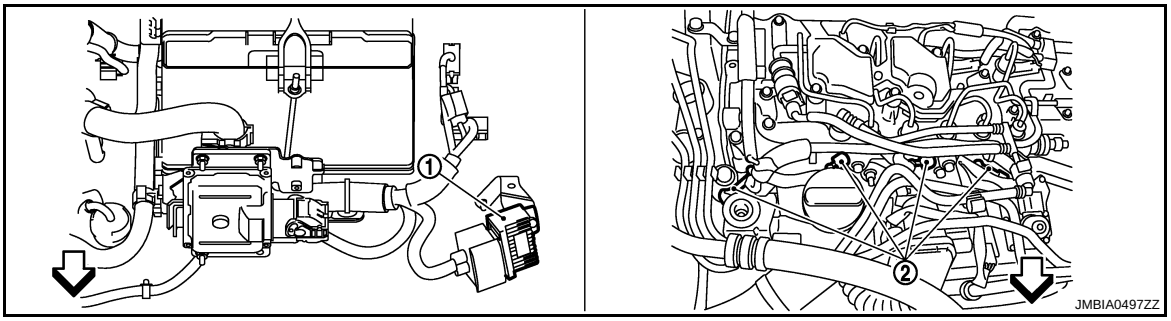
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



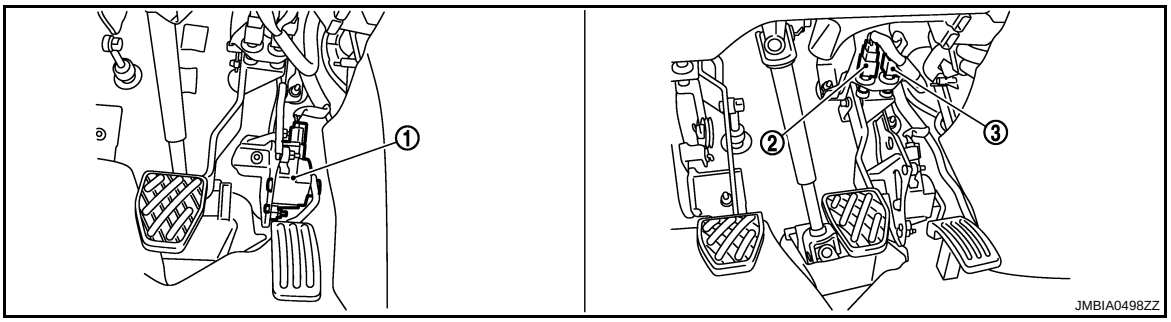
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

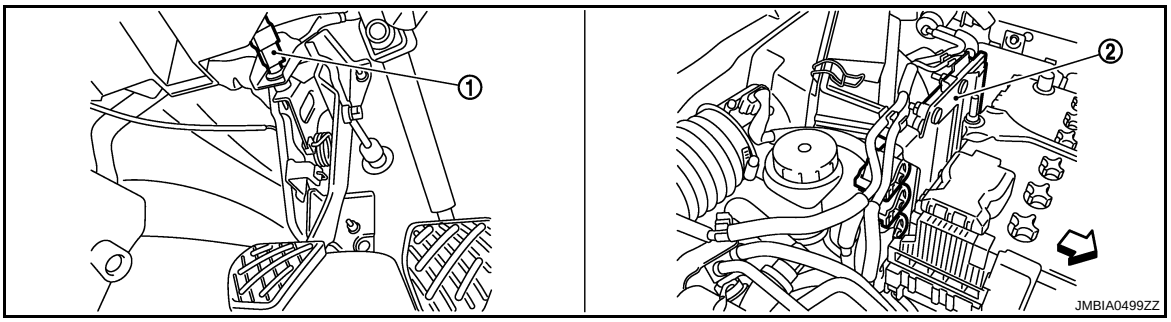


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

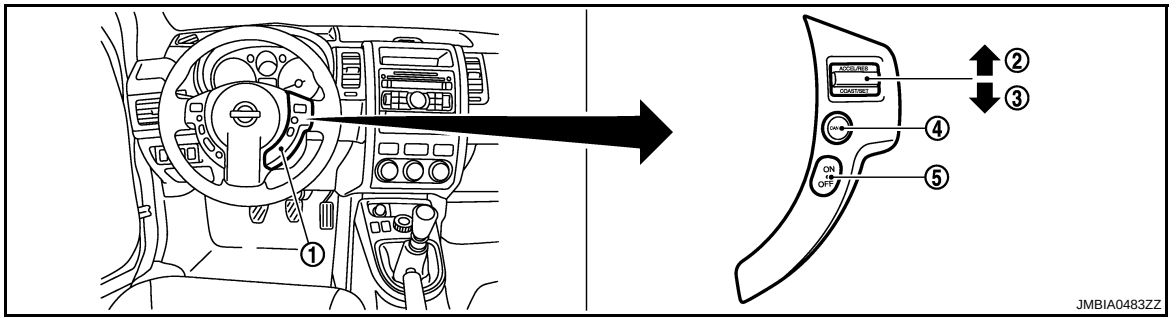


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

INFOID:0000000001307415

Component	Reference
A/F sensor 1	ECR-137, "Description"
A/F sensor 1 heater	ECR-145, "Description"
Accelerator pedal position sensor	ECR-158, "Description"
ASCD steering switch	ECR-192, "Description"
Barometric pressure sensor	ECR-247, "Description"
Brake pedal position switch	ECR-195, "Description"
Camshaft position sensor	ECR-169, "Description"
Cooling fan motor	ECR-284, "Description"
Crankshaft position sensor	ECR-167, "Description"
Clutch pedal position switch	ECR-282, "Description"
Differential exhaust pressure sensor	ECR-269, "Description"
EGR cooler bypass valve control solenoid valve	ECR-262, "Description"
EGR volume control valve	ECR-180, "Description"
EGR volume control valve control position sensor	ECR-175, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Exhaust gas pressure sensor	ECR-178, "Description"
Exhaust gas temperature sensor 1	ECR-187, "Description"
Exhaust gas temperature sensor 2	ECR-231, "Description"
Exhaust gas temperature sensor 3	ECR-264, "Description"
Fuel injector	ECR-155, "Description"
Fuel rail pressure control valve	ECR-256, "Description"
Fuel rail pressure sensor	ECR-150, "Description"
Fuel temperature sensor	ECR-148, "Description"
Intake air temperature sensor	ECR-130, "Description"
Mass air flow sensor	ECR-123, "Description"
Refrigerant pressure sensor	ECR-185, "Description"
Throttle position sensor	ECR-134, "Description"
Turbocharger boost control solenoid valve	ECR-117, "Description"
Turbocharger boost sensor	ECR-161, "Description"
Turbocharger cooling pump	ECR-274, "Description"
Vehicle speed sensor	ECR-184, "Description"

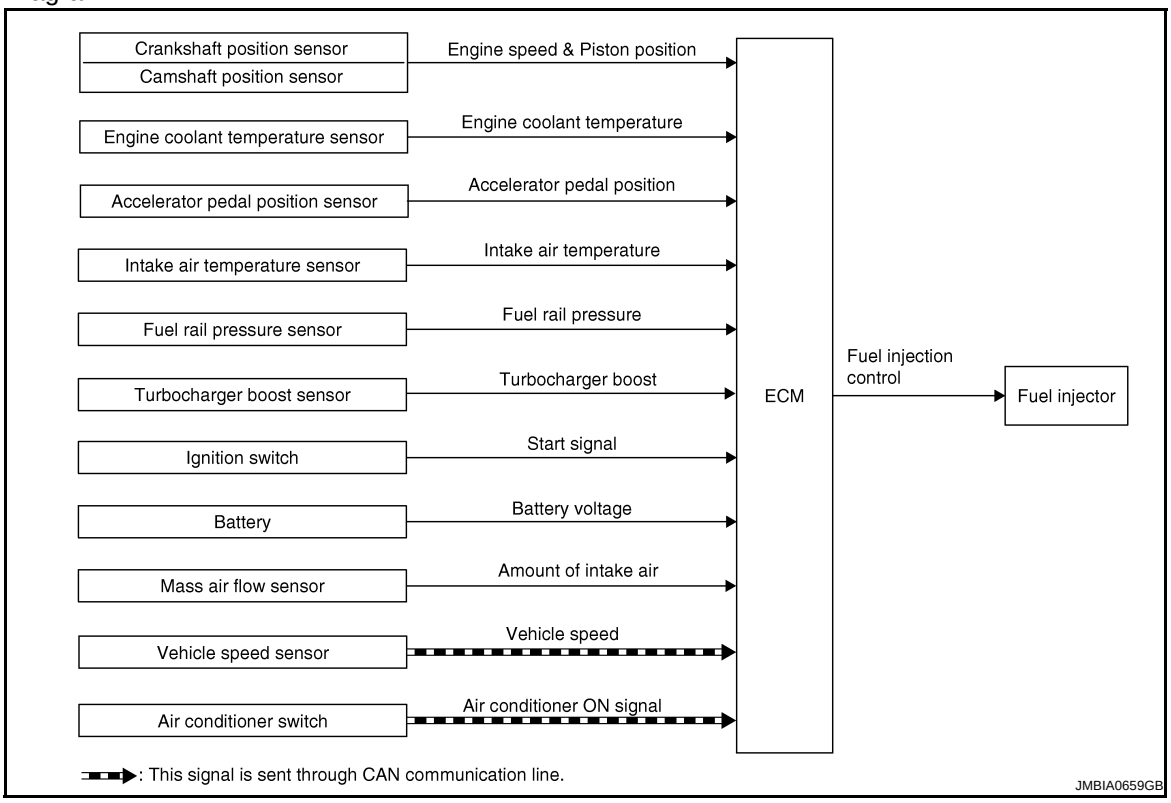
FUEL INJECTION CONTROL

System Description

INFOID:0000000001530571

FUEL INJECTION CONTROL

System Diagram



System Description

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed Piston position	Fuel injection control	Fuel injector
Camshaft position sensor			
Intake air temperature sensor	Intake air temperature		
Engine coolant temperature sensor	Engine coolant temperature		
Fuel rail pressure sensor	Fuel rail pressure sensor		
Accelerator pedal position sensor	Accelerator pedal position		
Turbocharger boost sensor	Turbocharger boost		
Ignition switch	Start signal		
Battery	Battery voltage		
Mass air flow sensor	Amount of intake air		
Vehicle speed sensor	Vehicle speed*		
Air conditioner switch	Air conditioner switch*		

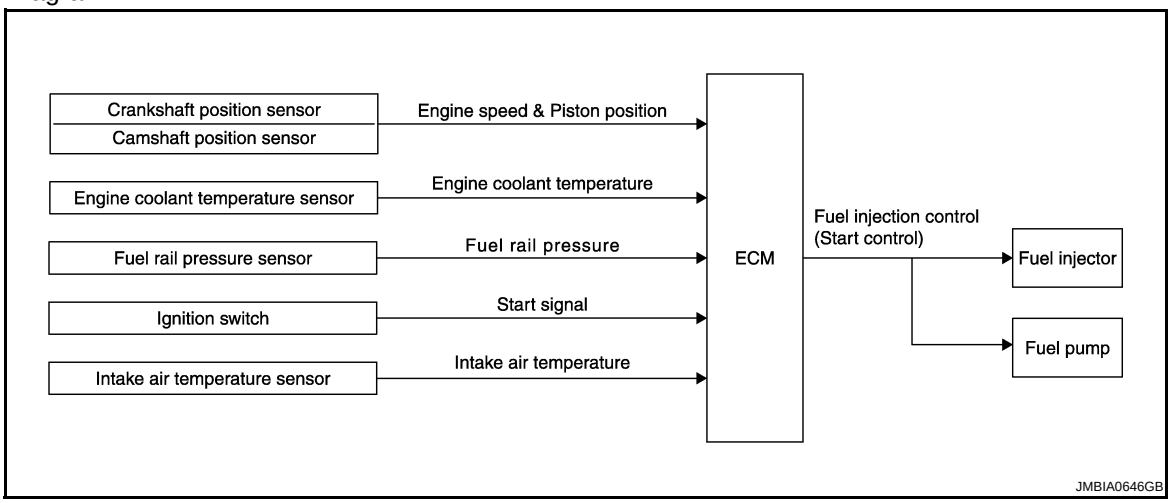
*: This signal is sent to the ECM through CAN communication line.

SYSTEM DESCRIPTION

Three types of fuel injection control are provided to accommodate engine operating conditions; normal control, idle control and start control. The ECM determines the appropriate fuel injection control. Above each control, the amount of fuel injected is adjusted to improve engine performance. Pulse signals are sent to fuel injectors according to the input signals to adjust the amount of fuel injected to preset value.

START CONTROL

System Diagram



System Description

INPUT/OUTPUT SIGNAL CHART

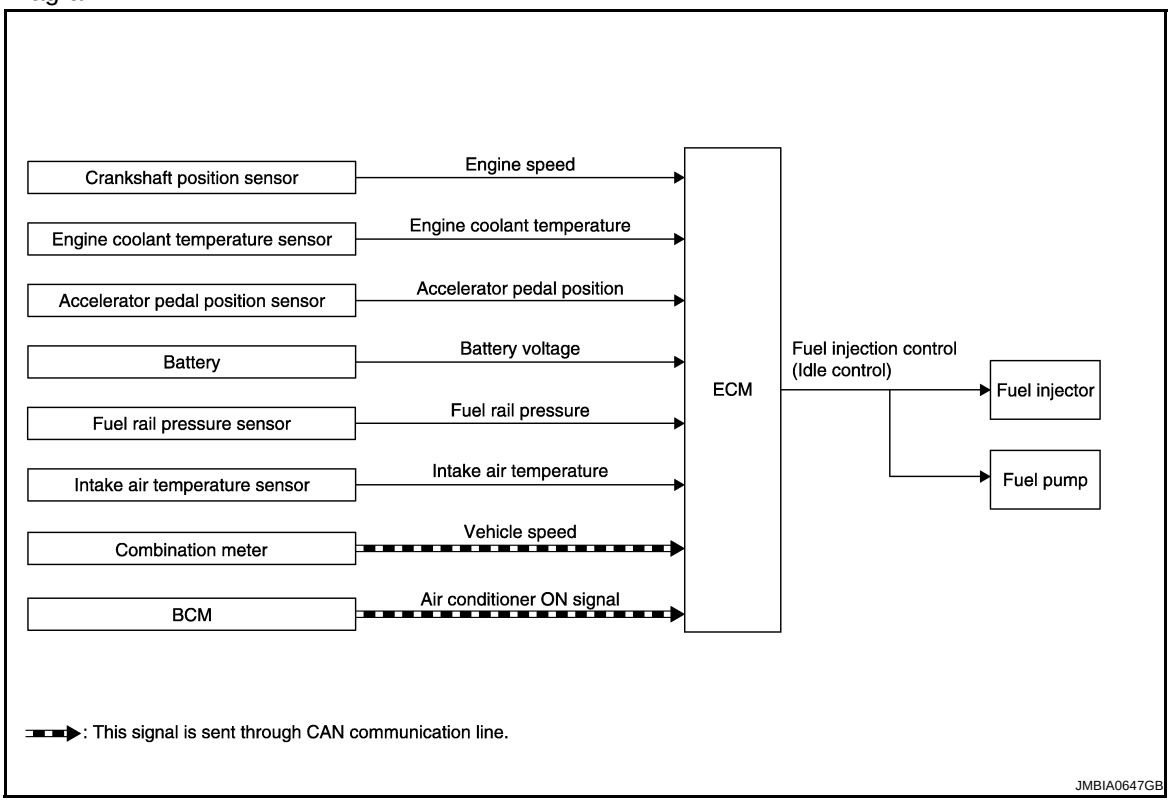
Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed Piston position	Fuel injection control (Start control)	Fuel injector Fuel pump
Camshaft position sensor			
Intake air temperature sensor	Intake air temperature		
Engine coolant temperature sensor	Engine coolant temperature		
Fuel rail pressure sensor	Fuel rail pressure sensor		
Ignition switch	Start signal		

SYSTEM DESCRIPTION

When ECM detected the engine revolution pulse at engine cranking, the ECM adapts the fuel injection system for the start control. The amount of fuel injected at engine starting is a preset program value in the ECM. The program is determined by the engine speed, engine coolant temperature, intake air temperature and fuel rail pressure. For better startability under cool engine conditions, the lower the coolant temperature becomes, the greater the amount of fuel injected. The ECM ends the start control when the engine speed reaches the specific value, and shifts the control to the normal or idle control.

IDLE CONTROL

System Diagram



System Description

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed	Fuel injection control (Idle control)	Fuel injector Fuel pump
Accelerator pedal position sensor	Accelerator pedal position		
Engine coolant temperature sensor	Engine coolant temperature		
Intake air temperature sensor	Intake air temperature		
Fuel rail pressure sensor	Fuel rail pressure sensor		
Battery	Battery voltage		
Vehicle speed sensor	Vehicle speed*		
Air conditioner switch	Air conditioner switch*		

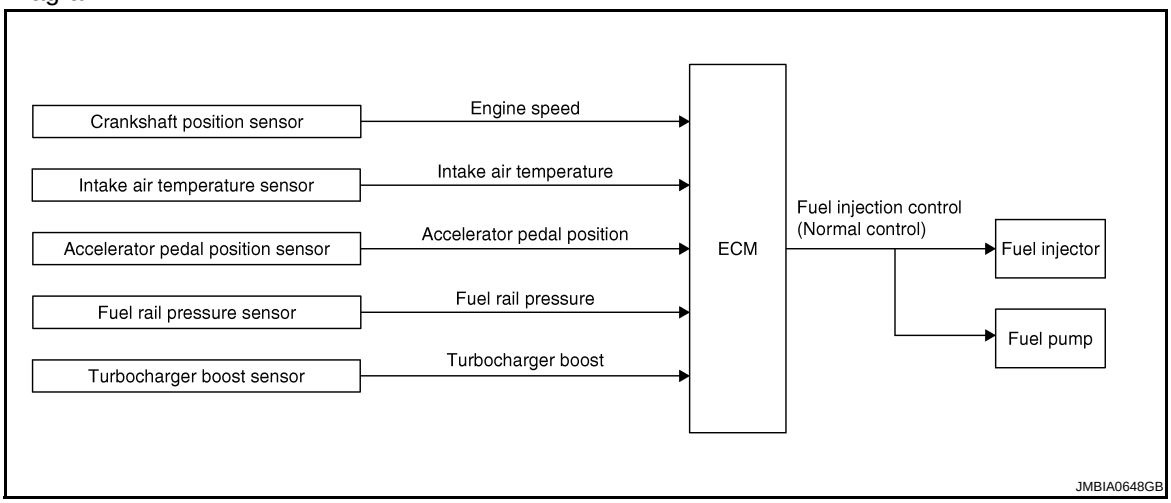
*: This signal is sent to the ECM through CAN communication line.

SYSTEM DESCRIPTION

When the ECM determines that the engine speed is at idle, the fuel injection system is adapted for the idle control. The ECM regulates the amount of fuel injected corresponding to changes in load applied to the engine to keep engine speed constant. The ECM also provides the system with a fast idle control in response to the engine coolant temperature signal.

NORMAL CONTROL

System Diagram



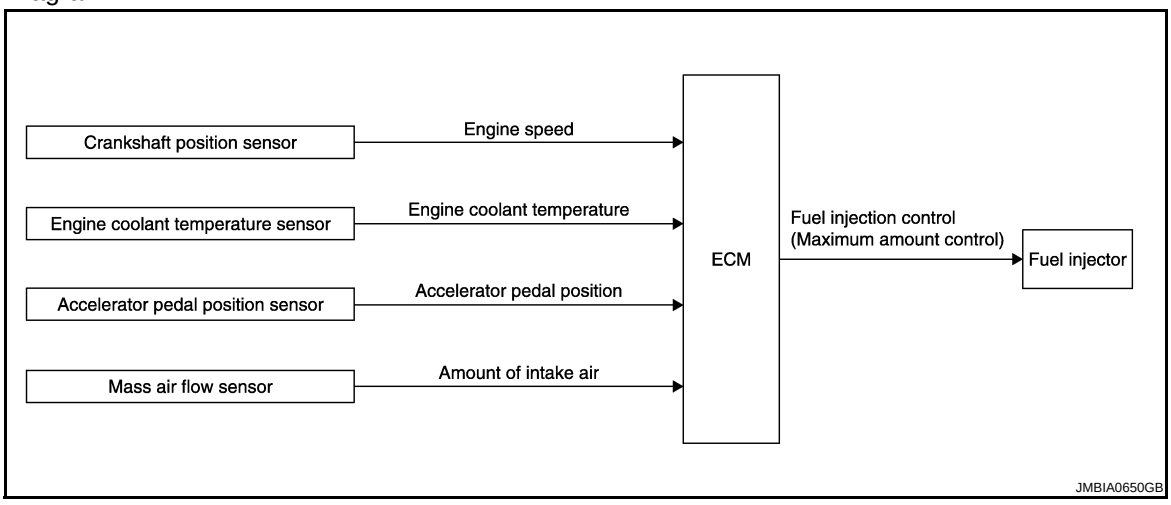
System Description
INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed	Fuel injection control (Normal control)	Fuel injector
Accelerator pedal position sensor	Accelerator pedal position		
Fuel rail pressure sensor	Fuel rail pressure sensor		
Intake air temperature sensor	Intake air temperature		
Turbocharger boost sensor	Turbocharger boost		

SYSTEM DESCRIPTION
The amount of fuel injected under normal driving conditions is determined according to sensor signals. The crankshaft position sensor detects engine speed, intake air temperature sensor detects intake air temperature, turbocharger boost sensor detects turbocharger boost, the accelerator pedal position sensor detects accelerator pedal position, fuel rail pressure sensor detects fuel rail pressure and other sensors detects each signal. These sensors send signals to the ECM. The fuel injection data, predetermined by correlation between various engine speeds, accelerator pedal position and fuel rail pressure are stored in the ECM memory, forming a map. The ECM detainees the optimal amount of fuel to be injected using the sensor signals in comparison with the map.

MAXIMUM AMOUNT CONTROL

System Diagram



System Description
INPUT/OUTPUT SIGNAL CHART

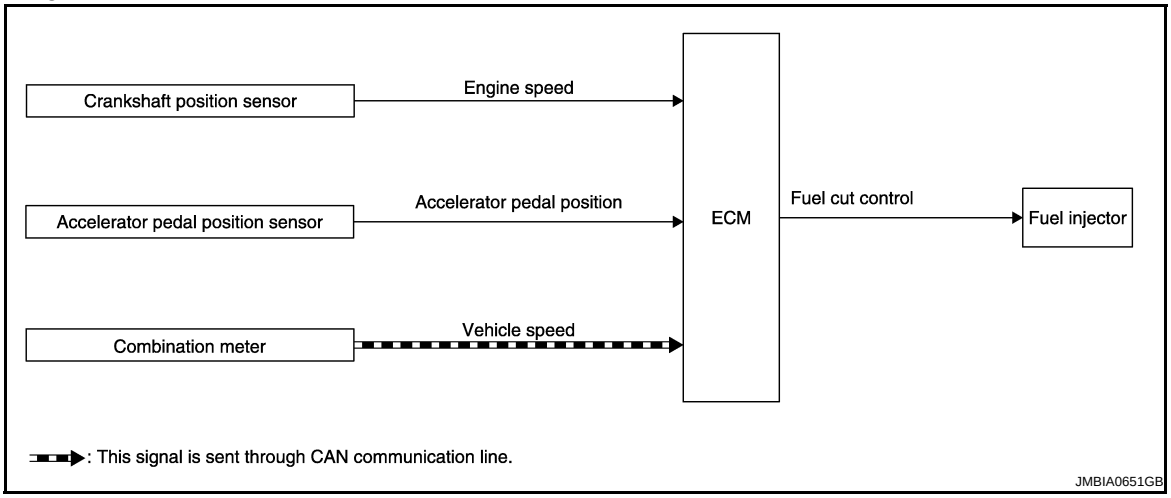
Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed	Fuel injection control (Maximum control)	Fuel injector
Accelerator pedal position sensor	Accelerator pedal position		
Engine coolant temperature sensor	Engine coolant temperature		
Mass air flow sensor	Amount of intake air		

SYSTEM DESCRIPTION

The maximum injection amount is controlled to an optimum by the engine speed, intake air amount, engine coolant temperature and accelerator opening in accelerator with the driving conditions. This prevents the over-supply of the injection amount caused by decreased air density at a high altitude or during a system failure.

FUELCUT CONTROL

System Diagram



System Description

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Vehicle speed sensor	Vehicle speed*	Fuel injection control (Fuel cut control)	Fuel injector
Crankshaft position sensor	Engine speed		
Accelerator pedal position sensor	Accelerator pedal position		

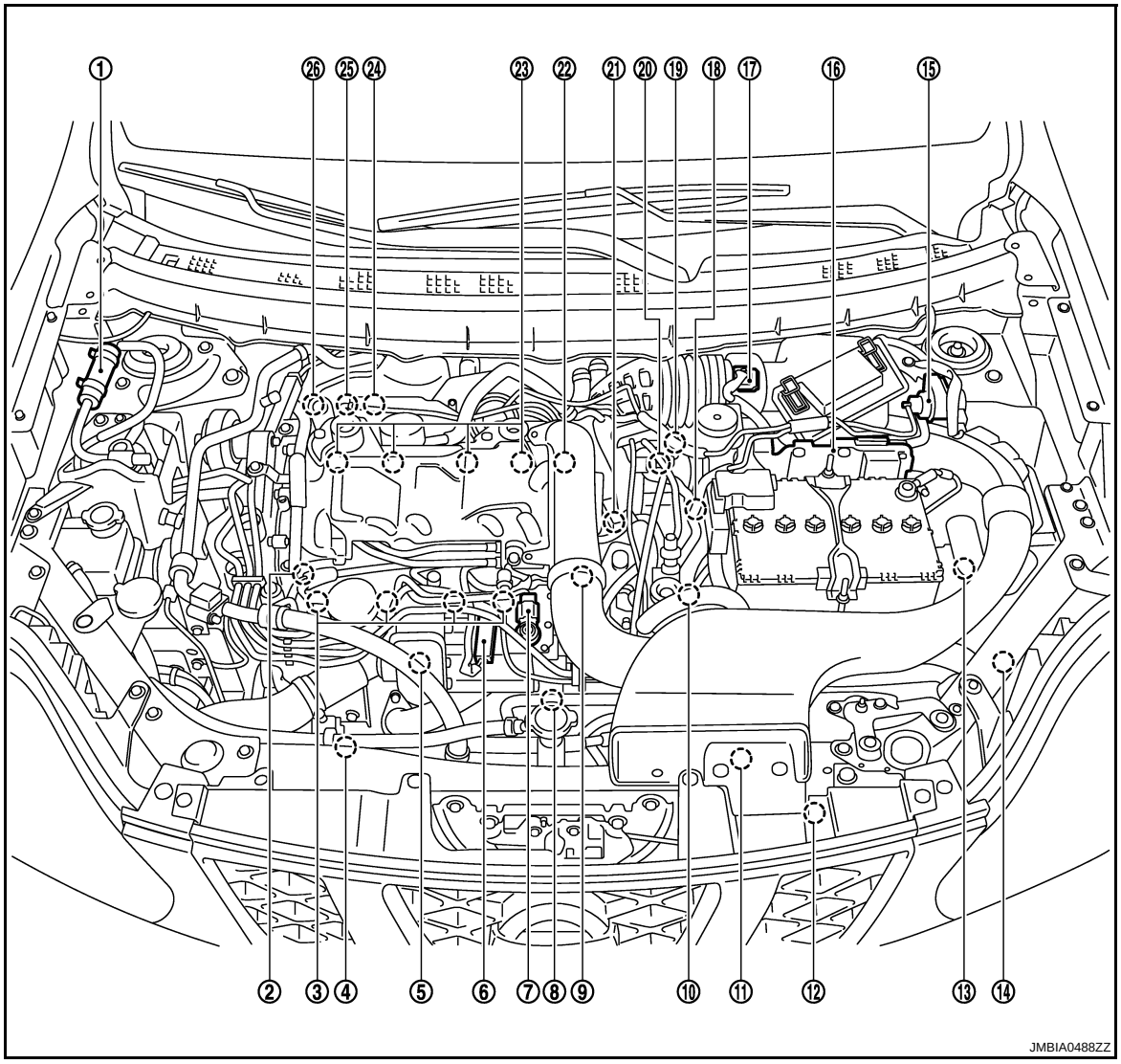
*: This signal is sent to the ECM though ECM CAN communication line.

SYSTEM DESCRIPTION

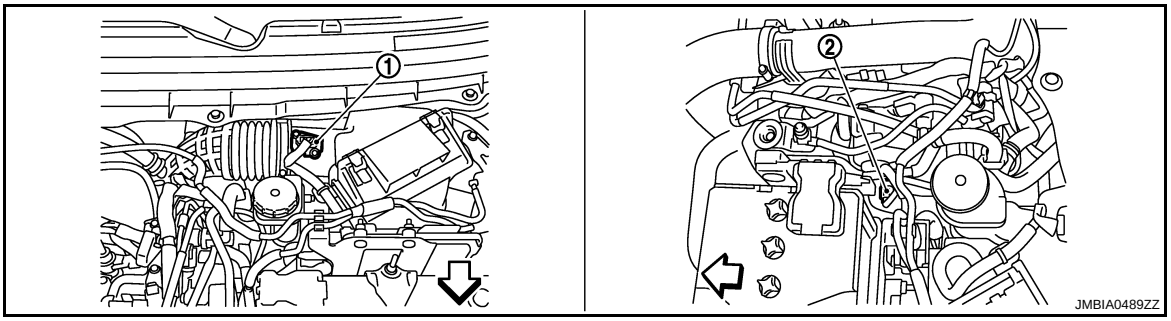
The ECM sends a fuel cut signal to the fuel injectors and fuel pump during deceleration for better fuel efficiency. The ECM determines the time of deceleration according to signals from the accelerator pedal position sensor, crankshaft positions sensor and vehicle speed sensor.

Component Parts Location

INFOID:0000000001542148

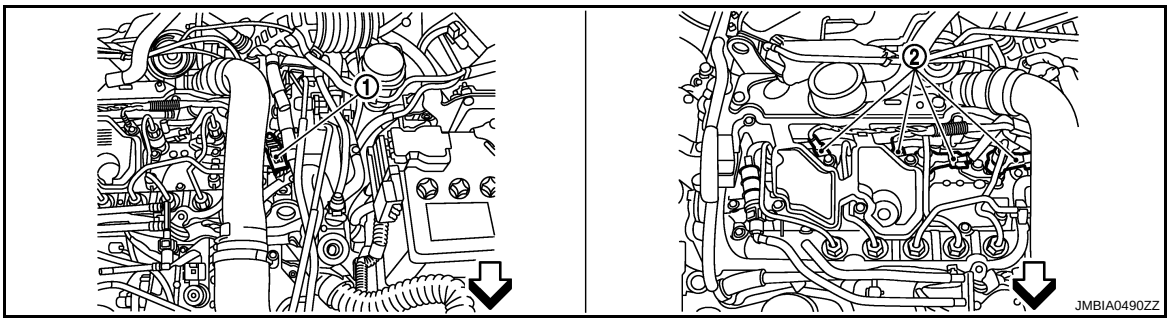


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



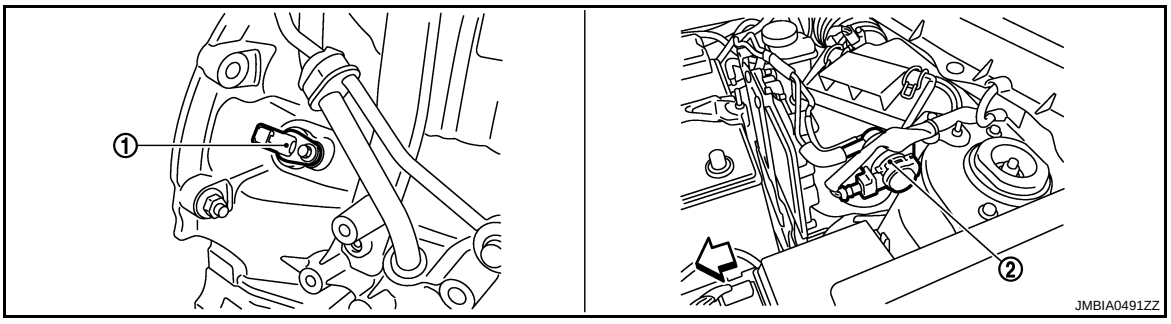
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



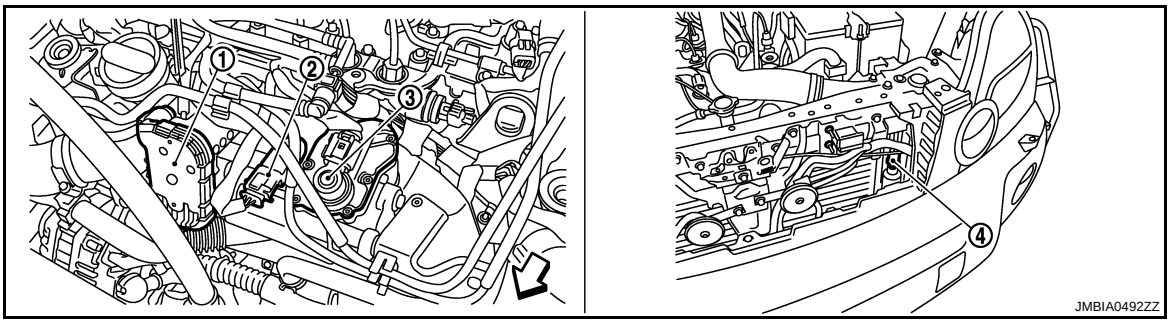
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



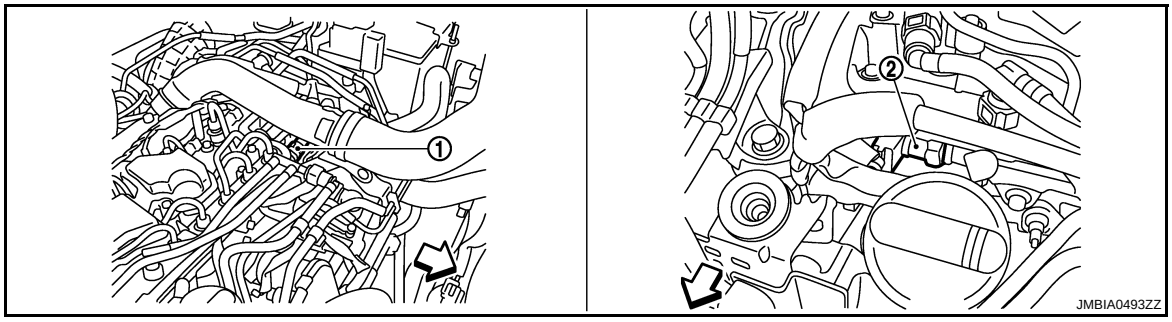
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



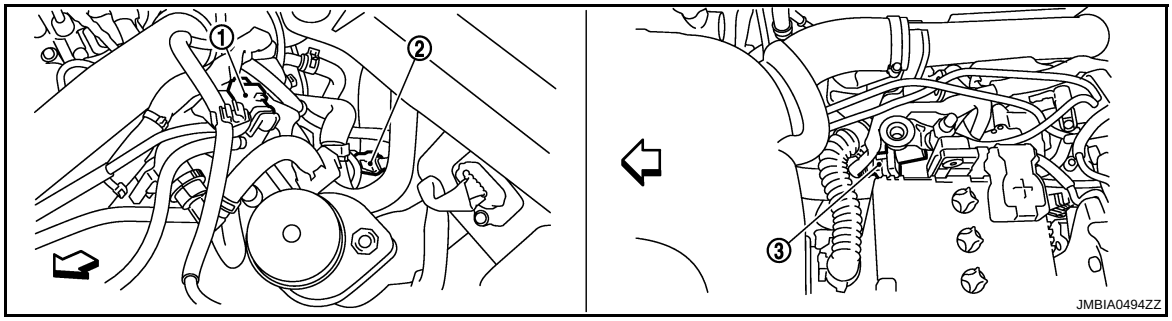
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



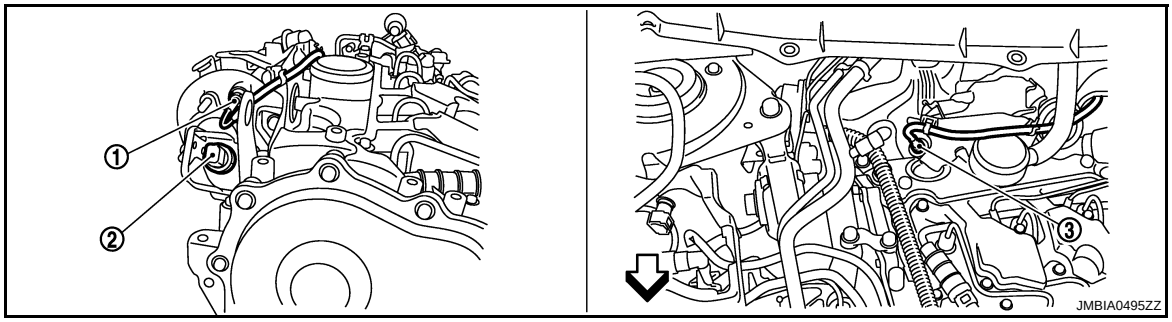
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



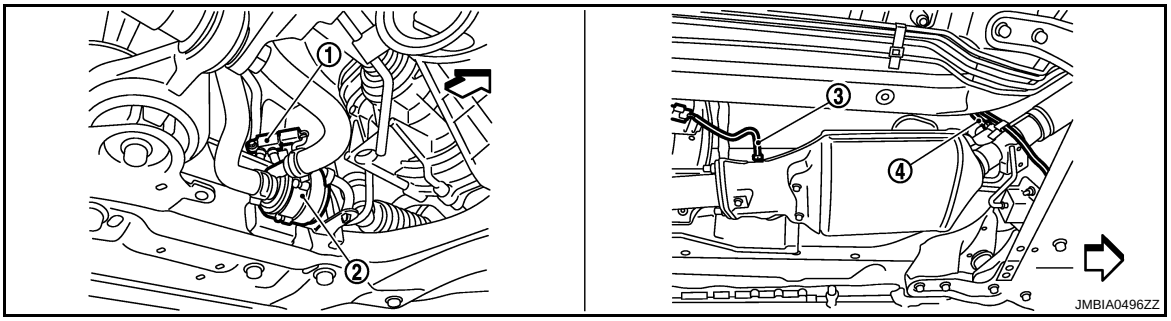
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



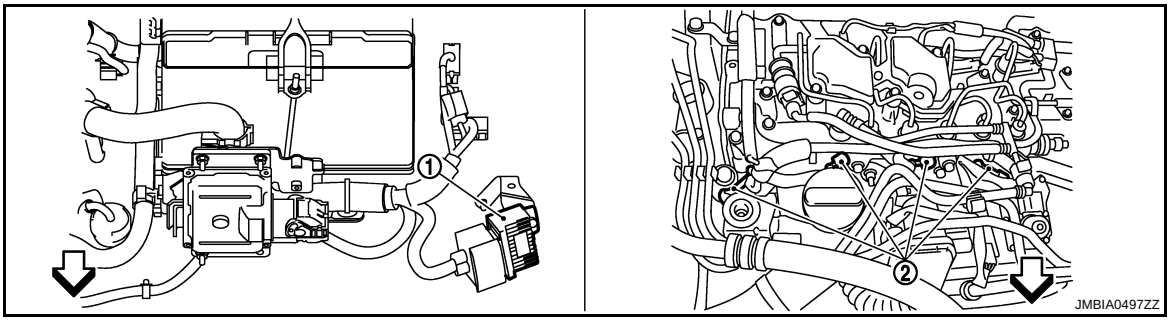
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



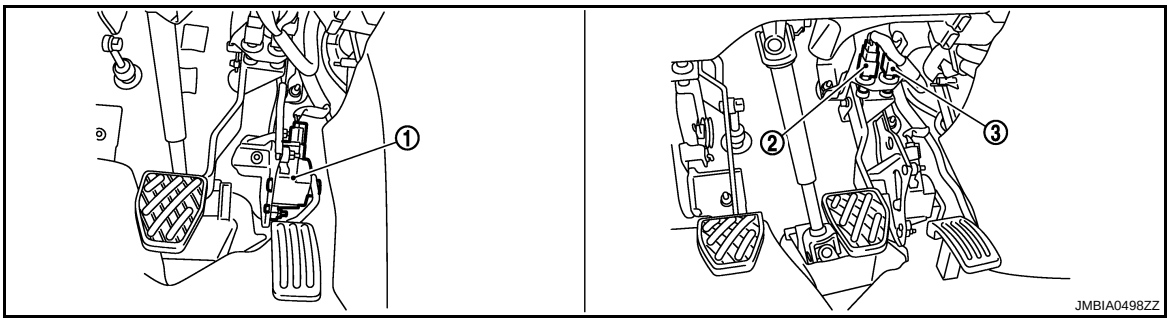
⇦ : Vehicle front

1. Differential exhaust pressure sensor 2. Turbocharger cooling pump 3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

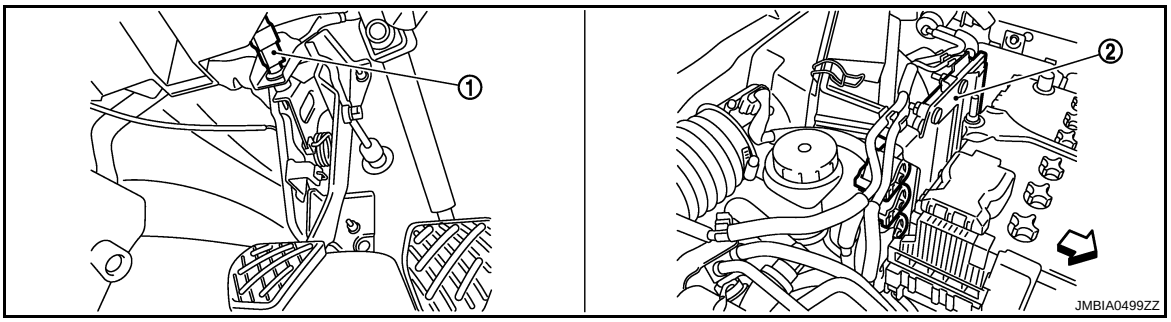


⇦ : Vehicle front

1. Glow control unit 2. Glow plug

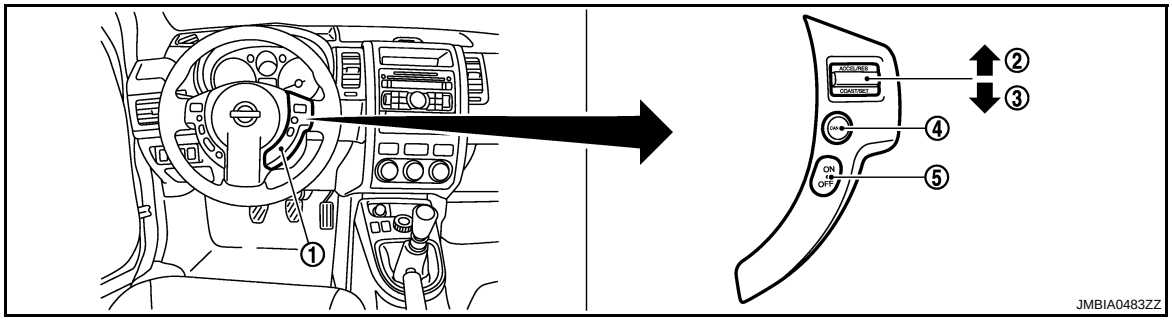


1. Accelerator pedal position sensor 2. Stop lamp switch 3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch 2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

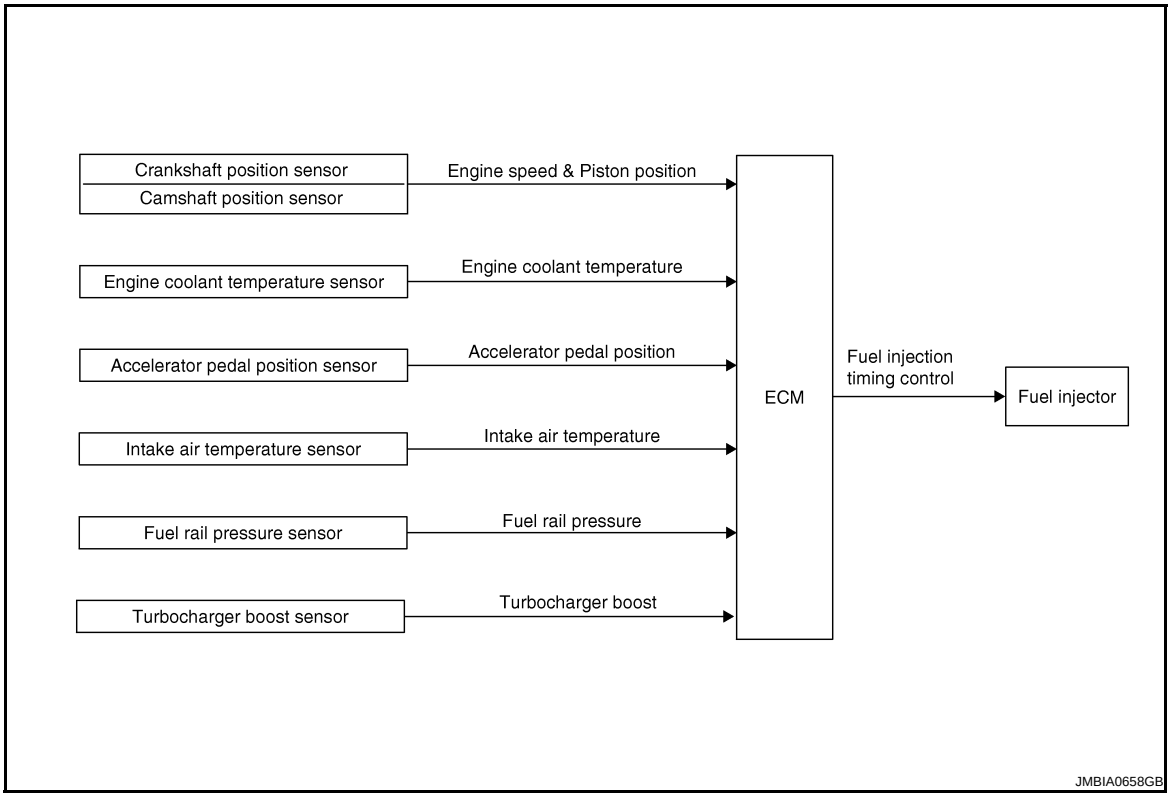
INFOID:0000000001542427

Component	Reference
Accelerator pedal position sensor	ECR-158, "Description"
Camshaft position sensor	ECR-169, "Description"
Crankshaft position sensor	ECR-167, "Description"
Clutch pedal position switch	ECR-282, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Fuel injector	ECR-155, "Description"
Fuel rail pressure sensor	ECR-150, "Description"
Mass air flow sensor	ECR-123, "Description"
Turbocharger boost sensor	ECR-161, "Description"
Vehicle speed sensor	ECR-184, "Description"

FUEL INJECTION TIMING CONTROL SYSTEM

System Diagram

INFOID:0000000001530694



System Description

INFOID:0000000001530695

INPUT/OUTPUT SIGNAL CHART

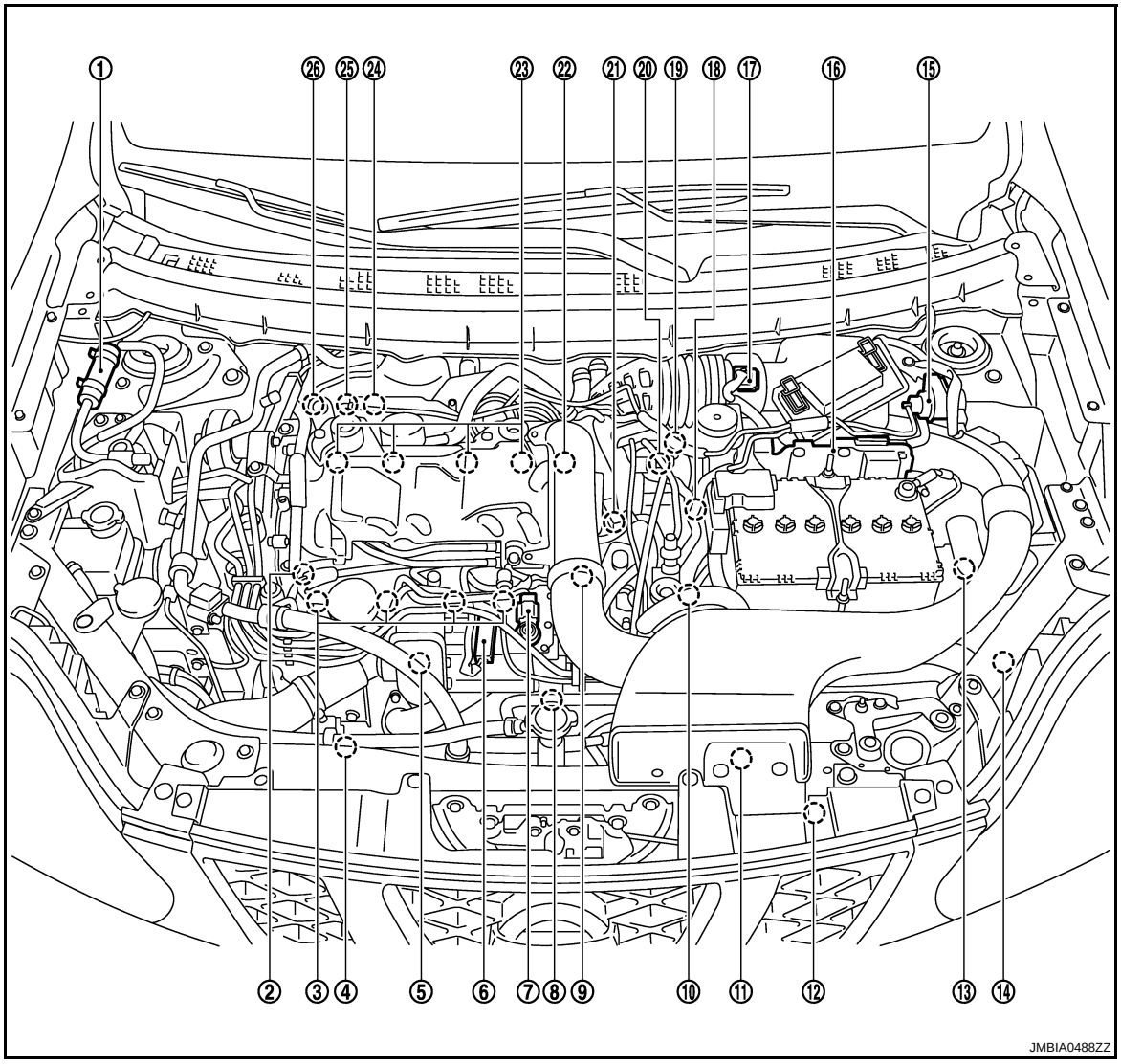
Input signal to ECM	ECM function	ECM function	Actuator
Crankshaft position sensor	Engine speed	Fuel injection timing control	Fuel injector
Camshaft position sensor	PIston position		
Engine coolant temperature sensor	Engine coolant temperature		
Intake air temperature	Intake air temperature sensor		
Fuel rail pressure	Fuel rail pressure		
Accelerator pedal position sensor	Accelerator pedal position		
Turbocharger boost sensor	Turbocharger boost		

SYSTEM DESCRIPTION

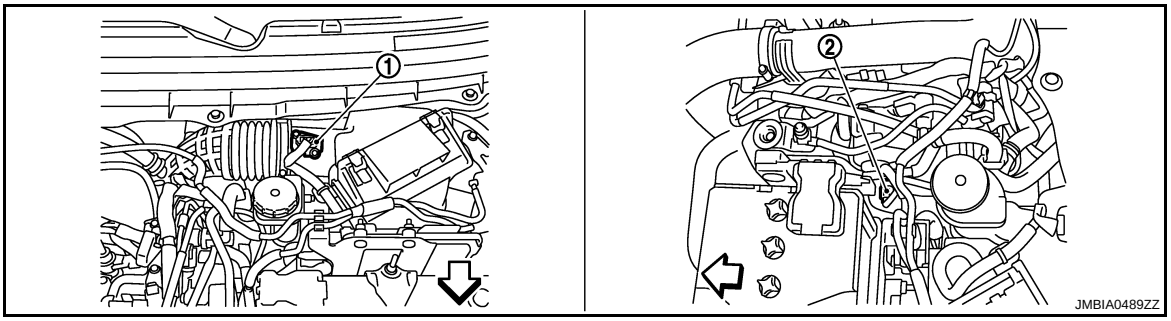
The target fuel injection timing in accordance with the engine speed and the fuel injection amount are recorded as a map in the ECM beforehand. The ECM determines the optimum injection timing using sensor signals accordance with the map.

Component Parts Location

INFOID:0000000001542149

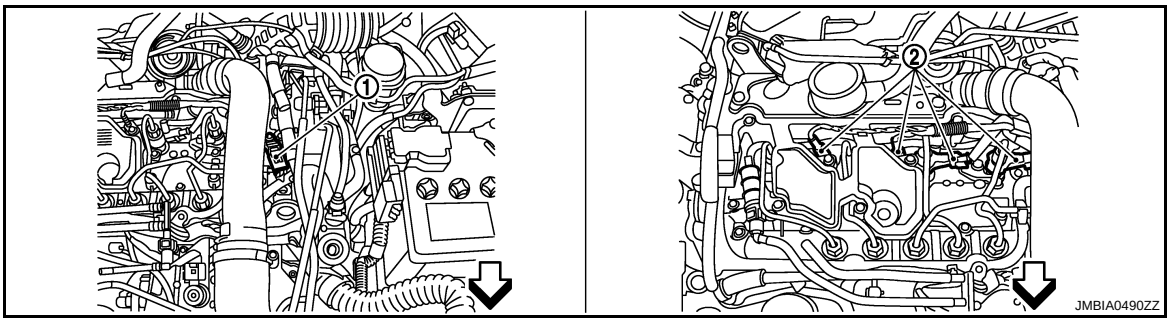


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



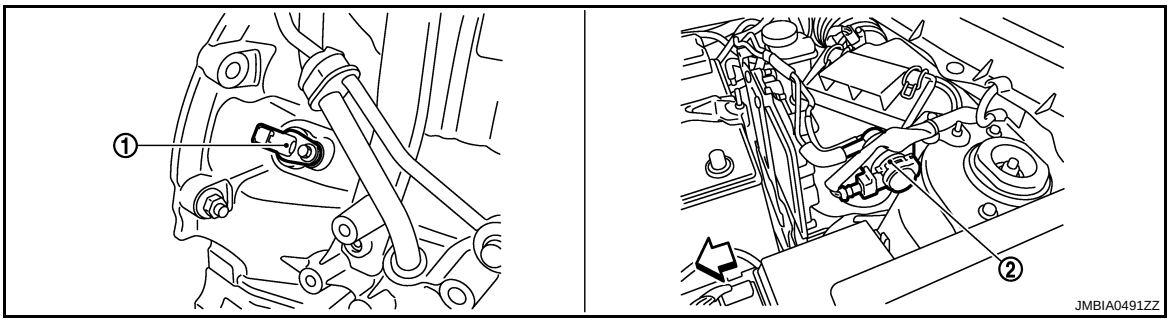
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



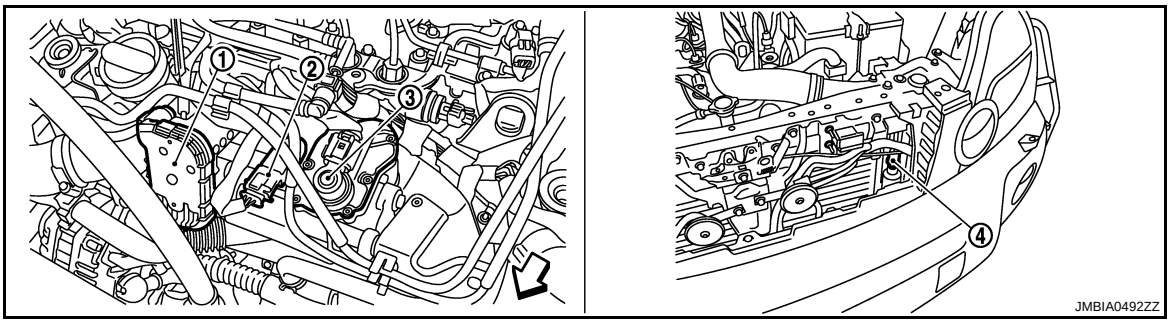
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



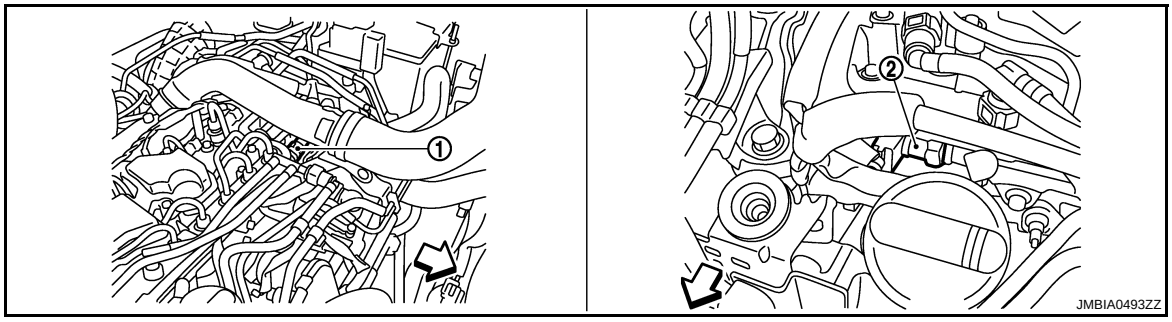
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



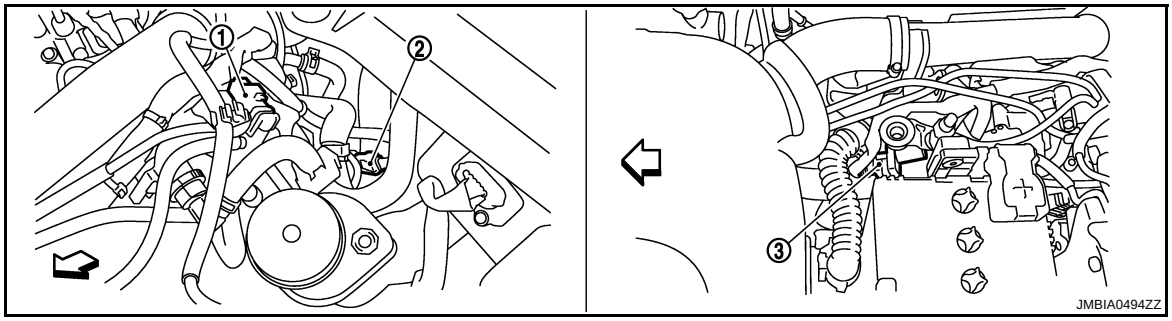
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



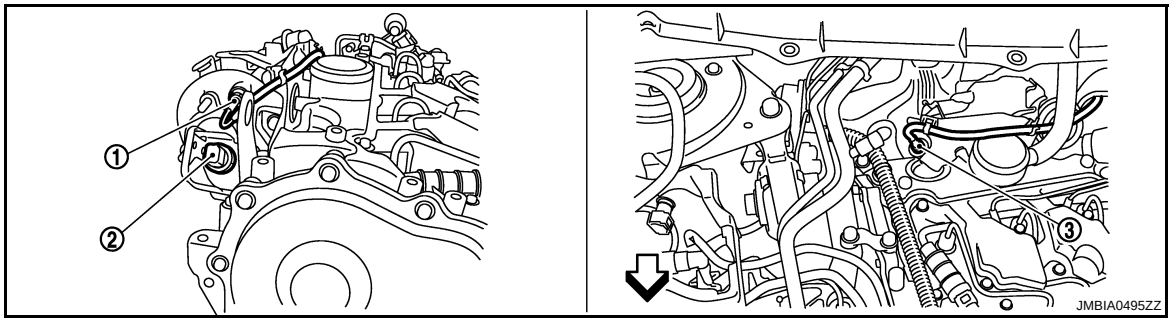
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



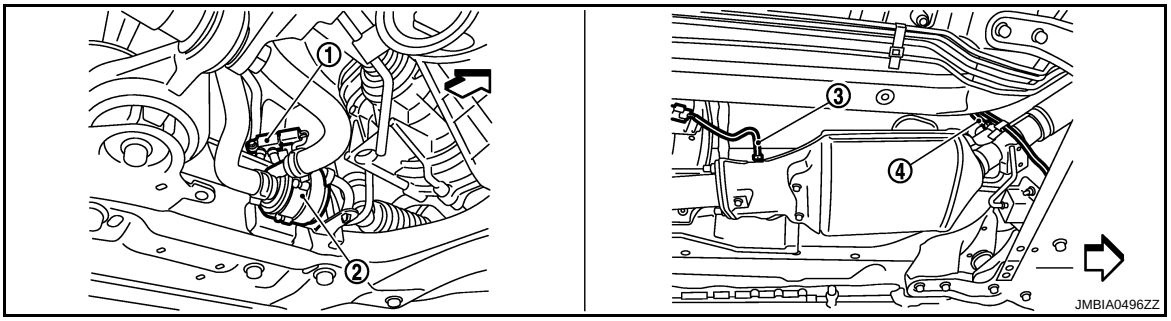
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



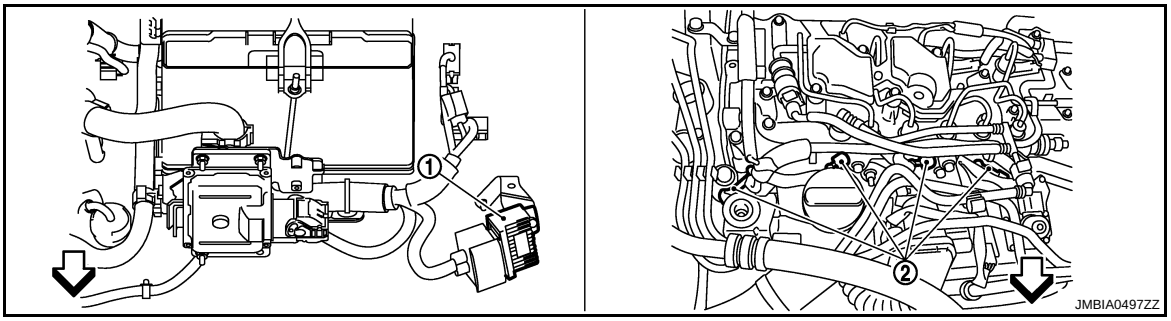
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



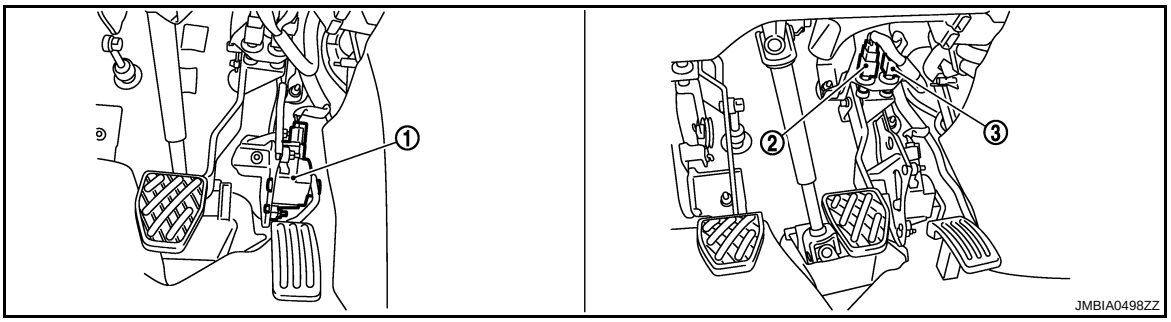
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

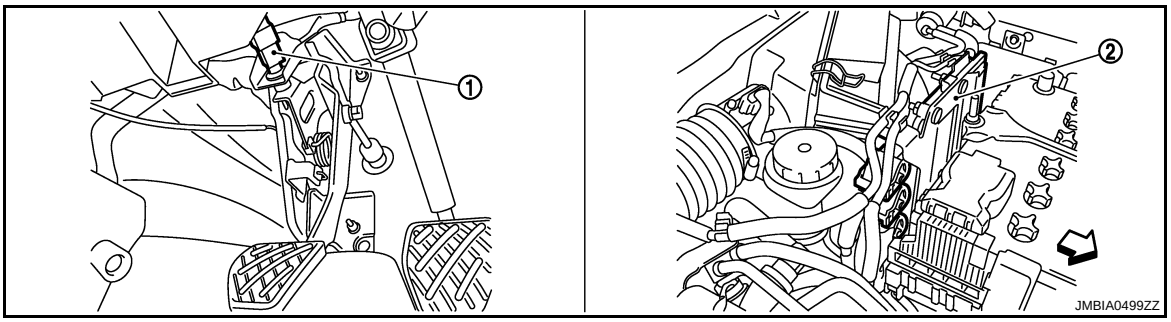


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

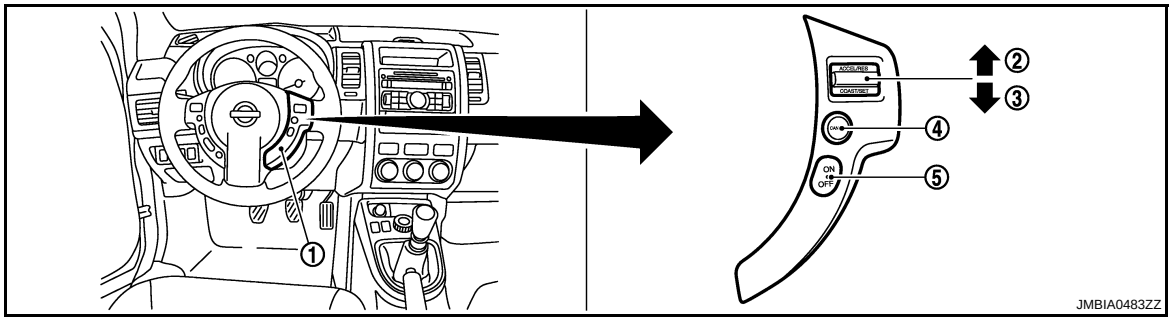


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

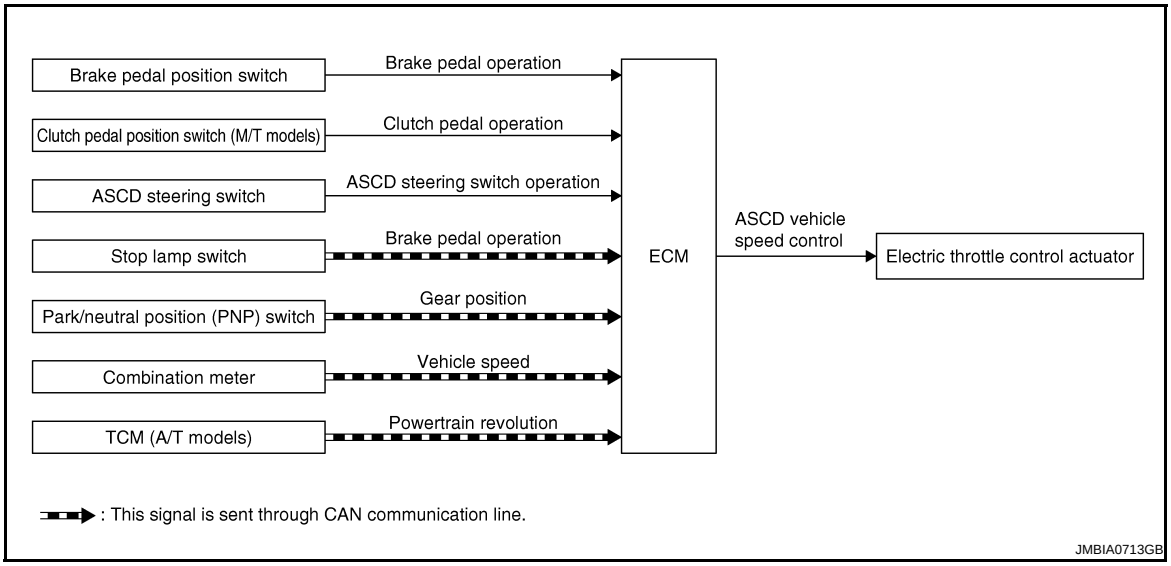
INFOID:0000000001542429

Component	Reference
Accelerator pedal position sensor	ECR-158, "Description"
Camshaft position sensor	ECR-169, "Description"
Crankshaft position sensor	ECR-167, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Fuel injector	ECR-155, "Description"
Fuel rail pressure sensor	ECR-150, "Description"
Intake air temperature sensor	ECR-130, "Description"
Mass air flow sensor	ECR-123, "Description"
Turbocharger boost sensor	ECR-161, "Description"
Vehicle speed sensor	ECR-184, "Description"

AUTOMATIC SPEED CONTROL DEVICE (ASCD)

System Diagram

INFOID:0000000001551301



System Description

INFOID:0000000001551302

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Brake pedal position switch	Brake pedal operation	ASCD vehicle speed control	Electric throttle control actuator
Stop lamp switch	Brake pedal operation*		
Clutch pedal position switch (M/T models)	Clutch pedal operation		
ASCD steering switch	ASCD steering switch operation		
Park/neutral position (PNP) switch	Gear position*		
Wheel sensor	Vehicle speed*		
TCM (A/T models)	Powertrain revolution*		

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

BASIC ASCD SYSTEM

Refer to Owner's Manual for ASCD operating instructions.
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 200 km/h (124 MPH).
ECM controls throttle angle of electric throttle control actuator to regulate engine speed.
Operation status of ASCD is indicated by CRUISE lamp and SET lamp in combination meter. If any malfunction occurs in ASCD system, it automatically deactivates control.
NOTE:
Always drive vehicle in safe manner according to traffic conditions and obey all traffic laws.

SET OPERATION

Press MAIN switch. (The CRUISE lamp in combination meter illuminates.)
When vehicle speed reaches a desired speed between approximately 40 km/h (25 MPH) and 200 km/h (124 MPH). press SET/COAST switch. (Then SET lamp in combination meter illuminates.)

ACCELERATE OPERATION

If the RESUME/ACCELERATE switch is pressed during cruise control driving, increase the vehicle speed 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 neutral position. (M/T models)
- Selector lever is changed to N, P, R position (A/T models)
- Vehicle speed decreased to 12 km/h (8 MPH) lower than 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 lamp.
- Engine coolant temperature is slightly higher than the normal operating temperature, CRUISE lamp may blink slowly.
  When the engine coolant temperature decreases to the normal operating temperature, CRUISE lamp will stop blinking and the cruise operation will be able to work by pressing SET/COAST switch or RESUME/ ACCELERATE switch.
- Malfunction for some self-diagnoses regarding ASCD control: SET lamp 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

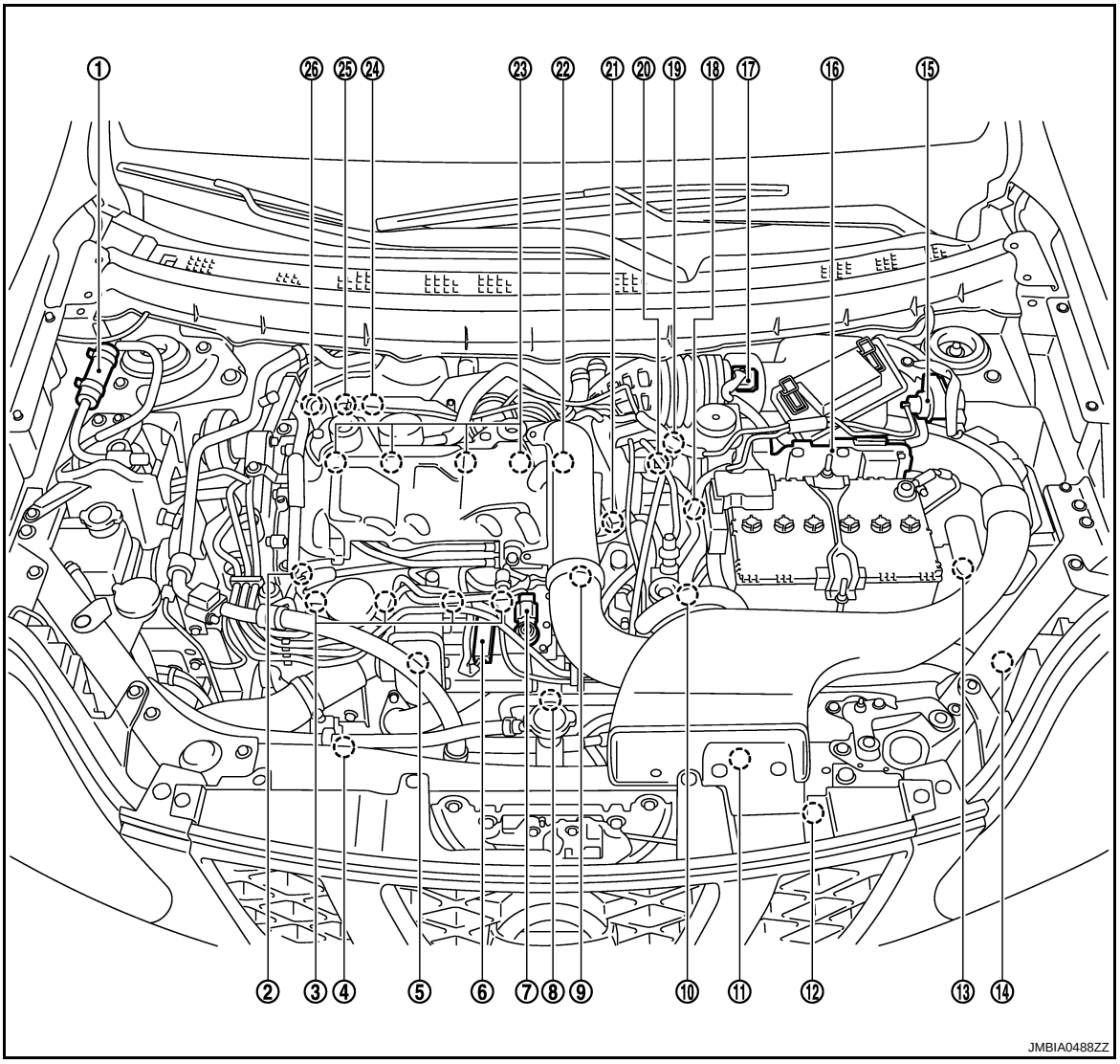
When the SET/COAST switch is pressed during cruise control driving, decrease vehicle set speed until the switch is released. And then ASCD will keep the new set speed.

RESUME OPERATION

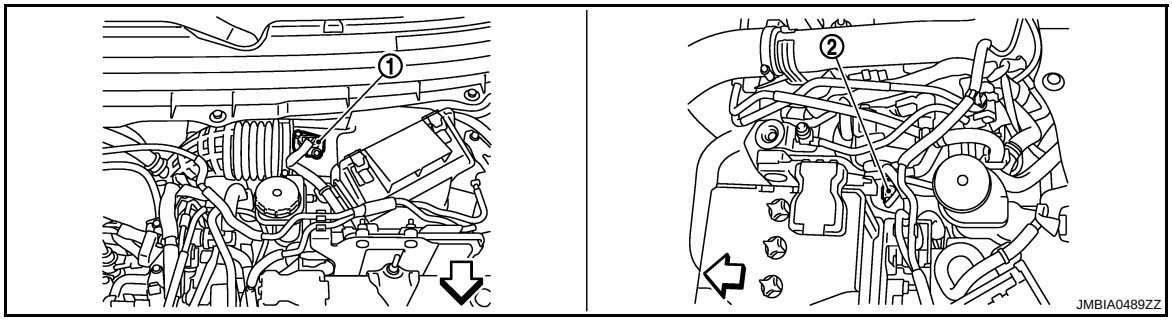
When the RESUME/ACCELERATE switch is pressed after cancel operation other than pressing MAIN switch is performed, vehicle speed will return to last set speed. To resume vehicle set speed, vehicle condition must meet following conditions.
- Brake pedal is released
- Clutch pedal is released (M/T models)
- Selector lever is in other than P and N positions (A/T models)
- Vehicle speed is greater than 40 km/h (25 MPH) and less than 200 km/h (124 MPH).

Component Parts Location

INFOID:0000000001551303

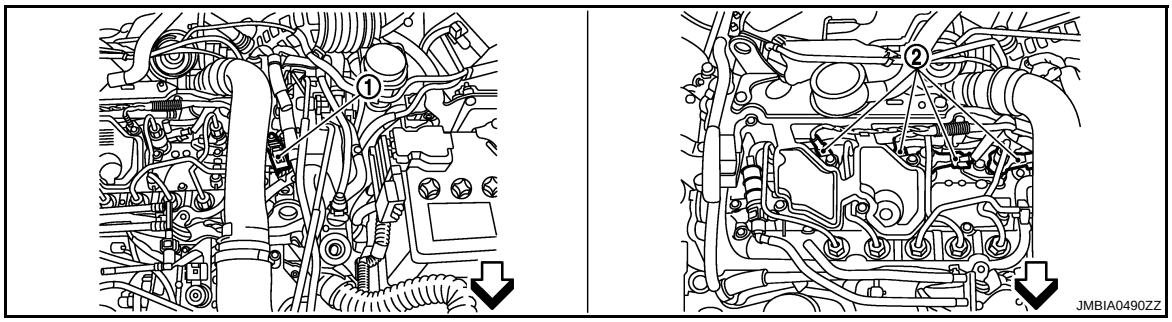


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



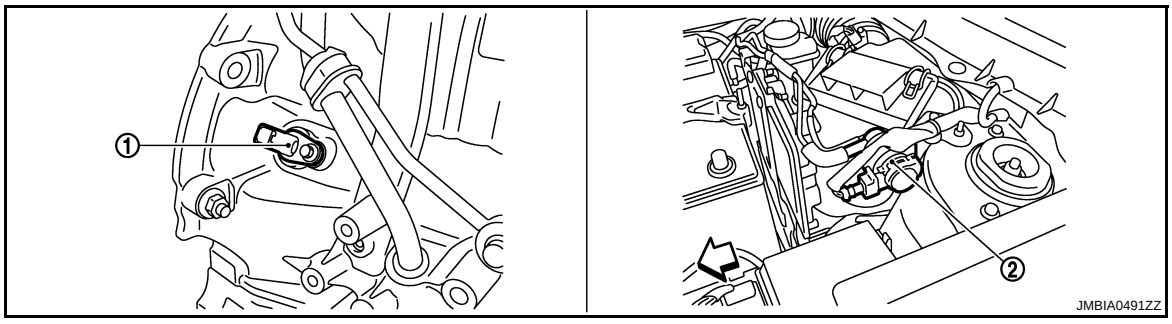
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



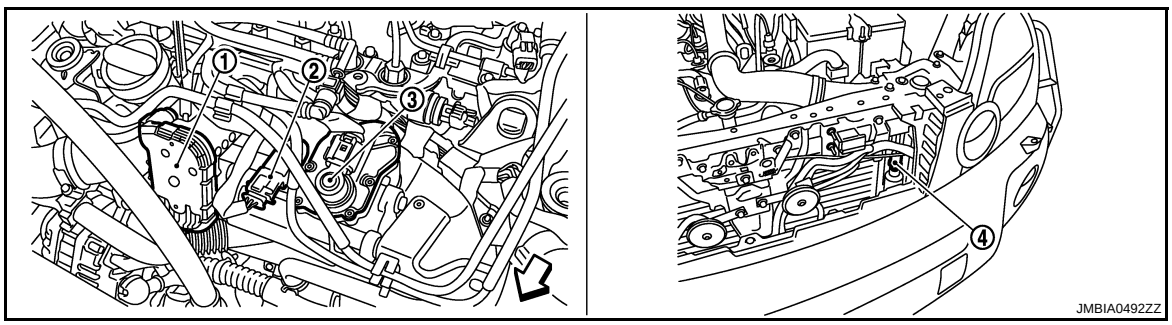
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



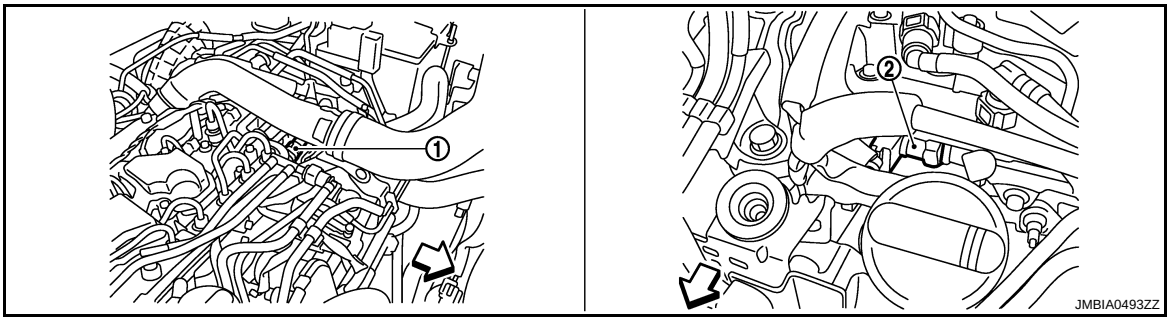
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



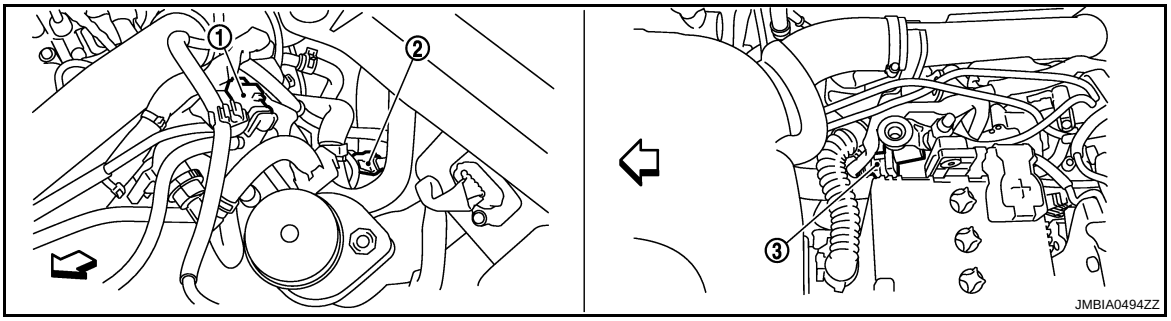
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



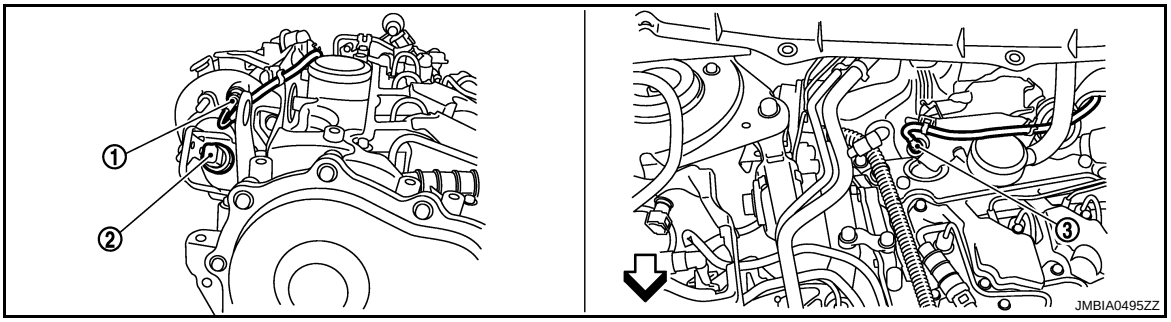
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



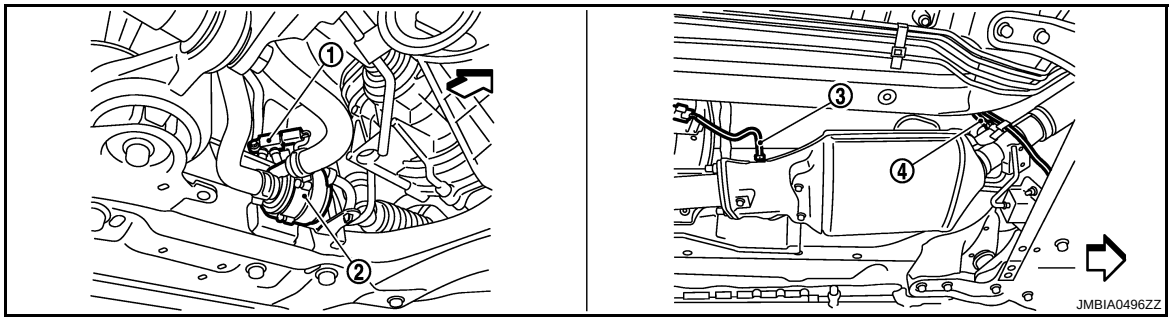
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



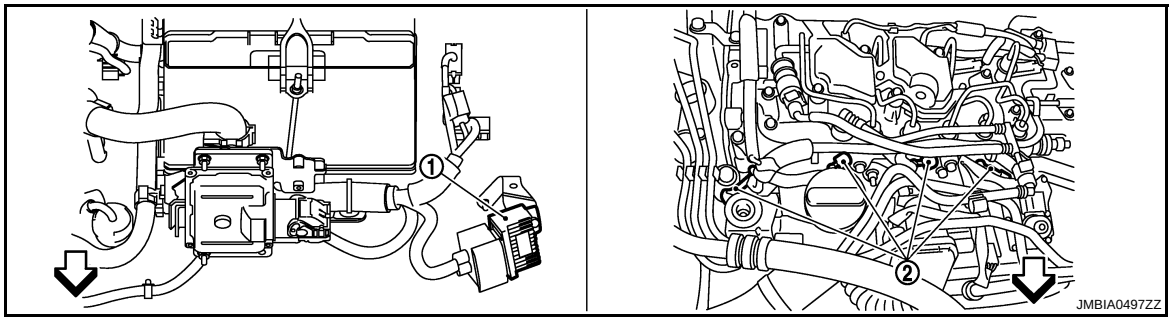
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



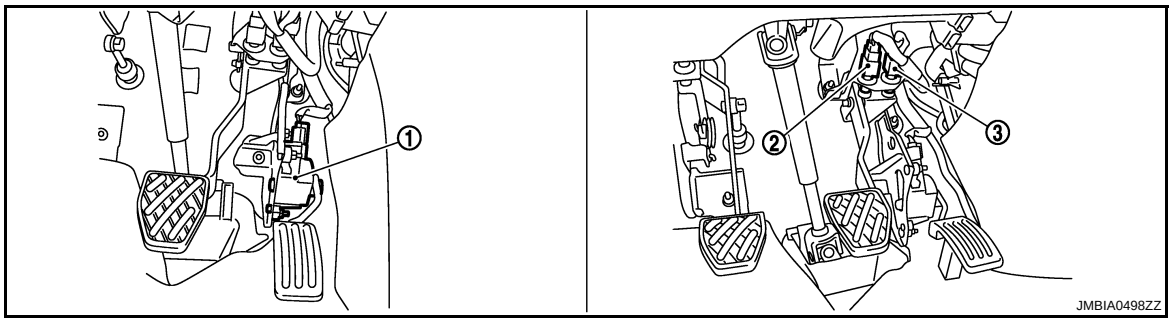
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

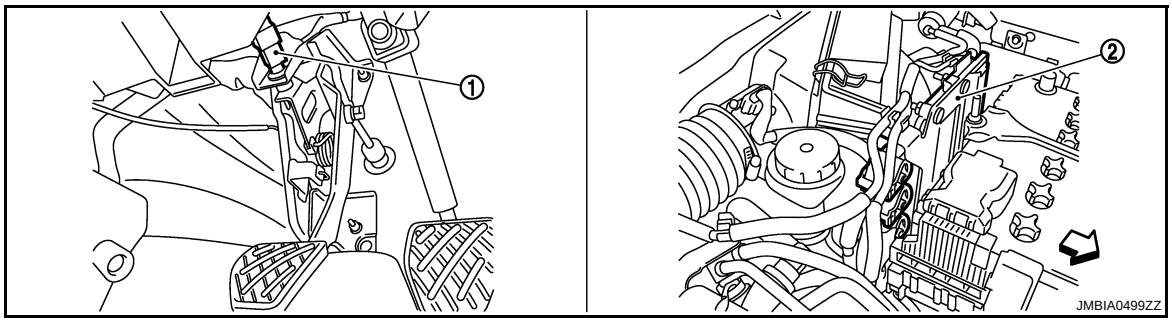


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

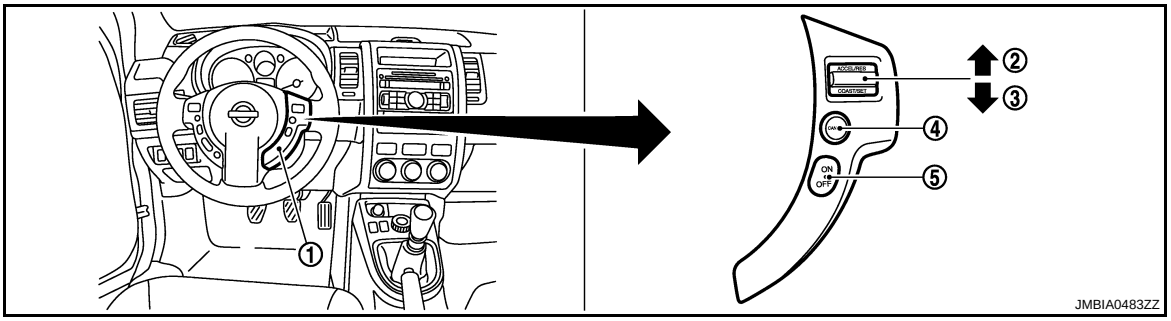


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

INFOID:0000000001551304

Component	Reference
ASCD steering switch	ECR-192, "Description"
Clutch pedal position switch	ECR-282, "Description"
Brake pedal position switch	ECR-195, "Description"
Electric throttle control actuator	ECR-236, "Description"
ASCD indicator	ECR-281, "Description"

CAN COMMUNICATION

System Description

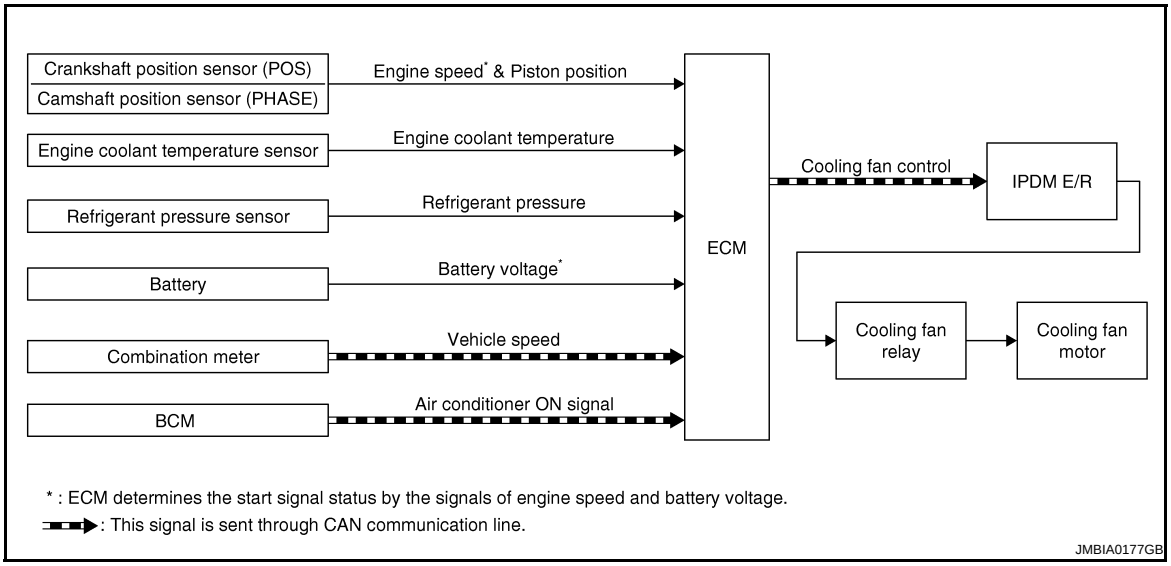
INFOID:0000000001307432

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-25, "CAN Communication Signal Chart", about CAN communication for detail.

COOLING FAN CONTROL

System Diagram

INFOID:0000000001530720



System Description

INFOID:0000000001530721

INPUT/OUTPUT SIGNAL CHART

Sensor	Input signal to ECM	ECM function	Actuator
Crankshaft position sensor (POS) Camshaft position sensor (PHASE)	Engine speed*1	Cooling fan control	IPDM E/R ↓ Cooling fan relay ↓ Cooling fan motor
Battery	Battery voltage*1		
Wheel sensor	Vehicle speed*2		
Engine coolant temperature sensor	Engine coolant temperature		
Air conditioner switch	Air conditioner ON signal*2		
Refrigerant pressure sensor	Refrigerant pressure		

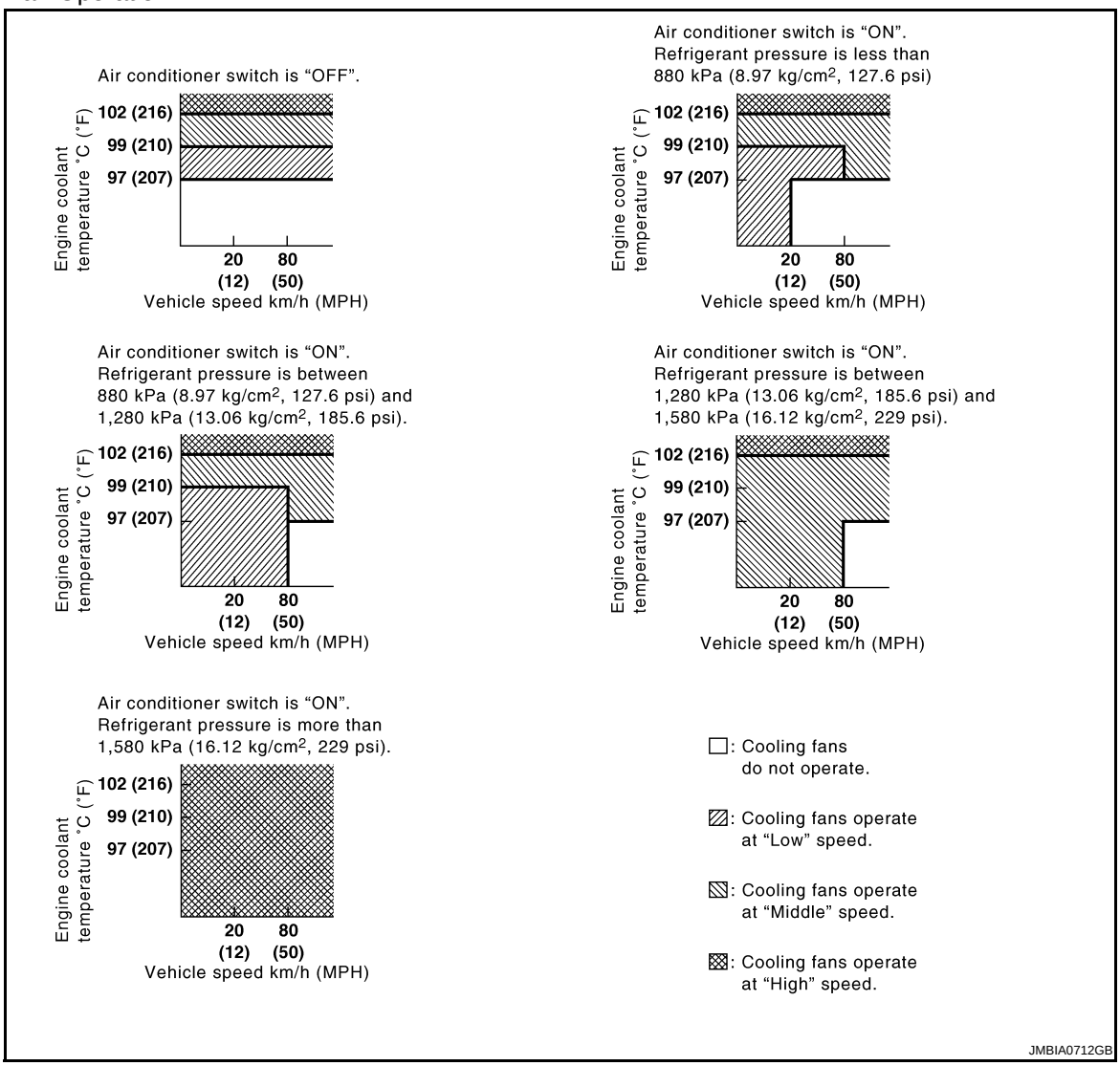
*1: The ECM determines the start signal status by the signals of engine speed and battery voltage.

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

SYSTEM DESCRIPTION

ECM controls cooling fan speed corresponding to vehicle speed, engine coolant temperature, refrigerant pressure, air conditioner ON signal. Then control system has 4-step control [HIGH/MIDDLE/LOW/OFF].

Cooling Fan Operation



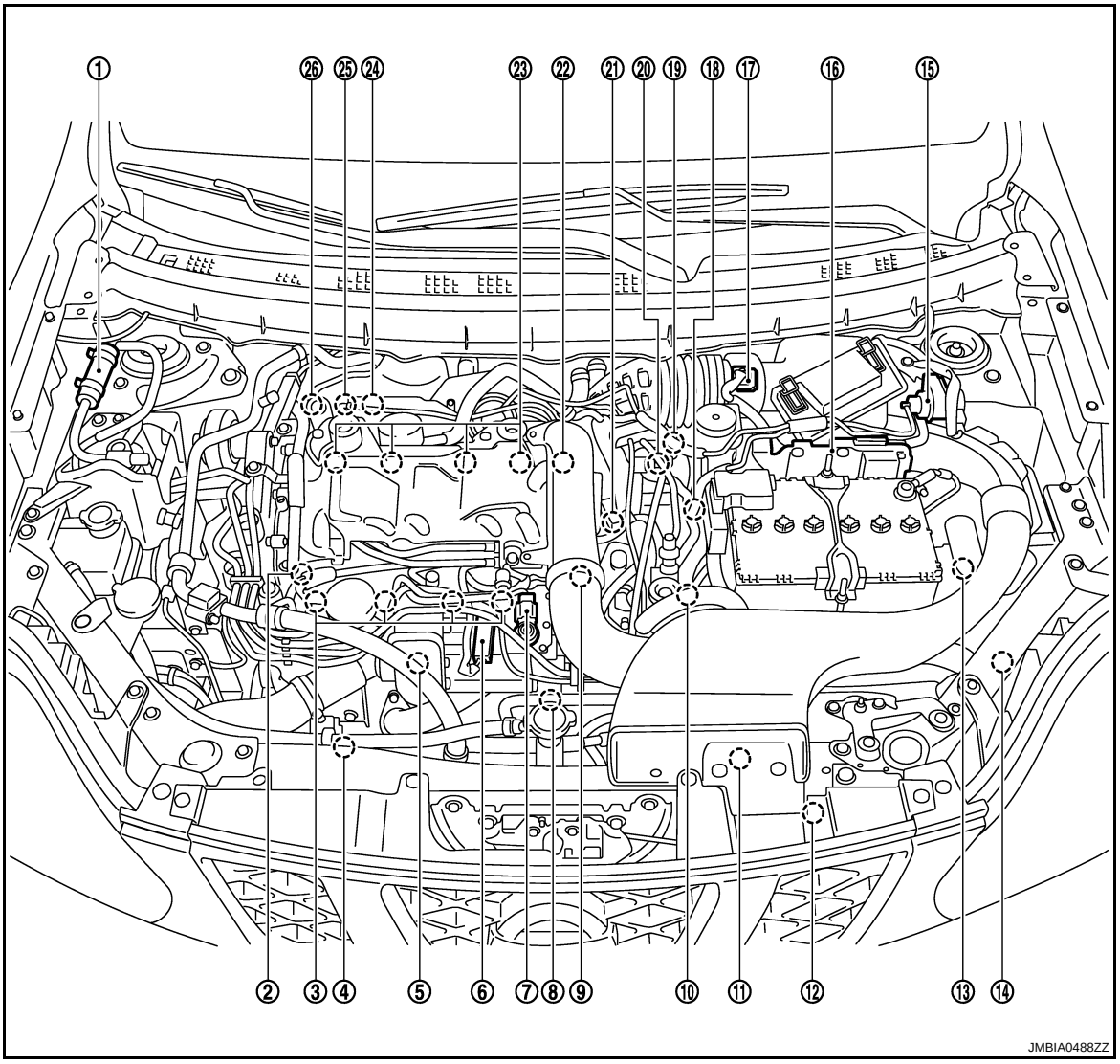
Cooling Fan Relay Operation

The ECM controls cooling fan relays through CAN communication line.

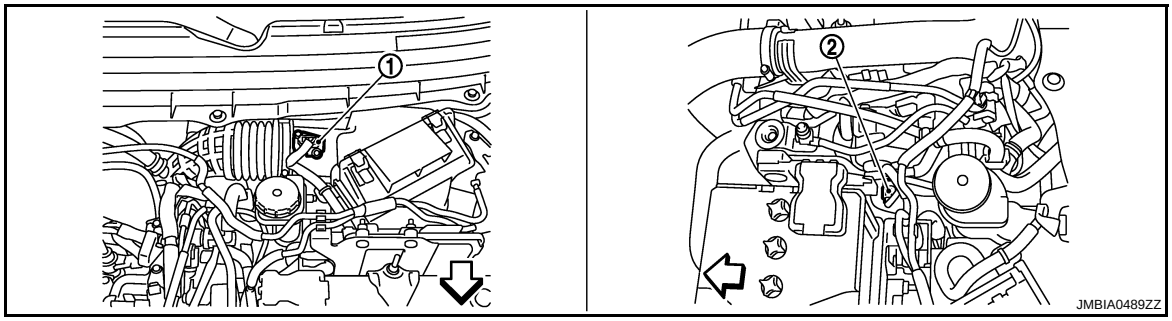
Cooling fan speed	Cooling fan relay				
	1	2	3	4	5
Stop (OFF)	OFF	OFF	OFF	OFF	OFF
Low (LOW)	OFF	OFF	OFF	ON	OFF
Middle (MID)	ON	OFF	OFF	OFF	ON
High (HI)	ON	ON	ON	OFF	ON

Component Parts Location

INFOID:0000000001542151

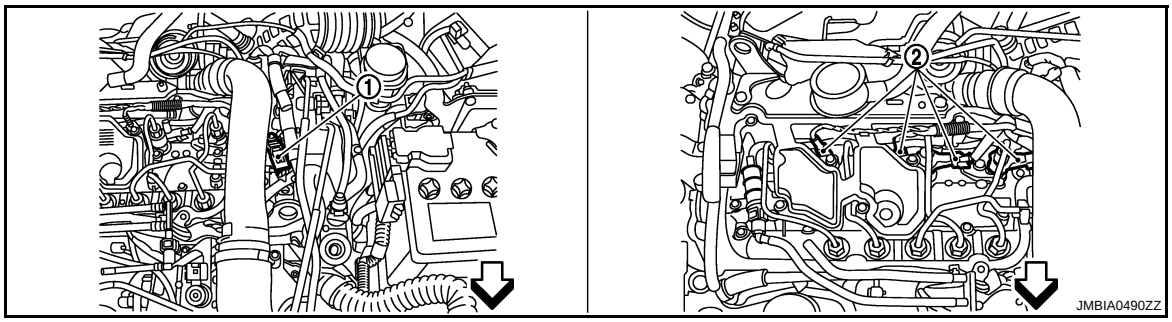


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



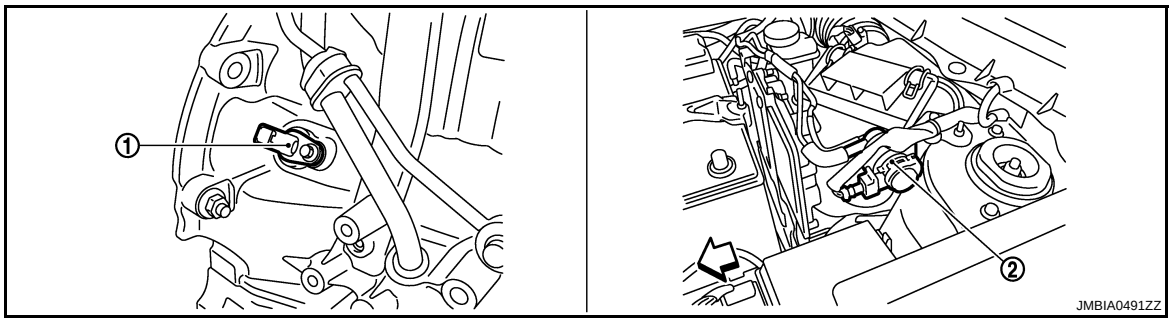
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



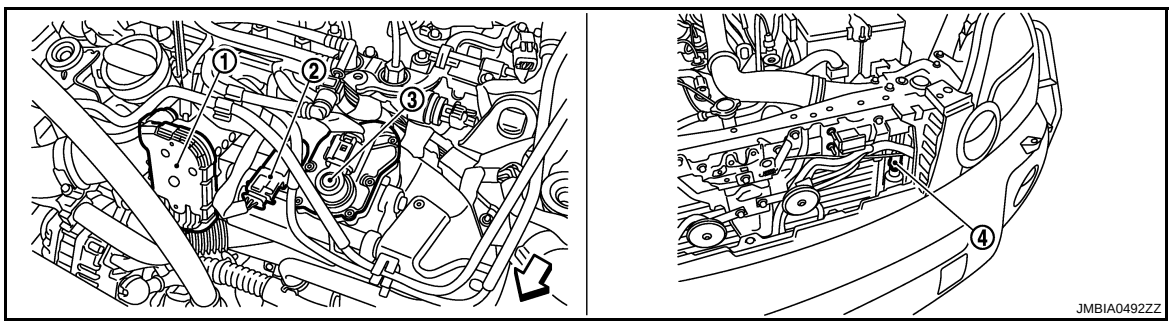
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



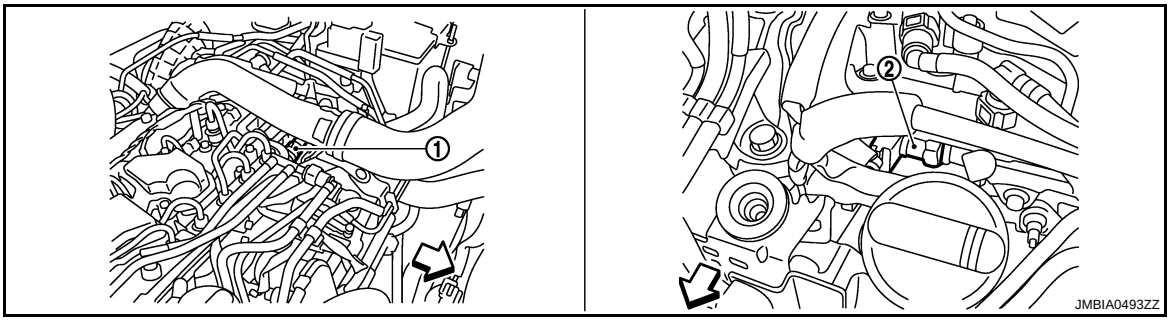
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



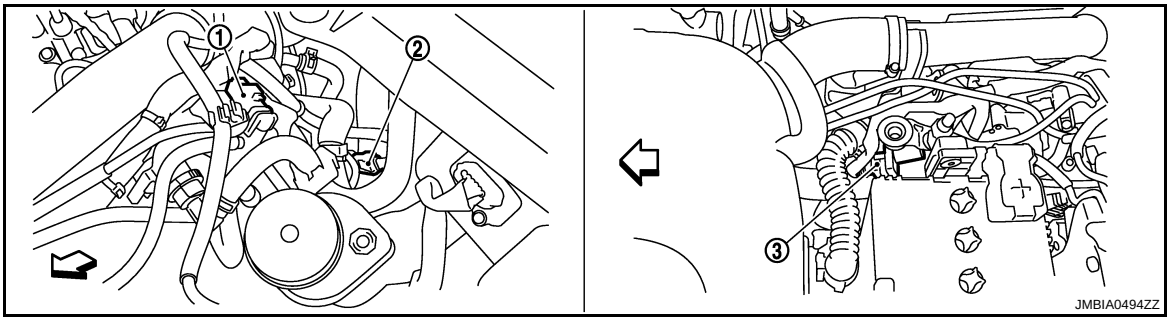
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



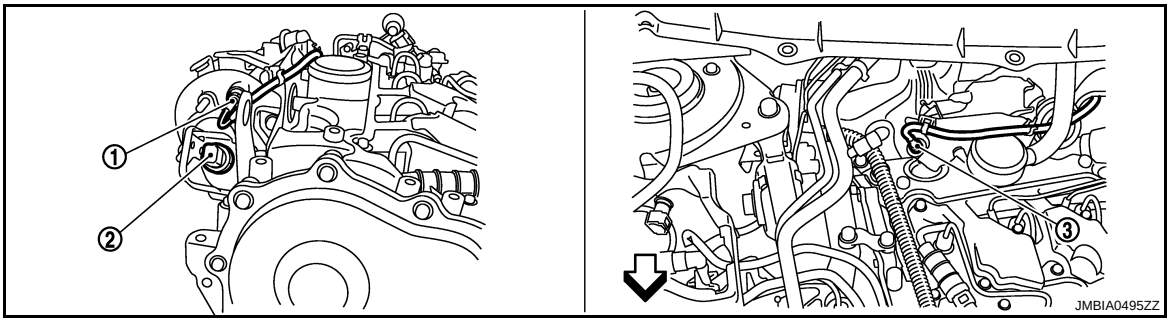
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



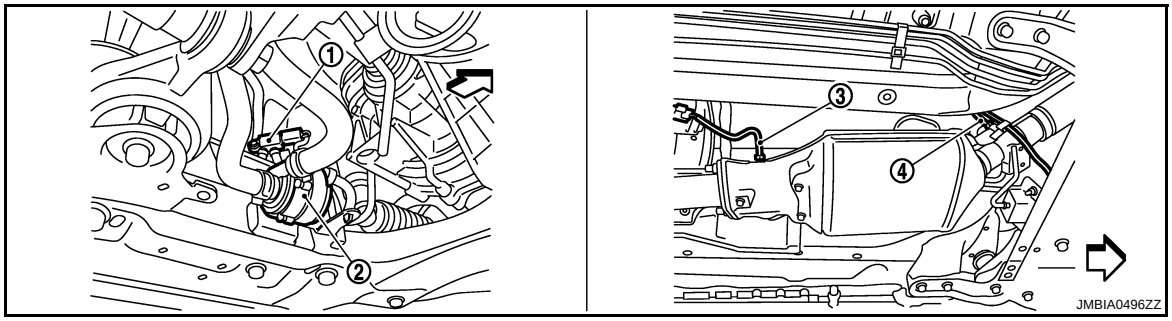
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



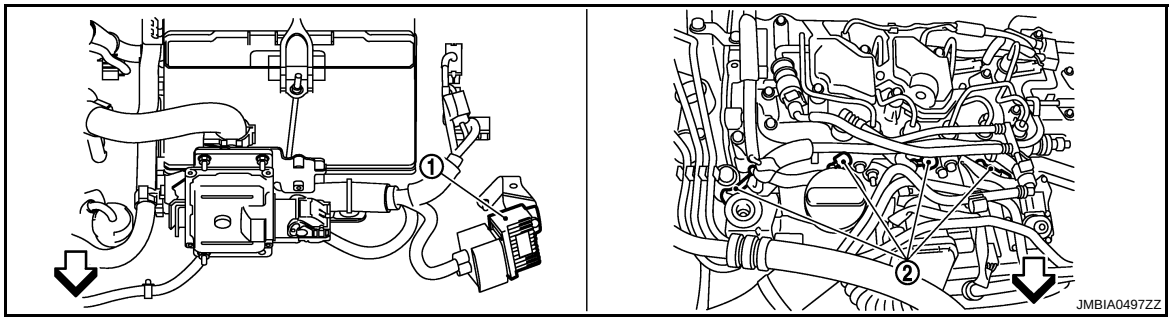
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



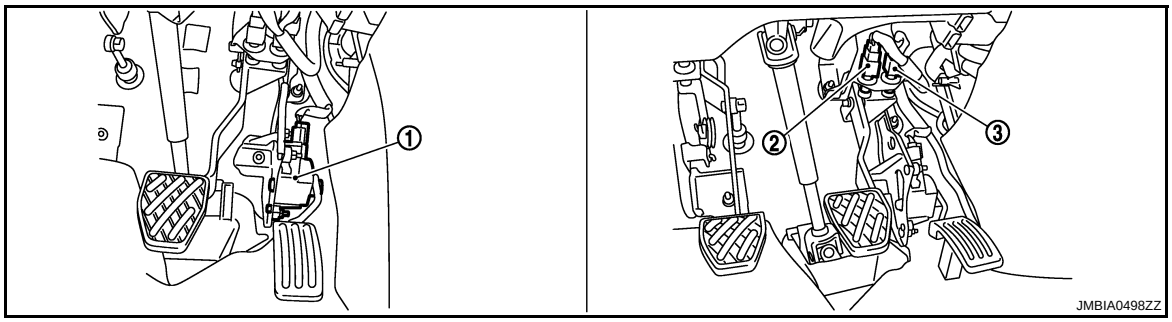
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

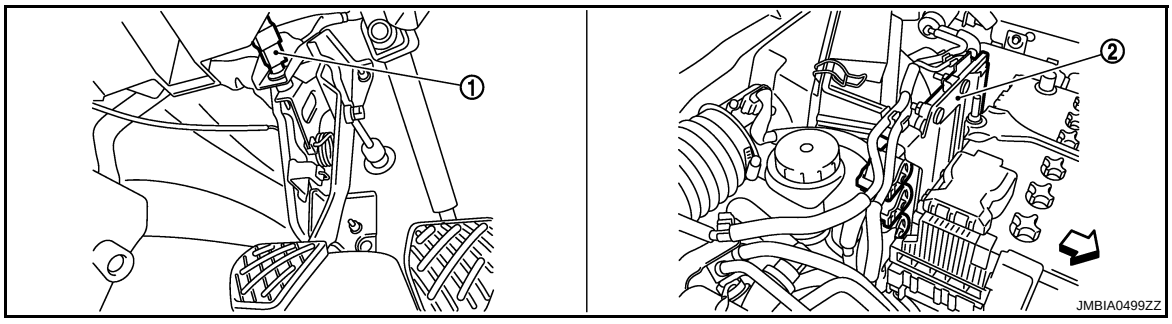


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

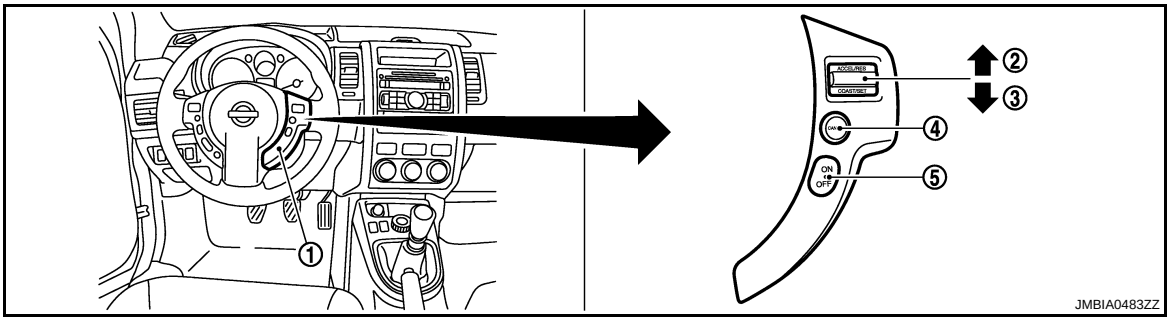


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

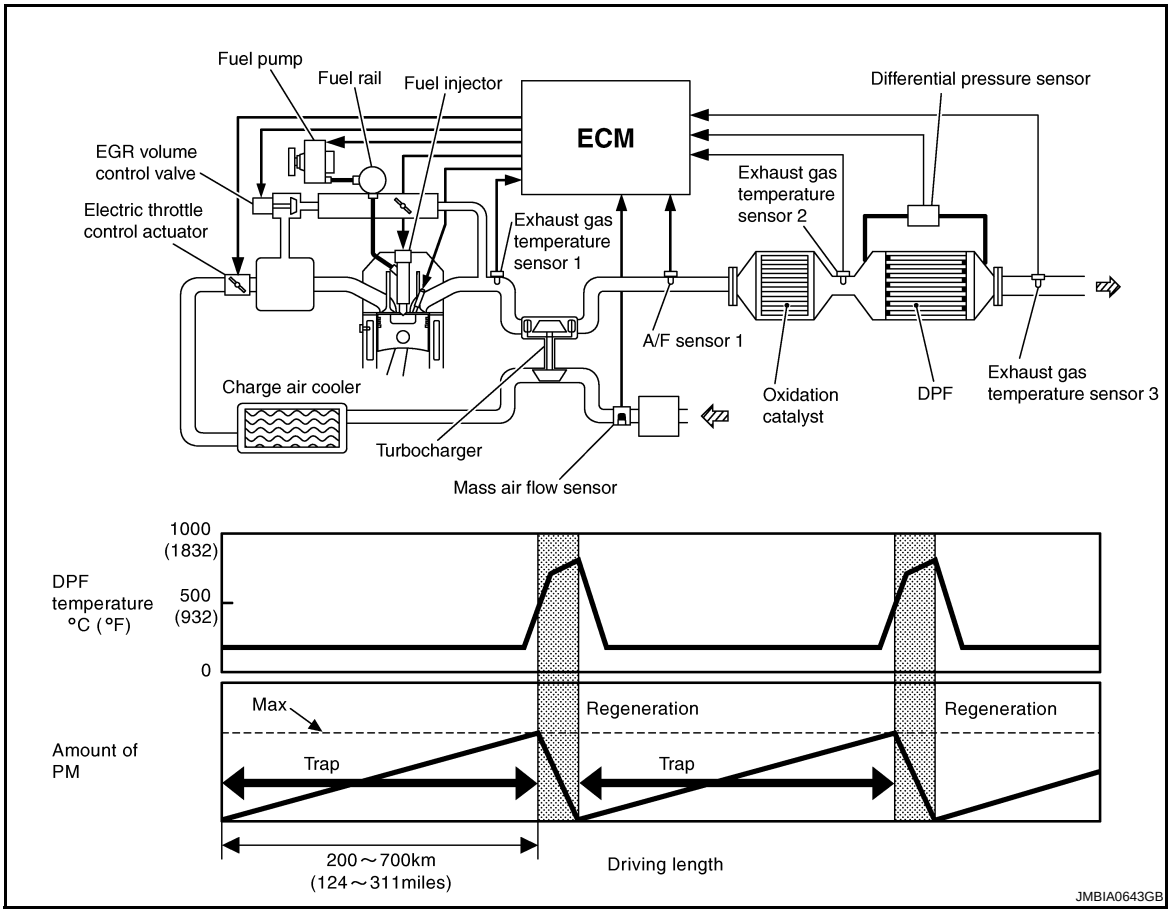
INFOID:0000000001542431

Component	Reference
Camshaft position sensor	ECR-169, "Description"
Cooling fan motor	ECR-284, "Description"
Crankshaft position sensor	ECR-167, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Refrigerant pressure sensor	ECR-185, "Description"
Vehicle speed sensor	ECR-184, "Description"

DPF

System Diagram

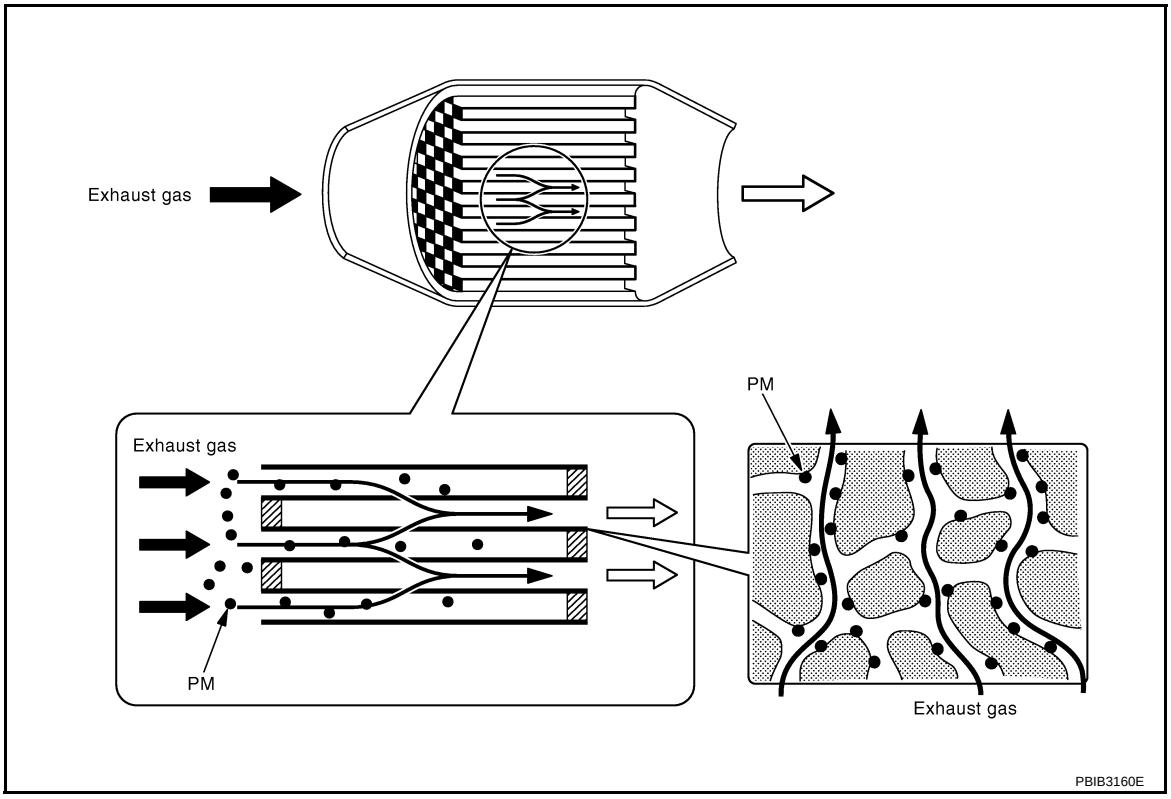
INFOID:0000000001542226



System Description

INFOID:0000000001527693

COMPONENT DESCRIPTION



DPF (Diesel Particulate Filter) is placed after the oxidation catalyst and traps PM (Particulate Matter) in exhaust gas. DPF is formed in a honeycomb form made of ceramic. This structure facilitates to trap particulate matter.
When the amount of particulate matter in the DPF reaches the specified level, the particulate matter needs to be reduced through burning to maintain the DPF function. This reducing of particulate matter is called Regeneration and should be performed periodically. DPF can be effective for a long time through the cycle of trapping particulate matter and regeneration.

SYSTEM DESCRIPTION

Sensor	Input Signal to ECM	ECM Function	Actuator
Crankshaft position sensor	Engine speed	Regeneration control	• Fuel injector • Electric throttle control actuator
Camshaft position sensor	Piston position		
Engine coolant temperature sensor	Engine coolant temperature		
Mass air flow sensor	Amount of intake air		
Combination meter	Vehicle speed*		
Differential exhaust pressure sensor	Differential exhaust pressure		
A/F sensor 1	Density of oxygen in exhaust gas		
Exhaust gas temperature sensor 2	Exhaust gas temperature before DPF		
Exhaust gas temperature sensor 3	Exhaust gas temperature after DPF		

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

NOTE:

In addition to the controls described above, ECM performs fuel injection control and EGR volume control for the regeneration.

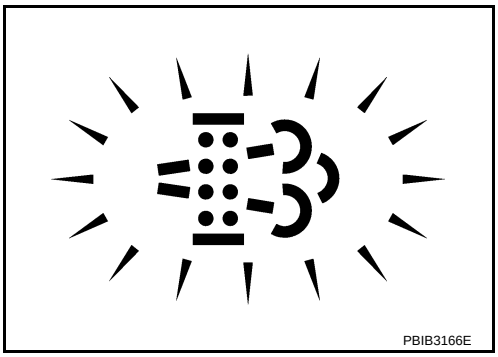
ECM estimates the amount of particulate matter in DPF based on the mileage and the differential exhaust pressure. ECM automatically performs regeneration when the amount of particulate matter in DPF reaches the specified level. When performing regeneration, ECM raise the exhaust gas temperature to activate Oxidation Catalyst. ECM performs the followings to raise exhaust gas temperature.

- Closing throttle valve to reduce intake air volume
- Retarding fuel injection timing
- Injecting additional fuel into combustion chamber during exhaust stroke (post injection)
- Performing EGR control

When exhaust gas temperature reaches the specified value, oxidation catalyst is activated. The trapped particulate matter is burned through a catalytic reaction using exhaust gas heat at 600 °C.

During regeneration ECM performs a feedback control to keep emission levels low and burn particulate matter safely and efficiently. This feedback control is performed based on the air fuel mixture ratio and the exhaust gas temperature.

When performing regeneration, ECM raise the exhaust gas temperature to activate Oxidation Catalyst. If the vehicle is driven in the driving pattern in which the exhaust gas temperature can not be raised, DPF warning light as shown in the figure lights up. DPF warning light is located on combination meter.


PBIB3166E

When DPF warning light lights up, drive the vehicle under any of the following condition to complete regeneration.

- The vehicle is driven continuously at 60km/h for 30 minutes*
- The vehicle is driven continuously 15km or more without being caught in traffic jam

If the vehicle is driven in the driving pattern in which the exhaust gas temperature can not be raised after DPF warning light lights up, ECM performs the following to protect DPF.

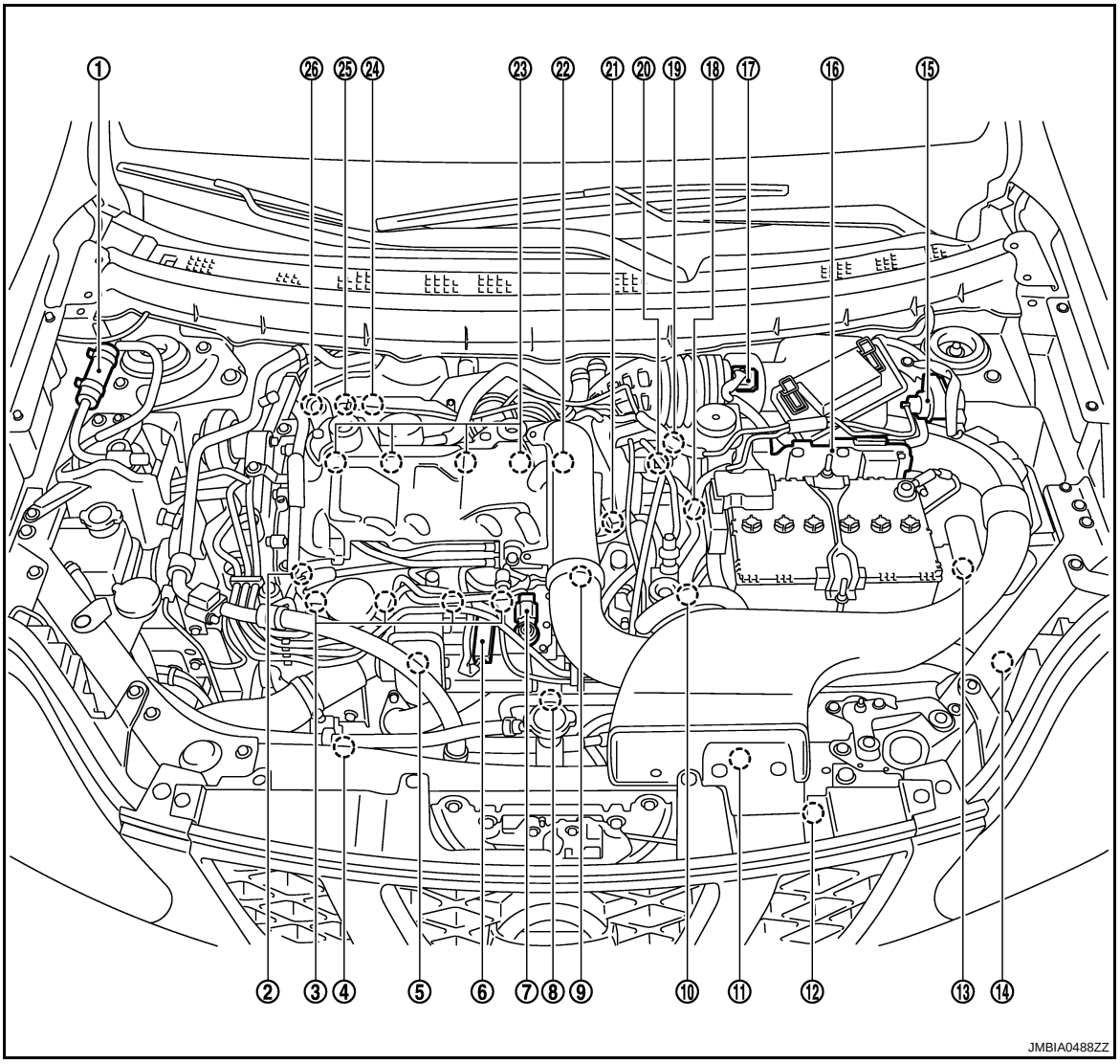
- ECM enters fail-safe mode and limits engine speed to 3,000 rpm with fuel cut.
- ECM stores DTC P2002 in the memory.

To recover from the condition described above, perform “Service Regeneration” with CONSULT-III to reduce the particulate matter through burning. Refer to ECR-16, "SERVICE REGENERATION : Description".

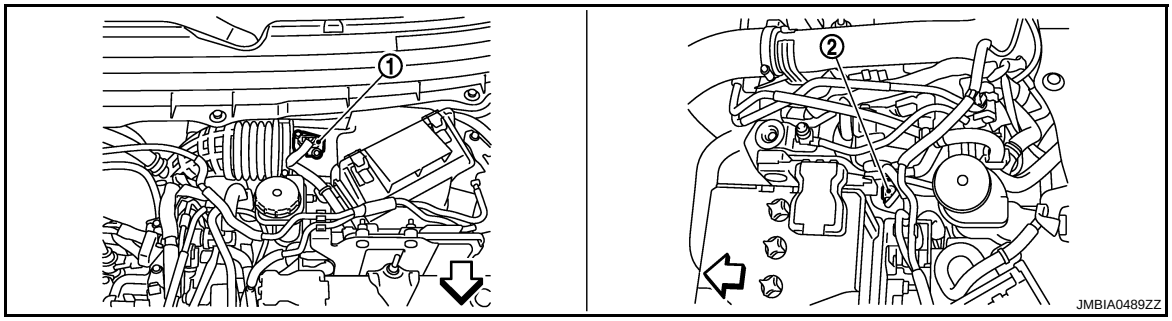
*: Always drive vehicle in safe manner according to traffic conditions and obey all traffic laws when driving.

Component Parts Location

INFOID:0000000001542225

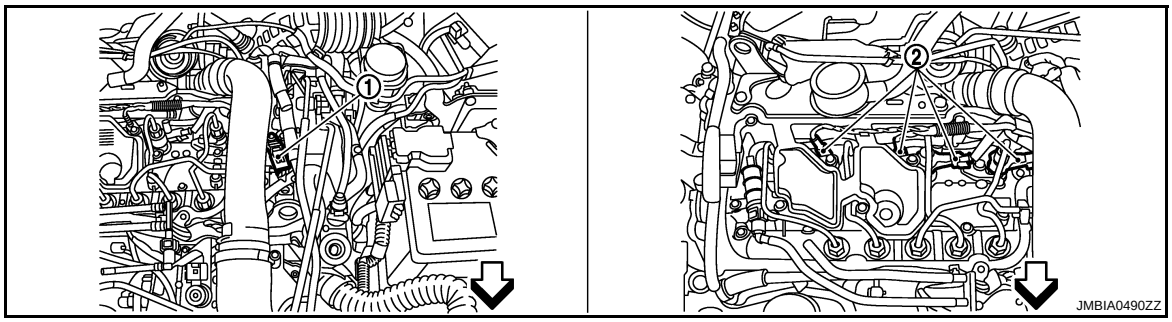


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



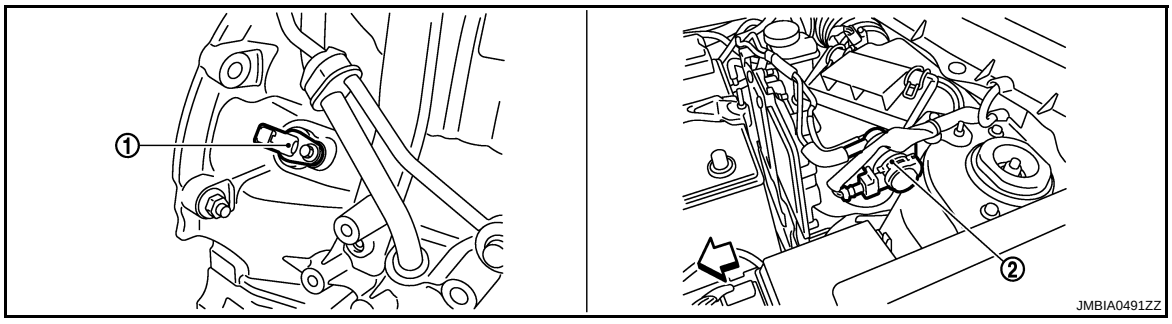
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



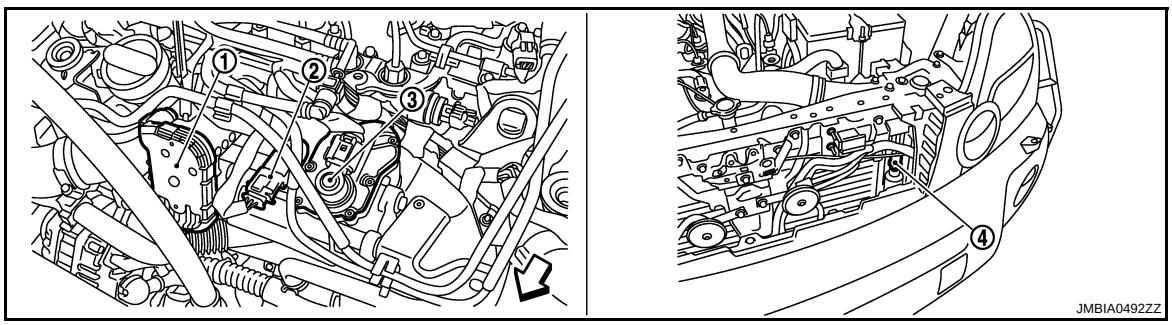
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



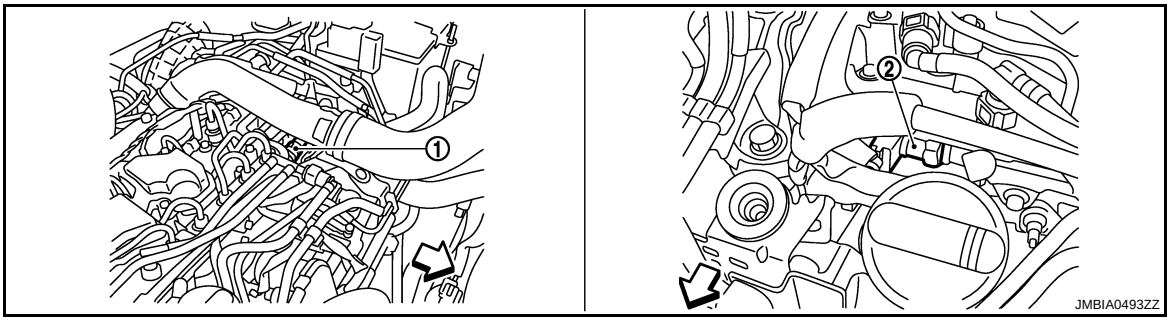
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



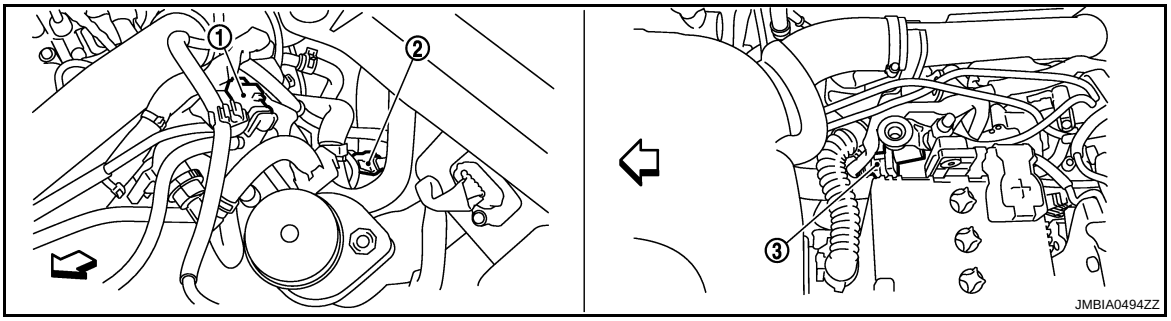
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



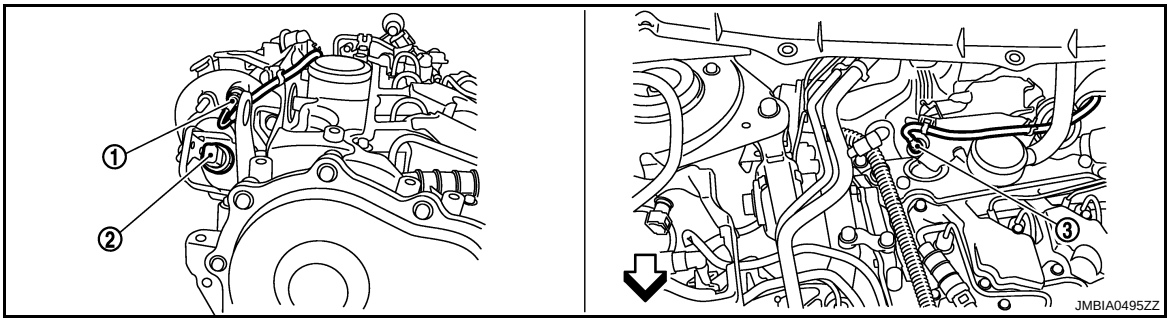
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



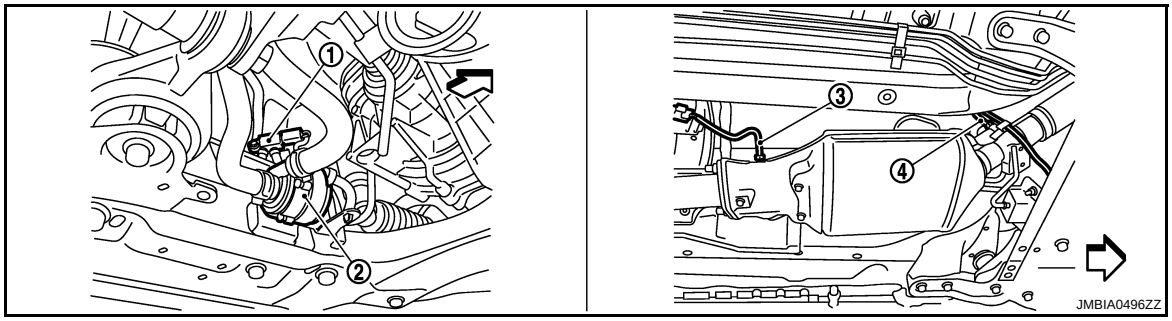
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



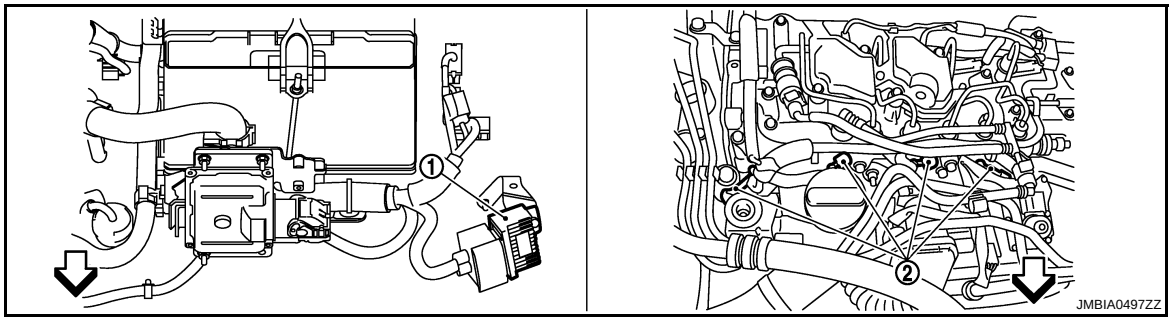
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



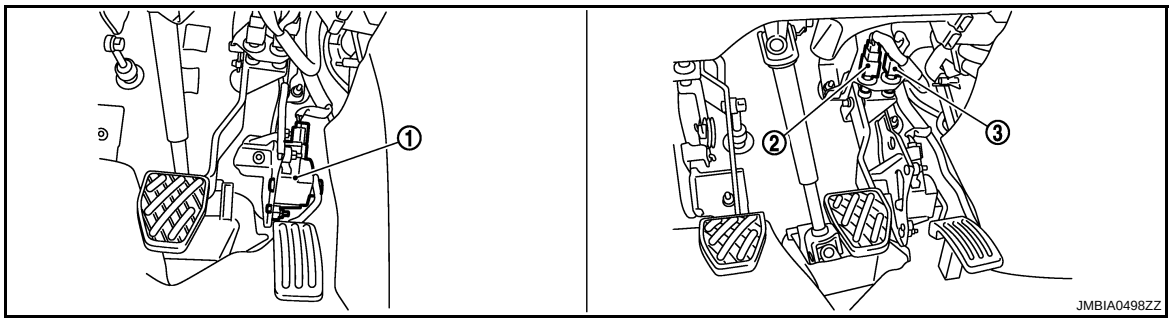
⇦ : Vehicle front

1. Differential exhaust pressure sensor 2. Turbocharger cooling pump 3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

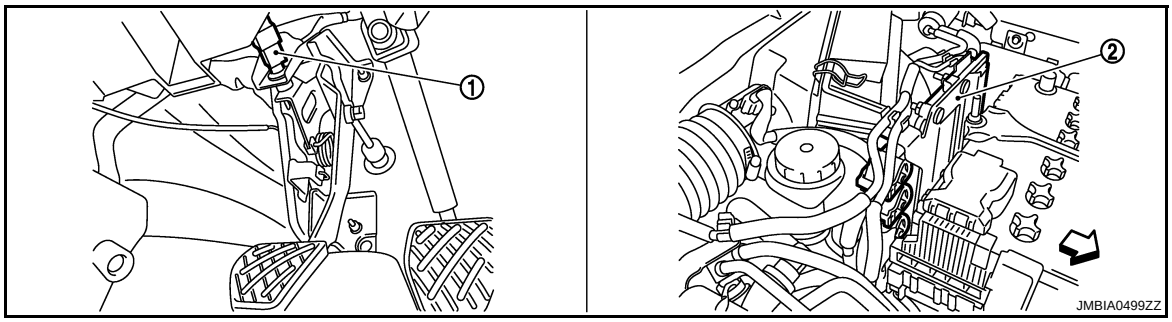


⇦ : Vehicle front

1. Glow control unit 2. Glow plug

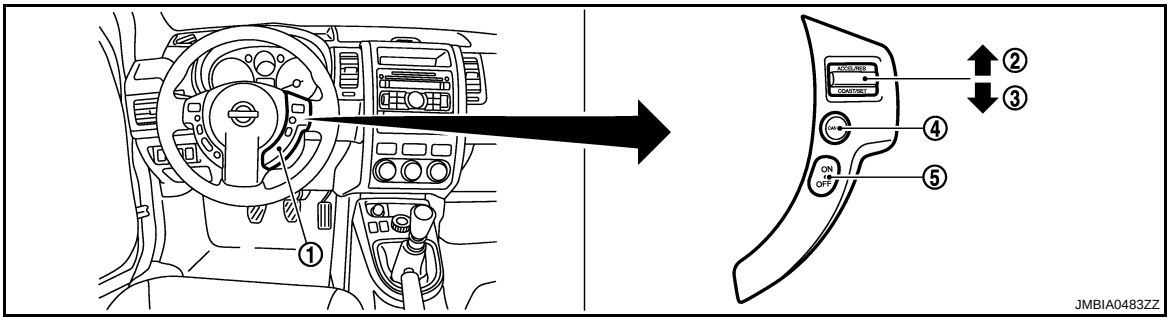


1. Accelerator pedal position sensor 2. Stop lamp switch 3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch 2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

INFOID:0000000001542432

Component	Reference
A/F sensor 1	ECR-137, "Description"
Camshaft position sensor	ECR-169, "Description"
Crankshaft position sensor	ECR-167, "Description"
Differential exhaust pressure sensor	ECR-269, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Exhaust gas temperature sensor 2	ECR-231, "Description"
Exhaust gas temperature sensor 3	ECR-264, "Description"
Fuel injector	ECR-155, "Description"
Mass air flow sensor	ECR-123, "Description"
Throttle position sensor	ECR-134, "Description"
Vehicle speed sensor	ECR-184, "Description"

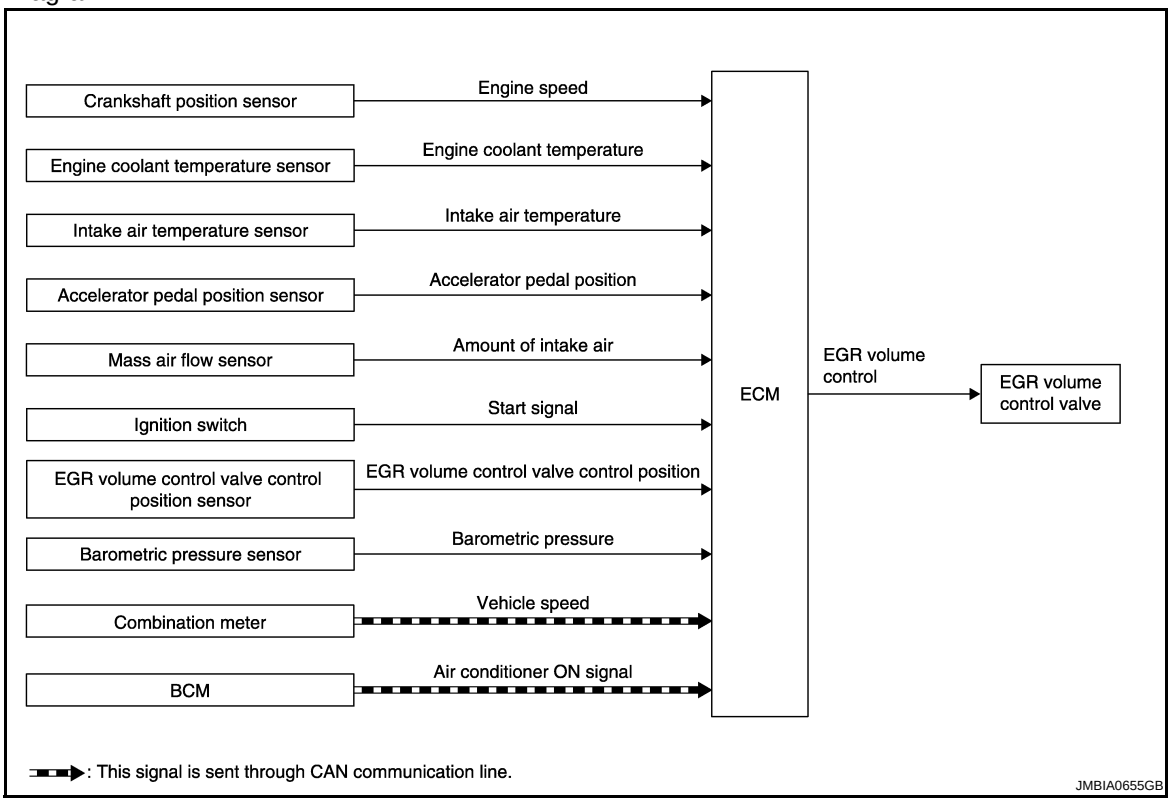
EGR SYSTEM

System Description

INFOID:0000000001530699

EGR VALVE CONTROL

System Diagram



System Description

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed	EGR volume control	EGR volume control valve
Engine coolant temperature sensor	Engine coolant temperature		
Intake air temperature sensor	Intake air temperature		
Mass air flow sensor	Amount of intake air		
Accelerator pedal position sensor	Accelerator pedal position		
Ignition switch	Start signal		
EGR volume control valve control position sensor	EGR volume control valve control position		
Barometric pressure sensor	Barometric pressure		
Vehicle speed sensor	Vehicle speed*		
Air conditioner switch	Air conditioner operation*		

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

SYSTEM DESCRIPTION

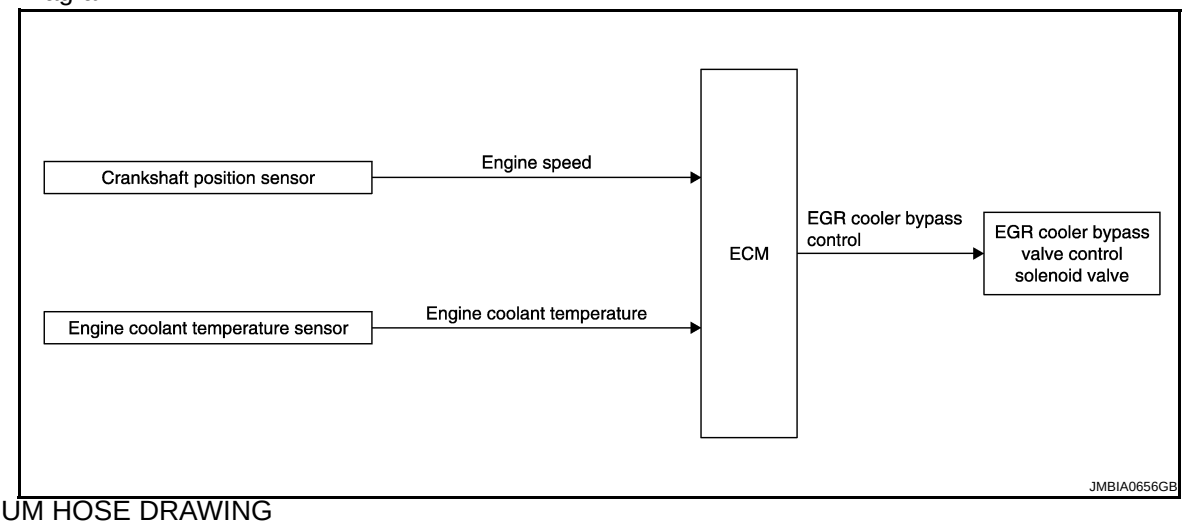
This system controls the flow rate of EGR led from exhaust manifold to intake manifold.
The opening of the EGR passage in the EGR volume control valve changes to control the EGR flow rate.
A built-in DC motor moves the valve continuously corresponding to the ECM output signal.
The EGR volume control valve control position sensor detects the valve position and sends the voltage signals to the ECM.
The ECM judges the current opening angle of the valve from this signals and the ECM controls the DC motor to make the valve opening angle properly.

The opening angle of the valve varies for optimum engine control. The optimum value stored in the ECM is determined b7y considering various engine conditions.
The EGR volume control valve remains close under the following conditions.

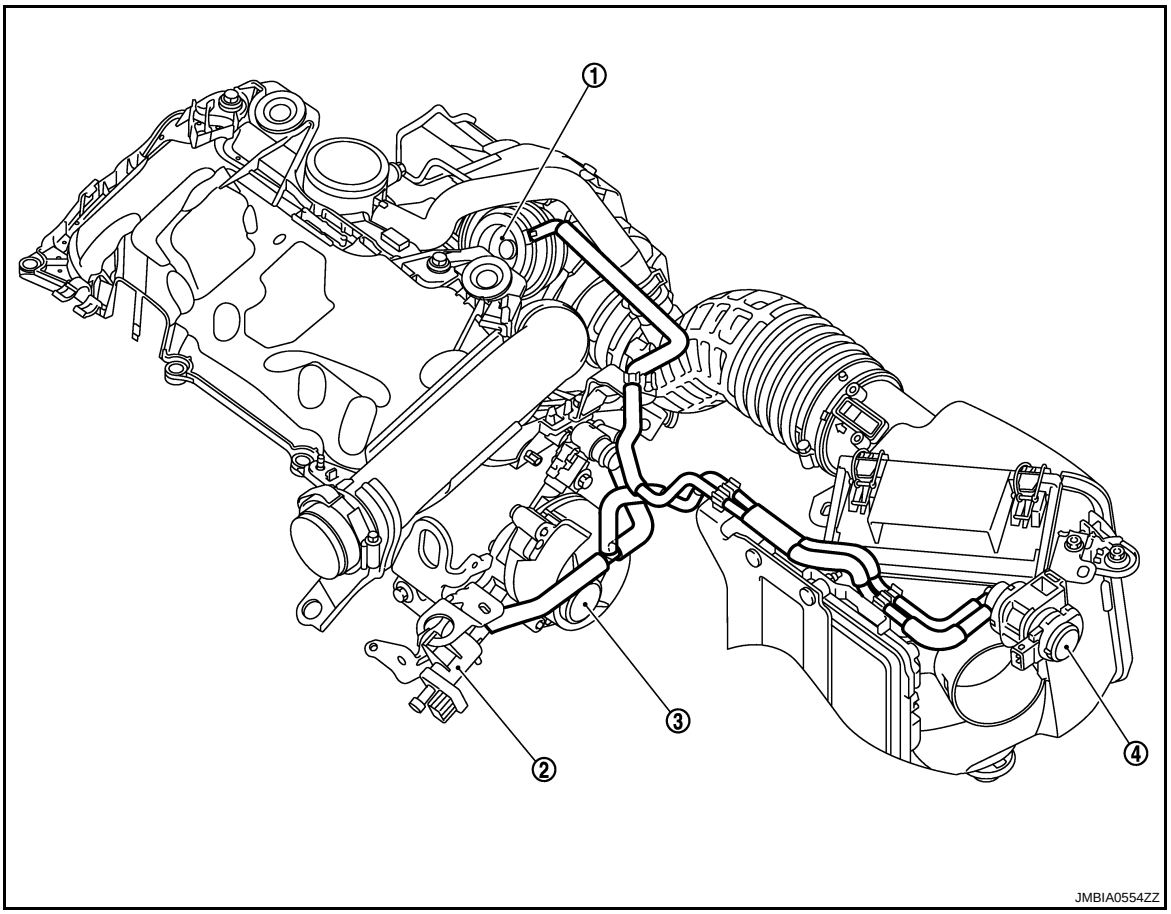
- Engine stopped
- Engine starting
- Low engine coolant temperature
- Excessively high engine coolant temperature
- High engine speed
- Accelerator pedal fully depressed

EGR COOLER BYPASS CONTROL

System Diagram



VACUUM HOSE DRAWING



1. Turbocharger boost control actuator
2. EGR cooler bypass valve control solenoid valve
3. Vacuum pump
4. Turbocharger boost control solenoid valve

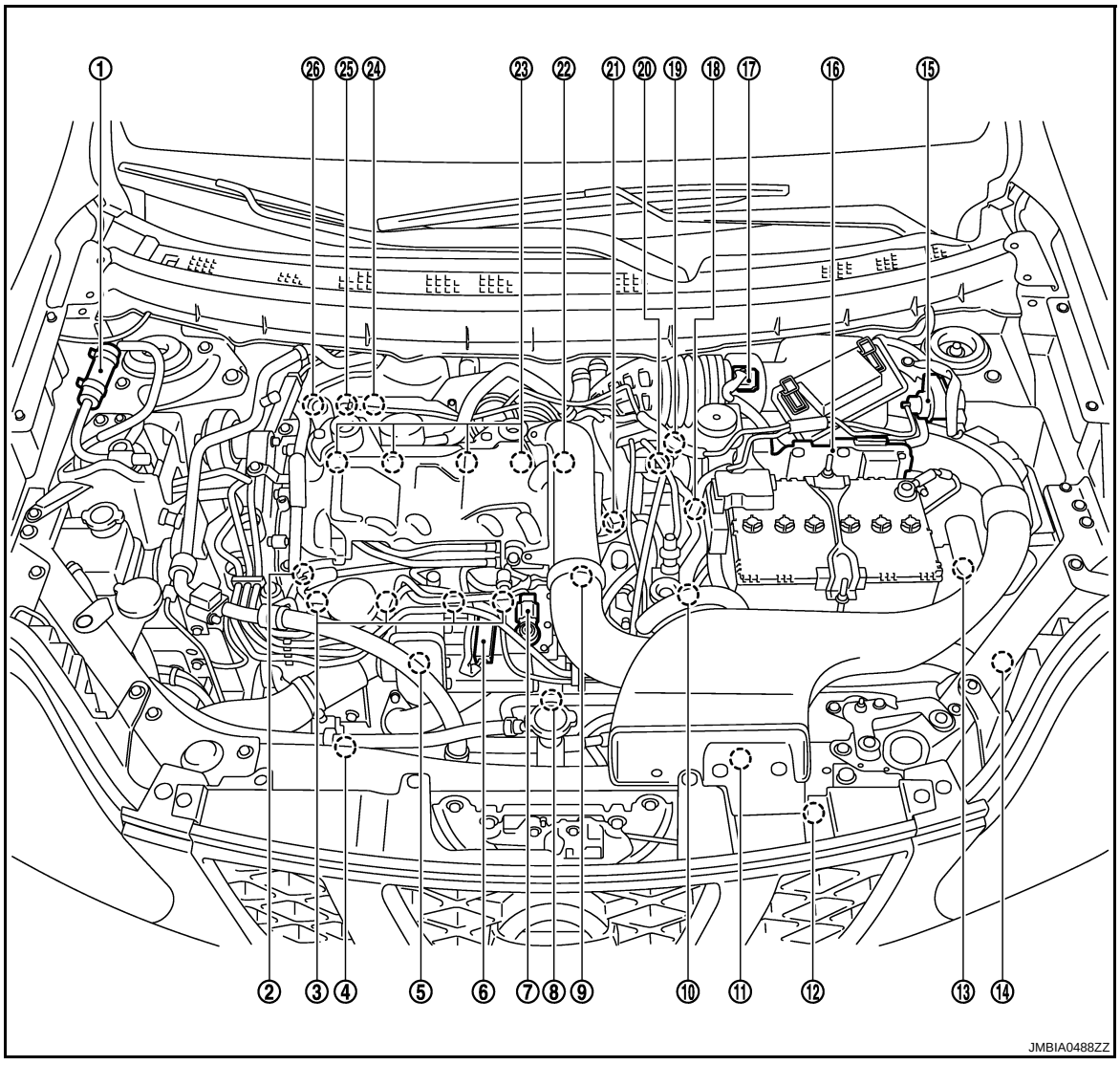
System Description
INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	EGR cooler bypass control	EGR cooler bypass valve control solenoid valve
Crankshaft position sensor	Engine speed		

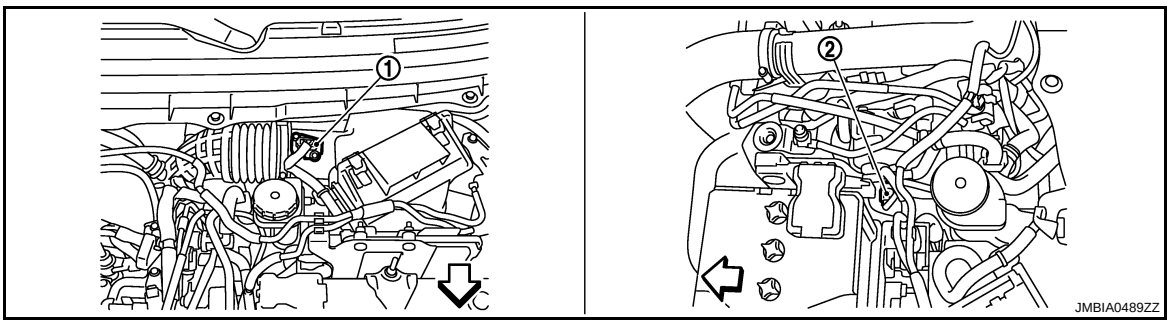
SYSTEM DESCRIPTION
ECM controls the bypass gas volume to EGR cooler at engine cold.
EGR cooler bypass valve control solenoid valve controls the vacuum signal to EGR cooler bypass valve control actuator.
ERG amount is controlled by changing the EGR cooler bypass valve opening using the rod.
EGR cooler bypass valve control solenoid valve is operated by ON/OFF signals (pulse signals) sent from ECM.
The longer is the ON pulse duration, the larger becomes the bypass gas volume.

Component Parts Location

INFOID:0000000001542152

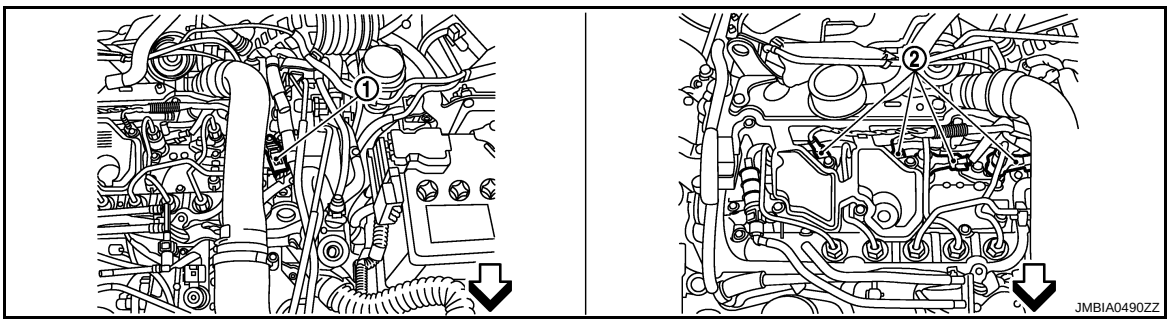


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



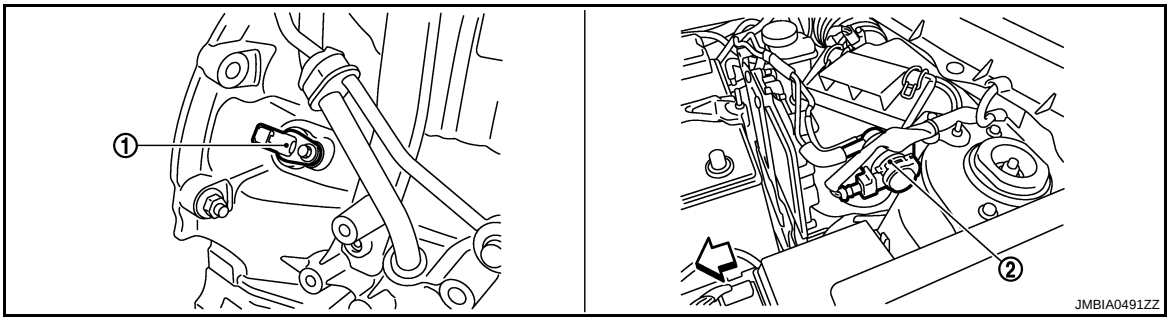
⇦: Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



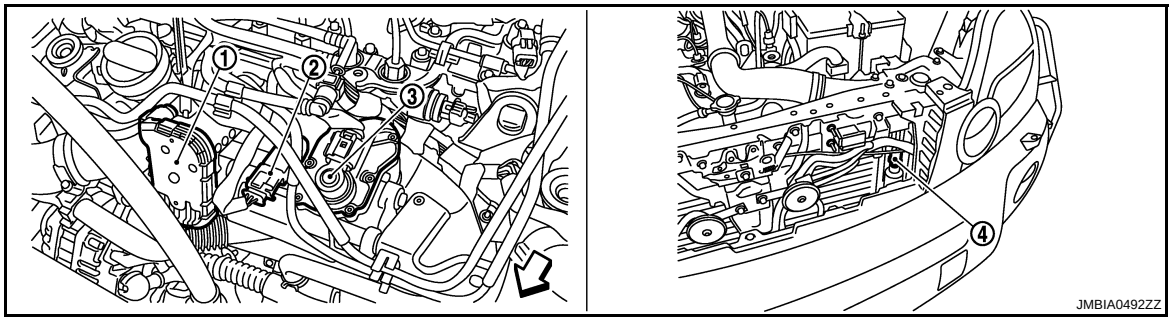
⇦: Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



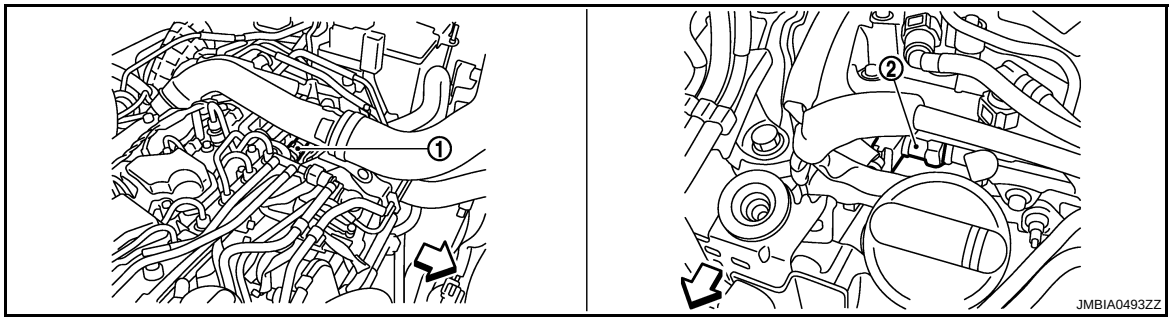
⇦: Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



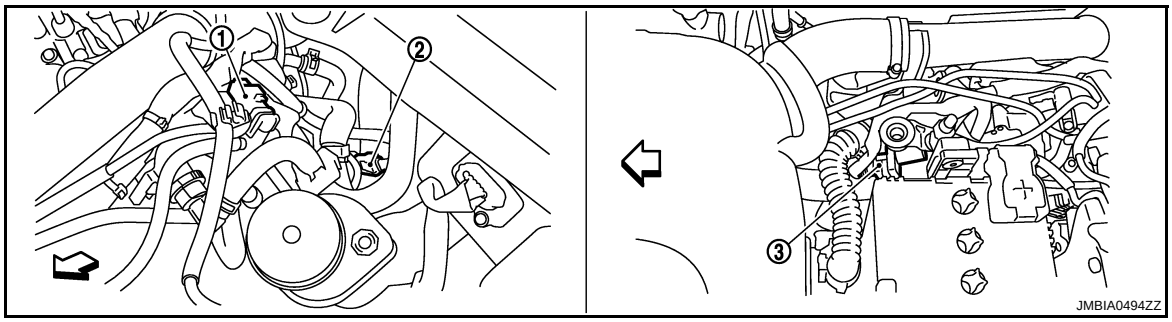
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



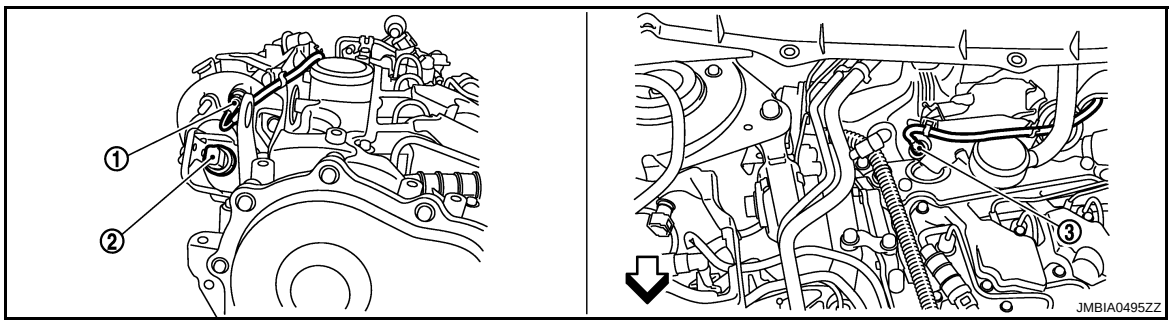
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



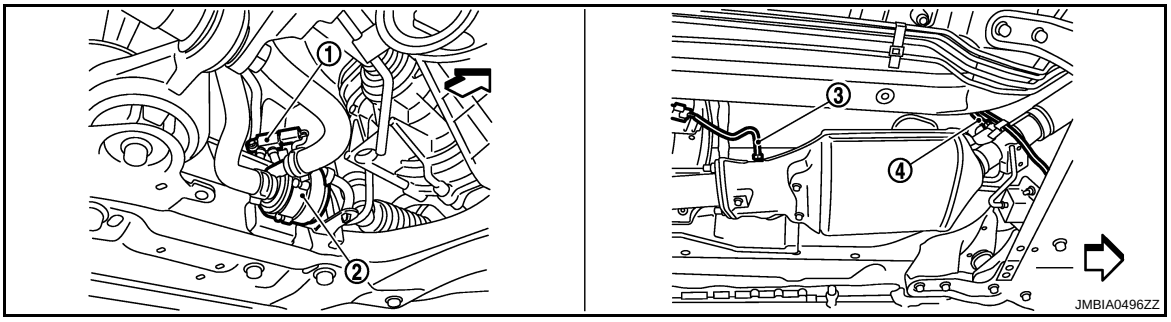
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



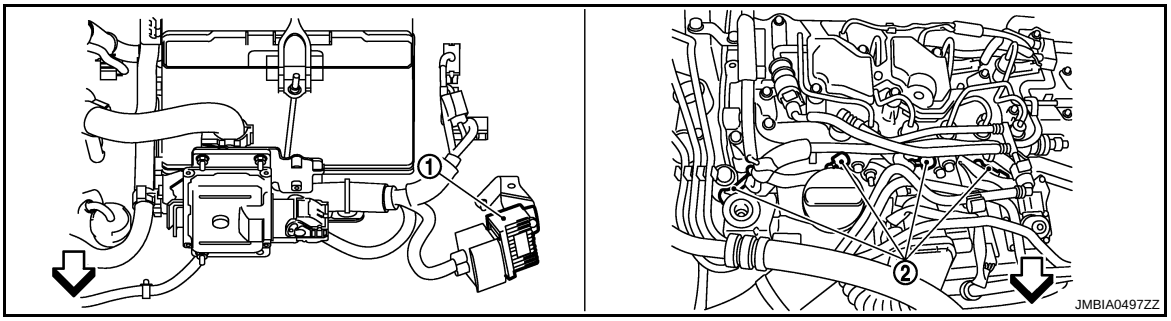
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1 2. Exhaust gas pressure sensor 3. Air fuel ratio (A/F) sensor



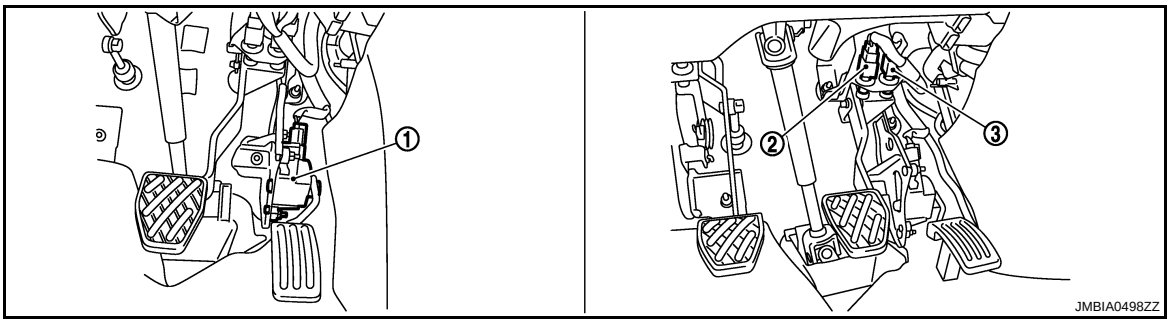
⇦ : Vehicle front

1. Differential exhaust pressure sensor 2. Turbocharger cooling pump 3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

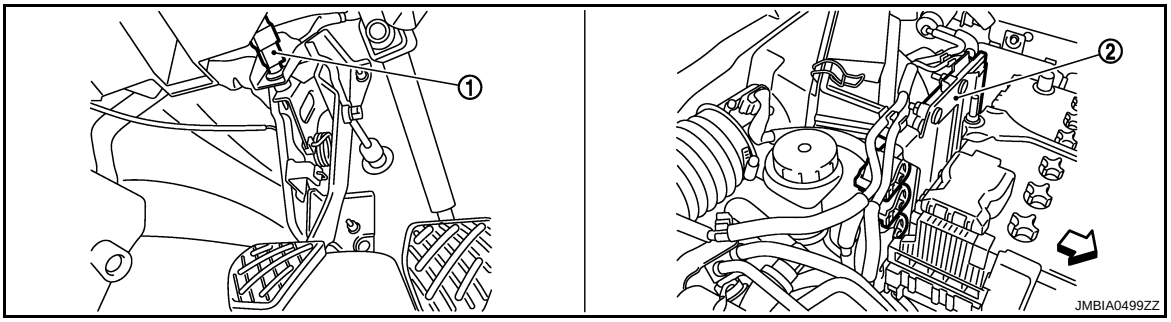


⇦ : Vehicle front

1. Glow control unit 2. Glow plug

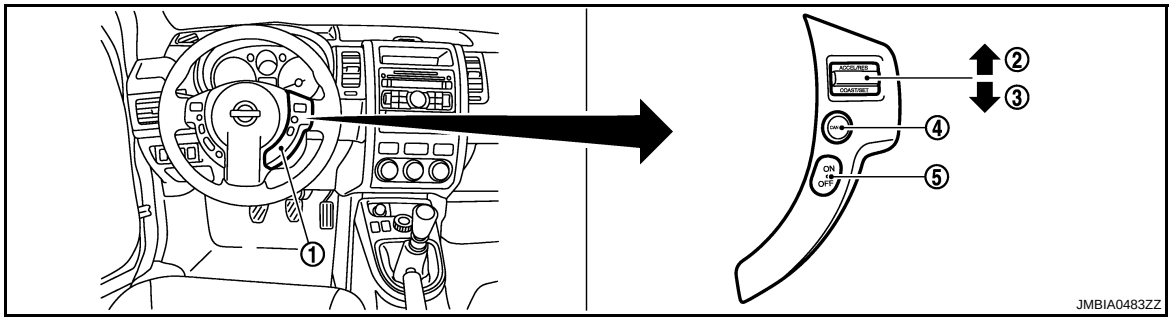


1. Accelerator pedal position sensor 2. Stop lamp switch 3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch 2. ECM



1. ASDC steering switch 2. CANSEL switch 3. RESUME/ACCCELERATE switch
4. SET/COAST switch 5. MAIN SWITCH

Component Description

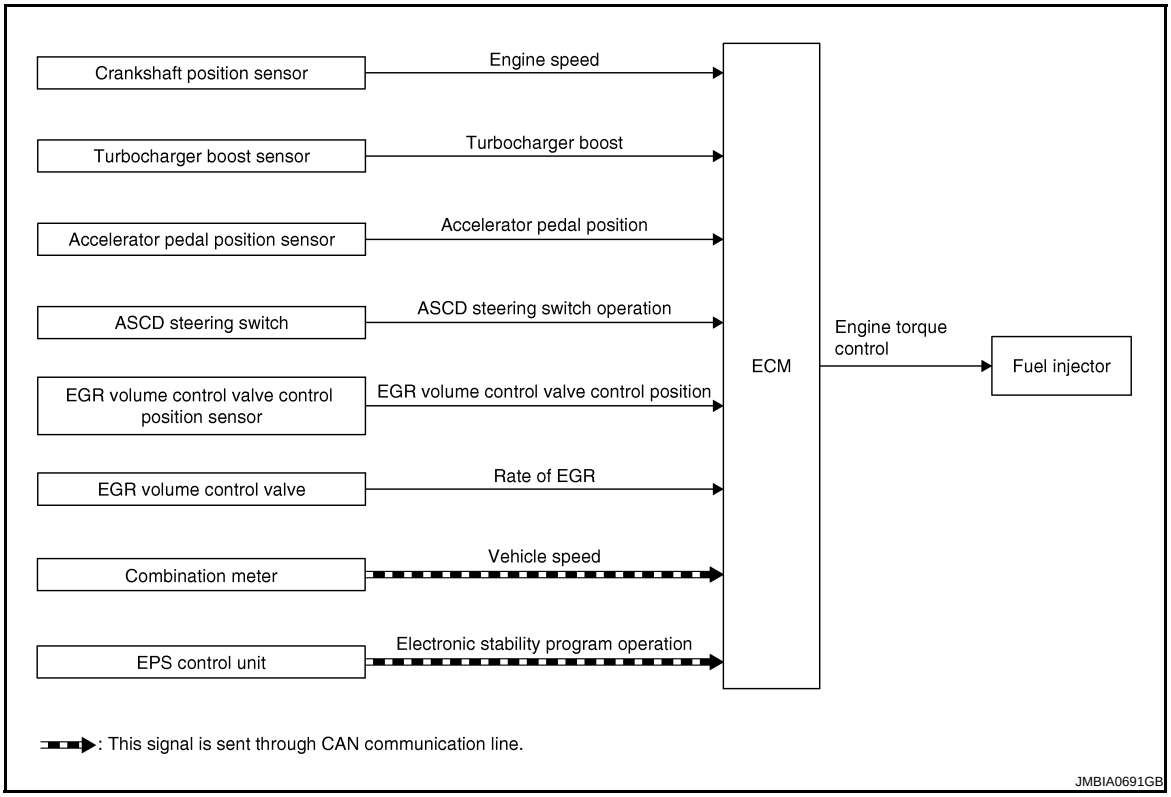
INFOID:0000000001542433

Component	Reference
Accelerator pedal position sensor	ECR-158, "Description"
Barometric pressure sensor	ECR-247, "Description"
Crankshaft position sensor	ECR-167, "Description"
EGR cooler bypass valve control solenoid valve	ECR-262, "Description"
EGR volume control valve	ECR-180, "Description"
EGR volume control valve control position sensor	ECR-175, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Intake air temperature sensor	ECR-130, "Description"
Mass air flow sensor	ECR-123, "Description"
Vehicle speed sensor	ECR-184, "Description"

ENGINE TORQUE CONTROL

System Diagram

INFOID:0000000001530707



System Description

INFOID:0000000001530708

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Crankshaft position sensor	Engine speed	Engine torque control	Fuel injector
Accelerator pedal position sensor	Accelerator pedal position		
Turbocharger boost pressure sensor	Turbocharger boost pressure		
EGR volume control valve control position sensor	EGR volume control valve control position		
EGR volume control valve	Rate of EGR		
ASCD steering switch	ASCD steering switch operation		
Vehicle speed sensor	Vehicle speed*		
EPS control unit	Electronic stability program operation*		

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

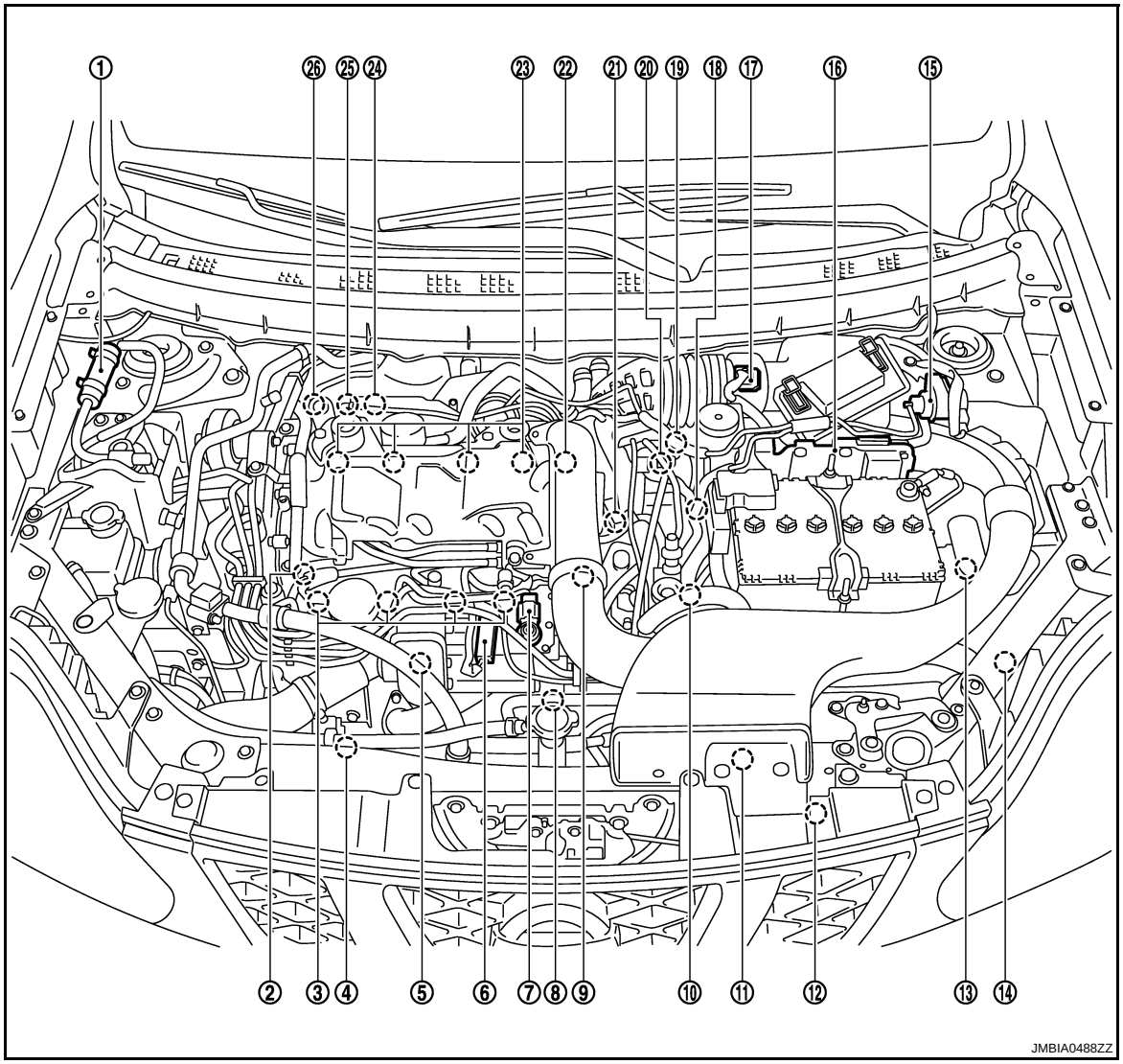
SYSTEM DESCRIPTION

The torque structure is the system which translates the driver's request into a torque supplied by the engine.
It is required for certain functions such as the electronic stability program (ESP), the automatic gearbox or the sequential gearbox if fitted.
Each inter-system (ESP, automatic gearbox, sequential gearbox) sends the ECM a torque request via the CAN communication. The ECM arbitrates between the inter-system torque requests and the driver's request (comprised of the accelerator pedal or the ASCD function). The result of the arbitration gives the torque setpoint.
From this torque setpoint, the ECM determines the quantity of fuel to be injected (injection duration and number of injections) and the amount of air required (turbocharging pressure and EGR rate) so that the engine is

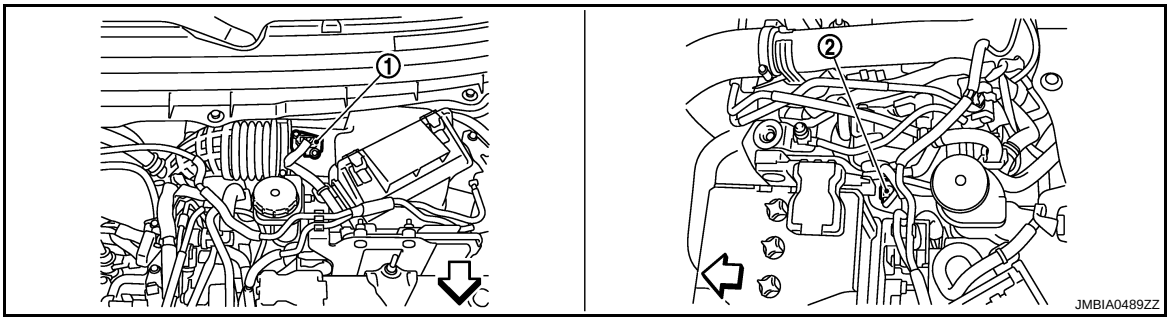
able to provide the torque required in the best possible conditions (in terms of smooth running performance, pollutant emissions, etc.).

Component Parts Location

INFOID:0000000001542153

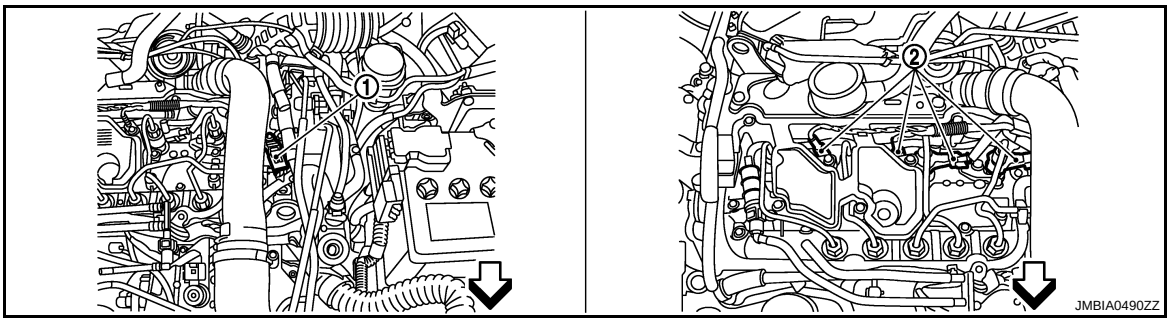


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



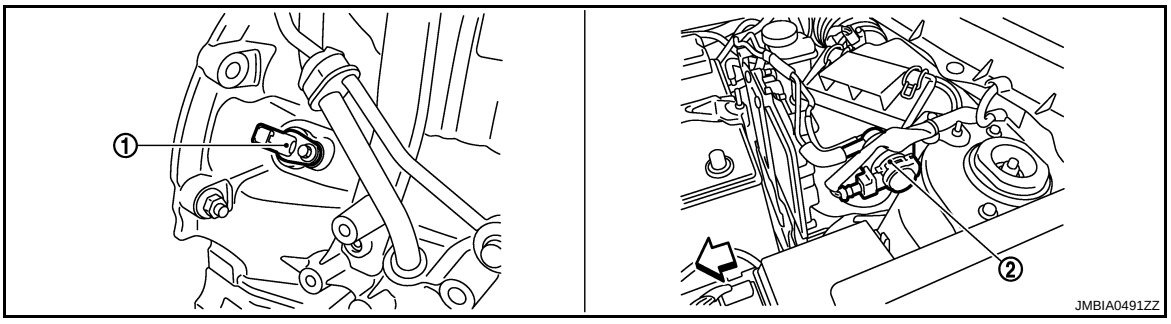
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



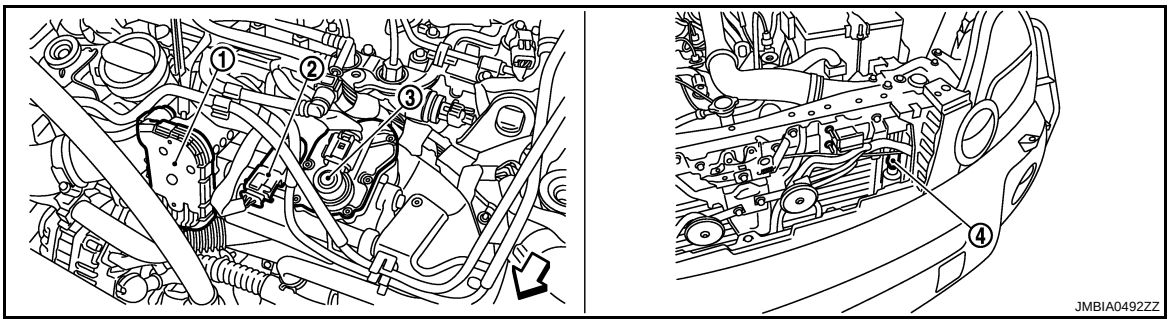
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



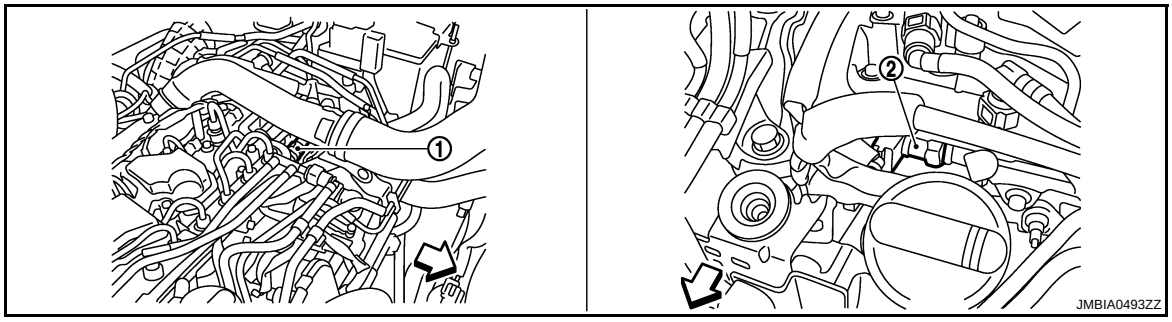
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



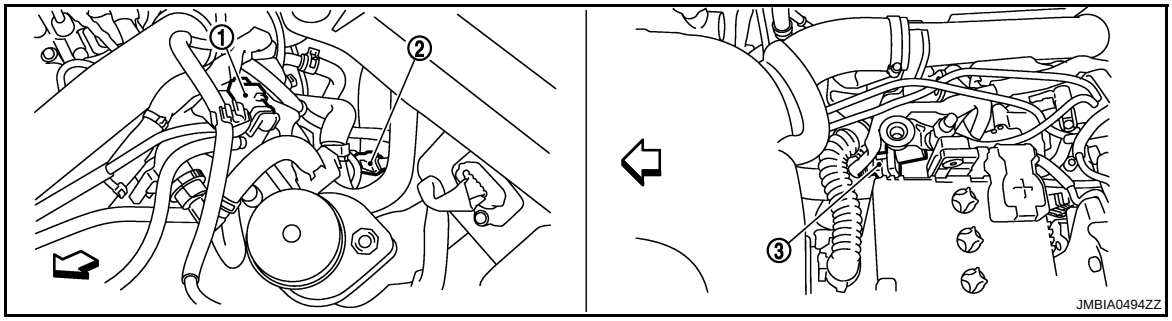
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



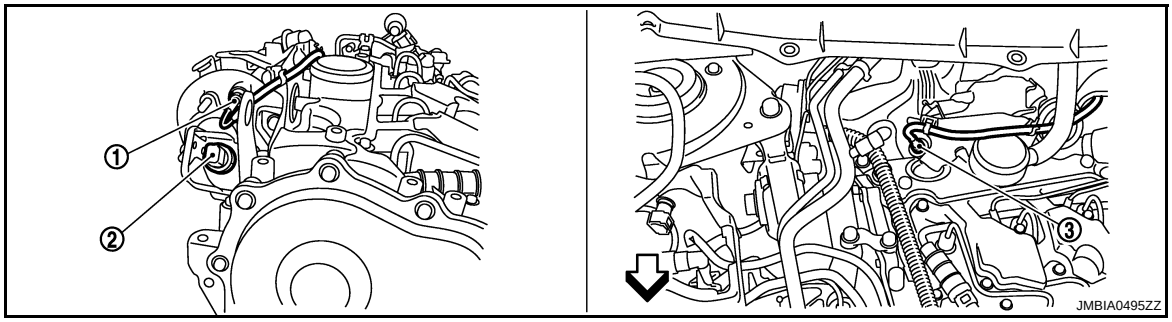
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



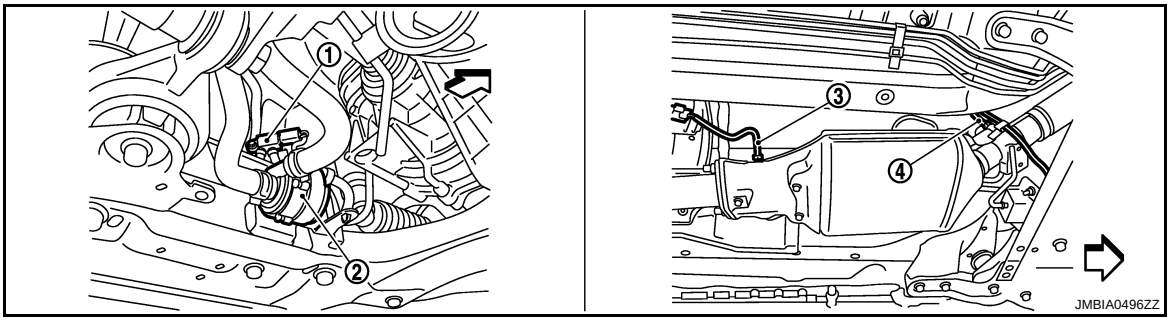
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



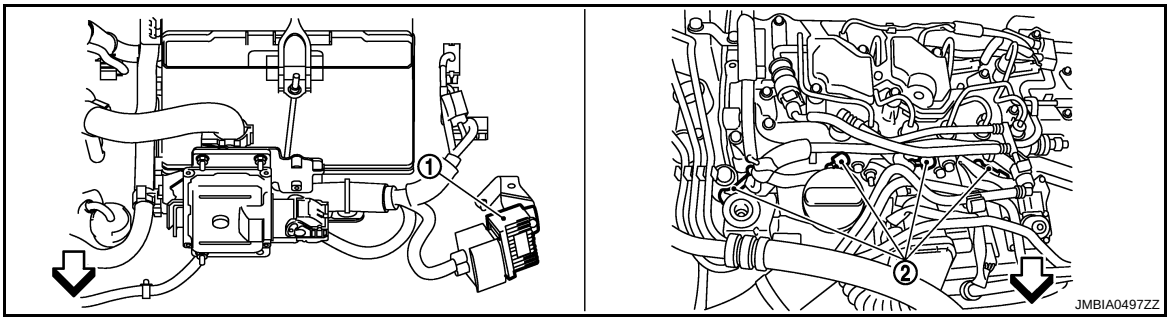
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



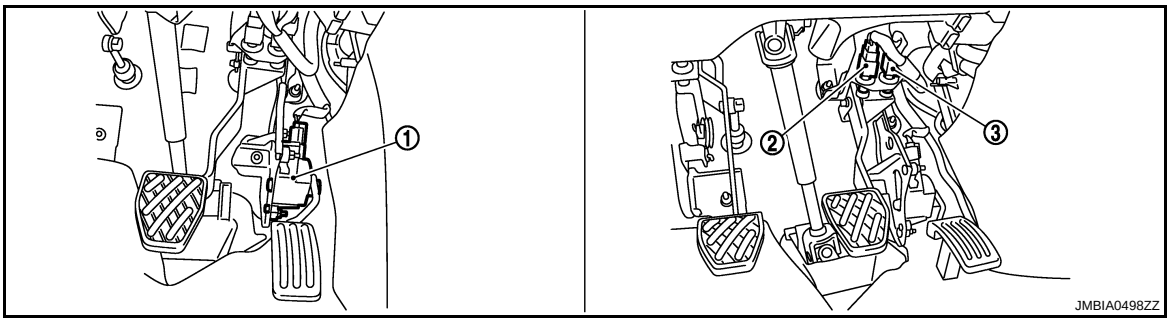
⇦ : Vehicle front

1. Differential exhaust pressure sensor 2. Turbocharger cooling pump 3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

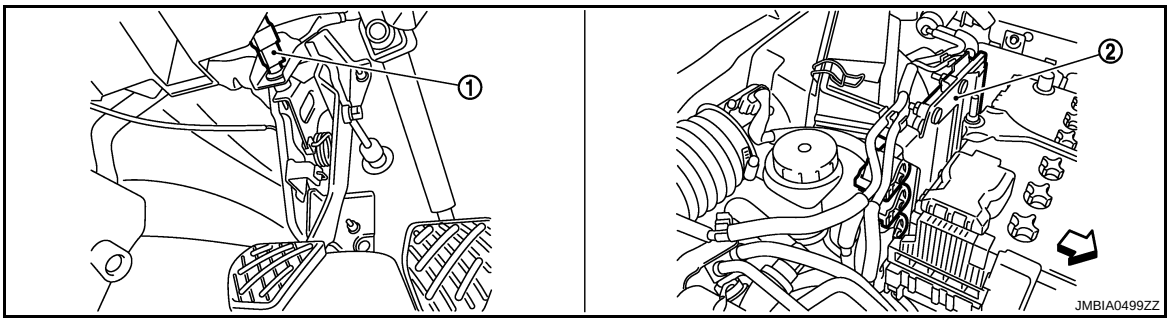


⇦ : Vehicle front

1. Glow control unit 2. Glow plug

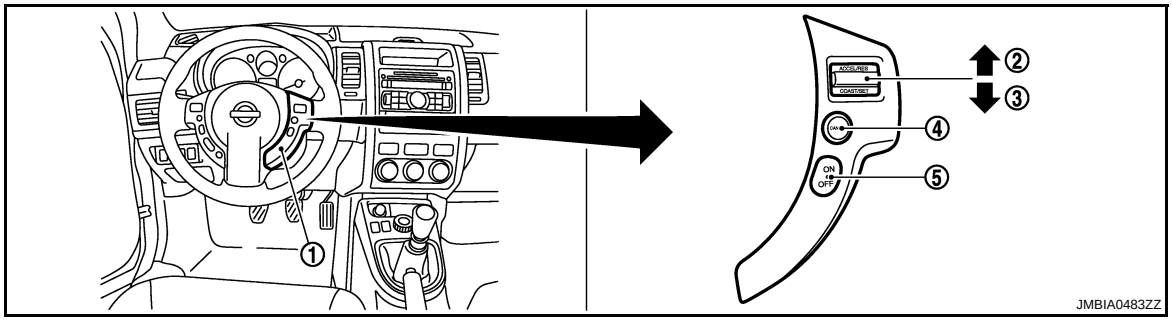


1. Accelerator pedal position sensor 2. Stop lamp switch 3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch 2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

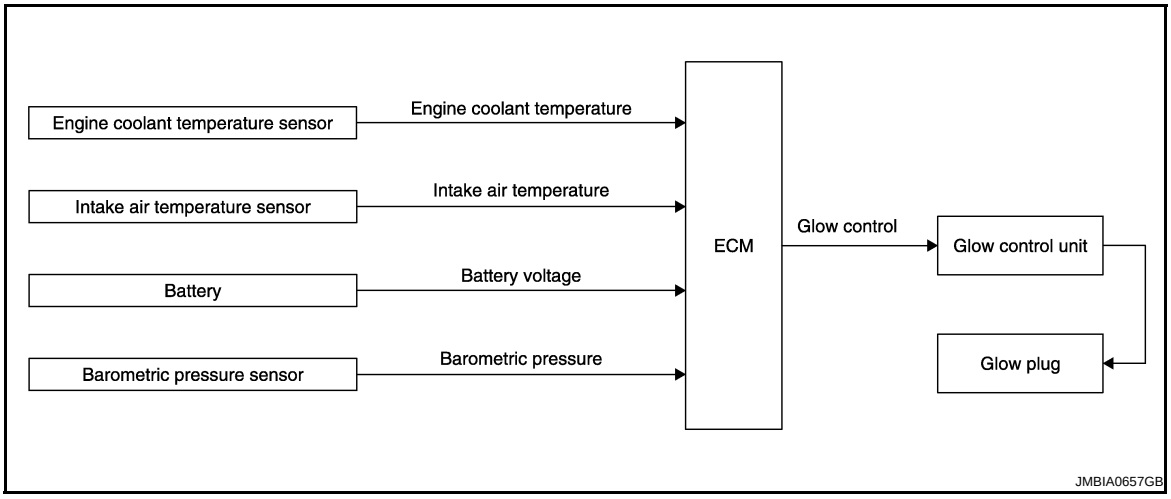
INFOID:0000000001542434

Component	Reference
Accelerator pedal position sensor	ECR-158, "Description"
ASCD steering switch	ECR-192, "Description"
Crankshaft position sensor	ECR-167, "Description"
EGR volume control valve	ECR-180, "Description"
EGR volume control valve control position sensor	ECR-175, "Description"
Fuel injector	ECR-155, "Description"
Turbocharger boost sensor	ECR-161, "Description"
Vehicle speed sensor	ECR-184, "Description"

GLOW CONTROL

System Diagram

INFOID:0000000001530711



System Description

INFOID:0000000001530712

INPUT/OUTPUT SIGNAL CHART

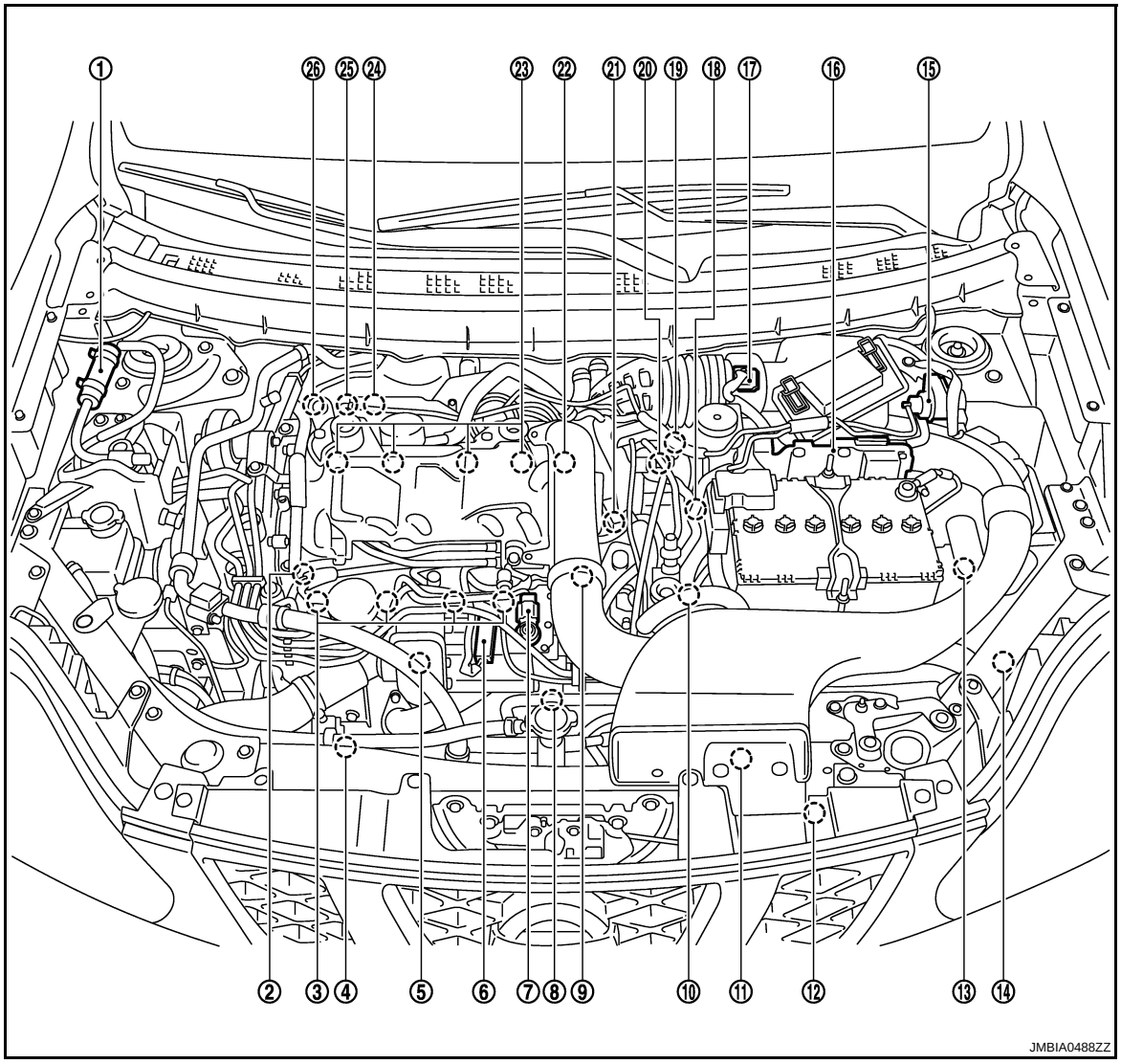
Sensor	Input Signal to ECM	ECM function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Glow control	Grow control unit ↓ Glow plug
Intake air temperature sensor	Intake air temperature		
Battery	Battery voltage		
Barometric pressure sensor	Barometric pressure		

SYSTEM DESCRIPTION

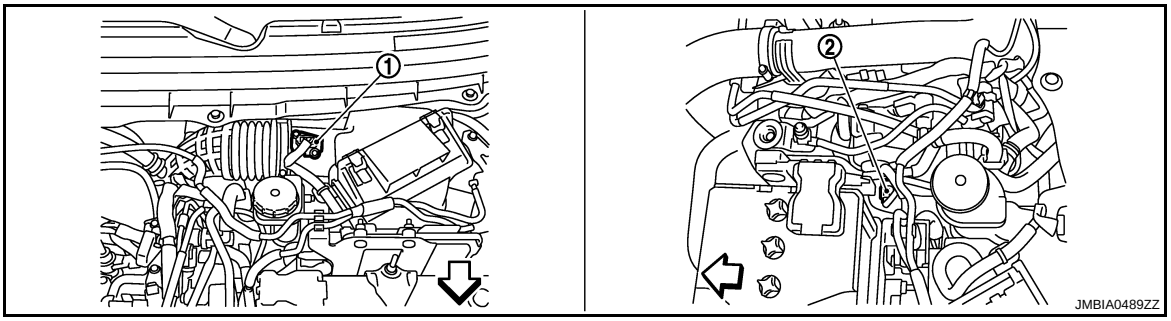
When ignition switch is turned ON while cooling temperature is lower than the specified value, ECM actuates glow plug through glow control unit. Because of this, combustion chamber is warmed and stabilized combustion at starting can be obtained under low cooling temperature. The preheating time is determined according to cooling temperature, inlet air temperature and battery voltage.

Component Parts Location

INFOID:0000000001542154

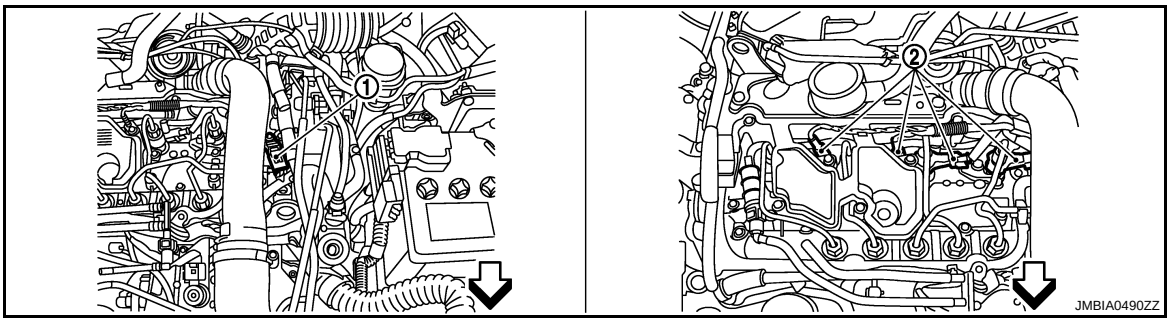


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



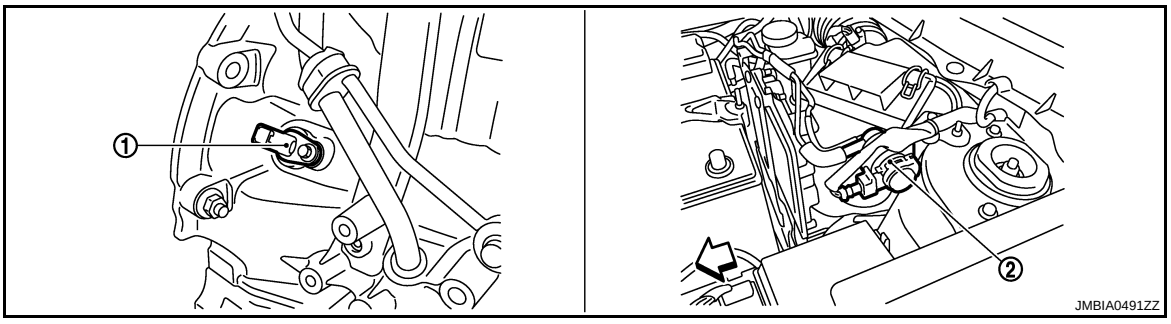
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



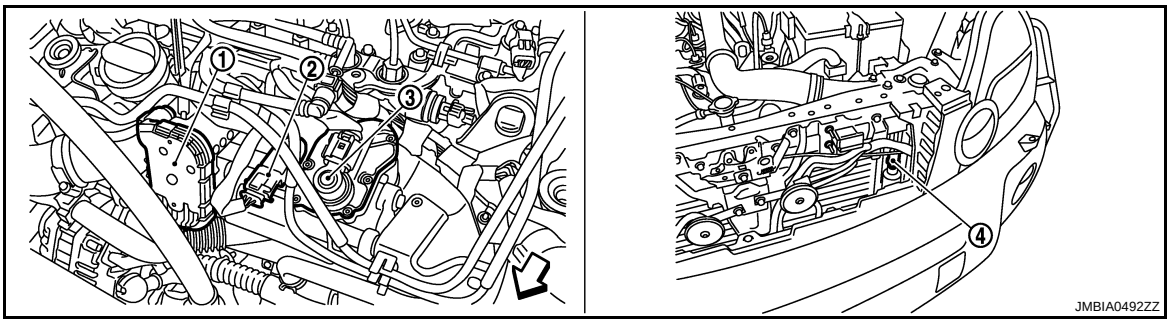
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



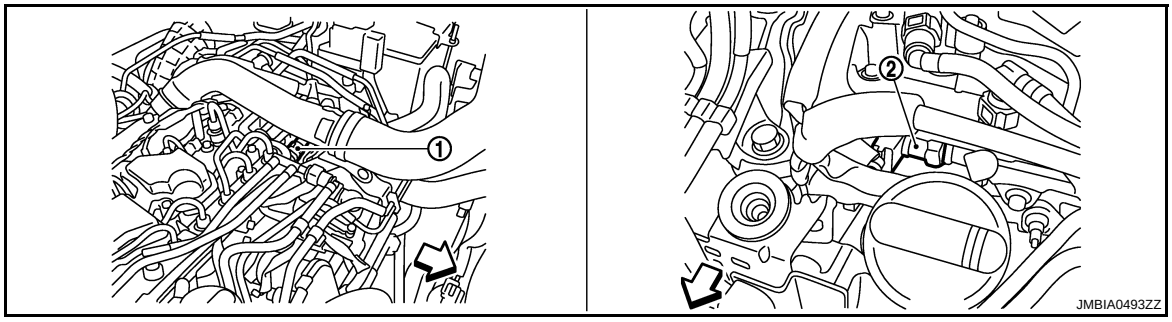
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



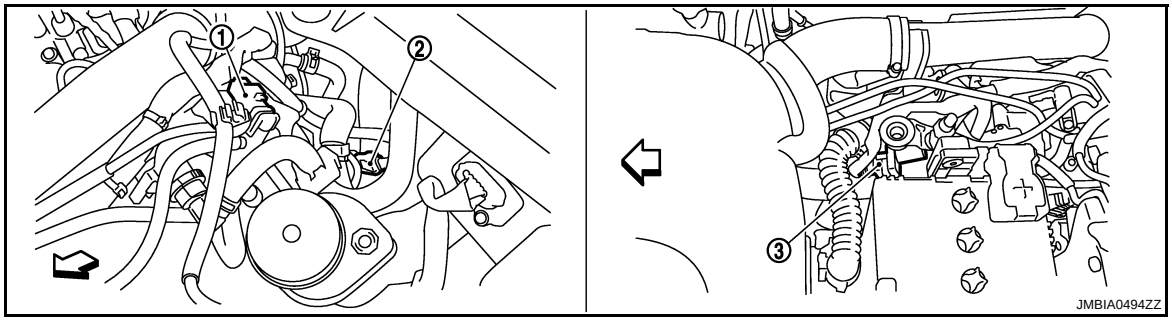
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



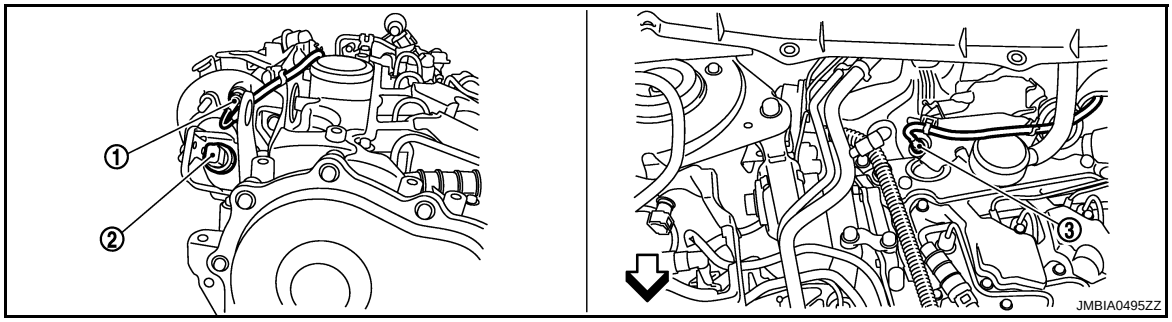
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



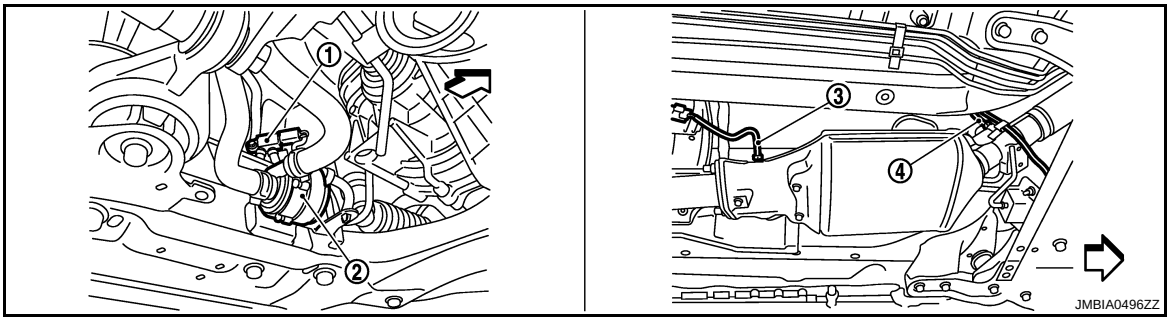
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



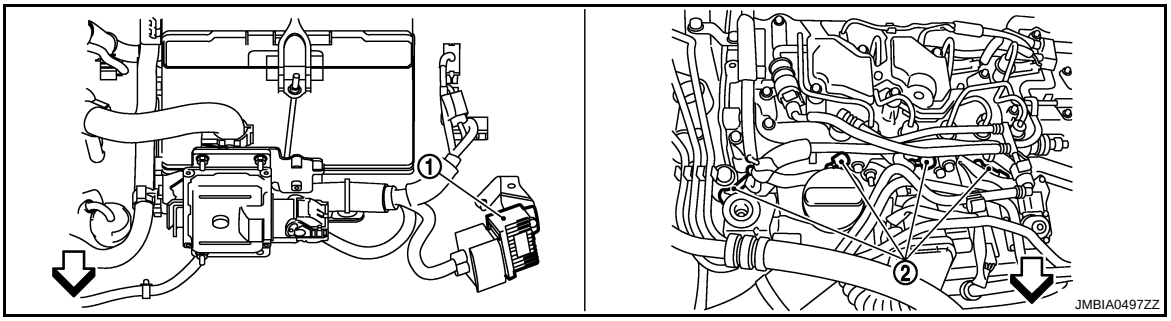
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



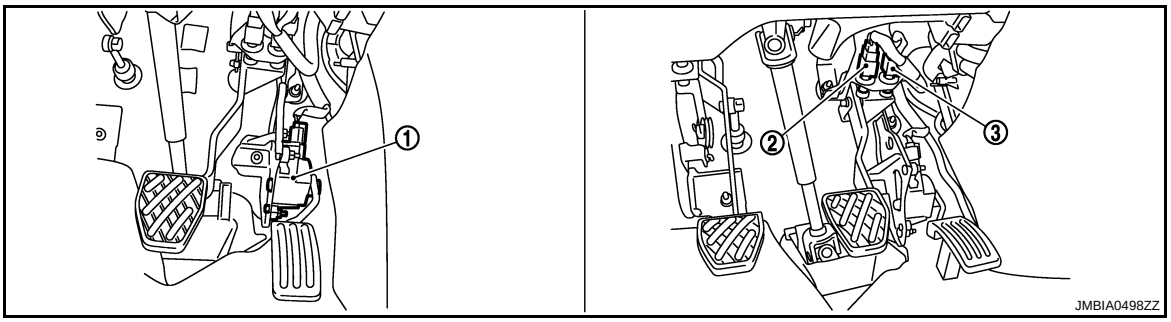
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

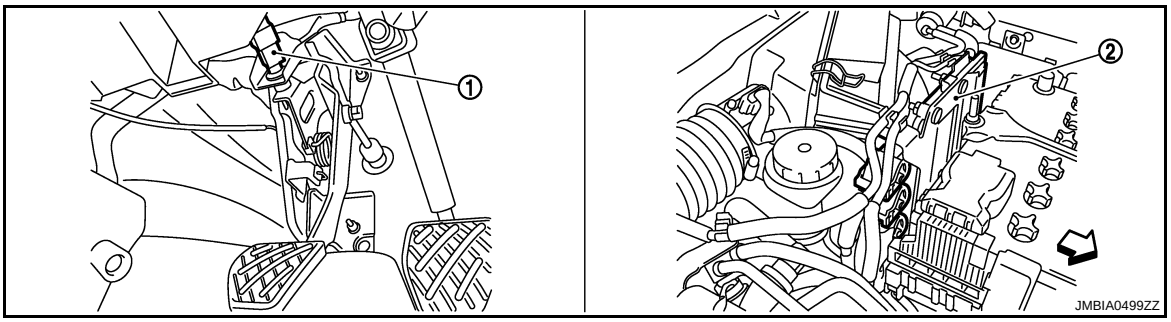


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

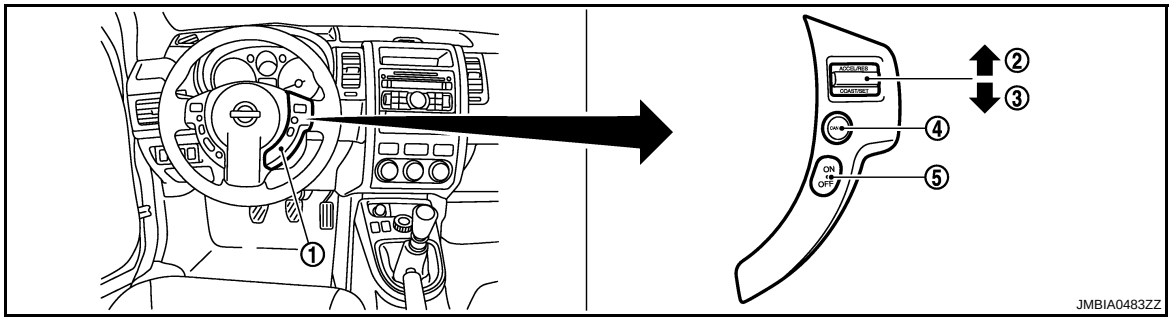


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

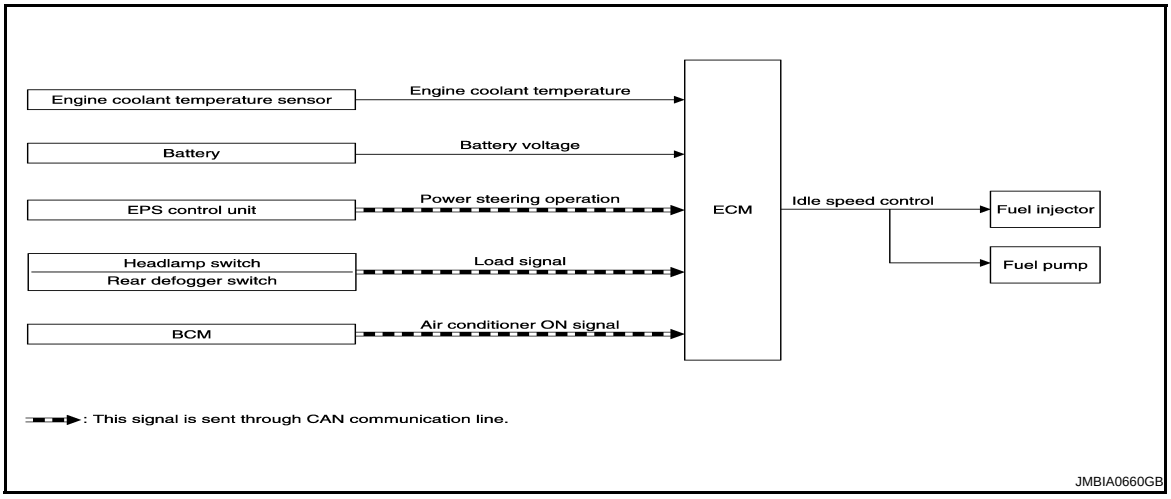
INFOID:0000000001542435

Component	Reference
Barometric pressure sensor	ECR-247, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Intake air temperature sensor	ECR-130, "Description"

IDLE SPEED CONTROL

System Diagram

INFOID:0000000001530715



System Description

INFOID:0000000001530716

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Idle speed control	Fuel injector Fuel pump
Battery	Battery voltage		
Headlamp switch Rear defogger switch	Load signal*		
EPS control unit	Power steering operation*		
Air conditioner switch	Air conditioner operation*		

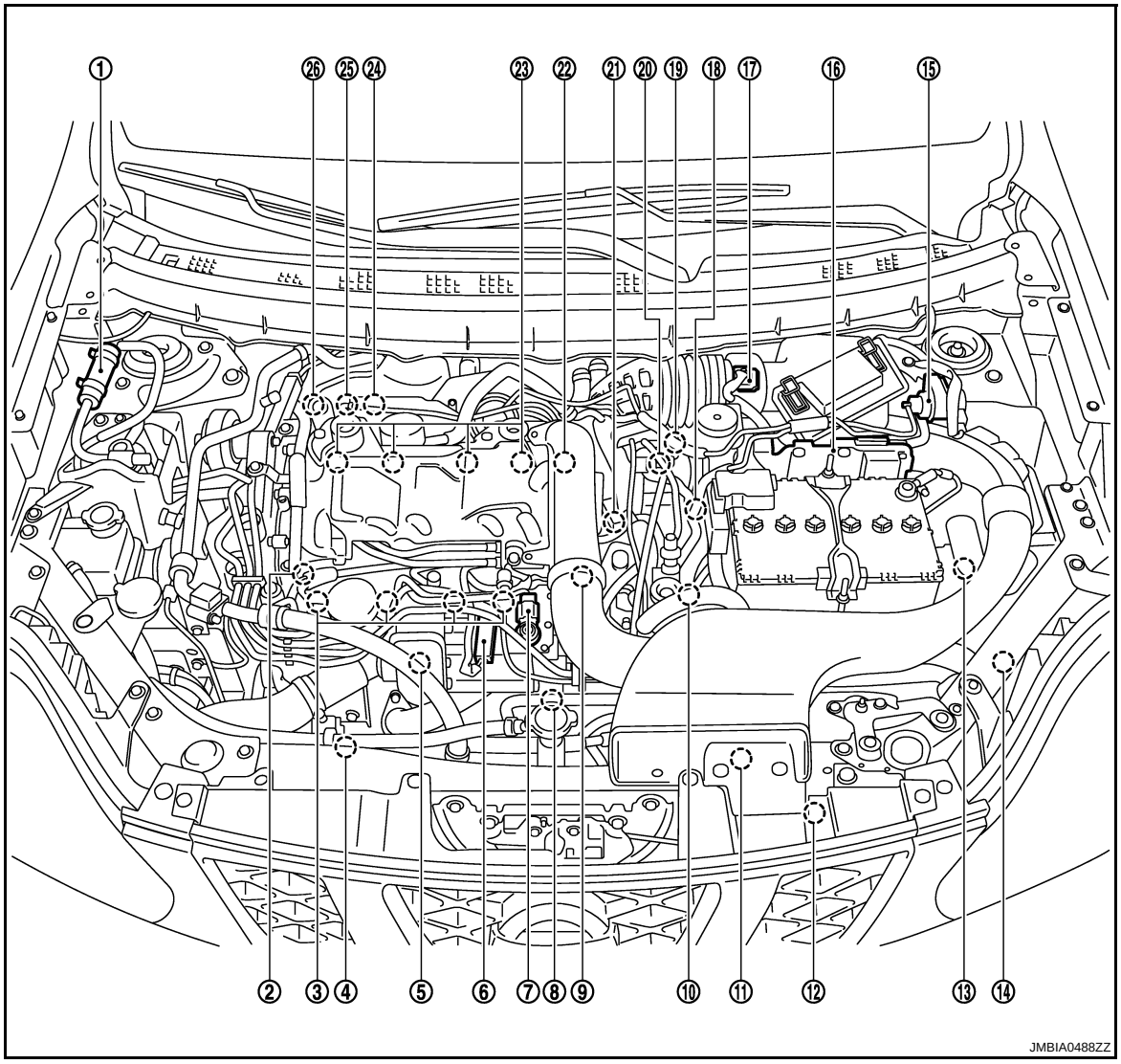
*: This signal is sent to the ECM through CAN communication line.

SYSTEM DESCRIPTION

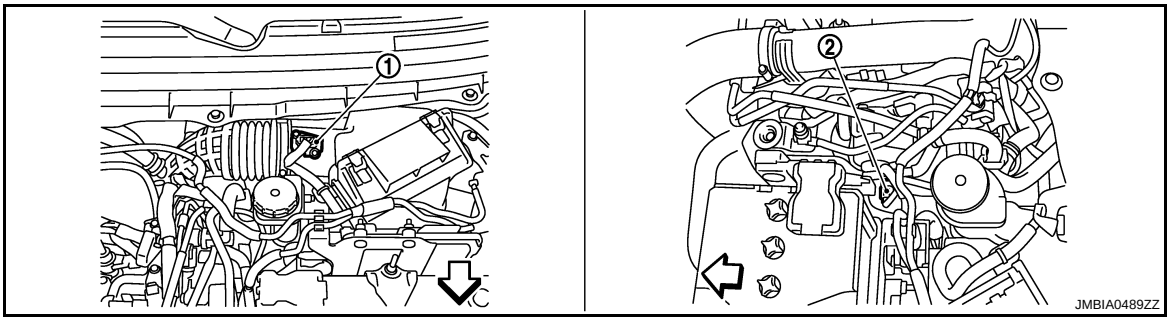
The ECM is responsible for regulating the idle speed as a function of the idle speed setpoint which it calculates.

Component Parts Location

INFOID:0000000001542155

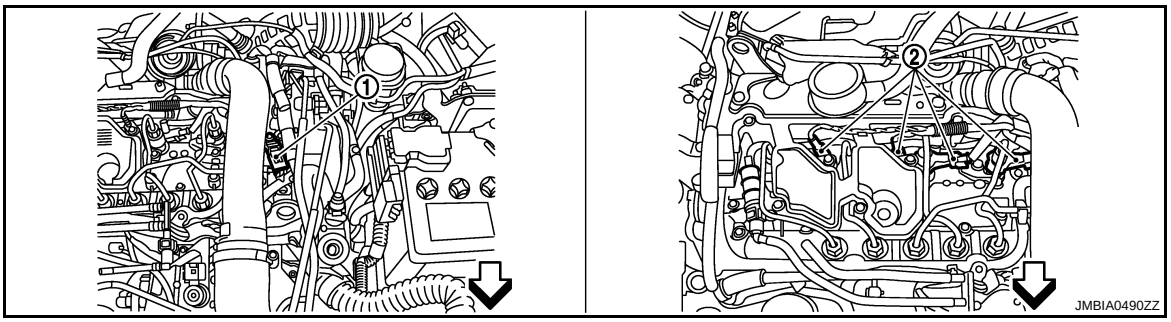


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



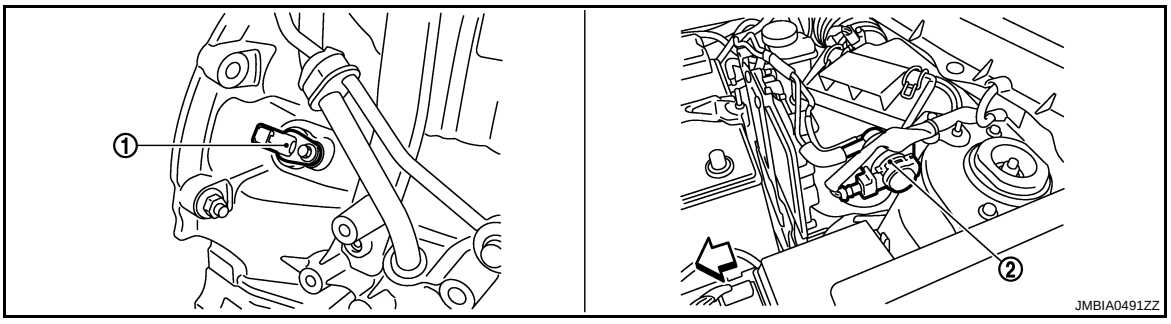
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



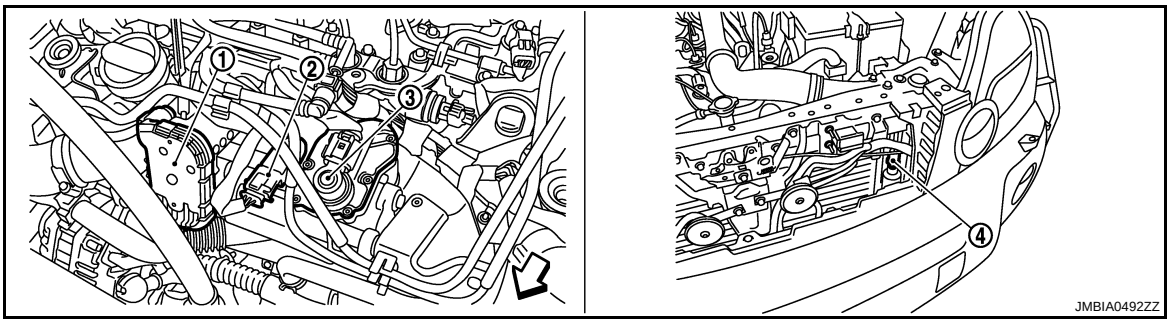
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



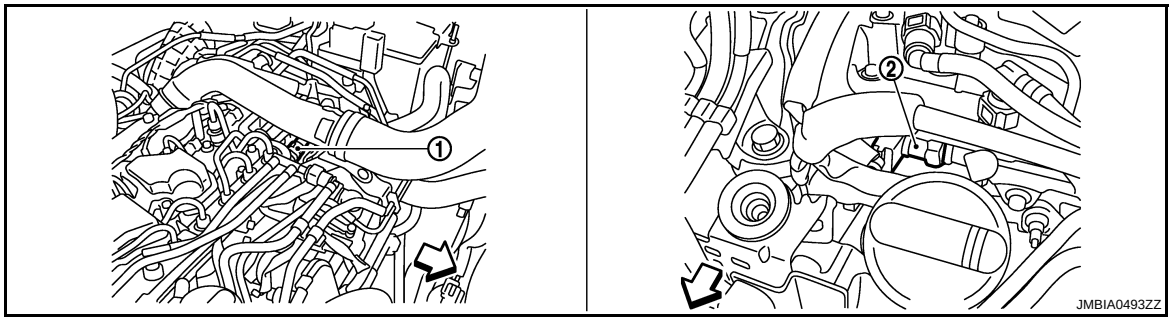
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



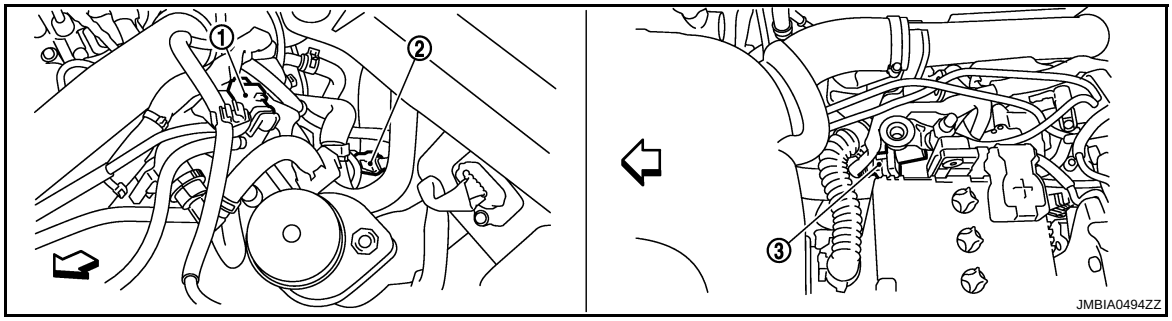
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



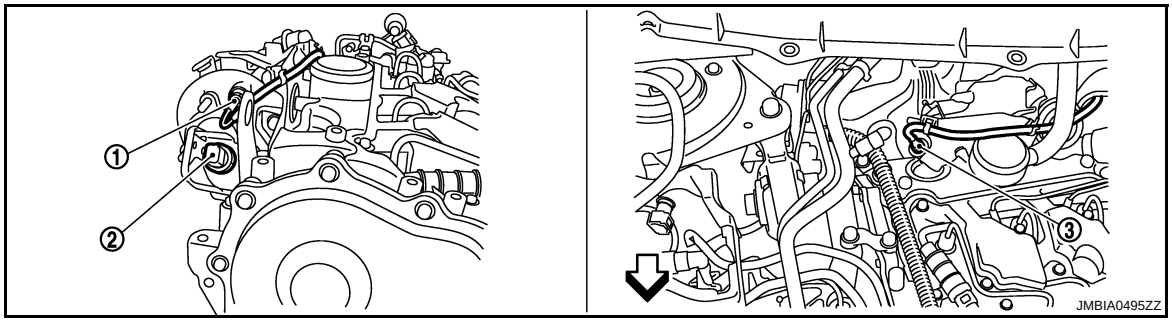
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



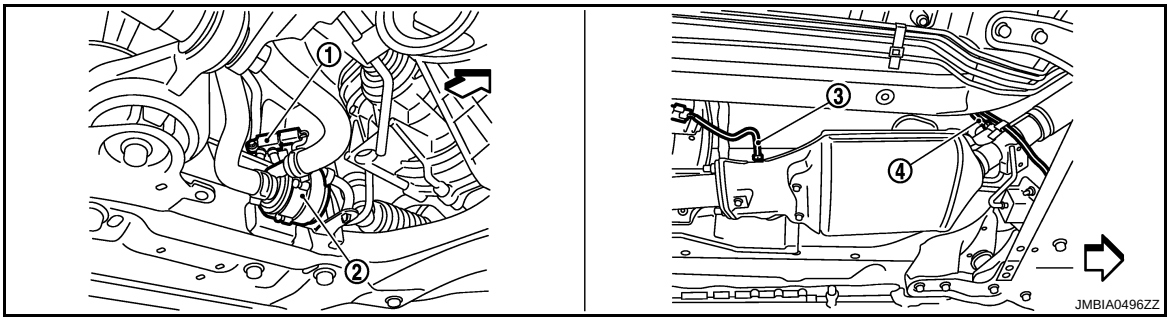
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



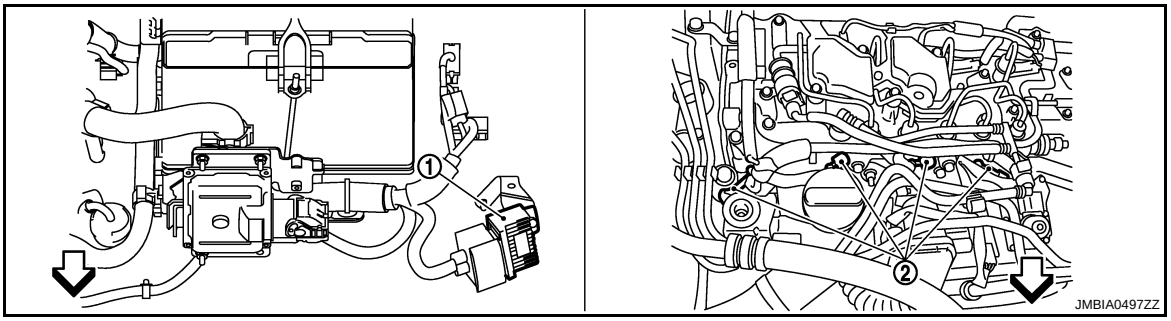
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



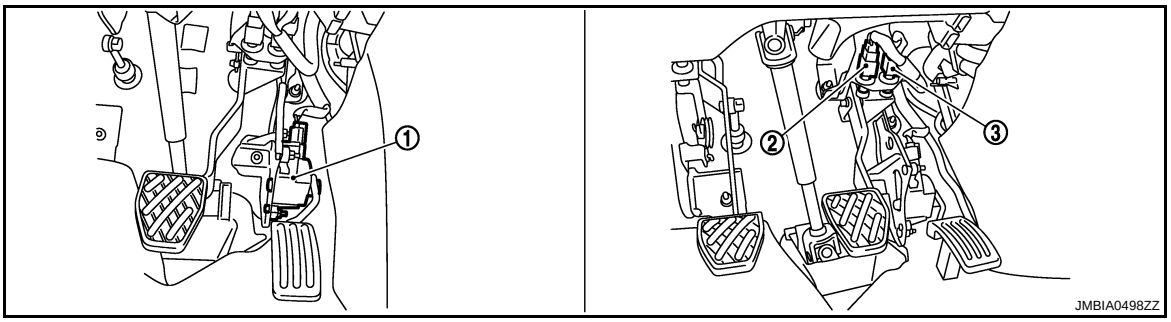
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

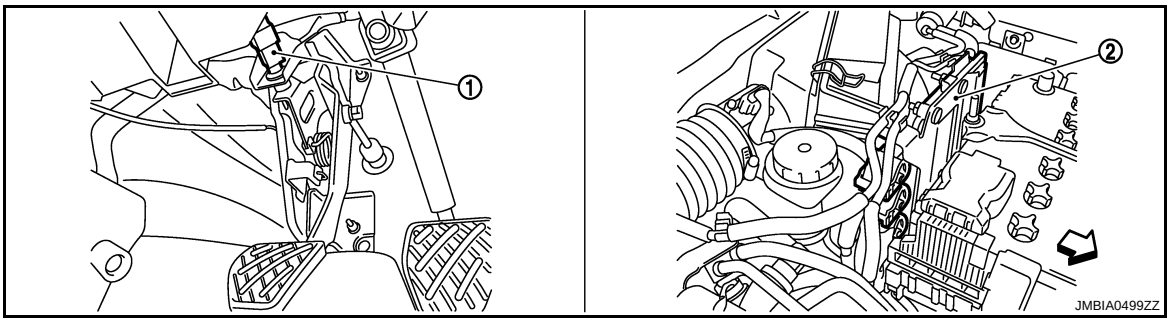


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

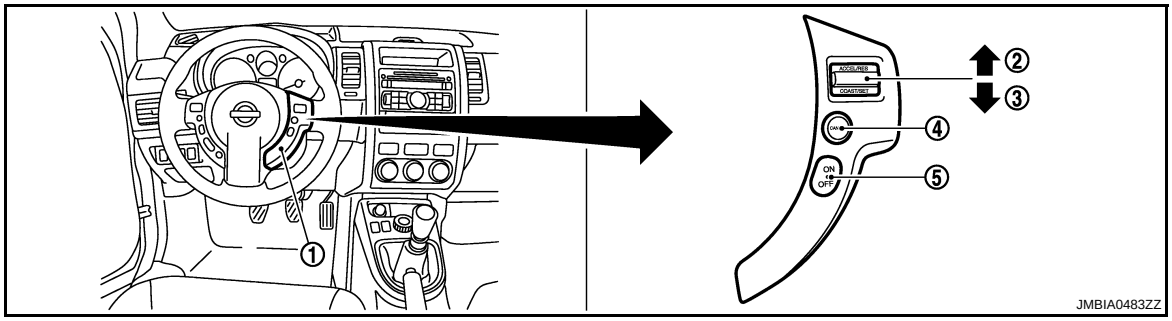


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

INFOID:0000000001542436

Component	Reference
Engine coolant temperature sensor	ECR-132, "Description"
Fuel injector	ECR-155, "Description"

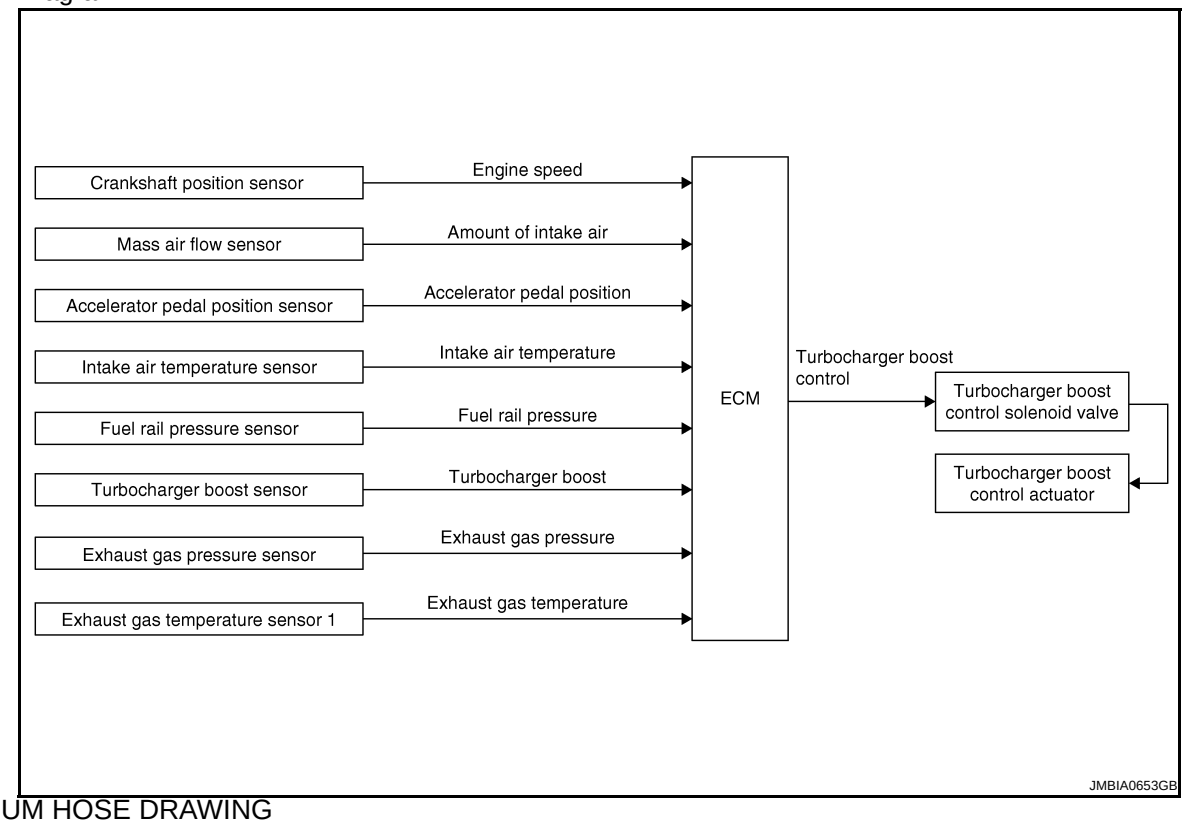
TURBOCHARGER BOOST CONTROL

System Description

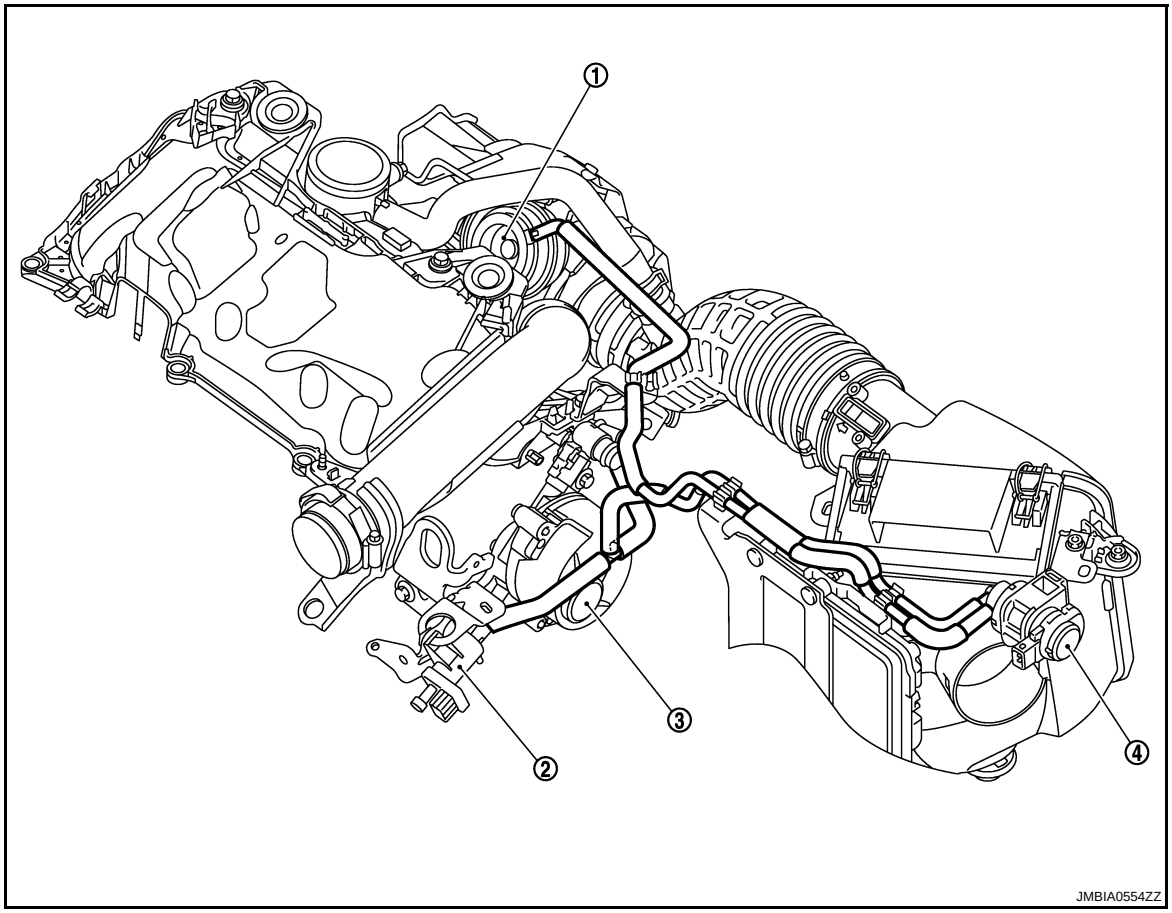
INFOID:0000000001530703

TURBOCHARGER BOOST CONTROL

System Diagram



VACUUM HOSE DRAWING



1. Turbocharger boost control actuator
2. EGR cooler bypass valve control solenoid valve
3. Vacuum pump
4. Turbocharger boost control solenoid valve

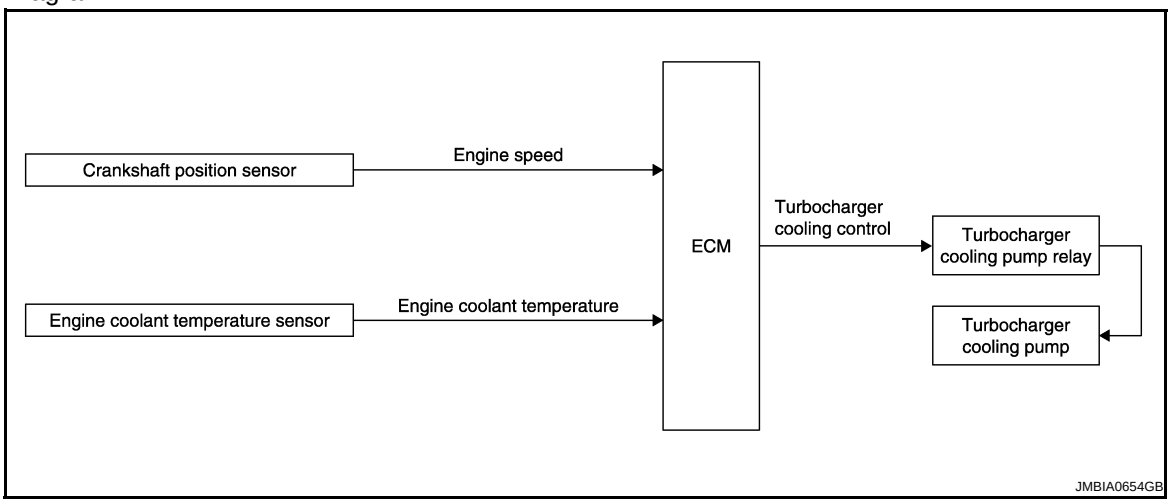
System Description
INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Mass air flow sensor	Amount of intake air	Turbocharger boost control	Turbocharger boost control solenoid valve ↓ Turbocharger boost control actuator
Crankshaft position sensor	Engine speed		
Intake air temperature sensor	Intake air temperature		
Accelerator pedal position sensor	Accelerator pedal position		
Fuel rail pressure sensor	Fuel rail pressure		
Turbocharger boost sensor	Turbocharger boost		
Exhaust gas pressure sensor	Exhaust gas pressure		
Exhaust gas temperature sensor 1	Exhaust gas temperature		

SYSTEM DESCRIPTION
Turbocharger boost control solenoid valve is operated by ON/OFF signals (pulse signals) from ECM.
Output signal to turbocharger boost control solenoid valve is feedback controlled to obtain the optimum boost pressure so that the amount of intake air detected by mas air flow sensor is equal to the target amount decided by engine revolution and injected amount of fuel.
Under the driving condition of increasing boost pressure, ON time rate of turbocharger boost control solenoid valve is increased by ECM signal to shift the nozzle vane in closing direction. Under the driving condition of decreasing boost pressure, ON time rate of turbocharger boost control solenoid valve is decreased by ECM signal to shift the nozzle vane in opening direction.

TURBOCHARGER COOLING CONTROL

System Diagram



System Description

INPUT/OUTPUT SIGNAL CHART

Sensor	Input Signal to ECM	ECM function	Actuator
Engine coolant temperature sensor	Engine coolant temperature	Turbocharger cooling control	Turbocharger cooling pump relay ↓ Turbocharger cooling pump
Crankshaft position sensor	Engine speed		

SYSTEM DESCRIPTION

To prevent high oil temperature around turbine bearing, cooling water is circulated around the bearing using turbocharger cooling pump.

Excessively high oil temperature causes the change of oil viscosity property resulting in bearing seizure.

Therefore, ECM actuates the cooling pump when the cooling water temperature exceeds the specified value.

Component Parts Location

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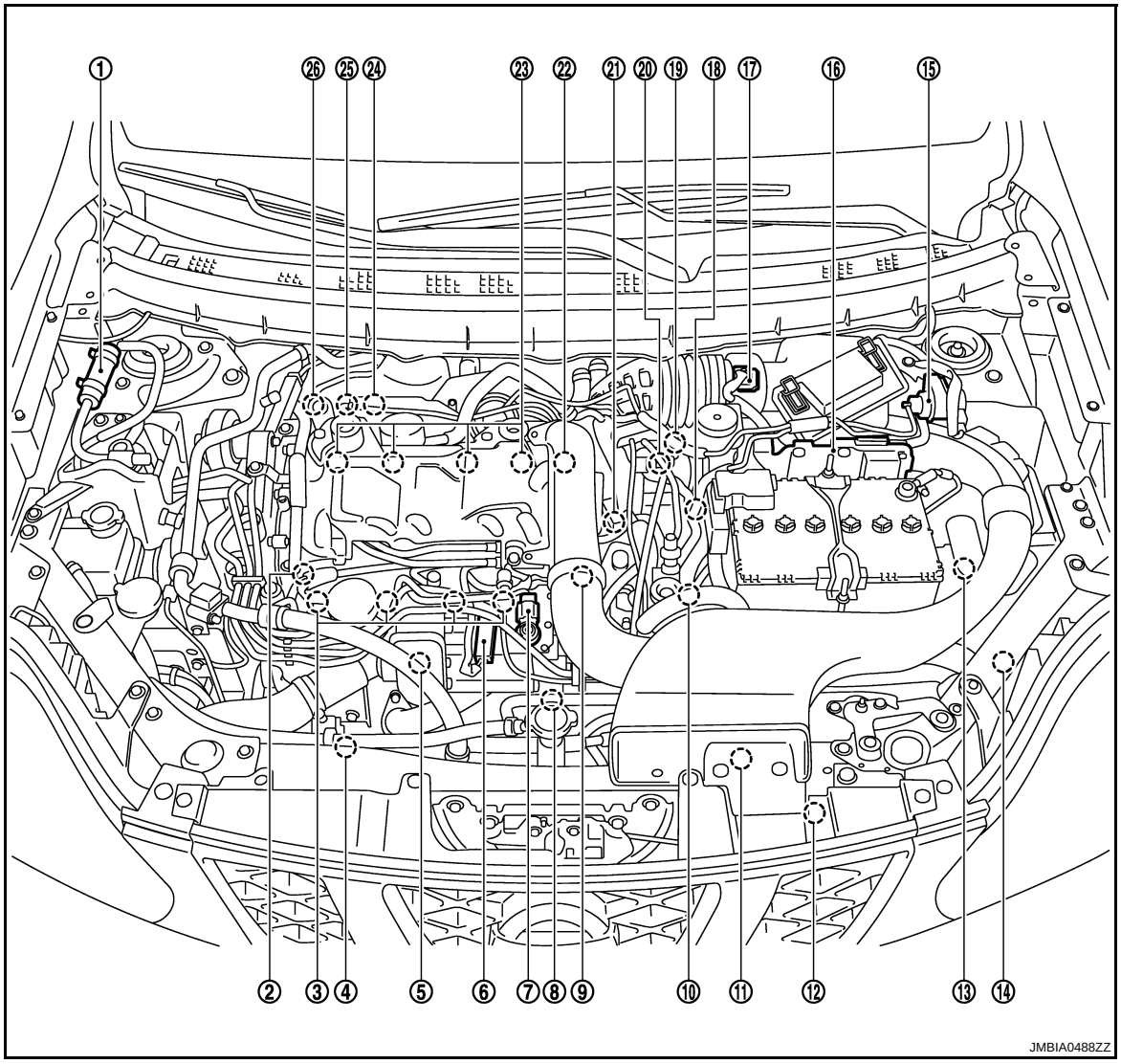
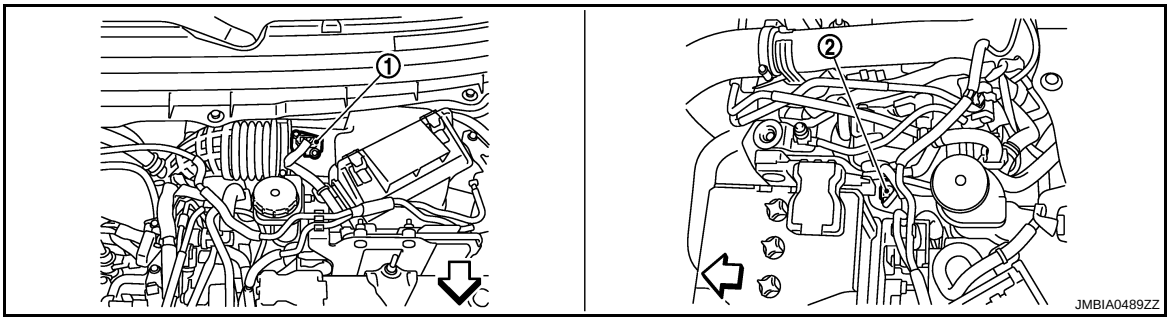
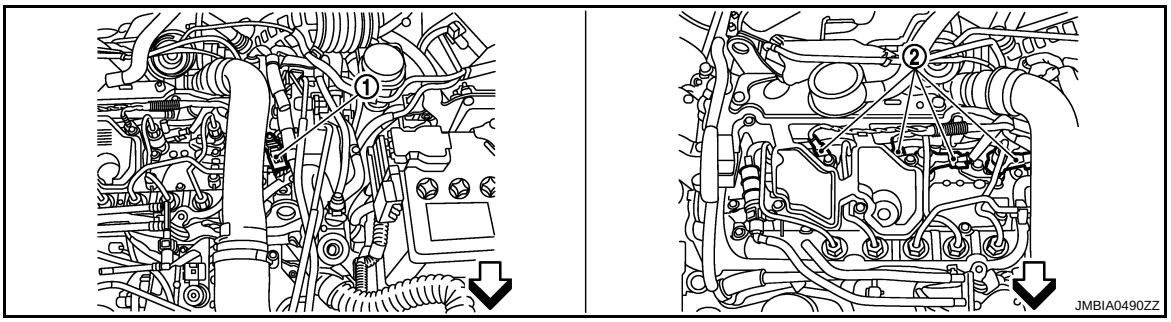


1. Priming pump
2. Fuel rail pressure control valve
3. Glow plug
4. Cooling fan motor 2
5. Electric throttle control actuator
6. Turbocharger boost sensor
7. EGR volume control valve
8. EGR cooler bypass valve
9. Fuel rail pressure sensor
10. EGR cooler bypass valve control solenoid valve
11. Cooling fan motor 1
12. Refrigerant pressure sensor
13. IPDM E/R
14. Glow control unit
15. Turbocharger boost control solenoid valve
16. ECM
17. Mass air flow sensor (with intake air temperature sensor)
18. Engine coolant temperature sensor
19. Fuel temperature sensor
20. Fuel pump
21. Camshaft position sensor
22. Crankshaft position sensor
23. Fuel injector
24. Air fuel ratio (A/F) sensor
25. Exhaust gas pressure sensor
26. Exhaust gas temperature sensor 1



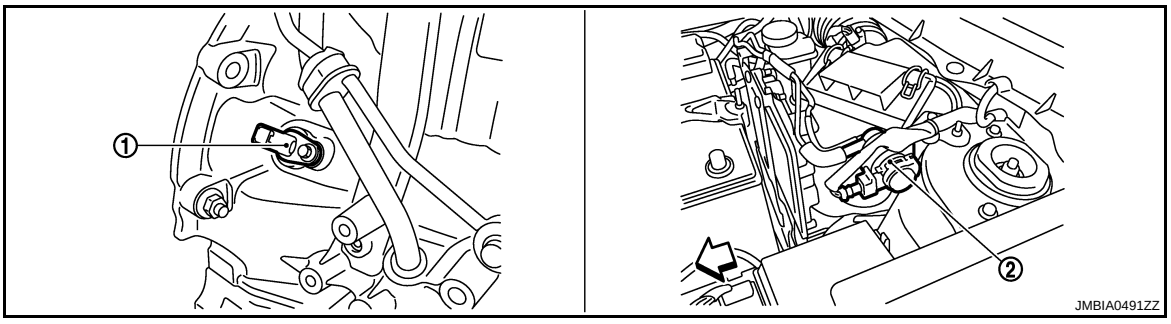
⇦ : Vehicle front

1. Mass air flow sensor (with intake air temperature sensor)
2. Engine coolant temperature sensor



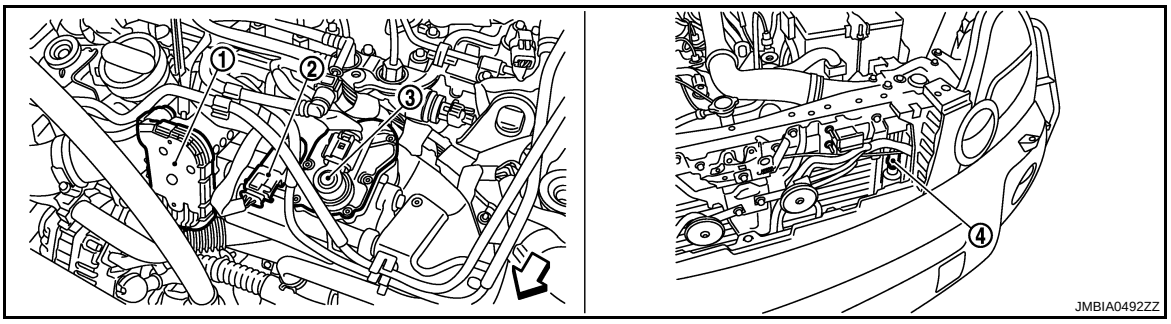
⇦ : Vehicle front

1. Camshaft Position Sensor
2. Fuel injector



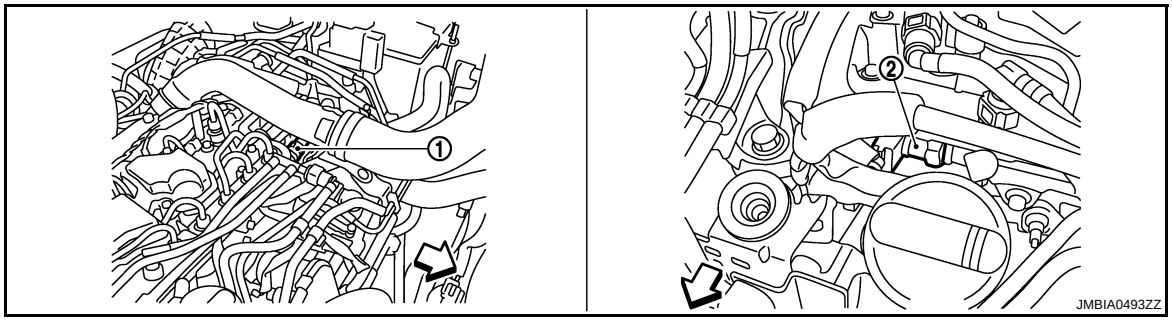
⇦ : Vehicle front

1. Crankshaft position sensor
2. Turbocharger boost control solenoid valve



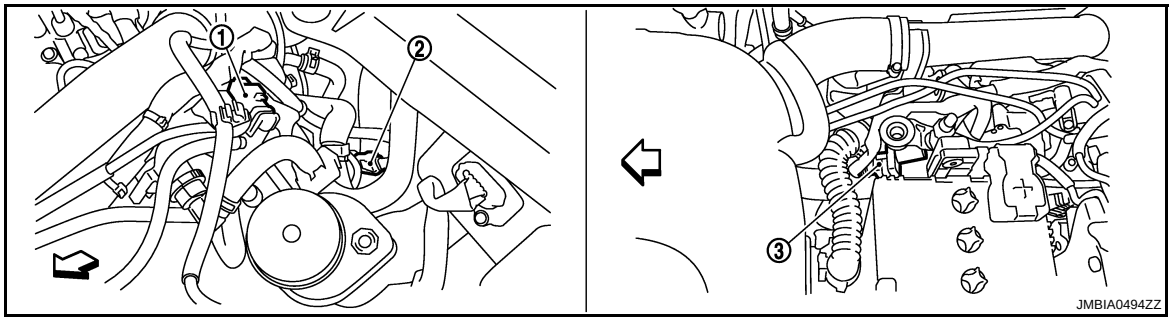
⇦ : Vehicle front

1. Electric throttle control actuator
2. Turbocharger boost sensor
3. EGR volume control valve
4. Refrigerant pressure sensor



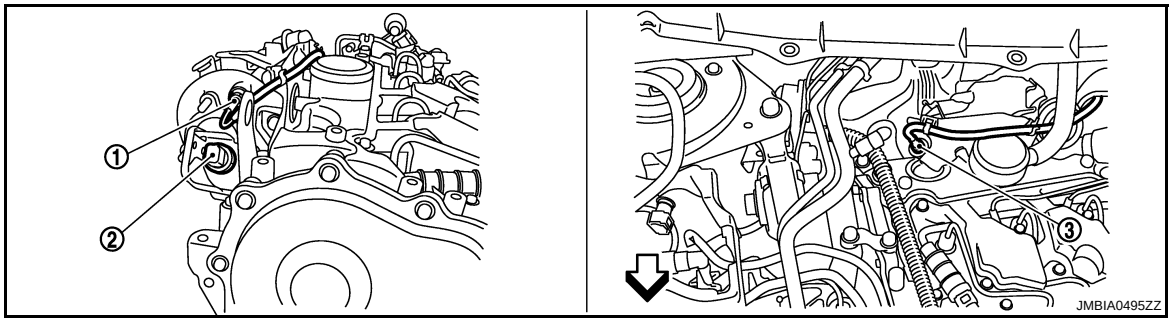
⇦ : Vehicle front

1. Fuel rail pressure sensor
2. Fuel rail pressure control valve



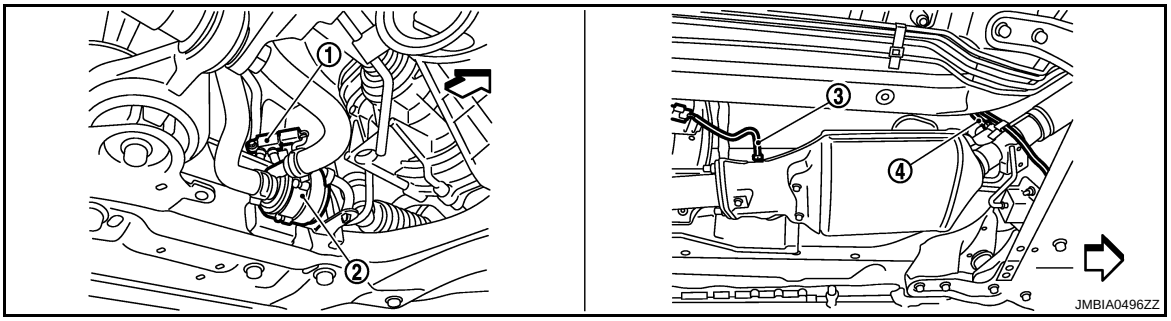
⇦ : Vehicle front

1. Fuel temperature sensor
2. Fuel pump
3. EGR cooler bypass valve control solenoid valve



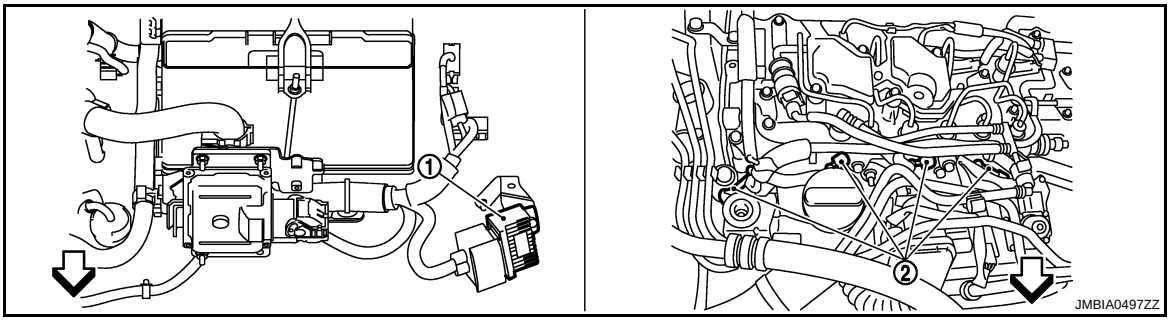
⇦ : Vehicle front

1. Exhaust gas temperature sensor 1
2. Exhaust gas pressure sensor
3. Air fuel ratio (A/F) sensor



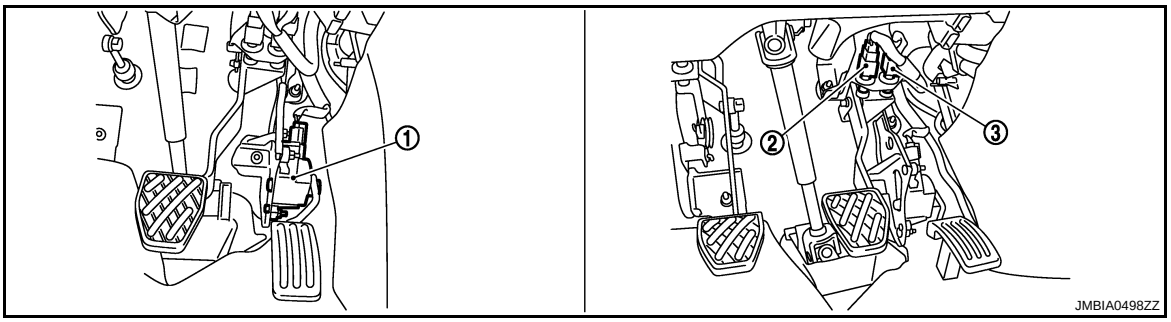
⇦ : Vehicle front

1. Differential exhaust pressure sensor
2. Turbocharger cooling pump
3. Exhaust gas temperature sensor 3
4. Exhaust gas temperature sensor 2

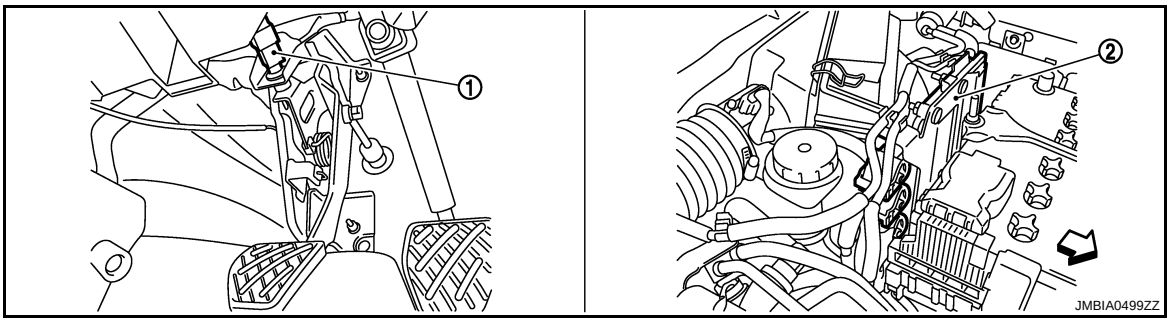


⇦ : Vehicle front

1. Glow control unit
2. Glow plug

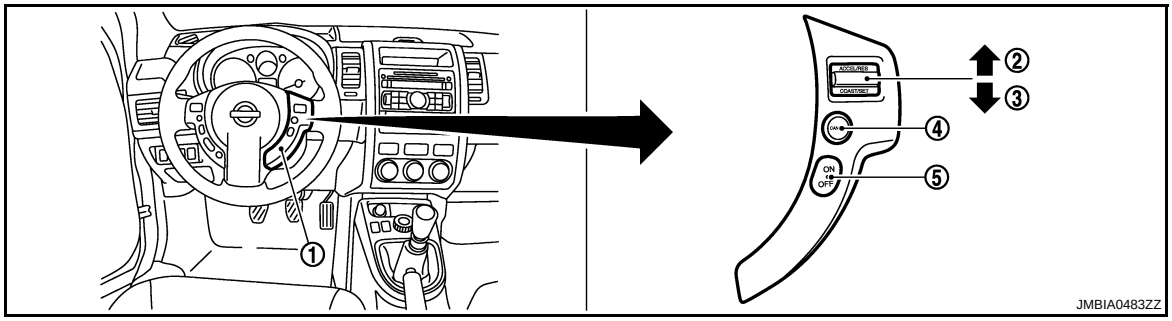


1. Accelerator pedal position sensor
2. Stop lamp switch
3. Brake pedal position switch



⇦ : Vehicle front

1. Clutch pedal position switch
2. ECM



1. ASDC steering switch
2. CANSEL switch
3. RESUME/ACCCELERATE switch
4. SET/COAST switch
5. MAIN SWITCH

Component Description

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Component	Reference
Accelerator pedal position sensor	ECR-158, "Description"
Crankshaft position sensor	ECR-167, "Description"
Engine coolant temperature sensor	ECR-132, "Description"
Exhaust gas pressure sensor	ECR-178, "Description"
Exhaust gas temperature sensor 1	ECR-187, "Description"
Fuel rail pressure sensor	ECR-150, "Description"
Intake air temperature sensor	ECR-130, "Description"
Mass air flow sensor	ECR-123, "Description"
Turbocharger boost control solenoid valve	ECR-117, "Description"
Turbocharger boost sensor	ECR-161, "Description"
Turbocharger cooling pump	ECR-274, "Description"

ON BOARD DIAGNOSTIC (OBD) SYSTEM

Diagnosis Description

INFOID:0000000001307433

INTRODUCTION

The ECM has an on board diagnostic system, which detects malfunctions related to engine sensors or actuators. The ECM also records various emission-related diagnostic information including:

Emission-related diagnostic information	ISO Standard
Diagnostic Trouble Code (DTC)	Service $03 of ISO 15031-5
1st/2nd Trip Diagnostic Trouble Code (1st/2nd Trip DTC)	Service $07 of ISO 15031-5
Calibration ID	Service $09 of ISO 15031-5

The above information can be checked using procedures listed in the table below.

×: Applicable —: Not applicable

	DTC	1st trip DTC	2nd trip DTC
CONSULT-III	×	×	×
GST	×	×	×

The malfunction indicator (MI) on the instrument panel lights up when the same malfunction is detected in three consecutive trips (Three trip detection logic).

THREE TRIP DETECTION LOGIC

When a malfunction is detected for the first time, 1st trip DTC is stored in the ECM memory. MI does not illuminate at this stage. <1st trip>
When the same malfunction is detected again during the next driving, 2nd trip DTC is stored in the ECM memory and 1st trip DTC is cleared from the ECM memory. MI does not illuminate at this stage. <2nd trip>
When the same malfunction is detected again at the third driving, DTC is stored in the ECM memory and 2nd trip DTC is cleared from the ECM memory. MI illuminates at the same time when DTC is stored. <3rd trip>
In other words, DTC is stored and MI illuminates when the same malfunction occurs in 3 consecutive trips. This is called “Three Trip Detection Logic”.

DTC AND 1ST/2ND TRIP DTC

The number of 1st/2nd trip DTC is the same as the number of DTC.
When a malfunction is detected during 1st trip, 1st trip DTC is stored in the ECM memory. MI does not illuminate at this time. When the same malfunction is detected in the next trip (2nd trip), 2nd trip DTC is stored in the ECM memory and 1st trip DTC is cleared from the ECM memory. MI does not illuminate at this time. In addition, DTC is stored in the ECM memory and MI lights up when the same malfunction is detected during the following consecutive trip (3rd trip).
The procedure for erasing DTC, 1st trip DTC, and 2nd trip DTC from the ECM memory is described in "HOW TO ERASE EMISSION-RELATED DIAGNOSTIC INFORMATION".
For malfunctions in which 1st/2nd trip DTC are displayed, Refer to "Emission-related Diagnostic Information".
1st/2nd trip DTC is specified in Service $07 of ISO15031-5. 1st/2nd trip DTC detection occurs without lighting up MI and therefore does not warn the driver of a malfunction.
When 1st/2nd trip DTC is detected, check, print out or write down, and erase 1st/2nd trip DTC as specified with step II of Work Flow, refer to ECR-7, "Work Flow". Then perform DTC Confirmation Procedure or Overall Function Check to try to duplicate the malfunction. If the malfunction is duplicated, it is necessary to investigate the cause again.

How to Read DTC and 1st/2nd Trip DTC

DTC and 1st/2nd trip DTC can be read by the following procedures.

With CONSULT-III
With GST

CONSULT-III or GST (Generic Scan Tool): Examples: P0016, P0335, P1409, etc.
These numbers are prescribed by ISO 15031-6.
(CONSULT-III also displays the malfunctioning parts and systems.)

How to Erase DTC

With CONSULT-III

The emission related diagnostic information in the ECM can be erased by selecting “All Erase” in the Description” of “FINAL CHECK” mode with CONSULT-III.

With GST

The emission related diagnostic information in the ECM can be erased by selecting Service $04 with GST.

1. If the ignition switch stays ON after repair work, be sure to turn ignition switch OFF once. Wait at least 30 seconds and then turn it ON (engine stopped) again.
2. Select Service $04 with GST (Generic Scan Tool).

- **If the battery is disconnected, the emission-related diagnostic information will be lost within 24 hours.**
- **The following data are cleared when the ECM memory is erased.**

- Diagnostic trouble codes
- 1st trip diagnostic trouble codes
- 2nd trip diagnostic trouble codes

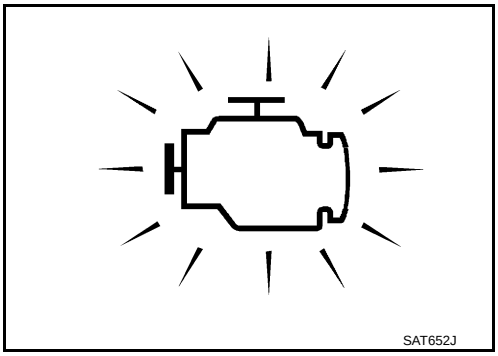
Actual work procedures are explained using a DTC as an example. Be careful so that not only the DTC, but all of the data listed above, are cleared from the ECM memory during work procedures.

MALFUNCTION INDICATOR (MI)

Description

The MI is located on the instrument panel.

1. The MI will light up when the ignition switch is turned ON without the engine running. This is a bulb check.
2. When the engine is started, the MI should go off.
   If the MI remains on, the on board diagnostic system has detected an engine system malfunction.



On Board Diagnostic System Function

The on board diagnostic system has the following three functions.

Diagnostic Test Mode	KEY and ENG. Status	Function	Explanation of Function
Mode I	Ignition switch in ON position  Engine stopped 	BULB CHECK	This function checks the MI bulb for damage (blown, open circuit, etc.). If the MI does not come on, check MI circuit.
	Engine running 	MALFUNCTION WARNING	This is a usual driving condition. When ECM detects a malfunction, the MI will light up to inform the driver that a malfunction has been detected.

Diagnostic Test Mode I — Bulb Check

In this mode, the MI on the instrument panel should stay ON. If it remains OFF, check the bulb.

Diagnostic Test Mode I — Malfunction Warning

MI	Condition
ON	When the malfunction is detected.
OFF	No malfunction.

OBD SYSTEM OPERATION CHART

Relationship Between MI, 1st/2nd Trip DTC, DTC, and Detectable Items

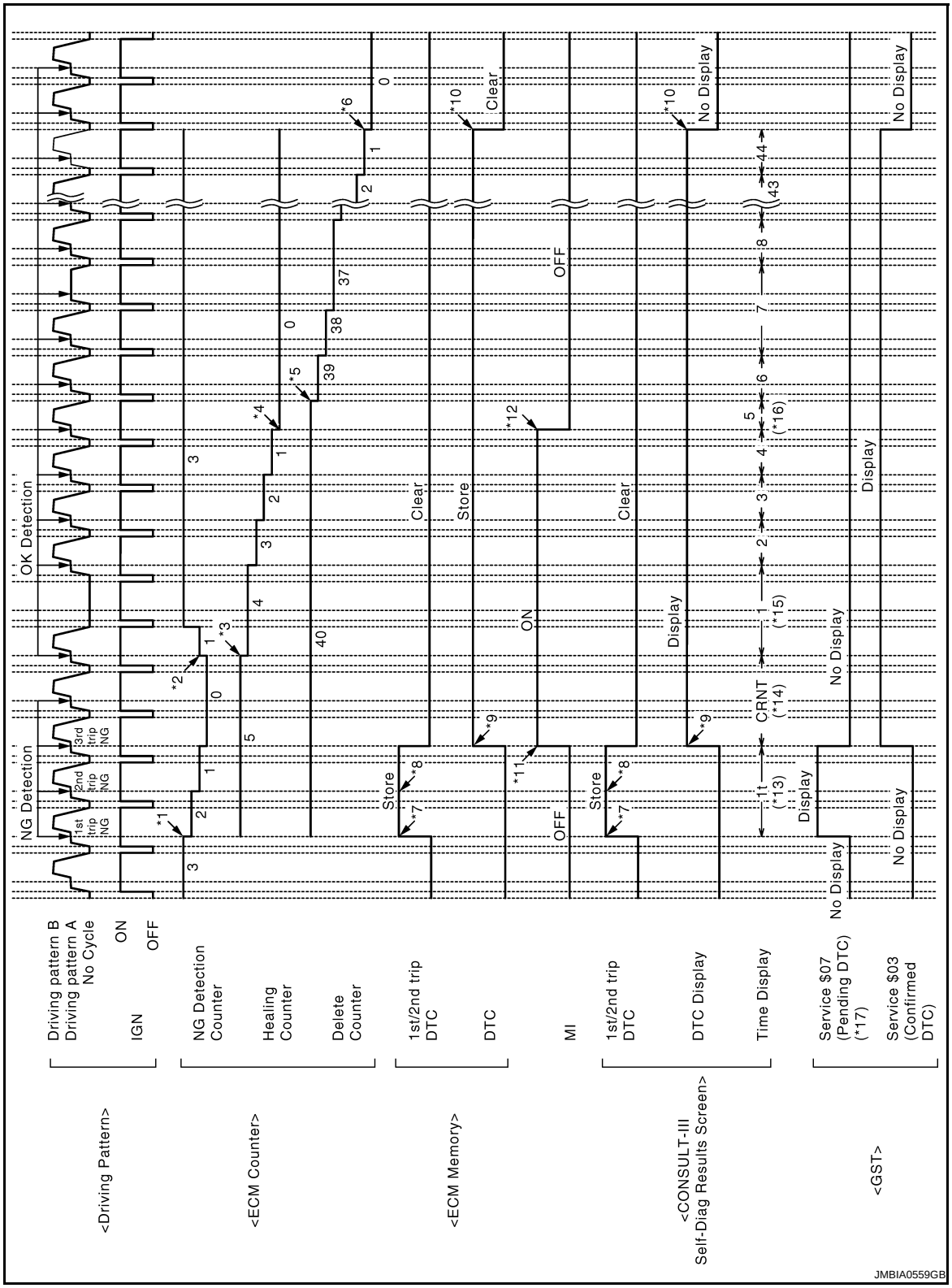
- When the malfunction is detected for the first time, 1st trip DTC is stored in the ECM memory.
- When the same malfunction is detected during 2nd consecutive trip, 2nd trip DTC is stored and 1st trip DTC is cleared.
- When the same malfunction is detected during 3rd consecutive trip, DTC is stored and MI illuminates. Refer to “Tree Trip Detection Logic” for details. 1st/2nd trip DTC is cleared from the ECM memory.
- MI will go off after the vehicle is driven 5 consecutive times with no malfunction (Driving pattern A).
- 1st/2nd trip DTC, DTC will be stored until the vehicle is driven 41 times (Driving pattern B) without the same malfunction recurring. “TIME” data displayed in the “SELF-DIAG RESULTS” mode of CONSULT-III shows the number of times the vehicle is driven without the same malfunction recurring.

Summary Chart

Items	Trip	Counter	Driving Pattern
MI (goes off)	5	0	A
DTC (clear)	41	0	B
1st/2nd Trip DTC (clear)	41	0	B

Refer to "RELATIONSHIP BETWEEN MI, DTC, 1ST/ 2NDTRIP DTC AND DRIVING PATTERNS" for details of pattern A and B.

Relationship Between MI, DTC, 1st/ 2ndtrip DTC and Driving Patterns



*1: When the ECM satisfies driving pattern A and detects the NG detection, the NG detection counter is decrement.

*2: When the ECM satisfies driving pattern A and detects OK detection, the NG detection counter is increment.

*3: When the ECM satisfies driving pattern A and detects OK detection, the healing counter is decrement.

*4: When the ECM detects OK detection and elapses 4 driving cycles, the healing counter will be reached to 0.

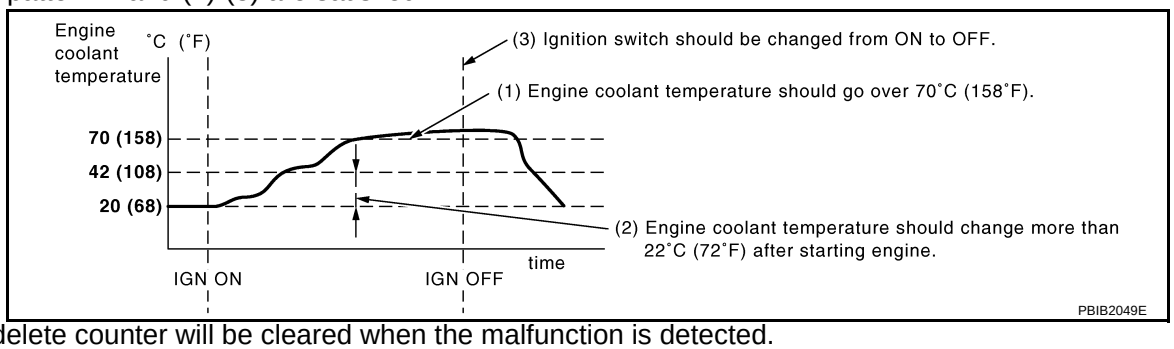
*5: When the ignition switch OFF after the ECM satisfies driving pattern B and detects OK detection, the delete counter is decrement.

*6: When the ECM detects OK detection and elapses 40 driving pattern B, the delete counter will be reached to 0.

*7: When the malfunction is detected for the first time, 1st trip DTC is stored in the ECM memory.
*8: When the sam malfunction is detected during 2nd consecutive trip, 2nd trip DTC is stored and 1st trip DTC is cleared.
*9: When the ECM detects NG detection, DTC is stored.
*10: When the detect counter is reached to 0, DTC is cleared.
*11: When the same malfunction is detected in 3 consecutive trips, MI will light up.
*12: MI will go off after vehicle is driven 5 times (driving pattern A) without any malfunctions.
*13: When the ECM detects 1st/2nd trip NG detection, the time “1t” will be displayed in the CONSULT-III Self diagnostic screen.
*14: When the ECM detects 3rd trip NG detection, the time “CRNT” will be displayed in the CONSULT-III Self diagnostic screen.
*15: When the healing counter is 4, the time “1” will be displayed in the CONSULT-III Self diagnostic screen.
*16: When the healing counter is 0 and the delete counter is 40, the time “5” will be displayed in the CONSULT-III Self diagnostic screen.
*17: The 1st/2nd trip DTC (pending DTC) is displayed in Service $07 of GST.

<Driving Pattern A>
Driving pattern A means the vehicle operation as follows:
Engine speed should go over 500 rpm at least 5 seconds and the DTC Confirmation Procedure is performed.
- The healing counter will be set when the malfunction is detected.
- The healing counter will be decrement when the same malfunction is not detected.
- The MI will go off when the healing counter reaches 0.

<Driving Pattern B>
Driving pattern B means the vehicle operation as follows:
Driving pattern A and (1)-(3) are satisfied.



- The delete counter will be cleared when the malfunction is detected.
- The delete counter will be decrement when the same malfunction is not detected.
- The DTC will not be displayed after the delete counter reaches 0.

CONSULT-III Function

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FUNCTION

Diagnostic test mode	Function
Work support	This mode enables a technician to adjust some devices faster and more accurately by following the indications on the CONSULT-III unit.
Self-diagnostic results	Self-diagnostic results such as DTC can be read and erased quickly.*
Data monitor	Input/Output data in the ECM can be read.
Active test	Diagnostic Test Mode in which CONSULT-III drives some actuators apart from the ECMs and also shifts some parameters in a specified range.
ECM part number	ECM part number and homologation number can be read.

*: The following emission-related diagnostic information is cleared when the ECM memory is erased.
- Diagnostic trouble codes
- 1st trip diagnostic trouble codes
- 2nd trip diagnostic trouble codes

ENGINE CONTROL COMPONENT PARTS/CONTROL SYSTEMS APPLICATION

Item			DIAGNOSTIC TEST MODE			
			WORK SUPPORT	SELF-DIAG RESULTS (DTC)	DATA MONITOR	ACTIVE TEST
ENGINE CONTROL COMPONENT PARTS	INPUT	Crankshaft position sensor		×	×	
		Camshaft position sensor		×	×	
		Engine coolant temperature sensor		×	×	
		Vehicle speed signal		×		
		Accelerator pedal position sensor 1		×	×	
		Accelerator pedal position sensor 2		×	×	
		Throttle position sensor	×	×		
		Fuel rail pressure sensor		×	×	
		Mass air flow sensor		×	×	
		Intake air temperature sensor		×	×	
		Fuel temperature sensor		×	×	
		Turbocharger boost sensor		×	×	
		Battery voltage		×	×	
		Stop lamp switch			×	
		Brake pedal position switch		×	×	
		Clutch pedal position switch		×	×	
		ASCD steering switch		×		
		EGR volume control valve control position sensor		×	×	
		Refrigerant pressure sensor		×	×	
		Barometric pressure sensor (built-into ECM)		×	×	
		A/F ratio sensor 1	×	×		
		Exhaust gas pressure sensor		×	×	
		Exhaust gas temperature sensor 1		×		
		Exhaust gas temperature sensor 2		×	×	
		Exhaust gas temperature sensor 3		×	×	
		Differential exhaust pressure sensor		×	×	
	OUTPUT	Fuel pump		×	×	×
		Fuel injector	×	×	×	
		Fuel rail pressure control valve		×	×	×
		Glow control unit		×	×	×
		Turbocharger boost control solenoid valve		×	×	×
		Turbocharger cooling pump		×	×	×
		EGR volume control valve	×	×	×	
		EGR cooler bypass valve control solenoid valve		×	×	×
		Throttle control motor		×		×
		Cooling fan motor		×	×	×

X: Applicable

WORK SUPPORT MODE

Work Item

WORK ITEM	DESCRIPTION	USAGE
CONFIG INITIALIZE	• In this mode vehicle configuration is initialized.	When ECM is replaced
INJ ADJ VAL REGIST	• In this mode, fuel injector adjustment value is registered.	When ECM or fuel injector(s) is replaced
CYL OPERATION DIAG	• In this mode, the diagnosis of each cylinder is performed.	To detect malfunctioning cylinder
HI PRESS CIRC DIAG	• In this mode, the diagnosis of high pressure fuel circuit is performed.	To detect malfunctioning portion of high pressure fuel circuit
EGR/V LEARN CLR	• In this mode, EGR volume control valve closed position learning is cleared.	When EGR volume control valve is removed or replaced
TP POS LEARN CLR	• In this mode, throttle valve closed position learning is cleared.	When electric throttle control actuator is removed or replaced
DPF DATA CLEAR	• In this mode, estimated PM amount in DPF is cleared.	When DPF is replaced
ZFC VALUE RESET	• In this mode, ZFC (Zero Fuel Calibration) and NVC (Nominal Voltage Calibration) are reset.	When ECM or fuel injector(s) is replaced When ECM is reprogrammed
A/F LARN CLR	• In this mode, A/F sensor learning value is cleared.	When A/F sensor 1 is replaced When ECM is replaced with used one which stores the A/F sensor learning value of another A/F sensor 1
COMPRESSION TEST	• This mode is used to: Find out the general condition of the combustion chamber (automatic mode). Take cylinder compression measurement without disconnecting fuel injector harness connector or crankshaft position sensor (manual mode).	
SERVC REGENERATION	• In this mode, service regeneration is performed.	When DPF is replaced with new one **CAUTION:** **Never perform when DPF is not replaced with new one. PDF may be damaged because regeneration is not performed at appropriate timing.**

SELF-DIAGNOSTIC MODE

Self Diagnostic Item

Regarding items detected in “SELF-DIAG RESULTS” mode, refer to — ECR-318, "DTC Index".

DATA MONITOR MODE

MONITOR ITEM	UNIT	CONDITION	SPECIFICATION
IGN SW	ABSENT/PRESENT	• Ignition switch condition is displayed. ABSENT: Ignition switch OFF PRESENT: Ignition switch ON	
NATS	INACT/ACTIV	• NATS condition is displayed. INACT: Inactive ACTIV: Active	
GLOW CONT	INACT/ACTIV	• Glow control condition is displayed. INACT: Glow is OFF. ACTIV: Glow is ON.	
A/C RELAY	NODON/DONE	• A/C relay condition is displayed. NODON: A/C relay is OFF. DONE: A/C relay is ON.	
CLUTCH STATUS	NO/YES	• Clutch condition is displayed NO: Clutch pedal is released. YES: Clutch pedal is depressed.	

MONITOR ITEM	UNIT	CONDITION	SPECIFICATION
ENGINE STATUS	'+APC/RUN/OFF	• Engine status is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
BPP SW	RELSD/PRSSD	• Brake pedal condition is displayed. RELSD: Brake pedal is released. PRSSD: Brake pedal is depressed.	
ENGINE START	PRHBT/ATHRD	• Engine stating authority is displayed. PRHBT: Prohibited ATHRD: Authorized	
IMPACT DETECTED	NO/YES	• Impact detection is displayed. NO: Impact is not detected. YES Impact is detected.	
A/C APPLD	NO/YES	• A/C application is displayed. NO: A/C is not applied. YES: A/C is applied.	
GLOW CONT SIGNAL	ABSENT/PRESENT	• Glow control signal is displayed. ABSENT: Glow control is OFF. PRESENT: Glow control is ON.	
COOLING FAN LOW	INACT/ACTIV	• Cooling fan low speed control is displayed. INACT: Low circuit is OFF. ACTIV: Low circuit is ON.	
COOLING FAN HIGH	INACT/ACTIV	• Cooling fan high speed control is displayed. INACT: High circuit is OFF. ACTIV: High circuit is ON.	
CKP CMP SYNCHRO	NODON/DONE	• Crankshaft position sensor and camshaft position sensor synchronization is displayed. NODON: Not synchronized DONE: Synchronized	
ECM-TCM COMM	ABSENT/PRESENT	• ECM-TCM communication condition is displayed. ABSENT: Not communicated PRESENT: Communicated	
A/C COMP	INACT/ACTIV	• A/C compressor status is displayed. INACT: A/C compressor is OFF. ACTIV: A/C compressor is ON.	
NATS CODE RGST	NO/YES	• NATS code registration condition is displayed. NO: Not registered. YES Registered.	
CPP SW	INACT/ACTIV	• Clutch pedal condition is displayed. INACT: Clutch pedal is released. ACTIV: Clutch pedal is depressed.	
EGR BYPAS S/V	INACT/ACTIV	• EGR cooler bypass valve control solenoid valve condition is displayed. INACT: EGR cooler bypass valve control solenoid valve is not operated. ACTIV: EGR cooler bypass valve control solenoid valve is operated.	
TURBO COOL PUMP	INACT/ACTIV	• Turbocharger cooling pump condition is displayed. INACT: Turbocharger cooling pump is not operated. ACTIV: Turbocharger cooling pump is operated.	

MONITOR ITEM	UNIT	CONDITION	SPECIFICATION
A/T GEAR POS	STAT1/1/2/3/4/5/6/BACK	• A/T gear position is displayed. STAT1: Neutral 1: 1st gear 2: 2nd gear 3: 3rd gear 4: 4th gear 5: 5th gear 6: 6th gear Back: Reverse gear	
RGN INCMP STAT1	'+APC/RUN/OFF	• Incomplete status No. 1 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT2	'+APC/RUN/OFF	• Incomplete status No. 2 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT3	'+APC/RUN/OFF	• Incomplete status No. 3 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT4	'+APC/RUN/OFF	• Incomplete status No. 4 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT5	'+APC/RUN/OFF	• Incomplete status No. 5 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT6	'+APC/RUN/OFF	• Incomplete status No. 6 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT7	'+APC/RUN/OFF	• Incomplete status No. 7 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT8	'+APC/RUN/OFF	• Incomplete status No. 8 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT9	'+APC/RUN/OFF	• Incomplete status No. 9 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	
RGN INCMP STAT10	'+APC/RUN/OFF	• Incomplete status No. 10 of DPF regeneration is displayed. '+APC: Ignition switch ON RUN: Engine is running. OFF: During self shut-off	

MONITOR ITEM	UNIT	CONDITION	SPECIFICATION
RGN REQ STAT1	STAT1/STAT2/STAT3/ STAT4	• Request status No. 1 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT2	STAT1/STAT2/STAT3/ STAT4	• Request status No. 2 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT3	STAT1/STAT2/STAT3/ STAT4	• Request status No. 3 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT4	STAT1/STAT2/STAT3/ STAT4	• Request status No. 4 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT5	STAT1/STAT2/STAT3/ STAT4	• Request status No. 5 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT6	STAT1/STAT2/STAT3/ STAT4	• Request status No. 6 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT7	STAT1/STAT2/STAT3/ STAT4	• Request status No. 7 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT8	STAT1/STAT2/STAT3/ STAT4	• Request status No. 8 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT9	STAT1/STAT2/STAT3/ STAT4	• Request status No. 9 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
RGN REQ STAT10	STAT1/STAT2/STAT3/ STAT4	• Request status No. 10 of DPF regeneration is displayed. STAT1: Engine stopped STAT2: Engine starting STAT3: Engine running STAT4: During self shut-off	
EGR COOL BYPAS/V	INACT/ACTIV	• EGR cooler bypass valve control solenoid valve status is displayed. INACT: EGR cooler bypass valve control solenoid valve is not operated. ACTIV: EGR cooler bypass valve control solenoid valve is operated.	
EGR/V TRG ANGLE	%	• EGR volume control valve target opening angle is displayed.	

MONITOR ITEM	UNIT	CONDITION	SPECIFICATION
TRG RAIL PRES	bar	• Target fuel rail pressure is displayed.	
TRG BOOST PRES	bar or mbar	• Target turbocharger boost pressure is displayed.	
INJ VOLUME	mg/cp	• Fuel injection volume is displayed.	
ACCEL PDL POS	%	• Accelerator pedal position is displayed.	
BARO PRES	bar or mbar	• Barometric pressure is displayed.	
RFRG PRES	mbar	• Refrigerant pressure is displayed.	
FUEL RAIL PRES	bar	• Fuel rail pressure is displayed.	
TC BOOST PRES	bar or mbar	• Turbocharger boost pressure is displayed.	
EGR VALVE POS	%	• EGR volume control valve control position is displayed.	
ENG SPEED	tr/min	• Engine speed computed from crankshaft position sensor is displayed.	
INT AIR TEMP	°C	• Intake air temperature is displayed.	
FUEL TEMP	°C	• Fuel temperature is displayed.	
ENG COOLAN TEMP	°C	• Engine coolant temperature is displayed.	
BAT VOLT	V	• Battery voltage is displayed.	
EGR POS/S VOLT	V	• EGR volume control valve control position sensor signal voltage is displayed.	
BARO SEN VOLT	V	• Barometric pressure sensor signal voltage is displayed.	
FRP SEN VOLT	V or mV	• Fuel rail pressure sensor signal voltage is displayed.	
FUEL TEMP/S VOLT	V or mV	• Fuel temperature sensor signal voltage is displayed.	
IAT SEN VOLT	V or mV	• Intake air temperature sensor signal voltage is displayed.	
ECT SEN VOLT	V or mV	• Engine coolant temperature sensor signal voltage is displayed.	
APP SEN1 VOLT	V or mV	• Accelerator pedal position sensor 1 signal voltage is displayed.	
APP SEN2 VOLT	V or mV	• Accelerator pedal position sensor 2 signal voltage is displayed.	
MASS AIR FLOW	kg/h	• Mass air flow is displayed.	
TRG INJ VOLUME	mg/cp	• Target fuel injection volume is displayed.	
TRG EGR VOLUME	mg/cp	• Target EGR volume is displayed.	
VSP/ENG SP RATIO	— or %	• Vehicle speed/engine speed ratio is displayed.	
TRG IDLE SPD	tr/min	• Target idle speed is displayed.	
TC BST PR/S VOLT	V or mV	• Turbocharger boost pressure sensor signal voltage is displayed.	
MAF SEN VOLT	V or mV	• Mass air flow sensor signal voltage is displayed.	
RFRG PRE/S VOLT	V or mV	• Refrigerant pressure sensor signal voltage is displayed.	
INJ1 ADJ VALUE	mg/cp	• Injector No. 1 adjustment value is displayed.	
INJ4 ADJ VALUE	mg/cp	• Injector No. 4 adjustment value is displayed.	
MIL	—	• Malfunction indicator status is displayed.	
EXH GAS TEMP3	°C	• Exhaust gas temperature computed from exhaust gas temperature sensor 3 is displayed.	
EXH GAS TEMP2	°C	• Exhaust gas temperature computed from exhaust gas temperature sensor 2 is displayed.	
INJ2 ADJ VALUE	mg/cp	• Injector No. 2 adjustment value is displayed.	
INJ3 ADJ VALUE	mg/cp	• Injector No. 3 adjustment value is displayed.	
DIFF EXH PRES	mbar	• Differential exhaust pressure is displayed.	

MONITOR ITEM	UNIT	CONDITION	SPECIFICATION
ASCD SET SPEED	km/h	• ASCD set speed is displayed.	
EXH GAS PRES	mbar	• Exhaust gas pressure is displayed.	
EX GAS PR/S VOLT	V	• Exhaust gas pressure sensor signal voltage is displayed.	

NOTE:

Any monitored item that does not match the vehicle being diagnosed is deleted from the display automatically.

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
TC BST CONT S/V	• Ignition switch: ON • Turn turbocharger boost control solenoid valve ON and OFF with the CONSULT-III and listen to operation sound.	Turbocharger boost control solenoid valve makes an operating sound.	• Harness and connector • Turbocharger boost control valve
FRP CONTROL VALVE	• Ignition switch: ON • Turn fuel rail pressure control valve ON and OFF with the CONSULT-III and listen to operation sound.	Fuel rail pressure control valve makes an operating sound.	• Harness and connector • Fuel rail pressure control valve
COOLING FAN LOW*	• Ignition switch: ON • Operate cooling fan at LOW speed and turn OFF.	Cooling fan moves at LOW speed and stops.	• Harness and connector • Cooling fan
COOLING FAN HIGH*	• Ignition switch: ON • Operate cooling fan at HIGH speed and turn OFF.	Cooling fan moves at HIGH speed and stops.	• Harness and connector • Cooling fan
GLOW CONTROL UNIT	• Ignition switch: ON (Engine stopped) • Turn the glow control unit ON and OFF using CONSULT-III and check voltage between glow plug terminals and ground.	Battery voltage should exist when glow control unit is ON.	• Harness and connector • Glow control unit
EGR COOLER BYPASS CONT S/V	• Ignition switch: ON • Turn EGR cooler bypass valve control solenoid valve ON and OFF with the CONSULT-III and listen to operation sound.	EGR cooler bypass valve control solenoid valve makes an operating sound.	• Harness and connector • EGR cooler bypass valve control solenoid valve
THROTTLE VALVE	• Ignition switch: ON • Turn throttle control motor ON and OFF with the CONSULT-III and confirm the operation.	Throttle valve is operated.	• Harness and connector • Electric throttle control actuator
FUEL PUMP	• Ignition switch: ON • Change EGR volume control valve opening angle using CONSULT-III	The opening angle of EGR volume control valve is changed properly.	• Harness and connector • EGR volume control valve
TURBOCHARGER COOLING PUMP	• Ignition switch: ON • Turn turbocharger cooling pump ON and OFF with the CONSULT-III and listen to operation sound.	Turbocharger cooling pump makes an operating sound.	• Harness and connector • Turbocharger cooling pump

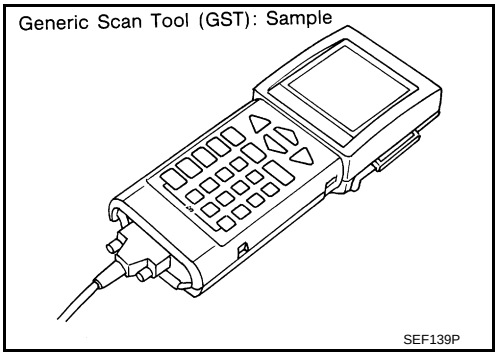
*: Leaving cooling fan OFF with CONSULT-III while engine is running may cause the engine overheat.

Diagnosis Tool Function

INFOID:0000000001551234

DESCRIPTION

Generic Scan Tool (OBDII scan tool) complying with SAE J1978 has 8 different functions explained below.
ISO9141 is used as the protocol.
The name “GST” or “Generic Scan Tool” is used in this service manual.

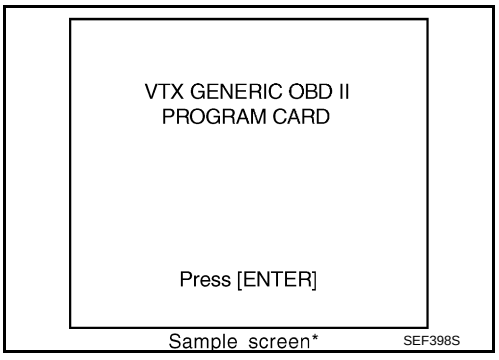


FUNCTION

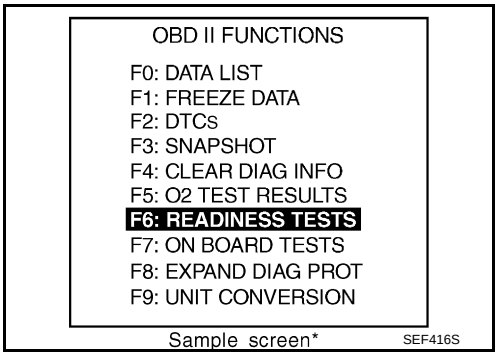
Diagnostic Service		Function
Service $01	READINESS TESTS	This diagnostic service gains access to current emission-related data values, including analog inputs and outputs, digital inputs and outputs, and system status information.
Service $03	DTCs	This diagnostic service gains access to emission-related power train trouble codes which were stored by ECM.
Service $04	CLEAR DIAG INFO	This diagnostic service can clear all emission-related diagnostic information. This includes: • Clear number of diagnostic trouble codes (Service $01) • Clear diagnostic trouble codes (Service $03) • Clear trouble code for freeze frame data (Service $01) • Reset status of system monitoring test (Service $01) • Clear on board monitoring test results (Service $07)
Service $06	(ON BOARD TESTS)	This diagnostic service accesses the results of on board diagnostic monitoring tests of specific components/systems that are not continuously monitored.
Service $07	(ON BOARD TESTS)	This diagnostic service enables the off board test drive to obtain test results for emission-related powertrain components/systems that are continuously monitored during normal driving conditions.
Service $09	(CALIBRATION ID)	This diagnostic service enables the off-board test device to request specific vehicle information such as Vehicle Identification Number (VIN) and Calibration IDs.

INSPECTION PROCEDURE

1. Turn ignition switch OFF.
2. Connect “GST” to data link connector, which is located under LH dash panel near the hood opener handle.
3. Turn ignition switch ON.
4. Enter the program according to instruction on the screen or in the operation manual.
   (*: Regarding GST screens in this section, sample screens are shown.)



5. Perform each diagnostic mode according to each service procedure.
   For further information, see the GST Operation Manual of the tool maker.



COMPONENT DIAGNOSIS

POWER SUPPLY AND GROUND CIRCUIT

Diagnosis Procedure

INFOID:0000000001307434

1.CHECK GROUND CONNECTION

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ECM GROUND CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connectors.
2. Check the continuity between ECM harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
E60	123	Ground	Existed
	124		
	125		
	128		

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to power in harness or connectors.

3.CHECK ECM POWER SUPPLY CIRCUIT-I

1. Reconnect ECM harness connectors.
2. Turn ignition switch ON.
3. Check the voltage between ECM harness connector terminals as follows.

(+)		(–)		Voltage
Connector	Terminal	Connector	Terminal	
E60	109	E60	128	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.DETECT MALFUNCTIONING PART

Check the following.
- 15A fuse (No. 64)
- Harness for open or short between ECM and IPDM E/R

>> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK ECM POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the voltage between ECM harness connector terminals as follows.

(+)		(–)		Voltage
Connector	Terminal	Connector	Terminal	
F68	93	E60	128	After turning ignition switch OFF, battery voltage will exist for 20 seconds, then drop approximately 0V.
	94			

Is the inspection result normal?

YES >> GO TO 12.
NO-1 >> Battery voltage does not exist: GO TO 6.
NO-2 >> Battery voltage exists for more than 20 seconds: GO TO 9.

6.CHECK ECM POWER SUPPLY CIRCUIT-III

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the voltage between ECM harness connector terminals as follows.

(+)		(–)		Voltage
Connector	Terminal	Connector	Terminal	
F68	62	E60	128	Battery voltage

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 9.

7.CHECK ECM POWER SUPPLY CIRCUIT-IV

1. Disconnect ECM harness connector.
2. Disconnect IPDM E/R harness connector E15.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

ECM		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
E68	93	E15	48	Existed
	94		47	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 12.
NO >> GO TO 8.

8.DETECT MALFUNCTIONING PART

Check the following.
- Harness or connectors E7, E121
- Harness for open or short between ECM and IPDM E/R

>> Repair open circuit or short to ground or short to power in harness or connectors.

9.CHECK ECM POWER SUPPLY CIRCUIT-V

1. Disconnect ECM harness connector.
2. Disconnect IPDM E/R harness connector E15.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

ECM		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
F68	62	E15	51	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 11.
NO >> GO TO 10.

10. DETECT MALFUNCTIONING PART

Check the following.
- Harness or connectors E7, E121
- Harness for open or short between ECM and IPDM E/R

>> Repair open circuit or short to ground or short to power in harness or connectors.

11. CHECK 20A FUSE

1. Disconnect 20A fuse (No. 62) from IPDM E/R.
2. Check 20A fuse.

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace 20A fuse.

12. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace IPDM E/R.
NO >> Repair open circuit or short to power in harness or connectors.

U1000 CAN COMM CIRCUIT

Description

INFOID:0000000001450329

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.

DTC Logic

INFOID:0000000001450373

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
U1000	CAN communication line	When ECM is not transmitting or receiving CAN communication signal of OBD (emission related diagnosis) for 2 seconds or more.	• Harness or connectors (CAN communication line is open or shorted)

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 >> ECR-114, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001450333

Go to LAN-21, "CAN System Specification Chart".

P0016 CKP - CMP CORRELATION

DTC Logic

INFOID:0000000001307441

DTC DETECTION LOGIC

NOTE:
If DTC P0016 is displayed with DTC P0335 or P0340, first perform the trouble diagnosis for DTC P0335 or P0340. Refer to ECR-167, "DTC Logic" or ECR-169, "DTC Logic".

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0016	Crankshaft position - camshaft position correlation	The correlation between crankshaft position sensor signal and camshaft position sensor signal is out of the normal range.	• Harness or connectors (CKP sensor circuit is open or shorted.) (CMP sensor circuit is open or shorted.) • Crankshaft position sensor • Camshaft position sensor • Timing chain • Signal plate

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
   If the engine does not start, keep ignition switch at START position for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-115, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307442

1.CHECK CMP SENSOR

Refer to ECR-171, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Replace camshaft position sensor.

2.CHECK SPROCKET

Visually check for chipping signal plate gear tooth.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace sprocket.

3.CHECK CKP SENSOR

Refer to ECR-168, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace crankshaft position sensor.

4.CHECK TIMING CHAIN

Refer to EM-294, "Removal and Installation".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace timing chain.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

P0045 TC BOOST CONTROL SOLENOID VALVE

Description

INFOID:0000000001532240

The turbocharger boost control solenoid valve controls vacuum signal to the turbocharger boost control actuator. By changing the variable nozzle vane opening through the rods, the intake air volume is adjusted.
The turbocharger boost control solenoid valve is moved by ON/OFF pulse from the ECM. The longer the ON pulse, the charge air pressure rises.

DTC Logic

INFOID:0000000001307444

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0045	Turbocharger boost control solenoid valve circuit	An improper voltage is sent to ECM through turbocharger boost control solenoid valve	• Harness or connectors (The solenoid valve circuit is open or shorted.) • Turbocharger boost control solenoid valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-117, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307445

1.CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect turbocharger boost control solenoid valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between turbocharger boost control solenoid valve harness connector and ground.

Turbocharger boost control solenoid valve		Ground	Voltage
Connector	Terminal		
E55	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 IPDM E/R and turbocharger boost control solenoid valve
- Harness for open or short between ECM and turbocharger boost control solenoid valve

>> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between turbocharger boost control solenoid valve harness connector and ECM harness connector.

Turbocharger boost control solenoid valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E55	2	F68	57	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 connector E7, F121
- Harness for open or short between ECM and turbocharger boost control solenoid valve

>> Repair open circuit or short to ground or short to power in harness or connectors.

5. CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE

Refer to ECR-118, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace turbocharger boost control solenoid valve.

6. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307446

1. CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE

1. Turn ignition switch OFF.
2. Disconnect turbocharger boost control solenoid valve harness connector.
3. Check the resistance between turbocharger boost control solenoid valve terminals as follows.

Terminals	Resistance
1 and 2	0.006 - 1 kΩ

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace turbocharger boost control solenoid valve.

P0089 FUEL PUMP

DTC Logic

INFOID:0000000001307450

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0089	Fuel pump performance	Fuel pressure is out of the target range	• Harness or connectors (Fuel pump circuit is open or shorted.) • Fuel pump • Fuel injector • Fuel filter • Air mixed with fuel • Lack of fuel • Fuel rail pressure sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-119, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307451

1.PERFORM FUEL FILTER AIR BLEEDING

NOTE:
If the DTC is detected because of air mixed with fuel (i.e.: caused by lack of fuel), it may become normal by performing following procedure.

1. Turn ignition switch ON.
2. Perform Fuel Filter Air Bleeding. Refer to FL-17, "Air Bleeding".
3. Erase DTC.
4. Perform DTC confirmation procedure again, refer to ECR-119, "DTC Logic".

Is 1st trip DTC detected?

Yes >> GO TO 2.
No >> **INSPECTION END**

2.CHECK FUEL RAIL PRESSURE SENSOR

Refer to ECR-151, "Component Inspection".

OK or NG

OK >> GO TO 3.
NG >> Replace fuel rail.

3.CHECK FUEL INJECTOR

Perform ECR-156, "Component Inspection".

OK or NG

OK >> GO TO 5.
NG >> GO TO 4.

4.REPLACE FUEL INJECTOR

1. Replace fuel injector of malfunctioning cylinder.
2. Perform Injector adjustment value registration. Refer to ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".

>> **INSPECTION END**

5.CHECK FUEL PUMP

Perform ECR-120, "Component Inspection".

OK or NG

OK >> GO TO 6.
NG >> Replace Fuel pump.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001542426

1.CHECK FUEL PUMP

1. Turn ignition switch OFF.
2. Disconnect fuel pump harness connector.
3. Check the resistance between fuel pump terminals as follows.

Terminals	Resistance
1 and 2	2 - 6 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel pump.

P0090 FUEL PUMP

DTC Logic

INFOID:0000000001307452

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0090	Fuel pump circuit	ECM detects fuel pump circuit is open.	• Harness or connectors (The fuel pump circuit is open or shorted.) • Fuel pump
		ECM detects fuel pump circuit is short to ground.	
		ECM detects fuel pump circuit is short to power.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-121, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307453

1.CHECK FUEL PUMP POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect fuel pump harness connector.
3. Turn ignition switch ON.
4. Check the voltage between fuel pump harness connector and ground.

Fuel pump		Ground	Voltage
Connector	Terminal		
F92	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 connector E7, F121
- Harness for open or short between IPDM E/R and fuel pump
- Harness for open or short between ECM and fuel pump

>> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK FUEL PUMP OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel pump harness connector and ECM harness connector.

Fuel pump		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F92	2	F68	89	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 or short to ground or short to power in harness or connectors.

4.CHECK FUEL PUMP

Refer to ECR-122, "Component Inspection".

Is the inspection result normal?

Yes >> GO TO 5.
No >> Replace fuel pump.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001542428

1.CHECK FUEL PUMP

1. Turn ignition switch OFF.
2. Disconnect fuel pump harness connector.
3. Check the resistance between fuel pump terminals as follows.

Terminals	Resistance
1 and 2	1.5 - 1,000 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel pump.

P0100 MAF SENSOR

Description

INFOID:0000000001307455

The mass air flow sensor is place 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 more air, the greater the heat loss.
Therefore, the electirc 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.

DTC Logic

INFOID:0000000001307456

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0100	Mass air flow sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Mass air flow sensor circuit is open or shorted.) • Mass air flow sensor
	Mass air flow sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	
	Mass air flow sensor circuit range/performance	An improper voltage from the sensor is sent to ECM during self shut-off.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-123, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Turn ignition switch ON and wait at least 10 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-123, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307457

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.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.

Mass air flow sensor		Ground	Voltage
Connector	Terminal		
E3	2	Ground	Battery voltage

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 IPDM E/R and mass air flow sensor
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

4.CHECK MASS AIR FLOW SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between mass air flow sensor harness connector and ECM harness connector.

Mass air flow sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E3	3	F68	87	Existed

3. 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 connector E6, F123
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

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	
E3	4	F68	80	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.
- Harness connector E6, F123
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

8.CHECK MASS AIR FLOW SENSOR

Refer to ECR-125, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace mass air flow sensor.

9. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001462648

1. CHECK MASS AIR FLOW SENSOR

1. Turn ignition switch OFF and wait at least 20 seconds.
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 as follows.

(+)		(–)		Condition	Voltage
Connector	Terminal	Connector	Terminal		
F68	80 (MAF sensor signal)	F68	87 (Sensor ground)	Ignition switch ON (Engine stopped.)	Approx. 0.4V
				Idle (Engine is warmed-up to normal operating temperature.)	1.1 - 1.4V
				Idle to about 4,000 rpm	1.1 - 1.4V to Approx. 4.0V*

*: 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 >> Replace mass air flow sensor.

P0101 MAF SENSOR

Description

INFOID:0000000001548244

The mass air flow sensor is place 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 more air, the greater the heat loss.
Therefore, the electirc 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.

DTC Logic

INFOID:0000000001548245

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0101	Mass air flow sensor circuit range/performance	Improper voltage from the sensor is sent to ECM compared with the driving condition.	• Harness or connectors (Mass air flow sensor circuit is open or shorted.) • Mass air flow sensor • Intake air leaks • Air cleaner • Intake air temperature sensor • EGR volume control valve • Turbocharger boost sensor

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

CAUTION:
Always drive vehicle at a safe speed.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Start engine and let it idle for at least 40 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-127, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Drive vehicle under the following conditions.

Engine speed	Approx. 2,800 rpm
Vehicle speed	70 - 100 km/h (43 - 62 MPH)
Shift lever	4th position

2. Release accelerator pedal for at least 10 seconds.
   Do not depress brake pedal during this procedure.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-127, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001548246

1. CHECK INTAKE SYSTEM

1. Check air cleaner for clogging.
2. Check the following for connection and cracks.

- Air duct
- Vacuum hoses
- Intake air passage between air duct and intake manifold

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or reconnect the parts.

2. CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace ground connection.

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.

Mass air flow sensor		Ground	Voltage
Connector	Terminal		
E3	2	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 IPDM E/R and mass air flow sensor
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

5. CHECK MASS AIR FLOW SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between mass air flow sensor harness connector and ECM harness connector.

Mass air flow sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E3	3	F68	87	Existed

3. 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 connector E6, F123
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

7.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	
E3	4	F68	80	Existed

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 8.

8.DETECT MALFUNCTIONING PART

Check the following.
- Harness connector E6, F123
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

9.CHECK INTAKE AIR TEMPERATURE SENSOR

Refer to ECR-131, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace mass air flow sensor.

10.CHECK TURBOCHARGER BOOST SENSOR

Refer to ECR-161, "Diagnosis Procedure".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Replace mass air flow sensor.

11.CHECK MASS AIR FLOW SENSOR

Refer to ECR-128, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace mass air flow sensor.

12.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 13.
NO >> Repair or replace.

13.REPLACE EGR VOLUME CONTROL VALVE

1. Replace EGR volume control valve.
2. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement".
3. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Special Repair Requirement".

>> INSPECTION END

Component Inspection

INFOID:0000000001548247

1.CHECK MASS AIR FLOW SENSOR

1. Turn ignition switch OFF and wait at least 20 seconds.
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 as follows.

(+)		(–)		Condition	Voltage
Connector	Terminal	Connector	Terminal		
F68	80 (MAF sensor signal)	F68	87 (Sensor ground)	Ignition switch ON (Engine stopped.)	Approx. 0.4V
				Idle (Engine is warmed-up to normal operating temperature.)	1.1 - 1.4V
				Idle to about 4,000 rpm	1.1 - 1.4V to Approx. 4.0V*

*: 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 >> Replace mass air flow sensor.

P0110 IAT SENSOR

Description

INFOID:0000000001307463

The intake air temperature sensor is built into 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 temperature rise.

DTC Logic

INFOID:0000000001307464

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0110	Intake air temperature sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Intake air temperature sensor circuit is open or shorted.) • Intake air temperature sensor
	Intake air temperature sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-130, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307465

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK INTAKE AIR TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect mass air flow sensor (with intake air temperature sensor) harness connector.
2. Turn ignition switch ON.
3. Check the voltage between mass air flow sensor harness connector and ground.

Mass air flow sensor		Ground	Voltage
Connector	Terminal		
E3	5	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.

- Harness connector E6, F123
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

4. CHECK INTAKE AIR TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
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	
E3	6	F68	87	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 connector E6, F123
- Harness for open or short between ECM and mass air flow sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

6. CHECK INTAKE AIR TEMPERATURE SENSOR

Refer to ECR-131, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace mass air flow sensor (with intake air temperature sensor).

7. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307466

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 5 and 6 under the following conditions.

Condition	Resistance (Ω)
25°C (77°F)	1.80 – 2.20
80°C (176°F)	0.28 – 0.36

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace mass air flow sensor (with intake air temperature sensor).

P0115 ECT SENSOR

Description

INFOID:0000000001307467

The engine coolant temperature sensor 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.

DTC Logic

INFOID:0000000001450518

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0115	Engine coolant temperature sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Engine coolant temperature sensor circuit is open or shorted.) • Engine coolant temperature sensor
	Engine coolant temperature sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-132, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307469

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ENGINE COOLANT TEMPERATURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect engine coolant temperature sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between engine coolant temperature sensor harness connector and ground.

Engine coolant temperature sensor		Ground	Voltage
Connector	Terminal		
F79	2	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK ENGINE COOLANT TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.

2. Disconnect ECM harness connector.
3. Check the continuity between engine coolant temperature sensor harness connector and ECM harness connector.

Engine coolant temperature sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F79	1	F85	24	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 or short to ground or short to power in harness or connectors.

4. CHECK ENGINE COOLANT TEMPERATURE SENSOR

Refer to ECR-133, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace engine coolant temperature sensor.

5. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307470

1. CHECK ENGINE COOLANT TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect engine coolant temperature sensor harness connector.
3. Check resistance between engine coolant temperature sensor terminals.

Terminal	Resistance
1 and 2	0.087 - 83 kΩ

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace engine coolant temperature sensor.

P0120 TP SENSOR

Description

INFOID:0000000001307471

Electric throttle control actuator consists of the following two components, throttle control motor with gear which operates throttle valve, throttle position sensor which detects throttle position sensor. Throttle valve is fully opened when regeneration is not performed and engine is running. The valve is closed to perform regeneration and to perform smooth engine stop when the ignition switch is turned OFF. Throttle position sensor detects the opening angle of throttle valve and converts the angle into a voltage signal. Based on the signal, ECM judges whether throttle control actuator operates throttle valve properly or not.

DTC Logic

INFOID:0000000001450519

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0120	Throttle position sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Throttle position sensor circuit is open or shorted.) • Throttle position sensor
	Throttle position sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-134, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307473

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK THROTTLE POSITION SENSOR 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		
F86	3	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or 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 and wait at least 20 seconds.
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	
F86	1	F68	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 or 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	
F86	6	F68	83	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 or short to ground or short to power in harness or connectors.

5.CHECK THROTTLE POSITION SENSOR

Refer to ECR-135, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace electric throttle control actuator.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001571006

1.CHECK THROTTLE POSITION SENSOR

1. Turn ignition switch OFF.
2. Reconnect all harness connectors disconnected.
3. Turn ignition switch ON.
4. Check the voltage between ECM harness connector terminals as follows.

ECM		ECM		Condition	Voltage
Connector	Terminal	Connector	Terminal		
F68	83 (TP sensor)	F68	85 (Sensor ground)	For 20 seconds after turning ignition switch OFF	Output voltage fluctuates between 0 V and 5 V
				More than 20 seconds after turning ignition switch OFF	0.63 - 0.77 V

Is the inspection result normal?

YES >> INSPECTION END

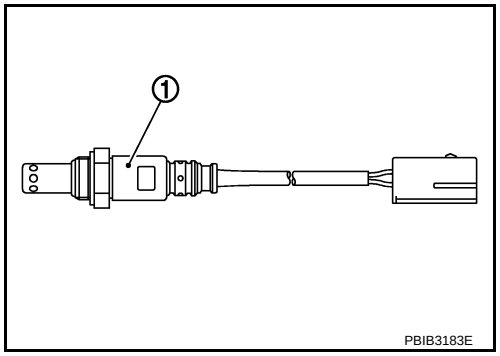
NO >> Replace electric throttle control actuator assembly.

P0130 A/F SENSOR 1

Description

INFOID:0000000001450351

Air fuel ratio (A/F) sensor 1 (1) is installed on the upstream of the oxidation catalyst. A/F sensor 1 measures the oxygen level in the exhaust gas and converts it into a voltage signal. A/F sensor 1 sends the signal to ECM. Based on the signal from A/F sensor 1, ECM calculates the air fuel mixture ratio. ECM uses the calculated ratio for the DPF regeneration control.
A heater is integrated in A/F sensor 1 to ensure the required operating temperature.



DTC Logic

INFOID:0000000001450521

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P0130	Air fuel ratio (A/F) sensor 1 circuit	The A/F signal computed by ECM from the air fuel ratio sensor 1 signal is out of the specified range.	• Harness or connectors (The air fuel ratio sensor 1 circuit is shorted.) • Air fuel ratio sensor 1

Diagnosis Procedure

INFOID:0000000001450340

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F68	81	Existed
	2		78	
	5		82	
	6		77	

4. Check the continuity between A/F sensor 1 harness connector or ECM harness connector and ground.

A/F sensor 1		ECM		Ground	Continuity
Connector	Terminal	Connector	Terminal		
F91	1	F68	81	Ground	Not existed
	2		78		
	5		82		
	6		77		

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

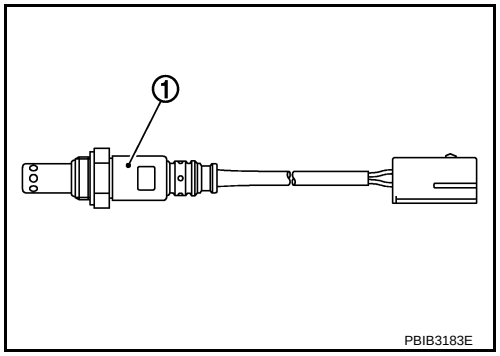
>> **INSPECTION END**

P0131 A/F SENSOR 1

Description

INFOID:0000000001548248

Air fuel ratio (A/F) sensor 1 (1) is installed on the upstream of the oxidation catalyst. A/F sensor 1 measures the oxygen level in the exhaust gas and converts it into a voltage signal. A/F sensor 1 sends the signal to ECM. Based on the signal from A/F sensor 1, ECM calculates the air fuel mixture ratio. ECM uses the calculated ratio for the DPF regeneration control.
A heater is integrated in A/F sensor 1 to ensure the required operating temperature.



DTC Logic

INFOID:0000000001548249

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P0131	Air fuel ratio (A/F) sensor 1 circuit	The A/F signal computed by ECM from the air fuel ratio sensor 1 signal is out of the specified range.	• Harness or connectors (The air fuel ratio sensor 1 circuit is shorted.) • Air fuel ratio sensor 1

Diagnosis Procedure

INFOID:0000000001548250

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F68	81	Existed
	2		78	
	5		82	
	6		77	

4. Check the continuity between A/F sensor 1 harness connector or ECM harness connector and ground.

A/F sensor 1		ECM		Ground	Continuity
Connector	Terminal	Connector	Terminal		
F91	1	F68	81	Ground	Not existed
	2		78		
	5		82		
	6		77		

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

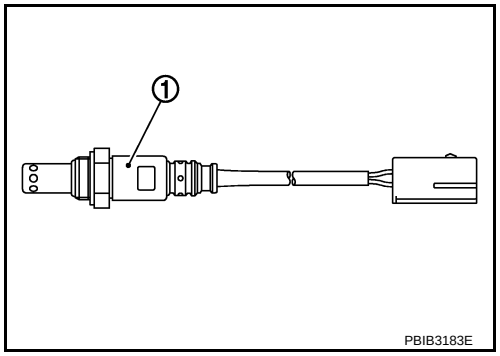
>> **INSPECTION END**

P0133 A/F SENSOR 1

Description

INFOID:0000000001548278

Air fuel ratio (A/F) sensor 1 (1) is installed on the upstream of the oxidation catalyst. A/F sensor 1 measures the oxygen level in the exhaust gas and converts it into a voltage signal. A/F sensor 1 sends the signal to ECM. Based on the signal from A/F sensor 1, ECM calculates the air fuel mixture ratio. ECM uses the calculated ratio for the DPF regeneration control.
A heater is integrated in A/F sensor 1 to ensure the required operating temperature.



DTC Logic

INFOID:0000000001548279

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P0133	Air fuel ratio (A/F) sensor 1 circuit	The response of the A/F signal computed by ECM from the air fuel ratio sensor 1 signal is out of the specified range.	• Harness or connectors (The air fuel ratio sensor 1 circuit is shorted.) • Air fuel ratio sensor 1

Diagnosis Procedure

INFOID:0000000001548280

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F68	81	Existed
	2		78	
	5		82	
	6		77	

4. Check the continuity between A/F sensor 1 harness connector or ECM harness connector and ground.

A/F sensor 1		ECM		Ground	Continuity
Connector	Terminal	Connector	Terminal		
F91	1	F68	81	Ground	Not existed
	2		78		
	5		82		
	6		77		

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

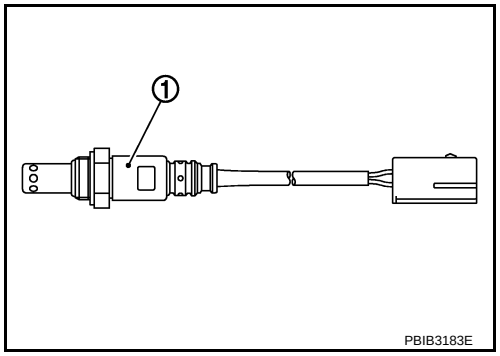
>> **INSPECTION END**

P0134 A/F SENSOR 1

Description

INFOID:0000000001551260

Air fuel ratio (A/F) sensor 1 (1) is installed on the upstream of the oxidation catalyst. A/F sensor 1 measures the oxygen level in the exhaust gas and converts it into a voltage signal. A/F sensor 1 sends the signal to ECM. Based on the signal from A/F sensor 1, ECM calculates the air fuel mixture ratio. ECM uses the calculated ratio for the DPF regeneration control.
A heater is integrated in A/F sensor 1 to ensure the required operating temperature.



DTC Logic

INFOID:0000000001551261

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P0134	Air fuel ratio (A/F) sensor 1 circuit	The A/F signal computed by ECM from the air fuel ratio sensor 1 signal is out of the specified range.	• Harness or connectors (The air fuel ratio sensor 1 circuit is shorted.) • Air fuel ratio sensor 1

Diagnosis Procedure

INFOID:0000000001551262

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F68	81	Existed
	2		78	
	5		82	
	6		77	

4. Check the continuity between A/F sensor 1 harness connector or ECM harness connector and ground.

A/F sensor 1		ECM		Ground	Continuity
Connector	Terminal	Connector	Terminal		
F91	1	F68	81	Ground	Not existed
	2		78		
	5		82		
	6		77		

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

>> **INSPECTION END**

P0135 A/F SENSOR 1 HEATER

Description

INFOID:0000000001450524

SYSTEM DESCRIPTION

Sensor	Input Signal to ECM	ECM function	Actuator
Camshaft position sensor Crankshaft position sensor	Engine speed	Air fuel ratio (A/F) sensor 1 heater control	Air fuel ratio (A/F) sensor 1 heater
Engine coolant temperature sensor	Engine coolant temperature		
Exhaust gas temperature sensor	Exhaust gas temperature		
Intake air temperature sensor	Intake air temperature		

Based on intake air temperature, engine coolant temperature and exhaust gas temperature, ECM switches the mode of A/F sensor heater from OFF to ON (or from ON to OFF).
During A/F sensor heater is ON, ECM controls A/F sensor heater with ON/OFF pulse duty signals according to driving conditions.

OPERATION

Condition	Air fuel ratio (A/F) sensor 1 heater
Ignition switch: ON (Engine stopped)	OFF
After the vehicle is driven for 6 minutes under the following conditions. • Warm-up condition • Vehicle speed: 80km/h (50MPH) • Shift lever: Suitable gear position	ON

DTC Logic

INFOID:0000000001450527

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0135	Air fuel ratio (A/F) sensor 1 heater circuit	The current amperage in the A/F sensor 1 heater circuit is out of the normal range. (An excessively low or high voltage signal is sent to ECM through the A/F sensor 1 heater)	• Harness or connectors (The air fuel ratio sensor 1 heater circuit is open or shorted.) • Air fuel ratio sensor 1 heater

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up normal operating temperature.
2. Drive the vehicle at a speed of 80 km/h (50 MPH) for a 6 minutes in the suitable gear position.
3. Release accelerator pedal for at least 3 seconds.
   Do not depress brake pedal during this procedure.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-145, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001451059

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 HEATER OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	3	F85	12	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 or short to ground or short to power in harness or connectors.

5.CHECK A/F SENSOR 1 HEATER

Refer to ECR-147, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

>> **INSPECTION END**

7.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

>> Repair or replace.

Component Inspection

INFOID:0000000001451064

1.CHECK AIR FUEL RATIO (A/F) SENSOR 1

1. Turn ignition switch OFF.
2. Disconnect A/F sensor 1 harness connector.
3. Check resistance between A/F sensor 1 terminals as follows.

Terminal	Resistance
3 and 4	2.4 - 4.0 Ω [at 25°C (77°F)]
3 and 1, 2	∞Ω (Continuity should not exist)
4 and 1, 2	

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE AIR FUEL RATIO (A/F) SENSOR 1

Replace malfunctioning air fuel ratio (A/F) sensor 1.

CAUTION:

- **Discard any air fuel ratio (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 air fuel ratio (A/F) sensor, clean exhaust system threads using Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

>> INSPECTION END

P0180 FUEL TEMPERATURE SENSOR

Description

INFOID:0000000001451239

The fuel temperature sensor is used to detect the fuel temperature inside the fuel line in the engine room. 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.

DTC Logic

INFOID:0000000001451240

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0180	Fuel temperature sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Fuel temperature sensor circuit is open or shorted.) • Fuel temperature sensor
	Fuel temperature sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-148, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307476

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK FUEL TEMPERATURE SENSOR SUPPLY CIRCUIT CIRCUIT

1. Disconnect fuel temperature sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between fuel pump temperature sensor connector and ground.

Fuel pump temperature sensor		Ground	Voltage
Connector	Terminal		
F100	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK FUEL TEMPERATURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.

2. Disconnect ECM harness connector.
3. Check the continuity between fuel pump temperature sensor harness connector and ECM harness connector.

Fuel pump temperature sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F100	2	F85	22	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 or short to ground or short to power in harness or connectors.

4.CHECK FUEL TEMPERATURE SENSOR

Refer to ECR-149, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace fuel temperature sensor.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307477

1.CHECK FUEL TEMPERATURE SENSOR

1. Turn ignition switch OFF.
2. Disconnect fuel temperature sensor harness connector.
3. Check resistance between fuel temperature sensor terminal.

Terminals	Resistance
1 and 2	0.085 - 50 kΩ

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace fuel temperature sensor.

P0190 FRP SENSOR

Description

INFOID:0000000001307478

The fuel rail pressure (FRP) sensor is placed to the fuel rail. It measures the fuel pressure in the fuel rail. The sensor sends voltage signal to the ECM. As the pressure increases, the voltage rises. The ECM controls the fuel pressure in the fuel rail by operating fuel rail pressure control valve. The ECM uses the signal from fuel rail pressure sensor as a feedback signal.

DTC Logic

INFOID:0000000001451243

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition		Possible cause
P0190	Fuel rail pressure sensor circuit low input	A)	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Fuel rail pressure sensor circuit is open or shorted.) • Fuel rail pressure sensor
	Fuel rail pressure sensor circuit high input		An excessively high voltage from the sensor is sent to ECM.	
	Fuel rail pressure sensor performance	B)	An improper voltage signal from sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION A

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to ECR-150, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION B

1. Start engine and let it idle for at least 5 seconds.
2. Check DTC.

Is DTC detected?

YES >> Go to ECR-150, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307480

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK FUEL RAIL PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect fuel rail pressure sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between fuel rail pressure sensor connector and ground.

Fuel rail pressure sensor		Ground	Voltage
Connector	Terminal		
F102	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK FUEL RAIL PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel rail pressure sensor harness connector and ECM harness connector.

Fuel rail pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F102	3	F85	34	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 or short to ground or short to power in harness or connectors.

4.CHECK FUEL RAIL PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between fuel rail pressure sensor harness connector and ECM harness connector.

Fuel rail pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F102	2	F85	30	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 or short to ground or short to power in harness or connectors.

5.CHECK FUEL RAIL PRESSURE SENSOR

Refer to ECR-151, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace fuel rail pressure sensor.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307481

1.CHECK FUEL RAIL PRESSURE SENSOR

1. Turn ignition switch OFF and wait at least 1 minutes.
2. Reconnect harness connector disconnected.
3. Turn ignition switch ON.
4. Select “DATA MONITOR” mode with CONSULT-III.
5. Check that the “FUEL RAIL PRES” indication.

Is the value lower than 90 bar?

YES >> **INSPECTION END**.

NO >> Replace fuel rail pressure sensor.

P0200 FUEL INJECTOR

DTC Logic

INFOID:0000000001451444

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P0200	Fuel injector circuit range/ performance	An excessively low voltage from the injectors is sent to ECM.	• Harness or connectors (The fuel injector circuit is shorted.)
		An excessively high voltage from the injectors is sent to ECM.	
		An improper voltage signal is sent to ECM through fuel injectors.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-153, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307483

1.CHECK FUEL INJECTOR POWER SUPPLY CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Disconnect fuel injector harness connector.
4. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	1	F85	6	Existed
2	F71	1	F85	7	
3	F72	1	F85	8	
4	F73	1	F85	5	

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

2.CHECK FUEL INJECTOR OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	2	F85	2	Existed
2	F71	2	F85	3	
3	F72	2	F85	4	
4	F73	2	F85	1	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK FUEL INJECTOR OUTPUT SIGNAL CIRCUIT FOR SHORT

Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	2	F85	1	Not existed
				3	
				4	
2	F71	2	F85	1	
				2	
				4	
3	F72	2	F85	1	
				2	
				3	
4	F73	2	F85	2	
				3	
				4	

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.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

P0201, P0202, P0203, P0204 FUEL INJECTOR

Description

INFOID:0000000001532244

The fuel injector is a small, precise solenoid valve. When the ECM supplies a ground to the fuel injector circuit, the fuel injector is energized. The energized coil pulls the needle valve back and allows fuel to flow through the fuel injector into the cylinder. The amount of fuel injected depends upon the injection pulse duration. Pulse duration is the length of time the fuel injector remains open. The ECM controls the injection pulse duration based on engine fuel needs.

DTC Logic

INFOID:0000000001307485

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0201	NO. 1 cylinder fuel injector circuit	An improper voltage signal is sent to ECM through No. 1 cylinder fuel injector	• Harness or connectors (The fuel injector circuit is open or shorted.) • Fuel injector
P0202	NO. 2 cylinder fuel injector circuit	An improper voltage signal is sent to ECM through No. 2 cylinder fuel injector	
P0203	NO. 3 cylinder fuel injector circuit	An improper voltage signal is sent to ECM through No. 3 cylinder fuel injector	
P0204	NO. 4 cylinder fuel injector circuit	An improper voltage signal is sent to ECM through No. 4 cylinder fuel injector	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-155, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307486

1.CHECK FUEL INJECTOR POWER SUPPLY CIRCUIT FOR OPEN

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Disconnect fuel injector harness connector.
4. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	1	F85	6	Existed
2	F71	1	F85	7	
3	F72	1	F85	8	
4	F73	1	F85	5	

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit in harness or connectors.

2.CHECK FUEL INJECTOR OUTPUT SIGNAL CIRCUIT FOR OPEN

Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	2	F85	2	Existed
2	F71	2	F85	3	
3	F72	2	F85	4	
4	F73	2	F85	1	

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit in harness or connectors.

3.CHECK FUEL INJECTOR CONTROL CIRCUIT FOR SHORT

Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	1	F85	2	Not existed
		2		6	
2	F71	1	F85	3	
		2		7	
3	F72	1	F85	4	
		2		8	
4	F73	1	F85	1	
		2		5	

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair short circuit in harness or connectors.

4.CHECK FUEL INJECTOR

Refer to ECR-156, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace fuel injector.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307487

1.CHECK FUEL INJECTOR

1. Turn ignition switch OFF.
2. Disconnect fuel injector harness connector.
3. Check resistance between fuel injector terminals as follows.

Terminals	Resistance
1 and 2	178.2 - 181.8Ω

Is the inspection result normal?

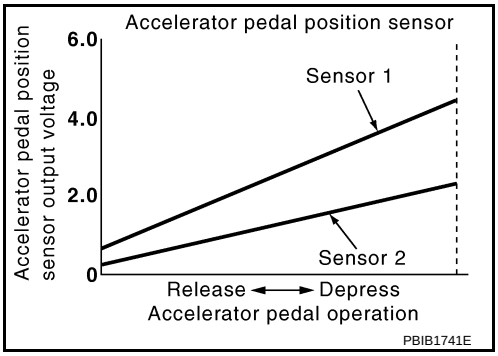
YES >> **INSPECTION END**
NO >> Replace malfunctioning fuel injector.

P0225 APP SENSOR

Description

INFOID:0000000001307490

The accelerator pedal position sensor is installed on the upper end of the accelerator pedal assembly. The sensors detect the accelerator pedal position and sends a signal to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.



DTC Logic

INFOID:0000000001451447

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0225	Accelerator pedal position sensor 1 circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Accelerator pedal position sensor circuit is open or shorted.) • Accelerator pedal position sensor (APP sensor 1 and 2)
	Accelerator pedal position sensor 1 circuit high input	An excessively high voltage from the sensor is sent to ECM.	
	Accelerator pedal position sensor 1, 2 signal correlation	The correlation between APP sensor 1 signal and APP sensor 2 signal is out of the normal range.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-158, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Depress accelerator pedal slowly spending 5 seconds, and then release it slowly spending 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-158, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307492

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY CIRCUIT

1. Disconnect accelerator pedal position sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between accelerator pedal position sensor connector and ground.

Accelerator pedal position sensor		Ground	Voltage
Connector	Terminal		
E110	4	Ground	Approx. 5V
	5		

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK ACCELERATOR PEDAL POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E110	1	E60	120	Existed
	2		127	

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 or short to ground or short to power in harness or connectors.

4.CHECK ACCELERATOR PEDAL POSITION SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E110	3	E60	126	Existed
	6		119	

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 or short to ground or short to power in harness or connectors.

5.CHECK ACCELERATOR PEDAL POSITION SENSOR

Refer to ECR-160, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace accelerator pedal position sensor.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001569787

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 between ECM harness connector terminals as follows.

ECM		ECM		Condition		Voltage
Connector	Terminal	Connector	Terminal			
E60	126 (APP sensor 1)	E60	127 (Sensor ground)	Accelerator pedal	Fully released	0.6 - 4.6 V
					Fully depressed	Less than 5 V
	119 (APP sensor 2)		120 (Sensor ground)		Fully released	More than 0.3 V
					Fully depressed	Less than 2.5 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace accelerator pedal assembly.

P0235 TC BOOST SENSOR

Description

INFOID:0000000001307494

The turbocharger boost sensor detects pressure in the exit side of the charge air cooler. The sensor output voltage to the ECM increases as pressure increases.

DTC Logic

INFOID:0000000001451448

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0235	Turbocharger boost sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Turbocharger boost sensor circuit is open or shorted.) • Turbocharger boost sensor • Barometric pressure sensor (built-into EC)
	Turbocharger boost sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	
	Turbocharger boost sensor circuit range/performance	Rationally incorrect voltage from the sensor is sent to ECM, compared with the voltage signal from barometric pressure sensor (built-into ECM)	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-161, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307496

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK TUBOCHARGER BOOST SENSOR POWER SUPPLY CIRCUIT

1. Disconnect turbocharger boost sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between turbocharger boost sensor harness connector and ground.

Turbocharger boost sensor		Ground	Voltage
Connector	Terminal		
F84	3	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK TUBOCHARGER BOOST SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between turbocharger boost sensor harness connector and ECM harness connector.

Turbocharger boost sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F84	2	F85	17	Existed

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 or short to ground or short to power in harness or connectors.

4.CHECK TUBOCHARGER BOOST SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between turbocharger boost sensor harness connector and ECM harness connector.

Turbocharger boost sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F84	1	F85	18	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 or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

6.REPLACE TUBOCHARGER BOOST SENSOR

Replace turbocharger boost sensor.

>> GO TO 7.

7.PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-161, "DTC Logic".

Is 1st trip DTC P0235 displayed again?

YES >> GO TO 8.
NO >> **INSPECTION END**

8.REPLACE ECM

1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> **INSPECTION END**

P0263, P0266, P0269, P0272 FUEL INJECTOR

Description

INFOID:0000000001532245

The fuel injector is a small, precise solenoid valve. When the ECM supplies a ground to the fuel injector circuit, the coil in the fuel injector is energized. The energized coil pulls the needle valve back and amount of fuel to flow through the fuel injector into the cylinder. The amount of fuel injected depends upon the injection pulse duration.Pulse duration is the length of time the fuel injector remains open.The ECM controls the injection pulse duration based on engine fuel needs.

DTC Logic

INFOID:0000000001375014

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0263	NO. 1 cylinder fuel injector performance	The zero fuel calibration value for fuel injector 1 is out of the specified range.	• Fuel injector
P0266	NO. 2 cylinder fuel injector performance	The zero fuel calibration value for fuel injector 2 is out of the specified range.	
P0269	NO. 3 cylinder fuel injector performance	The zero fuel calibration value for fuel injector 3 is out of the specified range.	
P0272	NO. 4 cylinder fuel injector performance	The zero fuel calibration value for fuel injector 4 is out of the specified range.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-163, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001375015

1.PERFORM INJECTOR ADJUSTAMENT VALUE REGSITRATION

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Turn ignition switch ON.
3. Perform injector adjustment value registration for malfunctioning cylinder. Refer to ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".

>> GO TO 2.

2.CHECK DTC

Perform DTC CONFIRMATION PROCEDURE again.
Refer to ECR-163, "DTC Logic".

Is DTC displayed again?

YES >> Replace malfunctioning fuel injector.
NO >> INSPECTION END

P0297 SERVICE REGENERATION

Description

INFOID:0000000001527778

Service regeneration is performed with CONSULT-III to reduce particulate matter in DPF.
For details, refer to ECR-16, "SERVICE REGENERATION : Description".

DTC Logic

INFOID:0000000001527779

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0297	Vehicle overspeed condition	ECM received vehicle speed signal [more than 5km/h (3 MPH)] during service regeneration.	Vehicle was driven at a speed of 5km/h (3 MPH) or more during service regeneration.

Diagnosis Procedure

INFOID:0000000001527780

1.PERFORM SERVICE REGENERATION

Refer to ECR-17, "SERVICE REGENERATION : Special Repair Requirement".

>> GO TO 2.

2.ERASE DTC

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.

Is DTC erased?

YES >> INSPECTION END
NO >> GO TO 3.

3.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

P0300, P0301, P0302, P0303, P0304 MISFIRE

DTC Logic

INFOID:0000000001348510

DTC DETECTION LOGIC

When a misfire occurs, engine speed will fluctuate. If the engine speed fluctuates enough to cause the crankshaft position 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

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0300	Multiple cylinder misfire detected	Multiple cylinder misfire.	• Poor compression • Incorrect fuel injector connection • Fuel injector • Lack of fuel
P0301	No.1 cylinder misfire detected	No. 1 cylinder misfires.	
P0302	No. 2 cylinder misfire detected	No. 2 cylinder misfires.	
P0303	No. 3 cylinder misfire detected	No. 3 cylinder misfires.	
P0304	No. 4 cylinder misfire detected	No. 4 cylinder misfires.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to normal operating temperature.
2. Turn ignition switch OFF and wait at least 20 seconds.
3. Restart engine and let it idle for about 30 seconds.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-165, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001348511

1.CHECK FOR LEAK

1. Start engine.
2. Visually check the following for fuel leak.

- Fuel line from fuel pump to fuel rail
- Fuel rail
- Fuel line from fuel rail to fuel injector.

3. Check PCV hose connection.

Is intake air leak detected?

YES >> Discover air leak location and repair.
NO >> GO TO 2.

2.CHECK FUEL INJECTOR-I

Refer to ECR-156, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 4.

3.CHECK FUEL INJECTOR-II

With CONSULT-III

1. Remove two fuel injectors.
   NOTE:
   One is from malfunctioning cylinder and the other is from any cylinder other than the malfunctioning cylinder.
2. Swap the two fuel injectors to the other cylinder.
3. Reconnect ECM harness connector and fuel injector harness connectors.
4. Turn ignition switch ON.
5. Perform Injector Adjustment Value Registration. Refer to ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".
6. Select “SELF DIAG RESULTS” mode with CONSULT-III.
7. Touch “ERASE”.
8. Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-165, "DTC Logic".
9. Is DTC displayed for the other cylinder?

With GST

1. Remove two fuel injectors.
   NOTE:
   One is from malfunctioning cylinder and the other is from any cylinder other than the malfunctioning cylinder.
2. Swap the two fuel injectors to the other cylinder.
3. Reconnect ECM harness connector and fuel injector harness connector.
4. Turn ignition switch ON.
5. Perform Injector Adjustment Value Registration. Refer to ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".
6. Select Service $04 with GST.
7. Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-165, "DTC Logic".

Is DTC displayed for the other cylinder?

YES >> GO TO 4.
NO >> GO TO 5.

4. REPLACE FUEL INJECOR

1. Replace fuel injector of malfunctioning cylinder.
2. Perform Injector Adjustment Value Registration. Refer to ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".
3. Perform Injector ZFC reset. Refer to ECR-14, "ZFC VALUE RESET : Special Repair Requirement".

>> INSPECTION END

5. CHECK COMPRESSION PRESSURE

Check compression pressure. Refer to EM-260, "Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

6. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

P0335 CKP SENSOR

Description

INFOID:0000000001532246

The crankshaft position (CKP) sensor is located on the cylinder block rear housing facing the gear teeth (cogs) of the signal plate.
The ECM receives the voltage signal and detects the function of the engine revolution.

DTC Logic

INFOID:0000000001307498

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0335	Crankshaft position sensor circuit	Crankshaft position sensor signal is not detected by ECM when engine is running.	• Harness or connectors (The sensor circuit is open or shorted.) • Crankshaft position sensor • Signal plate
	Crankshaft position sensor circuit range/performance	Crankshaft position sensor signal is not in the normal pattern when engine is running.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 10 seconds.
   If engine could not start, keep ignition switch at START position for 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-167, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307499

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK CKP SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Disconnect crankshaft position (CKP) sensor harness connector.
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	
F83	2	F68	50	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 or short to ground or short to power in harness or connectors.

3.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	
F83	1	F68	49	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 or short to ground or short to power in harness or connectors.

4.CHECK CKP SENSOR

Refer to ECR-168, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace crankshaft position sensor.

5.CHECK GEAR TOOTH

Visually check for chipping flywheel or signal plate gear tooth.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace flywheel or signal plate.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001307500

1.CHECK CKP SENSOR

1. Turn ignition switch OFF.
2. Disconnect CKP sensor harness connector.
3. Check resistance between CKP sensor terminals as follows.

Terminals	Resistance
1 and 2	0.6 - 1.0 kΩ

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace CKP sensor.

P0340 CMP SENSOR

Description

INFOID:0000000001532247

The camshaft position (CMP) sensor senses the retraction with camshaft (left side) to identify a particular cylinder. The camshaft position (CMP) sensor senses the piston position.
When the crankshaft position (CKP) sensor system becomes inoperative, the camshaft position (CMP) sensor provides various controls of engine parts instead, utilizing timing of cylinder identification signals.
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 cause the magnetic field near the sensor to change.
Due to the changing magnetic field, the voltage from the sensor changes.

DTC Logic

INFOID:0000000001452050

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0340	Camshaft position sensor circuit	Camshaft position sensor signal is not detected by ECM when engine is running.	• Harness or connectors (The sensor circuit is open or shorted.) • Camshaft position sensor • Signal plate
	Camshaft position sensor circuit range/performance	Camshaft position sensor signal is not in the normal pattern when engine is running.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-169, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307502

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK CMP SENSOR POWER SUPPLY CIRCUIT

1. Disconnect camshaft position (CMP) sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between CMP sensor harness connector and ground.

CMP sensor		Ground	Voltage
Connector	Terminal		
F82	3	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 4.

NO >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Harness connector E7, F121
- Harness for open or short between ECM and CMP sensor
- Harness for open or short between IPDM E/R and CMP sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

4. CHECK CMP SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between CMP sensor harness connector and ECM harness connector.

CMP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F82	1	F85	46	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 or short to ground or short to power in harness or connectors.

5. CHECK CMP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between CMP sensor harness connector and ECM harness connector.

CMP sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F82	2	F85	48	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 or short to ground or short to power in harness or connectors.

6. CHECK CMP SENSOR

Refer to ECR-171, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace camshaft position sensor.

7. CHECK SPROCKET

Visually check for chipping signal plate gear tooth.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace sprocket.

8. CHECK TIMING CHAIN

Refer to EM-293, "Exploded View".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Replace timing chain.

9. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001307503

1. CHECK CAMSHAFT POSITION SENSOR

1. Turn ignition switch OFF.
2. Disconnect camshaft position sensor harness connector.
3. Check the resistance between camshaft position sensor terminals as follows.

Terminals	Resistance
2 and 3	7.2 - 13.4 kΩ
1 and 2	More than 100 kΩ
1 and 3	More than 100 kΩ

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace camshaft position sensor.

P0380 GLOW CONTROL SYSTEM

DTC Logic

INFOID:0000000001307504

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0380	Glow control unit circuit	An improper voltage signal is sent to ECM from glow control unit	• Harness or connectors (Glow plug control circuit is open or shorted.) (Glow control unit input signal circuit is open or shorted.) • Glow plug • Glow control unit

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

With CONSULT-III

1. Turn ignition switch ON and select “DATA MONITOR” mode with CONSULT-III.
2. Check the “ENG COOLAN TEMP” indication.
   If indication is below 50 °C (122 °F), go to the next step.
   If indication is above 50 °C (122 °F), cool down engine and then go to the next step.
3. Wait at least 10 seconds.
4. Check 1st trip DTC.

With GST

Follow the procedure “With CONSULT-III” above.

Is 1st trip DTC detected?

YES >> Go to ECR-172, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307505

1.CHECK GLOW CONTROL UNIT POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect glow control unit harness connector.
3. Turn ignition switch ON.
4. Check the voltage between glow control unit harness connector and ground.

Glow control unit		Ground	Voltage
Connector	Terminal		
F94	4	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.

- 60A fusible link (letter N)
- Harness for open and short between glow control unit and battery

>> Repair open circuit or short to ground or short to power in harness or connectors.

3. CHECK GLOW CONTROL UNIT GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between glow control unit harness connector and ECM harness connector.

Glow control unit		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F94	5	F85	9	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 or short to ground or short to power in harness or connectors.

4. CHECK GLOW CONTROL UNIT INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between glow control unit harness connector and ECM harness connector.

Glow control unit		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F94	3	F68	53	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 or short to ground or short to power in harness or connectors.

5. CHECK GLOW PLUG CONTROL CIRCUIT FOR OPEN AND SHORT

1. Disconnect glow plug harness connector.
2. Check the continuity between glow control unit harness connector and glow plug harness connector.

Glow control unit			Glow plug		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F94	2	F95	1	Existed
2		7	F96	1	
3		1	F97	1	
4		6	F98	1	

3. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

6. CHECK GLOW PLUG

Refer to ECR-174, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace malfunctioning glow plug.

7. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace glow control unit.
NO >> Repair or replace.

Component Inspection

INFOID:0000000001349038

1. CHECK GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector.
3. Check resistance between glow plug terminals as follows.

Terminal	Resistance
1 and engine ground	0.1 - 1.0 Ω [at 20°C (68°F)]

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace malfunctioning glow plug.

P0409 EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR

Description

INFOID:0000000001532248

The EGR volume control valve consists of valve, actuator and position sensor, etc.The valve is installed in EGR passage, and operated by the actuator according to the output signal or the ECM. The actuator used DC motor and it opens or closes the valve to change the EGR flow rate.
The EGR volume control valve control position sensor consists of a permanent magnet and Hall IC. It senses the valve shaft movement and feeds the voltage signals to the ECM. The ECM judges the current opening angle of the valve from this signals, and controls the DC motor to make the valve opening angle in response to driving conditions.

DTC Logic

INFOID:0000000001452056

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0409	EGR volume control valve control position sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (EGR volume control valve control position sensor circuit is open or shorted.) • EGR volume control valve control position sensor
	EGR volume control valve control position sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-175, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307510

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR POWER SUPPLY CIRCUIT

1. Disconnect EGR volume control valve harness connector.
2. Turn ignition switch ON.
3. Check the voltage between EGR volume control valve control position sensor harness connector and ground.

EGR volume control valve control position sensor		Ground	Voltage
Connector	Terminal		
F99	4	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between EGR volume control valve control position sensor harness connector and ECM harness connector.

EGR volume control valve control position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F99	2	F85	36	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 or short to ground or short to power in harness or connectors.

4.CHECK EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR INPUT CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between EGR volume control valve control position sensor harness connector and ECM harness connector.

EGR volume control valve control position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F99	6	F85	32	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 or short to ground or short to power in harness or connectors.

5.CHECK EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR

Refer to ECR-176, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 6.

6.REPLACE EGR VOLUME CONTROL VALVE

1. Replace EGR volume control valve.
2. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement".
3. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Special Repair Requirement".

>> **INSPECTIO END**

7.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTIO END**

Component Inspection

INFOID:0000000001559390

1.CHECK EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR

1. Turn ignition switch OFF.

2. Disconnect EGR volume control valve harness connector.
3. Check the resistance between EGR volume control valve terminals as follows.

Terminals	Resistance
2 and 4	1 - 15 kΩ
2 and 6	

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EGR volume control valve.

P0470 EXHAUST GAS PRESSURE SENSOR

Description

INFOID:0000000001350914

Exhaust gas pressure sensor is conected turbocharger with exhasut pressure tube. Exhaust gas pressure sensor measures the exhaust gas pressure and convers the pressure into a voltage signal. ECM receives the signal and control turbocharger boost pressure.

DTC Logic

INFOID:0000000001452141

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0470	Exhaust gas pressure sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Exhaust gas pressure sensor circuit is open or shorted.) • Exhaust gas pressure sensor • Barometric pressure sensor (built-into EC) • Exhaust manifold and exhaust pipe
	Exhaust gas pressure sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	
	Exhaust gas pressure sensor circuit range/performance	Rationally incorrect voltage from the sensor is sent to ECM, compared with the voltage signal from barometric pressure sensor (built-into ECM)	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-178, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Start engine and let it idle at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-178, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001350916

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EXHAUST GAS PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect exhaust gas pressure sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between exhaust gas pressure sensor harness connector and ground.

Exhaust gas pressure sensor		Ground	Voltage
Connector	Terminal		
F81	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK EXHAUST GAS PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between exhaust gas pressure sensor harness connector and ECM harness connector.

Exhaust gas pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F81	3	F85	16	Existed

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 or short to ground or short to power in harness or connectors.

4.CHECK EXHAUST GAS PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between exhaust gas pressure sensor harness connector and ECM harness connector.

Exhaust gas pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F81	2	F85	20	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 or short to ground or short to power in harness or connectors.

5.CHECK EXHAUST MANIFOLD AND EXHAUST PIPE

Check the exhaust manifold and exhaust pipe for clogging and cracks.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace exhaust manifold or exhaust pipe.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace exhaust gas pressure sensor.
NO >> Repair or replace.

P0487 EGR VOLUME CONTROL VALVE

Description

INFOID:0000000001532249

The EGR volume control valve consists of valve, actuator and position sensor, etc. The valve is installed in EGR passage, and operated by the actuator according to the output signal of the ECM. The actuator used DC motor and it opens or closes the valve to change the EGR flow rate.
The EGR volume control valve control position sensor consists of a permanent magnet and Hall IC. It senses the valve shaft movement and feeds the voltage signals to the ECM. The ECM judges the current opening angle of the valve from this signals, and controls the DC motor to make the valve opening angle in response to driving conditions,

DTC Logic

INFOID:0000000001307511

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0487	EGR volume control valve circuit	ECM detects EGR volume control valve circuit is open.	• Harness or connectors (The EGR volume control valve control motor circuit is open or shorted.) • EGR volume control valve
		ECM detects EGR volume control valve circuit is short to ground.	
		ECM detects EGR volume control valve circuit is short to power.	
		ECM detects EGR volume control valve circuits are short to each other.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-180, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Turn ignition switch ON and wait at least 10 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-180, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307512

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EGR VOLUME CONTROL VALVE DC MOTOR CIRCUIT

1. Disconnect EGR volume control valve harness connector.
2. Disconnect ECM harness connector.
3. Check harness continuity between the following terminals.

EGR volume control valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F99	1	F68	95	Existed
			96	Not existed
	5		95	Not existed
			96	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 or short to ground or short to power in harness or connectors.

3.CHECK EGR VOLUME CONTROL VALVE

Refer to ECR-181, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 4.

4.REPLACE EGR VOLUME CONTROL VALVE

1. Replace the EGR volume control valve.
2. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement".
3. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Special Repair Requirement".

>> **INSPECTIO END**

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001307513

1.CHECK EGR VOLUME CONTROL VALVE CONTROL MOTOR

1. Turn ignition switch OFF.
2. Disconnect EGR volume control valve harness connector.
3. Check resistance between EGR volume control valve terminals as follows.

Terminals	Resistance
1 and 5	1 - 400 Ω

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace EGR volume control valve.

P0488 EGR SYSTEM

DTC Logic

INFOID:0000000001307514

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0488	EGR volume control valve function	• ECM detects EGR volume control valve is stuck closed. • ECM detects EGR volume control valve is stuck open. • EGR volume control valve closed position learning is not completed successfully.	• Harness or connectors (The EGR volume control valve circuit is open or shorted.) • EGR volume control valve • EGR volume control valve installation • EGR passage clogged

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and warm it up to normal operating temperature.
2. Let engine idle for at least 10 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-182, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307515

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EGR VOLUME CONTROL VALVE INSTALLATION

Check that EGR volume control valve is installed properly.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Install EGR volume control valve properly.

3.CHECK EGR VOLUME CONTROL VALVE CONTROL MOTOR CIRCUIT

1. Check harness continuity between the following terminals.

EGR volume control valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F99	2	F68	95	Existed
			96	Not existed
	6		95	Not existed
			96	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 or short to ground or short to power in harness or connectors.

4. CHECK EGR VOLUME CONTROL VALVE VISUALLY

1. Remove the EGR volume control valve
2. Check if foreign matter is caught between the EGR volume control valve and the housing.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Remove the foreign matter and clean the EGR volume control valve.

5. CHECK EGR PASSAGE

Check the following for clogging and cracks.
- EGR tube
- EGR hose
- EGR cooler

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace EGR passage.

6. CHECK EGR VOLUME CONTROL VALVE

Refer to ECR-181, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 8.

7. CHECK EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR

Refer to ECR-176, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 8.

8. REPLACE EGR VOLUME CONTROL VALVE

1. Replace the EGR volume control valve.
2. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement".
3. Perform ECR-15, "EGR VOLUME CONTROL VALVE CLOSED POSITION LEARNING : Special Repair Requirement".

>> **INSPECTIO END**

9. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTIO END**

P0500 VSS

Description

INFOID:0000000001307517

The vehicle speed signal is sent to the combination meter from the “ABS actuator and electric unit (control unit)” by CAN communication line. The combination meter then sends a signal to the ECM by CAN communication line.

DTC Logic

INFOID:0000000001307518

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0500	Vehicle speed signal	Vehicle speed signal is more than the specified range	• Harness or connectors (The CAN communication line is open or shorted) • Harness or connectors (The vehicle speed signal circuit is open or shorted) • Wheel sensor • Combination meter • ABS actuator and electric unit (control unit)

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 1 minutes.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-184, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307519

1.CHECK CAN COMMUNICATION LINE

Refer to LAN-25, "CAN Communication Signal Chart".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace

2.CHECK DTC WITH “ABS ACTUATOR AND ELECTRIC UNIT (CONTROL UNIT)”

Refer to BRC-104, "CONSULT-III Function (ABS)" (without ESP) or BRC-17, "CONSULT-III Function (ABS)" (with ESP).

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair or replace.

3.CHECK COMBINATION METER

Refer to MWI-24, "CONSULT-III Function (METER/M&A)".

>> **INSPECTION END**

P0530 REFRIGERANT PRESSURE SENSOR

Description

INFOID:0000000001450352

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.

DTC Logic

INFOID:0000000001450353

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0530	Refrigerant pressure sensor circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Refrigerant pressure sensor circuit is open or shorted.) • Refrigerant pressure sensor
	Refrigerant pressure sensor circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-185, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001450354

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.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 connector and ground.

Refrigerant pressure sensor		Ground	Voltage
Connector	Terminal		
E49	3	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
• Harness connector E6, F123

• Harness for open or short between ECM and refrigerant pressure sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

4. CHECK REFRIGERANT PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
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	
E49	1	F85	35	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 connector E6, F123
• Harness for open or short between ECM and refrigerant pressure sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

6. 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	
E49	2	F85	31	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.
• Harness connector E6, F123
• Harness for open or short between ECM and refrigerant pressure sensor

>> Repair open circuit or short to ground or short to power in harness or connectors.

8. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace refrigerant pressure sensor.
NO >> Repair or replace.

P0544 EGT SENSOR 1

Description

INFOID:0000000001350979

The exhaust gas temperature sensor 1 is used to detect the exhaust gas temperature before turbocharger. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the exhaust gas 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.

DTC Logic

INFOID:0000000001505655

DTC DETECTION LOGIC

If DTC P0544 is displayed with DTC P0115, first perform the trouble diagnosis for DTC P0115. Refer to ECR-132, "DTC Logic".

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0544	Exhaust gas temperature sensor 1 circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Exhaust gas temperature sensor 1 circuit is open or shorted.) • Exhaust gas temperature sensor 1
	Exhaust gas temperature sensor 1 circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-187, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Start engine and drive vehicle under the following conditions for at least 10 seconds.
- Gear position: 3rd position
- Vehicle speed: Accelerates from 55km/h (34 MPH) to 70 km/h (43 MPH)
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-187, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001350970

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EXHAUST GAS TEMPERATURE SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect exhaust gas temperature sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between exhaust gas temperature sensor 1 harness connector and ground.

Exhaust gas temperature sensor 1		Ground	Voltage
Connector	Terminal		
F101	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR 1 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between exhaust gas temperature sensor 1 harness connector and ECM harness connector.

Exhaust gas temperature sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F101	2	F85	10	Existed

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 or short to ground or short to power in harness or connectors.

4.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace exhaust gas temperature sensor 1.
NO >> Repair or replace.

P0560 BATTERY VOLTAGE

DTC Logic

INFOID:0000000001505734

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0560	Battery voltage	An excessively low voltage from the battery is sent to ECM.	• Harness or connectors (ECM power supply circuit is open or shorted.) • Battery • Battery terminal • Alternator • IPDM E/R
		An excessively high voltage from the battery is sent to ECM.	
		An improper voltage is sent to ECM through battery	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 30 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-189, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307524

1.CHECK BATTERY VOLTAGE

1. Turn ignition switch ON.
2. Check battery voltage.

Voltage: Above 11V

Is the inspection result normal?

YES >> GO TO 2.
NO >> Recharge the battery.

2.CHECK BATTERY TERMINALS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check battery terminals condition.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair the battery terminals.

3.CHECK BATTERY AND ALTERNATOR

Check that the proper type of battery and type of alternator are installed.
Refer to, PG-136, "Battery" and CHG-35, "Alternator".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace with a proper one.

4.CHECK ECM POWER SUPPLY CIRCUIT-I

Check the voltage between ECM harness connector and ground.

ECM		Ground	Voltage
Connector	Terminal		
F68	62	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 5.
NO >> GO TO 7.

5.CHECK ECM POWER SUPPLY CIRCUIT-II

1. Disconnect ECM harness connector.
2. Disconnect IPDM E/R harness connector E15.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

ECM		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
E68	93	E15	48	Existed
	94		47	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 6.

6.DETECT MALFUNCTIONING PART

Check the following.
- Harness or connectors E7, E121
- Harness for open or short between ECM and IPDM E/R

>> Repair open circuit or short to ground or short to power in harness or connectors.

7.CHECK ECM POWER SUPPLY CIRCUIT-III

1. Disconnect ECM harness connector.
2. Disconnect IPDM E/R harness connector E15.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

ECM		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
F68	62	E15	51	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 8.

8.DETECT MALFUNCTIONING PART

Check the following.
- Harness or connectors E7, E121
- Harness for open or short between ECM and IPDM E/R

>> Repair open circuit or short to ground or short to power in harness or connectors.

9.CHECK 20A FUSE

1. Disconnect 20A fuse (No. 62) from IPDM E/R.
2. Check 20A fuse.

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace 20A fuse.

10. CHECK GROUND CONNECTION

Check ground connection E9. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair or replace ground connection.

11. CHECK ECM GROUND CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between ECM harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
E60	123	Ground	Existed
	124		
	125		
	128		

2. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 12.
NO >> Repair open circuit or short power in harness or connectors.

12. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace IPDM E/R.
NO >> Repair or replace.

P0564 ASCD STEERING SWITCH

Description

INFOID:0000000001307528

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

DTC Logic

INFOID:0000000001505753

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0564	ASCD steering switch circuit	An excessively high voltage signal from the ASCD steering switch is sent to ECM.	• Harness or connectors (The switch circuit is open or shorted.) • ASCD steering switch
		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.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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. 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 RESUME/ACCELERATE switch for at least 10 seconds, then release it and wait at least 10 seconds.
5. Press SET/COAST switch for at least 10 seconds, then release it and wait at least 10 seconds.
6. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-192, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307530

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ASCD STEERING SWITCH CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals as follows.

(+)		(–)		Condition	Voltage
Connector	Terminal	Connector	Terminal		
E60	110 (ASCD steering switch signal)	E60	111 (ASCD steering switch ground)	MAIN switch: Pressed	Approx. 0V
				CANSEL switch: Pressed	Approx. 1V
				SET/COAST switch: Pressed	Approx. 2V
				RESUME/ACCELERATE switch: Pressed	Approx. 3V
				All ASCD steering switches: Released	Approx. 4V

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 3.

3. CHECK ASCD STEERING SWITCH GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect combination switch harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between combination switch (spiral cable) and ECM harness connector.

Combination switch (spiral cable)		ECM		Continuity
Connector	Terminal	Connector	Terminal	
—	15	E60	111	Existed

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

- Harness connectors M77, E105
- Combination switch (spiral cable)
- Harness for open or short between ECM and combination switch

>> Repair open circuit or 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 (spiral cable) and ECM harness connector.

Combination switch (spiral cable)		ECM		Continuity
Connector	Terminal	Connector	Terminal	
—	14	E60	110	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

- Harness connectors M77, E105
- Combination switch (spiral cable)
- Harness for open or short between ECM and combination switch

>> Repair open circuit or short to ground or short to power in harness or connectors.

7. CHECK ASCD STEERING SWITCH

Refer to ECR-194, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace ASCD steering switch.

8.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307531

1.CHECK ASCD STEERING SWITCH

1. Disconnect combination switch (spiral cable) harness connector M352.
2. Check the continuity between combination switch harness connector terminals under following conditions.

Combination meter		Condition	Resistance
Connector	Terminals		
M352	14 and 15 (Combination switch)	MAIN switch: Pressed	Approx. 0 Ω
		CANCEL switch: Pressed	Approx. 250 Ω
		SET/COAST switch: Pressed	Approx. 660 Ω
		RESUME/ACCELERATE switch: Pressed	Approx. 1,480 Ω
		All ASCD steering switches: Released	Approx. 4,000 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace ASCD steering switch

P0571 BPP SWITCH

Description

INFOID:0000000001532251

Brake switch signal is applied to the ECM through the brake pedal position when the brake pedal is depressed. Stop lamp switch signal is also sent to ECM through CAN communication line from BCM. These signals are used mainly to decrease the engine speed when the vehicle is driving.

DTC Logic

INFOID:0000000001307525

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0571	Brake pedal position switch/stop lamp switch inconsistency	Brake pedal position switch does not operate properly	• Harness or connectors (Brake pedal position switch circuit is open or shorted) (The CAN communication line is open or shorted) • Brake pedal position switch • BCM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 30 seconds.
2. Apply service brake for at least 30 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-195, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307526

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK BRAKE PEDAL POSITION SWITCH CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector and ground.

ECM		Ground	Condition		Voltage
Connector	Terminal				
E60	116 (Brake pedal position switch)	Ground	Brake pedal	Fully released	Battery voltage
				Slightly depressed	0V

Is the inspection result normal?

YES >> GO TO 7.
NO >> GO TO 3.

3.CHECK BRAKE PEDAL POSITION SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
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		
E112	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 connector E105, M77
- 10A fuse (No. 1)
- Harness for open or short between fuse and brake pedal position switch

>> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK BRAKE PEDAL POSITION SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
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	
E112	2	E60	116	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 or short to ground or short to power in harness or connectors.

6.CHECK BRAKE PEDAL POSITION SWITCH

Refer to ECR-197, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace brake pedal position switch.

7.CHECK BCM

Refer to BCS-29, "BCM : CONSULT-III Function (BCM - BCM)".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair or replace

8.CHECK CAN COMMUNICATION LINE

Refer to LAN-25, "CAN Communication Signal Chart".

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair or replace

9.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307527

1. CHECK BRAEK 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-8, "Inspection and Adjustment" (LHD models) or BR-58, "Inspection and Adjustment" (RHD models).
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.

P0575 ASCD STEERING SWITCH

Description

INFOID:0000000001348512

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

DTC Logic

INFOID:0000000001505756

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P0575	ASCD steering switch circuit	ECM detects that input signal from the ASCD steering switch is out of the specified range.	• Harness or connectors (ASCD steering switch circuit is open or shorted.) • ASCD steering switch

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-198, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001348514

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ASCD STEERING SWITCH CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector and ground.

(+)		(–)		Condition	Voltage
Connector	Terminal	Connector	Terminal		
E60	110 (ASCD steering switch signal)	E60	111 (ASCD steering switch ground)	MAIN switch: Pressed	Approx. 0V
				CANSEL switch: Pressed	Approx. 1V
				SET/COAST switch: Pressed	Approx. 2V
				RESUME/ACCELERATE switch: Pressed	Approx. 3V
				All ASCD steering switches: Released	Approx. 4V

Is the inspection result normal?

YES >> GO TO 8.
NO >> GO TO 3.

3.CHECK ASCD STEERING SWITCH GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect combination switch harness connector.
3. Disconnect ECM harness connector.
4. Check the continuity between combination switch (spiral cable) and ECM harness connector.

Combination switch (spiral cable)		ECM		Continuity
Connector	Terminal	Connector	Terminal	
—	15	E60	111	Existed

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

- Harness connectors M77, E105
- Combination switch (spiral cable)
- Harness for open or short between ECM and combination switch

>> Repair open circuit or 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 (spiral cable) and ECM harness connector.

Combination switch (spiral cable)		ECM		Continuity
Connector	Terminal	Connector	Terminal	
—	14	E60	110	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

- Harness connectors M77, E105
- Combination switch (spiral cable)
- Harness for open or short between ECM and combination switch

>> Repair open circuit or short to ground or short to power in harness or connectors.

7.CHECK ASCD STEERING SWITCH

Refer to ECR-199, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 8.
NO >> Replace ASCD steering switch.

8.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001348515

1.CHECK ASCD STEERING SWITCH

1. Disconnect combination switch (spiral cable) harness connector M352.

2. Check the continuity between combination switch harness connector terminals under following conditions.

Combination meter		Condition	Resistance
Connector	Terminals		
M352	14 and 15 (Combination switch)	MAIN switch: Pressed	Approx. 0 Ω
		CANCEL switch: Pressed	Approx. 250 Ω
		SET/COAST switch: Pressed	Approx. 660 Ω
		RESUME/ACCELERATE switch: Pressed	Approx. 1,480 Ω
		All ASCD steering switches: Released	Approx. 4,000 Ω

Is the inspection result normal?

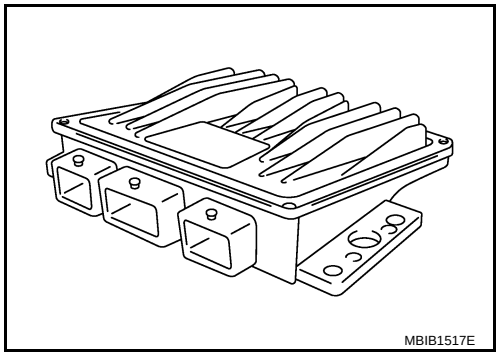
YES >> INSPECTION END
NO >> Replace ASCD steering switch

P0606 ECM

Description

INFOID:0000000001307532

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.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DTC Logic

INFOID:0000000001505777

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0606	Engine control module	ECM calculation function is malfunctioning.	• ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-201, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001505785

1.INSPECTION START

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.
4. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-201, "DTC Logic".

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.
3. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-201, "DTC Logic".

Is the 1st trip DTC P0606 displayed again?

YES >> GO TO 2.
NO >> INSPECTION END

2.REPLACE ECM

1. Replace ECM.

2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

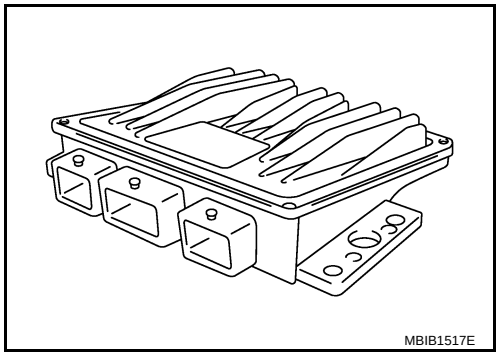
>> INSPECTION END

P060B ECM

Description

INFOID:0000000001518866

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.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DTC Logic

INFOID:0000000001518867

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P060B	Engine control module	ECM calculation function is malfunctioning.	• ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-203, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001518868

1.INSPECTION START

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.
4. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-203, "DTC Logic".

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.
3. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-203, "DTC Logic".

Is the 1st trip DTC P060B displayed again?

YES >> GO TO 2.
NO >> INSPECTION END

2.REPLACE ECM

1. Replace ECM.

2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> INSPECTION END

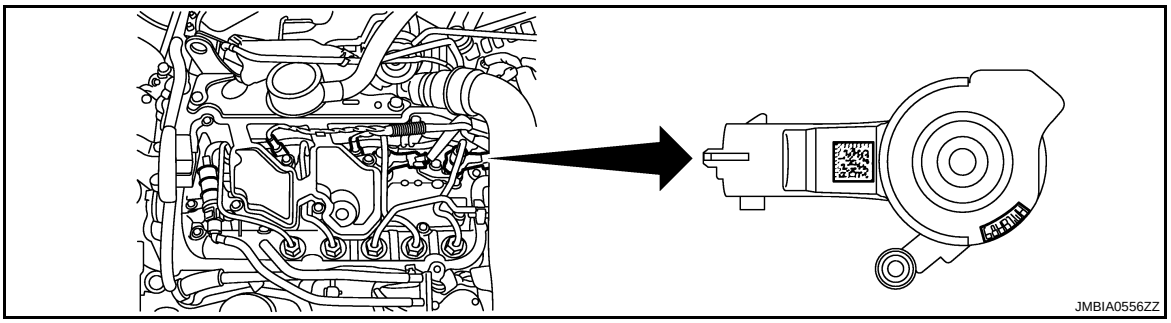
P0611 INJECTOR ADJUSTMENT VALUE

Description

INFOID:0000000001374942

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 a driveability may effect when there is a mismatch between the following two values.

- The injector adjustment value stored in ECM
- The injector adjustment value of the fuel injector which is installed on the vehicle



Example: Injector adjustment value = 68HBLWH

DTC Logic

INFOID:0000000001375027

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0611	Injector adjustment value data error	ECM detects at least one abnormal value of injector adjustment value.	• CONSULT-III communication status (The status of CONSULT-III communication becomes improper during Injector Adjustment Value Registration.) • ECM
	Injector adjustment value data uninput	At least one injector adjustment value is not stored in ECM.	• Injector adjustment value (Injector adjustment value has not been written onto ECM memory yet, or the value has been initialized.)

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-205, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001374945

1.PERFORM INJECTOR ADJUSTMENT VALUE REGISTRATION

Perform Injector Adjustment Value Registration. Refer to ECR-14, "INJECTOR ADJUSTMENT VALUE REGISTRATION : Special Repair Requirement".

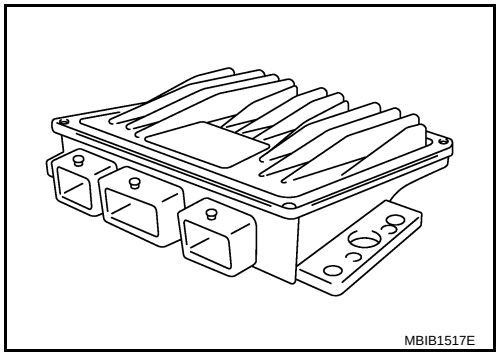
>> **INSPECTION END**

P062B ECM

Description

INFOID:0000000001367495

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.



DTC Logic

INFOID:0000000001569665

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P062B	Engine control module	ECM calculation function is malfunctioning.	• ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-207, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001569667

1.INSPECTION START

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.
4. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-207, "DTC Logic".

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.
3. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-207, "DTC Logic".

Is the 1st trip DTC P0606 displayed again?

YES >> GO TO 2.
NO >> INSPECTION END

2.REPLACE ECM

1. Replace ECM.

2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

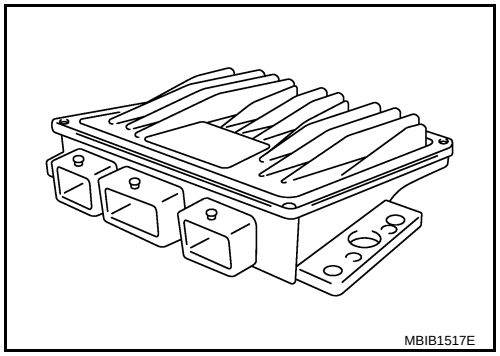
>> INSPECTION END

P062F ECM

Description

INFOID:0000000001367498

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.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DTC Logic

INFOID:0000000001367499

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P062F	ECM	ECM EEPROM system is malfunctioning.	• ECM

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-209, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Turn ignition switch ON and wait at least 10 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-209, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001569668

1.INSPECTION START

With CONSULT-III

1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.
4. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-209, "DTC Logic".

With GST

1. Turn ignition switch ON.
2. Select Service $04 with GST.

3. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-209, "DTC Logic".

Is the 1st trip DTC P0606 displayed again?

YES >> GO TO 2.
NO >> INSPECTION END

2.REPLACE ECM

1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> INSPECTION END

P0641 SENSOR POWER SUPPLY

DTC Logic

INFOID:0000000001348516

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0641	Sensor power supply circuit low	ECM detects a voltage of power source for sensor is excessively low.	• Harness or connectors (The APP sensor 1 power supply circuit is shorted.) (Turbocharger boost sensor circuit is shorted.) (Exhaust gas pressure sensor circuit is shorted.) • Accelerator pedal position sensor (APP sensor 1) • Turbocharger boost sensor • Exhaust gas pressure sensor
	Sensor power supply circuit high	ECM detects a voltage of power source for sensor is excessively high.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-211, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001348517

1.CHECK GROUND CONNECTION

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

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
Connector	Terminal		
E110	4	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK SENSOR POWER SUPPLY CIRCUITS

Check harness for short to power and short to ground, between the following terminals.

ECM		Sensor		
Connector	Terminal	Name	Connector	Terminal
E60	122	Accelerator pedal position sensor	E110	4
F85	25	Exhaust gas pressure sensor	F81	1
	21	Turbocharger boost sensor	F84	3

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair short to ground or short to power in harness or connectors.

4. CHECK APP SENSOR

Refer to ECR-160, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace APP sensor.

5. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

6. REPLACE TUBOCHARGER BOOST SENSOR

Replace turbocharger boost sensor.

>> GO TO 7.

7. PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-211, "DTC Logic".

Is 1st trip DTC P0641 displayed again?

YES >> GO TO 8.
NO >> **INSPECTION END**

8. REPLACE EXHAUST GAS PRESSURE SENSOR

Replace exhaust gas pressure sensor.

>> GO TO 9.

9. PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-211, "DTC Logic".

Is 1st trip DTC P0641 displayed again?

YES >> GO TO 10.
NO >> **INSPECTION END**

10. REPLACE ECM

1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> **INSPECTION END**

P0651 SENSOR POWER SUPPLY

DTC Logic

INFOID:0000000001351304

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0651	Sensor power supply circuit low	ECM detects a voltage of power source for sensor is excessively low.	• Harness or connectors (The APP sensor 2 power supply circuit is shorted.) (Differential exhaust pressure sensor circuit is shorted.) (EGR volume control valve control position sensor circuit is shorted.) (Throttle position sensor circuit is shorted.) (Refrigerant pressure sensor circuit is shorted.) • Accelerator pedal position sensor (APP sensor 2) • Exhaust differential pressure sensor • EGR volume control valve control position sensor • Throttle position sensor • Refrigerant pressure sensor
	Sensor power supply circuit high	ECM detects a voltage of power source for sensor is excessively high.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-213, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001351305

1.CHECK GROUND CONNECTION

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ACCELERATOR PEDAL POSITION SENSOR 2 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
Connector	Terminal		
E110	5	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK SENSOR POWER SUPPLY CIRCUITS

Check harness for short to power and short to ground between the following terminals.

ECM		Sensor		
Connector	Terminal	Name	Connector	Terminal
E60	118	APP sensor	E110	5
F68	75	Throttle position sensor	F86	3
F85	37	Exhaust differential pressure sensor	F88	3
	33	EGR volume control valve (EGR volume control valve control position sensor)	F99	4
	41	Refrigerant pressure sensor	F49	3

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair short to ground or short to power in harness or connectors.

4.CHECK COMPONENTS

Check the following.
- Throttle position sensor (Refer to ECR-134, "Diagnosis Procedure".)
- EGR volume control valve (EGR volume control valve control position sensor) (Refer to ECR-175, "Diagnosis Procedure".)

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace malfunctioning component.

5.CHECK APP SENSOR

Refer to ECR-160, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace APP sensor.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

7.REPLACE DIFFERENTIAL EXHAUST PRESSURE SENSOR

Replace differential exhaust pressure sensor.

>> GO TO 8.

8.PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-213, "DTC Logic".

Is 1st trip DTC P0651 displayed again?

YES >> GO TO 9.
NO >> **INSPECTION END**

9.REPLACE REFRIGERANT PRESSURE SENSOR

Replace refrigerant pressure sensor.

>> GO TO 10.

10.PERFORM DTC CONFIRMATION PROCEDURE

Perform DTC CONFIRMATION PROCEDURE again. Refer to ECR-213, "DTC Logic".

Is 1st trip DTC P0651 displayed again?

YES >> GO TO 11.
NO >> **INSPECTION END**

11. REPLACE ECM

1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> **INSPECTION END**

P0670 GLOW CONTROL SYSTEM

DTC Logic

INFOID:0000000001507063

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0670	Glow control unit circuit	ECM detects short circuit in output signal circuit.	• Harness or connectors (Glow control unit circuit is open or shorted.) • Glow control unit
		ECM detects open circuit in output signal circuit.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-216, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE

With CONSULT-III

1. Select “DATA MONITOR” mode with CONSULT-III.
2. Check the “ENG COOLAN TEMP” indication.
   If indication is below 50 °C (122 °F), go to the next step.
   If indication is above 50 °C (122 °F), cool down engine and then go to the next step.
3. Wait at least 10 seconds.
4. Check 1st trip DTC.

With GST

Follow the procedure “With CONSULT-III” above.

Is 1st trip DTC detected?

YES >> Go to ECR-216, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001351342

1.CHECK GLOW CONTROL UNIT POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect glow control unit harness connector.
3. Turn ignition switch ON.
4. Check the voltage between glow control unit harness connector and ground.

Glow control unit		Ground	Voltage
Connector	Terminal		
F94	4	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- 60A fusible link (letter N)
- Harness for open and short between glow control unit and battery

>> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK GLOW CONTROL UNIT GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between glow control unit harness connector and ECM harness connector.

Glow control unit		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F94	5	F85	9	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 or short to ground or short to power in harness or connectors.

4.CHECK GLOW CONTROL UNIT OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between glow control unit harness connector and ECM harness connector.

Glow control unit		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F94	8	F68	63	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 or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace glow control unit.
NO >> Repair or replace.

Component Inspection

INFOID:0000000001571444

1.CHECK GLOW PLUG

1. Turn ignition switch OFF.
2. Disconnect glow plug harness connector.
3. Check resistance between glow plug terminals as follows.

Terminal	Resistance
1 and engine ground	0.1 - 1.0 Ω [at 20°C (68°F)]

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace malfunctioning glow plug.

P0685 ECM RELAY

DTC Logic

INFOID:0000000001507069

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0685	ECM relay circuit low input	An excessively low voltage from the relay is sent to ECM.	• Harness or connectors (ECM relay circuit is open or shorted.) • ECM relay (IPDM E/R)
	ECM relay circuit high input	An excessively high voltage from the relay is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-218, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307540

1.CHECK ECM POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the voltage between ECM harness connector and ground.

ECM		Ground	Voltage
Connector	Terminal		
F68	62	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 4.

2.CHECK ECM POWER SUPPLY CIRCUIT-II

1. Disconnect ECM harness connector.
2. Disconnect IPDM E/R harness connector E15.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

ECM		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
F68	93	E15	48	Existed
	94		47	

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness or connectors E7, E121
- Harness for open or short between ECM and IPDM E/R

>> Repair open circuit or short to ground or short to power in harness or connectors.

4.CHECK ECM POWER SUPPLY CIRCUIT-III

1. Disconnect ECM harness connector.
2. Disconnect IPDM E/R harness connector E15.
3. Check the continuity between ECM harness connector and IPDM E/R harness connector.

ECM		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
F68	62	E15	51	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 or short to ground or short power in harness or connectors.

5.CHECK 20A FUSE

1. Disconnect 20A fuse (No. 62) from IPDM E/R.
2. Check 20A fuse.

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace 20A fuse.

6.CHECK GROUND CONNECTION

Check ground connection E17. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace ground connection.

7.CHECK ECM GROUND CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between ECM harness connector and ground.

ECM		Ground	Continuity
Connector	Terminal		
E60	123	Ground	Existed
	124		
	125		
	128		

2. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair open circuit or short power in harness or connectors.

8.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace IPDM E/R.
NO >> Repair or replace.

P0697 SENSOR POWER SUPPLY

DTC Logic

INFOID:0000000001307535

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P0697	Sensor power supply circuit low	ECM detects a voltage of power source for sensor is excessively low.	• Harness or connectors (Fuel rail pressure sensor circuit is shorted.) • Fuel rail pressure sensor
	Sensor power supply circuit high	ECM detects a voltage of power source for sensor is excessively high.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-220, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307536

1.CHECK GROUND CONNECTION

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK FUEL RAIL PRESSURE SENSOR POWER SUPPLY CIRCUIT-I

1. Disconnect fuel rail pressure sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between fuel rail pressure sensor harness connector and ground.

Fuel rail pressure sensor		Ground	Voltage
Connector	Terminal		
F102	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3.CHECK FUEL RAIL PRESSURE SENSOR POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connectors.
3. Check harness for short to power and short to ground between fuel rail pressure sensor harness connector and ECM harness connector.

ECM		Sensor		
Connector	Terminal	Name	Connector	Terminal
F85	29	Fuel rail pressure sensor	F102	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 FUEL RAIL PRESSURE SENSOR

Refer to ECR-151, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace fuel rail pressure sensor.

5. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

P1201, P1202, P1203, P1204 FUEL INJECTOR

Description

INFOID:0000000001532253

The fuel injector is a small, precise solenoid valve. When the ECM supplies a ground to the fuel injector circuit, the coil in the fuel injector is energized. The energized coil pulls the needle valve back and allows fuel to flow through the fuel injector into the cylinder. The amount of fuel injected depends upon the injection pulse duration. Pulse duration is the length of time the fuel injector remains open. The ECM controls the injection pulse duration based on engine fuel needs.

DTC Logic

INFOID:0000000001375017

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P1201	Fuel injector No. 1 performance	Fuel injector No. 1 does not operate properly.	• Harness or connectors (The fuel injector circuit is open or shorted.) • Fuel injector
P1202	Fuel injector No. 2 performance	Fuel injector No. 2 does not operate properly.	
P1203	Fuel injector No. 3 performance	Fuel injector No. 3 does not operate properly.	
P1204	Fuel injector No. 4 performance	Fuel injector No. 4 does not operate properly.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 1 minutes.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-222, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001375018

1.CHECK FUEL INJECTOR POWER SUPPLY CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Disconnect fuel injector harness connector.
4. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	1	F85	6	Existed
2	F71	1	F85	7	
3	F72	1	F85	8	
4	F73	1	F85	5	

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

2.CHECK FUEL INJECTOR OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	2	F85	2	Existed
2	F71	2	F85	3	
3	F72	2	F85	4	
4	F73	2	F85	1	

2. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK FUEL INJECTOR

Refer to ECR-223, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace fuel injector.

4.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001559840

1.CHECK FUEL INJECTOR

1. Turn ignition switch OFF.
2. Disconnect fuel injector harness connector.
3. Check resistance between fuel injector terminals as follows.

Terminals	Resistance
1 and 2	178.2 - 181.8Ω

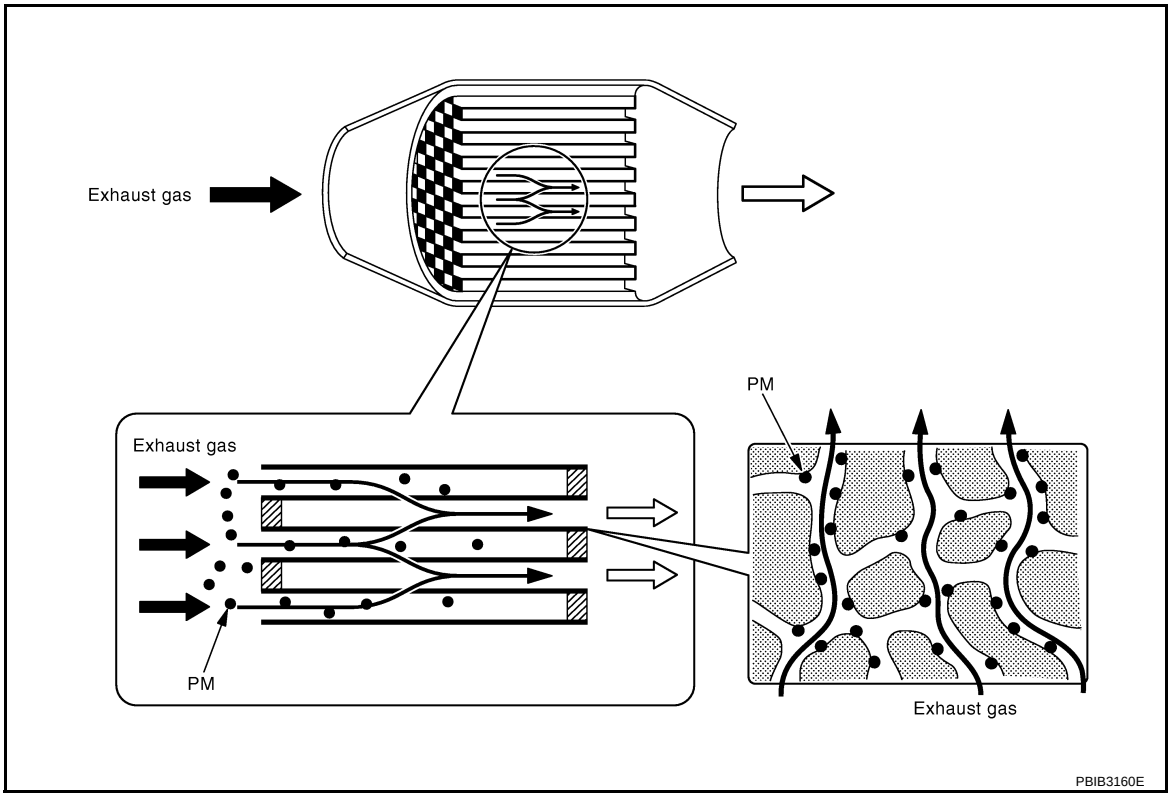
Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace malfunctioning fuel injector.

P1435 DPF REGENERATION

Description

INFOID:0000000001528585



DPF (Diesel Particulate Filter) is placed after oxidation catalyst and traps PM (Particulate Matter) in exhaust gas. DPF is formed in a honeycomb form made of ceramic. This structure facilitates to trap particulate matter. When the amount of particulate matter in the DPF reaches the specified level, the particulate matter needs to be reduced through burning to maintain the DPF function. This reducing of particulate matter is called Regeneration and should be performed periodically. DPF can be effective for a long time through the cycle of trapping particulate matter and regeneration.

DTC Logic

INFOID:0000000001528586

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P1435	Diesel particulate filter (DPF) regeneration performance	DPF regeneration failed many times.	DPF

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-225, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001528587

1.CHECK DPF

Refer to ECR-232, "Component Inspection".

OK or NG

OK >> **INSPECTION END**
NG >> GO TO 2.

2.REPLACE DPF

1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001528588

1.CHECK DPF-I

Check DPF for damage.

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK DPF-II

1. Perform “Service Regeneration”. Refer to ECR-17, "SERVICE REGENERATION : Special Repair Requirement".
2. Start engine and warm it up to normal operating temperature.
3. Connect CONSULT-III and select “DATA MONITOR” mode.
4. Select “DIFF EXH PRES” and check the indication under the following conditions.

Condition	DIFF EXH PRES [mbar]
• ENGINE SPEED·: 2000 tr/min • EXH GAS TEMP2: 150 - 200°C (302 - 392°F) • EXH GAS TEMP3: 150 - 200°C (302 - 392°F)	Less than 3.0

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.REPLACE DPF

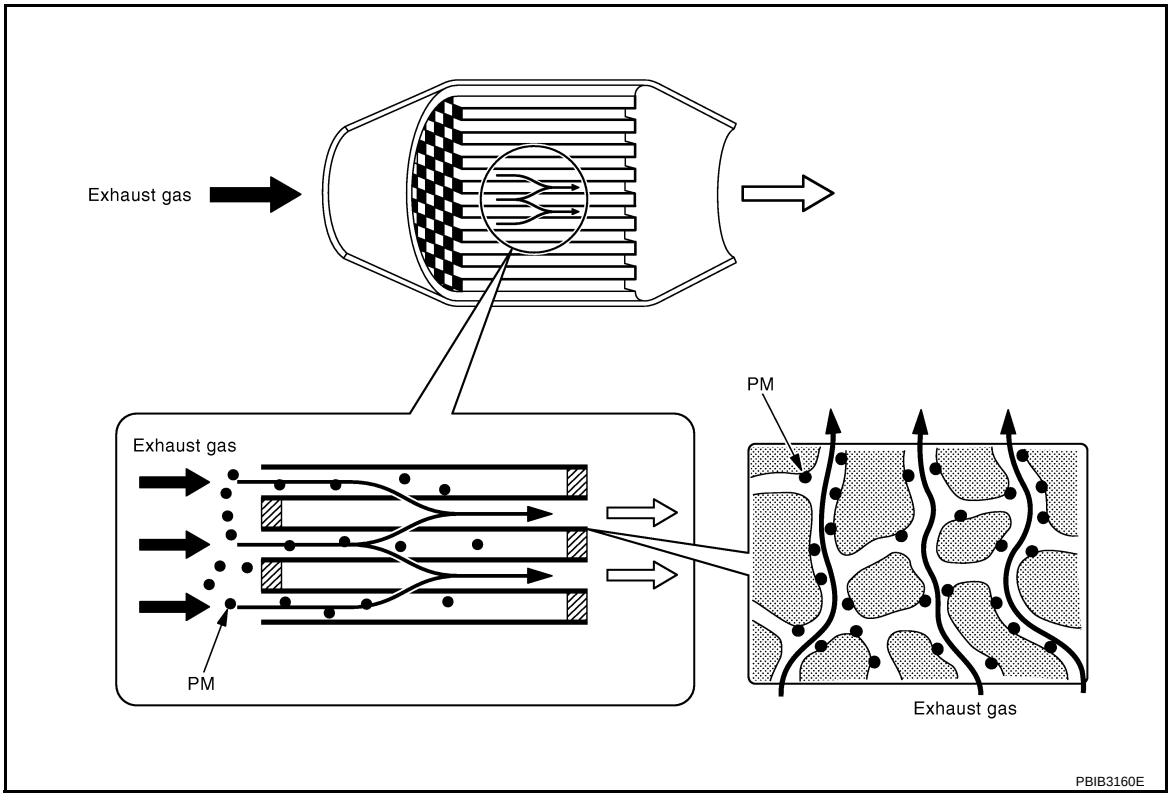
1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

>> INSPECTION END

P1436 DPF REGENERATION

Description

INFOID:0000000001528602



DPF (Diesel Particulate Filter) is placed after oxidation catalyst and traps PM (Particulate Matter) in exhaust gas. DPF is formed in a honeycomb form made of ceramic. This structure facilitates to trap particulate matter. When the amount of particulate matter in the DPF reaches the specified level, the particulate matter needs to be reduced through burning to maintain the DPF function. This reducing of particulate matter is called Regeneration and should be performed periodically. DPF can be effective for a long time through the cycle of trapping particulate matter and regeneration.

DTC Logic

INFOID:0000000001528603

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P1436	Diesel particulate filter (DPF) regeneration performance	DPF regeneration is not completed successfully.	DPF

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-227, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001528604

1.CHECK DPF

Refer to ECR-232, "Component Inspection".

OK or NG

OK >> **INSPECTION END**
NG >> GO TO 2.

2.REPLACE DPF

1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001559345

1.CHECK DPF-I

Check DPF for damage.

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK DPF-II

1. Perform “Service Regeneration”. Refer to ECR-17, "SERVICE REGENERATION : Special Repair Requirement".
2. Start engine and warm it up to normal operating temperature.
3. Connect CONSULT-III and select “DATA MONITOR” mode.
4. Select “DIFF EXH PRES” and check the indication under the following conditions.

Condition	DIFF EXH PRES [mbar]
• ENGINE SPEED·: 2000 tr/min • EXH GAS TEMP2: 150 - 200°C (302 - 392°F) • EXH GAS TEMP3: 150 - 200°C (302 - 392°F)	Less than 3.0

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.REPLACE DPF

1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

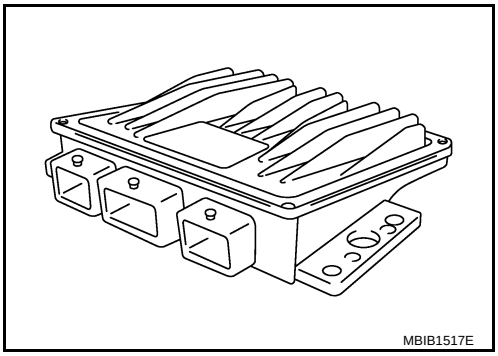
>> INSPECTION END

P1607 ECM

Description

INFOID:0000000001551263

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.



DTC Logic

INFOID:0000000001551264

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P1607	Engine control module	ECM function is malfunctioning.	• ECM

Diagnosis Procedure

INFOID:0000000001551265

1.INSPECTION START

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.
4. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-228, "DTC Logic".

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.
3. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-228, "DTC Logic".

Is the 1st trip DTC P0606 displayed again?

YES >> GO TO 2.
NO >> INSPECTION END

2.REPLACE ECM

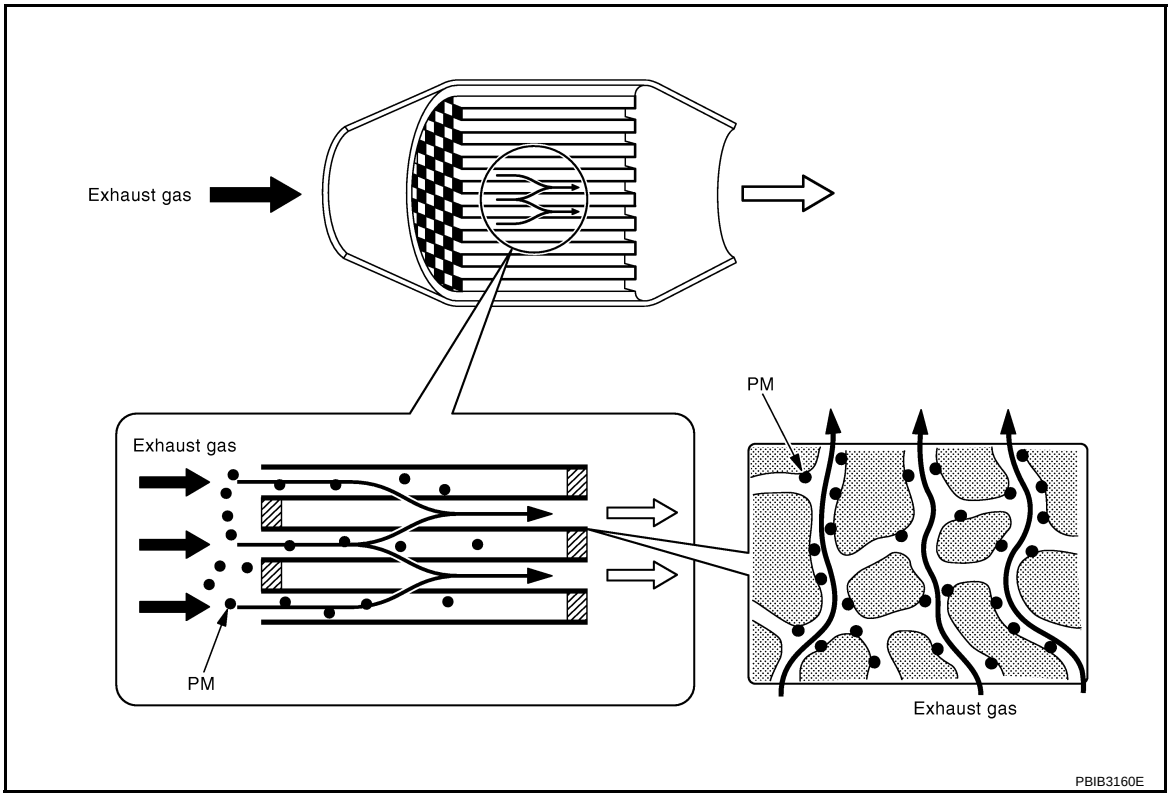
1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> INSPECTION END

P2002 DPF

Description

INFOID:0000000001375029



DPF (Diesel Particulate Filter) is placed after oxidation catalyst and traps PM (Particulate Matter) in exhaust gas. DPF is formed in a honeycomb form made of ceramic. This structure facilitates to trap particulate matter. When the amount of particulate matter in the DPF reaches the specified level, the particulate matter needs to be reduced through burning to maintain the DPF function. This reducing of particulate matter is called Regeneration and should be performed periodically. DPF can be effective for a long time through the cycle of trapping particulate matter and regeneration.

DTC Logic

INFOID:0000000001375028

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2002	Diesel particulate filter (DPF) efficiency below threshold	• Differential exhaust pressure exceeds a standard level for more than 10 seconds. • Exhaust gas temperature does not raise during DPF regeneration.	• DPF • Exhaust gas temperature sensor 2 • Exhaust gas temperature sensor 3

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 5 minutes.
2. Drive vehicle under the following conditions for at least 2 minutes.

- Gear position: 3rd position

- Engine speed: About 3,000 rpm

3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-187, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001374949

1.CHECK EXHAUST GAS TEMPERATURE SENSOR 2

Refer to ECR-232, "Component Inspection".

OK or NG

OK >> GO TO 2.
NG >> Replace exhaust gas temperature sensor 2.

2.CHECK EXHAUST GAS TEMPERATURE SENSOR 3

Refer to ECR-266, "Component Inspection".

OK or NG

OK >> GO TO 3.
NG >> Replace exhaust gas temperature sensor 3.

3.CHECK DPF

Refer to ECR-230, "Component Inspection".

OK or NG

OK >> **INSPECTION END**
NG >> Replace DPF.

Component Inspection

INFOID:0000000001559367

1.CHECK DPF-I

Check DPF for damage.

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK DPF-II

1. Perform “Service Regeneration”. Refer to ECR-17, "SERVICE REGENERATION : Special Repair Requirement".
2. Start engine and warm it up to normal operating temperature.
3. Connect CONSULT-III and select “DATA MONITOR” mode.
4. Select “DIFF EXH PRES” and check the indication under the following conditions.

Condition	DIFF EXH PRES [mbar]
• ENGINE SPEED·: 2000 tr/min • EXH GAS TEMP2: 150 - 200°C (302 - 392°F) • EXH GAS TEMP3: 150 - 200°C (302 - 392°F)	Less than 3.0

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.REPLACE DPF

1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

>> INSPECTION END

P2031 EGT SENSOR 2

Description

INFOID:0000000001374952

Exhaust gas temperature sensor 2 is installed before DPF and senses exhaust gas temperature. Exhaust gas temperature sensor 2 uses a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

<Reference data>

Exhaust gas temperature °C (°F)	Resistance kΩ
50 (122)	106.18
100 (212)	33.56
350 (662)	1.587 - 1.848
500 (932)	0.640 - 0.709
700 (1292)	0.277 - 0.297
900 (1652)	0.155

DTC Logic

INFOID:0000000001507171

DTC DETECTION LOGIC

If DTC P2031 is displayed with DTC P0115, first perform the trouble diagnosis for DTC P0115. Refer to ECR-132, "DTC Logic".

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2031	Exhaust gas temperature sensor 2 circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Exhaust gas temperature sensor 2 circuit is open or shorted.) • Exhaust gas temperature sensor 2
	Exhaust gas temperature sensor 2 circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-232, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Start engine and drive vehicle under the following conditions for at least 10 seconds.
- Gear position: 3rd position
- Vehicle speed: Accelerates from 55km/h (34 MPH) to 70 km/h (43 MPH)
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-232, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001374956

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EXHAUST GAS TEMPERATURE SENSOR 2 POWER SUPPLY CIRCUIT

1. Disconnect exhaust gas temperature sensor 2 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between exhaust gas temperature sensor 2 harness connector and ground.

Exhaust gas temperature sensor 2		Ground	Voltage
Connector	Terminal		
F89	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between exhaust gas temperature sensor 2 harness connector and ECM harness connector.

Exhaust gas temperature sensor 2		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F89	2	F85	39	Existed

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 or short to ground or short to power in harness or connectors.

4.CHECK EXHAUST GAS TEMPERATURE SENSOR 2

Refer to ECR-232, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace exhaust gas temperature sensor 2.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001374957

1.CHECK EXHAUST GAS TEMPERATURE SENSOR 2

With CONSULT-III

1. Turn ignition switch ON and select “EXH GAS TEMP2” in “DATA MONITOR” mode with CONSULT-III..
2. Start engine and keep engine speed at 3,000 rpm for at least 1 minute.
3. Check “EXH GAS TEMP2” indication.

Monitor item	Indication
EXH GAS TEMP2	60 - 950 °C (°F)

With GST

Follow the procedure “With CONSULT-III” above.

Is the inspection result normal?

YES >> **INSPECTION END**

NO >> Replace exhaust gas temperature sensor 2.

P2080 EGT SENSOR 1

Description

INFOID:0000000001375020

The exhaust gas temperature sensor 1 is used to detect the exhaust gas temperature before turbocharger. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the exhaust gas 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.

DTC Logic

INFOID:0000000001375031

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2080	Exhaust gas temperature sensor 1 performance	Exhaust gas temperature detected by exhaust gas temperature sensor 1 is too much higher than the threshold.	Exhaust gas temperature sensor 1

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and drive vehicle under the following conditions for at least 10 seconds.
- Gear position: 3rd position
- Vehicle speed: Accelerates from 55km/h (34 MPH) to 70 km/h (43 MPH)
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-234, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001375021

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK EXHAUST GAS TEMPERATURE SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect exhaust gas temperature sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between exhaust gas temperature sensor 1 harness connector and ground.

Exhaust gas temperature sensor 1		Ground	Voltage
Connector	Terminal		
F101	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK EXHAUST GAS TEMPERATURE SENSOR 1 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between exhaust gas temperature sensor 1 harness connector and ECM harness connector.

Exhaust gas temperature sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F101	2	F85	10	Existed

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 or short to ground or short to power in harness or connectors.

4. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace exhaust gas temperature sensor 1.
NO >> Repair or replace.

P2100 ELECTRIC THROTTLE CONTROL FUNCTION

Description

INFOID:0000000001367501

Throttle control motor is operated by ECM and it opens throttle valve. Throttle valve is fully opened when regeneration is not performed and engine is running. Based on the signal from throttle position sensor, ECM judges whether throttle control actuator operates throttle valve properly or not.

DTC Logic

INFOID:0000000001367502

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2100	Electric throttle control function	Electric throttle control function does not operate properly.	• Harness or connectors (Throttle control motor circuit is open or shorted) • Electric throttle control actuator

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-236, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Turn ignition switch ON and wait at least 10 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-236, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001367503

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR CIRCUIT

1. Disconnect electric throttle control actuator harness connector.
2. Disconnect ECM harness connectors.
3. Check the continuity between the following terminals.

Electric throttle control actuator		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F86	4	F68	91	Existed
			92	Not existed
	5		91	Not existed
			92	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 or short to ground or short to power in harness or connectors.

3.CHECK THROTRTLE CONTROL MOTOR

Perform ECR-237, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Replace electric throttle control actuator.

4.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

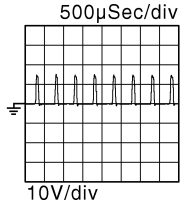
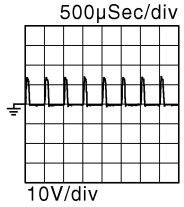
>> Repair open circuit or short to ground or short to power in harness or connectors.

Component Inspection

INFOID:0000000001367504

1.CHECK ELECTRIC THROTTLE CONTROL MOTOR

1. Reconnect all harness connectors disconnected.
2. Check the voltage between ECM harness connectors terminals under the following conditions.

(+)		(–)		Condition	Voltage
Connector	Terminal	Connector	Terminal		
F68	91 (Throttle control motor)	E60	128 (ECM ground)	**[Engine is running]** • **Warm-up condition** • Idle speed	0 - 2 V★ 500μSec/div  10V/div JMBIA0547GB
				[Ignition switch: OFF] • For 20 seconds after turning ignition switch OFF	0 - 2 V★ 500μSec/div  10V/div JMBIA0548GB
				[Ignition switch: OFF] • More than 20 seconds after turning ignition switch OFF	0.1 V
	92 (Throttle control motor)			**[Engine is running]** • **Warm-up condition** • Idle speed	0 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

1. Replace electric throttle control actuator.
2. Perform ECR-238, "Special Repair Requirement".

>> INSPECTION END

Special Repair Requirement

INFOID:0000000001367505

1.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR

Refer to ECR-16, "THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement"

>> GO TO 2.

2.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Refer to ECR-16, "THROTTLE VALVE CLOSED POSITION LEARNING : Special Repair Requirement"

>> END

P2101 ELECTRIC THROTTLE CONTROL FUNCTION

Description

INFOID:0000000001348521

Electric throttle cotnrol actuator consists of the following two components, throttle control motor with gear which operates throttle valve, throttle position sensor which detects throttle position sensor. Throttle valve is fully opened when regereration is not performed and engine is running. The valve is closed to perform regeneration and to perform smooth engine stop when the ignition switch is turned OFF. Throttle position sensor detects the opening angle of throttle valve and converts the angle into a voltage signal. Based on the signal, ECM judges whether throttle control actuator operates throttle valve properly or not.

DTC Logic

INFOID:0000000001348522

DTC DETECTION LOGIC

NOTE:
If DTC P2101 is displayed with DTC P0606, first perform the trouble diagnosis for DTC P0606. Refer to ECR-201, "DTC Logic".

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2101	Electric throttle control actuator performance	Electric throttle control actuator does not functions properly.	• Harness or connectors (Electric throttle control actuator circuit is open or shorted.) • Electric throttle control actuator

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-239, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001348523

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR CIRCUIT-I

1. Disconnect electric throttle control actuator harness connector.
2. Disconnect ECM harness connectors.
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	
F86	1	F68	85	Existed
	3		75	
	6		83	

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 or short to ground or short to power in harness or connectors.

3.CHECK ELECTRIC THROTTLE CONTROL ACTUATOR CIRCUIT-II

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	
F86	4	F68	91	Existed
	5		92	

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 or short to ground or short to power in harness or connectors.

4.CHECK THROTRTLE CONTROL MOTOR

Perform ECR-240, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace electric throttle control actuator.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

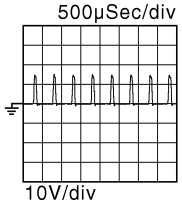
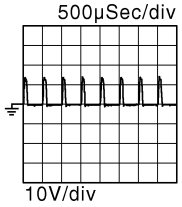
>> Repair open circuit or short to ground or short to power in harness or connectors.

Component Inspection

INFOID:0000000001569782

1.CHECK ELECTRIC THROTTLE CONTROL MOTOR

1. Reconnect all harness connectors disconnected.
2. Check the voltage between ECM harness connectors terminals under the following conditions.

(+)		(–)		Condition	Voltage
Connector	Terminal	Connector	Terminal		
F68	91 (Throttle control motor)	E60	128 (ECM ground)	**[Engine is running]** • **Warm-up condition** • Idle speed	0 - 2 V★ 500μSec/div  10V/div JMBIA0547GB
				[Ignition switch: OFF] • For 20 seconds after turning ignition switch OFF	0 - 2 V★ 500μSec/div  10V/div JMBIA0548GB
				[Ignition switch: OFF] • More than 20 seconds after turning ignition switch OFF	0.1 V
	92 (Throttle control motor)			**[Engine is running]** • **Warm-up condition** • Idle speed	0 V

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.REPLACE ELECTRIC THROTTLE CONTROL ACTUATOR

1. Replace electric throttle control actuator.
2. Perform ECR-241, "Special Repair Requirement".

>> INSPECTION END

Special Repair Requirement

INFOID:0000000001569783

1.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR

Refer to ECR-16, "THROTTLE VALVE CLOSED POSITION LEARNING VALUE CLEAR : Special Repair Requirement"

>> GO TO 2.

2.PERFORM THROTTLE VALVE CLOSED POSITION LEARNING

Refer to ECR-16, "THROTTLE VALVE CLOSED POSITION LEARNING : Special Repair Requirement"

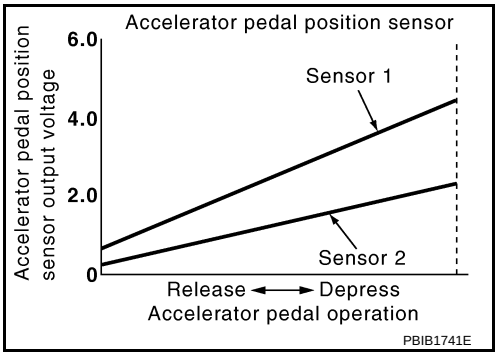
>> END

P2120 APP SENSOR

Description

INFOID:0000000001307553

The accelerator pedal position sensor is installed on the upper end of the accelerator pedal assembly. The sensors detect the accelerator pedal position and sends a signal to the ECM. The ECM uses the signal to determine the amount of fuel to be injected.



DTC Logic

INFOID:0000000001307554

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2120	Accelerator pedal position sensor 2 circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Accelerator pedal position sensor circuit is open or shorted.) • Accelerator pedal position sensor (APP sensor 1 and 2)
	Accelerator pedal position sensor 2 circuit high input	An excessively high voltage from the sensor is sent to ECM.	
	Accelerator pedal position sensor 1, 2 signal correlation	The correlation between APP sensor 1 signal and APP sensor 2 signal is out of the normal range.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-242, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Depress accelerator pedal slowly spending 5 seconds, and then release it slowly spending 5 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-242, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307555

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK ACCELERATOR PEDAL POSITION SENSOR 2 POWER SUPPLY CIRCUIT

1. Disconnect accelerator pedal position sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between accelerator pedal position sensor connector and ground.

Accelerator pedal position sensor		Ground	Voltage
Connector	Terminal		
E110	5	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK ACCELERATOR PEDAL POSITION SENSOR 2 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connectors.
3. Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E110	1	E60	120	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 or short to ground or short to power in harness or connectors.

4.CHECK ACCELERATOR PEDAL POSITION SENSOR 2 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E110	6	E60	119	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 or short to ground or short to power in harness or connectors.

5.CHECK ACCELERATOR PEDAL POSITION SENSOR

Refer to ECR-244, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Replace accelerator pedal position sensor.

6.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001569818

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 between ECM harness connector terminals as follows.

ECM		ECM		Condition		Voltage
Connector	Terminal	Connector	Terminal			
E60	126 (APP sensor 1)	E60	127 (Sensor ground)	Accelerator pedal	Fully released	0.6 - 4.6 V
					Fully depressed	Less than 5 V
	119 (APP sensor 2)		120 (Sensor ground)		Fully released	More than 0.3 V
					Fully depressed	Less than 2.5 V

Is the inspection result normal?

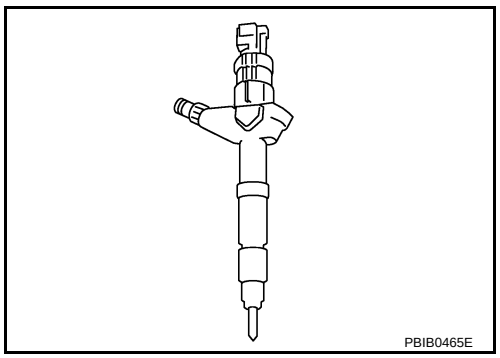
YES >> INSPECTION END
NO >> Replace accelerator pedal assembly.

P2146, P2149 FUEL INJECTOR POWER SUPPLY

Component Description

INFOID:0000000001374974

The fuel injector is a small, precise solenoid valve. When the ECM supplies a ground to the fuel injector circuit, the coil in the fuel injector is energized. The energized coil pulls the needle valve back and allows fuel to flow through the fuel injector into the cylinder. The amount of fuel injected depends upon the injection pulse duration. Pulse duration is the length of time the fuel injector remains open. The ECM controls the injection pulse duration based on engine fuel needs.



DTC Logic

INFOID:0000000001375032

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2146	No. 1 and 4 cylinder fuel injector power supply circuit open	An improper voltage signal is sent to ECM through No. 1 and 4 cylinder fuel injector.	• Harness or connectors (The fuel injector circuit is open.)
P2149	No. 2 and 3 cylinder fuel injector power supply circuit open	An improper voltage signal is sent to ECM through No. 2 and 3 cylinder fuel injector.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-245, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001374979

1.CHECK FUEL INJECTOR POWER SUPPLY CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Disconnect fuel injector harness connector.
4. Check the continuity between fuel injector harness connector and ECM harness connector.

Fuel injector			ECM		Continuity
Cylinder	Connector	Terminal	Connector	Terminal	
1	F70	1	F85	6	Existed
2	F71	1	F85	7	
3	F72	1	F85	8	
4	F73	1	F85	5	

5. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

2.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

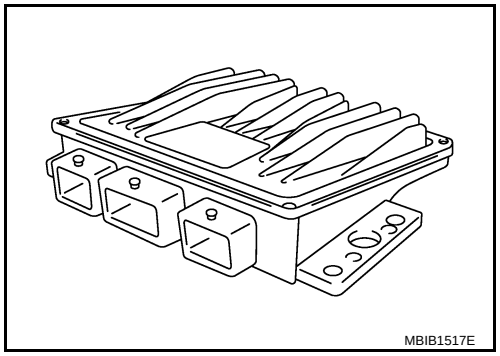
>> INSPECTION END

P2226 BARO SENSOR

Description

INFOID:0000000001307557

The barometric pressure sensor is built into ECM. The sensor detects ambient barometric pressure and sends the voltage signal to the microcomputer.



DTC Logic

INFOID:0000000001521393

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2226	Barometric pressure sensor circuit	An excessively low voltage from the barometric pressure sensor (built-into ECM) is sent to ECM.	• ECM
		An excessively high voltage from the barometric pressure sensor (built-into ECM) is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE FOR MALFUNCTION

1. Turn ignition switch ON.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-247, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001521394

1.INSPECTION START

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.
4. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-247, "DTC Logic".

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.
3. **Perform DTC CONFIRMATION PROCEDURE.**
   See ECR-247, "DTC Logic".

Is the 1st trip DTC P2226 displayed again?

YES >> GO TO 2.

NO >> INSPECTION END

2.REPLACE ECM

1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

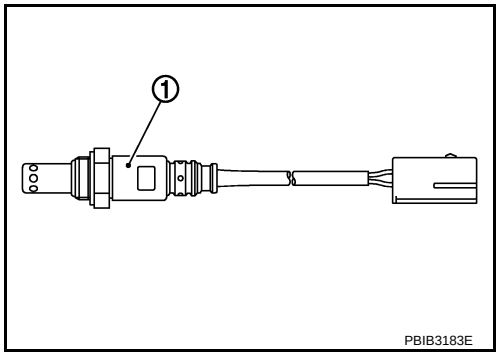
>> INSPECTION END

P2231 A/F SENSOR 1

Description

INFOID:0000000001551266

Air fuel ratio (A/F) sensor 1 (1) is installed on the upstream of the oxidation catalyst. A/F sensor 1 measures the oxygen level in the exhaust gas and converts it into a voltage signal. A/F sensor 1 sends the signal to ECM. Based on the signal from A/F sensor 1, ECM calculates the air fuel mixture ratio. ECM uses the calculated ratio for the DPF regeneration control.
A heater is integrated in A/F sensor 1 to ensure the required operating temperature.



DTC Logic

INFOID:0000000001551267

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P2231	Air fuel ratio (A/F) sensor 1 circuit	The A/F signal computed by ECM from the air fuel ratio sensor 1 signal is out of the specified range.	• Harness or connectors (The air fuel ratio sensor 1 circuit is shorted.) • Air fuel ratio sensor 1

Diagnosis Procedure

INFOID:0000000001551268

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F68	81	Existed
	2		78	
	5		82	
	6		77	

4. Check the continuity between A/F sensor 1 harness connector or ECM harness connector and ground.

A/F sensor 1		ECM		Ground	Continuity
Connector	Terminal	Connector	Terminal		
F91	1	F68	81	Ground	Not existed
	2		78		
	5		82		
	6		77		

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

>> **INSPECTION END**

P2263 TC SYSTEM

Description

INFOID:0000000001532254

The load from the turbocharger boost control solenoid valve controls the actuator. By changing the variable nozzle vane opening through the rods, the intake air volume is adjusted.
The turbocharger boost control solenoid valve is moved by ON/OFF pulse from the ECM. The longer the ON/OFF pulse from the ECM. The longer the ON pulse, the charge air pressure rises.

DTC Logic

INFOID:0000000001307560

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2263	Turbocharger boost control system performance	• ECM detects that turbocharger boost pressure is lower than the target value. • ECM detects that turbocharger boost pressure is higher than the target value.	• Harness or connectors (Turbocharger boost control solenoid valve circuit is open or shorted.) • Turbocharger boost control solenoid valve • Turbocharger boost sensor • Electric throttle control actuator • Intake air duct • Vacuum pump • Vacuum hose • Turbocharger

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and keep engine speed more than 3,000 rpm for at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-251, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

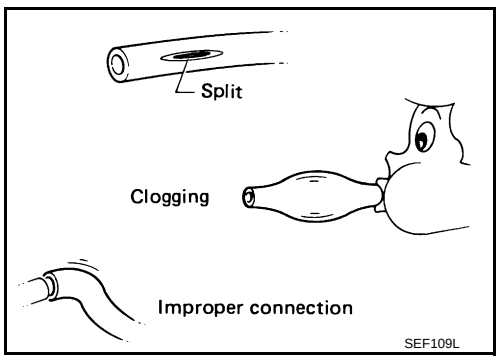
INFOID:0000000001307561

1.CECHECK VACUUM HOSES AND VACUUM GALLERY

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check vacuum hoses and vacuum gallery for clogging, cracks or improper connection. Refer to ECR-89, "System Description".

Is the inspection result normal?

Yes >> Repair or replace.
No >> GO TO 2.



2.CHECK AIR FILTER

Check that air filter is not obstructed.

Is the inspection result normal?

Yes >> Repair or replace.
No >> GO TO 3.

3.CHECK INTAKE AIR DUCT

Check that intake air duct is not obstructed.

Is the inspection result normal?

Yes >> Repair or replace.
No >> GO TO 4.

4.CHECK VACUUM PUMP

Check vacuum pump.

Is the inspection result normal?

Yes >> Repair or replace.
No >> GO TO 5.

5.CHECK TURBOCHARGER

Check turbocharger.

Is the inspection result normal?

Yes >> Repair or replace.
No >> GO TO 6.

6.CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Disconnect turbocharger boost control solenoid valve harness connector.
2. Turn ignition switch ON.
3. Check the voltage between turbocharger boost control solenoid valve harness connector and ground.

Turbocharger boost control solenoid valve		Ground	Voltage
Connector	Terminal		
E55	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

7.CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between turbocharger boost control solenoid valve harness connector and ECM harness connector.

Turbocharger boost control solenoid valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E55	2	F68	57	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 8.

8.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- Harness for open and short between turbocharger boost control solenoid valve and ECM

>> Repair open circuit or short to ground or short to power in harness or connectors.

9.CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE

Refer to ECR-253, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace turbocharger boost control solenoid valve.

10.CHECK THROTTLE CONTROL MOTOR

Refer to ECR-237, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Replace turbocharger boost sensor.

11.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace turbocharger boost sensor.
NO >> Repair or replace.

Component Inspection

INFOID:0000000001551475

1.CHECK TURBOCHARGER BOOST CONTROL SOLENOID VALVE

1. Turn ignition switch OFF.
2. Disconnect turbocharger boost control solenoid valve harness connector.
3. Check the resistance between turbocharger boost control solenoid valve terminals as follows.

Terminals	Resistance
1 and 2	16 - 24 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace turbocharger boost control solenoid valve.

P2293 FRP CONTROL SYSTEM

Description

INFOID:0000000001532255

Fuel rail pressure (FRP) sensor is installed on the fuel rail. It measures the fuel pressure in the fuel rail. The sensor sends voltage signal to the ECM. As the pressure increases, the voltage rises. The ECM controls the fuel pressure in the fuel rail by the inlet throttling device. The ECM uses the signal from fuel rail pressure sensor as a feedback signal.

DTC Logic

INFOID:0000000001538387

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2294	Fuel rail pressure control valve function	Fuel rail pressure is out of the target range.	• Harness or connectors (Fuel rail pressure control valve circuit is open or shorted.) • Fuel rail pressure control valve

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-254, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001538388

1.CHECK FUEL RAIL PRESSURE CONTROL VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect fuel rail pressure control valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between fuel rail pressure control valve harness connector and ground.

Fuel rail pressure control valve		Ground	Voltage
Connector	Terminal		
F93	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 connector E7, F121
- Harness for open or short between IPDM E/R and fuel rail pressure control valve
- Harness for open or short between ECM and fuel rail pressure control valve

>> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK FUEL RAIL PRESSURE CONTROL VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel rail pressure control valve harness connector and ECM harness connector.

Fuel rail pressure control valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F93	2	F68	90	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 or short to ground or short to power in harness or connectors.

4.CHECK FUEL RAIL PRESSURE CONTROL VALVE

Refer to ECR-255, "Component Inspection".

Is the inspection result normal?

Yes >> GO TO 5.
No >> Replace fuel rail pressure control valve.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001559568

1.CHECK FUEL RAIL PRESSURE CONTROL VALVE

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure control valve harness connector.
3. Check resistance between fuel rail pressure control valve terminals as follows.

Terminals	Resistance
1 and 2	2 - 6 Ω

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel rail pressure control valve.

P2294 FRP CONTROL VALVE

Description

INFOID:0000000001532256

Fuel rail pressure control valve controls fuel rail pressure based on fuel rail pressure sensor signal. When the fuel pressure in fuel rail increases to excessively high, ECM controls fuel rail pressure control valve to carry excess fuel to the return hose.

DTC Logic

INFOID:0000000001521443

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2294	Fuel rail pressure control valve circuit	An excessively low voltage from the control valve is sent to ECM.	• Harness or connectors (Fuel rail pressure control valve circuit is open or shorted.) • Fuel rail pressure control valve
		An excessively high voltage from the control valve is sent to ECM.	
		An improper voltage is sent to ECM through control valve.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-256, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001367494

1.CHECK FUEL RAIL PRESSURE CONTROL VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect fuel rail pressure control valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between fuel rail pressure control valve harness connector and ground.

Fuel rail pressure control valve		Ground	Voltage
Connector	Terminal		
F93	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 connector E7, F121
- Harness for open or short between IPDM E/R and fuel rail pressure control valve
- Harness for open or short between ECM and fuel rail pressure control valve

>> Repair open circuit or short to ground or short to power in harness or connectors.

3. CHECK FUEL RAIL PRESSURE CONTROL VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between fuel rail pressure control valve harness connector and ECM harness connector.

Fuel rail pressure control valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F93	2	F68	90	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 or short to ground or short to power in harness or connectors.

4. CHECK FUEL RAIL PRESSURE CONTROL VALVE

Refer to ECR-257, "Component Inspection".

Is the inspection result normal?

Yes >> GO TO 5.
No >> Replace fuel rail pressure control valve.

5. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001559816

1. CHECK FUEL RAIL PRESSURE CONTROL VALVE

1. Turn ignition switch OFF.
2. Disconnect fuel rail pressure control valve harness connector.
3. Check resistance between fuel rail pressure control valve terminals as follows.

Terminals	Resistance
1 and 2	0.002 - 1 kΩ

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace fuel rail pressure control valve.

P2299 ACCELERATOR/BRAKE PEDAL POSITION INCONSISTENCY

DTC Logic

INFOID:0000000001307562

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2299	Accelerator pedal/brake pedal position inconsistency	Accelerator pedal position sensor does not operate properly	• Harness or connectors (Accelerator pedal position sensor circuit is open or shorted.) (Brake pedal position switch circuit is open or shorted.) • Accelerator pedal position sensor (APP sensor 1 and 2) • Brake pedal position switch • Accelerator pedal installation
	Accelerator pedal position sensor circuit	No signal from accelerator pedal position sensor is sent to ECM	• Harness or connectors (Accelerator pedal position sensor circuit is open or shorted.) • Accelerator pedal position sensor (APP sensor 1 and 2)

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 30 seconds.
2. Keep engine speed at 2,000 rpm for at least 30 seconds.
3. Release accelerator pedal and apply service brake for at least 30 seconds.
4. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-258, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001307563

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK BRAKE PEDAL POSITION SWITCH CIRCUIT

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector terminals as follows.

(+)		(–)		Condition		Voltage
Connector	Terminal	Connector	Terminal			
E60	116	E60	128	Brake pedal	Fully released	Battery voltage
					Slightly depressed	0 V

Is the inspection result normal?

YES >> GO TO 3.

NO >> GO TO 8.

3. CHECK ACCELERATOR PEDAL POSITION SENSOR CIRCUIT

1. Check the voltage between ECM harness connector and ground.

(+)		(–)		Condition		Voltage
Connector	Terminal	Connector	terminal			
E60	119	E60	128	Accelerator pedal	Fully released	0.3 - 0.6 V
					Slightly depressed	1.95 - 2.4 V
	126				Fully released	0.6 - 0.9 V
					Slightly depressed	3.9 - 4.7 V

Is the inspection result normal?

YES >> GO TO 12.
NO >> GO TO 4.

4. CHECK ACCELERATOR PEDAL POSITION SENSOR POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect accelerator pedal position sensor harness connector.
3. Turn ignition switch ON.
4. Check the voltage between accelerator pedal position sensor harness connector and ground.

Accelerator pedal position sensor			Ground	Voltage
Sensor	Connector	Terminal		
1	E110	4	Ground	Approx. 5V
2		5		

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5. CHECK ACCELERATOR PEDAL POSITION SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor			ECM		Continuity
Sensor	Connector	Terminal	Connector	Terminal	
1	E110	2	E60	127	Existed
2		1		120	

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 or short to ground or short to power in harness or connectors.

6. CHECK ACCELERATOR PEDAL POSITION SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between accelerator pedal position sensor harness connector and ECM harness connector.

Accelerator pedal position sensor			ECM		Continuity
Sensor	Connector	Terminal	Connector	Terminal	
1	E110	3	E60	126	Existed
2		6		119	

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 or short to ground or short to power in harness or connectors.

7. CHECK ACCELERATOR PEDAL POSITION SENSOR

Refer to ECR-160, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace accelerator pedal position sensor.

8. CHECK BRAKE PEDAL POSITION SWITCH POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
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		
E112	1	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 10.
NO >> GO TO 9.

9. DETECT MALFUNCTIONING PART

Check the following.
- Harness connector E105, M77
- 10A fuse (No. 1)
- Harness for open or short between fuse and brake pedal position switch

>> Repair open circuit or short to ground or short to power in harness or connectors.

10. CHECK BRAKE PEDAL POSITION SWITCH INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
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	
E112	2	E60	116	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

11. CHECK BRAKE PEDAL POSITION SWITCH

Refer to ECR-197, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 12.
NO >> Replace brake pedal position switch.

12. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

P2425 EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE

Description

INFOID:0000000001532257

EGR cooler bypass valve control solenoid valve controls vacuum signal to the EGR cooler bypass valve control actuator. ERG amount is controlled by changing the EGR cooler bypass valve opening using the rod. EGR cooler bypass valve control solenoid valve is operated by ON/OFF signals (pulse signals) sent from ECM. The longer is the ON pulse duration, the larger becomes the bypass gas volume.

DTC Logic

INFOID:0000000001375039

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2425	EGR cooler bypass valve control solenoid valve circuit	An excessively low voltage from the solenoid valve is sent to ECM.	• Harness or connectors (EGR cooler bypass valve control solenoid valve circuit is open or shorted.) • EGR cooler bypass valve control solenoid valve
		An excessively high voltage from the solenoid valve is sent to ECM.	
		An improper voltage is sent to ECM through solenoid valve.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-262, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001375040

1.CHECK EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE POWER SUPPLY CIRCUIT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect EGR cooler bypass valve control solenoid valve harness connector.
3. Turn ignition switch ON.
4. Check the voltage between EGR cooler bypass valve control solenoid valve harness connector and ground.

EGR cooler bypass valve control solenoid valve		Ground	Voltage
Connector	Terminal		
F90	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 IPDM E/R and EGR cooler bypass valve control solenoid valve
- Harness for open or short between ECM and EGR cooler bypass valve control solenoid valve

>> Repair open circuit or short to ground or short to power in harness or connectors.

3. CHECK EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between EGR cooler bypass valve control solenoid valve harness connector and ECM harness connector.

EGR cooler bypass valve control solenoid valve		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F90	2	F68	59	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 or short to ground or short to power in harness or connectors.

4. CHECK EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE

Refer to ECR-263, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace EGR cooler bypass valve control solenoid valve.

5. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001375041

1. CHECK EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE

1. Turn ignition switch OFF.
2. Disconnect EGR cooler bypass valve control solenoid valve harness connector.
3. Check resistance between EGR cooler bypass valve control solenoid valve terminals as follows.

Terminals	Resistance
1 and 2	43 - 49 Ω [at 25°C (77°F)]

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace EGR cooler bypass valve control solenoid valve.

P242A EGT SENSOR 3

Description

INFOID:0000000001521454

Exhaust gas temperature sensor 3 is installed after DPF and senses exhaust gas temperature. Exhaust gas temperature sensor 3 uses a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

<Reference data>

Exhaust gas temperature °C (°F)	Resistance kΩ
250 (482)	132.5
300 (572)	44.28 - 63.54
500 (932)	3.173 - 3.264
600 (1112)	1.378
800 (1472)	0.323 - 0.371

DTC Logic

INFOID:0000000001521455

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P242A	Exhaust gas temperature sensor 3 circuit low input	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Exhaust gas temperature sensor 3 circuit is open or shorted.) • Exhaust gas temperature sensor 3
	Exhaust gas temperature sensor 3 circuit high input	An excessively high voltage from the sensor is sent to ECM.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 4 minutes.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-265, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

With CONSULT-III

1. Start engine and warm it up to normal operating temperature.
2. Select “EXH GAS TEMP2” in “DATA MONITOR” mode with CONSULT-III.
3. Drive vehicle under the following conditions for at least 70 seconds.

Monitor item	Indication
EXH GAS TEMP2	More than 340 °C (644 °F)

4. Check 1st trip DTC.

With GST

Follow the procedure “With CONSULT-III” above.

Is 1st trip DTC detected?

YES >> Go to ECR-265, "Diagnosis Procedure".

NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001374984

1. CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2. CHECK EXHAUST GAS TEMPERATURE SENSOR 3 POWER SUPPLY CIRCUIT

1. Disconnect exhaust gas temperature sensor 3 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between exhaust gas temperature sensor 3 harness connector and ground.

Exhaust gas temperature sensor 3		Ground	Voltage
Connector	Terminal		
B50	1	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 4.
NO >> GO TO 3.

3. DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- Harness connectors M77, E105
- Harness connectors B1, M11
- Harness for open or short between ECM and exhaust gas temperature sensor 3

>> Repair open circuit or short to ground or short to power in harness or connectors.

4. CHECK EXHAUST GAS TEMPERATURE SENSOR 3 GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between exhaust gas temperature sensor 3 harness connector and ECM harness connector.

Exhaust gas temperature sensor 3		ECM		Continuity
Connector	Terminal	Connector	Terminal	
B50	2	F85	23	Existed

3. 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 connectors E7, F121
- Harness connectors M77, E105
- Harness connectors B1, M11
- Harness for open or short between ECM and exhaust gas temperature sensor 3

>> Repair open circuit or short to ground or short to power in harness or connectors.

6. CHECK EXHAUST GAS TEMPERATURE SENSOR 3

Refer to ECR-266, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Replace exhaust gas temperature sensor 3.

7.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001569840

1.CHECK EXHAUST GAS TEMPERATURE SENSOR 3

With CONSULT-III

1. Turn ignition switch ON and select “EXH GAS TEMP3” in “DATA MONITOR” mode with CONSULT-III..
2. Start engine and drive vehicle at a speed of 120 km/h (75 MPH) for at least 2 minute.
3. Check “EXH GAS TEMP3” indication during driving.

Monitor item	Indication
EXH GAS TEMP3	230 - 950 °C (446 - 1742 °F)

With GST

Follow the procedure “With CONSULT-III” above.

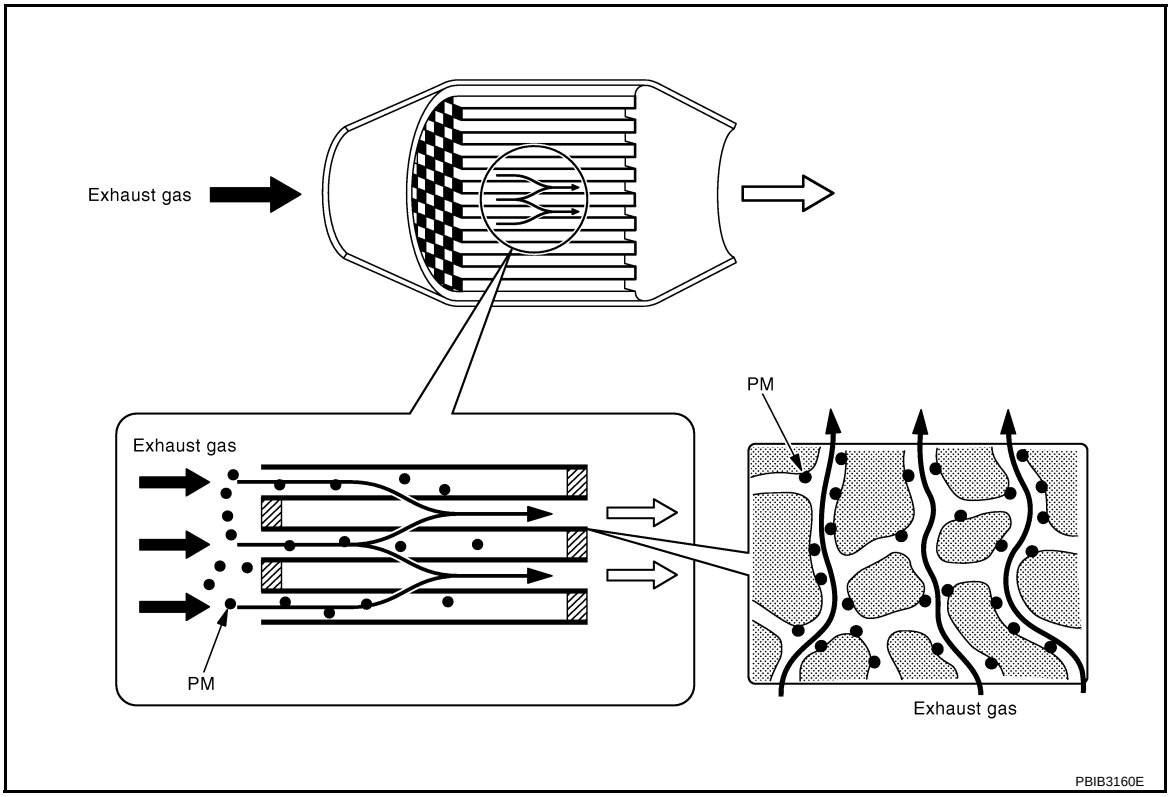
Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace exhaust gas temperature sensor 3.

P242F DPF

Description

INFOID:0000000001528610



DPF (Diesel Particulate Filter) is placed after oxidation catalyst and traps PM (Particulate Matter) in exhaust gas. DPF is formed in a honeycomb form made of ceramic. This structure facilitates to trap particulate matter. When the amount of particulate matter in the DPF reaches the specified level, the particulate matter needs to be reduced through burning to maintain the DPF function. This reducing of particulate matter is called Regeneration and should be performed periodically. DPF can be effective for a long time through the cycle of trapping particulate matter and regeneration.

DTC Logic

INFOID:0000000001528611

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P242F	Diesel particulate filter (DPF) performance	DPF is overloaded with particulate matter.	DPF

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Start engine and let it idle for at least 5 minutes.
2. Drive vehicle under the following conditions for at least 2 minutes.
- Gear position: 3rd position
- Engine speed: About 3,000 rpm
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-268, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001528612

1.CHECK DPF

Refer to ECR-232, "Component Inspection".

OK or NG

OK >> **INSPECTION END**
NG >> GO TO 2.

2.REPLACE DPF

1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

>> **INSPECTION END**

Component Inspection

INFOID:0000000001559374

1.CHECK DPF-I

Check DPF for damage.

Is the inspection result normal?

YES >> GO TO 2.
NO >> GO TO 3.

2.CHECK DPF-II

1. Perform “Service Regeneration”. Refer to ECR-17, "SERVICE REGENERATION : Special Repair Requirement".
2. Start engine and warm it up to normal operating temperature.
3. Connect CONSULT-III and select “DATA MONITOR” mode.
4. Select “DIFF EXH PRES” and check the indication under the following conditions.

Condition	DIFF EXH PRES [mbar]
• ENGINE SPEED·: 2000 tr/min • EXH GAS TEMP2: 150 - 200°C (302 - 392°F) • EXH GAS TEMP3: 150 - 200°C (302 - 392°F)	Less than 3.0

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 3.

3.REPLACE DPF

1. Replace DPF.
2. Perform “DPF Data Clear”. Refer to ECR-17, "DPF DATA CLEAR : Special Repair Requirement".

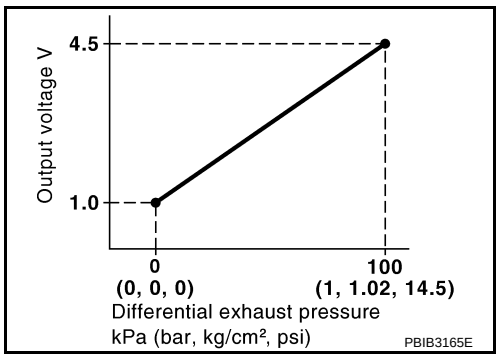
>> INSPECTION END

P2452 DIFFERENTIAL EXHAUST PRESSURE SENSOR

Description

INFOID:0000000001374994

Differential exhaust pressure sensor is connected to DPF with differential pressure sensor tubes (upstream and downstream). Differential exhaust pressure sensor measures the difference between the exhaust pressure before and after the DPF. Differential exhaust pressure sensor converts the difference into a voltage signal. ECM receives the signal and estimates the amount of particulate matter in DPF.



DTC Logic

INFOID:0000000001521447

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2452	Differential exhaust pressure sensor circuit	An excessively low voltage from the sensor is sent to ECM.	• Harness or connectors (Differential exhaust pressure sensor circuit is open or shorted.) • Differential exhaust pressure sensor
		An excessively high voltage from the sensor is sent to ECM.	
		An improper voltage is sent to ECM through sensor.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 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 1st trip DTC detected?

YES >> Go to ECR-269, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001374999

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK DIFFERENTIAL EXAUST PRESSURE SENSOR POWER SUPPLY CIRCUIT

1. Disconnect differential exhaust pressure sensor harness connector.
2. Turn ignition switch ON.
3. Check the voltage between differential exhaust pressure sensor harness connector and ground.

Differential exhaust pressure sensor		Ground	Voltage
Connector	Terminal		
F88	3	Ground	Approx. 5V

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK DIFFERENTIAL EXAUST PRESSURE SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check the continuity between differential exhaust pressure sensor harness connector and ECM harness connector.

Differential exhaust pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F88	2	F85	42	Existed

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 or short to ground or short to power in harness or connectors.

4.CHECK DIFFERENTIAL EXAUST PRESSURE SENSOR INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between differential exhaust pressure sensor harness connector and ECM harness connector.

Differential exhaust pressure sensor		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F88	1	F85	38	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 or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

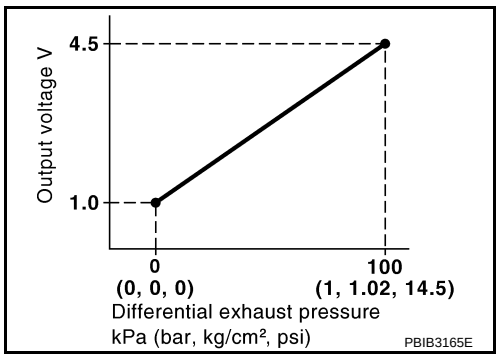
YES >> Replace differential exhaust pressure sensor.
NO >> Repair or replace.

P2453 DIFFERENTIAL EXHAUST PRESSURE SENSOR

Description

INFOID:0000000001375036

Differential exhaust pressure sensor is connected to DPF with differential pressure sensor tubes (upstream and downstream). Differential exhaust pressure sensor measures the difference between the exhaust pressure before and after the DPF. Differential exhaust pressure sensor converts the difference into a voltage signal. ECM receives the signal and estimates the amount of particulate matter in DPF.



DTC Logic

INFOID:0000000001375038

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2453	Differential exhaust pressure sensor (Upstream)	Differential exhaust pressure sensor (Upstream) malfunction.	• Differential exhaust pressure sensor • Differential exhaust pressure sensor tube (Upstream) leaks • Differential pressure sensor tube installed incorrectly

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> 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 ECR-271, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001375006

1.CHECK DIFFERENTIAL EXHAUST PRESSURE SENSOR TUBE (UPSTREAM)

1. Remove differential exhaust pressure sensor tube (Upstream).
2. Check differential exhaust pressure sensor tube (Upstream) for crack, clogging, improper connection or disconnection.

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair differential exhaust pressure sensor tube (Upstream).

2.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

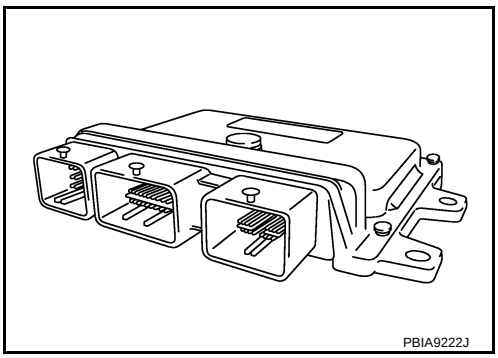
YES >> Replace differential exhaust pressure sensor.
NG >> Repair or replace.

P2505 ECM POWER SUPPLY

Description

INFOID:0000000001367506

The ECM consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.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DTC Logic

INFOID:0000000001367507

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2505	Ignition signal circuit	Ignition signal is not entered to ECM when ignition switch is turned ON.	• Harness or connectors (Ignition relay circuit is open or shorted.) • Ignition relay

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON and wait at least 10 second.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-272, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001367508

1.CHECK ECM INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Turn ignition switch ON.
4. Check the voltage between ECM harness connector terminals as follows.

(+)		(–)		Voltage
Connector	Terminal	Connector	Terminal	
E60	109	E60	128	Battery voltage

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.

- 15A fuse (No. 64)
- IPDM E/R harness connector E15
- Harness for open or short between ECM and IPDM E/R

>> Repair or replace harness or connectors.

3. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 4.
NO >> Repair or replace harness or connectors.

4. PERFORM DTC CONFIRMATION PROCEDURE

1. Turn ignition switch ON.
2. Erase the DTC.
3. Perform DTC CONFIRMATION PROCEDURE again.
   See ECR-272, "DTC Logic".

Is the 1st trip DTC P2505 displayed again?

YES >> GO TO 5.
NO >> INSPECTION END

5. REPLACE ECM

1. Replace ECM.
2. Go to ECR-12, "ADDITIONAL SERVICE WHEN REPLACING CONTROL UNIT : Special Repair Requirement".

>> INSPECTION END

P2600 TC COOLING PUMP

Description

INFOID:0000000001532258

Turbocharger cooling pump circulates cooling water around the turbine bearing to prevent high oil temperature around it. Therefore, ECM actuates the cooling pump when the cooling water temperature exceeds the specified value.

DTC Logic

INFOID:0000000001521456

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P2600	Turbocharger cooling pump circuit	An excessively low voltage from the control valve is sent to ECM.	• Harness or connectors (Turbocharger cooling pump circuit is open or shorted.) • Turbocharger cooling pump • Turbocharger cooling pump relay
		An excessively high voltage from the control valve is sent to ECM.	
		An improper voltage is sent to ECM through control valve.	

DTC CONFIRMATION PROCEDURE

1.PRECONDITIONING

If DTC Confirmation Procedure has been previously conducted, always turn ignition switch OFF and wait at least 20 seconds before conducting the next test.

>> GO TO 2.

2.PERFORM DTC CONFIRMATION PROCEDURE-I

1. Turn ignition switch ON and wait at least 10 seconds.
2. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-274, "Diagnosis Procedure".
NO >> GO TO 3.

3.PERFORM DTC CONFIRMATION PROCEDURE-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Turn ignition switch ON and wait at least 10 seconds.
3. Check 1st trip DTC.

Is 1st trip DTC detected?

YES >> Go to ECR-274, "Diagnosis Procedure".
NO >> INSPECTION END

Diagnosis Procedure

INFOID:0000000001375043

1.CHECK TURBOCHARGER COOLING PUMP POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect turbocharger cooling pump relay.
3. Turn ignition switch ON.
4. Check the voltage between turbocharger cooling pump relay harness connector and ground.

Turbocharger cooling pump relay		Ground	Voltage
Connector	Terminal		
E56	2	Ground	Battery voltage
	3		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- 10A fuse (No. 32)
- Harness for open or short between turbocharger cooling pump relay and battery
- Harness for open or short between turbocharger cooling pump relay and IPDM E/R
- Harness for open or short between turbocharger cooling pump relay and ECM

>> Repair open circuit or short to ground or short to power in harness or connectors.

3.CHECK TURBOCHARGER COOLING PUMP POWER SUPPLY CIRCUIT-II

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect turbocharger cooling pump harness connector.
3. Check the continuity between turbocharger cooling pump harness connector and turbocharger cooling pump relay harness connector.

Turbocharger cooling pump		Turbocharge cooling pump relay		Continuity
Connector	Terminal	Connector	Terminal	
F87	1	E56	5	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 connectors E7, F121
- Harness for open or short between turbocharger cooling pump and turbocharger cooling pump relay

>> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK TURBOCHARGER COOLING PUMP GROUND CIRCUIT FOR OPEN AND SHORT

1. Check the continuity between turbocharger cooling pump harness connector and ground.

Turbocharger cooling pump		Ground	Continuity
Connector	Terminal		
F87	2	Ground	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 connectors E7, F121
- Harness for open or short between turbocharger cooling pump and ground

>> Repair open circuit or short to ground or short to power in harness or connectors.

7.CHECK TURBOCHARGER COOLING PUMP OUTPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connectors.

2. Check the continuity between turbocharger cooling pump relay harness connector and ECM harness connector.

Turbocharger cooling pump relay		EM		Continuity
Connector	Terminal	Connector	Terminal	
E56	1	F68	56	Existed

Is the inspection result normal?

YES >> GO TO 9.
NO >> GO TO 8.

8. DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- Harness for open or short between ECM and turbocharger cooling pump relay

>> Repair open circuit or short to ground or short to power in harness or connectors.

9. CHECK TURBOCHARGER COOLING PUMP RELAY

Refer to ECR-276, "Component Inspection (Turbocharger Cooling Pump Relay)".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace turbocharger cooling pump relay.

10. CHECK TURBOCHARGER COOLING PUMP

Refer to ECR-276, "Component Inspection (Turbocharger Cooling Pump)".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Replace turbocharger cooling pump.

11. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection (Turbocharger Cooling Pump)

INFOID:0000000001375139

1. CHECK TURBOCHARGER COOLING PUMP

1. Turn ignition switch OFF.
2. Disconnect turbocharger cooling pump harness connector F87.
3. Supply turbocharger cooling pump terminal with battery voltage and check operation.

Terminals		Operation
(+)	(–)	
1	2	Turbocharger cooling pump operates.

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace turbocharger cooling pump.

Component Inspection (Turbocharger Cooling Pump Relay)

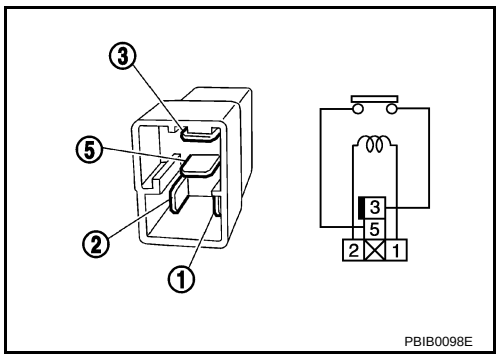
INFOID:0000000001375140

1. CHECK TURBOCHARGER COOLING PUMP RELAYS

1. Turn ignition switch OFF.
2. Remove turbocharger cooling pump relay.

3. Check the continuity between turbocharger cooling pump relay terminals under the following conditions.

Terminals	Conditions	Continuity
3 and 4	12V direct current supply between terminals 1 and 2	Existed
	No current supply	Not existed



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Is the inspection result normal?

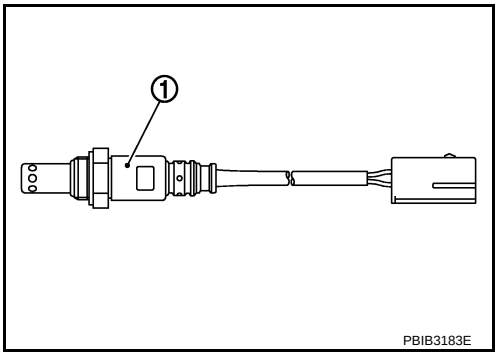
YES >> **INSPECTION END**
NO >> Replace turbocharger cooling pump relay.

P2A00 A/F SENSOR 1

Description

INFOID:0000000001548281

Air fuel ratio (A/F) sensor 1 (1) is installed on the upstream of the oxidation catalyst. A/F sensor 1 measures the oxygen level in the exhaust gas and converts it into a voltage signal. A/F sensor 1 sends the signal to ECM. Based on the signal from A/F sensor 1, ECM calculates the air fuel mixture ratio. ECM uses the calculated ratio for the DPF regeneration control.
A heater is integrated in A/F sensor 1 to ensure the required operating temperature.



DTC Logic

INFOID:0000000001548282

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible Cause
P2A00	Air fuel ratio (A/F) sensor 1 circuit	The A/F signal computed by ECM from the air fuel ratio sensor 1 signal is out of the specified range.	• Harness or connectors (The air fuel ratio sensor 1 circuit is shorted.) • Air fuel ratio sensor 1

Diagnosis Procedure

INFOID:0000000001548283

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connections.

2.CHECK AIR FUEL RATIO (A/F) SENSOR 1 POWER SUPPLY CIRCUIT

1. Disconnect A/F sensor 1 harness connector.
2. Turn ignition switch ON.
3. Check the voltage between A/F sensor 1 harness connector and ground.

A/F sensor 1		Ground	Voltage
Connector	Terminal		
F91	4	Ground	Battery voltage

OK or NG

OK >> GO TO 4.
NG >> GO TO 3.

3.DETECT MALFUNCTIONING PART

Check the following.
- Harness connectors E7, F121
- IPDM E/R connector E15
- Harness for open or short between A/F sensor 1 and IPDM E/R
- Harness for open or short between A/F sensor 1 and ECM

>> Repair or replace harness or connectors.

4.CHECK A/F SENSOR 1 INPUT SIGNAL CIRCUIT FOR OPEN AND SHORT

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect ECM harness connector.
3. Check the continuity between A/F sensor 1 harness connector and ECM harness connector.

A/F sensor 1		ECM		Continuity
Connector	Terminal	Connector	Terminal	
F91	1	F68	81	Existed
	2		78	
	5		82	
	6		77	

4. Check the continuity between A/F sensor 1 harness connector or ECM harness connector and ground.

A/F sensor 1		ECM		Ground	Continuity
Connector	Terminal	Connector	Terminal		
F91	1	F68	81	Ground	Not existed
	2		78		
	5		82		
	6		77		

5. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

5.CHECK INTERMITTENT INCIDENT

Perform GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> GO TO 6.
NO >> Repair or replace.

6.REPLACE A/F SENSOR 1

Replace A/F sensor 1.

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 Heated Oxygen Sensor Thread Cleaner tool and approved anti-seize lubricant.**

>> **INSPECTION END**

P3031 SERVICE REGENERATION

Description

INFOID:0000000001528616

Service regeneration is performed with CONSULT-III to reduce particulate matter in DPF.
For details, refer to ECR-16, "SERVICE REGENERATION : Description".

DTC Logic

INFOID:0000000001528617

DTC DETECTION LOGIC

DTC No.	Trouble diagnosis name	DTC detecting condition	Possible cause
P3031	Service regeneration performance	Service regeneration was interrupted because of extremely high exhaust gas temperature.	DPF

Diagnosis Procedure

INFOID:0000000001528618

1.PERFORM SERVICE REGENERATION

Refer to ECR-17, "SERVICE REGENERATION : Special Repair Requirement".

>> GO TO 2.

2.ERASE DTC

With CONSULT-III
1. Turn ignition switch ON.
2. Select “SELF-DIAG RESULTS” mode with CONSULT-III.
3. Touch “ERASE”.

With GST
1. Turn ignition switch ON.
2. Select Service $04 with GST.

Is DTC erased?

YES >> INSPECTION END
NO >> GO TO 3.

3.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

ASCD INDICATOR

Description

INFOID:0000000001307570

ASCD indicator lamp illuminates to indicate ASCD operation status. Lamp has two indicators, CRUISE and SET, and is integrated in combination meter.
CRUISE lamp illuminates when MAIN switch on ASCD steering switch is turned ON to indicated that ASCD system is ready for operation.
SET lamp illuminates when following conditions are met.
- CRUISE lamp is illuminated.
- SET/COAST switch on ASCD steering switch is turned ON while vehicle speed is within the range of ASCD setting.

SET lamp remains lit during ASCD control.

Component Function Check

INFOID:0000000001307571

1.ASCD INDICATOR FUNCTION

Check ASCD indicator under the following conditions.

CONDITION		INDICATOR
• Ignition switch: ON	• MAIN switch: Pressed at the 1st time →at the 2nd time	Illuminated → Not illuminated
• MAIN switch: ON • When vehicle speed: Between 40 km/h (25 MPH) and 144 km/h (89 MPH)	• ASCD: Operating	Illuminated
	• ASCD: Not operating	Not illuminated

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Go to ECR-281, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000001307572

1.CHECK CAN COMMUNICATION LINE

Refer to LAN-21, "CAN System Specification Chart".

OK or NG

OK >> GO TO 2.
NG >> Repair or replace.

2.CHECK COMBINATION METER OPERATION

Refer to MWI-24, "CONSULT-III Function (METER/M&A)".

Is the inspection result normal?

YES >> GO TO 3.
NO >> Check combination meter circuit. Refer to MWI-5, "METER SYSTEM : System Diagram".

3.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

CLUTCH PEDAL POSITION SWITCH

Description

INFOID:0000000001307543

Clutch pedal position switch signal is applied to the ECM through the clutch pedal position switch when the clutch pedal is depressed.

Component Function Check

INFOID:0000000001521457

1.CHECK FOR CLUTCH PEDAL POSITION SWITCH FUNCTION

1. Turn ignition switch ON.
2. Check the voltage between ECM harness connector and ground.

ECM		Ground		Condition		Voltage
Connector	Terminal	Connector	Terminal			
E60	108 (Clutch pedal position switch signal)	E60	128 (ECM ground)	Clutch pedal	Slightly depressed	Battery voltage
					Fully released	Approx. 0V

Is the inspection result normal?

YES >> INSPECTION END.
NO >> Go to ECR-282, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000001307545

1.CHECK GROUND CONNECTIONS

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E17. Refer to Ground inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 2.
NO >> Repair or replace ground connection.

2.CHECK CLUTCH PEDAL POSITION SWITCH GROUD CIRCUIT FOR OPEN AND SHORT

1. Disconnect clutch pedal position switch harness connector.
2. Check the continuity between clutch pedal position switch harness connector and ground.

Clutch pedal position switch		Ground	Continuity
Connector	Terminal		
E111	1	E38	Existed

3. Also check harness for short to power.

Is the inspection result normal?

YES >> GO TO 3.
NO >> Repair open circuit or short to power in harness or connectors.

3.CHECK CLUTCH PEDAL POSITION SWITCH INPUT SIGANL CIRCUIT FOR OPEN AND SHORT

1. Disconnect ECM harness connectors.
2. Check the continuity between clutch pedal position switch harness connector and ECM harness connector.

Clutch pedal position switch		ECM		Continuity
Connector	Terminal	Connector	Terminal	
E111	2	E60	108	Existed

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 or short to ground or short to power in harness or connectors.

4.CHECK CLUTCH PEDAL POSITION SWITCH

Refer to ECR-283, "Component Inspection".

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace clutch pedal position switch.

5.CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

>> INSPECTION END

Component Inspection

INFOID:0000000001307546

1.CHECK CLUTCH PEDAL POSITION SWITCH-I

1. Turn ignition switch OFF.
2. Disconnect clutch pedal position switch harness connector.
3. Check the continuity between clutch pedal position switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Clutch pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> GO TO 2.

2.CHECK CLUTCH PEDAL POSITION SWITCH-II

1. Adjust clutch pedal position switch installation. Refer to CL-5, "Inspection and Adjustment".
2. Check the continuity between clutch pedal position switch terminals under the following conditions.

Terminals	Condition		Continuity
1 and 2	Clutch pedal	Fully released	Existed
		Slightly depressed	Not existed

Is the inspection result normal?

YES >> INSPECTION END
NO >> Replace clutch pedal position switch.

COOLING FAN

Description

INFOID:0000000001307573

Cooling fan operates at each speed when the current flows in the cooling fan motor as follows.
Refer to ECR-49, "System Diagram" for cooling fan operation.

Cooling fan speed	Cooling fan motor terminals	
	(+)	(–)
Middle (MID)	1	3 and 4
	2	3 and 4
	1 and 2	3
	1 and 2	4
High (HI)	1 and 2	3 and 4

The cooling fan operates at low (LOW) speed when cooling fan motors-1 and 2 are circuited in series under middle speed condition.

Component Function Check

INFOID:0000000001307574

1.CHECK COOLING FAN OPERATION

With CONSULT-III
1. Start engine and let it idle.
2. Select “COOLING FAN LOW” in “ACTIVE TEST” mode with CONSULT-III.
3. Select “COOLING FAN HIGH” in “ACTIVE TEST” mode with CONSULT-III.
4. Check that cooling fans-1 and 2 operate at each speed.

With GST
1. Start engine and let it idle.
2. Perform IPDM E/R auto active test. Refer to PCS-8, "Diagnosis Description".
3. Check that cooling fans-1 and 2 operate at each speed.

Is the inspection result normal?

YES >> INSPECTION END
NO >> Refer to ECR-284, "Diagnosis Procedure".

Diagnosis Procedure

INFOID:0000000001307575

1.CHECK COOLING FAN POWER SUPPLY CIRCUIT-I

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect cooling fan motor-2 harness connector.
3. Check the voltage between cooling fan motor-2 harness connector and ground.

Cooling fan motor-2		Ground	Voltage
Connector	Terminal		
E54	1	Ground	Battery voltage
	2		

Is the inspection result normal?

YES >> GO TO 3.
NO >> GO TO 2.

2.DETECT MALFUNCTIONING PART

Check the following.
- 40A fusible link (letter M)
- Harness for open or short between cooling fan motor-3 and battery

>> Repair or replace malfunctioning part.

3. CHECK COOLING FAN POWER SUPPLY CIRCUIT-II

1. Disconnect cooling fan relay-4 and cooling fan relay-5.
2. Turn ignition switch ON.
3. Check the voltage between cooling fan relay-4 harness connector and ground.

Cooling fan relay-4		Ground	Voltage
Connector	Terminal		
E57	2	Ground	Battery voltage

4. Check the voltage between cooling fan relay-5 harness connector and ground.

Cooling fan relay-5		Ground	Voltage
Connector	Terminal		
E59	2	Ground	Battery voltage

Is the inspection result normal?

YES >> GO TO 6.
NO >> GO TO 4.

4. CHECK FUSE

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Disconnect 15A fuse (No. 63) from IPDM E/R and check it for blown.

Is the inspection result normal?

YES >> GO TO 5.
NO >> Replace fuse.

5. CHECK COOLING FAN POWER SUPPLY CIRCUIT-III

1. Disconnect IPDM E/R harness connector E14.
2. Check the continuity between cooling fan relay-4 harness connector and IPDM E/R harness connector.

Cooling fan relay-4		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
E57	2	E14	40	Existed

3. Check the continuity between cooling fan relay-5 harness connector and IPDM E/R harness connector.

Cooling fan relay-5		IPDM E/R		Continuity
Connector	Terminal	Connector	Terminal	
E59	2	E14	40	Existed

4. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 11.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

6. CHECK GROUND CONNECTION

1. Turn ignition switch OFF and wait at least 20 seconds.
2. Check ground connection E21 and E38. Refer to Ground Inspection in GI-41, "Circuit Inspection".

Is the inspection result normal?

YES >> GO TO 7.
NO >> Repair or replace ground connections.

7. CHECK COOLING FAN GROUND CIRCUIT FOR OPEN AND SHORT

1. Disconnect IPDM E/R harness connector E11.
2. Disconnect cooling fan motor-1 harness connector.
3. Check the continuity between IPDM E/R harness connector and ground.

IPDM E/R		Ground	Continuity
Connector	Terminal		
E11	11	Ground	Existed

4. Check the continuity between cooling fan motor-1 harness connector and ground.

Cooling fan motor-1		Ground	Continuity
Connector	Terminal		
E53	3	Ground	Existed
	4		

5. Check the continuity between cooling fan relay-5 harness connector and ground.

Cooling fan relay-5		Ground	Continuity
Connector	Terminal		
E59	5	Ground	Existed

6. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 8.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

8. CHECK COOLING FAN CONTROL CIRCUIT FOR OPEN AND SHORT

1. Disconnect IPDM E/R harness connectors E10, E13 and E15.
2. Check the continuity between IPDM E/R harness connector and cooling fan relay-4 harness connector.

IPDM E/R		Cooling fan relay-4		Continuity
Connector	Terminal	Connector	Terminal	
E10	7	E57	3	Existed
	8		5	
E13	1		1	

3. Check the continuity between IPDM E/R harness connector and cooling fan relay-5 harness connector.

IPDM E/R		Cooling fan relay-5		Continuity
Connector	Terminal	Connector	Terminal	
E15	50	E59	1	Existed

4. Check the continuity between IPDM E/R harness connector and cooling fan motor-1 harness connector.

IPDM E/R		Cooling fan motor-1		Continuity
Connector	Terminal	Connector	Terminal	
E10	4	E53	1	Existed
	8		2	

5. Check the continuity between IPDM E/R harness connector and cooling fan motor-2 harness connector.

IPDM E/R		Cooling fan motor-2		Continuity
Connector	Terminal	Connector	Terminal	
E10	7	E54	3	Existed

6. Check the continuity between cooling fan motor-2 harness connector and cooling fan relay-5 harness connector.

Cooling fan motor-2		Cooling fan relay-5		Continuity
Connector	Terminal	Connector	Terminal	
E54	4	E59	3	Existed

7. Also check harness for short to ground and short to power.

Is the inspection result normal?

YES >> GO TO 9.
NO >> Repair open circuit or short to ground or short to power in harness or connectors.

9. CHECK COOLING FAN RELAY

Refer to ECR-287, "Component Inspection (Cooling Fan Relay)".

Is the inspection result normal?

YES >> GO TO 10.
NO >> Replace malfunctioning cooling fan relay.

10. CHECK COOLING FAN MOTOR

Refer to ECR-287, "Component Inspection (Cooling Fan Motor)".

Is the inspection result normal?

YES >> GO TO 11.
NO >> Replace cooling fan motor.

11. CHECK INTERMITTENT INCIDENT

Refer to GI-39, "Intermittent Incident".

Is the inspection result normal?

YES >> Replace IPDM E/R.
NO >> Repair or replace harness or connector.

Component Inspection (Cooling Fan Motor)

INFOID:0000000001307576

1. CHECK COOLING FAN MOTORS-1AND -2

1. Turn ignition switch OFF.
2. Disconnect cooling fan motor harness connector.
3. Supply cooling fan motor terminals with battery voltage and check operation.

Cooling fan speed	Cooling fan motor terminals	
	(+)	(–)
Middle (MID)	1	3 and 4
	2	3 and 4
	1 and 2	3
	1 and 2	4
High (HI)	1 and 2	3 and 4

Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace cooling fan motor.

Component Inspection (Cooling Fan Relay)

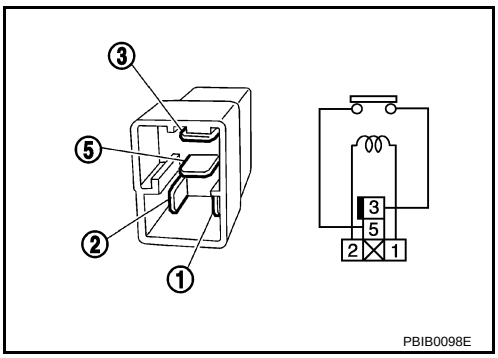
INFOID:0000000001307577

1. CHECK COOLING FAN RELAYS-4 AND -5

1. Turn ignition switch OFF.
2. Remove cooling fan relay.

3. Check the continuity between cooling fan relay terminals under the following conditions.

Terminals	Conditions	Continuity
3 and 4	12V direct current supply between terminals 1 and 2	Existed
	No current supply	Not existed



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Is the inspection result normal?

YES >> **INSPECTION END**
NO >> Replace cooling fan relay.

ECU DIAGNOSIS

ECM

Reference Value

INFOID:0000000001521459

VALUES ON THE DIAGNOSIS TOOL

Remarks:

- Specification data are reference values.
- Specification data are output/input values which are detected or supplied by the ECM at the connector.

* Specification data may not be directly related to their components signals/values/operations.

I.e. Adjust ignition timing with a timing light before monitoring IGN TIMING, because the monitor may show the specification data in spite of the ignition timing not being adjusted to the specification data. this IGN TIMING monitors the data calculated by the ECM according to the signals input from the camshaft position sensor and other ignition timing related sensors.

Monitor item	condition		Values/Status
IGN SW	• Ignition switch: ON → OFF → ON		PRESENT → ABSENT → PRESENT
GLOW CONT	• Engine: Running (Less than 60 seconds after starting engine.)	Engine coolant: Less than 50°C (122°F)	ACTIV
		Engine coolant: More than 80°C (176°F)	INACT
CLUTCH STATUS	• Ignition switch: ON	Clutch pedal: Fully released	NO
		Clutch pedal: Slightly depressed	YES
A/C RELAY	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	NODON
		Air conditioner switch: ON	DONE
ENGINE STATUS	• Ignition switch: ON		+APC
	• Engine: Running (Less than 60 seconds after starting engine.)		RUN
	• Ignition switch: OFF (A few seconds after turning ignition switch OFF)		OFF
BPP SW	• Ignition switch: ON	Brake pedal: Fully released	RELSD
		Brake pedal: Slightly depressed	PRSSD
A/C APPLD	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	NO
		Air conditioner switch: ON	YES
GLOW CONT SIGNAL	• Engine: Running (Less than 60 seconds after starting engine.)	Engine coolant: Less than 50°C (122°F)	PRESENT
		Engine coolant: More than 80°C (176°F)	ABSENT
COOLING FAN LOW	• Engine: After warming up, idle the engine • Air conditioner switch: OFF	Engine coolant: 99°C (210°F) or less	ACTIV
		Engine coolant: 102°C (216°F) or more	INACT
COOLING FAN HIGH	• Engine: After warming up, idle the engine • Air conditioner switch: OFF	Engine coolant: 99°C (210°F) or less	INACT
		Engine coolant: 102°C (216°F) or more	ACTIV
ECM-TCM COMM	• Ignition switch: ON	ECM-TCM communication: Communicated	PRESENT
		ECM-TCM communication: Not communicated	ABSENT
A/C COMP	• Engine: After warming up, idle the engine	Air conditioner switch: OFF	INACT
		Air conditioner switch: ON	ACTIV
NATS CODE RGST	• Ignition switch: ON	NATS code registration: Not registered.	NO
		NATS code registration: Registered.	YES
CPP SW	• Ignition switch: ON	Clutch pedal: Fully released	INACT
		Clutch pedal: Slightly depressed	ACTIV
EGR BYPAS S/V	• Engine Running	Not warm-up condition	INACT
		Warm-up condition	ACTIV

Monitor item	condition		Values/Status
TURBO COOL PUMP	• Engine Running	Engine coolant temperature: Less than 79°C (174°)	INACT
		Engine coolant temperature: More than 80°C (176°)	ACTIV
RGN INCMP STAT1	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT2	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT3	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT4	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT5	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT6	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT7	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT8	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF

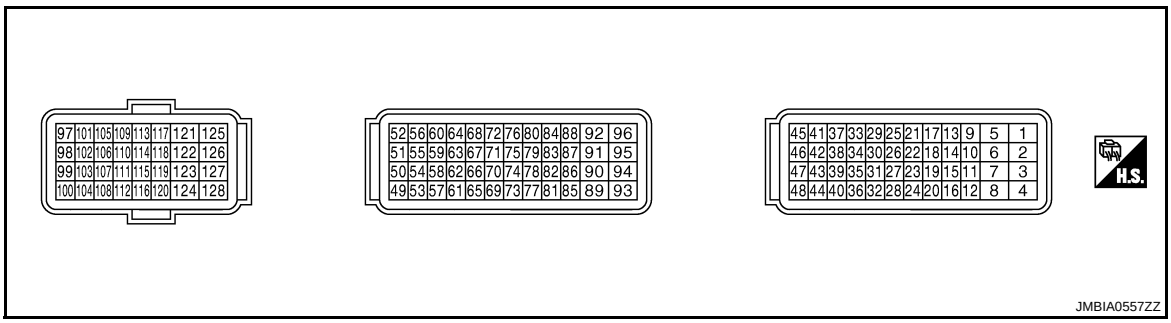
Monitor item	condition		Values/Status
RGN INCMP STAT9	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN INCMP STAT10	• Ignition switch: ON	Incomplete condition of DPF regeneration: Ignition switch ON	+APC
		Incomplete condition of DPF regeneration: Engine is running.	RUN
		Incomplete condition of DPF regeneration: During self shut-off	OFF
RGN REQ STAT1	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT2	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT3	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT4	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT5	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4

Monitor item	condition		Values/Status
RGN REQ STAT6	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT7	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT8	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT9	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
RGN REQ STAT10	• Ignition switch: ON	Incomplete condition of DPF regeneration: Engine stopped	STAT1
		Incomplete condition of DPF regeneration: Engine starting	STAT2
		Incomplete condition of DPF regeneration: Engine running	STAT3
		Incomplete condition of DPF regeneration: During self shut-off	STAT4
EGR COOL BYPAS/V	• Engine Running	Not warm-up condition	INACT
		Warm-up condition	ACTIV
EGR/V TRG ANGLE	• Ignition switch: ON		Less than 1%
	• Engine idle		Approx. 20 - 30%
TRG RAIL PRES	• Engine Running		Approx. 10 bar
TRG BOOST PRES	• Engine Running	Idle speed	ApproxApprox. Atmospheric pressure
		Engine speed: 2000 rpm	Approx. 10 bar (1000 mbar)
INJ VOLUME	• Engine Running	Idle speed	Approx. 5 - 10 mg/cp
		Engine speed: 2000 rpm	Approx. 5 - 10 mg/cp

Monitor item	condition		Values/Status
ACCEL PDL POS	• Ignition switch: ON	Accelerator pedal: Fully released	0%
		Accelerator pedal: Fully depressed	100%
BARO PRES	• Ignition switch: ON		Altitude Approx. 0 m: Approx. 1.0062 bar (100.62 mbar, 1.062kg / cm^2, 14.59 psi) Approx. 1,000 m: Approx. 0.8895 bar (88.95 mbar, 0.907kg /cm^2, 12.90 psi) Approx. 1,500 m: Approx. 0.8316 bar (93.16 mbar, 0.848 kg /cm^2, 12.06 psi) Approx. 2,000 m: Approx. 0.7836 bar (78.36 mbar, 0.799 kg /cm^2, 11.36 psi)
FUEL RAIL PRES	• Engine Running		Approx. 9 - 11 bar
TC BOOST PRES	• Engine Running	Idle speed	Approx. Atmospheric pressure
		Engine speed: 2000 rpm	Approx. 10 bar (1000 mbar)
EGR VALVE POS	• Engine idle		Approx. 20 - 90%
ENG SPEED	• Run engine and compare CONSULT-III value with the tachometer indication.		Almost the same speed as the tachometer indication
INT AIR TEMP	• Ignition switch: ON		Indicates intake air temperature
EXT AIR TEMP	• Ignition switch: ON		Indicates external air temperature
FUEL TEMP	• Ignition switch: ON		Indicates fuel temperature
ENG COOLAN TEMP	• Ignition switch: ON		Indicates engine coolant temperature
BAT VOLT	• Ignition switch: ON		11 - 14V
EGR POS/S VOLT	• Engine idle		Approx. 1 - 4.2V
FRP SEN VOLT	• Engine Running	Idle speed	Approx. 1V (1000 mV)
		Engine speed: 2000 rpm	Approx. 1.8V (1800 mV)
FUEL TEMP/S VOLT	• Engine Running		0.3 - 5.0V (300 - 5000 mV) Output voltage varies with fuel temperature.
IAT SEN VOLT	• Engine Running		0.3 - 5.0V (300 - 5000 mV) Output voltage varies with intake air temperature.
ECT SEN VOLT	• Engine Running		0.3 - 5.0V (300 - 5000 mV) Output voltage varies with engine coolant temperature.
APP SEN1 VOLT	• Ignition switch: ON	Accelerator pedal: Fully released	0.6 - 4.6V (600 - 4600 mV)
		Accelerator pedal: Fully depressed	Less than 5V (5000 mV)
APP SEN2 VOLT	• Ignition switch: ON	Accelerator pedal: Fully released	More than 0.3V (300 mV)
		Accelerator pedal: Fully depressed	Less than 2.5V (2500 mV)
TRG IDLE SPD	• Engine: After warming up, idle the engine		750 ± 50 tr/min
TC BST PR/S VOLT	• Engine Running	Idle speed	Approx. 1.2V (1200 mV)
		Engine speed: 2000 rpm	Approx. 1.8V (1800 mV)

Monitor item	condition		Values/Status
MAF SEN VOLT	• Engine: After warming up • Air conditioner switch: OFF • Shift lever: P or N (A/T), Neutral (M/T) • No load	Ignition switch: ON (Engine stopped)	Approx. 0.4V (400 mV)
		Idle speed	1.1 - 1.4V (1100 - 1400 mV)
		Engine is revving form idle to about 4,000 rpm	1.1 - 1.4V (1100 - 1400 mV) to 4.0V (40000 mV) (Check for liner voltage rise in response to engine being increased to about 4,000 rpm.)
RFRG PRE/S VOLT	• Engine: After warming up • Both A/C switch and blower fan switch: ON (Compressor operates)		1 - 1.25 V (1000 - 1250 mV)
INJ1 ADJ VALUE	• Engine Running	Idle speed	Approx. 5- 10 mg/cp
		Engine speed: 2000 rpm	Approx. 5- 10 mg/cp
INJ2 ADJ VALUE	• Engine Running	Idle speed	Approx. 5- 10 mg/cp
		Engine speed: 2000 rpm	Approx. 5- 10 mg/cp
INJ3 ADJ VALUE	• Engine Running	Idle speed	Approx. 5- 10 mg/cp
		Engine speed: 2000 rpm	Approx. 5- 10 mg/cp
INJ4 ADJ VALUE	• Engine Running	Idle speed	Approx. 5- 10 mg/cp
		Engine speed: 2000 rpm	Approx. 5- 10 mg/cp
EXH GAS TEMP2	• Engine: After warming up • Drive the vehicle at a speed of 120 km/h (75 MPH) for at least 2 minutes		Approx. 60°C (140°F) - 950°C (1742°F)
EXH GAS TEMP3	• Engine: After warming up • Reving engine from idle up to 3000rpm at least 60 seconds.		Approx. 230°C (446°F) - 950°C (1742°F)
DIFF EXH PRES	• Engine: 2000 rpm		Approx. 30 mbar
ASCD SET SPEED	• Engine Running	ASCD: Operating	Almost the same speed as the tachometer indication.
EX GAS PR/S VOLT	• Engine Running	Idle speed	Approx. 1 V (1000 mV)
		Engine speed: 2000 rpm	Approx. 1.4 V (1400 mV)
A/T GEAR POS	• Ignition switch: ON	A/T gear position: Neutral	STAT1
		A/T gear position: 1st gear	STAT1
		A/T gear position: 2nd gear	STAT2
		A/T gear position: 3rd gear	STAT3
		A/T gear position: 4th gear	STAT4
		A/T gear position: 5th gear	STAT5
		A/T gear position: 6th gear	STAT6
		A/T gear position: Reverse gear	BACK

TERMINAL LAYOUT



PHYSICAL VALUES

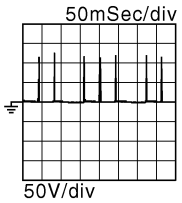
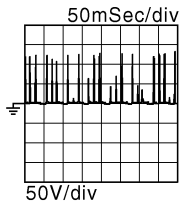
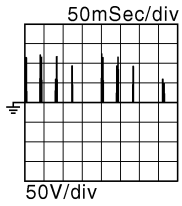
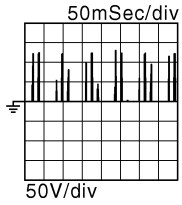
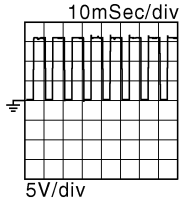
NOTE:

- ECM is located near the battery in the engine room.

- Specification data are reference values and are measured between each terminal and ground.
- Pulse signal is measured by CONSULT-III.

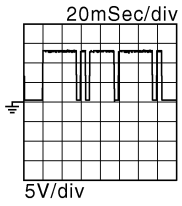
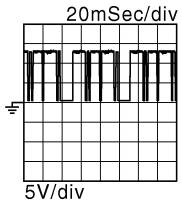
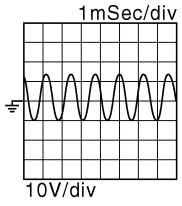
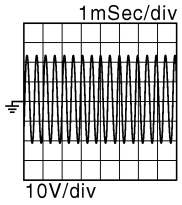
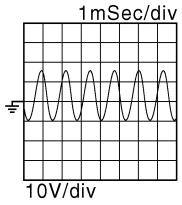
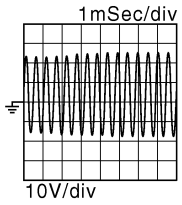
CAUTION:

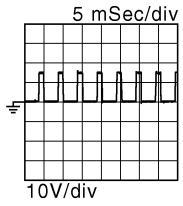
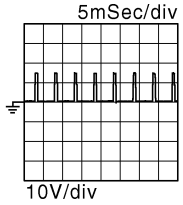
Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECMs transistor. Use a ground other than ECM terminals, such as the ground.

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
1 (GR)	128 (B)	Fuel injector No. 4	Input	**[Engine is running]** • **Warm-up condition** • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle.	0 - 5 V★  JMBIA0530GB
2 (W)		Fuel injector No. 1			
3 (Y)		Fuel injector No. 2		**[Engine is running]** • **Warm-up condition** • Engine speed: 2,000 rpm	5 - 8 V★  JMBIA0531GB
4 (G)		Fuel injector No. 3			
5 (O)	128 (B)	Fuel injector power supply No. 4	Output	**[Engine is running]** • **Warm-up condition** • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle.	0 - 4 V★  JMBIA0532GB
6 (R)		Fuel injector power supply No. 1			
7 (L)		Fuel injector power supply No. 2		**[Engine is running]** • **Warm-up condition** • Engine speed: 2,000 rpm	4 - 6 V★  JMBIA0533GB
8 (BR)		Fuel injector power supply No. 3			
9 (B)	128 (B)	Glow control unit ground	—	**[Engine is running]** • **Warm-up condition** • Idle speed	0 V
10 (Y)	—	Sensor ground (Exhaust gas temperature sensor 1)	—	—	—
12 (P)	128 (B)	Air fuel ratio sensor heater	Output	**[Engine is running]** • After the vehicle is driven for 6 minutes under the following conditions - Warm-up condition - Vehicle speed: 80 km/h - Shift lever: Suitable gear position	6 - 14 V★  JMBIA0534GB
				[Ignition switch ON] • Engine: Stopped	BATTERY VOLTAGE (11 - 14 V)

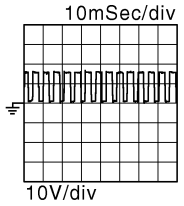
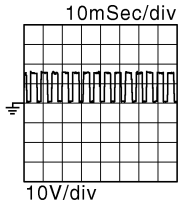
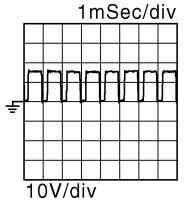
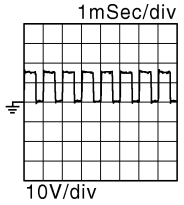
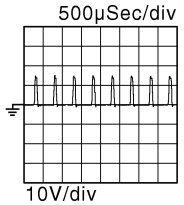
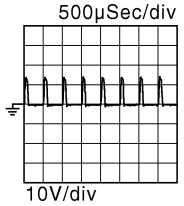
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
14 (SB)	10 (Y)	Exhaust gas temperature sensor 1	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	0.3 - 5.0 V Output voltage varies with exhaust gas temperature.
16 (Y)	—	Sensor ground (Exhaust gas pressure sensor)	—	—	—
17 (O)	—	Sensor ground (Turbocharger boost sensor)	—	—	—
18 (LG)	17 (O)	Turbocharger boost sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1.2 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	1.3 V
19 (G)	23 (Y)	Exhaust gas temperature sensor 3	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	0.3 - 5.0 V Output voltage varies with exhaust gas temperature.
20 (R)	25 (O)	Exhaust gas pressure sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	1.4 V
21 (BR)	17 (O)	Sensor power supply (Turbocharger boost sensor)	—	**[Ignition switch: ON]**	5 V
22 (W)	—	Sensor ground (Fuel temperature sensor)	—	—	—
23 (Y)	—	Sensor ground (Exhaust gas temperature sensor 3)	—	—	—
24 (O)	—	Sensor ground (Engine coolant temperature sensor)	—	—	—
25 (SB)	16 (Y)	Sensor power supply (Exhaust gas pressure sensor)	—	**[Ignition switch: ON]**	5 V
26 (V)	22 (W)	Fuel temperature sensor	Input	**[Engine is running]** • **Warm-up condition**	0.3 - 5.0 V Output voltage varies with fuel temperature.
27 (GR)	39 (L)	Exhaust gas temperature sensor 2	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	0.3 - 5.0 V Output voltage varies with exhaust gas temperature.
28 (P)	24 (O)	Engine coolant temperature sensor	Input	**[Engine is running]** • **Warm-up condition**	0.3 - 5.0 V Output voltage varies with engine coolant temperature.
29 (G)	34 (Y)	Sensor power supply (Fuel rail pressure sensor)	—	**[Ignition switch: ON]**	5 V

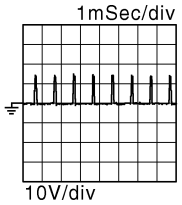
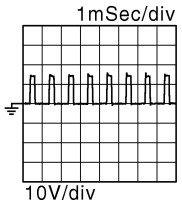
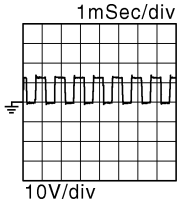
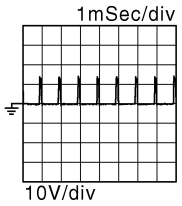
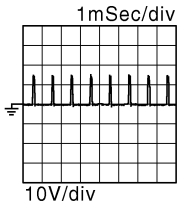
Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
30 (L)	34 (Y)	Fuel rail pressure sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	1.8 V
31 (SB)	35 (V)	Refrigerant pressure sensor	Input	**[Engine is running]** • **Warm-up condition** • Both A/C switch and blower fan switch: ON (Compressor operates)	1 - 2.5 V
32 (BR)	36 (R)	EGR volume control valve control position sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1 - 4.2 V
33 (GR)	36 (R)	Sensor power supply (EGR volume control valve control position sensor)	—	**[Ignition switch: ON]**	5 V
34 (Y)	—	Sensor ground (Fuel rail pressure sensor)	—	—	—
35 (V)	—	Sensor ground (Refrigerant pressure sensor)	—	—	—
36 (R)	—	Sensor ground (EGR volume control valve control position sensor)	—	—	—
37 (W)	42 (R)	Sensor power supply (Differential exhaust pressure sensor)	—	**[Ignition switch: ON]**	5 V
38 (LG)	42 (R)	Differential exhaust pressure sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	1.6 - 4.9 V
39 (L)	—	Sensor ground (Exhaust gas temperature sensor 2)	—	—	—
41 (L)	35 (V)	Sensor power supply (Refrigerant pressure sensor)	—	**[Ignition switch: ON]**	5 V
42 (R)	—	Sensor ground (Differential exhaust pressure sensor)	—	—	—
46 (B)	—	Sensor ground (Camshaft position sensor)	—	—	—

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
48 (Y)	46 (B)	Camshaft position sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle.	0 - 14 V★  JMBIA0535GB
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	0 - 14 V★  JMBIA0536GB
49 (L)	128 (B)	Crankshaft position sensor (+)	Input	**[Engine is running]** • **Warm-up condition** • Idle speed **NOTE:** The pulse cycle changes depending on rpm at idle.	0 - 3 V★  JMBIA0537GB
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	2.5 V★  JMBIA0538GB
50 (Y)	128 (B)	Crankshaft position sensor (–)	—	**[Engine is running]** • **Warm-up condition** • Idle speed	0 - 4 V★  JMBIA0539GB
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	2.5 V★  JMBIA0540GB

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
53 (GR)	128 (B)	Glow control unit	Output	**[Engine is running]** • Idle speed • Engine coolant temperature: Less than 50 °C (122 °F)	BATTERY VOLTAGE (11 - 14 V)
				[Engine is running] • Idle speed • Engine coolant temperature: More than 80 °C (176 °F)	BATTERY VOLTAGE (11 - 14 V)
56 (R)	128 (B)	Turbocharger cooling pump relay	Output	**[Engine is running]** • **Warm-up condition** (Engine coolant temperature is more than 80 °C) • Idle speed (For 5 minutes)	0 - 1 V
				Except above conditions	BATTERY VOLTAGE (11 - 14 V)
57 (V)	128 (B)	Turbocharger boost control solenoid valve	Output	**[Engine is running]** • **Warm-up condition** • Idle speed	0 - 5 V★  JMBIA0541GB
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	0 - 5 V★  JMBIA0542GB
59 (SB)	128 (B)	EGR cooler bypass valve control solenoid valve	Output	**[Engine is running]** • **Not warm-up condition** • Idle speed	1.5 V
				[Engine is running] • **Warm-up condition** • Idle speed	BATTERY VOLTAGE (11 - 14 V)
62 (W)	128 (B)	ECM relay (Self shut-off)	Output	**[Ignition switch: ON]** **[Ignition switch: OFF]** • For 20 seconds after turning ignition switch OFF	0 - 1 V
				[Ignition switch: OFF] • More than 20 seconds after turning ignition switch OFF	BATTERY VOLTAGE (11-14 V)
63 (O)	128 (B)	Glow control unit	Output	**[Engine is running]** • Idle speed • Engine coolant temperature: Less than 50 °C (122 °F)	Less than 12 V
				[Engine is running] • Idle speed • Engine coolant temperature: More than 80 °C (176 °F)	BATTERY VOLTAGE (11 - 14 V)
75 (BR)	85 (P)	Sensor power supply (Throttle position sensor)	—	**[Ignition switch: ON]**	5 V

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
77 (O)	128 (B)	Air fuel ratio sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	3 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	3 V
78 (GR)	128 (B)	Air fuel ratio sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	2.5 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	2.5 V
80 (R)	87 (W)	Mass air flow sensor	Input	**[Ignition switch: ON]** • Engine stopped	0.4 V
				[Engine is running] • **Warm-up condition** • Idle speed	1.1 - 1.4 V
				[Engine is running] • **Warm-up condition** • Engine is revving from idle to about 4,000 rpm	1.1 - 1.4 V to 4.0 V (Check for linear voltage rise in response to engine being increased to about 4,000 rpm.)
81 (SB)	128 (B)	Air fuel ratio sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	3.1 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	3.1 V
82 (V)	128 (B)	Air fuel ratio sensor	Input	**[Engine is running]** • **Warm-up condition** • Idle speed	3.2 V
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	3.2 V
83 (V)	85 (P)	Throttle position sensor	Input	**[Ignition switch: OFF]** • For 20 seconds after turning ignition switch OFF	0 - 5 V Output voltage fluctuates between 0 V and 5 V.
				[Ignition switch: OFF] • More than 20 seconds after turning ignition switch OFF	0.7 V
84 (B)	87 (W)	Intake air temperature sensor	Input	**[Engine is running]** • **Warm-up condition**	0.3 - 5.0 V Output voltage varies with intake air temperature.
85 (P)	—	Sensor ground (Throttle position sensor)	—	—	—
87 (W)	—	Sensor ground (Mass air flow sensor/ Intake air temperature sensor)	—	—	—

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
89 (BR)	128 (B)	Fuel pump	Output	**[Engine is running]** • **Warm-up condition** • Idle speed	11 - 14 V★  JMBIA0543GB
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	8 - 10 V★  JMBIA0544GB
90 (GR)	128 (B)	Fuel rail pressure control valve	Output	**[Engine is running]** • **Warm-up condition** • Idle speed	0.4 V★  JMBIA0545GB
				[Engine is running] • **Warm-up condition** • Engine speed: 2,000 rpm	0.4 V★  JMBIA0546GB
91 (SB)	128 (B)	Throttle control motor (+)	Output	**[Engine is running]** • **Warm-up condition** • Idle speed	0 - 2 V★  JMBIA0547GB
				[Ignition switch: OFF] • For 20 seconds after turning ignition switch OFF	0 - 2 V★  JMBIA0548GB
				[Ignition switch: OFF] • More than 20 seconds after turning ignition switch OFF	0.1 V

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
92 (LG)	128 (B)	Throttle control motor (–)	—	**[Engine is running]** • **Warm-up condition** • Idle speed	0 V
93 (G) 94 (V)	128 (B)	Power supply for ECM	—	**[Ignition switch: ON]**	BATTERY VOLTAGE (11 - 14 V)
95 (P)	128 (B)	EGR volume control valve (DC motor)	Output	**[Ignition switch: OFF]** • For 20 seconds after the following conditions are met and ignition switch is turned OFF. - Warm-up condition - Start engine and let it idle for 3 minutes.	0 - 1 V★  JMBIA0549GB
				[Engine is running] • **Warm-up condition** • Idle speed **NOTE:** The duty cycle changes depending on EGR volume control valve operation.	0 - 5 V★  JMBIA0550GB
96 (O)	128 (B)	EGR volume control valve (DC motor)	Output	**[Ignition switch: ON]** • For 3 seconds after ignition switch is turned ON	0 - 1 V★  JMBIA0551GB
				[Ignition switch: ON] • More than 3 seconds after ignition switch is turned ON	0 - 1 V★  JMBIA0552GB
				[Engine is running] • **Warm-up condition** • Idle speed **NOTE:** The duty cycle changes depending on EGR volume control valve operation.	0 - 5 V★  JMBIA0553GB
99 (P)	—	CAN signal (low)	—	—	—
100 (L)	—	CAN signal (high)	—	—	—
104 (Y)	128 (B)	Data link connector	—	**[Ignition switch: ON]** • GST: Disconnected	BATTERY VALTAGE (11 - 14 V)

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
108 (G)*1 (SB)*2	128 (B)	Clutch pedal position switch	Input	**[Ignition switch: ON]** • Clutch pedal: Slightly depressed	0 V
				[Ignition switch: ON] • Clutch pedal: Fully released	BATTERY VOLTAGE (11 - 14 V)
109 (LG)	128 (B)	Ignition switch	Input	**[Ignition switch: OFF]**	0 V
				[Ignition switch: ON]	BATTERY VOLATGE (11 - 14 V)
110 (V)	111 (B)	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] • RESUME/ACCELERATE switch: Pressed	3 V
				[Ignition switch: ON] • SET/COAST switch: Pressed	2 V
111 (B)	—	ASCD steering switch ground	—	—	—
116 (GR)	128 (B)	Brake pedal position switch	Input	**[Ignition switch: ON]** • Brake pedal: Slightly depressed	0V
				[Ignition switch: ON] • Brake pedal: Fully released	BATTERY VAOLTAGE (11 - 14 V)
118 (L)	120 (P)	Sensor power supply (Accelerator pedal position sensor 2)	—	**[Ignition switch: ON]**	5 V
119 (V)	120 (P)	Accelerator pedal position sensor 2	Input	**[Ignition switch: ON]** • Engine stopped • Accelerator pedal: Fully released	More than 0.3 V
				[Ignition switch: ON] • Engine stopped • Accelerator pedal: Fully depressed	Less than 2.5 V
120 (P)	—	Sensor ground (Accelerator pedal position sensor 2)	—	—	—
122 (G)	127 (Y)	Sensor power supply (Accelerator pedal position sensor 1)	—	**[Ignition switch: ON]**	5 V
123 (B) 124 (B) 125 (B)	—	ECM ground	—	—	—
126 (W)	127 (Y)	Accelerator pedal position sensor 1	Input	**[Ignition switch: ON]** • Engine stopped • Accelerator pedal: Fully released	0.6 - 4.6 V
				[Ignition switch ON] • Engine stopped • Accelerator pedal: Fully depressed	Less than 5 V

Terminal No. (Wire color)		Description		Condition	Value (Approx.)
+	–	Signal name	Input/ Output		
127 (Y)	—	Sensor ground (Accelerator pedal position sensor 1)	—	—	—
128 (B)	—	ECM ground	—	—	—

★: Average voltage for pulse signal (Actual pulse signal can be confirmed by oscilloscope.)

*1: M/T models with ESP

*2: M/T models without ESP

Wiring Diagram - ENGINE CONTROL SYSTEM -

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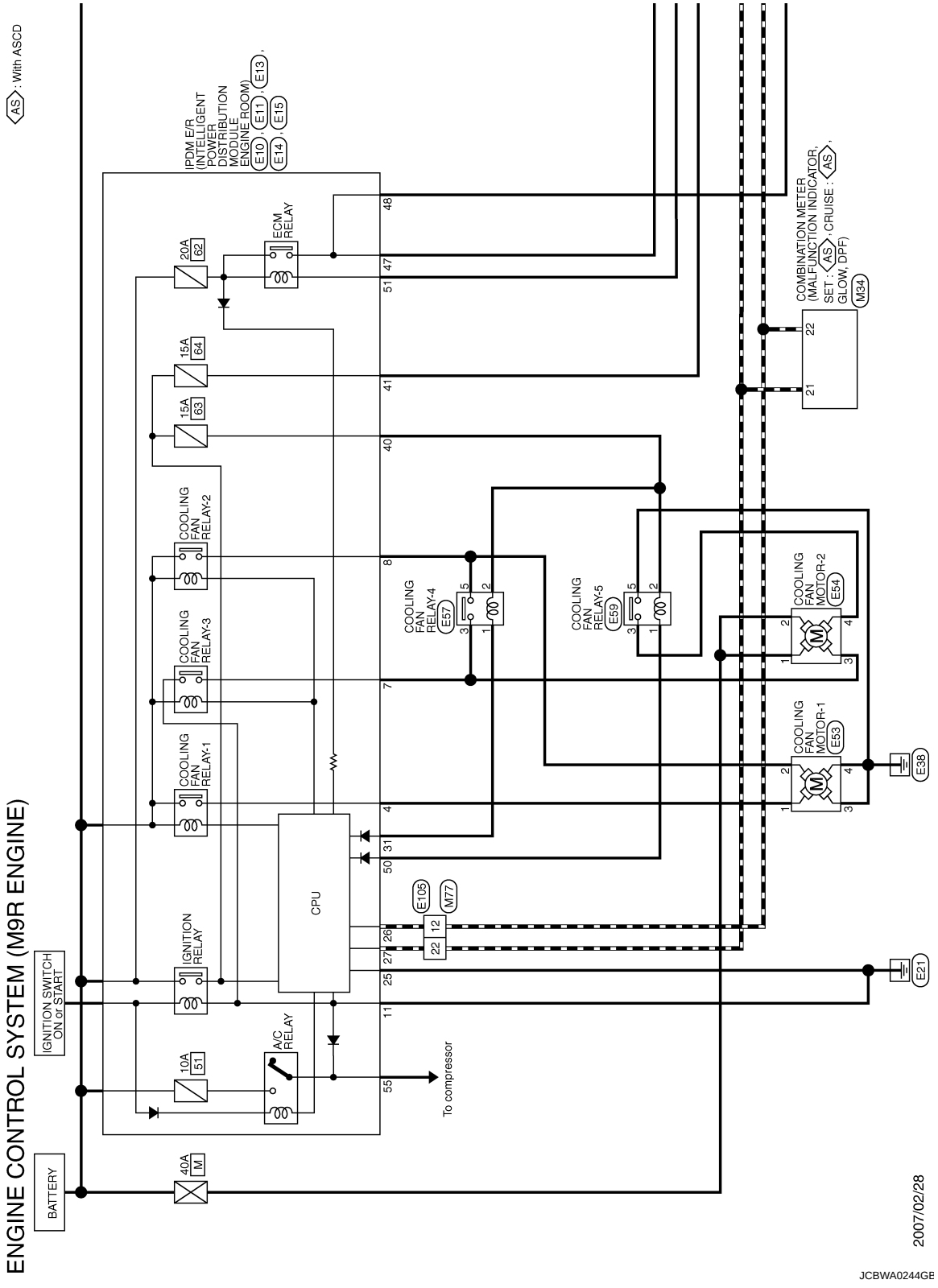
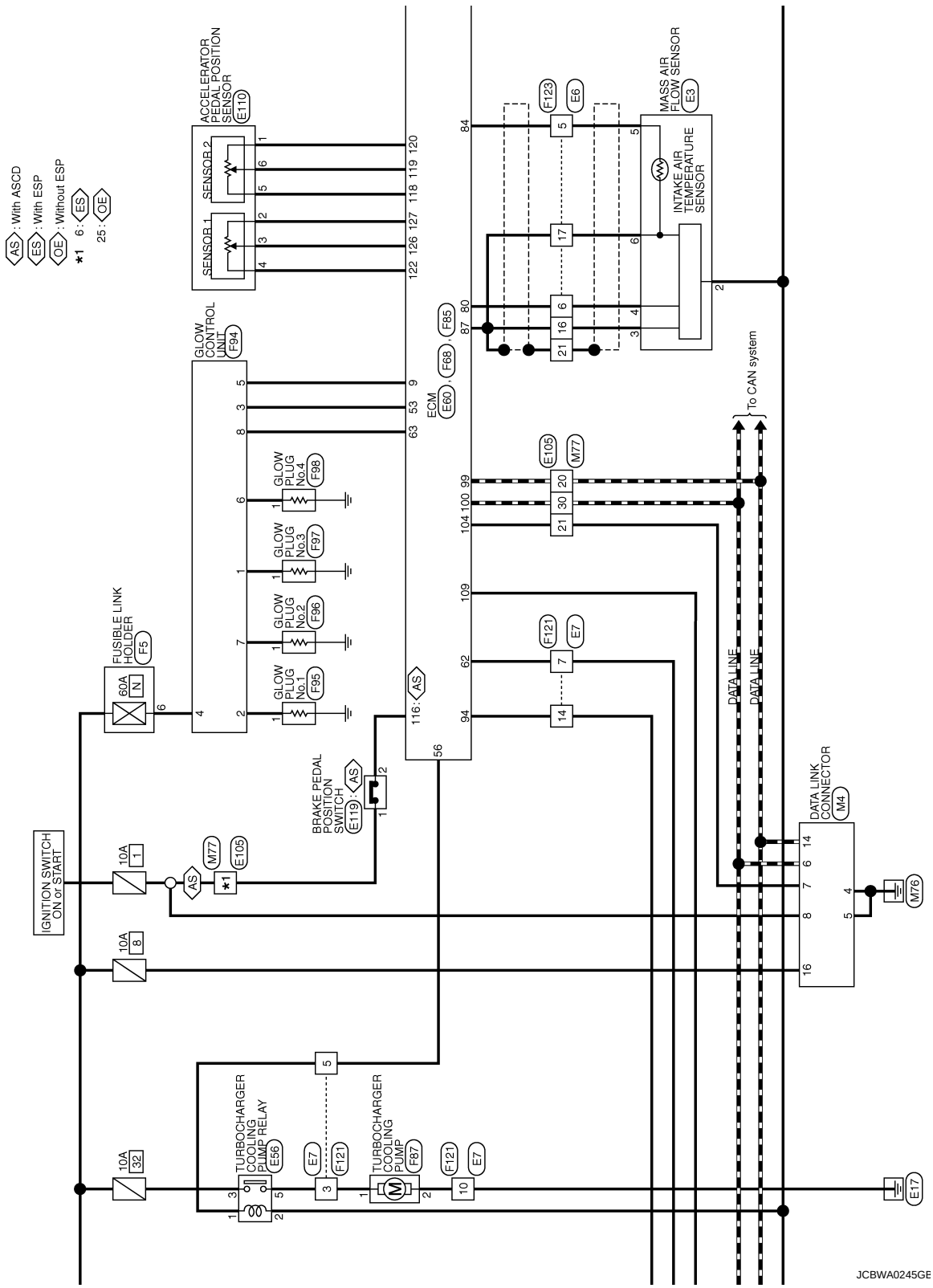
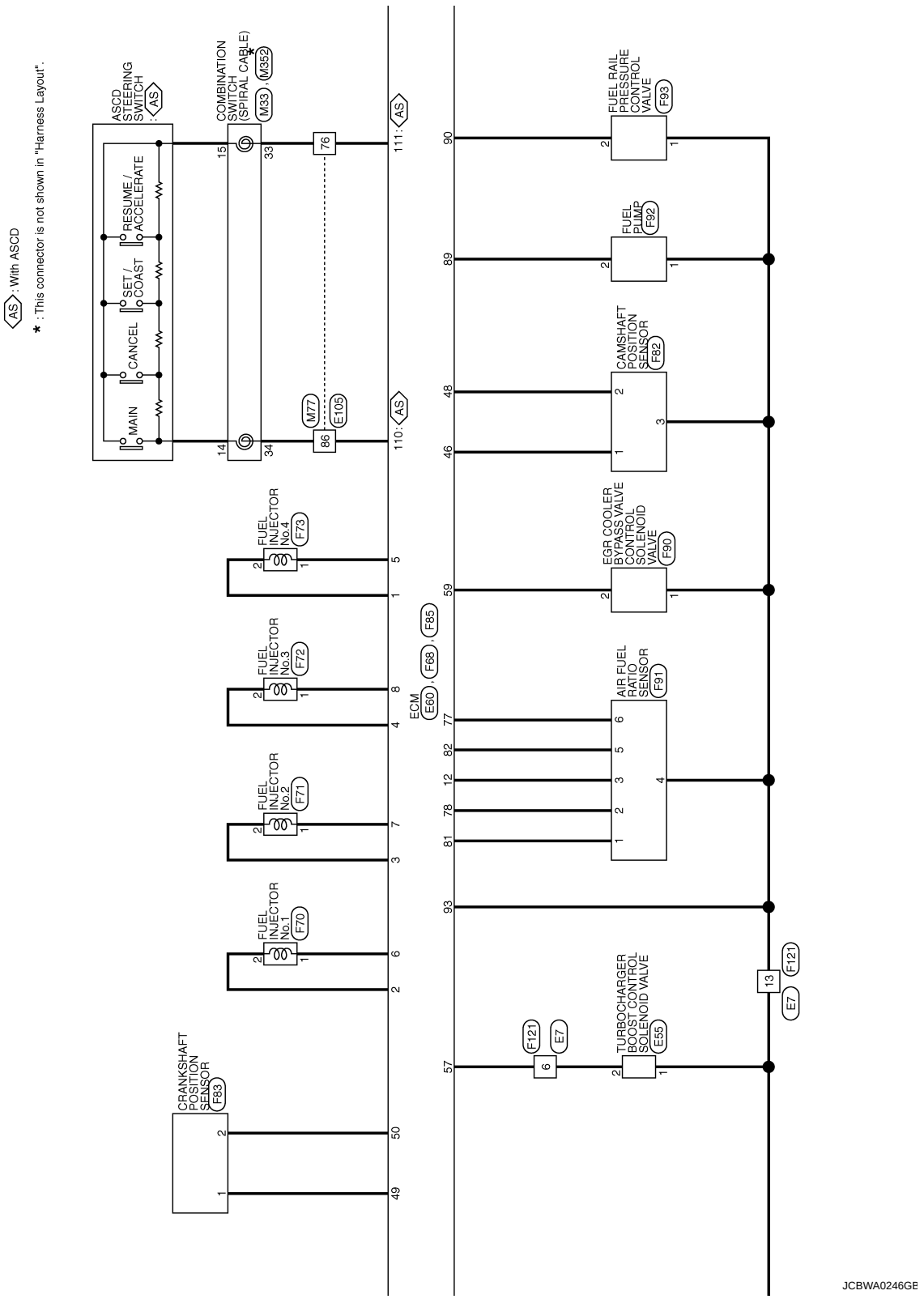
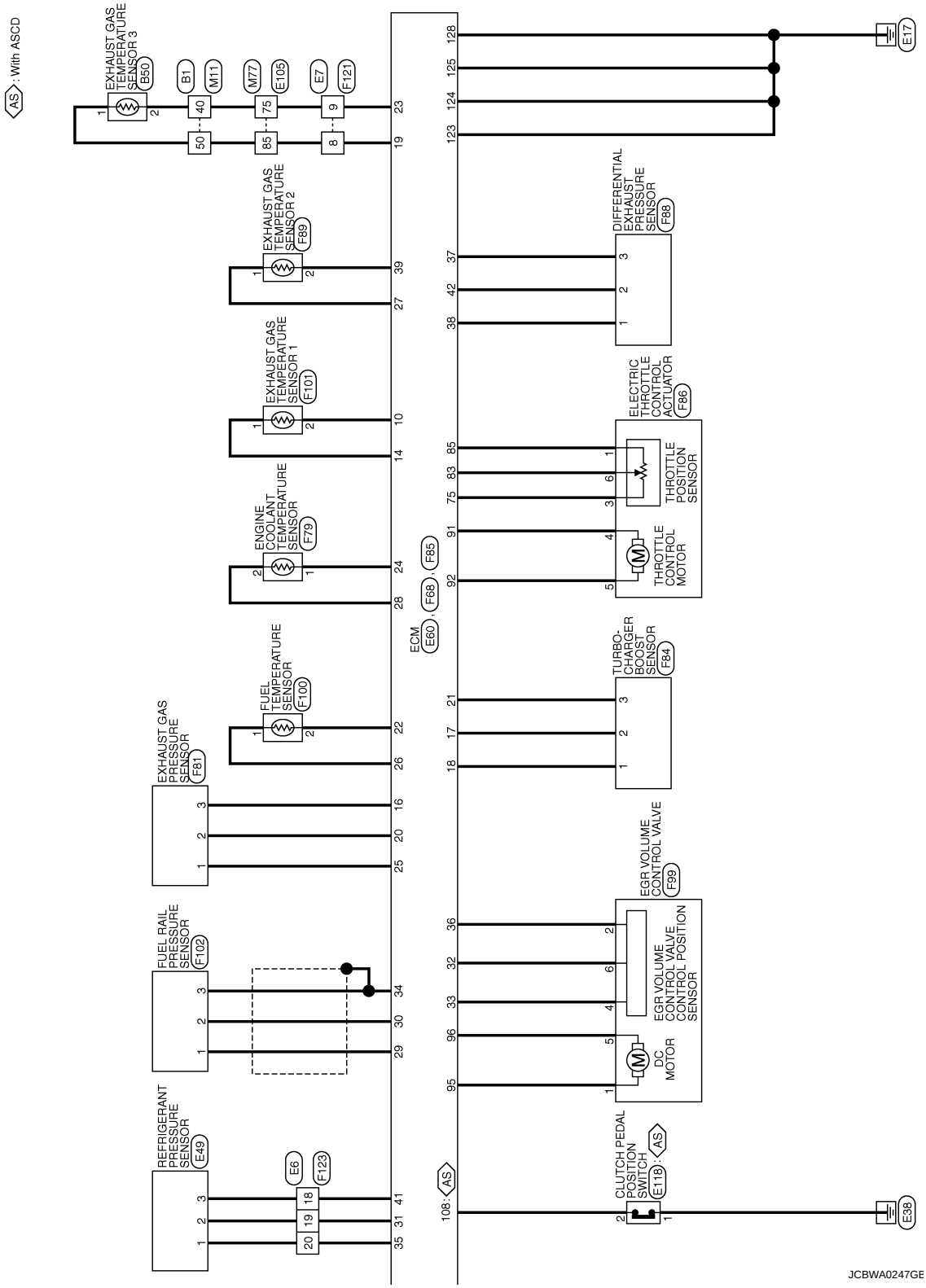



AS : With ASCD
ES : With ESP
OE : Without ESP
*1 6 : ES
25 : OE
ACCELERATOR PEDAL POSITION SENSOR E110
SENSOR 2
SENSOR 1
GLOW CONTROL UNIT F94
ECM E60, F68, F85
MASS AIR FLOW SENSOR E3
INTAKE AIR TEMPERATURE SENSOR
To CAN system
GLOW PLUG No.4 F98
GLOW PLUG No.3 F97
GLOW PLUG No.2 F96
GLOW PLUG No.1 F95
FUSIBLE LINK HOLDER F5
60A N
BRAKE PEDAL POSITION SWITCH E119
IGNITION SWITCH ON or START
10A 1
10A 8
10A 32
TURBOCHARGER COOLING PUMP RELAY E56
TURBOCHARGER COOLING PUMP F87
DATA LINE
DATA LINK CONNECTOR M4
M76
E17
JCBWA0245GE


AS : With ASCD
* : This connector is not shown in "Harness Layout".
ASCD STEERING SWITCH
AS
MAIN
CANCEL
SET / COAST
RESUME / ACCELERATE
COMBINATION SWITCH (SPIRAL CABLE)
M352
M33
15
33
14
34
76
86
M77
E105
111: AS
110: AS
FUEL INJECTOR No.4 F73
FUEL INJECTOR No.3 F72
FUEL INJECTOR No.2 F71
FUEL INJECTOR No.1 F70
CRANKSHAFT POSITION SENSOR F83
ECM E60, F68, F85
FUEL RAIL PRESSURE CONTROL VALVE F93
FUEL PUMP F92
CAMSHAFT POSITION SENSOR F82
EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE F90
AIR FUEL RATIO SENSOR F91
TURBOCHARGER BOOST CONTROL SOLENOID VALVE E55
F121
E7
JCBWA0246GB


AS : With ASCD
EXHAUST GAS TEMPERATURE SENSOR 3 B50
EXHAUST GAS TEMPERATURE SENSOR 2 F89
EXHAUST GAS TEMPERATURE SENSOR 1 F101
ENGINE COOLANT TEMPERATURE SENSOR F79
FUEL TEMPERATURE SENSOR F100
EXHAUST GAS PRESSURE SENSOR F81
FUEL RAIL PRESSURE SENSOR F102
REFRIGERANT PRESSURE SENSOR E49
ECM E60 (F68), (F85)
DIFFERENTIAL EXHAUST PRESSURE SENSOR F88
ELECTRIC THROTTLE CONTROL ACTUATOR F86
THROTTLE POSITION SENSOR
THROTTLE CONTROL MOTOR
TURBO-CHARGER BOOST SENSOR F84
EGR VOLUME CONTROL VALVE F99
EGR VOLUME CONTROL VALVE CONTROL POSITION SENSOR
DC MOTOR
CLUTCH PEDAL POSITION SWITCH E118
E17
E38
E6
F123
B1
M11
M77
E105
E7
F121
JCBWA0247GE

ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	B1
Connector Name	WIRE TO WIRE
Connector Type	TH80MW-CS16-TM4

Terminal No.	Color of Wire	Signal Name [Specification]
40	Y	–
50	G	–

Connector No.	B50
Connector Name	EXHAUST GAS TEMPERATURE SENSOR 3
Connector Type	HS02MB-5V

Terminal No.	Color of Wire	Signal Name [Specification]
1	G	SIG
2	Y	GND

Connector No.	E3
Connector Name	MASS AIR FLOW SENSOR
Connector Type	RH06FB

Terminal No.	Color of Wire	Signal Name [Specification]
2	L	–
3	W	–
4	R	–
5	B	–
6	G	–

Connector No.	E6
Connector Name	WIRE TO WIRE
Connector Type	TK24MW-1V

Terminal No.	Color of Wire	Signal Name [Specification]
5	B	–[With diesel engine]
6	R	–[With diesel engine]
16	W	–[With diesel engine]
17	G	–[With diesel engine]
18	L	–
19	SB	–[Without QR engine]
20	V	–
21	SHIELD	–[With diesel engine]

Connector No.	E7
Connector Name	WIRE TO WIRE
Connector Type	NS16MW-CS

Terminal No.	Color of Wire	Signal Name [Specification]
3	O	–
5	R	–[With diesel engine]
6	L	–[With diesel engine]
7	W	–[With diesel engine]
8	G	–[With diesel engine]
9	BR	–[With diesel engine]
10	B	–
13	G	–[With diesel engine]
14	V	–[With diesel engine]

Connector No.	E10
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	M06FW-LC

Terminal No.	Color of Wire	Signal Name [Specification]
4	W	–
7	P	–
8	G	–

Connector No.	E11
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	M06FB-LC

Terminal No.	Color of Wire	Signal Name [Specification]
11	B	–

Connector No.	E13
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	TH12FW-NH

Terminal No.	Color of Wire	Signal Name [Specification]
25	B	–
26	P	–
27	L	–
31	V	–

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ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	E14
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS12FBR-CS

Terminal No.	Color of Wire	Signal Name [Specification]
40	V	–
41	LG	–

Connector No.	E15
Connector Name	IPDM E/R (INTELLIGENT POWER DISTRIBUTION MODULE ENGINE ROOM)
Connector Type	NS16FW-CS

Terminal No.	Color of Wire	Signal Name [Specification]
47	V	–
48	G	–[With diesel engine]
50	G	–[With diesel engine]
51	W	–
55	O	–

Connector No.	E49
Connector Name	REFRIGERANT PRESSURE SENSOR
Connector Type	RK03FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	V	–
2	SB	–[Without QR engine]
3	L	–

Connector No.	E53
Connector Name	COOLING FAN MOTOR-1
Connector Type	RS04FGY-PR

Terminal No.	Color of Wire	Signal Name [Specification]
1	W	–
2	G	–
3	B	–
4	B	–

Connector No.	E54
Connector Name	COOLING FAN MOTOR-2
Connector Type	RS04FGY-PR

Terminal No.	Color of Wire	Signal Name [Specification]
1	O	–
2	O	–
3	P	–
4	GR	–

Connector No.	E55
Connector Name	TURBOCHARGER BOOST CONTROL SOLENOID VALVE
Connector Type	BS02FB-AHY-S

Terminal No.	Color of Wire	Signal Name [Specification]
1	G	–
2	L	–

Connector No.	E56
Connector Name	TURBOCHARGER COOLING PUMP RELAY
Connector Type	MS02FL-M2

Terminal No.	Color of Wire	Signal Name [Specification]
1	R	–
2	G	–
3	L	–
5	O	–

Connector No.	E57
Connector Name	COOLING FAN RELAY-4
Connector Type	MS02FL-M2

Terminal No.	Color of Wire	Signal Name [Specification]
1	V	–
2	O	–
3	P	–
5	G	–

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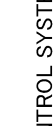
ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	E59
Connector Name	COOLING FAN RELAY-5
Connector Type	MS02FL-M2



Terminal No.	Color of Wire	Signal Name [Specification]
1	G	–
2	V	–
3	GR	–
5	B	–

Connector No.	E110
Connector Name	ACCELERATOR PEDAL POSITION SENSOR
Connector Type	RH06FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	P	–[With diesel engine]
2	Y	–[With diesel engine]
3	W	–[With diesel engine]
4	G	–[With diesel engine]
5	L	–[Without QR engine]
6	V	–[With diesel engine]

Connector No.	E60
Connector Name	ECM
Connector Type	MAA24FB-MEA8-LH

Terminal No.	Color of Wire	Signal Name [Specification]
99	P	MAIN CAN-L(BODY)
100	L	MAIN CAN-H(BODY)
104	Y	K-LINE
108	G	CLUTCH SW(M/T models with ASCD and ESP)
108	SB	CLUTCH SW(M/T models with ASCD without ESP)
109	LG	IGN
110	V	CRUISE CONTROL PANEL
111	B	GND CRUISE CONTROL PANEL
116	GR	BRAKE REDUNDANT
118	L	AVCC-APS2
119	V	APS2

Connector No.	E118
Connector Name	CLUTCH PEDAL POSITION SWITCH
Connector Type	M02FBR-LC

Terminal No.	Color of Wire	Signal Name [Specification]
1	B	–
2	G	–[With ESP]
2	SB	–[Without ESP]

120	P	GND-APS2
122	G	AVCC-APS1
123	B	GND
124	B	GND
125	B	
126	W	APS1
127	Y	GND-APS1
128	B	GND

Connector No.	E119
Connector Name	BRAKE PEDAL POSITION SWITCH
Connector Type	M02FBR-LC

Terminal No.	Color of Wire	Signal Name [Specification]
1	W	–
2	GR	–

Connector No.	E105
Connector Name	WIRE TO WIRE
Connector Type	TH80FW-CS16-TM4

Terminal No.	Color of Wire	Signal Name [Specification]
6	W	–
12	P	–
20	P	–
21	Y	–
22	L	–
25	L	–
30	L	–
75	BR	–
76	B	–
85	G	–
86	V	–

Connector No.	F5
Connector Name	FUSIBLE LINK HOLDER
Connector Type	L01FB-MC

Terminal No.	Color of Wire	Signal Name [Specification]
6	W	–

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ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	F68
Connector Name	ECM
Connector Type	MAA40FBR-MEA8-RH

Terminal No.	Color of Wire	Signal Name [Specification]
49	L	CRANK SHAFT SENS+
50	Y	CRANK SHAFT SENS–
53	GR	GLOW PLUG DIAGNOSTIC
56	R	TURBINE COOLANT PUMP PLY
57	V	VNT ACTUATOR COIL
59	SB	EGR BY-PASS VALVE
62	W	MAIN RLY
63	O	GLOW PLUG COMMOND
75	BR	AVCC-FLAP POSITION
77	O	CAT UEGO SENS
78	GR	CAT UEGO SENS GND
80	R	AIR FLOW
81	SB	CAT UEGO SENS
82	V	CAT UEGO SENS
83	V	INTAKE FLAP POSITION
84	B	INTAKE AIR TEMP
85	P	GND FLAP POSITION
87	W	GND–AIR FLOW
89	BR	MPROP
90	GR	PCV
91	SB	INTAKE FLAP DC–
92	LG	INTAKE FLAP DC+
93	G	VBATT
94	V	VBATT
95	P	EGR DC+
96	O	EGR DC–

Connector No.	F72
Connector Name	FUEL INJECTOR No.3
Connector Type	BOSCH 1928404072

Terminal No.	Color of Wire	Signal Name [Specification]
1	BR	–
2	G	–

Connector No.	F73
Connector Name	FUEL INJECTOR No.4
Connector Type	BOSCH 1928404072

Terminal No.	Color of Wire	Signal Name [Specification]
1	O	–
2	GR	–

Connector No.	F70
Connector Name	FUEL INJECTOR No.1
Connector Type	BOSCH 1928404072

Terminal No.	Color of Wire	Signal Name [Specification]
1	R	–
2	W	–

Connector No.	F71
Connector Name	FUEL INJECTOR No.2
Connector Type	BOSCH 1928404072

Terminal No.	Color of Wire	Signal Name [Specification]
1	L	–
2	Y	–

Connector No.	F79
Connector Name	ENGINE COOLANT TEMPERATURE SENSOR
Connector Type	RH02FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	O	–
2	P	–

Connector No.	F81
Connector Name	EXHAUST GAS PRESSURE SENSOR
Connector Type	AAZ03FB1

Terminal No.	Color of Wire	Signal Name [Specification]
1	SB	5V
2	R	VS
3	Y	GND

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ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	F82
Connector Name	CAMSHAFT POSITION SENSOR
Connector Type	FEA03FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	B	–
2	Y	–
3	G	–

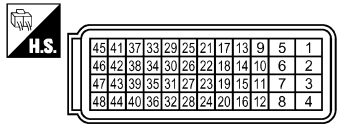
Connector No.	F83
Connector Name	CRANKSHAFT POSITION SENSOR
Connector Type	FEA02FG

Terminal No.	Color of Wire	Signal Name [Specification]
1	L	–
2	Y	–

Connector No.	F84
Connector Name	TURBOCHARGER BOOST SENSOR
Connector Type	BOSCH 1928404073

Terminal No.	Color of Wire	Signal Name [Specification]
1	LG	VS
2	O	GND
3	BR	5V

Connector No.	F85
Connector Name	ECM
Connector Type	MAA40FB-MEA8-RH



Terminal No.	Color of Wire	Signal Name [Specification]
1	GR	INJ#1-LSD
2	W	INJ#2-LSD
3	Y	INJ#3-LSD
4	G	INJ#4-LSD
5	O	INJ#1-HSD
6	R	INJ#2-HSD
7	L	INJ#3-HSD
8	BR	INJ#4-HSD
9	B	GND GLOW PLUG
10	Y	GND-TURBINE TEMP
12	P	CAT UEGO SENS HEATER
14	SB	TURBINE TEMP
16	Y	GND-TURBINE PRESS
17	O	GND BOOST PRESS
18	LG	BOOST PRESS
19	G	DPF DOWN TEMP
20	R	TURBINE PRESS
21	BR	AVCC-BOOST PRESS
22	W	GND-FUEL TEMP
23	Y	GND-DPF DOWN TEMP
24	O	GND-WATER TEMP
25	SB	AVCC-TURBINE PRESS
26	V	FUEL TEMP
27	GR	DPF UP TEMP
28	P	WATER TEMP
29	G	AVCC-RAIL PRESS
30	L	RAIL PRESS
31	SB	FREON PRESS
32	BR	EGR POSITION
33	GR	AVCC-EGR POSITION
34	Y	GND-RAIL PRESS
35	V	GND FREON PRESS
36	R	GND-EGR POSITION
37	W	AVCC-DPF DEFFERENTIAL
38	LG	DPF DEFFERENTIAL
39	L	GND DPF UP TEMP
41	L	AVCC-FREON PRESS
42	R	GND-DPF DEFFERENTIAL
46	B	GND CAMSHAFT SENS
48	Y	CAMSHAFT SENS

Connector No.	F86
Connector Name	ELECTRIC THROTTLE CONTROL ACTUATOR
Connector Type	AEU06FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	BR	5V
3	P	GND
4	SB	–
5	LG	+
6	Y	SIG

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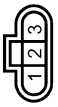
ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	F87
Connector Name	TURBOCHARGER COOLING PUMP
Connector Type	AHYS02FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	O	–
2	B	–

Connector No.	F88
Connector Name	DIFFERENTIAL EXHAUST PRESSURE SENSOR
Connector Type	BOSCH 1928404073



Terminal No.	Color of Wire	Signal Name [Specification]
1	LG	VS
2	R	GND
3	W	5V

Connector No.	F89
Connector Name	EXHAUST GAS TEMPERATURE SENSOR 2
Connector Type	YZK-7282-7022-10

Terminal No.	Color of Wire	Signal Name [Specification]
1	GR	SIG
2	L	GND

Connector No.	F90
Connector Name	EGR COOLER BYPASS VALVE CONTROL SOLENOID VALVE
Connector Type	BS02FB-AHY-S

Terminal No.	Color of Wire	Signal Name [Specification]
1	G	–
2	SB	–

Connector No.	F91
Connector Name	AIR FUEL RATIO SENSOR
Connector Type	AEU06FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	SB	PUMPING CURRENT
2	GR	VIRTUELLE GND
3	P	HEATER-
4	G	HEATER+
5	V	TRIM CURRENT
6	O	NERNST VOLAGE

Connector No.	F92
Connector Name	FUEL PUMP
Connector Type	BOSCH 1928404072

Terminal No.	Color of Wire	Signal Name [Specification]
1	G	–
2	BR	–

Connector No.	F93
Connector Name	FUEL RAIL PRESSURE CONTROL VALVE
Connector Type	BOSCH 1928404072

Terminal No.	Color of Wire	Signal Name [Specification]
1	R	–
2	GR	–

Connector No.	F94
Connector Name	GLOW CONTROL UNIT
Connector Type	FCI 240PC089S0015

Terminal No.	Color of Wire	Signal Name [Specification]
1	Y	–
2	W	–
3	GR	–
4	W	–
5	B	–
6	L	–
7	G	–
8	O	–

JCBWA0253GE

ENGINE CONTROL SYSTEM (M9R ENGINE)

Connector No.	F95
Connector Name	GLOW PLUG No.1
Connector Type	TYCO-AMP 953631-1

Terminal No.	Color of Wire	Signal Name [Specification]
1	W	–

Connector No.	F96
Connector Name	GLOW PLUG No.2
Connector Type	TYCO-AMP 953631-1

Terminal No.	Color of Wire	Signal Name [Specification]
1	G	–

Connector No.	F97
Connector Name	GLOW PLUG No.3
Connector Type	TYCO-AMP 953631-1

Terminal No.	Color of Wire	Signal Name [Specification]
1	Y	–

Connector No.	F98
Connector Name	GLOW PLUG No.4
Connector Type	TYCO-AMP 953631-1

Terminal No.	Color of Wire	Signal Name [Specification]
1	L	–

Connector No.	F99
Connector Name	EGR VOLUME CONTROL VALVE
Connector Type	FEP-42032800

Terminal No.	Color of Wire	Signal Name [Specification]
1	P	–
2	R	–
4	GR	–
5	O	–
6	BR	–

Connector No.	F100
Connector Name	FUEL TEMPERATURE SENSOR
Connector Type	FEA02FGY

Terminal No.	Color of Wire	Signal Name [Specification]
1	V	–
2	W	–

Connector No.	F101
Connector Name	EXHAUST GAS TEMPERATURE SENSOR 1
Connector Type	FEA02FY

Terminal No.	Color of Wire	Signal Name [Specification]
1	SB	SIG
2	Y	–

Connector No.	F102
Connector Name	FUEL RAIL PRESSURE SENSOR
Connector Type	BHZ03FB

Terminal No.	Color of Wire	Signal Name [Specification]
1	G	–
2	L	–
3	Y	–

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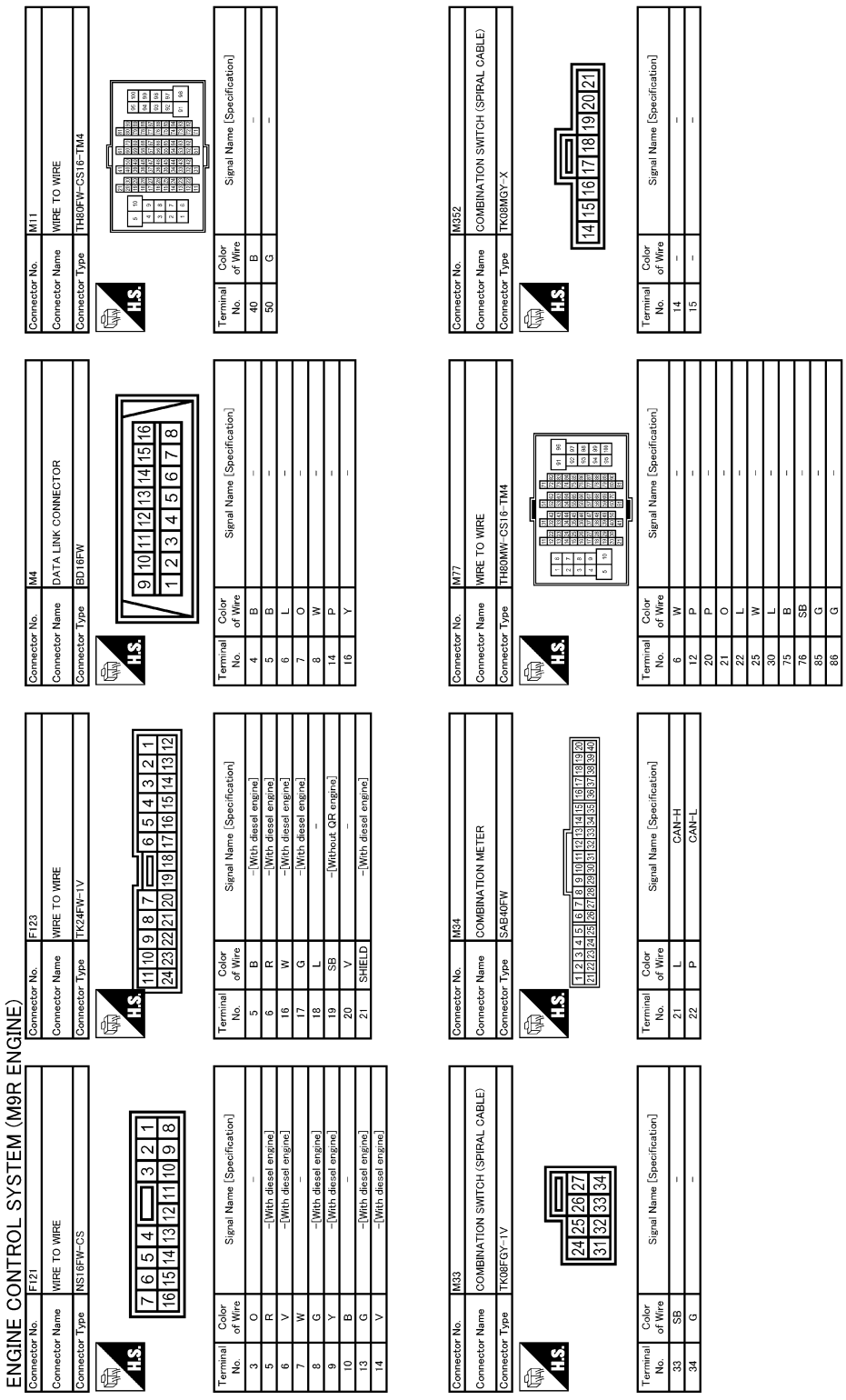

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Fail Safe

INFOID:0000000001530534

DTC No.	Detected items	Engine operating condition in fail-safe mode
P2002	Particulate matter over accumulation	Engine speed will not rise more than 2,000 rpm due to the fuel cut.

DTC Inspection Priority Chart

INFOID:0000000001530535

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	• U1000 CAN communication line • P0016 Crankshaft position - camshaft position correlation • P0100 Mass air flow sensor • P0110 Intake air temperature sensor • P0115 Engine coolant temperature sensor • P0120 Throttle position sensor • P0130 P0131 P0133 P0134 P2231 P2A00 Air fuel ratio (A/F) sensor 1 • P0135 Air fuel ratio (A/F) sensor 1 heater • P0180 Fuel temperature sensor • P0190 P2293 Fuel rail pressure sensor • P0225 P2120 Accelerator pedal position sensor • P0235 Turbocharger boost sensor • P0335 Crankshaft position sensor • P0340 Camshaft position sensor • P0409 EGR volume control valve control position sensor • P0470 Exhaust gas pressure sensor • P0500 Vehicle speed sensor • P0530 Refrigerant pressure sensor • P0544 Exhaust gas temperature sensor 1 • P0560 Battery voltage • P0606 P060B P062B P062F P1607 ECM • P0611 Injector adjustment value • P0641 P0651 P0697 Sensor power supply • P1610 - P1616 NATS • P2031 Exhaust gas temperature sensor 2 • P2080 Exhaust gas temperature sensor 3 • P2226 Barometric sensor • P2299 Accelerator pedal - brake pedal position sensor inconsistency • P242A Exhaust gas temperature sensor 3 • P2452 Differential exhaust gas pressure sensor • P2453 Differential exhaust gas pressure sensor
2	• P0045 Turbocharger boost control solenoid valve • P0089 P2294 Fuel rail pressure control valve • P0090 Fuel pump • P0200 P0201 - P0204 P0263 P0266 P0269 P0272 P1201 - P1204 P2146 P2149 Fuel injector • P0380 Glow plug • P0487 P0488 EGR volume control valve • P0571 Brake pedal position sensor • P0670 Glow control unit • P0685 ECM relay • P2100 Electric throttle control actuator • P2101 Throttle position sensor • P2425 EGR cooler bypass valve control solenoid valve • P2505 Ignition relay • P2600 Turbocharger cooling pump
3	• P0297 P3031 Service regeneration • P0300 - P0304 Misfire • P0564 P0575 ASCD steering switch • P1435 P1436 DPF regeneration • P2002 P242F DPF • P2263 Turbocharger system

DTC Index

INFOID:0000000001307583

X: Applicable —: Not applicable

DTC*	Items (CONSULT-III screen terms)	Trip	MI lighting up	Reference page
U1000	CAN COMM CIRCUIT	3	–	ECR-114
P0016	CMP/CKP RELATION	3	–	ECR-115
P0045	TC BOOST SOL/V	3	×	ECR-117
P0089	FUEL PUMP	3	×	ECR-119
P0090	FUEL PUMP	3	×	ECR-121
P0100	MAF SENSOR	3	×	ECR-123
P0101	MAF SENSOR	3	×	ECR-126
P0110	IAT SENSOR	3	×	ECR-130
P0115	ECT SENSOR	3	×	ECR-132
P0120	TP SENSOR	3	×	ECR-134
P0130	A/F SENSOR1	3	×	ECR-137
P0131	A/F SENSOR1	3	×	ECR-139
P0133	A/F SENSOR1	3	×	ECR-141
P0134	A/F SENSOR1	3	×	ECR-143
P0135	A/F SEN1 HTR	3	×	ECR-145
P0180	FUEL TEMP SENSOR	3	–	ECR-148
P0190	FRP SENSOR	3	×	ECR-150
P0200	INJECTOR	3	×	ECR-153
P0201	CYL 1 INJECTOR	3	×	ECR-155
P0202	CYL 2 INJECTOR	3	×	ECR-155
P0203	CYL 3 INJECTOR	3	×	ECR-155
P0204	CYL 4 INJECTOR	3	×	ECR-155
P0225	APP SENSOR 1	3	×	ECR-158
P0235	TC BOOST SENSOR	3	×	ECR-161
P0263	CYL 1 INJECTOR	3	–	ECR-163
P0266	CYL 2 INJECTOR	3	–	ECR-163
P0269	CYL 3 INJECTOR	3	–	ECR-163
P0272	CYL 4 INJECTOR	3	–	ECR-163
P0297	SERVICE REGENERATN	3	–	ECR-164
P0300	MULTI CYL MISFIRE	3	–	ECR-165
P0301	CYL 1 MISFIRE	3	–	ECR-165
P0302	CYL 2 MISFIRE	3	–	ECR-165
P0303	CYL 3 MISFIRE	3	–	ECR-165
P0304	CYL 4 MISFIRE	3	–	ECR-165
P0335	CKP SENSOR	3	×	ECR-167
P0340	CMP SENSOR	3	×	ECR-169
P0380	GLOW RELAY	3	–	ECR-172
P0409	EGR POS SENSOR	3	×	ECR-175
P0470	EXH GAS PRESS SEN	3	×	ECR-178
P0487	EGR CONT VALVE	3	×	ECR-180
P0488	EGR SYSTEM	3	×	ECR-182

DTC*	Items (CONSULT-III screen terms)	Trip	MI lighting up	Reference page
P0500	VEHICLE SPEED	3	–	ECR-184
P0530	REFRGRT PRESS SEN	3	–	ECR-185
P0544	EGT SENSOR 1	3	–	ECR-187
P0560	BATTERY VOLTAGE	3	–	ECR-189
P0564	ASCD SW	3	–	ECR-192
P0571	BPP SW	3	–	ECR-195
P0575	ASCD SW	3	–	ECR-198
P0606	ECM	3	ON or –	ECR-201
P060B	ECM	3	×	ECR-203
P0611	INJ ADJ VAL	3	×	ECR-205
P062B	ECM	3	ON or –	ECR-207
P062F	ECM	3	×	ECR-209
P0641	SENSOR PWR/CIRC1	3	×	ECR-211
P0651	SENSOR PWR/CIRC2	3	×	ECR-213
P0670	GLOW CONT SYSTEM	3	–	ECR-216
P0685	ECM RELAY	3	×	ECR-218
P0697	SENSOR PWR/CIRC3	3	×	ECR-220
P1201	CYL 1 INJECTOR	3	–	ECR-222
P1202	CYL 2 INJECTOR	3	–	ECR-222
P1203	CYL 3 INJECTOR	3	–	ECR-222
P1204	CYL 4 INJECTOR	3	–	ECR-222
P1435	DPF REGENERATION	3	×	ECR-224
P1436	DPF REGENERATN	3	–	ECR-226
P1607	ECM	3	×	ECR-228
P1610	LOCK MODE	3	–	SEC-37
P1611	ID DISCORD,IMMU-ECM	3	–	SEC-38 or SEC-251
P1612	CHAIN OF ECM-IMMU	3	–	SEC-40 or SEC-253
P1614	CHAIN OF IMMU-KEY	3	–	SEC-41 or SEC-254
P1615	DIFFERENCE OF KEY	3	–	SEC-43 or SEC-256
P1616	ECM	3	–	SEC-44 or SEC-257
P2002	PM OVER ACCMLT	3	–	ECR-229
P2031	EGT SENSOR 2	3	–	ECR-231
P2080	EGT SENSOR 1	3	–	ECR-234
P2100	ETC FUNCTION	3	–	ECR-236
P2101	ETC FUNCTION	3	–	ECR-239
P2120	APP SENSOR 2	3	×	ECR-242
P2146	INJ PWR/CIRC	3	×	ECR-245
P2149	INJ PWR/CIRC	3	×	ECR-245
P2226	BARO SENSOR	3	×	ECR-247
P2231	A/F SENSOR1	3	×	ECR-249
P2263	TC SYSTEM	3	×	ECR-251
P2293	FRP CONTROL SYSTEM	3	×	ECR-254
P2294	FRP CONTROL VALVE	3	×	ECR-256
P2299	APP/BPP INCNSSTNCY	3	–	ECR-258

DTC*	Items (CONSULT-III screen terms)	Trip	MI lighting up	Reference page
P2425	EGR COOLER BYP/V	3	–	ECR-262
P242A	EGT SENSOR 3	3	–	ECR-264
P242F	DPF	3	–	ECR-267
P2452	DIFF EX PRESS SEN	3	×	ECR-269
P2453	DIFF EX PRESS SWN	3	×	ECR-271
P2505	ECM POWER SUPPLY	3	–	ECR-272
P2600	TC COOLING PUMP	3	–	ECR-274
P2A00	A/F SENSOR1	3	×	ECR-278
P3031	SERVICE REGENERATN	3	–	ECR-280

*: This number is prescribed by ISO 15031-6.

SYMPTOM DIAGNOSIS

ENGINE CONTROL SYSTEM SYMPTOMS

Symptom Table

INFOID:0000000001530541

SYSTEM — Basic engine control system	SYMPTOM													Reference page
	HARD/NO START/RESTART (EXCP. HA)				ENGINE STALL									
	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	
Warranty symptom code	AA				AB			AC	AD	AE		AF		
Fuel pump	5	5	5	5	5	5	5	5		5	5		5	—
Fuel injector	3	3	3	3	3	3	3	3	3	4	4	3	3	ECR-163, ECR-222
Glow control system	1	1	1	1					1					ECR-172, ECR-216
Engine body	3	3	3	3	3	3	3		3	4	4		3	EM-312
EGR system										3	3			ECR-182
Air cleaner and duct										3	3			EM-263
Turbocharger cooling pump										3	3			ECR-274
Electric throttle control actuator	2	2	2	2	1	1	1			1	1			ECR-236, ECR-239

SYSTEM — Basic engine control system		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)				ENGINE STALL									
		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	
Warranty symptom code		AA				AB			AC	AD	AE		AF		
ENGINE CONTROL	Fuel pump circuit	4	4	4	4	4	4	4	4		4	4		4	ECR-121
	Fuel injector circuit	1	1	1	1	1	1	1	1	1	1	1	1	1	ECR-155
	Fuel injector adjustment value registration								1	1	1	1			ECR-205
	Mass air flow sensor circuit								1		1	1			ECR-123
	Engine coolant temperature circuit			1		1		1						1	ECR-132
	Vehicle speed signal circuit											1			ECR-184
	A/F sensor 1 circuit														ECR-137
	Accelerator pedal position sensor circuit								1		1	1			ECR-158, ECR-242
	Fuel rail pressure sensor circuit														ECR-150
	Fuel rail pressure control valve circuit	4	4	4	4	4	4	4	4		4	4	4	4	ECR-256
	Fuel temperature sensor circuit														ECR-148

SYSTEM — Basic engine control system		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)				ENGINE STALL									
		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	
Warranty symptom code		AA				AB			AC	AD	AE		AF		
ENGINE CONTROL	Crankshaft position sensor circuit		1	1	1	1	1	1	1	1	1	1			ECR-167
	Camshaft position sensor circuit			3	3										ECR-169
	Turbocharger boost sensor circuit								1		1	1			ECR-161
	Turbocharger boost control solenoid valve circuit								1		1	1			ECR-117
	Start signal circuit	1	1	1	1	1		1	1		1	1			STR-20
	Ignition switch circuit		1			1	1	1							ECR-111
	Power supply for ECM circuit		1			1	1	1							ECR-272
	EGR volume control valve circuit								1		1	1			ECR-180
	EGR cooler bypass valve control solenoid valve														ECR-262
	Differential exhaust pressure sensor circuit										3	3	3		ECR-269
	Exhaust gas temperature sensor 1 circuit														ECR-187
	Exhaust gas temperature sensor 2 circuit														ECR-231
	Exhaust gas temperature sensor 3 circuit														ECR-264

SYSTEM — Basic engine control system		SYMPTOM													Reference page
		HARD/NO START/RESTART (EXCP. HA)				ENGINE STALL									
		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	
Warranty symptom code		AA				AB			AC	AD	AE		AF		
ENGINE CONTROL	Exhaust gas pressure sensor circuit										3	3			ECR-178
	Throttle position sensor circuit														ECR-134
	Refrigerant pressure sensor circuit					2	2	2							ECR-185
	ECM relay (Self shut-off) circuit		1				1	1	1						ECR-218
	ECM	2	2	2	2	2	2	2	2	2	2	2	2	2	ECR-201, ECR-203, ECR-207, ECR-209
NATS (Nissan Anti-theft System)			1												SEC-16, SEC-235

1 - 5: The numbers refer to the order of inspection.

(continued on next page)

SYSTEM — Basic engine control system		SYMPTOM												Reference page
		ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR		DEAD BATTERY (UNDER CHARGE)	DPF warning light illuminates.*	Malfunction indicator illuminates.	Can be detected by CONSULT-III?	
								BLACK SMOKE	WHITE SMOKE					
Warranty symptom code		AG	AH	AJ	AK	AL	AM	AP		HA				
Fuel pump		5	5	5		5					3	1	1	—
Fuel injector		3	3	3		4		3	3		1	1	1	ECR-163, ECR-222
Glow control system									1					ECR-172, ECR-216
Engine body			3	3	3	3	1		3					EM-312
EGR system								3			1			ECR-182
Air cleaner and duct								3						EM-263
Electric throttle control actuator											1	1	1	ECR-236, ECR-239
Turbocharger cooling pump														ECR-274
ENGINE CONTROL	Fuel pump circuit	4	4	4		4					1	1	1	ECR-121
	Fuel injector circuit	1	1	1		1		1	1		1	1	1	ECR-155
	Fuel injector adjustment value registration	1	1					1	1		1		1	ECR-205
	Mass air flow sensor circuit							1			1	1	1	ECR-123
	Engine coolant temperature circuit	1	1		1							1	1	ECR-132
	A/F sensor 1 circuit										2	1	1	ECR-137
	Vehicle speed signal circuit											1	1	ECR-184
	Accelerator pedal position sensor circuit			1								1	1	ECR-158, ECR-242
	Fuel rail pressure sensor circuit										1	1	1	ECR-150
	Fuel rail pressure control valve circuit	4	4	4		4								ECR-256
	Fuel temperature sensor circuit													ECR-148

SYSTEM — Basic engine control system		SYMPTOM												Reference page
		ROUGH IDLE/HUNTING	IDLING VIBRATION	SLOW/NO RETURN TO IDLE	OVERHEAT/HIGH ENGINE COOLANT TEMPERATURE	EXCESSIVE FUEL CONSUMPTION	EXCESSIVE OIL CONSUMPTION	ABNORMAL SMOKE COLOR		DEAD BATTERY (UNDER CHARGE)	DPF warning light illuminates.*	Malfunction indicator illuminates.	Can be detected by CONSULT-III?	
								BLACK SMOKE	WHITE SMOKE					
Warranty symptom code		AG	AH	AJ	AK	AL	AM	AP		HA				
ENGINE CONTROL	Crankshaft position sensor circuit	1	1								3	1	1	ECR-167
	Camshaft position sensor circuit										3	1	1	ECR-169
	Turbocharger boost sensor circuit										2	1	1	ECR-161
	Turbocharger boost control solenoid valve circuit							1	1		1			ECR-117
	Start signal circuit													STR-20
	Ignition switch circuit													ECR-111
	Power supply for ECM circuit											1	1	ECR-272
	EGR cooler bypass valve control solenoid valve circuit					3		1						ECR-262
	EGR volume control valve circuit							1			1			ECR-182
	Differential exhaust gas pressure sensor circuit										2	1	1	ECR-269
	Exhaust gas temperature sensor 1 circuit										2	1	1	ECR-187
	Exhaust gas temperature sensor 2 circuit										2	1	1	ECR-231
	Exhaust gas temperature sensor 3 circuit										2	1	1	ECR-264
	Throttle position sensor circuit										1	1	1	ECR-134
	Refrigerant pressure sensor circuit			3		4								ECR-185
	ECM relay (Self shut-off) circuit												1	ECR-218
	ECM	2	2	2	2	2	2	2	2	2	2	2	2	ECR-201, ECR-203, ECR-207, ECR-209
NATS (Nissan Anti-theft System)													1	SEC-16, SEC-235

1 - 5: The numbers refer to the order of inspection.

*: Although there is no malfunction in the engine control system, DPF warning light may light up because the vehicle is driven in the specified driving pattern. For the detail, refer to ECR-57, "System Description".

PRECAUTION

PRECAUTIONS

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

INFOID:0000000001557095

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 AIRBAG” and “SEAT BELT” 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, all maintenance must be performed by an authorized NISSAN/INFINITI dealer.**
- **Improper maintenance, 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 “SRS AIRBAG”.**
- **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.**

Precaution Necessary for Steering Wheel Rotation After Battery Disconnect

INFOID:0000000001557096

NOTE:

- This Procedure is applied only to models with Intelligent Key system and NATS (NISSAN ANTI-THEFT SYSTEM).
- Remove and install all control units after disconnecting both battery cables with the ignition knob in the ″LOCK″ position.
- Always use CONSULT-III to perform self-diagnosis as a part of each function inspection after finishing work. If DTC is detected, perform trouble diagnosis according to self-diagnostic results.

For models equipped with the Intelligent Key system and NATS, an electrically controlled steering lock mechanism is adopted on the key cylinder.

For this reason, if the battery is disconnected or if the battery is discharged, the steering wheel will lock and steering wheel rotation will become impossible.

If steering wheel rotation is required when battery power is interrupted, follow the procedure below before starting the repair operation.

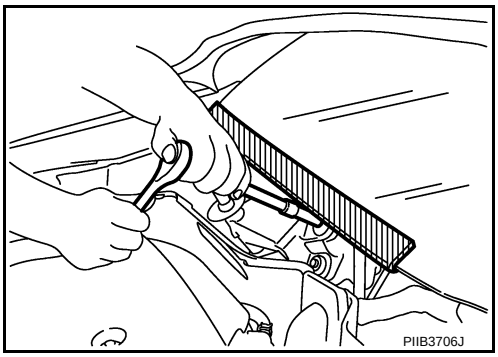
OPERATION PROCEDURE

1. Connect both battery cables.
   NOTE:
   Supply power using jumper cables if battery is discharged.
2. Use the Intelligent Key or mechanical key to turn the ignition switch to the ″ACC″ position. At this time, the steering lock will be released.
3. Disconnect both battery cables. The steering lock will remain released and the steering wheel can be rotated.
4. Perform the necessary repair operation.
5. When the repair work is completed, return the ignition switch to the ″LOCK″ position before connecting the battery cables. (At this time, the steering lock mechanism will engage.)
6. Perform a self-diagnosis check of all control units using CONSULT-III.

Precaution for Procedure without Cowl Top Cover

INFOID:0000000001557097

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



Precautions For Xenon Headlamp Service

INFOID:0000000001583159

WARNING:

Comply with the following warnings to prevent any serious accident.

- **Disconnect the battery cable (negative terminal) or the power supply fuse before installing, removing, or touching the xenon headlamp (bulb included). The xenon headlamp contains high-voltage generated parts.**
- **Never work with wet hands.**
- **Check the xenon headlamp ON-OFF status after assembling it to the vehicle. Never turn the xenon headlamp ON in other conditions. Connect the power supply to the vehicle-side connector. (Turning it ON outside the lamp case may cause fire or visual impairments.)**
- **Never touch the bulb glass immediately after turning it OFF. It is extremely hot.**

CAUTION:

Comply with the following cautions to prevent any error and malfunction.

- **Install the xenon bulb securely. (Insufficient bulb socket installation may melt the bulb, the connector, the housing, etc. by high-voltage leakage or corona discharge.)**
- **Never perform HID circuit inspection with a tester.**
- **Never touch the xenon bulb glass with hands. Never put oil and grease on it.**
- **Dispose of the used xenon bulb after packing it in thick vinyl without breaking it.**
- **Never wipe out dirt and contamination with organic solvent (thinner, gasoline, etc.).**

On Board Diagnostic (OBD) System of Engine

INFOID:0000000001307631

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

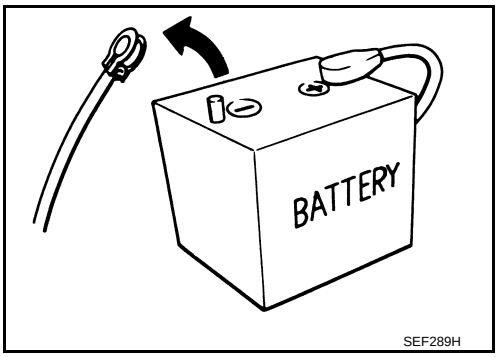
CAUTION:

- **Be sure to turn the ignition switch OFF and disconnect the battery negative cable before any repair or inspection work. The open/short circuit of related switches, sensors, solenoid valves, etc. will cause the MI to light up.**
- **Be sure to connect and lock the connectors securely after work. A loose (unlocked) connector will cause the MI 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-120, "Description".**
- **Be sure to route and secure the harnesses properly after work. The interference of the harness with a bracket, etc. may cause the MI 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 MI to light up due to the malfunction of the fuel system, etc.**
- **Be sure to erase the unnecessary malfunction information (repairs completed) from the ECM before returning the vehicle to the customer.**

General Precautions

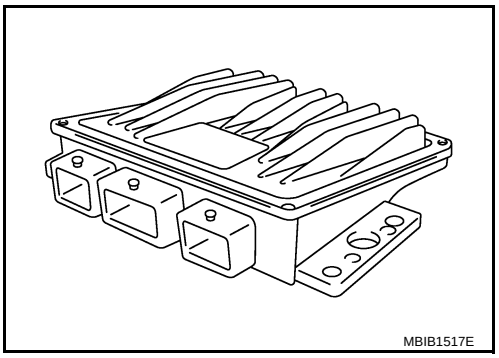
INFOID:0000000001307632

- **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, wait 3 minutes and disconnect battery negative 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 negative cable.**

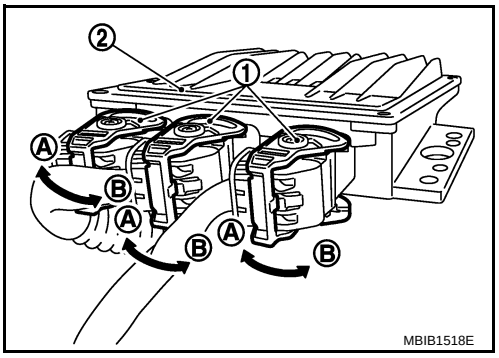


SEF289H

- **Do not disassemble ECM.**

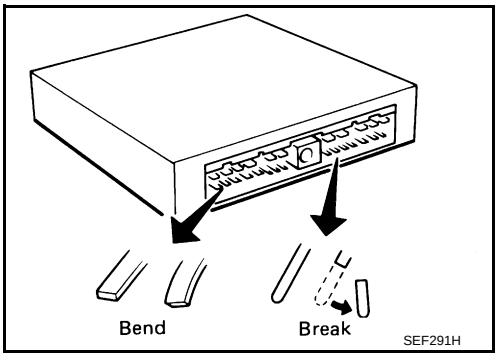

MBIB1517E

- **When connecting ECM harness connector, fasten (A) it securely with levers (1) as far as they will go as shown in the figure.**
- **ECM (2)**
- **Loosen (B)**



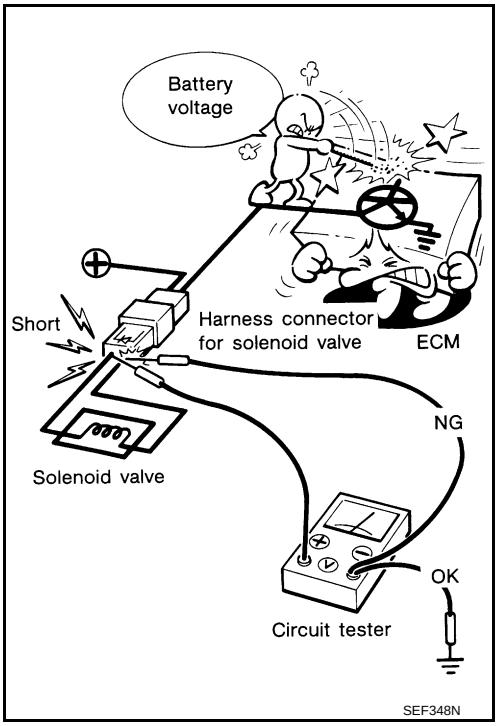
MBIB1518E

- **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 IC's.
- **Keep engine control system harness at least 10cm (4 in) away from adjacent harness, to prevent engine control system malfunctions due to receiving external noise, degraded operation of IC's, etc.**
- **Keep engine control system parts and harness dry.**
- **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.**
- **Even a slight leak in the air intake system can cause serious incidents.**
- **Do not shock or jar the camshaft position sensor, crankshaft position sensor.**

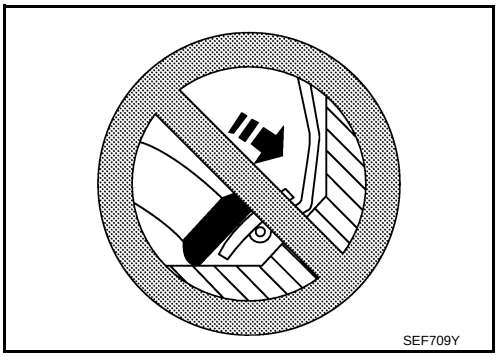


SEF291H

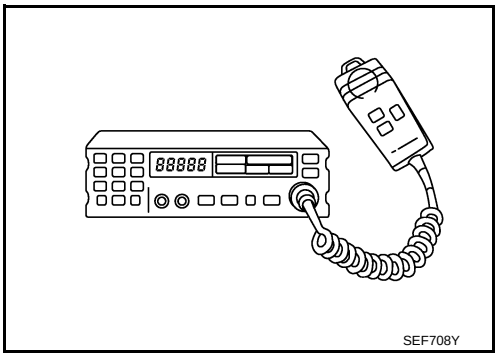
- **When measuring ECM signals with a circuit tester, never allow the two tester probes to contact.**
  Accidental contact of probes will cause a short circuit and damage the ECM power transistor.
- **Do not use ECM ground terminals when measuring input/output voltage. Doing so may result in damage to the ECM's transistor. Use a ground other than ECM terminals, such as the ground.**
- **Do not disassemble fuel pump.**
  If NG, take proper action.
- **Do not disassemble fuel injector.**
  If NG, replace fuel injector.



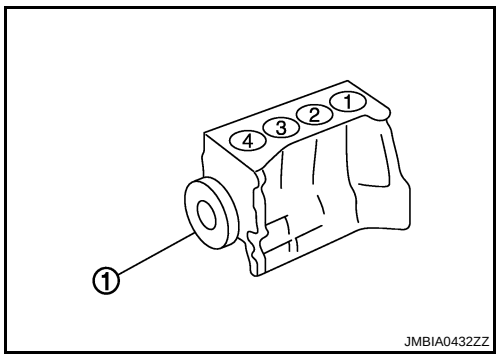
- **Do not depress accelerator pedal when staring.**
- **Immediately after staring, do not rev up engine unnecessarily.**
- **Do not rev up engine just prior to shutdown.**



- **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 standingwave radio can be kept smaller.**
- **Be sure to ground the radio to vehicle body.**



- **Cylinder NO.1 is at the flywheel end.**
  -1: Crankshaft pulley



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ENGINE RUNNING

- **No work should be carried out on the hydraulic system while engine is running.**
- **Remember that fuel pressure values in hydraulic circuit can reach up to 1,600 bar.**
- **Keep hands or face (particularly eyes) out of any high pressure leak.**
- **Recall that fuel is dangerous for health.**

FUEL RAIL PRESSURE SENSOR

- **Under warranty, do not remove the fuel rail pressure sensor from the rail.**
- **Do not try to measure the resistance of the fuel rail pressure sensor. This test is destructive for the internal components.**

FUEL INJECTOR

- **Fuel injectors are driven by over 100V.**
- **FUEL injector electronics are polarised. In case of intervention on wiring harness, do not invertwires. It is destructive for the piezo components.**
- **Do not drive the fuel injectors if their body is not connected to the battery ground (risk ofelectro-static discharge). For instance, fuel injector body have to be in contact with cylinder.**
- **Piezo fuel injector connector must not be unplugged while engine is running. Risk of majordamage to the engine (fuel injector could stay opened).**

Cleanliness

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Cleanliness

RISKS ASSOCIATED WITH CONTAMINATION

The high pressure direct injection system is highly sensitive to contamination. The risks associated withcontamination are:

- damage to or destruction of the high pressure injection system,
- components jamming,
- components losing seal integrity.

All After-Sales operations must be performed under very clean conditions. This means that no impurities (particles a few microns in size) should have entered the system during dismantling.

The cleanliness principle must be applied from the filter to the fuel injectors.

What are the sources of contamination?

- metal or plastic chips,
- paint,
- fibres:
  - from cardboard,
  - from brushes,
  - from paper,
  - from clothing,
  - from cloths,
- foreign bodies such as hair,
- ambient air
- etc.

NOTE:

Cleaning the engine using a high pressure washer is prohibited because of the risk of damaging connections. In addition, moisture may collect in the connectors and create electrical connection malfunction.

INSTRUCTIONS TO BE FOLLOWED BEFORE CARRYING OUT ANY WORK

NOTE:
Before any work is carried out on the high pressure injection system, protect:
- the accessories and timing belts,
- the electrical accessories, (starter, alternator, electric power assisted steering pump),
- the flywheel surface, to prevent any diesel from running onto the clutch friction plate.

- Check that you have plugs for the unions to be opened (set of plugs available from the Parts Department). The plugs are single-use only. After use, they must be discarded (once used they are soiled and cleaning is not sufficient to make them reusable). Unused plugs must be discarded.
- Check that you have hermetically resealable plastic bags for storing removed parts. Stored parts will therefore be less subject to the risk of impurities. The bags are to be used once only, and discarded after use.
- Use lint-free cleaning cloths. Using normal cloth or paper is prohibited. They are not lint-free and could contaminate the fuel circuit. Each cloth should only be used once.
- Use fresh cleaning agent for each operation (used cleaning agent is contaminated). Pour it into an uncontaminated container.
- For each operation, use a clean brush in good condition (the brush must not shed its bristles).
- Use a brush and cleaning agent to clean the unions to be opened.
- Blast compressed air over the cleaned parts (tools, workbench, the parts, unions and injection system zones). Check that no bristles remain.
- Wash your hands before and during the operation if necessary.
- When wearing leather protective gloves cover them with latex gloves to prevent contamination.

INSTRUCTIONS TO BE FOLLOWED WHEN CARRYING OUT ANY WORK
- As soon as the circuit is open, all openings must be plugged to prevent impurities from entering the system. The plugs to be used are available from the Parts Department. The plugs must not be reused under any circumstances.
- Seal the pouch shut, even if it has to be opened shortly afterwards. Ambient air carries contamination.
- All components removed from the injection system must be stored in a hermetically sealed plastic bag once they have been plugged.
- Using a brush, cleaning agent, air gun, sponge or normal cloth is strictly prohibited once the circuit has been opened. These items could allow contamination to enter the system.
- A new component replacing an old one must not be removed from its packaging until it is to be fitted to the vehicle.

SERVICE DATA AND SPECIFICATIONS (SDS)

SERVICE DATA AND SPECIFICATIONS (SDS)

Idle Speed

INFOID:0000000001307634

Condition	Specification
No load* (in Neutral position)	750 ± 50 rpm

*: Under the following conditions

- A/C switch: OFF
- Electric load: OFF (Lights, glow plug, heater fan & rear window defogger)
- Steering wheel: Kept in straight-ahead position