

I - SYSTEM/COMPONENT TESTS

1991 Mitsubishi Montero

1991 ENGINE PERFORMANCE
System & Component Testing

Chrysler Motors: Ram-50
Mitsubishi: Montero, Pickup

INTRODUCTION

Before testing separate components or systems, perform procedures in F - BASIC TESTING article in the ENGINE PERFORMANCE Section. Since many computer controlled and monitored components set a trouble code if they malfunction, also perform procedures in G - TESTS W/CODES article in the ENGINE PERFORMANCE Section.

NOTE: Testing individual components does not isolate shorts or opens. Perform all voltage tests with a Digital Volt-Ohmmeter (DVOM) with a minimum 10-megohm input impedance, unless stated otherwise in test procedure. Use ohmmeter to isolate wiring harness shorts or opens.

COMPUTERIZED ENGINE CONTROLS

CONTROL UNIT

NOTE: To identify ECU power and ground circuits, see appropriate L - WIRING DIAGRAMS article in the ENGINE PERFORMANCE Section.

Ground Circuits

1) ECU is located near right kick panel. Turn ignition off. Using an ohmmeter, check for continuity between ground and ECU terminals No. 101 and 106. Resistance should be zero ohms. If resistance is not zero ohms, repair open circuit between ECU connector and ground.

2) Connect voltmeter negative lead to ground. Connect positive lead to ECU ground terminals as in step 1). With vehicle running, voltmeter should indicate less than one volt. If voltmeter reading is greater than one volt, check for open, corrosion or loose connection in ground circuit.

Power Circuits

ECU is located near right kick panel. Turn ignition on. Check for battery voltage on ECU terminals No. 102 and 107. If battery voltage is not present, check operation of MPI control relay. See RELAYS under MOTORS, RELAYS & SOLENOIDS.

ENGINE SENSORS & SWITCHES

BAROMETRIC PRESSURE SENSOR

Sensor is a component part of airflow sensor assembly. See G - TESTS W/CODES article in the ENGINE PERFORMANCE Section.

COOLANT TEMPERATURE SENSOR

1) Remove coolant temperature sensor located near thermostat housing (2-wire connector). Place end of sensor in water with terminal

connector portion of sensor slightly above water.

2) Gradually heat water and read resistance values across terminal connectors. See COOLANT TEMPERATURE SENSOR RESISTANCE table. If resistance is not within specification, replace sensor.

COOLANT TEMPERATURE SENSOR RESISTANCE TABLE

Temperature °F (°C)	Ohms
Montero & Pickup 3.0L	
32 (0)	5900
68 (20)	2500
104 (40)	2700
176 (80)	300
All Others	
32 (0)	5900
68 (20)	2500
104 (40)	1100
176 (80)	300

CRANK ANGLE SENSOR

See IGNITION SYSTEM.

DETONATION SENSOR

See IGNITION SYSTEM.

EGR TEMPERATURE SENSOR

California

See EXHAUST GAS RECIRCULATION (EGR) under EMISSION SYSTEMS & SUB-SYSTEMS.

IDLE POSITION SWITCH

NOTE: Idle position switch is incorporated in idle speed control motor assembly, motor position sensor or throttle position sensor, depending upon vehicle application.

Pickup 2.4L & Ram-50 2.4L

1) Disconnect motor position sensor (MPS) connector. Connect ohmmeter lead between ground and MPS connector terminal No. 4. See Fig. 2.

2) With accelerator pedal pressed, no continuity should be present. With accelerator pedal released, continuity should be present. If switch continuity is not as specified, replace MPS.

Montero, Pickup 3.0L & Ram-50 3.0L

1) Disconnect throttle position sensor (TPS) connector. Connect ohmmeter between TPS connector terminals No. 1 and 2. See Fig. 6.

2) With accelerator pedal pressed, no continuity should be present. With accelerator pedal released, continuity should be present. If idle switch continuity is not as specified, replace TPS.

INHIBITOR SWITCH

Automatic Transmission

Switch is mounted to automatic transaxle, near shift lever

mechanism. Testing information is not available from manufacturer. See appropriate wiring diagram in L - WIRING DIAGRAMS article in the ENGINE PERFORMANCE Section.

INTAKE AIR TEMPERATURE SENSOR

1) Sensor is incorporated in airflow sensor assembly inside air filter housing. Disconnect airflow sensor connector. See Fig. 1.

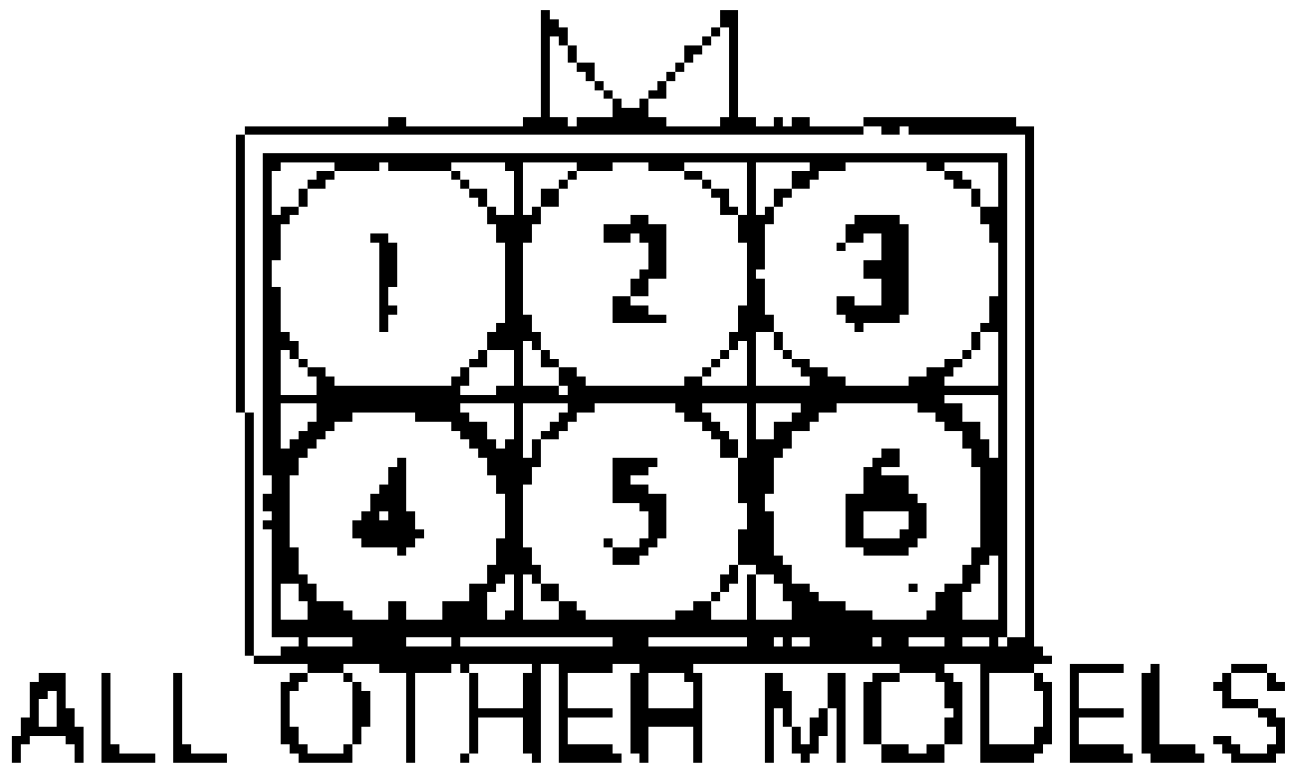


Fig. 1: Airflow Sensor Connector Terminal ID
Courtesy of Mitsubishi Motor Sales of America.

2) Measure resistance between terminals No. 4 and 6 of airflow sensor connector (sensor side of connector). For specifications, see INTAKE AIR TEMPERATURE SENSOR RESISTANCE table. Replace airflow sensor assembly if air temperature sensor resistance is not within specification.

INTAKE AIR TEMP SENSOR RESISTANCE TABLE

Temperature °F (°C)	Ohms
All Models	
32 (0)	6000
68 (20)	2700
176 (80)	400

MOTOR POSITION SENSOR

NOTE: Some engines are not equipped with Motor Position Sensor (MPS). MPS may be a separate unit mounted to throttle body or it may be incorporated in ISC motor assembly, depending upon vehicle application.

Pickup 2.4L & Ram-50 2.4L

1) Disconnect MPS connector. See Fig. 2. Connect ohmmeter lead to ground. Connect other ohmmeter lead to terminal No. 3 of sensor connector. If continuity is not present, repair wiring harness as necessary. If continuity is present, go to next step.



Motor position
sensor connector

Fig. 2: Motor Pos. Sensor Connector Term. ID
Courtesy of Mitsubishi Motor Sales of America.

2) Connect ohmmeter leads to terminals No. 2 and 3.
Resistance should be 4000-6000 ohms. If resistance is not within

specified range, replace MPS.

CAUTION: DO NOT apply more than 6 volts to ISC motor.

3) Operate ISC motor by connecting a 6-volt source directly to appropriate terminals of ISC motor connector. For ISC motor operation test procedures, see IDLE SPEED CONTROL (ISC) MOTOR OPERATION TEST under IDLE CONTROL SYSTEM.

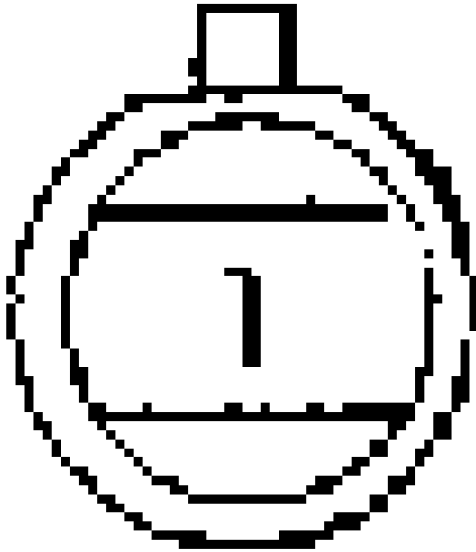
4) While operating ISC motor, measure resistance between MPS connector terminals No. 3 and 5. Observe ohmmeter during ISC motor operation. If MPS resistance does not vary within a 4000-6000 ohm range or if resistance does not change smoothly, replace MPS (vehicles equipped with separate MPS) or ISC motor assembly (vehicles equipped with MPS incorporated in ISC).

OXYGEN SENSOR

1-Wire Or 2-Wire

1) On all models, warm engine until coolant temperature is 185-205°F (85-96°C). Disconnect oxygen sensor connector. See Fig. 3 or 4.

2) Connect digital voltmeter between terminal No. 1 and ground. Repeatedly race engine and observe oxygen sensor output voltage. If output is not 0.6-1.0 volt, replace oxygen sensor.



Single-Wire

Fig. 3: O2 Sensor Connector Terminal ID (1 Wire)
Courtesy of Mitsubishi Motor Sales of America.

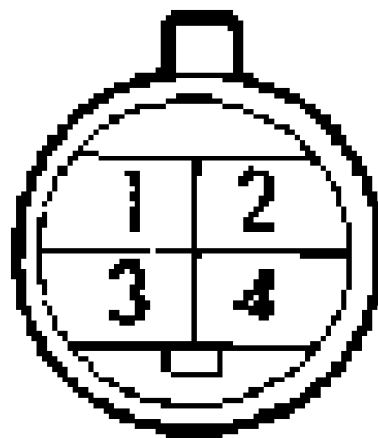


2-Wire

Fig. 4: O2 Sensor Connector Terminal ID (2 Wire)
Courtesy of Mitsubishi Motor Sales of America.

- 4-Wire Heated
- 1) Warm engine until coolant temperature is 185-205°F (85-

95°C). Disconnect oxygen sensor connector. See Fig. 5. Connect ohmmeter between heater terminals of oxygen sensor connector as specified in OXYGEN SENSOR 4-WIRE CONNECTOR TERMINAL IDENTIFICATION table. This test checks resistance of oxygen sensor heater element.



4-Wire ALL OTHER MODELS

Fig. 5: O2 Sensor Connector Term. ID
Courtesy of Mitsubishi Motor Sales of America.

2) When oxygen sensor is at 68°F (20°C), resistance should be approximately 12 ohms (20 ohms on 3.0L models). If resistance is not within specification, replace oxygen sensor.

CAUTION: DO NOT apply battery voltage to oxygen sensor output terminals. Damage to oxygen sensor could result.

3) Apply battery voltage to oxygen sensor heater terminals as specified in OXYGEN SENSOR 4-WIRE CONNECTOR TERMINAL IDENTIFICATION table. This heats oxygen sensor heater element.

4) Connect digital voltmeter between output terminals specified in OXYGEN SENSOR 4-WIRE CONNECTOR TERMINAL IDENTIFICATION table. Repeatedly race engine and observe oxygen sensor output voltage. If oxygen sensor output voltage is not within 0.6-1.0 volt, replace oxygen sensor.

OXYGEN SENSOR 4-WIRE CONNECTOR TERMINAL ID TABLE

Heater

Output

Application	Circuit Terminals	Circuit Terminals
Montero, Pickup 3.0L & Ram-50 3.0L 2 & 4 1 & 3

POWER STEERING OIL PRESSURE SWITCH

- 1) Power steering oil pressure switch is mounted on power steering pump. Disconnect single wire connector at switch. Start engine.
- 2) Connect ohmmeter between switch terminal and ground. If continuity is present with steering wheel in straight-ahead position, replace switch. If continuity is not present while turning steering wheel, perform POWER STEERING IDLE-UP SYSTEM TEST. See IDLE-UP SYSTEMS under IDLE CONTROL SYSTEM.

THROTTLE POSITION SENSOR

- 1) TPS is mounted to throttle body, at end of throttle shaft. Disconnect TPS connector. See Fig. 6. Using ohmmeter, measure total resistance between TPS connector terminals as specified in TPS CONNECTOR TERMINAL IDENTIFICATION table. If resistance is not 3500-6500 ohms, replace TPS.
- 2) Using an analog (needle-type) ohmmeter, measure variable resistance between TPS connector terminals as specified in TPS CONNECTOR TERMINAL IDENTIFICATION table.
- 3) Operate throttle valve from closed to wide open throttle. If rate of resistance does not change smoothly within 3500-6500 ohms throughout range of throttle valve movement, replace TPS.



Fig. 6: TPS Sensor Connector Terminal ID
 Courtesy of Mitsubishi Motor Sales of America.

TPS CONNECTOR TERMINAL IDENTIFICATION TABLE

Application	Terminal Numbers
Total Resistance	1 & 4
Variable Resistance	
Montero, Pickup 3.0L, & Ram-50 3.0L	1 & 3
All Others	2 & 4

VEHICLE SPEED SENSOR

1) Vehicle Speed Sensor (VSS) is located in speedometer assembly. Connect an ohmmeter between sensor terminals on back of instrument panel. See Fig. 7 or 8.

2) Rotate speedometer cable. For each revolution of speedometer cable, sensor should make and break continuity 4 times. If ohmmeter reading does not fluctuate between continuity and no continuity or if sensor does not make and break continuity 4 times for each revolution, replace sensor.

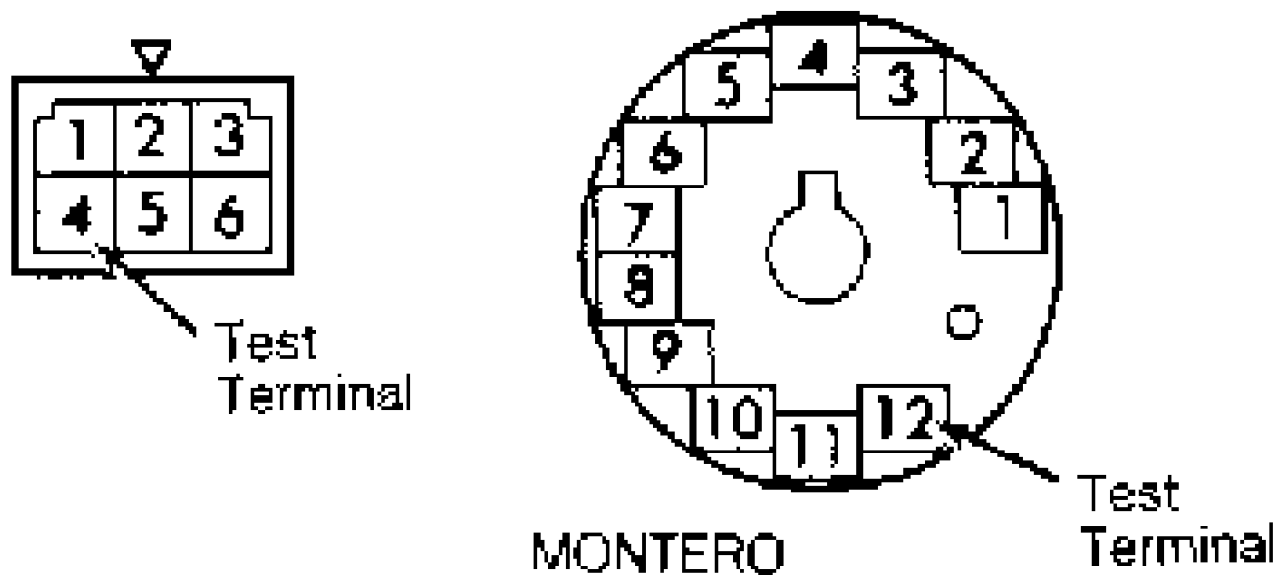


Fig. 7: VSS Sensor Connector Term. ID (Montero)
Courtesy of Mitsubishi Motor Sales of America.

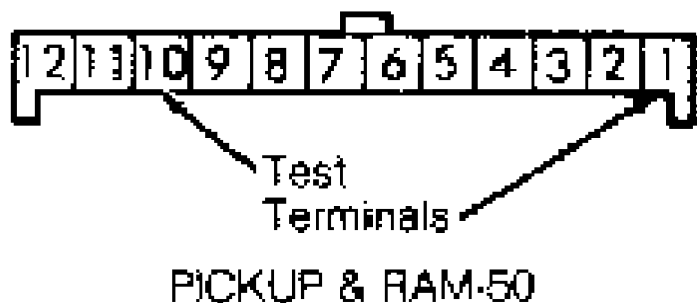


Fig. 8: VSS Sensor Connector Term. ID (P/U & Ram 50)
Courtesy of Mitsubishi Motor Sales of America.

MOTORS, RELAYS & SOLENOIDS

MOTORS

ISC Motor
See IDLE CONTROL SYSTEM.

RELAYS

NOTE: For internal wiring diagram of MPI control relay, see appropriate L - WIRING DIAGRAMS article in the ENGINE PERFORMANCE Section.

MPI Control Relay (Montero, Pickup 3.0L & Ram-50 3.0L)

1) MPI control relay is located near right kick panel. Check for battery voltage at terminal No. 10 of relay connector. See Fig. 9. If battery voltage is present, go to step 3). If battery voltage is not present, check circuit between relay and battery, including fusible link No. 1.



Fig. 9: MPI Control Relay Connector Term. ID (10 Pin)
Courtesy of Mitsubishi Motor Sales of America.

2) Apply battery voltage to terminal No. 10. Battery voltage should not be present at terminals No. 4 and 5. Apply battery voltage to terminal No. 10, and ground terminal No. 8. Battery voltage should now be present at terminals No. 4 and 5.

3) Apply battery voltage to terminal No. 3. Battery voltage should not be present at terminal No. 2. Apply battery voltage to terminal No. 3, and ground terminal No. 7. Battery voltage should now be present at terminal No. 2.

4) Apply battery voltage to terminal No. 9. Battery voltage should not be present at terminal No. 2. Apply battery voltage to terminal No. 9, and ground terminal No. 6. Battery voltage should now be present at terminal No. 2. Replace relay if it does not test as specified.

MPI Control Relay (Pickup 2.4L & Ram-50)

1) MPI control relay is located near right kick panel. Check for battery voltage at terminal No. 4 of relay connector. See Fig. 10. If battery voltage is present, go to step 3). If battery voltage is

not present, check circuit between relay and battery, including fusible link No. 1.

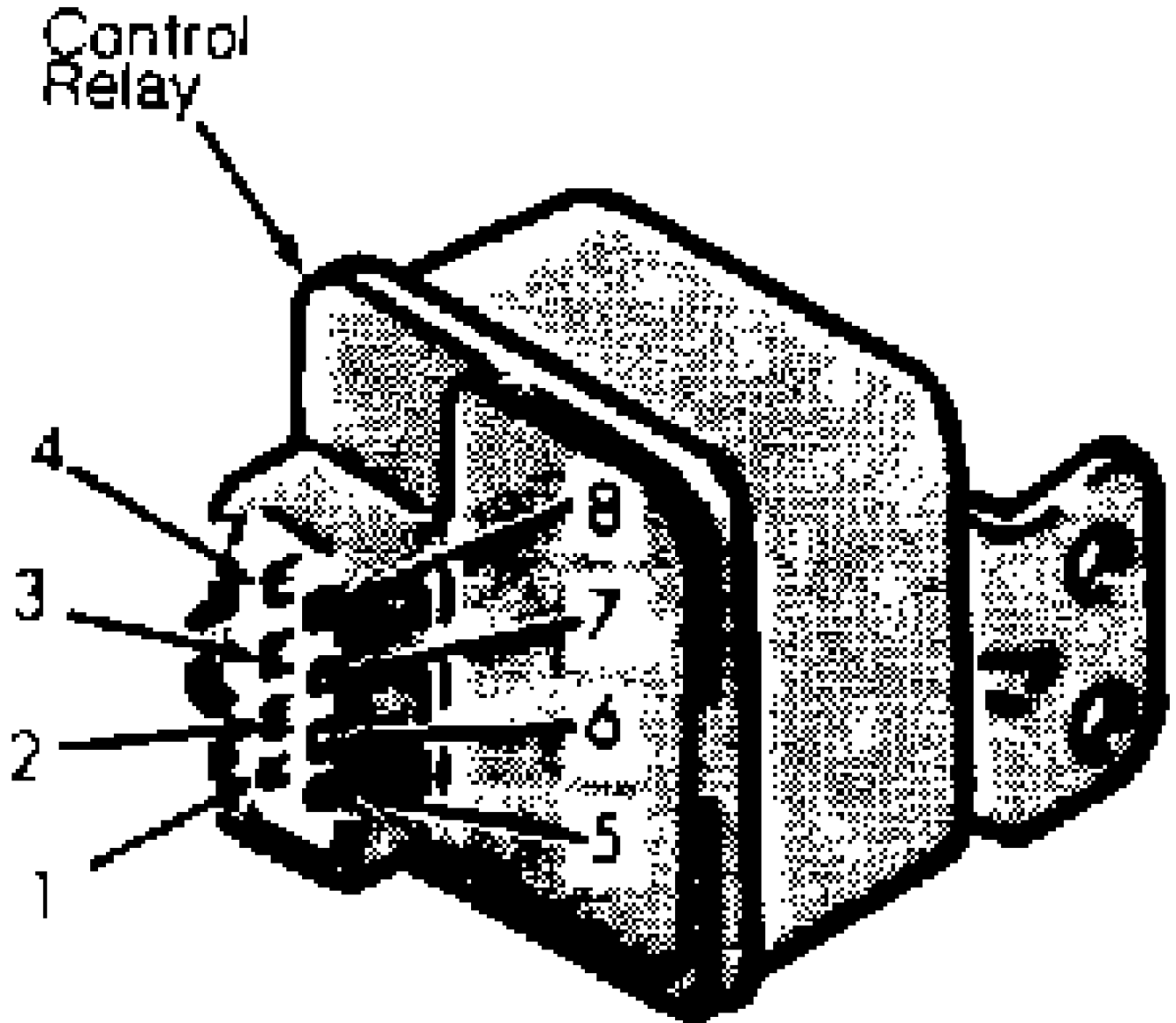


Fig. 10: MPI Control Relay Connector Term. ID (8 Pin)
Courtesy of Mitsubishi Motor Sales of America.

2) Disconnect wiring harness connector at relay. Remove relay. Check continuity between terminals No. 1 and 4, terminals No. 2 and 4 and terminals No. 3 and 4. If there is no continuity, go to next

step. If there is continuity, replace relay.

3) Check diode operation between terminals No. 6 and 8. If there is continuity in only one direction, go to next step. If there is no continuity in either direction or if there is continuity in both directions, replace relay.

4) Measure resistance between terminals No. 6 and 7. If resistance is approximately 35 ohms, go to next step. If resistance is not approximately 35 ohms, replace relay.

5) Measure resistance between terminals No. 2 and 5 and between terminals No. 3 and 5. In both tests, if resistance is approximately 95 ohms, go to next step. If resistance is not approximately 95 ohms, replace relay.

6) Connect positive lead of 12-volt source to terminal No. 7 and negative lead to terminal No. 6. If there is continuity between terminals No. 1 and 4, go to next step. If there is no continuity, replace relay.

7) Connect positive lead of 12-volt source to terminal No. 5 and negative lead to terminal No. 2. If there is continuity between terminals No. 1 and 4, go to next step. If there is no continuity, replace relay.

8) Connect positive lead of 12-volt source to terminal No. 5 and negative lead to terminal No. 3. If there is continuity between terminals No. 1 and 4, go to next step. If there is no continuity, replace relay.

9) Connect positive lead of 12-volt source to terminal No. 8 and negative lead to terminal No. 6. If there is continuity between terminals No. 3 and 4 and between terminals No. 2 and 4, relay is okay. If there is no continuity, replace relay.

SOLENOIDS

Fuel Pressure Control Solenoid Valve
See FUEL DELIVERY under FUEL SYSTEM.

Fuel Injector Solenoids
See FUEL CONTROL under FUEL SYSTEM.

FUEL SYSTEM

FUEL DELIVERY

NOTE: For fuel system pressure testing, see F - BASIC TESTING article in the ENGINE PERFORMANCE Section.

FUEL CONTROL

Fuel Injectors

1) Using a stethoscope, check operating sound of injector(s) during engine cranking or idling. If clicking sound is heard, injectors are okay. If clicking sound is not heard at each injector, go to step 2).

2) Disconnect injector electrical connector. Measure resistance between injector connector terminals. At 68°F (20°C), if resistance is not 13-16 ohms, replace injector.

3) If resistance is within specification, check injector wiring circuit for open or short to ground. If wiring circuit tests okay, replace injector.

IDLE CONTROL SYSTEM

NOTE: ISC motor adjusts throttle plate angle to regulate idle air

by-pass volume.

IDLE SPEED CONTROL (ISC) MOTOR OPERATION TEST

CAUTION: DO NOT apply more than 6 volts to ISC motor.

Pickup 2.4L & Ram-50 2.4L

Connect 6-volt DC source across terminals No. 1 and 2 of ISC motor connector. See Fig. 11. Reverse leads of 6-volt source. If motor does not operate in both directions, replace ISC motor assembly.

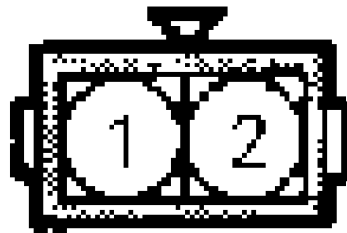


Fig. 11: ISC Motor Connector Term. ID (2 Pin)
Courtesy of Mitsubishi Motor Sales of America.

Montero, Pickup 3.0L & Ram-50 3.0L

1) Remove throttle body from intake plenum. Remove ISC motor from throttle body. Apply 6-volt source parallel to terminals No. 2 and 5 of ISC motor connector. See Fig. 12.

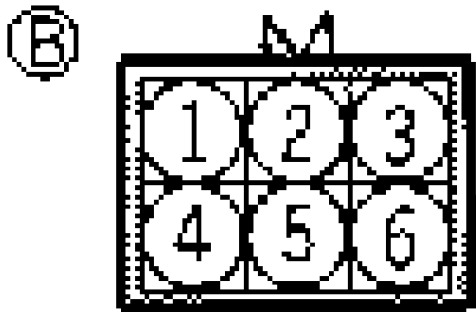


Fig. 12: ISC Motor Connector Term. ID (6 Pin)
 Courtesy of Mitsubishi Motor Sales of America.

2) Apply source ground lead to ISC motor connector terminals No. 3 and 6. Note slight movement of ISC motor plunger. Remove ground leads from terminals No. 3 and 6.

3) Apply and remove source ground at terminals No. 1 and 6, 1 and 4, 3 and 4, and 3 and 6. Note slight movement of ISC motor plunger during each phase of test.

4) Beginning at terminal No. 6, reverse grounding sequence following same procedure specified in step 2). If motor does not operate when grounding any of specified terminals, replace ISC motor.

IDLE SPEED CONTROL (ISC) MOTOR RESISTANCE TEST

Pickup 2.4L & Ram-50 2.4L

Disconnect ISC motor connector. Connect ohmmeter between terminals No. 1 and 2 of ISC motor connector. See Fig. 11. If resistance is not 5-35 ohms at 68°F (20°C), replace ISC motor assembly.

Montero, Pickup 3.0L & Ram-50 3.0L

Measure resistance between terminals No. 1 and 2, 2 and 3, 4 and 5, and 5 and 6 of ISC motor connector. See Fig. 12. In each case, if resistance is not 28-33 ohms at 68°F (20°C), replace ISC motor

assembly.

IDLE-UP SYSTEMS

Power Steering Idle-Up System Test

1) Disconnect pressure hose from power steering pump. Connect in-line a pressure gauge and hoses capable of handling 300 psi (21 kg/cm²). Also connect a shut-off valve in-line with pressure gauge. See Fig. 13.

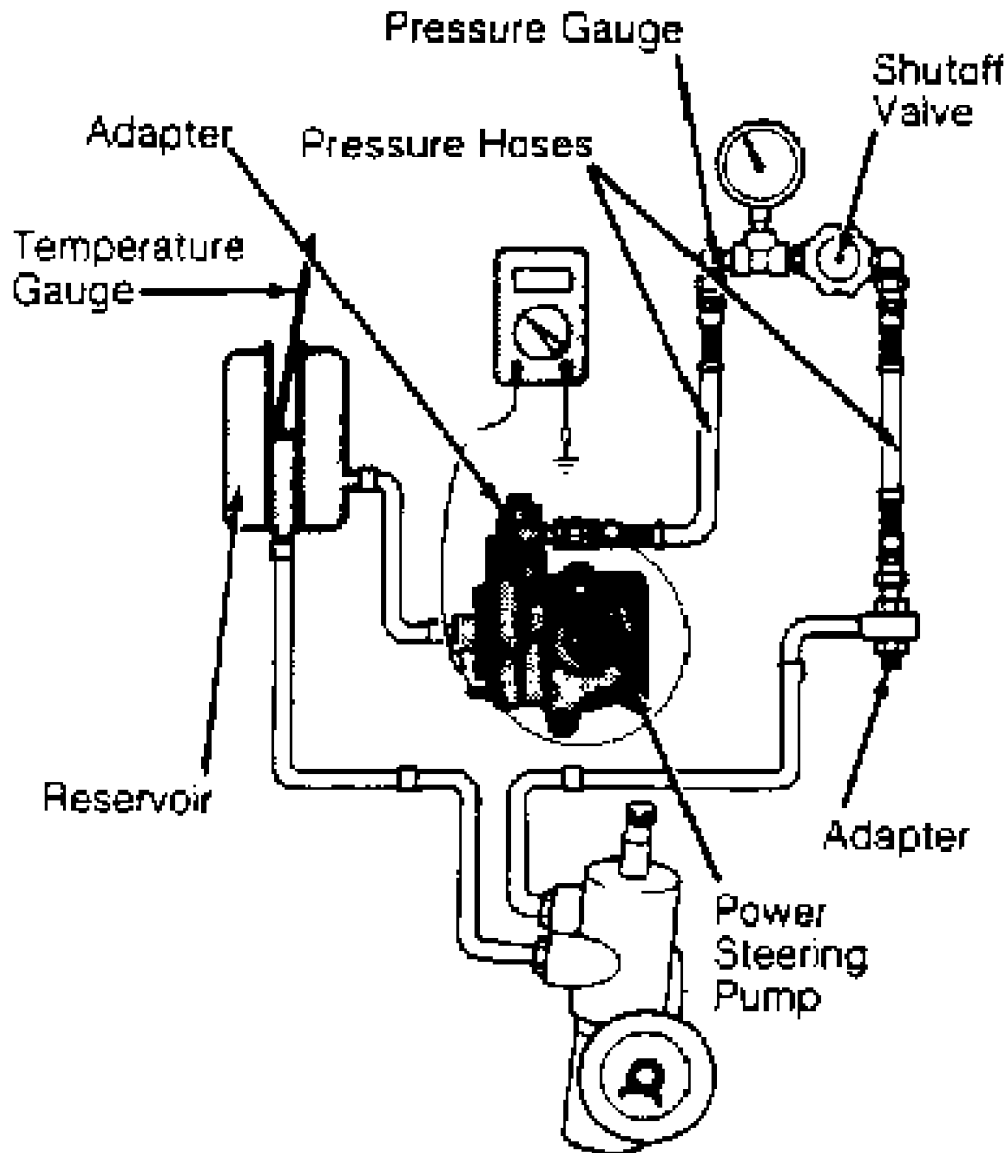


Fig. 13: Connecting Pressure Gauge Shutoff Valve Assembly
Courtesy of Mitsubishi Motor Sales of America.

2) Bleed air from system by disabling ignition system and cranking engine while turning steering wheel completely from left to

right several times. Start engine, and turn steering wheel back and forth to raise fluid temperature to approximately 122-140°F (50-60°C).

3) With engine idling, gradually close shutoff valve of pressure gauge to increase hydraulic pressure. If idle speed does not increase 200-250 RPM when fluid pressure reaches 213-284 psi (15-20 kg/cm²), replace power steering idle-up switch.

4) Gradually open shutoff valve. If engine speed does not return to curb idle speed between 100-142 psi (7-10 kg/cm²), replace power steering idle-up switch. Remove testing equipment. Bleed air from system as in step 2).

IGNITION SYSTEM

NOTE: For basic ignition checks, see F - BASIC TESTING article in ENGINE PERFORMANCE Section.

TIMING CONTROL SYSTEMS

Crank Angle Sensor

Crank angle sensor is located inside distributor on SOHC engines and is attached to cylinder head on DOHC engines. If malfunction occurs, Code 22 will set. For testing procedure, see appropriate G - TESTS W/CODES article in the ENGINE PERFORMANCE Section.

EMISSION SYSTEMS & SUB-SYSTEMS

EXHAUST GAS RECIRCULATION (EGR)

System Testing (Federal)

1) Disconnect Green-striped hose from throttle body, and connect vacuum pump to hose end. Plug nipple where hose was connected to throttle body. When engine is cold, 122°F (50°C) or less, and at idle, apply vacuum to disconnected hose. If idle does not change and vacuum bleeds down, system is okay.

2) When engine is hot, 205°F (95°C), and at idle, apply 1.8 in. Hg. If idle does not change and vacuum holds, system is okay. Using a vacuum pump, apply 7.7 in. Hg. If idle becomes unstable or engine stalls (and vacuum holds), system is okay.

System Testing (California)

1) Connect vacuum "T" fitting into Green-striped hose from EGR valve, and connect vacuum gauge to vacuum tee. When engine coolant temperature is 68°F (20°C) or less and engine is idling, snap throttle open to race engine. If no change in vacuum reading is detected on gauge, system is okay.

2) When engine coolant temperature is 158°F (70°C) or more and engine is idling, snap throttle open to race engine. If vacuum increases to 3.9 in. Hg or higher, system is okay.

3) Using vacuum pump, apply specified vacuum to open EGR valve. See EGR VALVE SPECIFICATIONS table. If idle becomes unstable or engine stalls, system is okay.

EGR Control Solenoid Valve (Pickup & Ram-50, California)

1) EGR control solenoid valve is located near left shock tower. Label and disconnect vacuum hoses and wiring harness from solenoid valve.

2) Connect hand vacuum pump to vacuum nipple where Green-striped vacuum hose was connected. Apply vacuum and ensure vacuum does not hold. Apply battery voltage to one terminal of solenoid, and ground other. Ensure vacuum holds.

3) Using an ohmmeter, measure resistance between terminals of solenoid valve. At room temperature, reading should be 36-44 ohms. Replace solenoid if not to specification.

NOTE: EGR temperature sensor only determines if EGR is operating. An inoperative sensor will not affect driveability or exhaust emissions.

EGR Temperature Sensor (California)

1) Remove EGR temperature sensor from EGR valve. Place EGR temperature sensor in water. While increasing water temperature, measure resistance between wire terminals.

2) At a temperature of 122°F (50°C), resistance should be 60,000-80,000 ohms. At 212°F (100°C), resistance should be 11,000-14,000 ohms. Replace EGR temperature sensor if resistance differs significantly from specifications.

EGR Valve

1) Remove EGR valve. Check valve for sticking, carbon deposits and damage. Clean valve with solvent if necessary. Apply 19.8 in. Hg to valve diaphragm. If valve does not hold vacuum, replace valve.

2) Apply specified vacuum to valve diaphragm. See CLOSED IN. HG in EGR VALVE SPECIFICATIONS table. If valve begins to open below specification, replace valve.

3) Apply specified vacuum to valve diaphragm. See OPEN IN. HG in EGR VALVE SPECIFICATIONS table. If valve is not completely open at or above specification, replace valve.

EGR VALVE SPECIFICATIONS TABLE

Application	Closed In. Hg	Open In. Hg
Montero	2.4	6.7
Pickup & Ram-50	1.2	9.4

FUEL EVAPORATION

System Test

1) Disconnect Red-striped purge hose from throttle body, and connect to hand vacuum pump. Plug nipple on throttle body where purge hose was removed.

2) With engine coolant temperature at 140°F (60°C) or less and engine idling, apply 14.8 in. Hg. Vacuum should hold. Raise engine speed to 3000 RPM and again apply 14.8 in. Hg. Vacuum should hold.

3) With engine coolant temperature at 158°F (70°C) or more and engine idling, apply 14.8 in. Hg. Vacuum should hold. Turn engine off. Start engine and within 3 minutes of starting engine, apply vacuum. Vacuum should bleed down.

4) With engine running for more than 3 minutes after starting, raise engine speed to 3000 RPM and apply 14.8 in. Hg. Vacuum should hold momentarily and then bleed down.

NOTE: In step 4), vacuum should bleed down continuously if vehicle is at an altitude of 7200 ft. (2200 m) or higher or if intake air temperature is 122°F (50°C) or higher.

Purge Control Solenoid Valve

1) Purge control solenoid valve is located near left shock tower. Label and disconnect both vacuum hoses from solenoid valve. Disconnect electrical connector. Connect hand vacuum pump to solenoid

valve nipple where Red-striped hose was connected. Apply vacuum to solenoid valve. Vacuum should hold.

2) Apply battery voltage to terminals of solenoid valve. Vacuum should bleed down when voltage is applied to terminals. Using an ohmmeter, check resistance across solenoid valve terminals. Reading should be 36-44 ohms at 68°F (20°C). If reading is not within specification, replace valve.

POSITIVE CRANKCASE VENTILATION (PCV)

PCV Valve

Remove PCV valve, and insert thin screwdriver into threaded end of valve to ensure plunger moves.