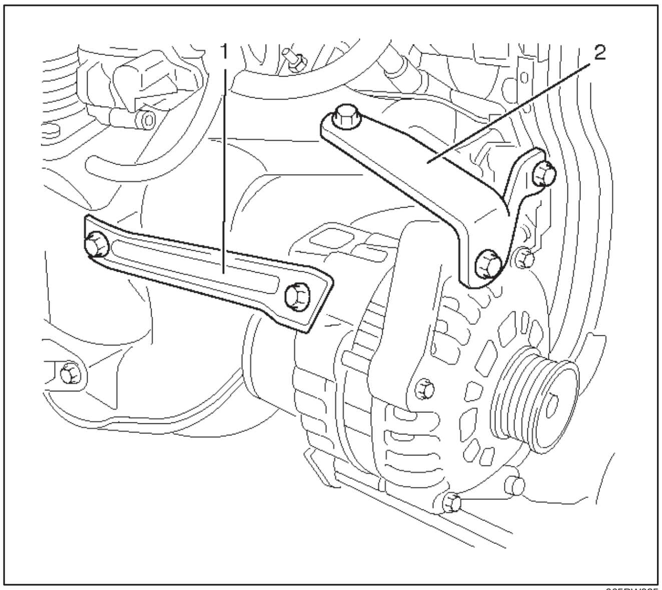
Generator

Removal

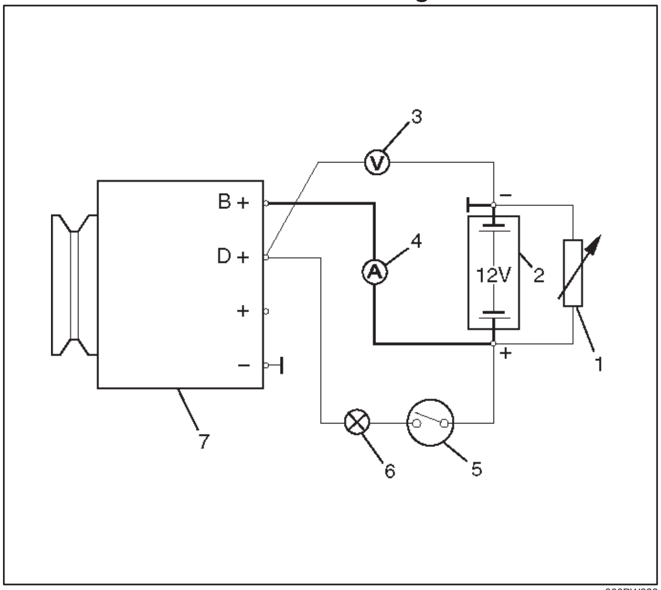
1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt.
3. Disconnect terminal "B" wiring connector and connector.
4. Remove generator bracket (1), (2) and remove generator assembly.



065RW025

Inspection

Generator Power and Circuit Diagram



066RW020

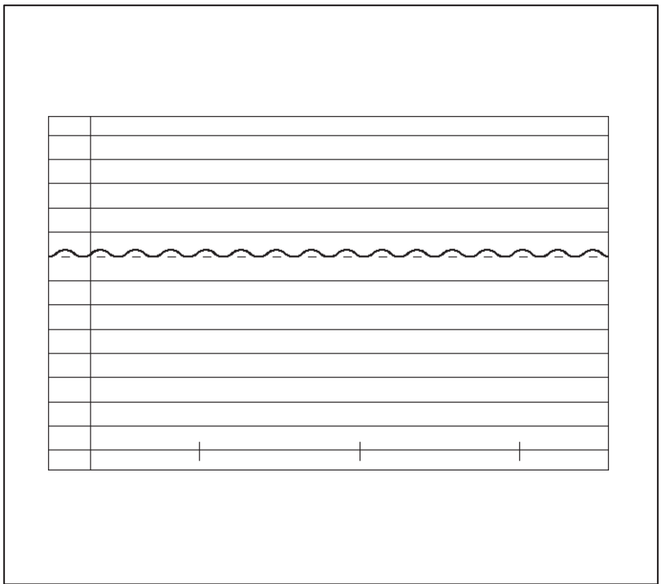
Legend

(1) Load resistor, set parallel to battery
(2) Battery
(3) Voltmeter
(4) Ammeter
(5) Ignition Lock
(6) Charge Telltale
(7) Generator

1. Disconnect battery.
2. Close off connecting cable from alternator terminal "B+".
3. Set ammeter (measuring range 100A) in disconnected line.
4. Connect controllable load resistor to battery terminal.
5. Set resistor in front of connection to "0"; connect first to battery, then to resistor.
6. Connect tachometer.
7. Connect oscilloscope according to manufacturer's instructions.
8. Connect battery.
9. Start engine and read off resulting current at various engine speeds.

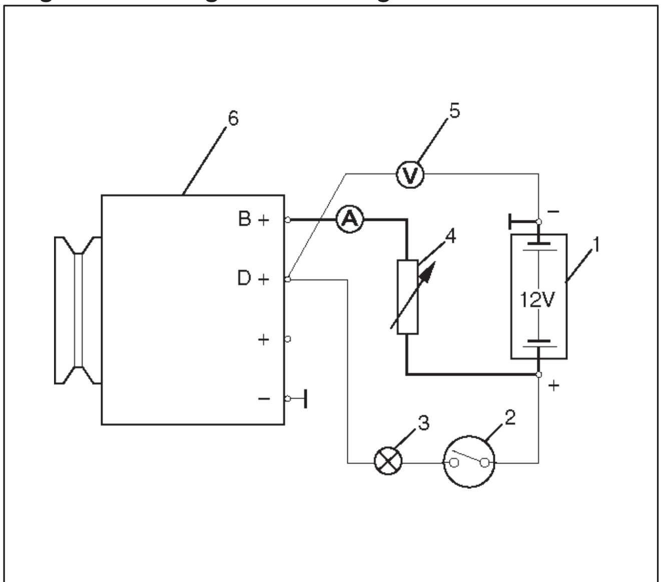
Generator Power

1. Adjust load resistor, if the required load currents are not attained.
2. The shape of the voltage curves on oscilloscope curve should be regular.
3. Test value: 5 to 7A.
4. If the required minimum current intensity is not attained, or if the oscilloscope picture shows variations, the alternator should be overhauled.



066RW018

Regulated Voltage Circuit Diagram



066R100009

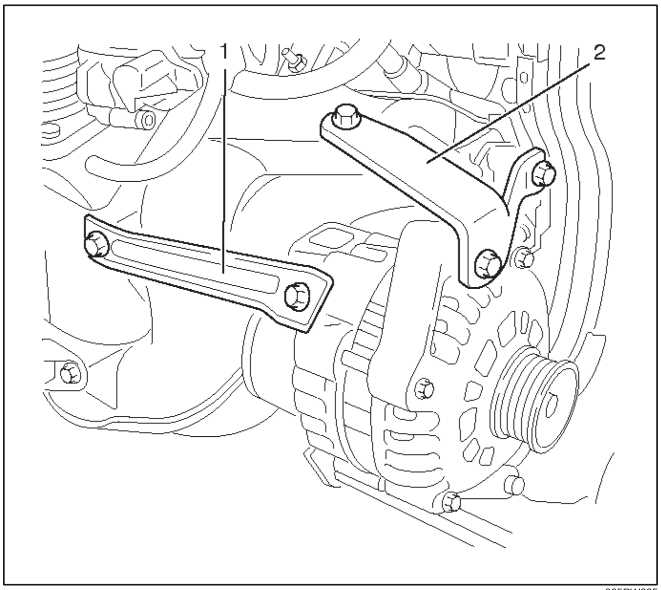
Legend

(1) Battery
(2) Ignition Lock
(3) Charge Telltale
(4) Resistor, for attainment of load current with the battery set in series
(5) Voltmeter
(6) Generator

Installation

1. Install generator assembly and bring generator assembly to the position to be installed.
2. Install generator bracket (1), (2) and tighten to the specified torque.

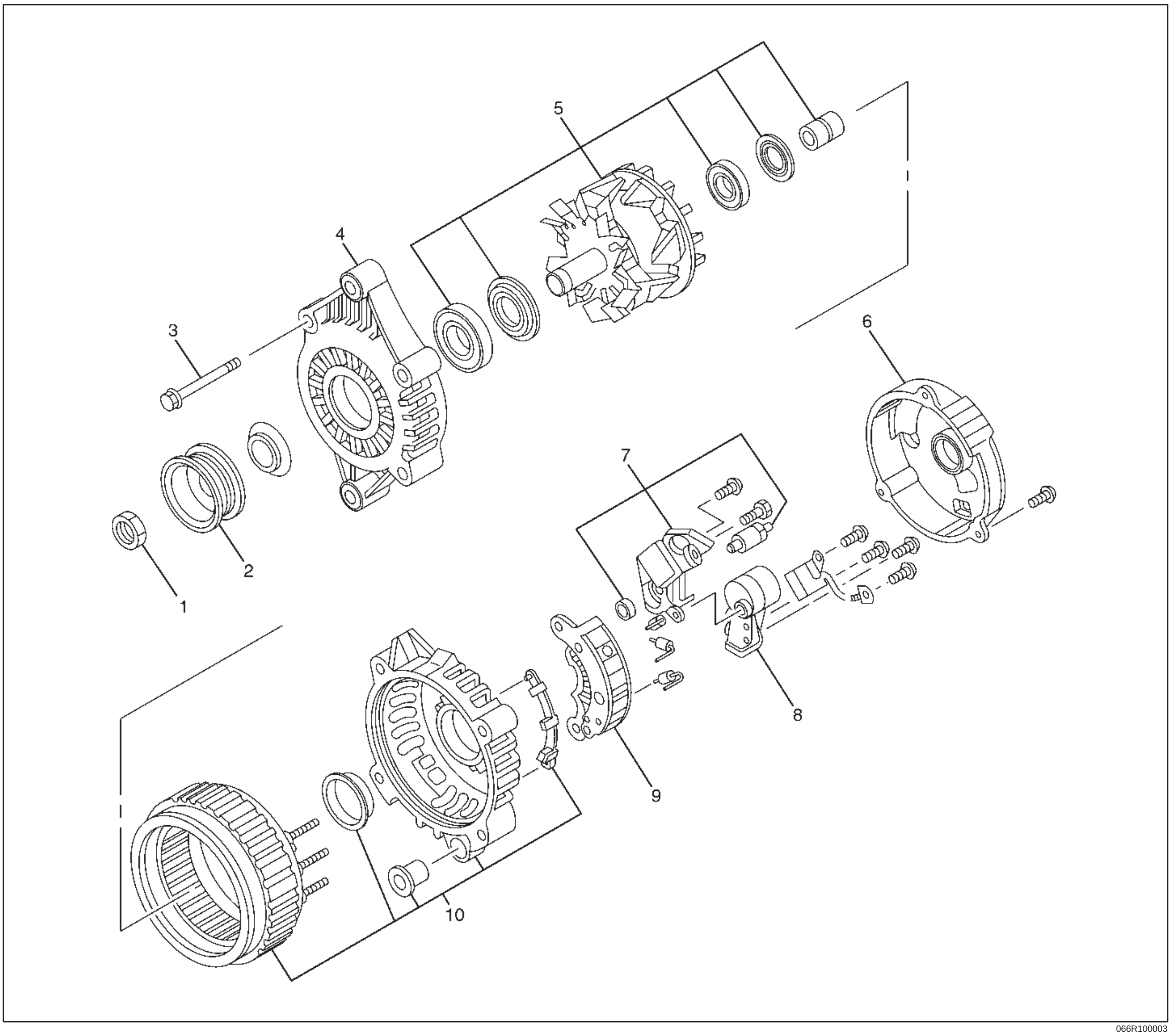
Torque:
Long bolt: 35 N·m (26 lb ft)
Short bolt: 20 N·m (15 lb ft)



065RW025

3. Connect wiring harness connector.
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

Disassembled View

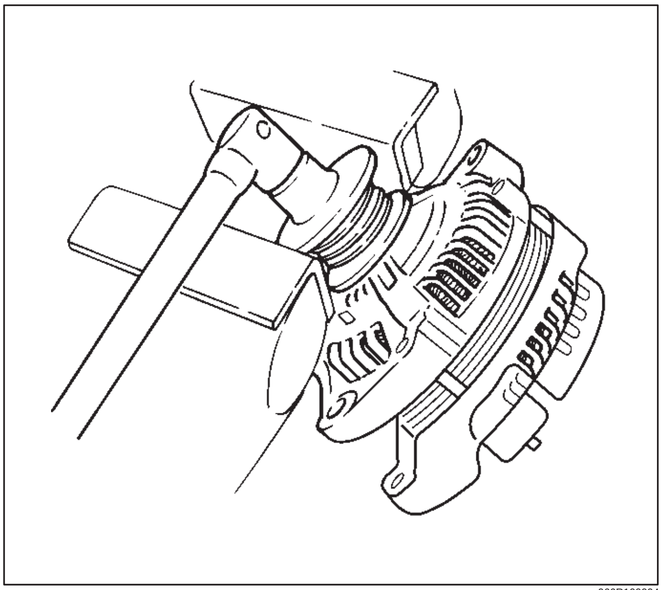


Legend

- (1) Pulley Nut
- (2) Pulley
- (3) Through Bolt
- (4) Front Cover Assembly
- (5) Rotor Assembly
- (6) Cover
- (7) Regulator Assembly
- (8) Brush Holder Assembly
- (9) Rectifire
- (10) Rear Cover Assembly

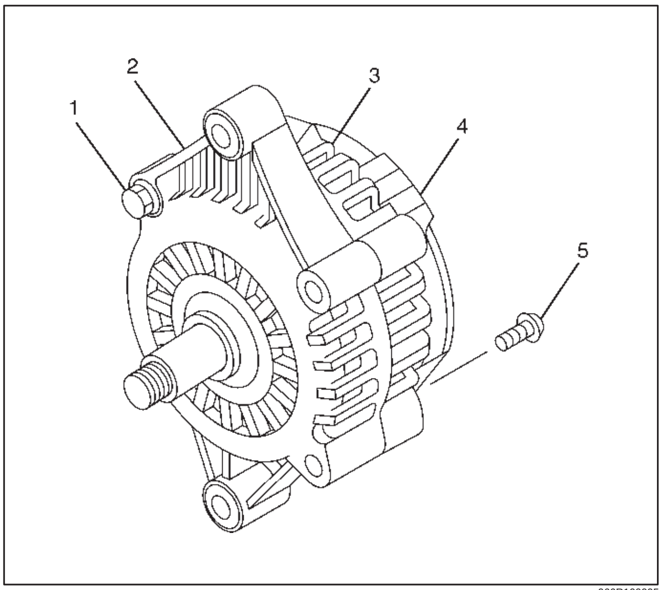
Disassembly

1. Belt pulley nut.



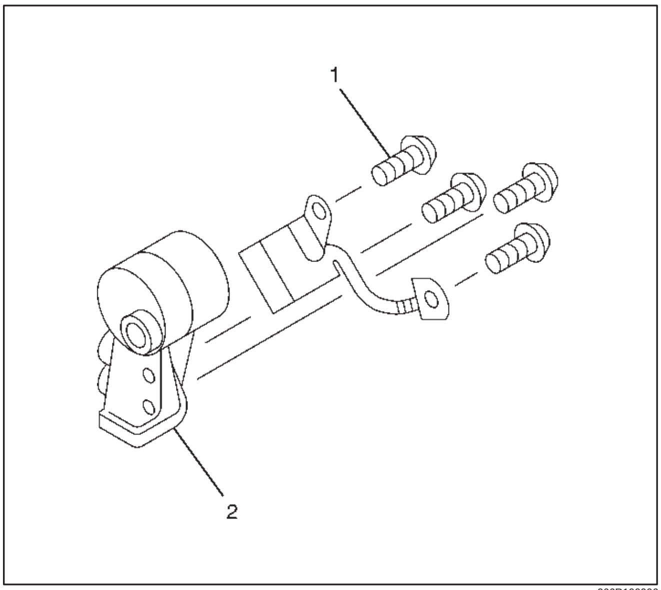
066R100004

2. Remove the four through bolts (1).
3. Remove the front cover (2).
4. Remove the three cover fixing bolts (5), regulator terminal nut and battery terminal nut.
5. Remove the cover (4).
6. Remove the rotor assembly.
7. Remove the rear cover assembly (3).



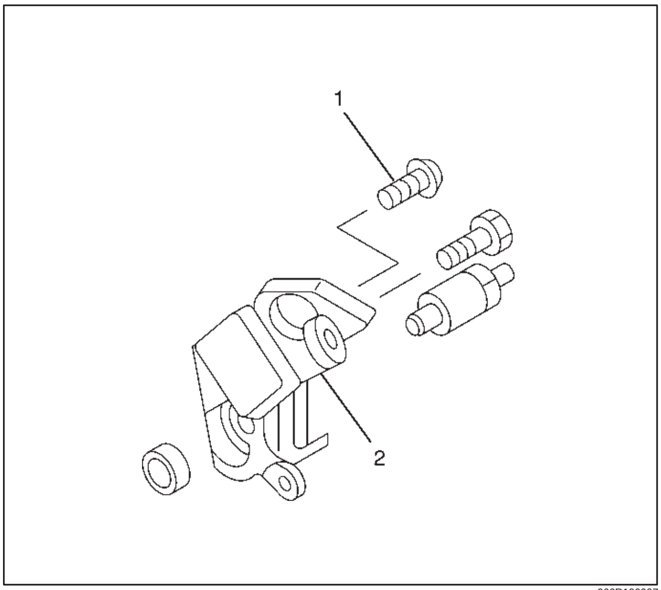
066R100005

8. Remove the four brush holder fixing bolts and brush holder assembly.



066R100006

9. Remove the two regulator fixing bolts and regulator assembly.



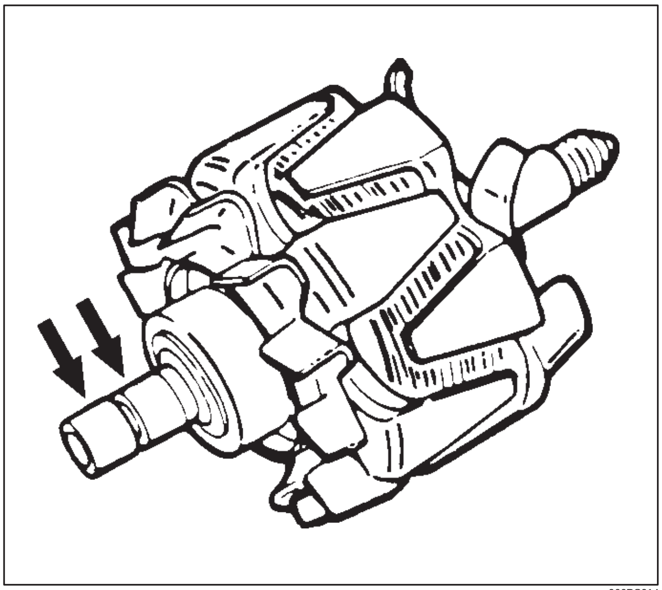
066R100007

Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

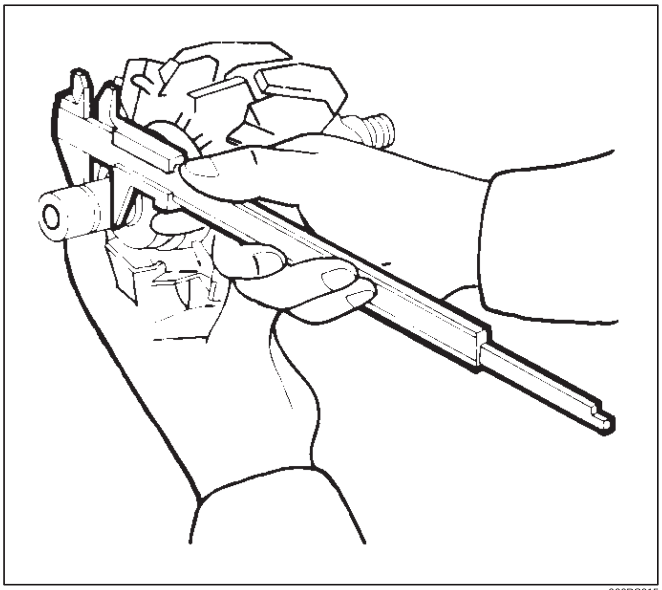
Rotor Assembly

1. Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500–600 sandpaper.



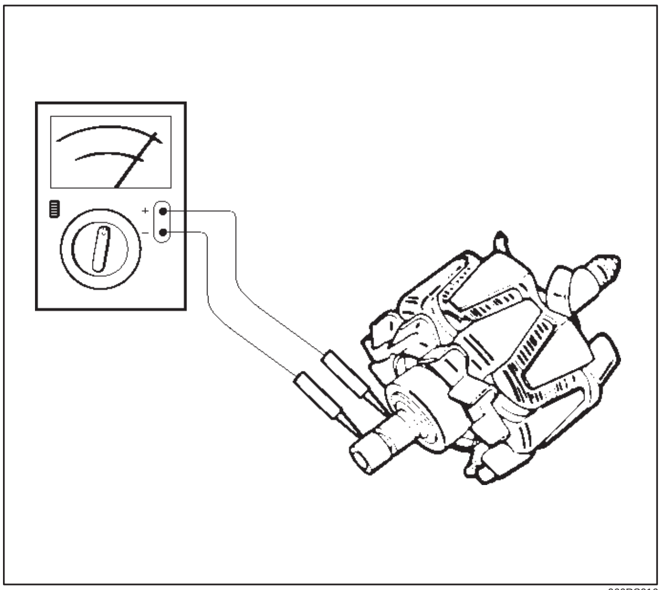
066RS014

2. Measure the slip ring diameter, and replace if it exceeds the limit.



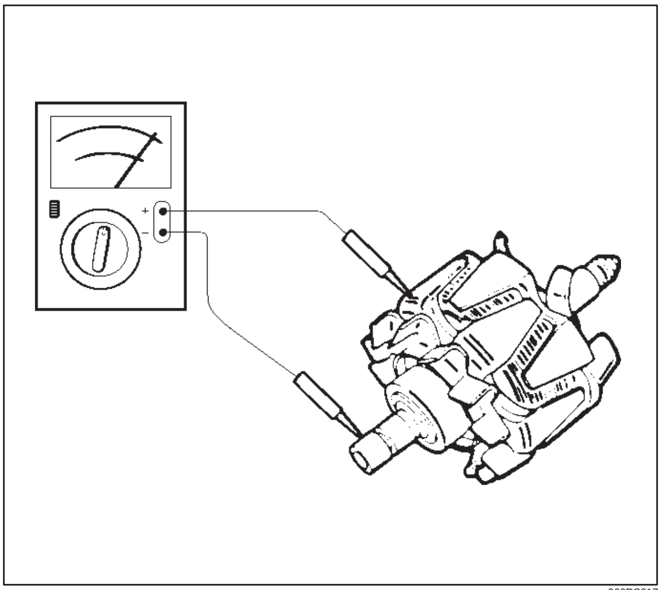
066RS015

3. Check continuity between slip rings, and replace if there is no continuity.



066RS016

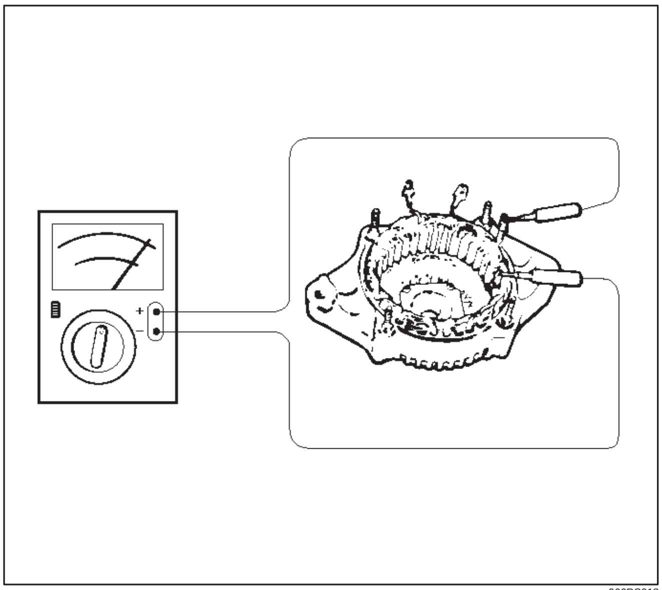
4. Check for continuity between slip ring and rotor core. In case of continuity, replace the generator assembly.



066RS017

Stator Coil

1. Measure resistance between respective phases.
2. Measure insulation resistance between stator coil and core with a mega–ohmmeter.
   If less than standard, replace the generator assembly.

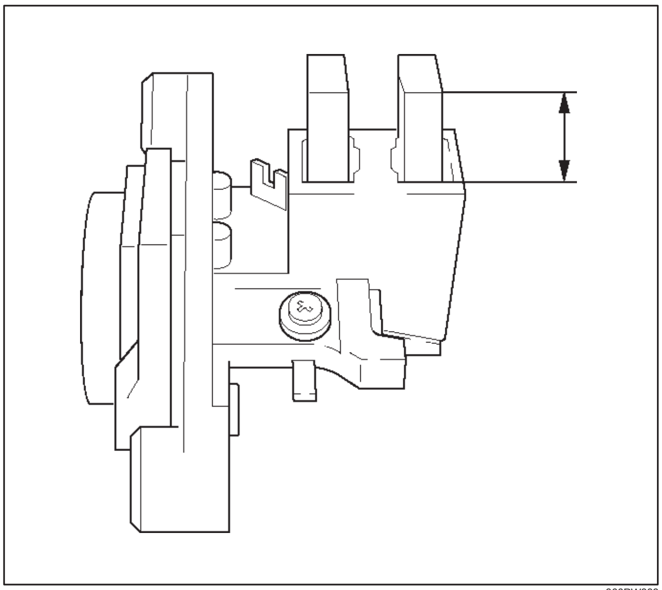


066RS018

Brush

Measure the brush length.
If more than limit, replace the brush.

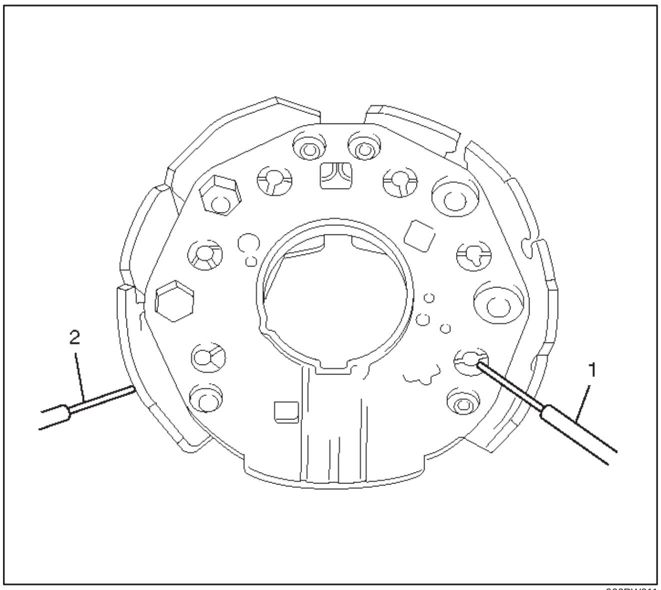
Standard: 5 mm (0.20 in)



066RW009

Rectifier Assembly

Check for continuity across “1” and “2” in the × 100W range of multimeter.



066RW011

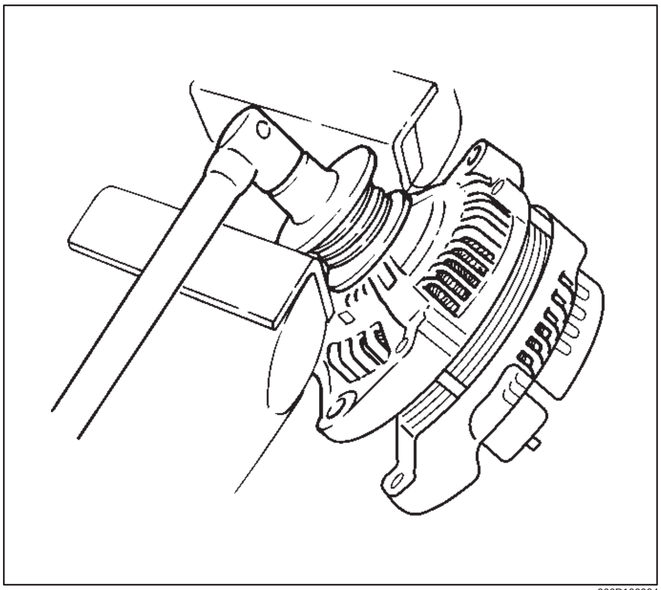
Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the rectifier assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

1. Install pulley on the rotor shaft.
   Clamp pulley to the vise, and tighten nut to the specified torque.

Torque: 40 N·m (30 lb ft)



066R100004

Main Data and Specifications

General Specifications

Battery voltage	V	12
Rated output	A	100
Direction of rotation (as viewed from pulley side)		Clockwise
Maximum speed	rpm	8000

RODEO

CONTROL SYSTEM

RODEO 2.2L ENGINE DRIVEABILITY AND EMISSIONS

CONTENTS

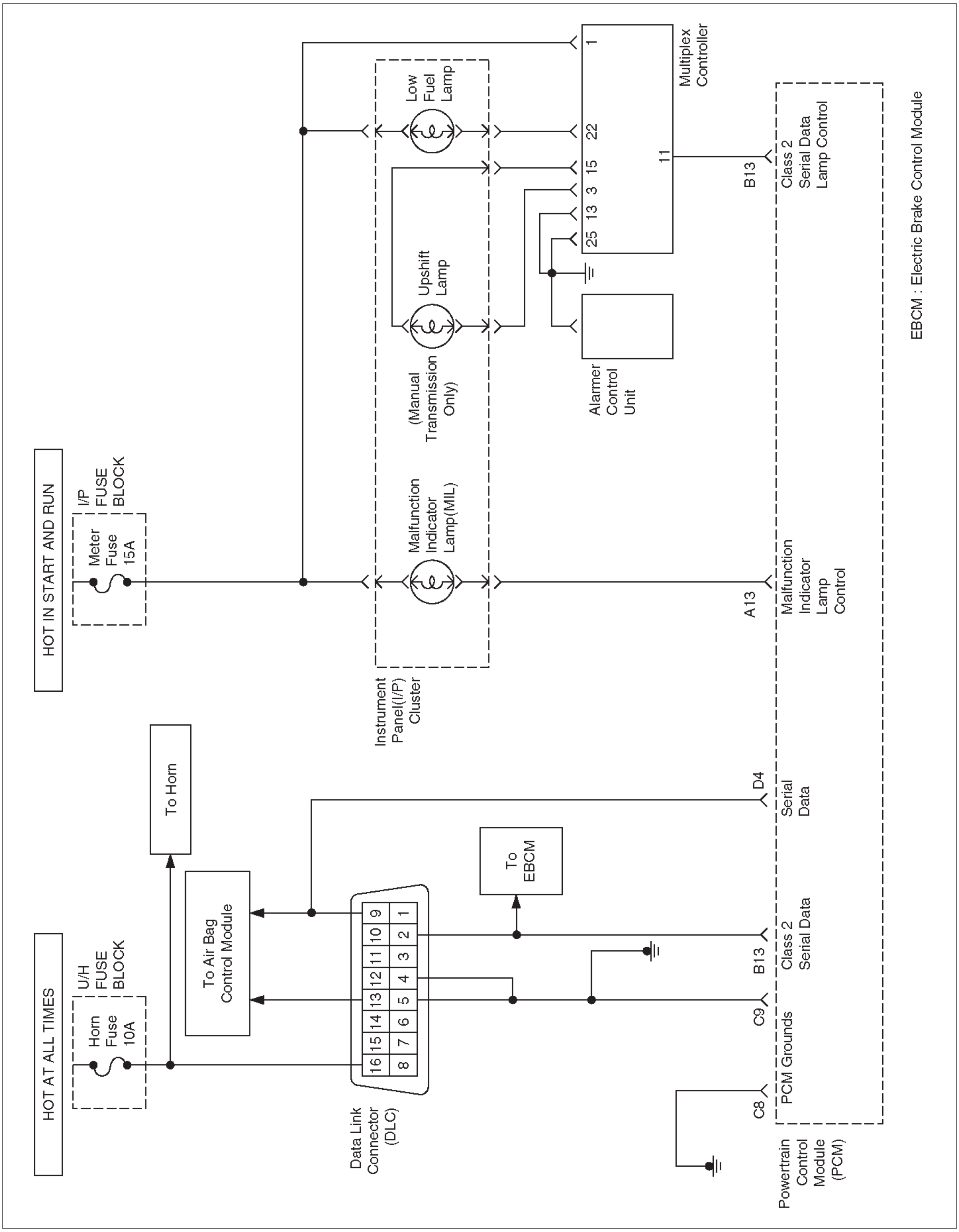
SPECIFICATIONS

TIGHTENING SPECIFICATIONS

Application	N–m	Lb Ft	Lb In
Crankshaft Position Sensor Mounting Bolt	9	—	78
EGR Nut	14	—	130
Engine Coolant Temperature Sensor	30	22	—
Fuel Drain Plug	20	14	—
Fuel Pressure Regulator Attaching Screw	6.5	—	60
Fuel Rail Bolts	7	—	75
Fuel Tank Undercover Retaining Bolts	36	27	—
Heated Oxygen Sensor	5	40	—
Spark Plugs	25	18	—
Throttle Body Mounting Bolts	13	—	120
VSS Retaining Bolt	13	—	120
Crankshaft Pulse Pick–up Sensor Disc to Crankshaft	13	—	115
Spark Plug to Cylinder Head	25	18	—

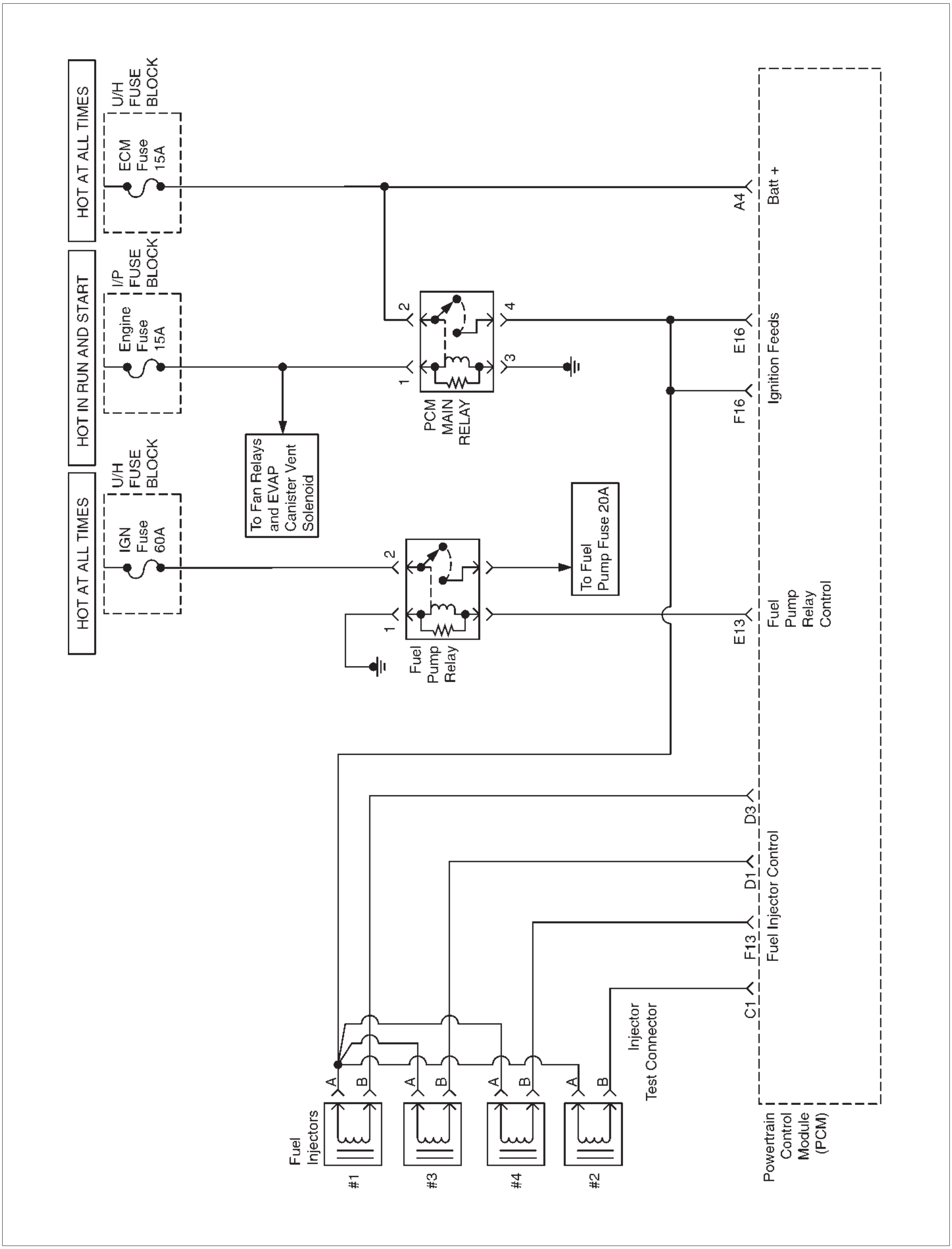
DIAGRAMS AND SCHEMATICS

PCM WIRING DIAGRAM (1 of 13)



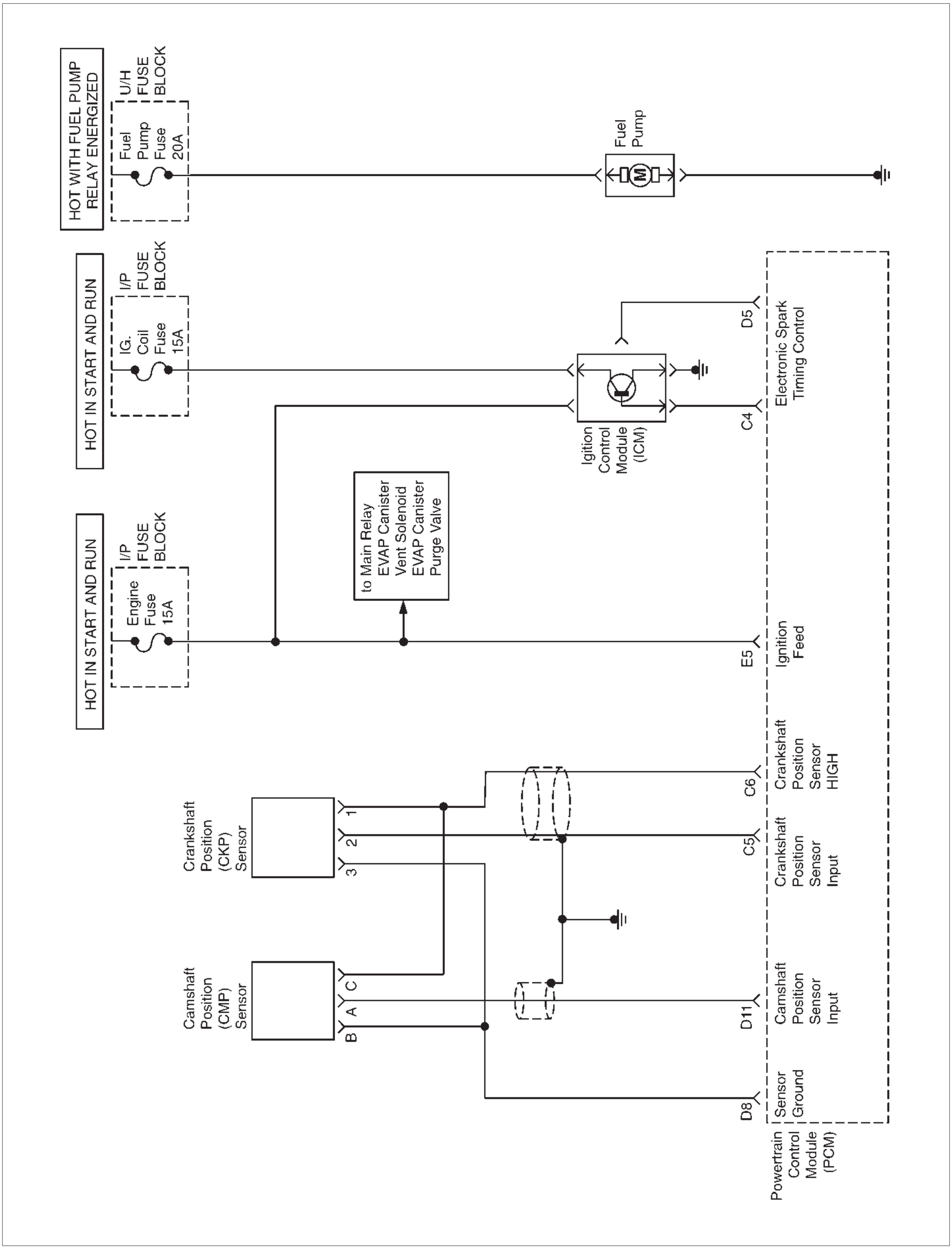
060R100090

PCM WIRING DIAGRAM (2 of 13)



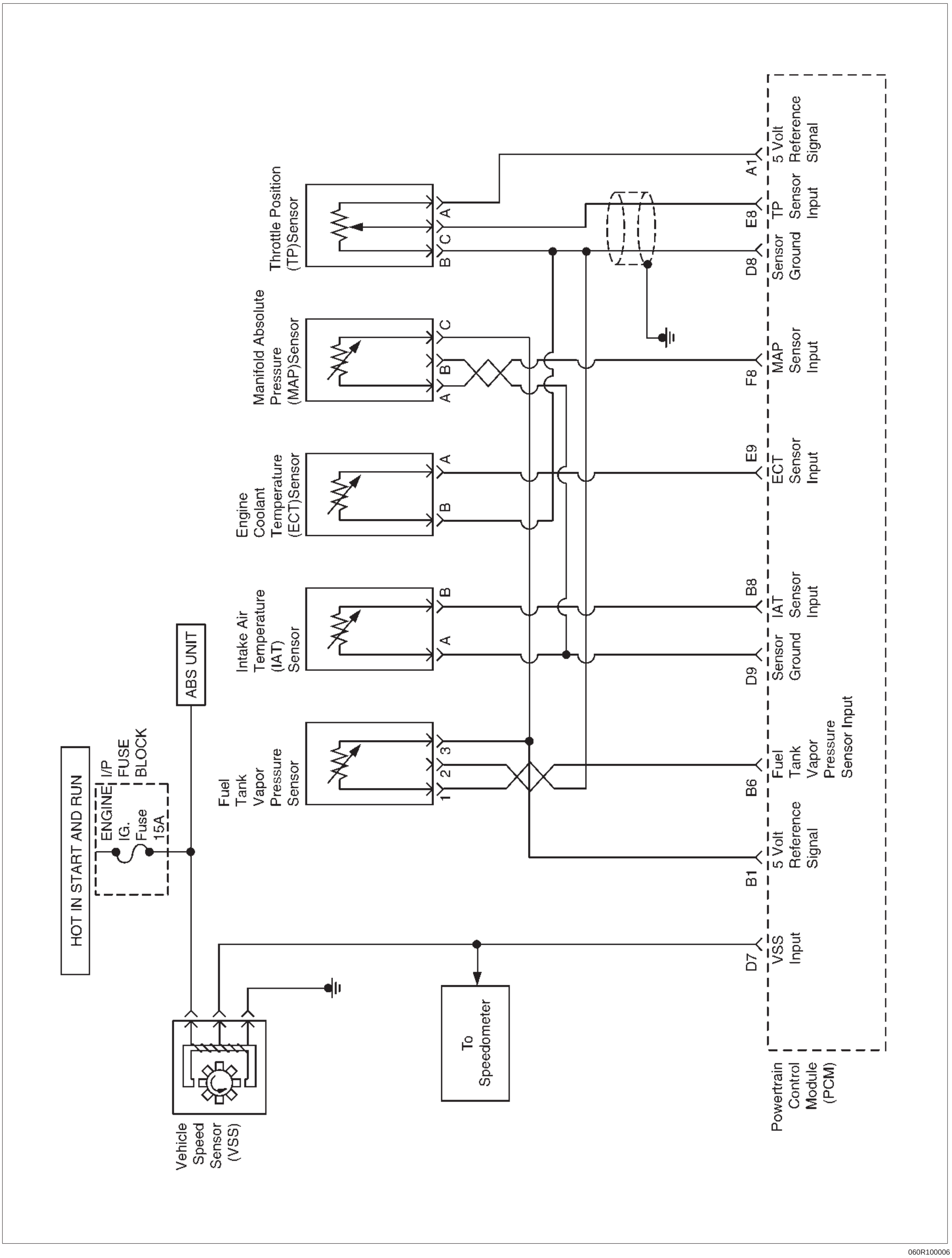
060R100004

PCM WIRING DIAGRAM (3 of 13)



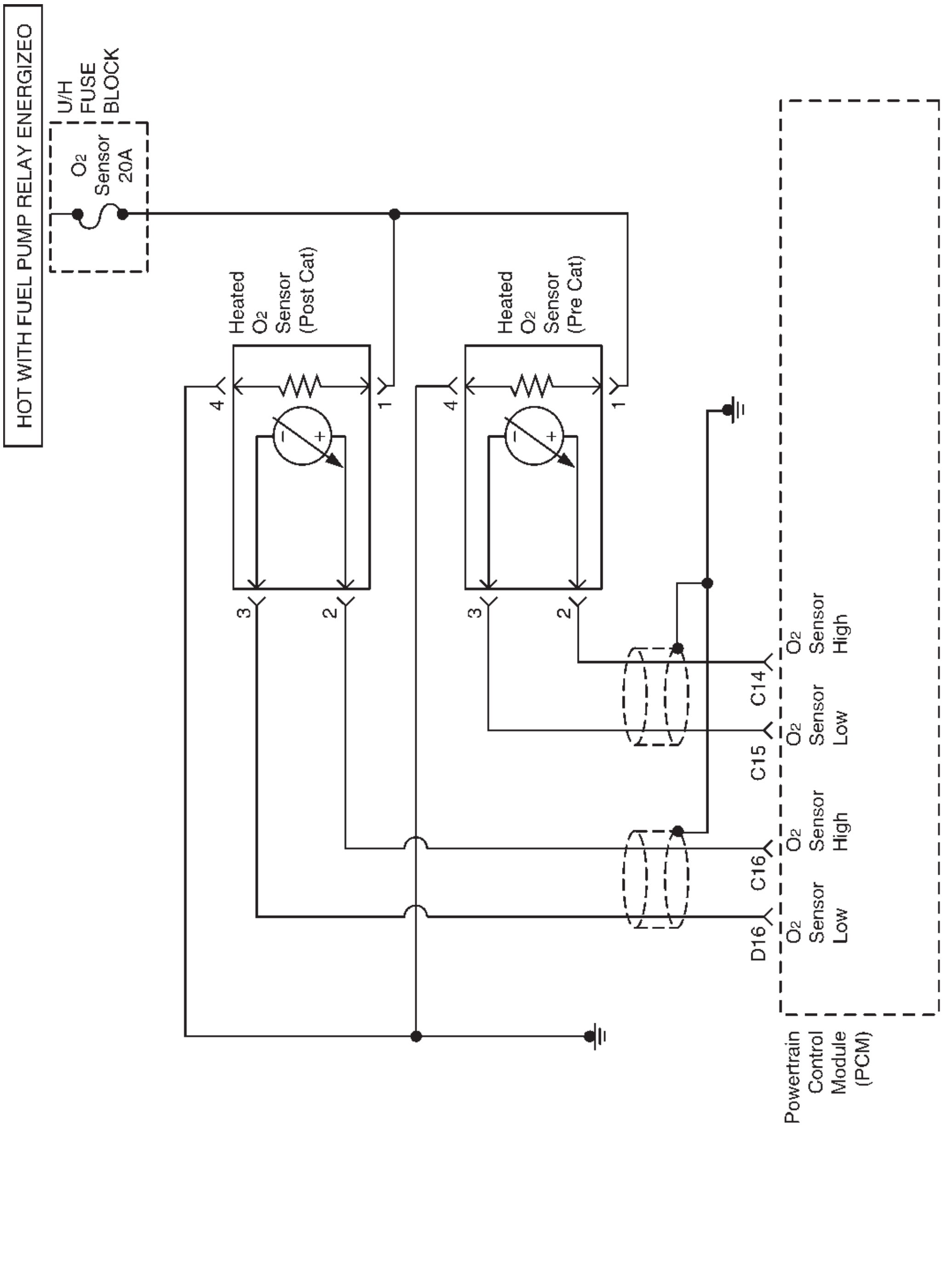
060R100005

PCM WIRING DIAGRAM (4 of 13)



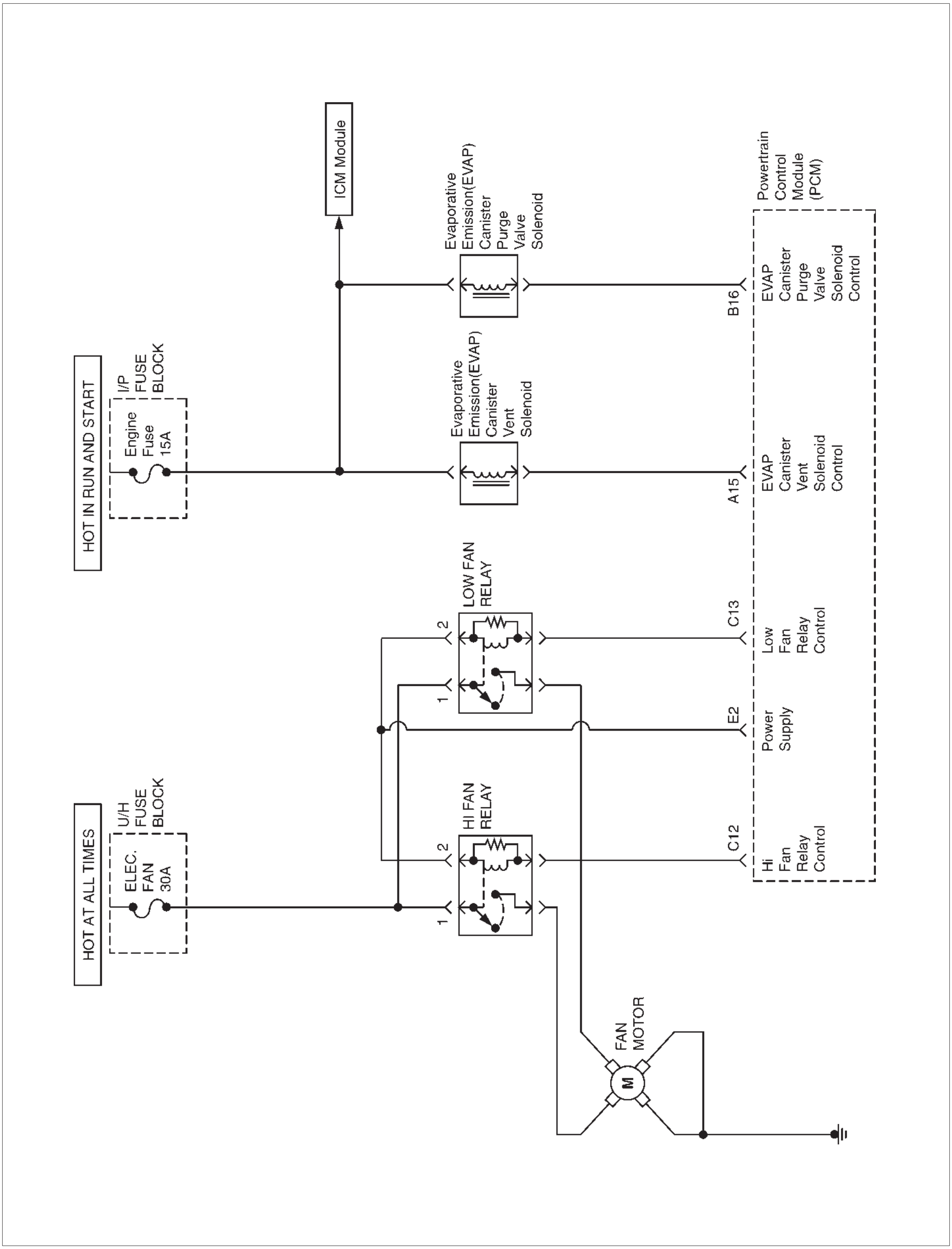
060R100006

PCM WIRING DIAGRAM (5 of 13)



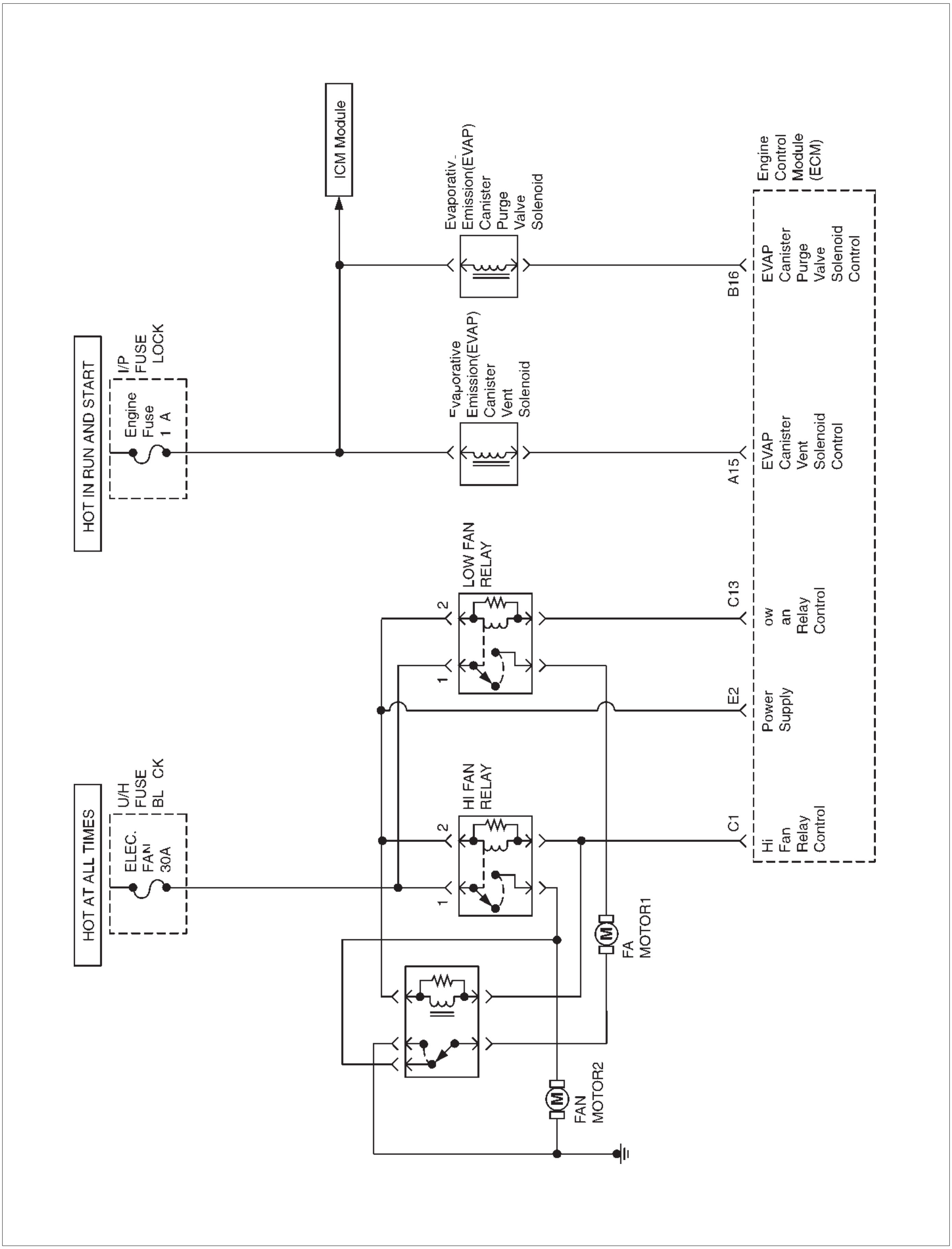
060R100007

PCM WIRING DIAGRAM (6 of 13)



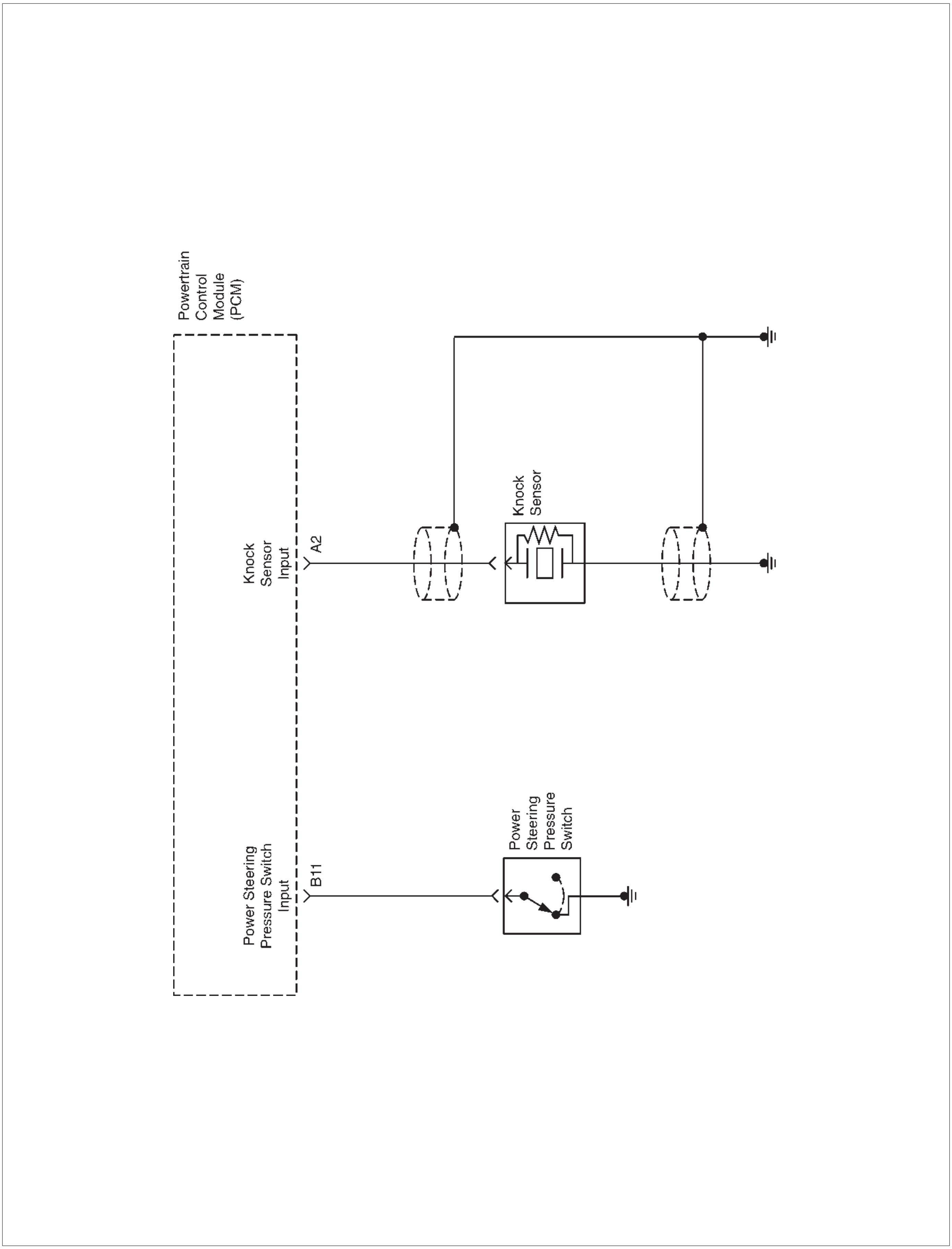
060R100008

PCM WIRING DIAGRAM (7 of 13)



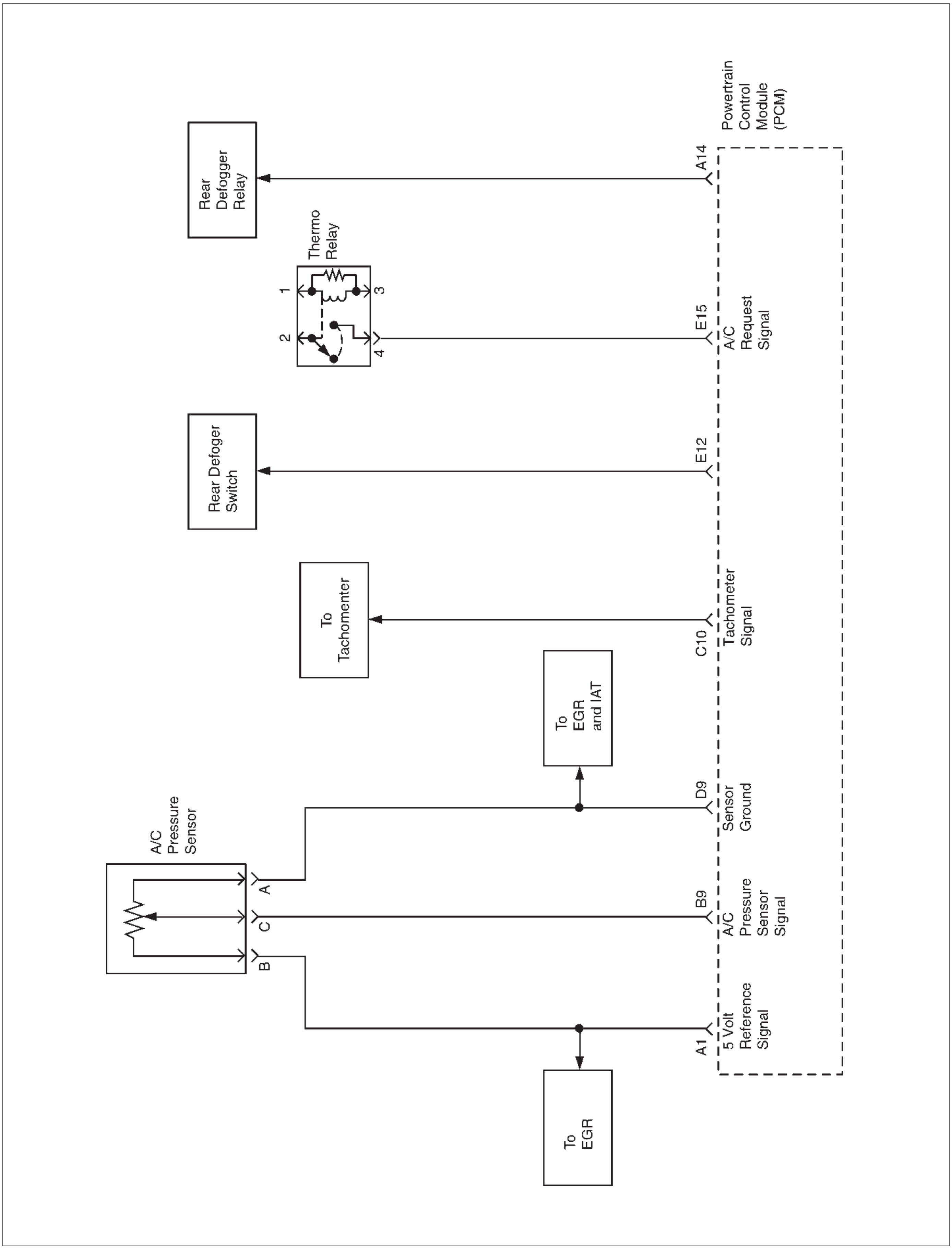
060R100009

PCM WIRING DIAGRAM (8 of 13)



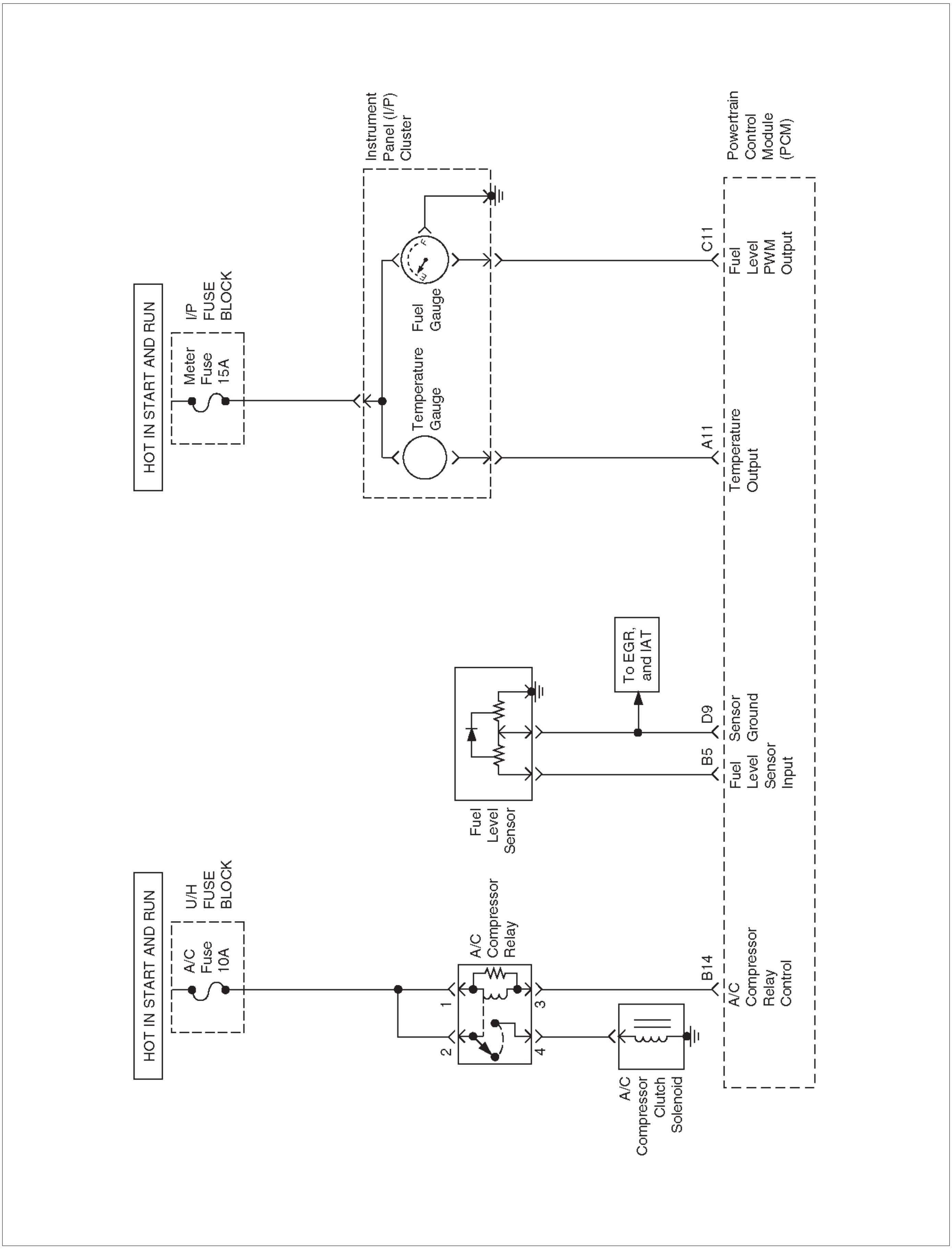
060R100010

PCM WIRING DIAGRAM (9 of 13)



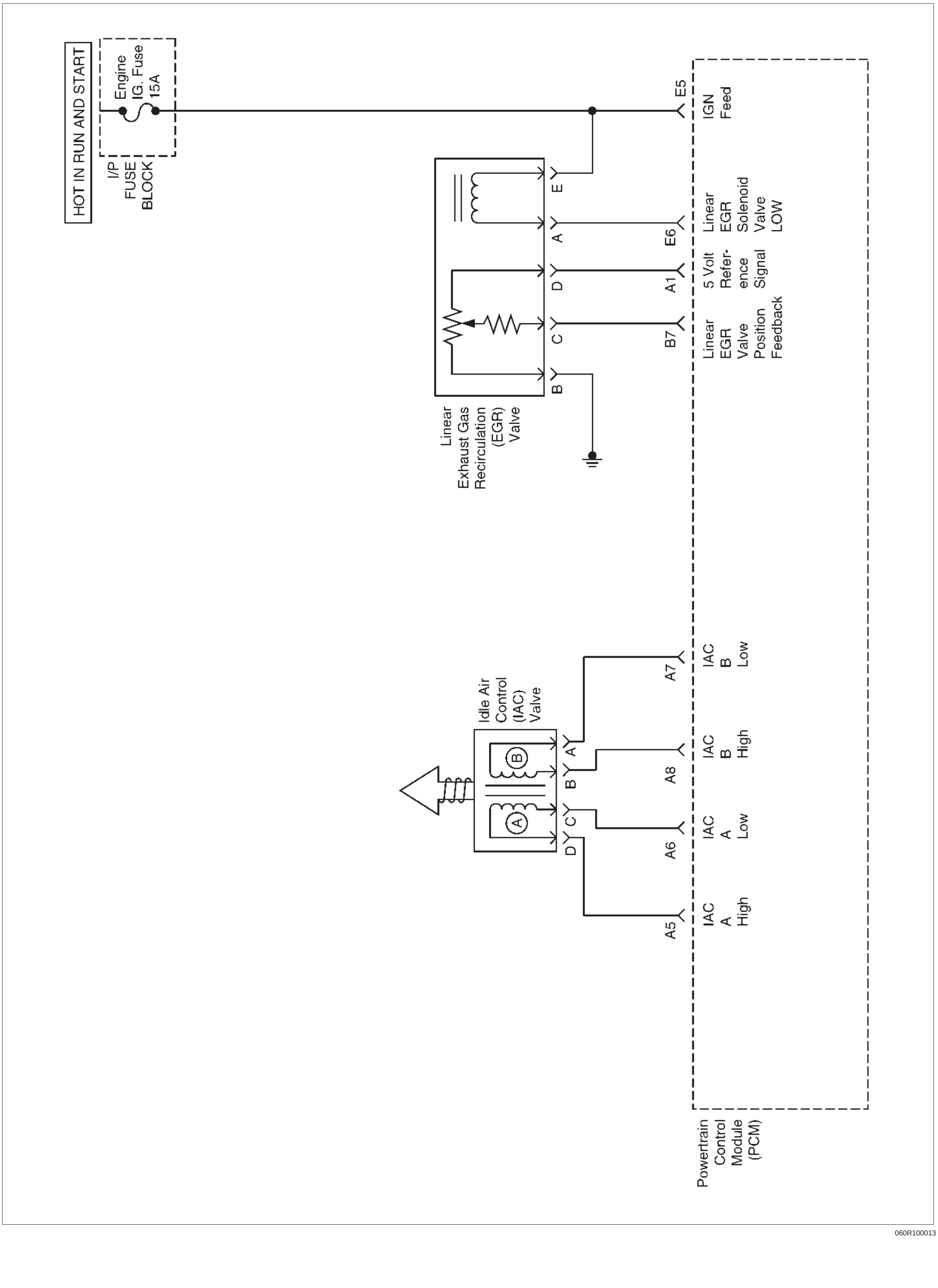
060R100011

PCM WIRING DIAGRAM (10 of 13)



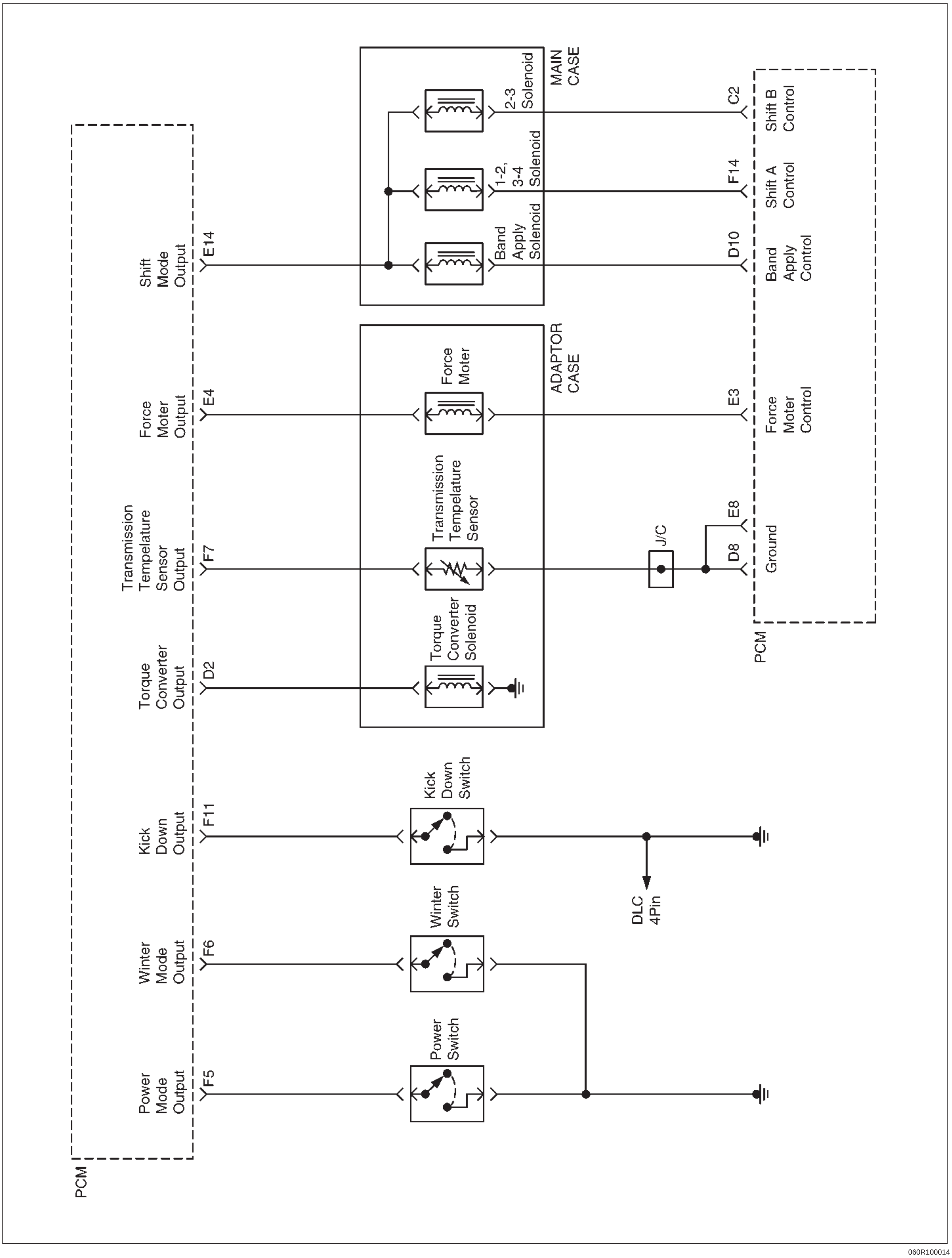
060R100089

PCM WIRING DIAGRAM (11 of 13)



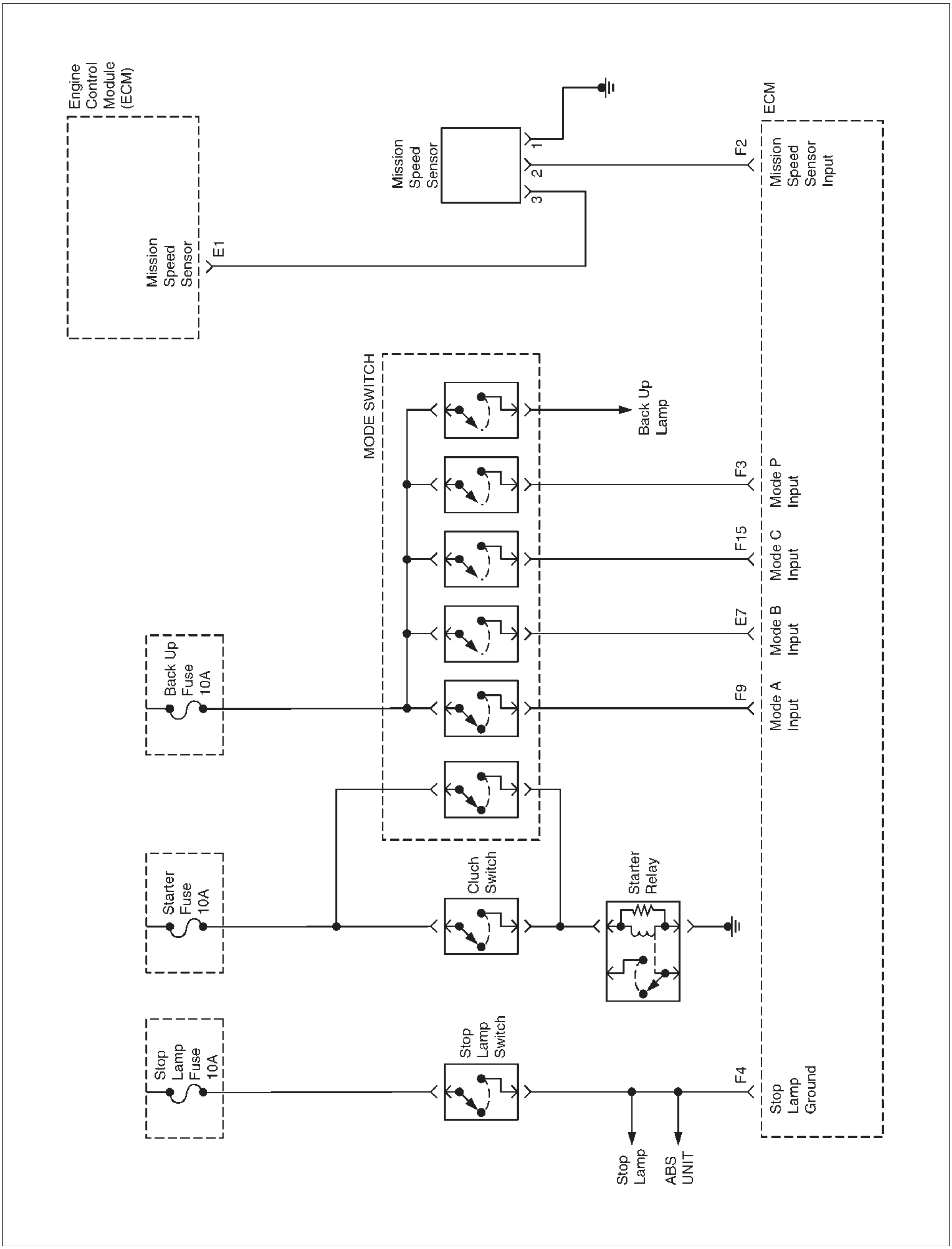
060R100013

PCM WIRING DIAGRAM (12 of 13)



060R100014

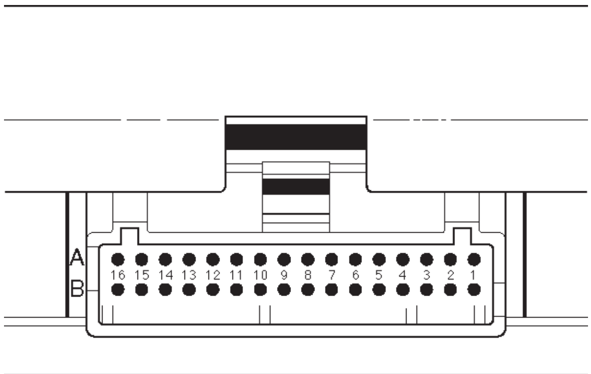
PCM WIRING DIAGRAM (13 of 13)



060R100015

PCM PINOUTS

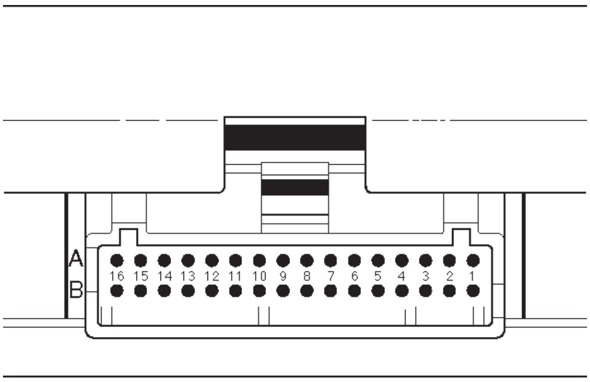
PCM Pinout Table, 32–Pin Red Connector – Row ”A”



TS23344

PIN	PIN Function	IGN ON	ENG RUN	Refer To
A1	5 Volt Reference Signal	5.0 V	5.0 V	Appropriate Sensor
A2	Knock Sensor Input	—	3.0 V (MAX)	General Description and Operation, Knock Sensor
A3	Not Used			
A4	Battery Feed	B+	B+	Chassis Electrical
A5	Idle Air Control (IAC) ”A” High	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A6	IAC ”A” Low	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A7	IAC ”B” Low	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A8	IAC ”B” High	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A9	Not Used	—	—	—
A10	Not Used	—	—	—
A11	Temperature Gage	Varies with Temperature	Varies with Temperature	General Description and Operation
A12	Low Fuel Warning Lamp Control	0.4–0.9 V	B+	Chassis Electrical
A13	Malfunction Indicator Lamp (MIL) Control	0.4–0.9 V	B+	Chassis Electrical
A14	Rear Defogger Relay	B+	B+	Classis Electrical
A15	EVAP Canister Vent Solenoid Control	B+	0–5 V (varies)	General Description and Operation, EVAP Emission Control System
A16	Not Used	—	—	—

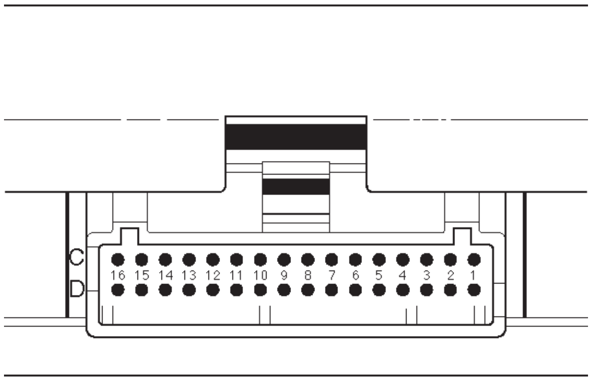
PCM Pinout Table, 32–Pin Red Connector – Row ”B”



TS23344

PIN	PIN Function	IGN ON	ENG RUN	Refer To
B1	5 Volt Reference Signal	5.0 V	5.0 V	Fuel Tank Pressure
B2	Not Used	—	—	—
B3	Not Used	—	—	—
B4	Not Used	—	—	—
B5	Fuel Tank Level Sensor	—	—	General Description and Operation, Fuel Pump
B6	Fuel Tank Pressure Sensor Input	0.2 to 4.9 V (0.5V = +5in H2O)	0.2 to 4.9 V (4.5V = –15 in H2O)	General Description and Operation, Fuel Pump
B7	Exhaust Gas Recirculation (EGR) Position Feedback	0.6 V	0.6 V	General Description and Operation, Linear EGR Control
B8	Intake Air Temperature (IAT) Sensor	~3V (0V = 151°C {304°F})	~3 V (5V = –40°C {–40°F})	General Description and Operation, IAT
B9	A/C Pressure Sensor Signal	~1 V	~1 V	A/C System
B10	Not Used	—	—	—
B11	Power Steering Pressure (PSP) Switch Input	B+	B+	General Description and Operation, PSP
B12	Not Used	B+	B+	Chassis Electrical
B13	Class 2 Data	0.0 V	0.0 V	Diagnosis, Class 2 Serial Data
B14	A/C Compressor Clutch Relay Control Compressor	0 (A/C OFF)	B+ (A/C ON)	General Description and Operation, A/C Clutch Circuit Operation
B15	Not Used	—	—	—
B16	EVAP Canister Purge Valve Solenoid	—	—	General Description and Operation, EVAP

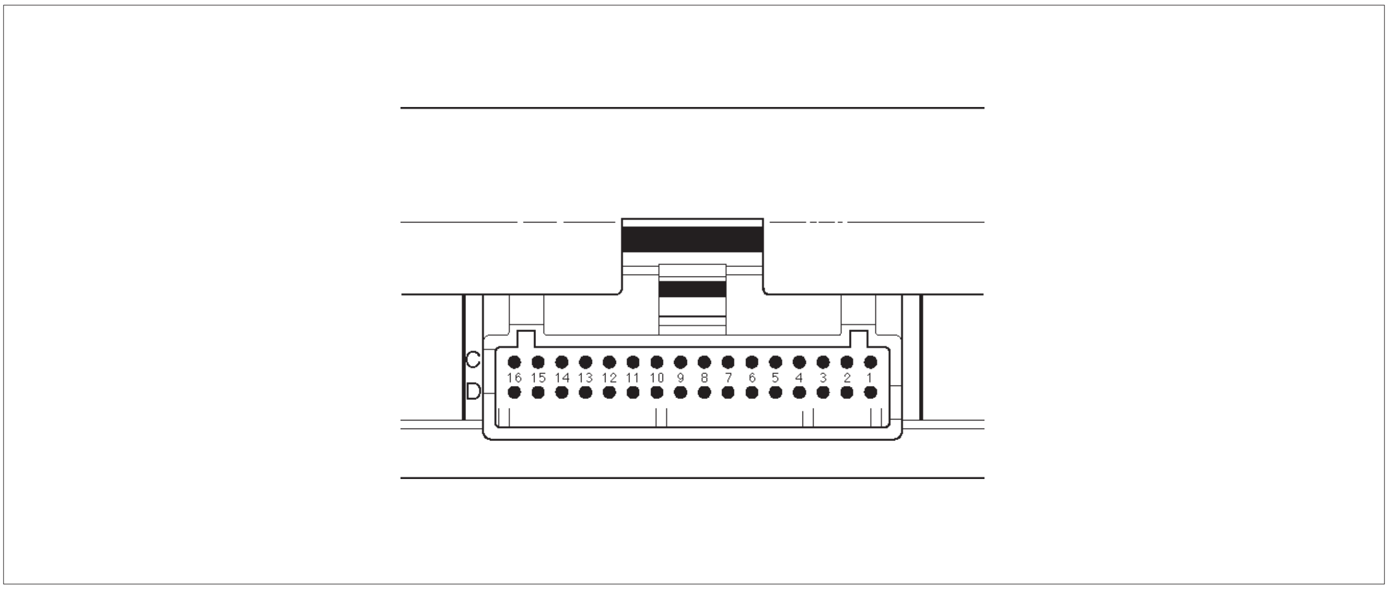
PCM Pinout Table, 32–Pin White Connector – Row ”C”



TS23345

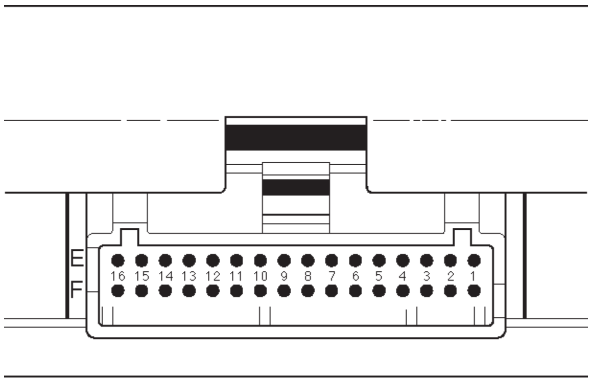
PIN	PIN Function	IGN ON	ENG RUN	Refer To
C1	Injector Cylinder #2	B+ Varies	B+ Varies	General Description and Operation, Fuel Injector
C2	Shift Solenoid B (A/T)	—	—	—
C3	Not Used	—	—	—
C4	Ignition Control Module (ICM) Input	0.0 V	0.1 V	General Description and Operation, Fuel Injector
C5	Crankshaft Position (CKP) Sensor Low	4.98 V	0.76 V (at idle)	General Description and Operation, Crankshaft Position Sensor
C6	Crankshaft Position Sensor (CKP) High	5V	5V	General Description and Operation, Crankshaft Position Sensor
C7	PCM Ground	0.0 V	0.0 V	Chassis Electrical
C8	PCM Ground	0.0 V	0.0 V	Chassis Electrical
C9	PCM Ground	0.0 V	0.0 V	Chassis Electrical
C10	Tachometer Signal	—	—	General Description and Operation
C11	Fuel Gauge PWM Output	Varies with Fuel Level	Varies with Fuel Level	General Description and Operation
C12	High Fan Relay Control	10.5 V	B+	Chassis Electrical
C13	Low Fan Relay Control	—	—	Chassis Electrical
C14	Bank 1 HO2S 1 High	0.3 V	–0.1 to 1.1 V	General Description and Operation, Fuel HO2S 1
C15	Bank 1 HO2S 1 Low	0.0 V	0.1 V	General Description and Operation, Fuel HO2S 1
C16	Bank 1 HO2S 2 High	0.3 V	–0.1 to 1.1 V	General Description and Operation, Catalyst HO2S 2

PCM Pinout Table, 32–Pin White Connector – Row ”D”



PIN	PIN Function	IGN ON	ENG RUN	Refer To
D1	Injector Cylinder #3	B+	B+	General Description and Operation, Fuel Injector
D2	Torque Converter Solenoid (A/T)	—	—	—
D3	Injector Cylinder #1	B+	B+	General Description and Operation, Fuel Injector
D4	SDATA	—	—	Air Bag Control Module Data
D5	Ignition Control Module (ICM) Input	—	—	General Description and Operation
D6	Not Used	—	—	—
D7	VSS Input	—	—	Chassis Electrical
D8	Sensor Ground 5 V Reference A Return	0.0 V	0.0 V	Vapor Pressure, TPS
D9	Sensor Ground 5 V Reference B Return	0.0 V	0.0 V	MAT, MAP, A/C Pressure Fuel Level
D10	Not Used	—	—	—
D11	Camshaft Position Sensor Input	5.0 V	4.6 V	General Description and Operation, Camshaft Position Sensor
D12	Not Used	—	—	—
D13	Not Used	—	—	—
D14	Not Used	—	—	—
D15	Not Used	—	—	—
D16	Bank 1 HO2S 2 Low	0.0 V	0.1 V	General Description and Operation, Catalyst HO2S 2

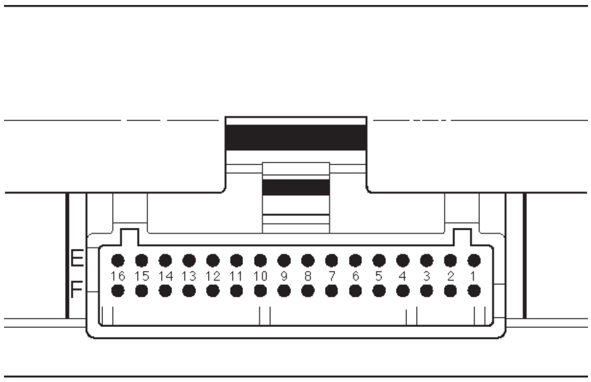
PCM Pinout Table, 32–Pin White Connector – Row ”E”



TS23346

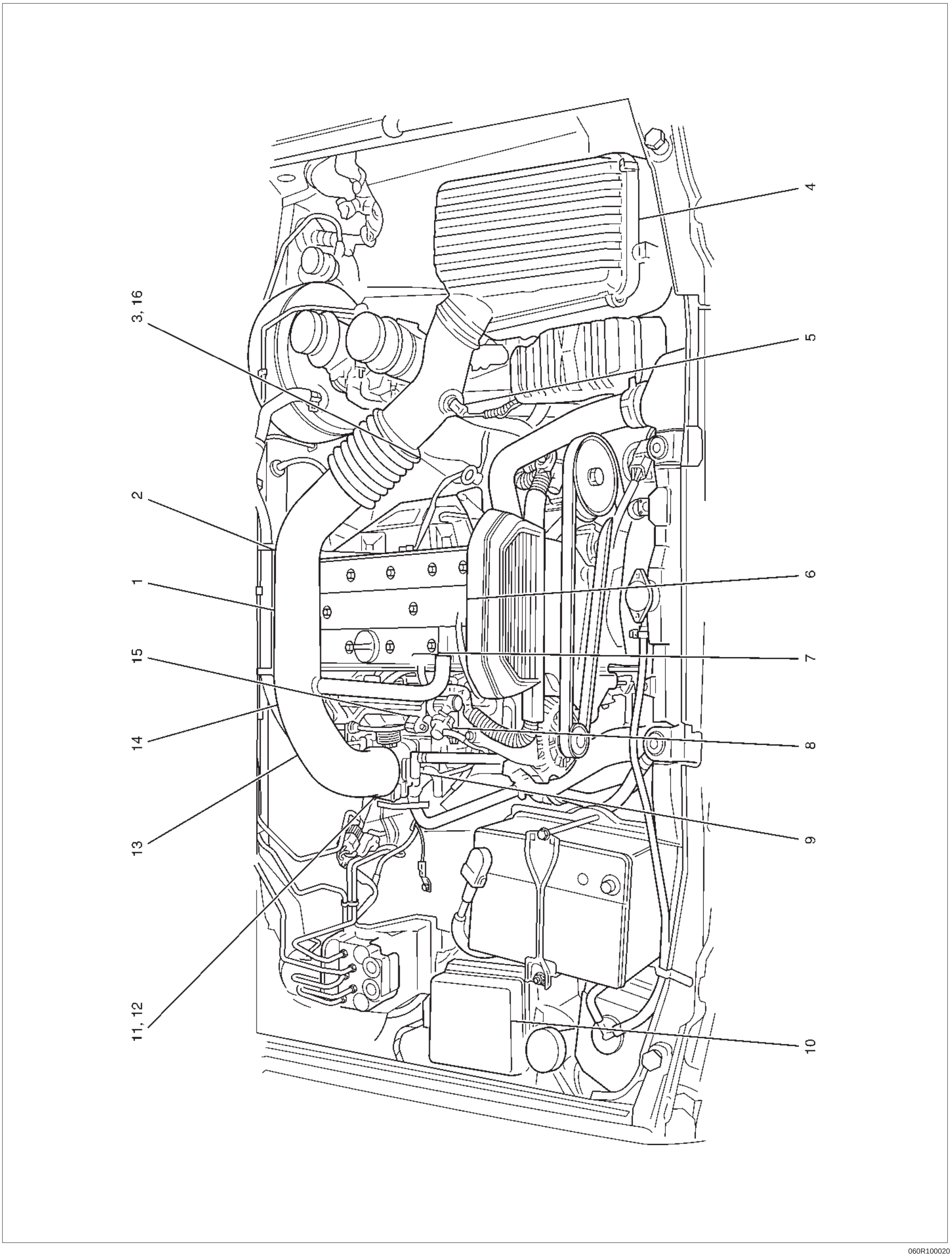
PIN	PIN Function	IGN ON	ENG RUN	Refer To
E1	Transmission Speed Sensor Input (A/T)	—	—	—
E2	Fan Control	0.0V	B+	Chassis Electrical
E3	Force Moter (A/T) High	—	—	—
E4	Force Moter (A/T) Low	—	—	—
E5	Ignition Feed	B+	B+	General Description and Operation
E6	Exhaust Gas Recirculation (EGR) Valve Low	B+ Varies	B+ Varies	General Description and Operation, EGR Control
E7	Shift Mode Switch (A/T)	—	—	—
E8	Throttle Position (TP) Sensor Input and Temperature Retrn	0.25 V (0% = 0.25 V)	0.25 V (at idle) (100% = 4.75 V)	General Description and Operation, Throttle Position Sensor
E9	Engine Coolant Temperature (ECT) Sensor Input	2.3 V (O V = 151˚C {304˚F})	2.1 V (5 V = –40˚C {–40˚F})	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
E10	Not Used	—	—	—
E11	Not Used	—	—	—
E12	Rear Defogger Switch	B+	B+	Chassis Electrical
E13	Fuel Pump (FP) Relay Control	0.0 V	B+	On–Vehicle Service, Fuel Pump Relay
E14	Shift Solenoid High (A/T)	—	—	—
E15	A/C Request (Thermo Relay)	0.0 V	0.0 V	Electric Cooling Fans
E16	Ignition Feed	B+	B+	General Description and Operation

PCM Pinout Table, 32–Pin White Connector – Row ”F”

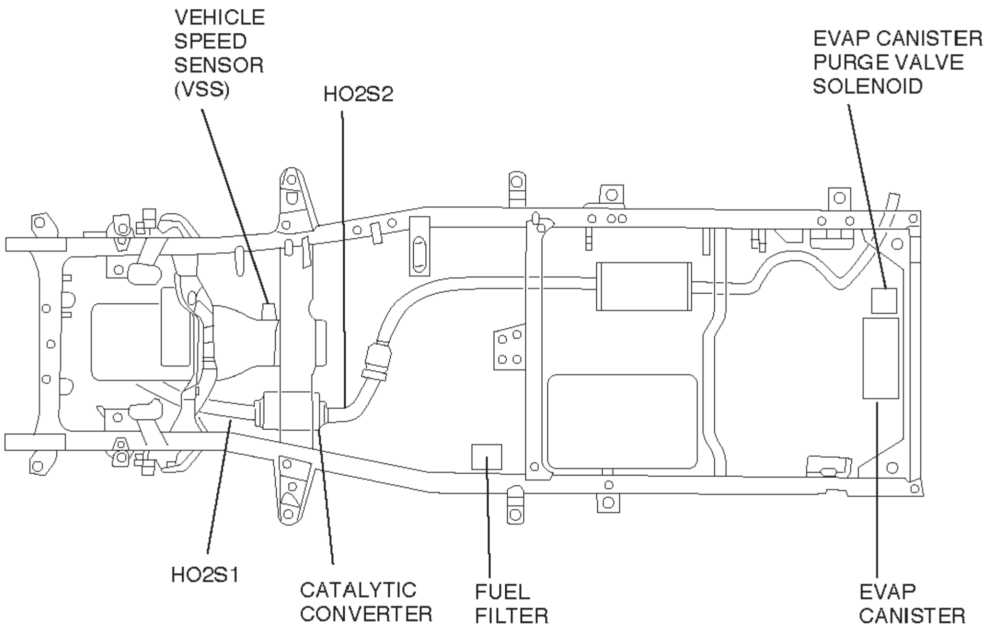


PIN	PIN Function	IGN ON	ENG RUN	Refer To
F1	Not Used	—	—	—
F2	Transmission Speed Sensor High (A/T)	—	—	—
F3	Shift Mode Switch (A/T)	—	—	—
F4	Stop Lamp Switch (A/T)	—	—	—
F5	Power Switch (A/T)	—	—	—
F6	Ivineer Switch (A/T)	—	—	—
F7	T/M Oil Temperature Sensor Input (A/T)	—	—	—
F8	Manifold Absolute Pressure (MAP) Sensor Input	~4.7 V (0 V = 10kPa)	~1.1 V (5 V = 104kPa)	General Description and Operation, Manifold Absolute Pressure
F9	Shift Mode Switch (A/T)	—	—	—
F10	Not Used	—	—	—
F11	Kick Down Switch (A/T)	—	—	—
F12	Not Used	—	—	Class 2 Serial Data
F13	Injector ”C” Cylinder #4	B+	B+	General Description and Operation, Fuel Injector
F14	Shift Solenoid (A/T)	—	—	—
F15	Shift Mode Switch (A/T)	—	—	—
F16	Ignition Feed	B+	B+	General Description and Operation

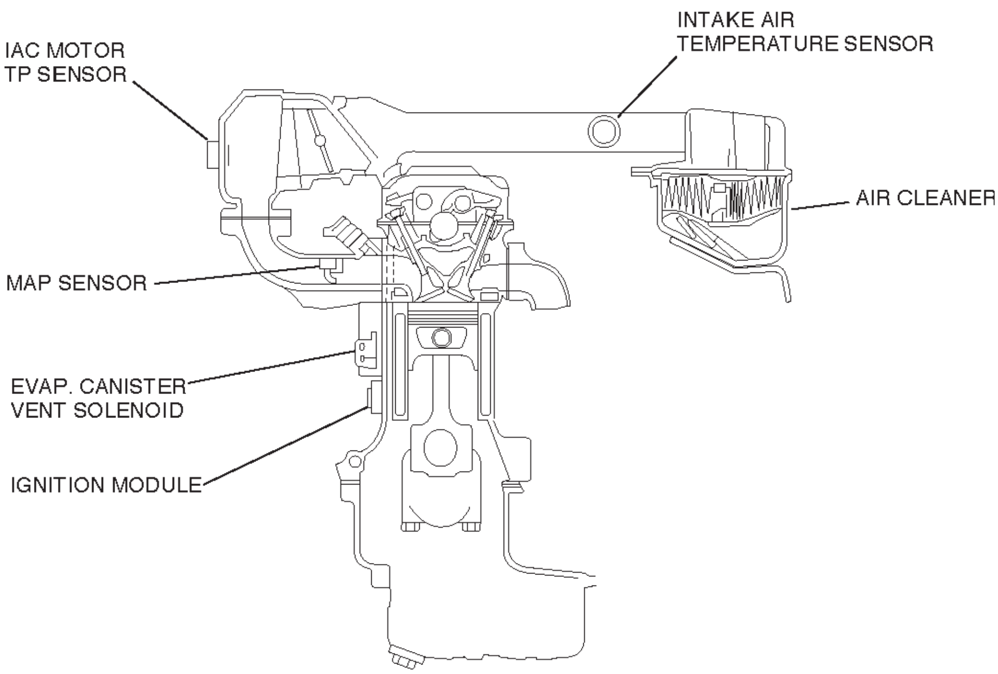
COMPONENT LOCATOR



060R100020



010RX001



028RX001

Engine Component Locator Table

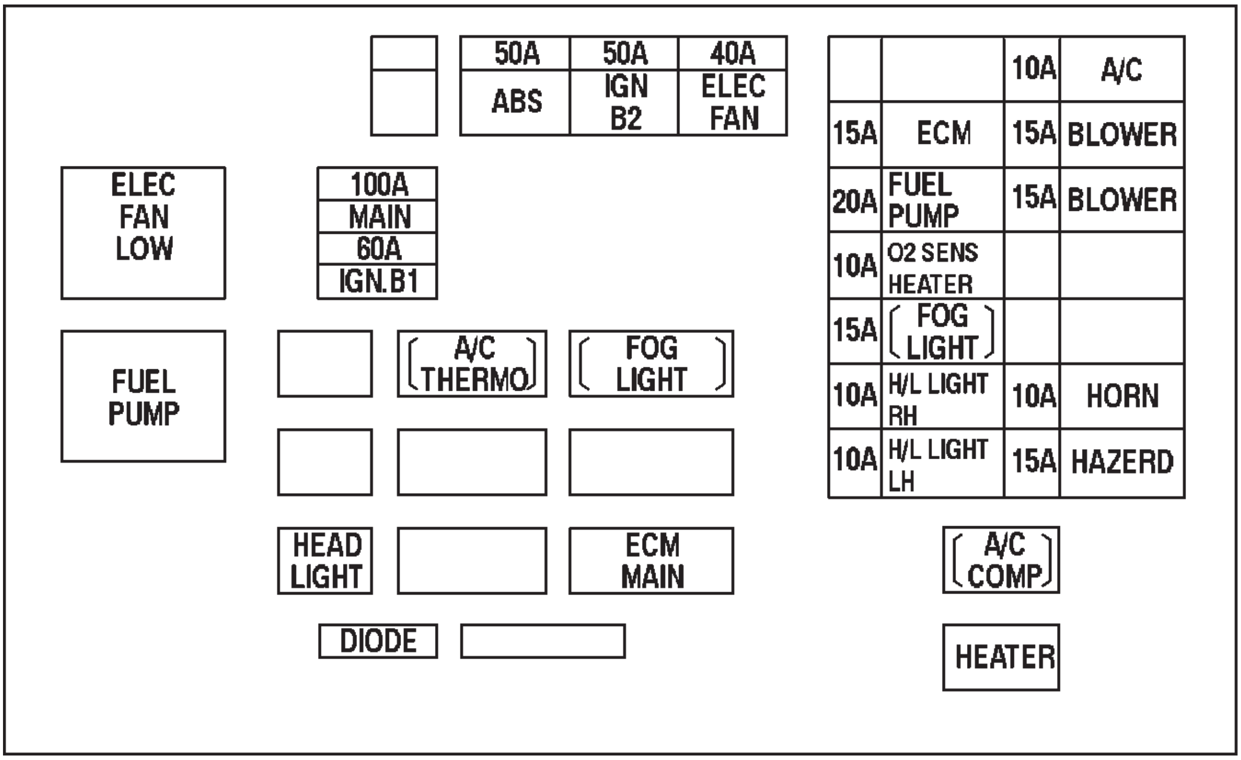
Number	Name	Location
1	Engine Coolant Temperature (ECT) Sensor	Rear of engine, near ignition coils
2	Linear Exhaust Gas Recirculation (EGR) Valve	On the left rear of the engine at the bulkhead
3	Heated Oxygen Sensor (HO2S), Bank 1, Sensor 1	On the exhaust pipe, left side of engine, immediately behind the exhaust manifold
4	Air Cleaner	Left front of the engine bay
5	Intake Air Temperature (IAT) Sensor	On the intake air duct near the air cleaner
6	Camshaft Position (CMP) Sensor	Inside the front cover assembly
7	Positive Crankcase Ventilation (PCV) Port	On the right front corner of the valve cover
8	Fuel Pressure Regulator	On the forward end of the fuel rail, to the right of the PVC port
9	Throttle Body	Between the intake air duct and the intake manifold
10	Fuse/Relay Box	Along the inside of the right fender
11	Throttle Position (TP) Sensor	On the front of the throttle body
12	Idle Air Control (IAC) Valve	On the rear of the throttle body
13	EVAP Canister Vent Solenoid	At the right rear of the engine, behind the Throttle body
14	Ignition Control Module (ICM)	Mounted on a heat sink on the lower right side of the engine block, above the starter motor
15	Manifold Absolute Pressure (MAP) Sensor	Bolted to the front edge of the intake manifold, under the fuel rail
16	Knock Sensor	Left side engine block.

Undercarriage Component Locator Table

Name	Location
Fuel Pump Assembly	Installed in the top of the fuel tank
EVAP Canister	Behind rear axle, near fuel tank filler nozzle
EVAP Canister Purge Valve Solenoid	Behind rear axle, near fuel tank filler nozzle
Heated Oxygen Sensor (HO2S) Bank 1, Sensor 2	Threaded into the exhaust pipe behind the catalytic converter
Vehicle Speed Sensor (VSS)	Protrudes from the right side of the transmission housing, near the output shaft
Crankshaft Position (CKP) Sensor	Lower left hand front of engine, behind power steering pump bracket

Fuse And Relay Panel (Underhood Electrical Center)

Underhood (U/H) Fuse and Relay Panel



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DIAGNOSIS Strategy–Based Diagnostics

Strategy–Based Diagnostics

The strategy–based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
   - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
   - Conduct a thorough visual inspection.
   - Review the service history.
   - Detect unusual sounds or odors.
   - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
   - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
   - ”System checks” contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze–frame data.
2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Scan Tools, such as the Tech 2, have data–capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re–examine the complaint.

   When the complaint cannot be successfully found or isolated, a re–evaluation is necessary. The complaint should be re–verified and could be intermittent as defined in *Intermittents,* or could be normal.
2. Repair and verify.

   After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:
   - Conditions noted by the customer.
   - If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Fame data will only be stored for an A or B type diagnostic and only if the MIL (”Check Engine” lamp) has been requested).
2. Clear the DTC(s).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

GENERAL SERVICE INFORMATION

OBD II Serviceability Issues

With the introduction of OBD II diagnostics across the entire passenger car and light–duty truck market in 1996, illumination of the MIL ("Check Engine" lamp) due to a non–vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non–vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL ("Check Engine" lamp) with OBD II systems is new.

Fuel additives such as "dry gas" and "octane enhancers" may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will show up as a Misfire DTC P0300. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reid Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic as well.

Using fuel with the wrong octane rating for vehicle may cause driveability problems. Many of the major fuel companies advertise that using "premium" gasoline will improve the performance of vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol–enhanced fuels may raise the octane rating, the fuel's ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non–OEM Parts

All of the OBD II diagnostics have been calibrated to run with OEM parts. Something as simple as a high–performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL ("Check Engine" lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL ("Check Engine" lamp) to turn on.

Aftermarket electronics, such as transceiver, stereos, and anti–theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL ("Check Engine" lamp).

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain–soaked, it can temporarily cause engine misfire and turn on the MIL ("Check Engine" lamp).

Refueling

A new OBD II diagnostic was introduced in 1996 on some vehicles. This diagnostic checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the on–board diagnostic system will sense this as a system faultand turn on the MIL ("Check Engine" lamp) with a DTC P0440.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL ("Check Engine" lamp) with a P0300 Misfire DTC.

Poor Vehicle Maintenance

The sensitivity of OBD II diagnostics will cause the MIL ("Check Engine" lamp) to turn ON if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD II. Poor vehicle maintenance can't be classified as a "non–vehicle fault", but with the sensitivity of OBD II diagnostics, vehicle maintenance schedules must be more closely followed.

Severe Vibration

The Misfire diagnostic measures small changes in the rotational speed of the crankshaft. Severe driveline vibrations in the vehicle, such as caused by an excessive amount of mud on the wheels, can have the same effect on crankshaft speed as misfire and therefore may set a Misfire DTC P0300.

Related System Faults

Many of the OBD II system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until the Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Emissions Control Information Label

The engine compartment "Vehicle Emissions Control Information Label" contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the emission standard (Federal, California, or Canada) of the engine, the displacement of the engine in liters, the class of the vehicle, and the type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every vehicle. If the label has been removed it should be replaced, it can be ordered from Isuzu Dealer ship.

Maintenance Schedule

Refer to the Maintenance Schedule.

Visual/Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for pinches, cuts, disconnection, and Droper routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge Of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

SERIAL DATA COMMUNICATIONS

Class II Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the "Class II" communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides Tech 2 manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on the other Tech 2 will appear the same, with some exceptions. Some Scan Tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. For more information on this system of coding, refer to Decimal/Binary/Hexadecimal Conversions. On this vehicle the Tech 2 displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

ON–BOARD DIAGNOSTIC (OBD II)

On–Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to monitor emissions–related input and output powertrain components. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To illuminate The MIL* is a list of components, features or functions that could fall under this requirement.

Input Components:

Input components are monitored for circuit continuity and out–of–range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage). Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor

In addition to the circuit continuity and rationality check the ECT sensor is monitored for its ability to achieve a steady state temperature to enable "Closed Loop" fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out–of–range values if applicable.

Output components to be monitored include, but are not limited to the following circuit:

- Idle Air Control (IAC) Motor
- EVAP Canister Purge Valve Solenoid
- A/C relays
- Cooling fan relay(s)
- VSS output
- MIL control
- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on–board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm–Up Cycle

A warm–up cycle means that engine at temperature must reach a minimum of 70˚C (160˚F) and rise at least 22˚C (40˚F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions–related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to Storing And Erasing Freeze Fame Data for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD II Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on–board memory, while Freeze Frame stores information only for emission–related faults that command the MIL ON.

System Status And Drive Cycle For Satisfying Federal Inspection/Maintenance (I/M 240) Regulations

I/M Ready Status means a signal or flag for each emission system test that had been set in the PCM. I/M Ready Status indicates that the vehicle on–board emissions diagnostics have been run. I/M Ready Status is not concerned whether the emission system passed or failed the test, only that on–board diagnosis is complete. Not all vehicles use all possible I/M flags.

Common OBD II Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on–board test run by the vehicle’s Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire
- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term ”enable criteria” is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. ”Enable criteria” is another way of saying ”conditions required”.

The enable criteria for each diagnostic is listed on the first page of the DTC description in Section 6E1 under the heading ”Conditions for Setting the DTC”. Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- A/C ON

Trip

Technically, a trip is a key on–run–key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is at idle; some diagnostics function with the TCC disabled. Some run only immediately following a cold engine start–up.

A trip then, is defined as a key on–run–key off cycle in which the vehicle was operated in such a way as to satisfy the enabling criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as follows:

- Commanding the MIL (”Check Engine” lamp) ON and OFF
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Non–emission related Service Lamp (future)
- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic
- System Status (I/M ready)

The Diagnostic Executive records DTCs and turns ON the MIL when emission–related faults occur. It can also turn OFF the MIL if the conditions cease which caused the DTC to set.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple faults present.

There is a continuous self–diagnosis on certain control functions. This diagnostic capability is complimented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) (”Check Engine” lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with (”Check Engine” lamp). However, OBD II requires that it illuminate under a strict set of guide lines.

Basically, the MIL is turned ON when the PCM detects a DTC that will impact the vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned ON if an emissions–related diagnostic test indicates a malfunction has occurred. It will stay ON until the system or component passes the same test, for three consecutive trips, with no emissions–related faults.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three–Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and the MIL will stop flashing and remain ON steady.

Extinguishing the MIL

When the MIL is ON, the Diagnostic Executive will turn OFF the MIL after *three (3) consecutive* trips that a ”test passed” has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned OFF, the DTC will remain in the PCM memory (both Freeze Frame and Failure Records) until *forty(40) warm–up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire–related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur with 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last test failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL (”Check Engine” lamp) is on the instrument panel and has the following functions:

- It informs the driver that a fault that affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come ON with the key ON and the engine not running. When the engine is started, the MIL will turn OFF.

- When the MIL remains ON while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On–Board Diagnostic (OBD) System Check must be performed. The procedures for these checks are given in On–Board Diagnostic (OBD II) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL of the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty)
  - Stores a Fail Record
  - Updates the Fail Record each time the diagnostic test fails
- Type B
  - Emissions related
  - ”Armed” after one (1) trip with a fail
  - ”Disarmed” after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
  - Stores a Freeze Frame on the second consecutive trip with a fail (if empty)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non–Emissions related
  - Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails
- Type D. (*Type D* non–emissions related are not utilized on certain vehicle applications).
  - Non–Emissions related
  - Does not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to “flash” at a rate of once per second during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of *Type B* diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned OFF, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as a reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal *Type B* diagnostic, and does not use the stored conditions. However, if a malfunction occurs on two non–consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- Engine coolant temperature is in the same range as the previous test that failed.

Storing and Erasing Freeze Frame Data and Failure Records

Government regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Freeze Frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate

- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

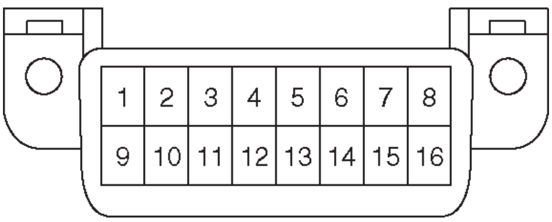
In the case of an ”intermittent” fault, the MIL (”Check Engine” lamp) may illuminate and then (after three trips) go OFF. However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the ”Diagnostic Aids” associated with the diagnostic trouble code. A physical inspection of the applicable sub–system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communicating with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel. The DLC is used to connect to the Tech 2 Scan tool. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs)
- Clearing DTCs
- Performing output control tests
- Reading serial data



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Decimal/Binary/Hexadecimal Conversions

Beginning in 1996, Federal Regulations require that all auto manufacturers selling vehicles in the United States provide Scan tool manufacturers with software information to display vehicle operating parameters. All Scan tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some Scan Tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for Scan Tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using A Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Scan tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the ”warm–up” cycles with no further faults detected, the DTC will automatically be cleared from the PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan tool ”clear DTCs” or ”clear information” function. When clearing DTCs follow instructions supplied by the tool manufacturer.

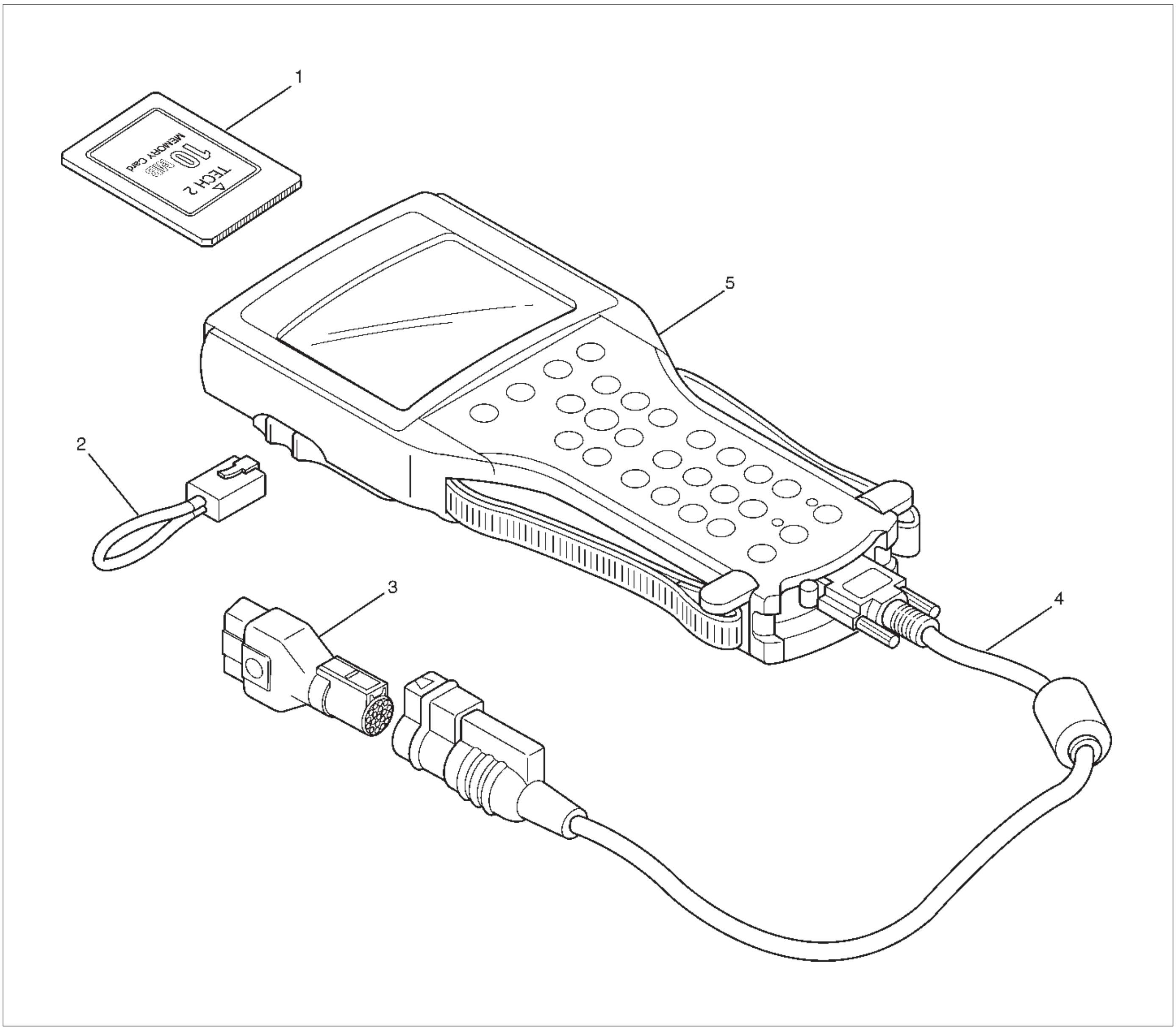
When a Tech 2 is not available, DTCs can also be cleared by disconnecting one of the following sources for at least thirty (30) seconds.

NOTE: To prevent system damage, the ignition key must be OFF when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery PCM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on–board memory data, such as preset radio tuning).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use the Tech 2 scan tool. Please refer to the Tech 2 user guide.



901RW180

Legend

(1) PCMCIA Card
(2) R232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech 2

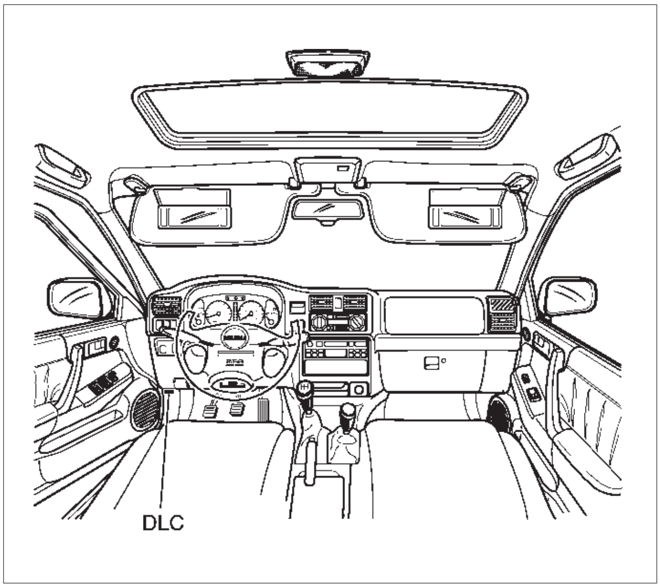
Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volt.
2. After connecting and/or installing, the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press “F1: Clear DTC Info”.

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



740RW060

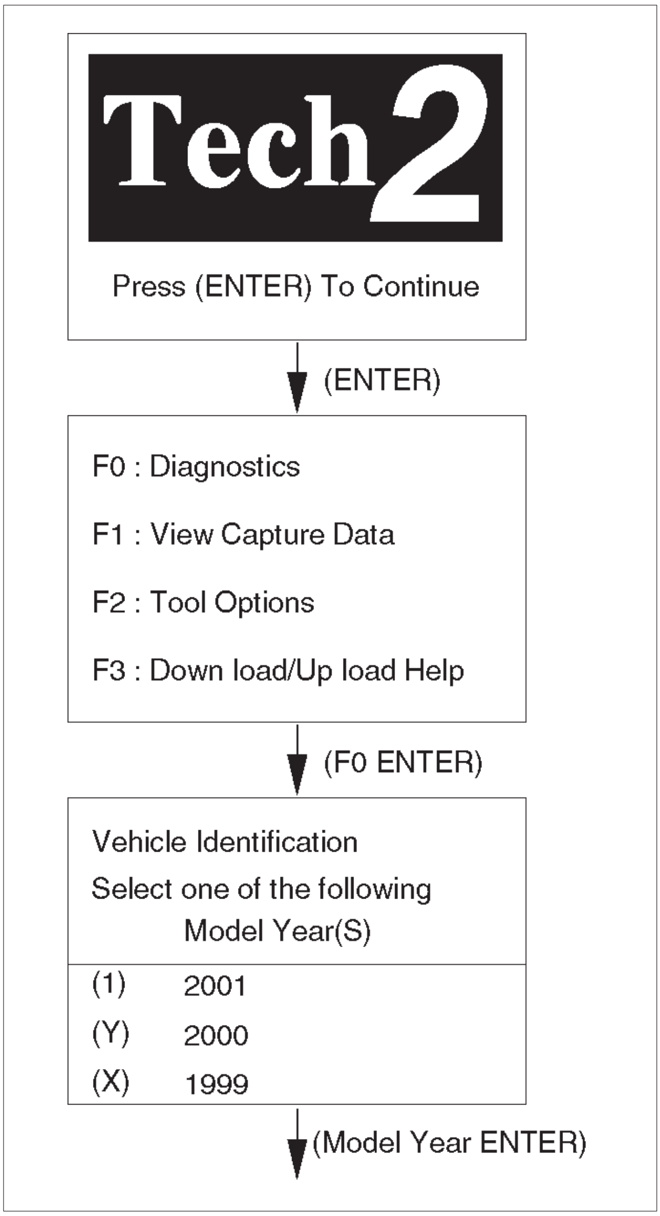
6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and Verify the Tech 2 power up display.

060RW009

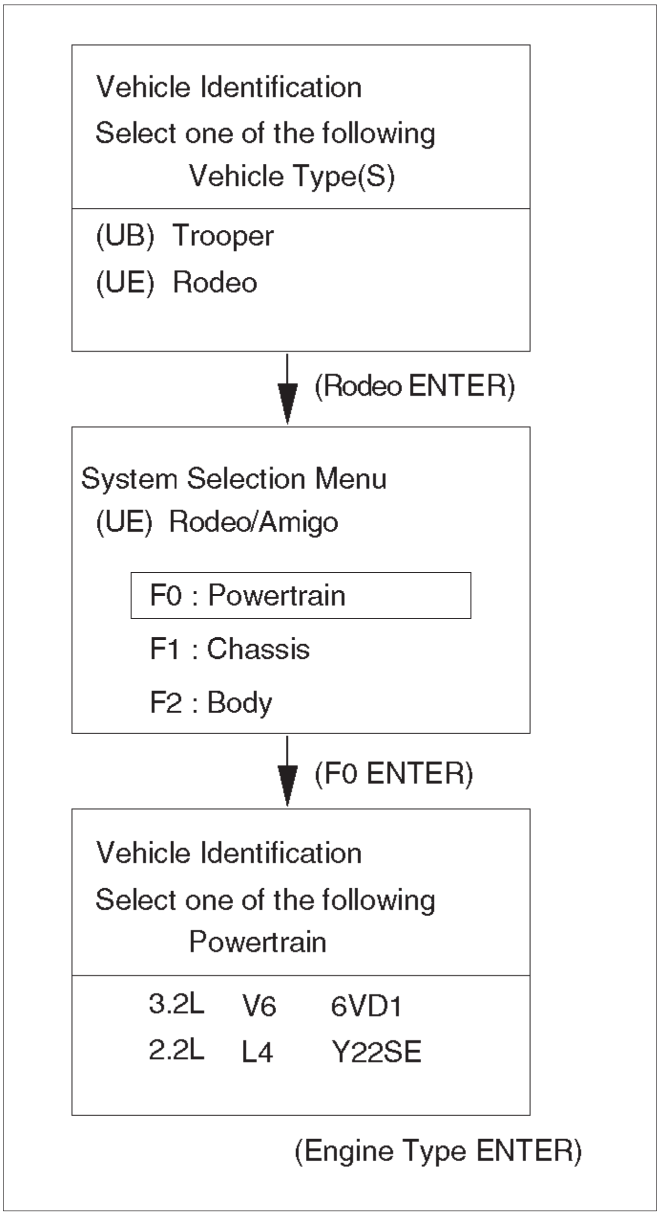
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure (Example)

The power up screen is displayed when you power up the tester with the Isuzu system PCMCIA card. Follow the operating procedure below.



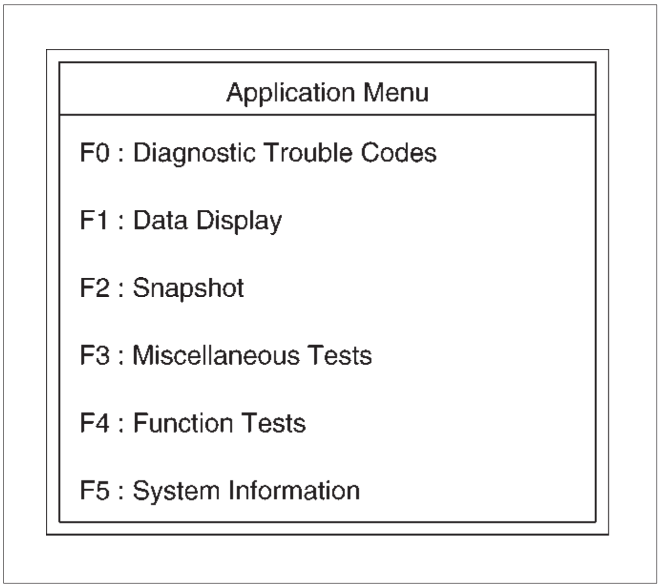
060R100088



060R100087

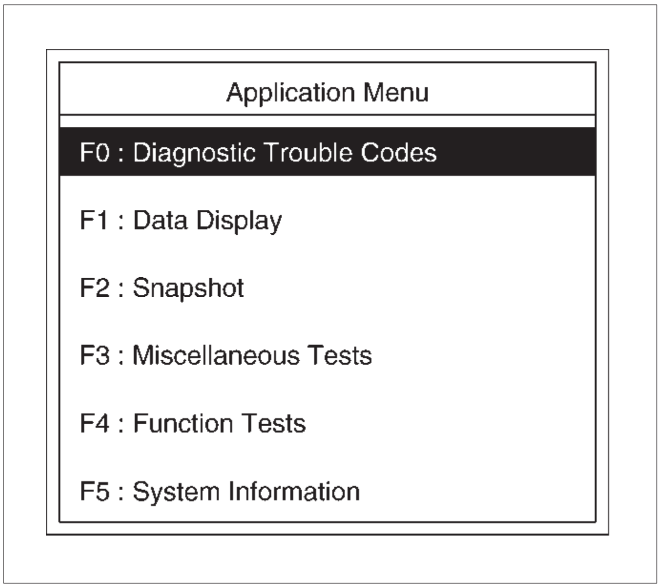
Menu

- The following table shows which functions are used for the available equipment versions.



060R100018

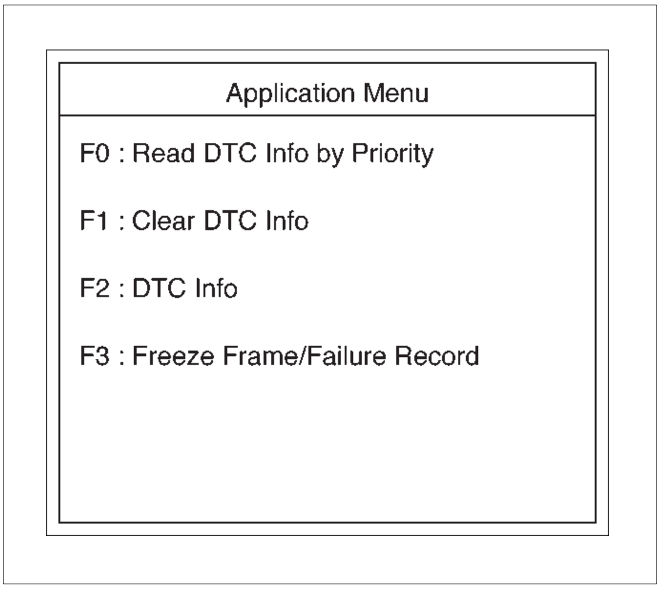
DTC Modes



060R100077

On OBD II vehicles there are five options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears:

- DTC Info
- Freeze Frame
- Fail Records (not all applications)
- Clear Info

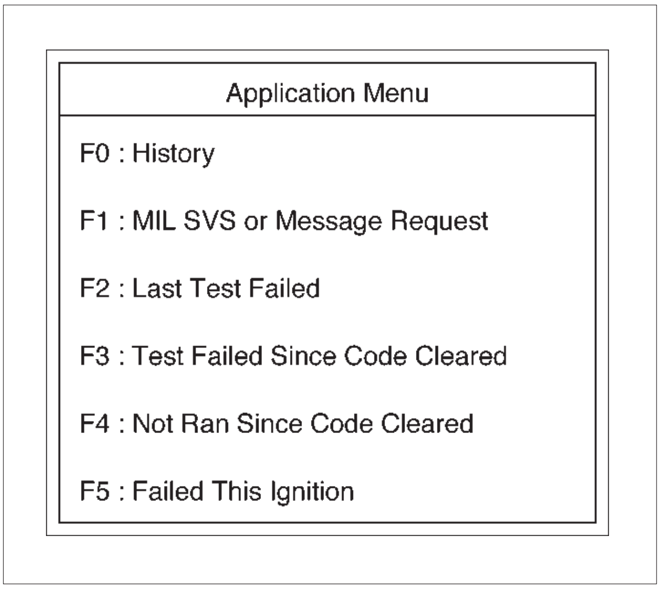


060RW223

The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are six choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.



060RW221

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM's history memory. It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test run. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Cleared

This option will display up to 33 DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Miscellaneous Test

This test consists of eight menus-Lights, Relays, EVAP, IAC System, Fuel System, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.

In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.

To judge intermittent trouble,

1. Confirm DTC freeze frame data, and match the freeze frame data as test conditions with the data list displayed by Miscellaneous Test.
2. Confirm DTC setting conditions, and match the setting conditions as test conditions with the data list displayed by Miscellaneous Test.
3. Refer to the latest Service Bulletin.
   Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

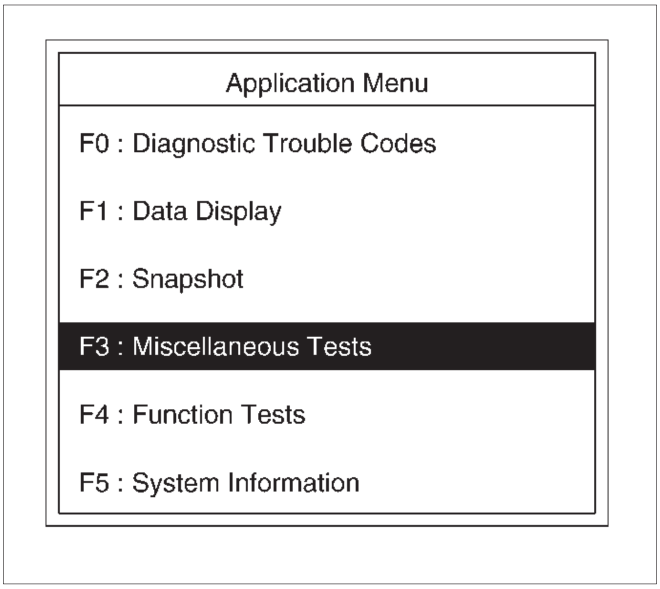
Lamps Test

This test is conducted check MIL and Low Fuel Lamp for its working.

Tech 2 must be used for this test.

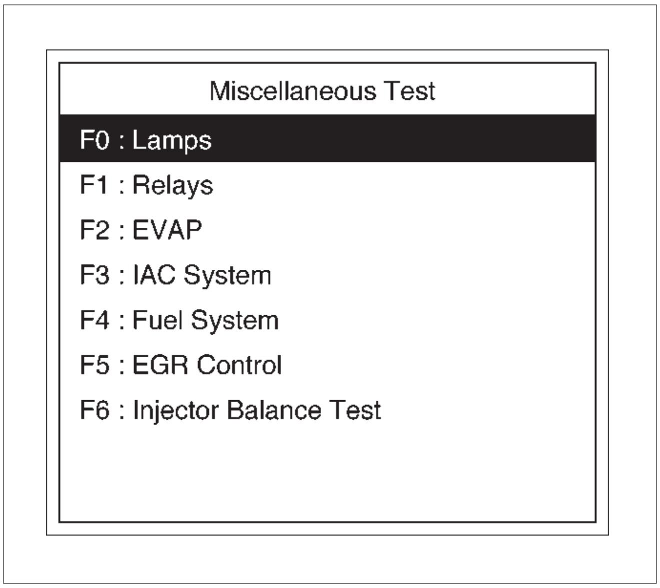
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.

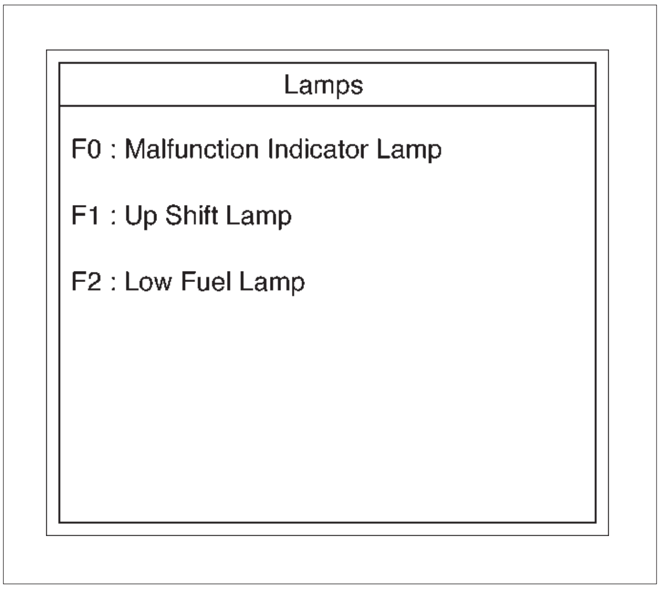


060R100078

4. Select F0:Lamps Test in the Miscellaneous Test.

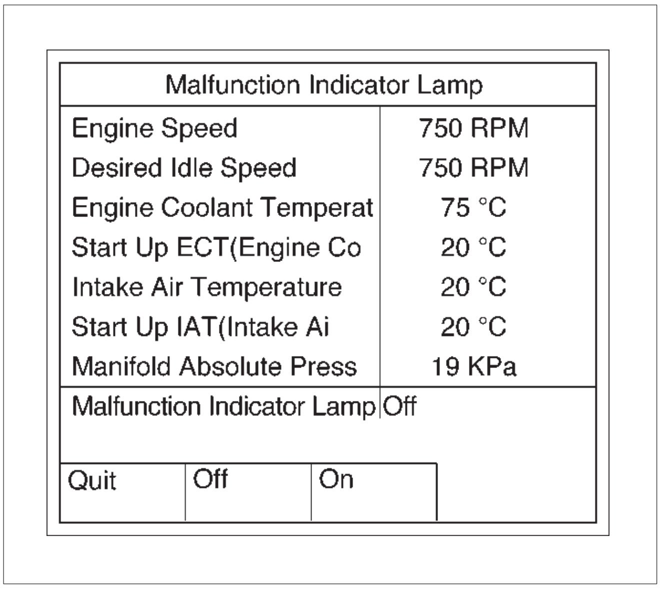


060RX043



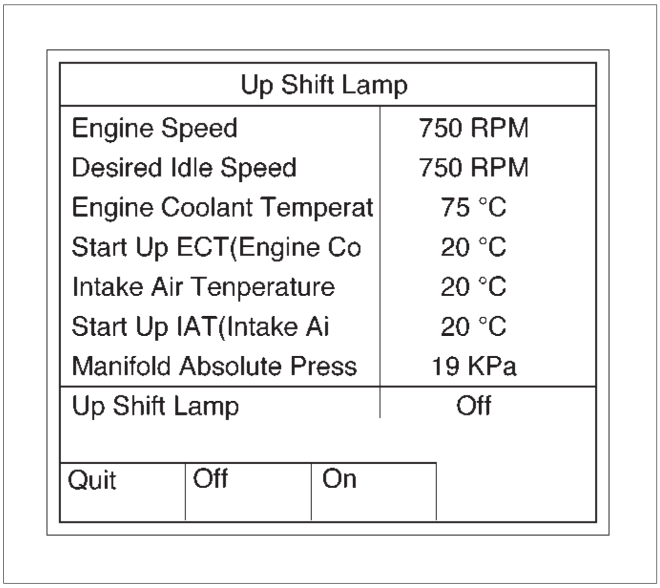
060RX044

5. Select F0:Malfunction Indicator Lamp.



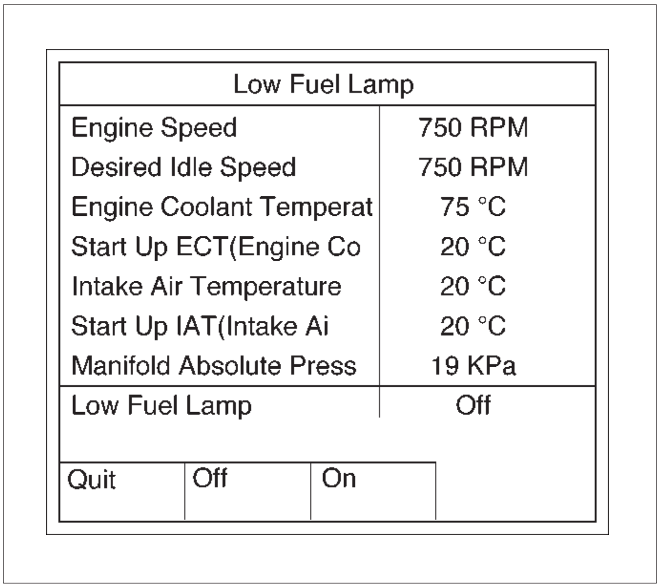
060RX019

6. Push “On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.
9. Select F1:Up Shift Lamp



060RX045

Select F2:Low Fuel Lamp



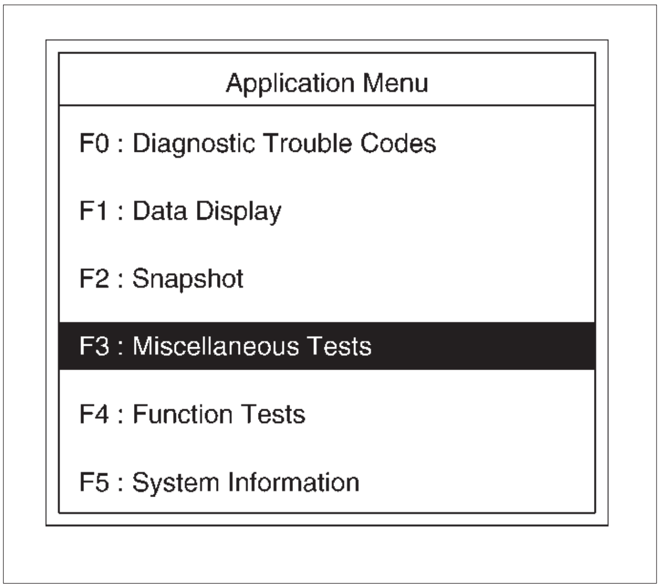
060RX020

10. Push “On” soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operaing correctly.

Relays Test

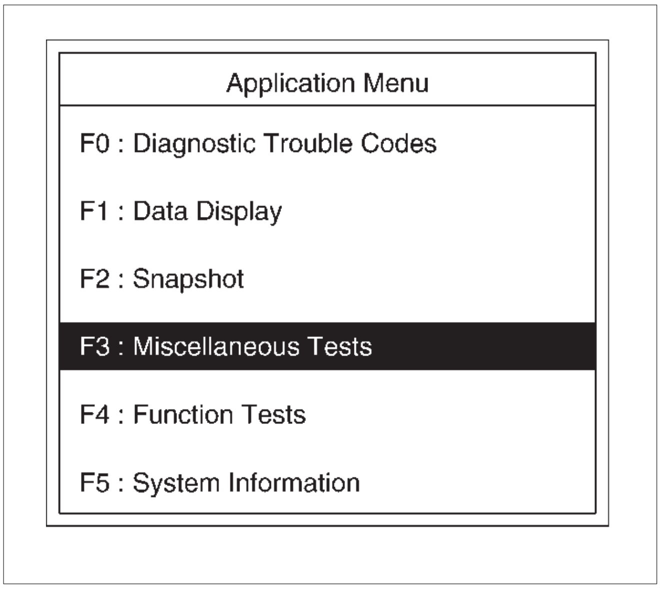
This test is conducted to check Fuel Pump Relay, A/C Clutch Low Fan and High Fan for prepor operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



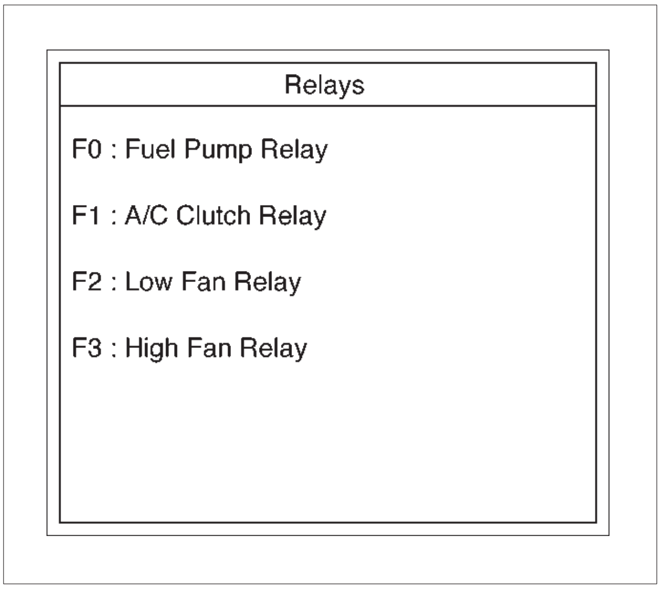
060R100078

4. Select F1:Relay Test in the Miscellaneous Test.



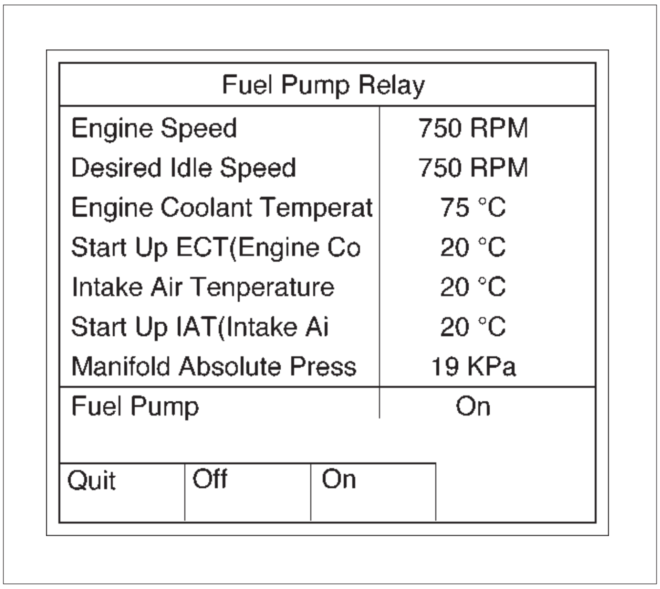
060R100078

5. Select F0:Fuel Pump Relay.



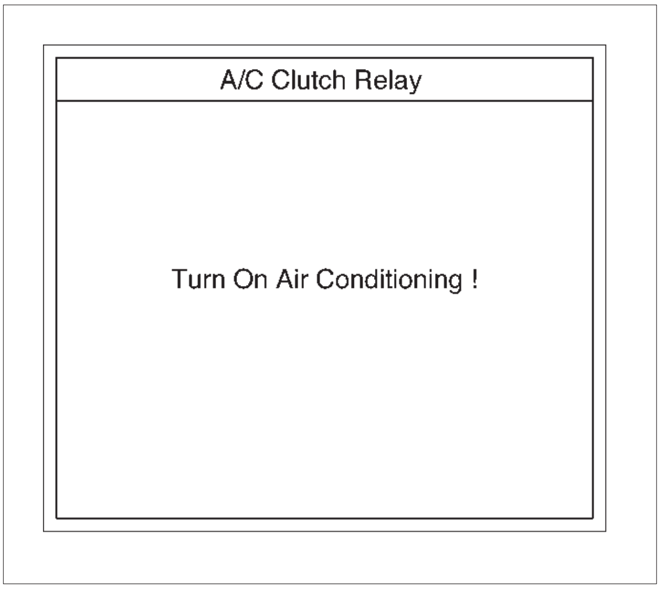
060RX047

6. Push “On” soft key.



060RX022

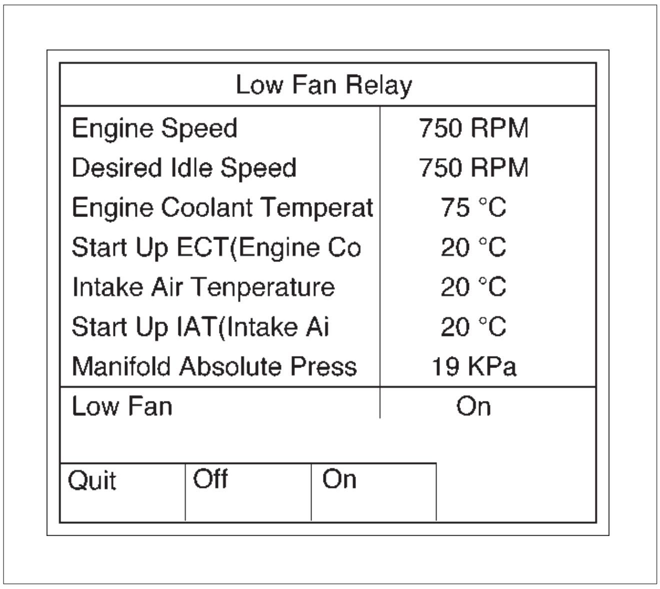
7. Control Fuel Pump Relay and check a data list.
8. If the data list chenges, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. *Run the Engine at idle.
11. Turn on Air Condtioning.



060RX023

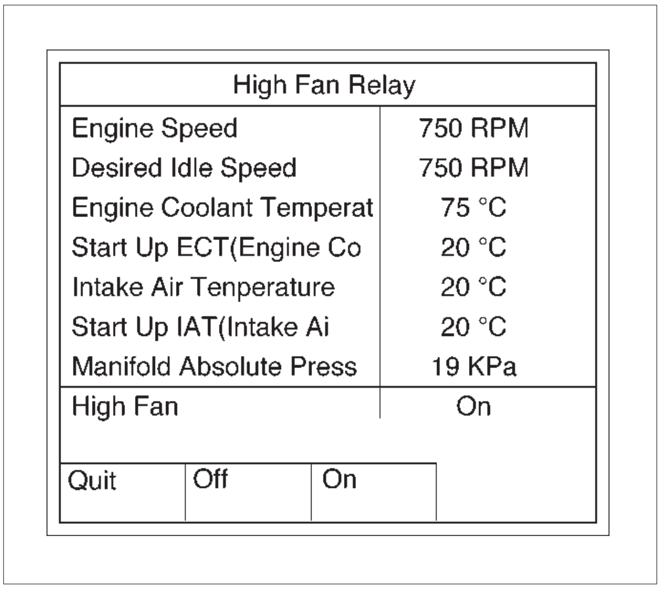
12. Push “On” and “Off” of soft key.
13. Control A/C Clutch Relay and check a data list.
14. If the data list changes, the A/C Clutch Relay is normal.

15. Select F2: Low Fan Relay.



060RX048

16. Push “On” and “Off” of soft key.
17. Control Low Fan Relay and check a data list.
18. If the data list changes, the Low Fan Relay is normal.
19. Run the Fan Motor.
20. Select F3: High Fan Relay.



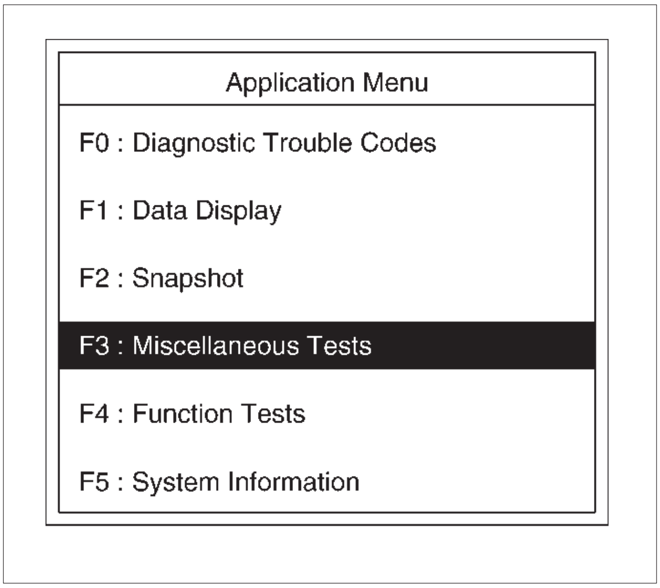
060RX049

21. Push “On” and “Off” of soft key.
22. Control High Fan Relay and check a data list.
    If the data list changes, the High Fan Relay is normal.
23. Run the Fan Motor.

EVAP Test

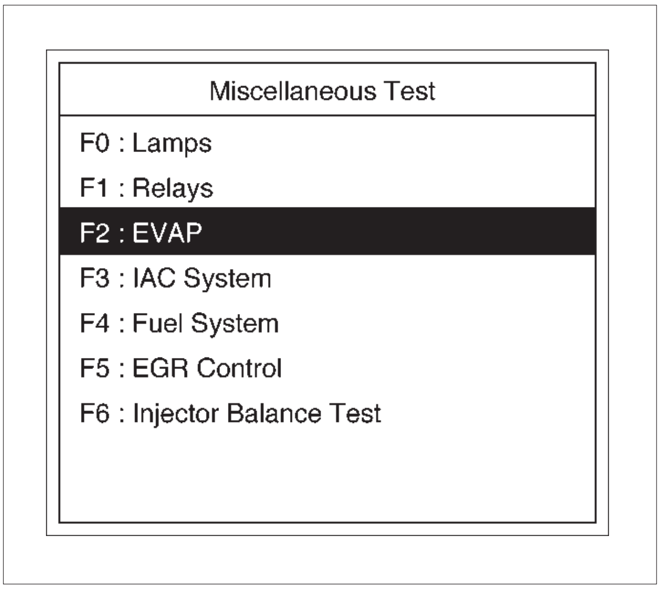
This test is conducted check EVAP system for its working. Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



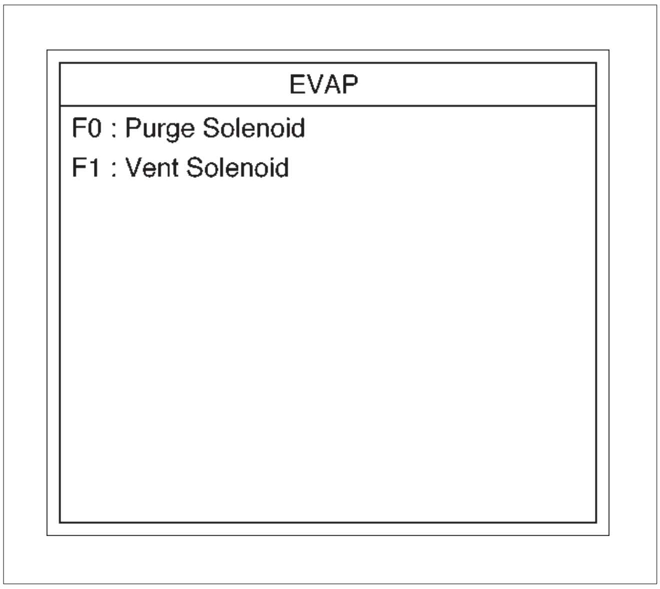
060R100078

4. Select F2:EVAP Test in the Miscellaneous Test.



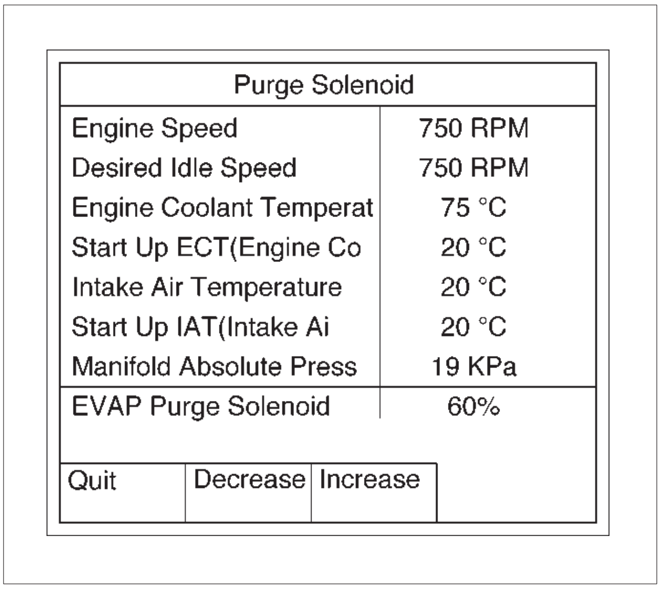
060RX050

5. Select F0: Purge Solenoid.



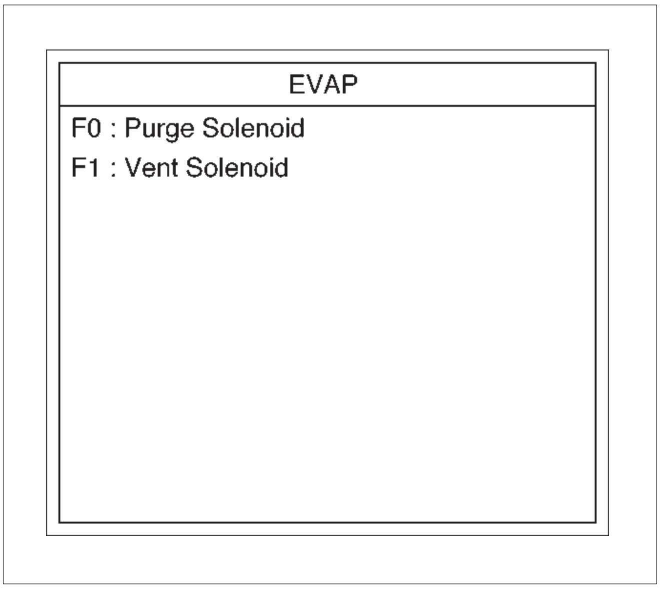
060RX025

6. Push “Decrease” or “Increase” soft key.



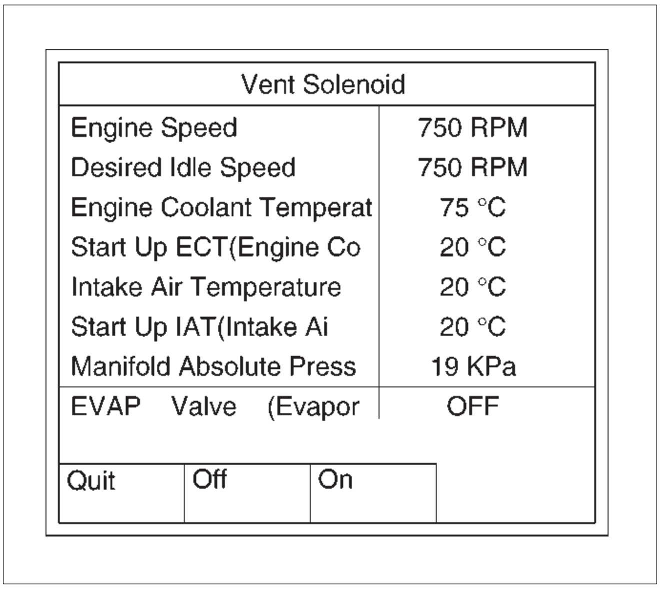
060RX026

7. Control EVAP Purge Solenoid and check a data list.
8. If the data list changes, the purge Solenoid is normal. Ignition SW is “On”.
9. Turn engine off, turn ignition SW “On”.
10. Select F1:EVAP Vent Solenoid.



060RX025

11. Push “On” or “Off” of soft key.



060R100019

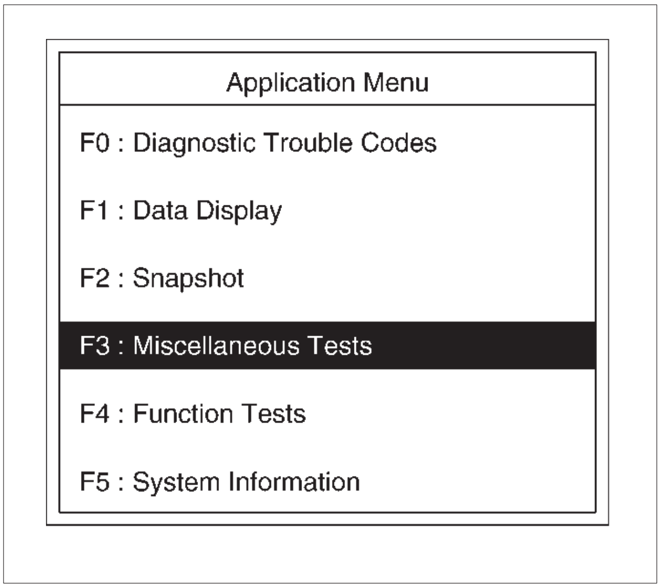
12. Control EVAP Vent Solenoid and check a data list.
13. If the data list changes, the EVAP Vent Solenoid is normal.

Idle Air Control System Test

This test is conducted check to IAC system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

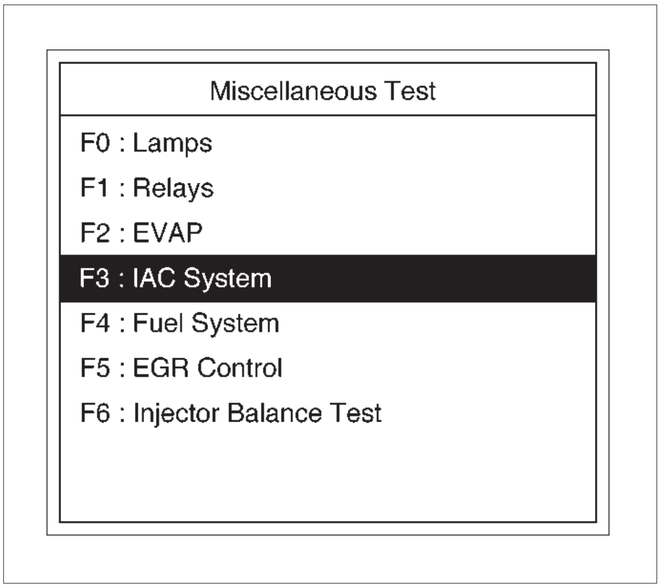
1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.

3. Select F3: Miscellaneous Test in the Application Menu.



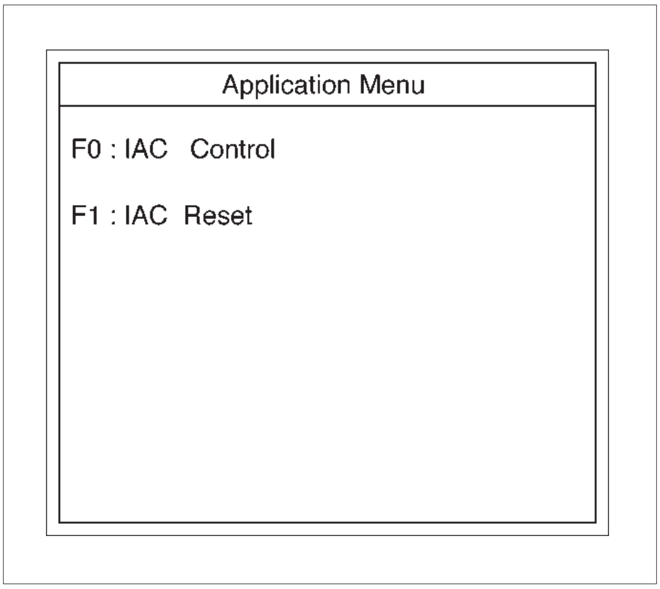
060R100078

4. Select F3: IAC System Test in the Miscellaneous Test.



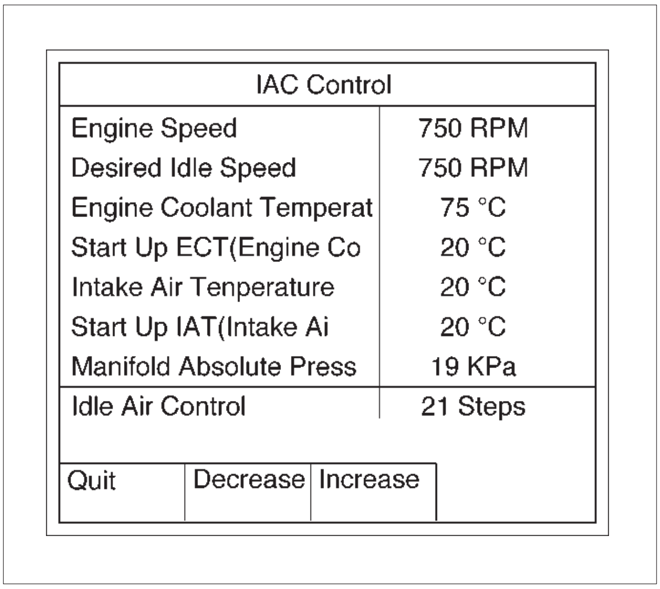
060RX051

5. Select F1: IAC Control Test.



060RX052

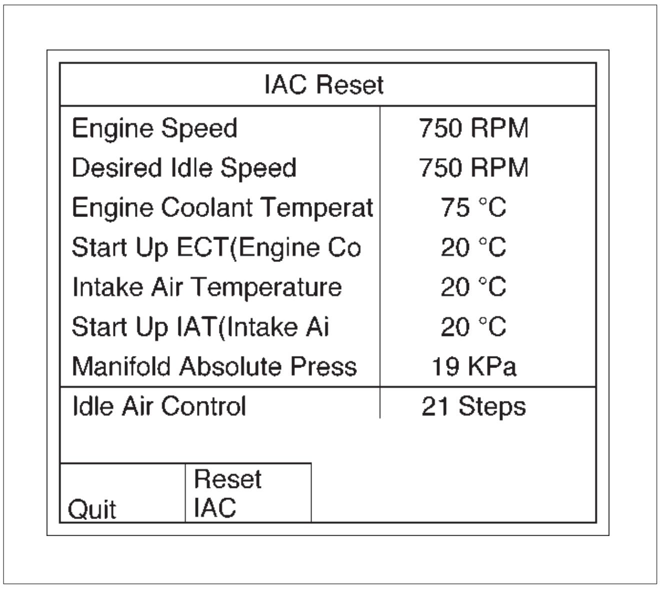
6. Push “Increase” or “Decrease” soft key.
7. Control IAC system and check a data list.
   - F0: IAC Control



060RX015

8. Select F1: IAC Reset.
9. Push “Reset IAC” soft key.
10. Control IAC Reset and check data list.

11. If data list changes, the IAC has been Reset.

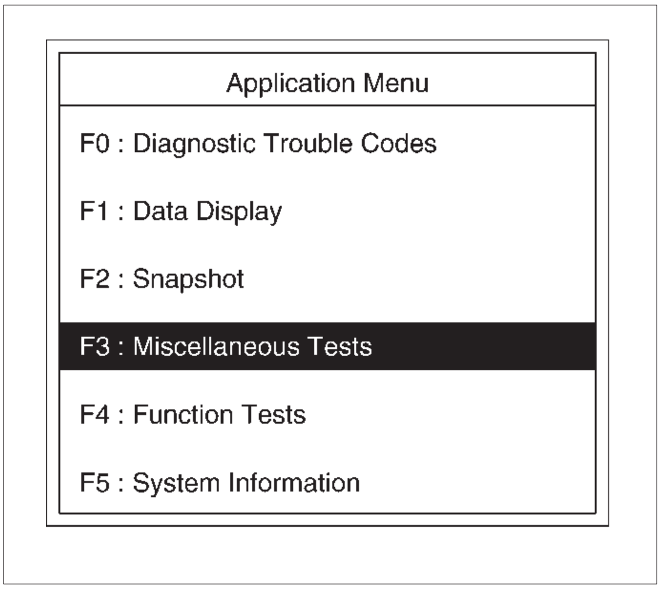


060RW231–1

Fuel System Test

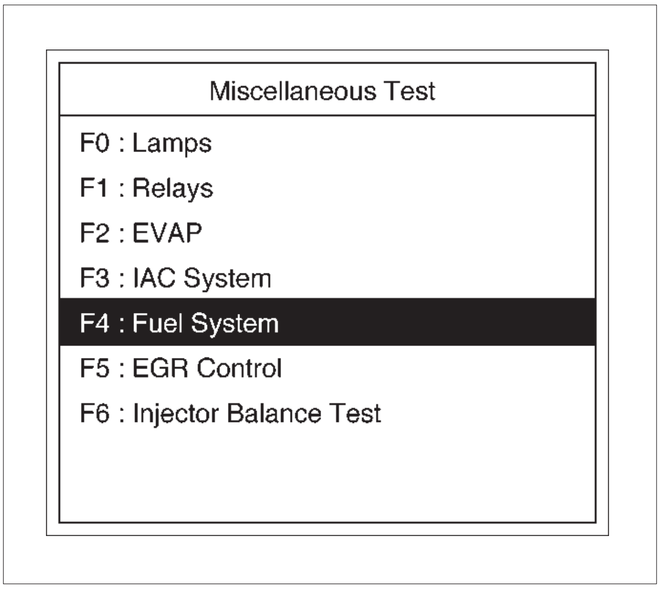
This test is conducted check Fuel Level Gauge for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



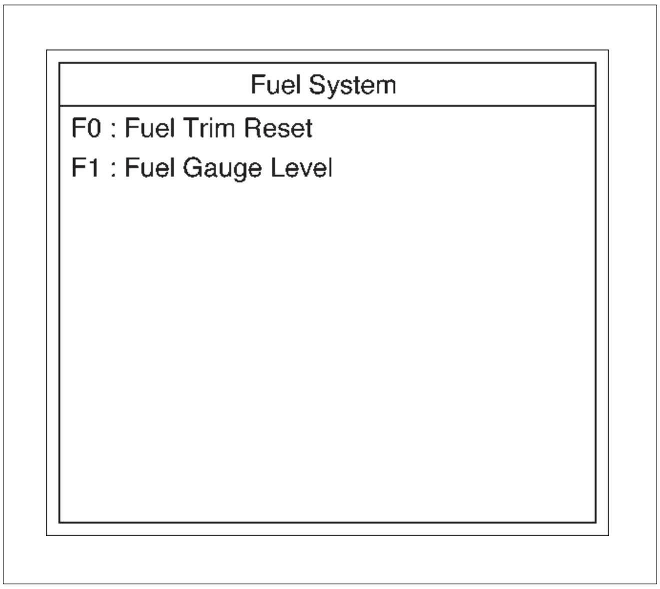
060R100078

4. Select F4: Fuel System in the Miscellaneous Menu.



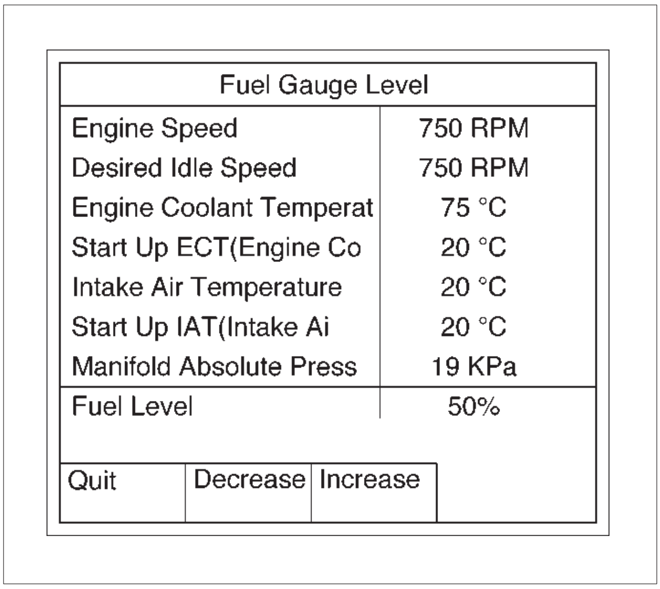
060RX053

5. Select F1: Fuel Gauge Level



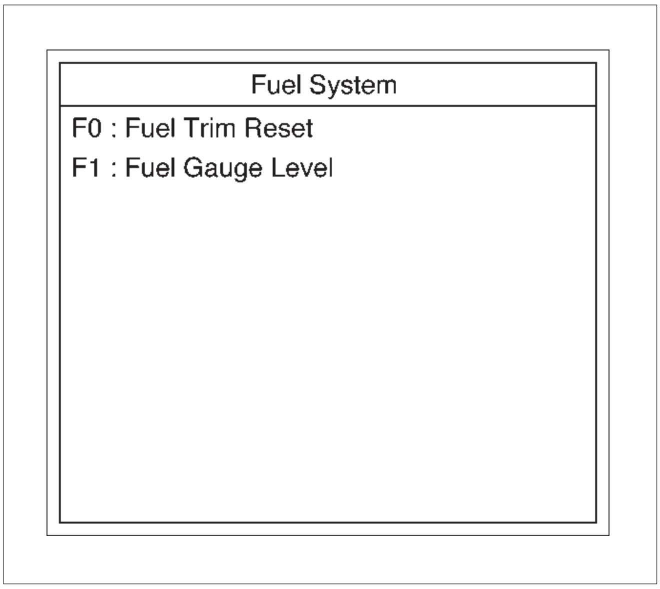
060RX028

6. Push “Decrease” or “Increase” of soft key.



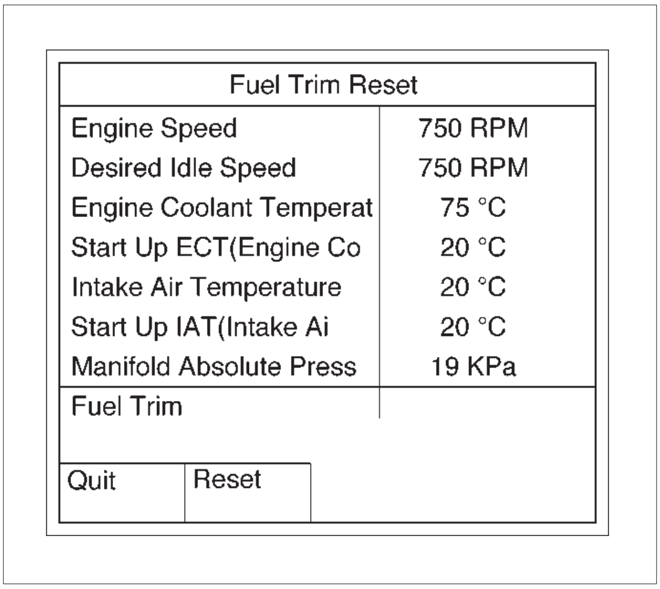
060RX030

7. Control Fuel Level and check data list.
8. If data list changes, the Fuel Gauge Level is normal.
9. Select F0: Fuel Trim Reset.



060RX028

10. Push “Reset” of soft key.



060RX029

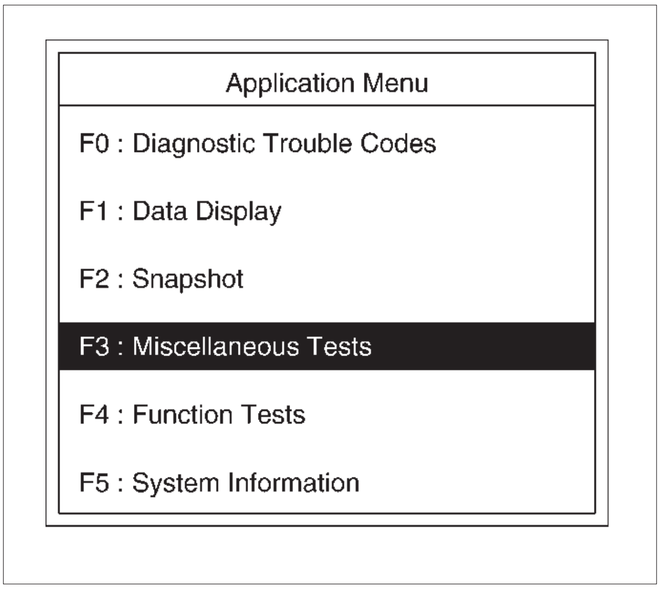
EGR Control Test

This test is conducted check EGR valve for proper operation.

Tech 2 must be used for this test.

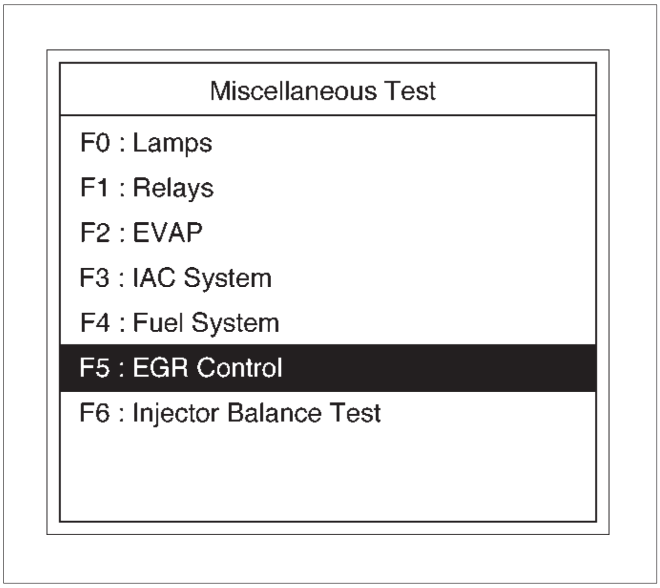
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



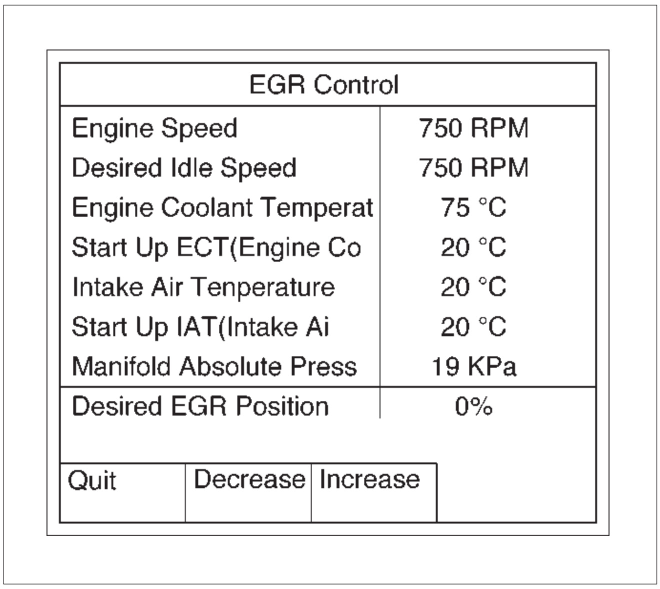
060R100078

4. Select F5: EGR Control Test in the Miscellaneous Test.



060RX054

5. Control EGR Valve and check data list.



060RX017

6. If the change, the EGR Control is normal.

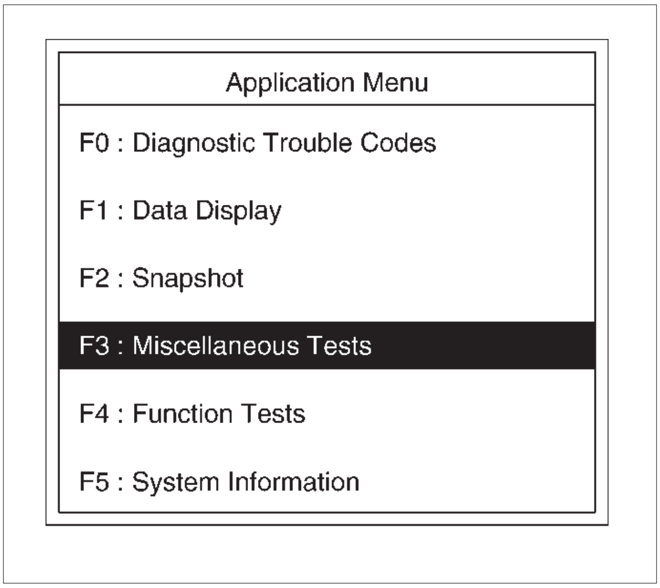
Injector Balance Test

This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6.

Tech 2 must be used for this test.

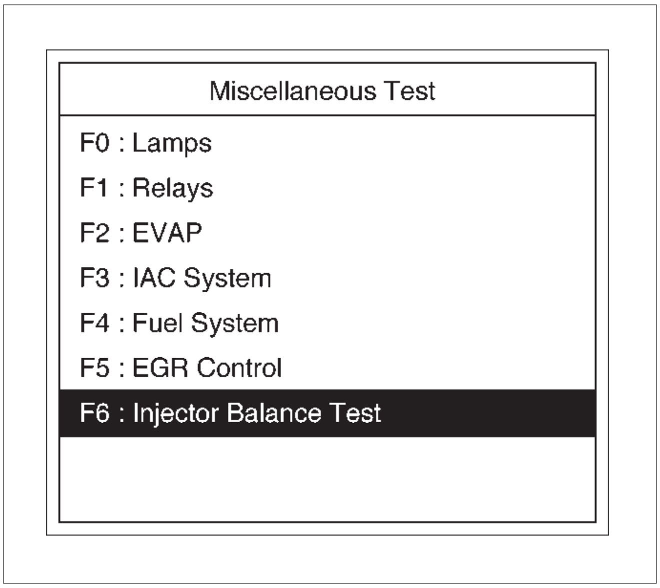
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



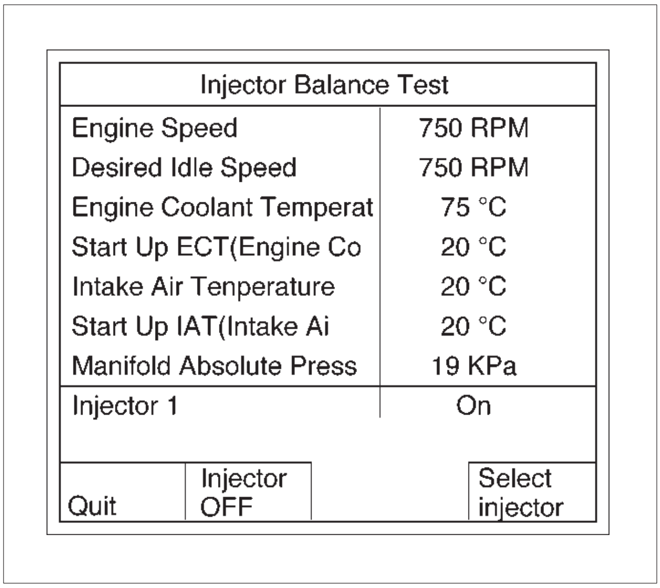
060R100078

4. Select F6: Injector Balance Test in the Miscellaneous Test.



060RX055

5. Select injector number and push “injector off” of soft key.

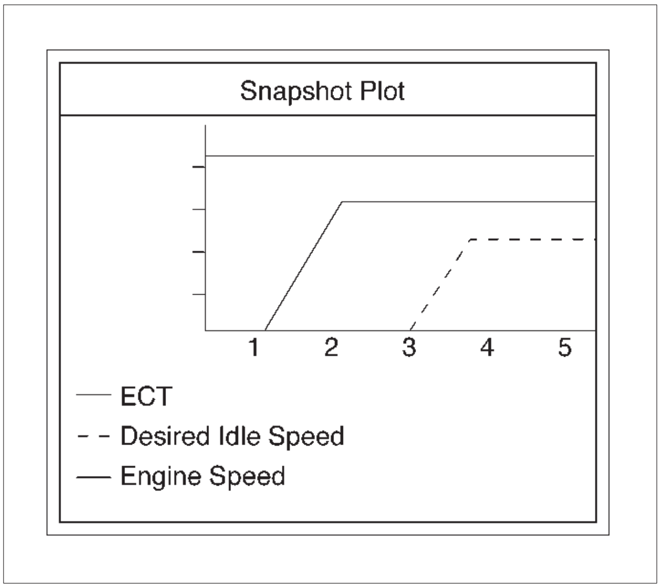


060RW230–1

6. Make sure of engine speed change.
7. If engine speed changes, the injector electric circuit is normal.
   If engine speed does not change, the injector electric circuit or the injector itself is not normal.

Plotting Snapshot Graph

This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.



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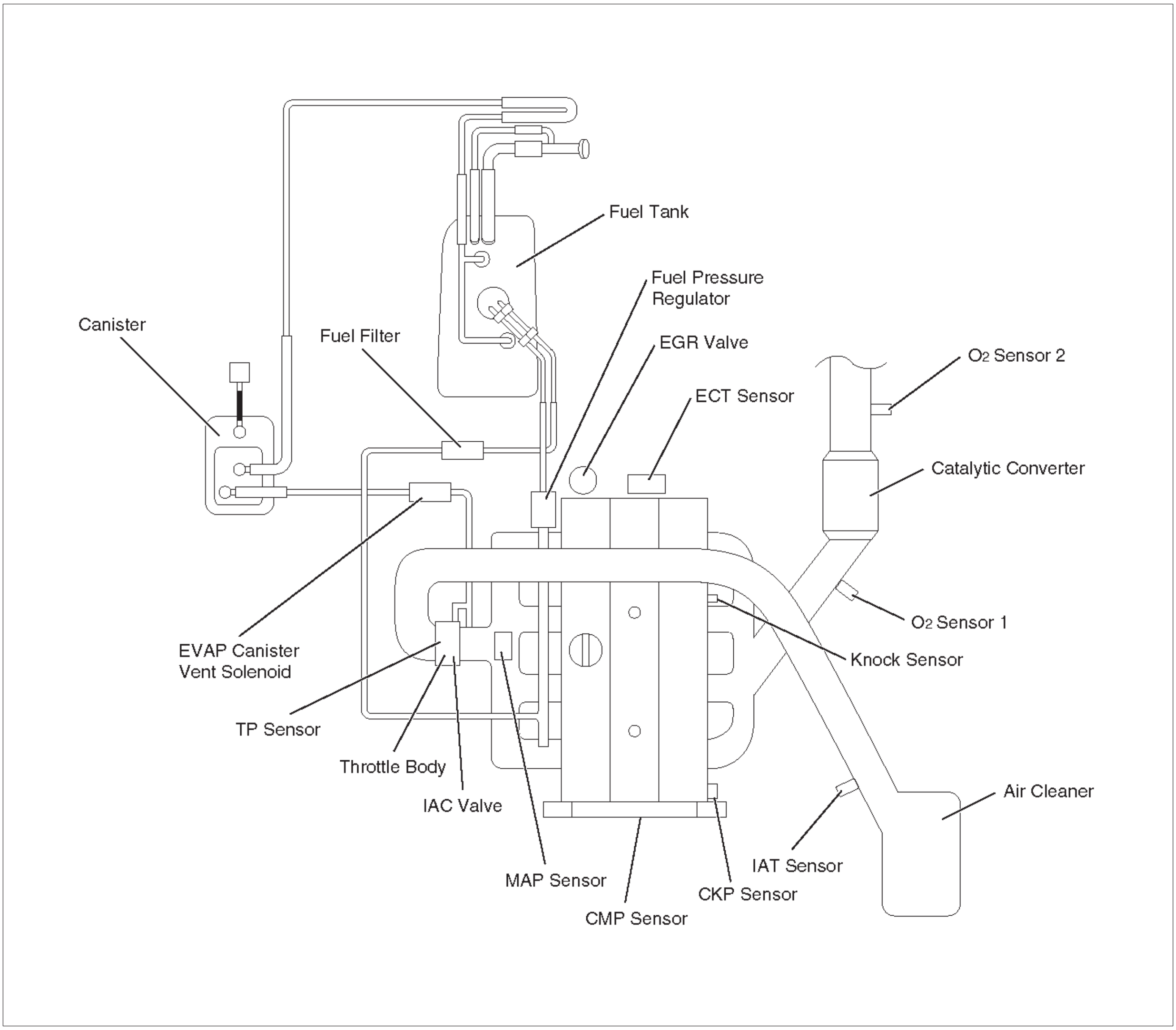
For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle. You can replay the snapshot data as needed. There fore, accurate diagnosis is possible, even though the vehicle is not available.

System Check at Tech 2



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General Description

1. Turn on the ignition and check the check engine lamp. If it is not turned on, execute Miscellaneous Test at Tech 2. (Refer to “Miscellaneous Test”) And if problems are found, repair a blown bulb or a short circuit.
2. Ignition on, engine on. Check flashing check engine lamp. If it keep flashing, Check Diagnosis trouble code (DTC) at Tech 2

CHECK POINT:

- Kind of DTC
- Which is current DTC or history.
- Recording freeze frame data in Tech 2.
- DTC history
- “F1: MIL SVS or Message Request” at Tech 2
- DTC at Current ignition cycle

3. When the lamp don’t turn on, Check a DTC at Tech 2 too.

CHECK POINT:

- Kind of DTC
- Which is current DTC or history.
- Recording freeze frame data in Tech 2.
- DTC history
- “F3: Test Failed Since Code Cleared” at Tech 2.
- DTC at Current ignition cycle

4. Case DTC stored at PCM
   Record the DTC and the freeze frame data and flash it.
   After reappear the trouble from the freeze frame data.
   Check power supply circuits, ground circuits, and signal circuit.

CHECK POINT:

- Which is mechanical trouble or electrical trouble.
- Snapshot the engine data at the Tech 2. And observe variation of the any data, faulty data, fixed data and etc.

5. Case DTC did not store at PCM

CHECK POINT:

- Which is mechanical trouble or electrical trouble.
- Snapshot the engine data at the Tech 2. And observe variation of the any data, faulty data, fixed data and etc.

CHECK POINT:

1. A systematic error is caused by a low accuracy of electric items.
2. A random error is caused by electric trouble. It is disturbance and mechanical trouble.
3. A fixed error is caused by broken electric item, open circuit, short circuit.

System Check at the Tech 2

Step	Action	Value(s)	Yes	No
1	1. Ignition “On”, engine “Off”. 2. Check the check engine lamp. Did it turm on?	—	Go to *Step 2*	Go to *“No Malfunction Indicator Lamp”*
2	1. Ignition “Off”. 2. Install Tech 2 3. Ignition “On”, engine “Off”. 4. Indicate the engine data at Tech 2 The engine data is illuminate on Tech 2	—	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “Off”. 2. Discconnect the PCM. 3. Check the class2 data circuit for a open, a short to ground or short to voltage. 4. Checke the power supply cirucit at the DLC for a open, a short to ground or short to voltage. If the problelm is found, repair as necessary. Was a problem found?	—	Verify Repair	Go to *Step 4*
4	1. Ignition “On”, engine “On”. Did it run and keep running?	—	Go to *Step 4*	Go to *“Engine Cranke But Will Not Run”*
5	1. Turn on Tech 2 and select Model year and this engine after selected “Powertrain”. 2. Select menu item “F0:Diagnostic Trouble Code” on Tech 2. 3. Select menu item “F0:Read DTC info Priority” on Thch 2. Is Tech2 illuminated any DTCs?	—	Go to *Step 6*	—
6	1. Check DTC type which is current, history or intermittent. Is the DTC current?	—	Go to *Step 8*	Go to *Step 7*

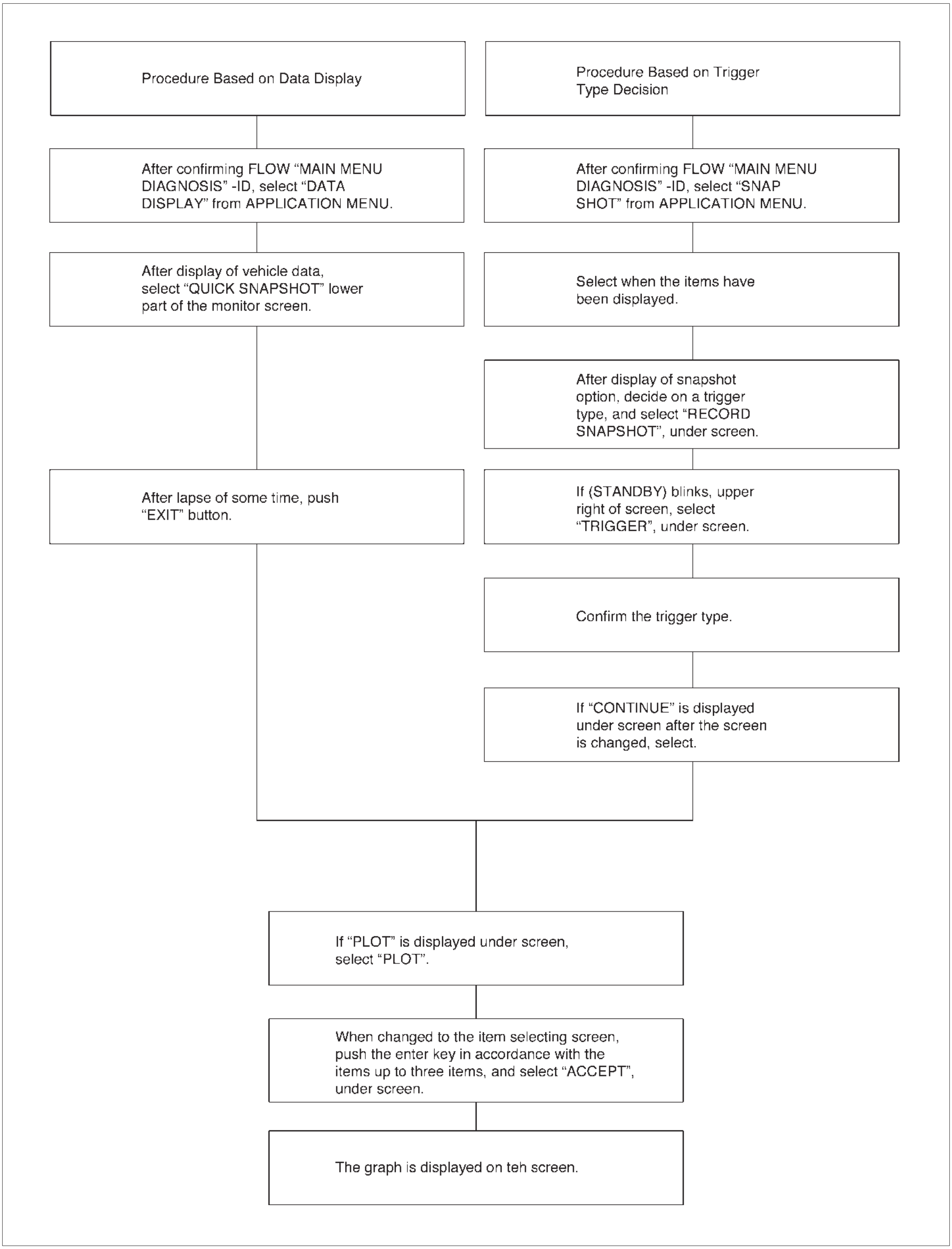
System Check at the Tech 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Record the DTC and the freeze frame data. 2. Flash the DTC. 3. Check trouble setteing condition at the freeze frame data. 4. Reappear the trouble from the freeze frame data. 5. Select menu item "F2:DTC Info." On the DTC. 6. Select menu item "F4:Not Run Since Code Cleared" on the DTC. 7. Check DTC id not illuminated on the svreen.(When the action is completed, the PCM checked relevant failure.) 8. Select menu item "F0:Read DTC info by Priority" and check DTC. Was the DTC illuminated on the Tech 2?	—	Go to *Step 8*	Go to *"General decription 5. Case DTC did not store at PCM" in this chapter*
8	1. Turn on Tech 2 and select Model year and this engine after selcted "Powertrain". 2. Select menu item "F0:Diagnostic Trouble Code" on Tech 2. 3. Select menu itme "F2:DTC Information". 4. Select menu itme "F2:Last Test Failed". 5. As obderve the Tech2 screen, vibrate relevant sensor body, connector, harness and actuator. If the screen is shaded, the vibrated point is breaking. Was a problem found?	—	Verify Repair	Go to *Step 9*
9	1. Turn on Tech 2 and select Model year and this engine after selected "Powertrain". 2. Select menu item "F3:Miscellaneous Tests" on Tech 2. 3. Select menu itme relevant sensor, actuator and parts. 4. If a relevant part is not fined on the screen, go to step 10. 5. After a test executed, If a problem is found, repair as necessary. Was problem found?	—	Verify Repair	Go to *Step 10*
10	1. Turn on Tech 2 and selct Model year and this engine after selected "Powertrain". 2. Select menu item "F1:Data Display" on Tech 2. 3. Select menu item "F0:Engine Data" or "F1:O2 sensor Data". 4. Ignition "On", engine "On". And keep idling speed. 5. As observe the Tech 2 screen, Vibrate relevant sensor body. connector, harness and actuator. If the screen is shaded, the vibrated point is braking. Was a problem found?	—	Verify Repair	Go to *step 11*

System Check at the Tech 2 (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn on Tech 2 and select Model year and this engine agter selected "Powertrain". 2. Select menu item "F1:Date Display" on Tech2. 3. Select menu itne "F0:Engine Data" or "F1:O2 sensor Data". 4. Ignition "On", engine "On". And keep idling speed. (Warm it enough temprature.) 5. Using Tech 2, Start snapshot data. 6. Few minutes later, run up engine unitl 2500rpm for engine data recording. 7. Terminat snapshot, and reappear the engine data. 8. Compare specified value with it, and reappear the engine data. 9. If a problem was found, check the error which is systematic error, random error fixed error. ● A systematic error is caused by a low accuracy of electric items. So a lot of cases will be replaced it. ● A randonm error id caused by electric trouble, it is disturbance and mechanical trouble. In this case, check out applied voltage to electric itme exitence of EMI(electromagnetic interference) parts, elctrical interference, fitting of non genuine parts and mechanical parts. ● A fixed error is caused by broken electric item, open circuit, short circuit. For example when ECT sensor circuit was open ciruit, it is illuminated -40˚C on Tech 2. 10. If a problem was found, repair as neceesaary. Was a problem found?	—	Verify Repair	Go to *Step 12*
12	1. Countercheck mechanical of the engine. Refer to engine work shop manual. 2. If a problem was found, repair as necessary. Was a problem found?	—	Verify Repair	Go to *Step 13*
13	1. Countercheck this check table. 2. When this table is not found a trouble, check following point. ● Physical/Visual check ● Theh 2 data ● Freeze fram data ● Conceivable circuit 3. If a problem was found, repair as necessary. Was a problem found?	—	Verify Repair	—

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



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Flow Chart for Snapshot Replay (Plotting Graph)

Press the enter-key in initial display.

Select "VIEW CAPTURE DATA"

If snapshot option is displayed, decide on a trigger type, and slect “REVIEW DATA” under screen.

When the data triggered by vehicle is displayed, select the data.
(Plural display of data depending on the number of times of triggering.)

data is displayed on the screen.
To see the graph, select “PLOT” under screen.

Changed to the item selection screen, push the enter key up to three times, and select “ACCEPT” under screen.

The graph is displayed on the screen.

060RX040

PRIMARY SYSTEM–BASED DIAGNOSTICS

Primary System–Based Diagnostics

There are primary system–based diagnostics which evaluate system operation and its effect on vehicle emissions. The primary system–based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control heated oxygen sensor (HO2S 1) is diagnosed for the following conditions:

- Heater performance (time to activity on cold start)
- Slow response
- Response time (time to switch R/L or L/R)
- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

The catalyst monitor heated oxygen sensor (HO2S 2) is diagnosed for the following conditions:

- Heater performance (time to activity on cold start).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to On–Vehicle Service, Heated Oxygen Sensors.

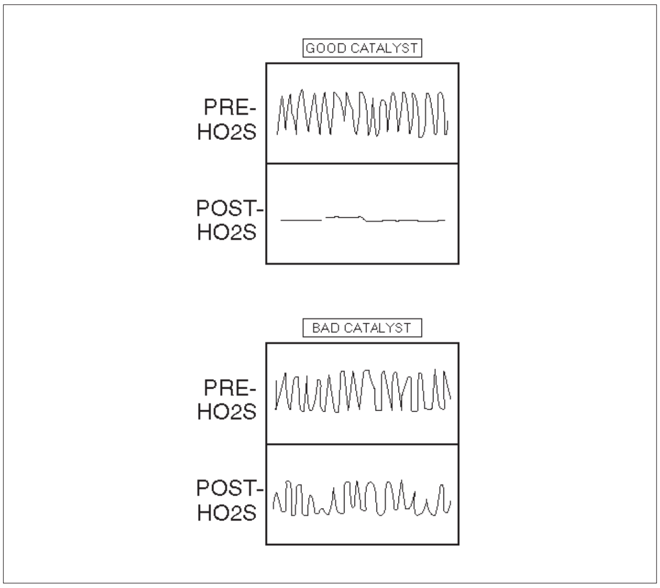
Fuel Control Heated Oxygen Sensors

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in ”Closed Loop” to adjust fuel injector pulse width. While in ”Closed Loop”, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability. The fuel control heated oxygen sensors are also used to determine catalyst efficiency.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensor (HO2S 1) to become active. Oxygen sensor heaters are required by the catalyst monitor sensor (HO2S 2) to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Catalyst Monitor Heated Oxygen Sensors And Diagnostic Operation



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To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the pre–catalyst and post–catalyst heated oxygen sensors. The pre–catalyst sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The post–catalyst sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst’s ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the pre–catalyst signal will be far more active than that produced by the post–catalyst sensor.

In addition to catalyst monitoring, the heated oxygen sensors have a limited role in controlling fuel delivery. If the sensor signal indicates a high or low oxygen content for an extended period of time while in ”Closed Loop”, the PCM will adjust the fuel delivery slightly to compensate.

- For the 2.2L engine, the pre–catalyst monitor sensor is designated Bank 1 HO2S 1. The post–catalyst sensor is Bank 1 HO2S 2.

Catalyst Monitor Outputs

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S contamination
- Alternate fuels

Exhaust system leaks may cause the following:

- Preventing a degraded catalyst from failing the diagnostic.
- Causing a false failure for a normally functioning catalyst.
- Preventing the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants will prevent the TWC diagnostic from functioning properly.

Three–Way Catalyst Oxygen Storage Capacity

The Three–Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre–catalyst HO2S and post–catalyst HO2S oxygen sensors. When the TWC is operating properly, the post–catalyst oxygen sensor will have significantly less activity than the pre–catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre–catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post–catalyst oxygen sensor approaches that of the pre–catalyst oxygen sensor, the catalyst's efficiency is degraded.

Stepped or staged testing level allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on–board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The second stage then looks at the inputs from the pre and post catalyst HO2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

MISFIRE MONITOR DIAGNOSTIC OPERATION

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The PCM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires, the crankshaft slows down momentarily. By monitoring the crankshaft and camrhaft position sensor signals, the PCM can calculate when a misfire occurs.

For a non–catalyst damaging misfire, the diagnostic will be required to monitor a misfire present for between 1000–3200 engine revolutions.

For catalyst–damaging misfire, the diagnostic will respond to misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road will cause torque to be applied to the drive wheels and drive train. This torque can intermittently decrease the crankshaft rotational velocity. This may be falsely detected as a misfire.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These "misfire counters" are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Cur #1–4) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist#1–4) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 200 cylinder firing events. A misfire counter is maintained for each cylinder.

If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting a DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring.

Use diagnostic equipment to monitor misfire counter data on OBD II–compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counters indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

Misfire counter information is located in the "Specific Eng." menu, "Misfire Data" sub–menu of the data list.

The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel
- Low fuel
- Fuel–fouled spark plugs
- Basic engine fault

FUEL TRIM SYSTEM MONITOR DIAGNOSTIC OPERATION

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short–term and long–term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short–term fuel trim values and long–term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

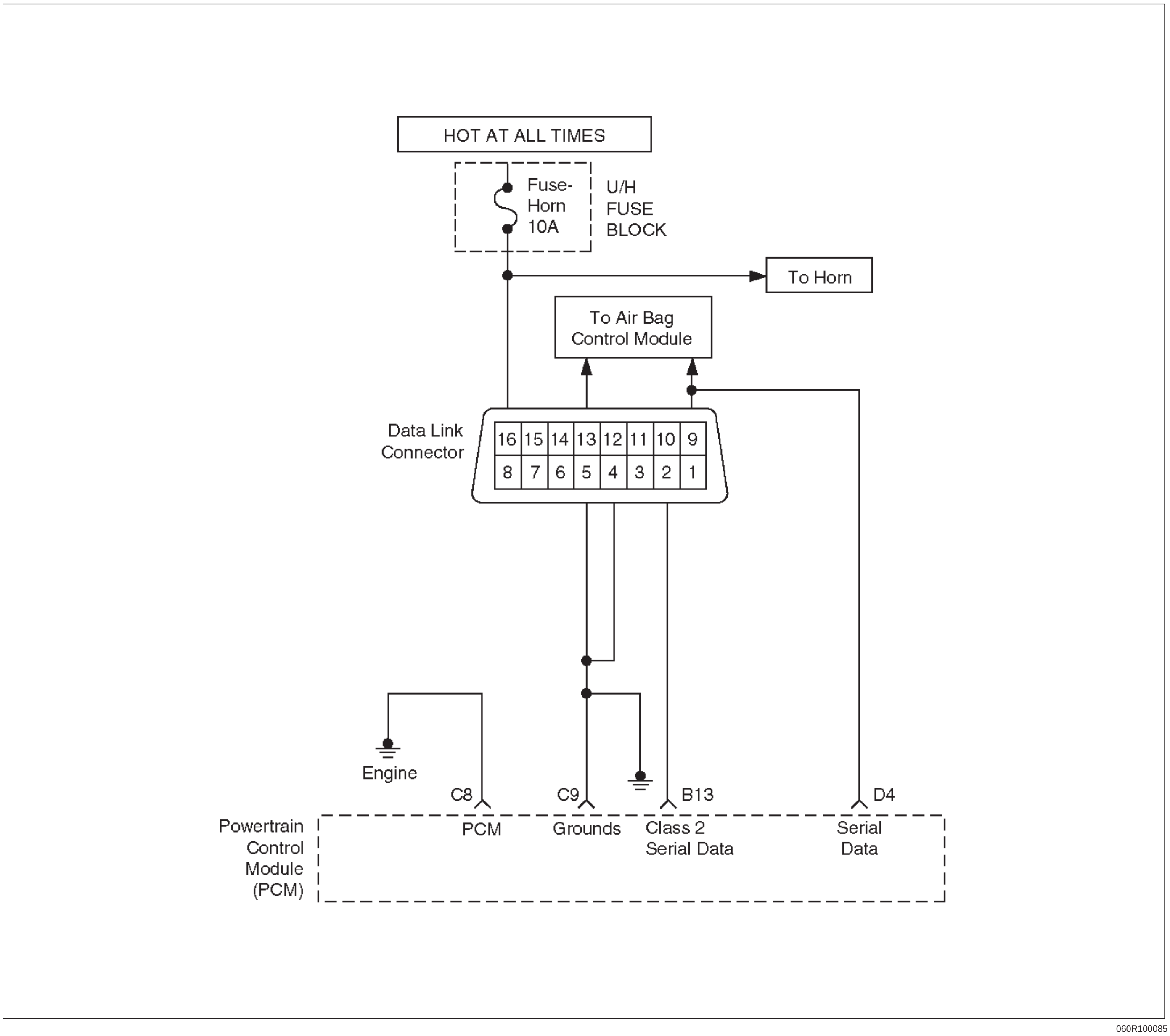
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

ON–BOARD DIAGNOSTIC (OBD II) SYSTEM CHECK



Circuit Description

The on–board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on–board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The MIL (”Check Engine” lamp) should be ON steady with the ignition ON/engine OFF. If not, isolate the malfunction in the MIL circuit.
2. Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.
3. This test ensures that the PCM is capable of controlling the MIL and the MIL driver circuit is not shorted to ground.
4. If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.

7. A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

10. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

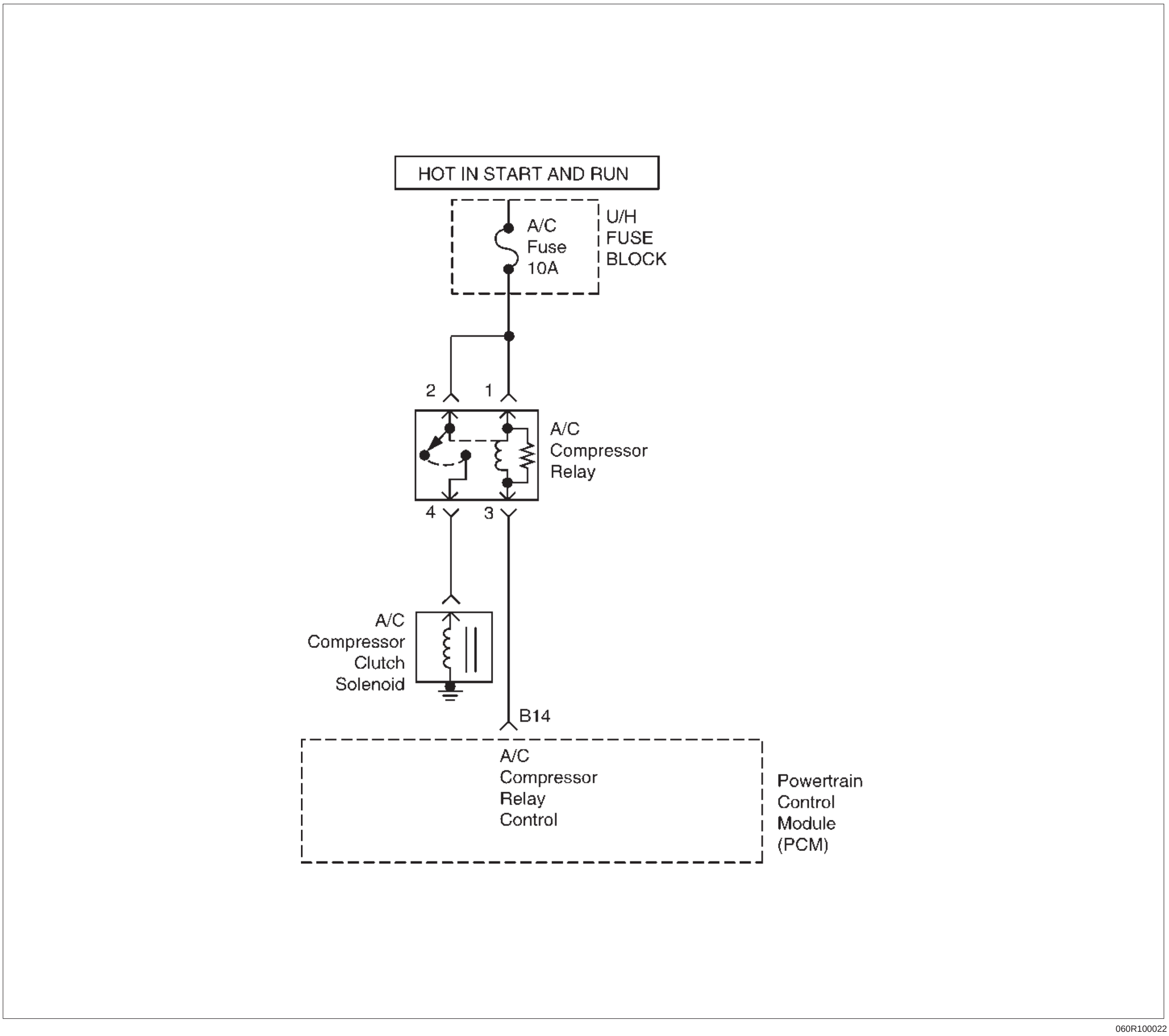
On–Board Diagnostic (OBD II) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition ON, engine OFF. 2. Observe the malfunction indicator lamp (MIL or ”Check Engine lamp”). Is the MIL (”Check Engine lamp”) ON?	—	Go to *Step 2*	Go to *No MIL*
2	1. Ignition OFF. 2. Install a Tech 2. 3. Ignition ON. 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to *Step 3*	Go to *Step 8*
3	1. Using the Tech 2 output tests function, select MIL dash lamp control and command the MIL OFF. 2. Observe the MIL. Did the MIL turn OFF?	—	Go to *Step 4*	Go to MIL *(”Check Engine Lamp”) On Steady*
4	Attempt to start the engine. Did the engine start and continue to run?	—	Go to *Step 5*	Go to *Cranks But Will Not Run*
5	Select ”Display DTCs” with the Tech 2. Are any DTCs stored?	—	Go to *Step 6*	Go to *Step 7*
6	Are two or more of the following DTCs stored? P0107, P0113, P0118, P0122, P0123.	—	Go to *“Multiple PCM Information Sensor DTCs Set”*	Go to *applicable DTC table*
7	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to *“Typial Scan” Data Value*	Go to *indicated Component System Checks*
8	1. Ignition OFF, disconnect the PCM. 2. Ignition ON, engine OFF. 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuits for an open. 4. If a problem found, repair as necessary. Was a problem found?	—	Go to *Step 2*	Go to *Step 9*

On–Board Diagnostic (OBD II) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Attempt to reprogram the PCM. Refer to Powertrain Control Module (PCM) in On–Vehicle Service. 2. Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to *Step 2*	Go to *Step 10*
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to Powertrain Control Module (PCM) in On–Vehicle Service. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

A/C CLUTCH CONTROL CIRCUIT DIAGNOSIS



Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerent charge, a 12–volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily cancelled during system operation by the electronic thermostat in the evaporator case. The electronic thermostat may intermittently remove the control circuit ground for the A/C thermostat relay to prevent the evaporator from forming ice. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, battery voltage is supplied to the compressor clutch coil.

The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125°C (257°F)
- The intake air temperature (IAT) is less than 5°C (41°F).
- The power steering pressure switch signals a high pressure condition position.

Diagnostic Aids

To diagnose an intermittent fault, check for the following conditions:

- Poor connection at the PCM – Inspect harness connections for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery voltage, and open circuits. If the harness appears to be OK, observe the A/C clutch while moving connnectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commended the A/C clutch ON. The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1546. Does the Tech 2 indicate DTC P1546 ”Ran and Passed”?	—	*Refer to Diagnostic Aids*	Go to *Step 3*
3	1. Ignition OFF. 2. Remove the A/C Compressor Relay from the Underhood Electrical Center. 3. Ignition ON, engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Fused pins of the A/C Compressor Clutch Relat connector. Does the DVM read the following value?	12 Volts	Go to *Step 5*	Go to *Step 4*
4	Check the suspect circuit(s) between the A/C Compressor Clutch Relay connector and the Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the Powertrain Controlm Module (PCM) connectors from the PCM. 3. Check the A/C Compressor Clutch Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to *Step 6*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reinstall the A/C Compressor Clutch Relay. 2. Using a fused jumper, ground the A/C Compressor Clutch Relay control circuit at the PCM connector. 3. Ignition ON, engine OFF. Does the A/C Compressor turn ON?	—	Go to *Step 9*	Go to *Step 7*
7	1. Ignition OFF. 2. Check the A/C Compressor Clutch circuit between the A/C Compressor Clutch Relay and A/C Compressor Clutch for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to *Step 8*
8	Replace the A/C Compressor Clutch Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

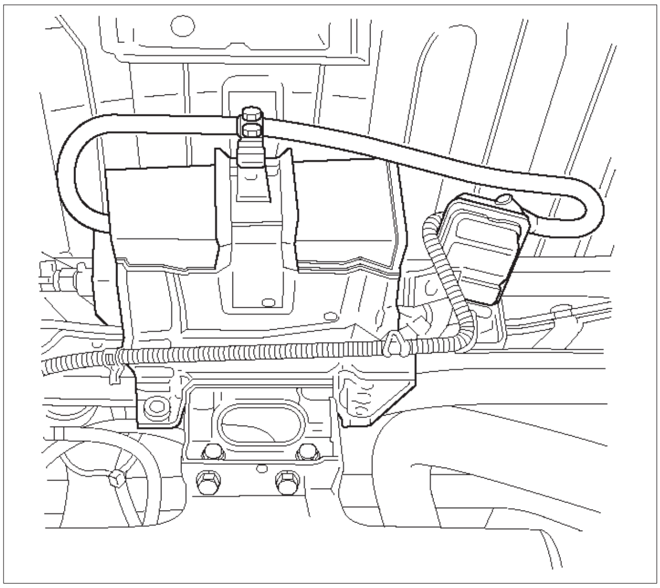
ELECTRONIC IGNITION SYSTEM DIAGNOSIS

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is in the ignition system or the fuel system. If DTC P0300, P0341, P0342, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis.
If a misfire is being experienced with no DTC set, for diagnosis, refer to the Symptoms section.

EVAP CANISTER PURGE SOLENOID

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. A fault (small leak) in the EVAP purge vacuum system will set a DTC P0442. Refer to the DTC charts for further information.

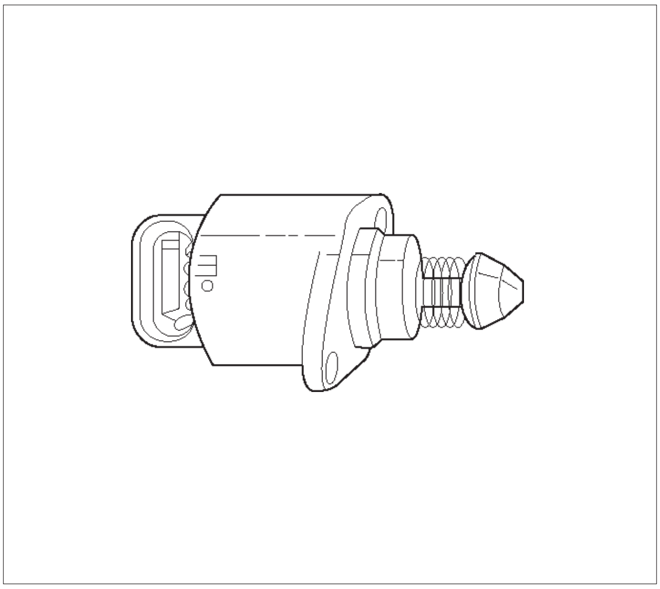
VISUAL CHECK OF THE EVAPORATIVE EMISSION CANISTER



014RX001

- If the canister is cracked or damaged, replace the canister.
- If fuel is leaking from the canister, replace the canister and check hoses and hose routing.

IDLE AIR CONTROL (IAC) VALVE



0006

The Tech 2 displays the IAC pintle position in counts. A count of ”0” indicates the PCM is commanding the IAC pintle to be driven all the way into a fully–seated position. This is usually caused by a vacuum leak.
The higher the number of counts, the more air is being commanded to bypass the throttle blade. In order to diagnose the IAC system, refer to IAC System Check.
For other possible causes of idle problems, refer to Rough, Unstable, or Incorrect Idle, Stalling in Symptoms.

FUEL SYSTEM PRESSURE TEST

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to Fuel System Diagnosis.

FUEL METERING SYSTEM CHECK

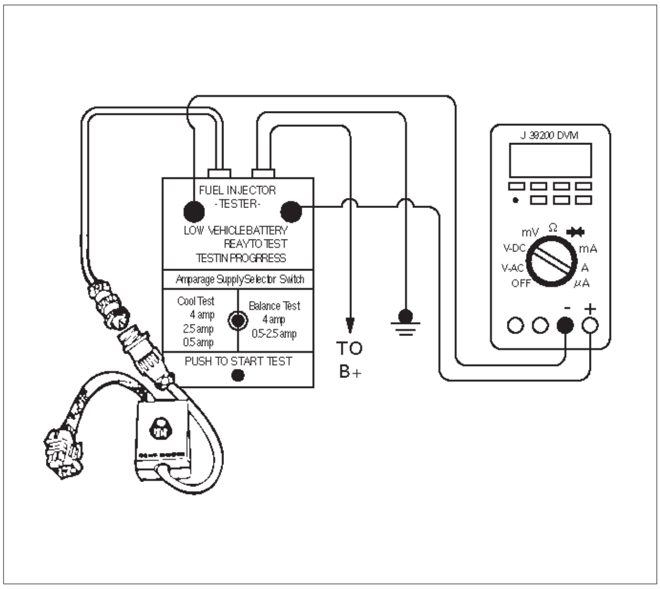
Some failures of the fuel metering system will result in an ”Engine Cranks But Will Not Run” symptom. If this condition exists, refer to the Cranks But Will Not Run chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.

For the fuel system wiring schematic, refer to Fuel System Electrical Test.

If there is a fuel delivery problem, to diagnose the fuel injectors, the fuel pressure regulator, and the fuel pump,refer to Fuel System Diagnosis.

If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the evaporative emission canister purge is ON, the long term fuel trim may be as low as –38%. If the long term fuel trim values are greater than +23%, for items which can cause a lean HO2S signal, refer to DTC P0131, DTC P0171, and DTC 1171.

FUEL INJECTOR COIL TEST PROCEDURE AND FUEL INJECTOR BALANCE TEST PROCEDURE



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the J 34730–1 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch OFF open the valve on the fuel pressure gauge.

3.Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance Ohms	Voltage Specification at 10˚C–35˚C (50˚F–95˚F)
11.8 – 12.6	5.7 – 6.6

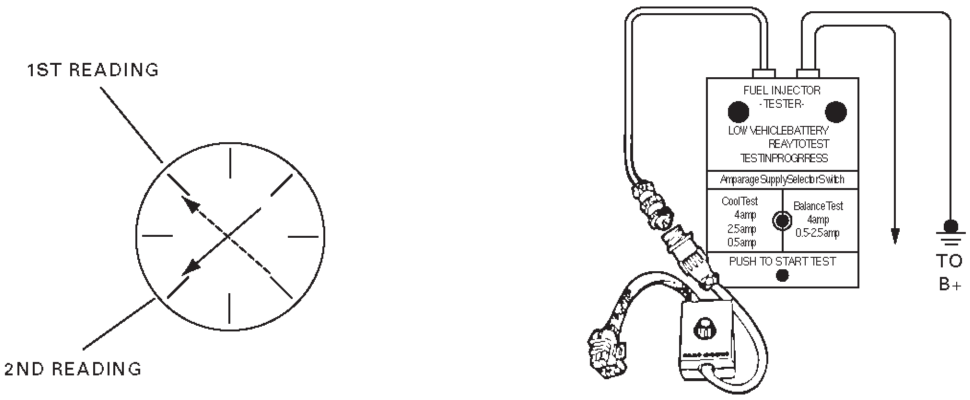
- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35˚C/10˚C (95˚F/50˚F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volt

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool–down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to ”Hot Soak” fuel boiling.

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11)



R262001

CYLINDER				
	1	2	3	4
1st Reading	296 kPa (43psi)	296 kPa (43psi)	296 kPa (43psi)	296 kPa (43psi)
2nd Reading	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)
Amount of Drop (1st Reading–2nd Reading	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)
Av. drop = 166 kPa/24 psi +/–10 kPa/1.5 psi = 156 – 176 kPa or 22.5 – 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the engine OFF. NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure. 2. Relieve the fuel pressure. Refer to Test Description Number 2. 3. Connect the J 39021–5V Fuel Injector Tester to B+ and ground, and to the J39021–90 Injector Switch Box. 4. Connect the injector switch box to the grey fuel injector harness connector located at the front of the EVAP canister bracket. 5. Set the amperage supply selector switch on the fuel injector tester to the ”Coil Test” 0.5 amp position. 6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the fuel injector tester. Refer to the illustrations associated with the test description. 7. Set the DVM to the tenths scale (0.0). 8. Observe the engine coolant temperature. Is the engine coolant temperature within the specified values?	10°C (50°F) to 35°C (95°F)	Go to *Step 3*	Go to *Step 5*
3	1. Set the injector switch box to injector #1. 2. Press the ”Push to Start Test” button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?	5.7–6.6 V	Go to *Step 4*	Go to *Step 7*
4	Replace the faulty fuel injector(s). Refer to Fuel Injector. Is the action complete?	—	Go to *Step 7*	—

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Set the injector switch box to injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?	9.5 V	Go to *Step 4*	Go to *Step 6*
6	1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. For any injector, is the subtracted value in step 2 greater than the specified value?	0.6 V	Go to *Step 4*	Go to *Step 7*
7	**CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.** 1. Connect the J 34730–1 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the Tech 2. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. Is the fuel pressure within the specified values?	296 kPa– 376 kPa (43–55 psi)	Go to *Step 8*	Go to *Fuel System Diagnosis*
8	Turn the fuel pump OFF. Does the fuel pressure remain constant?	—	Go to *Step 9*	Go to *Fuel System Diagnosis*