AXIOM

# ENGINE

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# ENGINE MECHANICAL (6VE1 3.5L)

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## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# General Description

## Engine Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to all friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
- At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The six cylinders of this engine are identified by numbers; Right side cylinders 1, 3 and 5, Left side cylinders 2, 4 and 6, as counted from crankshaft pulley side to flywheel side.

## General Information on Engine Service

The following information on engine service should be noted carefully, as it is important in preventing damage and contributing to reliable engine performance.

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and the oil pump strainer, jacking against the oil pan may cause damage to the oil pick–up unit.
- The 12–volt electrical system is capable of damaging circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.
- Any time the intake air duct or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material into the cylinder which could cause extensive damage when the engine is started.

## Cylinder Block

The cylinder block is made of aluminum die–cast casting for 75˚V–type six cylinders. It has a rear plate integrated structure and employs a deep skirt. The cylinder liner is cast and the liner inner diameter and crankshaft journal diameter are classified into grades. The crankshaft is supported by four bearings of which width is different between No.2, No.3 and No.1, No.4; the width of No.3 bearing on the body side is different in order to support the thrust bearing. The bearing cap is made of nodular cast iron and each bearing cap uses four bolts and two side bolts.

## Cylinder Head

The cylinder head, made of aluminum alloy casting employs a pent–roof type combustion chamber with a spark plug in the center. The intake and exhaust valves are placed in V–type design. The ports are cross–flow type.

## Valve Train

Intake and exhaust camshaft on both banks are driven with a camshaft drive gear by the timing belt. The valves are operated by the camshaft and the valve clearance is adjusted to select suitable thickness shim.

## Intake Manifold

The intake manifold system is composed of the aluminum cast common chamber and intake manifold attached with six fuel injectors.

## Exhaust Manifold

The exhaust manifold is made of nodular cast iron.

## Pistons and Connecting Rods

Aluminum pistons are used after selecting the grade that meets the cylinder bore diameter. Each piston has two compression rings and one oil ring. The piston pin made of chromium steel is offset 1mm toward the thrust side, and the thrust pressure of piston to the cylinder wall varies gradually as the piston travels. The connecting rods are made of forged steel. The connecting rod bearings are graded for correct size selection.

## Crankshaft and Bearings

The crankshaft is made of Ductile cast–iron. Pins and journals are graded for correct size selection for their bearing.

# Engine Diagnosis

First of all the engine diagnose to check the fuel quantity, the engine level and the engine coolant level.

## Hard Starting

### 1. Starting Motor Does Not Turn Over

**Troubleshooting Procedure**

Turn on headlights and starter switch.

| Condition | Possible cause | Correction |
|---|---|---|
| Headlights go out or dim considerably | Battery run down or under charged | Recharge or replace battery |
| | Terminals poorly connected | Clean battery posts and terminals and connect properly |
| | Starting motor coil circuit shorted | Overhaul or replace |
| | Starting motor defective | Overhaul or replace |

### 2. Ignition Trouble — Starting Motor Turns Over But Engine Does Not Start

**Spark Test**

Disconnect an ignition coil from any spark plug. Connect the spark plug tester (For example J–26792), start the engine, and check if a spark is generated in the spark plug tester. Before starting the engine, make sure that the spark plug tester is properly grounded. To avoid electrical shock, do not touch the part where insulation of the ignition coil is broken while the engine is running.

| Condition | Possible cause | Correction |
|---|---|---|
| Spark jumps across gap | Spark plug defective | Clean, adjust spark gap or replace |
| | Ignition timing incorrect | Refer to Ignition System |
| | Fuel not reaching fuel injector(s) or engine | Refer to item 3 (Trouble in fuel system) |
| | Valve timing incorrect | Adjust |
| | Engine lacks compression | Refer to item 4 (Engine lacks compression) |
| No sparking takes place | Ignition coil disconnected or broken | Connect properly or replace |
| | Electronic Ignition System with module | Replace |
| | Poor connections in engine harness | Correct |
| | Powertrain Control Module cable disconnected or defective | Correct or replace |

### 3. Trouble In Fuel System

| Condition | Possible cause | Correction |
|---|---|---|
| Starting motor turns over and spark occurs but engine does not start. | Fuel tank empty | Fill |
| | Water in fuel system | Clean |
| | Fuel filter clogged | Replace filter |
| | Fuel pipe clogged | Clean or replace |
| | Fuel pump defective | Replace |
| | Fuel pump circuit open | Correct or replace |
| | Evaporative Emission Control System circuit clogged | Correct or replace |
| | Multiport Fuel Injection System faulty | Refer to “Electronic Fuel Injection” section |

**4. Engine Lacks Compression**

| Condition | Possible cause | Correction |
|---|---|---|
| Engine lacks compression | Spark plug loosely fitted or spark plug gasket defective | Tighten to specified torque or replace gasket |
| | Valve timing incorrect | Adjust |
| | Cylinder head gasket defective | Replace gasket |
| | Valve incorrectly seated | Lap valve |
| | Valve stem seized | Replace valve and valve guide |
| | Valve spring weakened or broken | Replace |
| | Cylinder or piston rings worn | Overhaul engine |
| | Piston ring seized | Overhaul engine. |

## Engine Compression Test Procedure

1. Start and run the engine until the engine reaches normal operating temperature.
2. Turn the engine off.
3. Remove all the spark plugs.
4. Remove ignition coil fuse (15A) and disable the ignition system.
5. Remove the fuel pump relay from the relay and fuse box.
6. Engage the starter and check that the cranking speed is approximately 300 rpm.
7. Install cylinder compression gauge into spark plug hole.
8. With the throttle valve opened fully, keep the starter engaged until the compression gage needle reaches the maximum level. Note the reading.
9. Repeat the test with each cylinder.
   If the compression pressure obtained falls below the limit, engine overhaul is necessary.

   **Limit; 1000 kPa (145 psi)**

## Rough Engine Idling or Engine Stalling

| Condition | Possible cause | Correction |
|---|---|---|
| Trouble in fuel injection system | Throttle shutting off incomplete | Correct or replace |
| | Throttle position sensor circuit open or shorted | Correct or replace |
| | Fuel injector circuits open or shorted | Correct or replace |
| | Fuel injectors damaged | Replace |
| | Fuel pump relay defective | Replace |
| | Mass Airflow Sensor circuit open or poor connections | Correct or replace |
| | Mass Airflow Sensor defective | Replace |
| | Manifold Absolute Pressure Sensor circuit open or poor connections | Correct or replace |
| | Manifold Absolute Pressure Sensor defective | Replace |
| | Engine Coolant Temperature Sensor circuit open or poor connections | Correct or replace |
| | Engine Coolant Temperature Sensor defective | Replace |
| | Intake Air Temperature sensor circuit open or poor connections | Correct or replace |
| | Intake Air Temperature sensor defective | Replace |
| | Ion Sensing Module cable broken or poor connections | Correct or replace |
| | Ion Sensing Module defective | Replace |
| | Vehicle Speed Sensor circuit open or shorted | Correct or replace |
| | Vehicle Speed Sensor defective | Replace |
| Trouble in emission control system | Powertrain Control Module defective | Replace |
| | Exhaust Gas Recirculation Valve circuit open or poor connections | Correct or replace |
| | Exhaust Gas Recirculation Valve faulty | Replace |
| | Canister purge valve circuit open or poor connections | Correct or replace |
| | Canister purge valve defective | Replace |
| | Evaporative Emission Canister Purge control valve defective | Replace |
| | Trouble in ignition system | Refer to “Hard Start” |
| Others | Engine lacks compression | Refer to “Hard Start” |
| | Valve incorrectly seated | Lap valve |
| | Air Cleaner Filter clogged | Replace filter element |
| | Valve timing incorrect | Readjust |
| | Idle air control valve broken | Replace |
| | Fast idle solenoid defective | Replace |
| | Positive Crankcase Ventilation valve defective or clogged | Replace |

## Rough Engine Running

| Condition | Possible cause | Correction |
|---|---|---|
| Engine misfires periodically | Ignition coil layer shorted | Replace |
| | Spark plugs fouling | Clean or install hotter type plug |
| | Spark plug(s) insulator nose leaking | Replace |
| | Fuel injector(s) defective | Replace |
| | Powertrain control module faulty | Replace |
| Engine knocks periodically | Spark plugs running too hot | Install colder type spark plugs |
| | Powertrain control module faulty | Replace |
| | Ion Sensing module faulty | Refer or replace |
| Engine lacks power | Spark plugs fouled | Clean |
| | Fuel injectors defective | Replace |
| | Mass Airflow Sensor or Intake Airflow Sensor circuit defective | Correct or replace |
| | Manifold Absolute Pressure (MAP) Sensor or Manifold Absolute Pressure Sensor circuit defective | Correct or replace |
| | Engine Coolant Temperature Sensor or Engine Coolant Temperature Sensor circuit defective | Correct or replace |
| | Powertrain Control Module faulty | Replace |
| | Intake Air Temperature Sensor or Intake Air Temperature Sensor circuit defective | Correct or replace |
| | Throttle Position Sensor or Throttle Position Sensor circuit defective | Correct or replace |
| | ION Sensing Module or ION Sensing Module circuits defective | Correct or replace |

## Hesitation

| Condition | Possible cause | Correction |
|---|---|---|
| Hesitation on acceleration | Throttle Position Sensor adjustment incorrect | Replace throttle valve assembly |
| | Throttle Position Sensor circuit open or shorted | Correct or replace |
| | Mass Airflow Sensor circuit open or poor connections | Correct or replace |
| | Mass Airflow Sensor defective | Replace |
| | Manifold Absolute Pressure (MAP) Sensor circuit open or shorted | Correct or replace |
| | MAP Sensor defective | Replace |
| | Intake Air Temperature (IAT) Sensor circuit open or poor connections | Correct or replace |
| | Ion Sensing Module circuit open or poor connections | Correct or replace |
| | Ion Sensing Module defective | Replace |
| | IAT Sensor defective | Replace |
| Hesitation at high speeds (Fuel pressure too low) | Fuel tank strainer clogged | Clean or replace |
| | Fuel pipe clogged | Clean or replace |
| | Fuel filter clogged | Replace |
| | Defective fuel pump system | Check and replace |
| | Fuel Pressure Control Valve leaking | Replace |
| Hesitation at high speeds (Fuel injector not working normally) | Power supply or ground circuit for Multiport Fuel Injection System shorted or open | Check and correct or replace |
| | Fuel Injector defective | Replace |
| | Cable of Multiport Fuel Injection System circuit open or poor connections | Correct or replace |

| Condition | Possible cause | Correction |
|---|---|---|
| Hesitation at high speeds | Powertrain Control Module defective | Replace |
| | Throttle Position Sensor cable broken or poor connections | Correct or replace |
| | Throttle Position Sensor defective | Replace |
| | Engine Coolant Temperature Sensor circuit open or shorted | Correct or replace |
| | Engine Coolant Temperature Sensor defective | Replace |
| | Mass Airflow Sensor circuit open or poor connections | Correct or replace |
| | Mass Airflow Sensor defective | Replace |
| | MAP Sensor cable broken or poor connections | Correct or replace |
| | MAP Sensor defective | Replace |
| | IAT Sensor circuit open or poor connections | Correct or replace |
| | IAT Sensor defective | Replace |
| | Ion Sensing Module circuit open or poor connections | Correct or replace |
| | Ion Sensing Module defective | Replace |
| | Throttle valve not fully opened | Check and correct or replace |
| | Air Cleaner Filter clogged | Replace filter element |
| | Power supply voltage too low | Check and correct or replace |

## Engine Lacks Power

| Condition | Possible cause | Correction |
|---|---|---|
| Trouble in fuel system | Fuel Pressure Control Valve not working normally | Replace |
| | Fuel injector clogged | Clean or replace |
| | Fuel pipe clogged | Clean |
| | Fuel filter clogged or fouled | Replace |
| | Fuel pump drive circuit not working normally | Correct or replace |
| | Fuel tank not sufficiently breathing due to clogged Evaporative Emission Control System circuit | Clean or replace |
| | Water in fuel system | Clean |
| | Inferior quality fuel in fuel system | Use fuel of specified octane rating |
| | Powertrain Control Module supplied poor voltage | Correct circuit |
| | Throttle Position Sensor cable broken or poor connections | Correct or replace |
| | Throttle Position Sensor defective | Replace |
| | Mass Airflow Sensor not working normally | Replace |
| | Manifold Absolute Pressure Sensor not working normally | Replace |
| | Intake Air Temperature Sensor not working normally | Replace |
| | Engine Coolant Temperature Sensor circuit open or shorted | Correct or replace |
| | Engine Coolant Temperature Sensor defective | Replace |
| | Powertrain Control Module defective | Replace |
| Trouble in intake or exhaust system | Air Cleaner Filter clogged | Replace filter element |
| | Air duct kinked or flattened | Correct or replace |
| | TWC defective | Repair |
| Ignition failure | ——— | Refer to Hard Start Troubleshooting Guide |
| | Heat range of spark plug inadequate | Install spark plugs of adequate heat range |
| | Ignition coil defective | Replace |

| Condition | Possible cause | Correction |
|---|---|---|
| Engine overheating | Level of Engine Coolant too low | Replenish |
| | Fan clutch defective | Replace |
| | Incorrect fan installed | Replace |
| | Thermostat defective | Replace |
| | Engine Coolant pump defective | Correct or replace |
| | Radiator clogged | Clean or replace |
| | Radiator filler cap defective | Replace |
| | Level of oil in engine crankcase too low or wrong engine oil | Change or replenish |
| | Resistance in exhaust system increased | Clean exhaust system or replace defective parts |
| | Throttle Position Sensor adjustment incorrect | Replace with Throttle Valve ASM |
| | Throttle Position Sensor circuit open or shorted | Correct or replace |
| | Cylinder head gasket damaged | Replace |
| Engine overcooling | Thermostat defective | Replace (Use a thermostat set to open at 82°C (180°F)) |
| Engine lacks compression | ——— | Refer to Hard Start |
| Others | Tire inflation pressure abnormal | Adjust to recommended pressures |
| | Brake drag | Adjust |
| | Clutch slipping | Adjust or replace |
| | Level of oil in engine crankcase too high | Correct level of engine oil |
| | Exhaust Gas Recirculation Valve defective | Replace |

## Engine Noisy

Abnormal engine noise often consists of various noises originating in rotating parts, sliding parts and other moving parts of the engine. It is, therefore, advisable to locate the source of noise systematically.

**Troubleshooting Procedure for Crankshaft Journals or Crankshaft Bearing Noise**

| Condition | Possible cause | Correction |
|---|---|---|
| Noise from crank journals or from crank bearings<br>(Faulty crank journals and crank bearings usually make dull noise that becomes more evident when accelerating) | Oil clearance increased due to worn crank journals or crank bearings | Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing |
| | Crankshaft out of round | Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing |
| | Crank bearing seized | Crank bearing seized Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing |

**Troubleshooting Procedure for Connecting Rods or Connecting Rod Bearing Noise**

Short out each spark plug in sequence using insulated spark plug wire removers. Locate cylinder with defective bearing by listening for abnormal noise that stops when spark plug is shorted out.

| Condition | Possible cause | Correction |
|---|---|---|
| Noise from connecting rods or from connecting rod bearings<br>(Faulty connecting rods or connecting rod bearings usually make an abnormal noise slightly higher than the crank bearing noise, which becomes more evident when engine is accelerated) | Bearing or crankshaft pin worn | Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing |
| | Crankpin out of round | Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing |
| | Connecting rod bent | Correct or replace |
| | Connecting rod bearing seized | Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing |

**Troubleshooting Procedure for Piston and Cylinder Noise**

Abnormal noise stops when the spark plug on the cylinder with defective part is shorted out.

| Condition | Possible cause | Correction |
|---|---|---|
| Piston and cylinder noise<br>(Faulty piston or cylinder usually makes a combined mechanical thumping noise which increases when engine is suddenly accelerated but diminishes gradually as the engine warms up) | Piston clearance increased due to cylinder wear | Replace piston and cylinder body |
| | Piston seized | Replace piston and cylinder body |
| | Piston ring broken | Replace piston and cylinder body |
| | Piston defective | Replace pistons and others |

**Troubleshooting Procedure for Piston Pin Noise**

Short out each spark plug and listen for change in engine noise.

| Condition | Possible cause | Correction |
|---|---|---|
| Piston pin noise<br>(Piston makes noise each time it goes up and down) | Piston pin or piston pin hole worn | Replace piston, piston pin and connecting rod assy |

**Troubleshooting Procedure for Slapping or Hitting etc Noise**

The slapping sound stops when spark plug on bad cylinder is shorted out.

| Condition | Possible cause | Correction |
|---|---|---|
| Timing belt noise | Timing belt tension is incorrect | Replace pusher or adjust the tension pulley or replace timing belt |
| | Tensioner bearing defective | Replace |
| | Timing belt defective | Replace |
| | Timing pulley defective | Replace |
| | Timing belt comes in contact with timing cover | Replace timing belt and timing cover |
| Valve noise | Valve clearance incorrect | Replace adjusting shim |
| | Valve and valve guide seized | Replace valve and valve guide |
| | Valve spring broken or weakened | Replace |
| | Valve seat off–positioned | Correct |
| | Camshaft worn out | Replace |
| Crankshaft noise | Crankshaft end play excessive (noise occurs when clutch is engaged) | Replace thrust bearing |
| Engine knocking | Preignition due to use of spark plugs of inadequate heat range | Install Spark Plugs of adequate heat range |
| | Carbon deposits in combustion chambers | Clean |
| | Fuel too low in octane rating | Replace fuel |
| | Wide Open Throttle enrichment system failure | Refer to Section 6E |
| | Selection of transmission gear incorrect | Caution operator of incorrect gear selection |
| | Engine overheating | Refer to “Engine Lacks Power” |
| Others | Water pump defective | Replace |
| | Drive belt slipping | Replace auto tensioner or drive belt |

## Abnormal Combustion

| Condition | Possible cause | Correction |
|---|---|---|
| Trouble in fuel system | Fuel pressure control valve defective | Replace |
| | Fuel filter clogged | Replace |
| | Fuel pump clogged | Clean or replace |
| | Fuel tank or fuel pipe clogged | Clean or replace |
| | Fuel injector clogged | Clean or replace |
| | Fuel pump relay defective | Replace |
| | Power supply cable for fuel pump broken or poor connections | Reconnect, correct or replace |
| | Mass Airflow (MAF) Sensor circuit open or defective | Correct or replace |
| | MAF Sensor defective | Replace |
| | Manifold Absolute Pressure Sensor circuit open or shorted | Correct or replace |
| | Manifold Absolute Pressure Sensor defective | Replace |
| | Engine Coolant Temperature (ECT) Sensor circuit open or shorted | Correct or replace |
| | ECT Sensor defective | Replace |
| | Throttle Position Sensor adjustment incorrect | Readjust |
| | Throttle Position Sensor defective | Replace |
| | Throttle Position Sensor connector poor connections | Reconnect |
| | Vehicle Speed Sensor cable poor connections or defective | Correct or replace |
| | Vehicle Speed Sensor loosely fixed | Fix tightly |
| | Vehicle Speed Sensor in wrong contact or defective | Replace |
| | Powertrain Control Module cable poor connections or defective | Correct or replace |
| Trouble in emission control system | Heated Oxygen Sensor circuit open | Correct or replace |
| | Heated Oxygen Sensor defective | Replace |
| | Signal vacuum hose loosely fitted or defective | Correct or replace |
| | EGR Valve circuit open or shorted | Correct or replace |
| | Exhaust Gas Recirculation Valve defective | Replace |
| | ECT Sensor circuit open or shorted | Correct or replace |
| | Canister Purge Valve circuit open or shorted | Correct or replace |
| | Canister Purge Valve defective | Replace |
| | ECT Sensor defective | Replace |
| | Positive Crankcase Ventilation (PCV) valve and hose clogged | Correct or replace |
| | Evaporator system | Refer to Section 6E |
| Trouble in ignition system | ———— | Refer to “Engine Lacks Power” |

| Condition | Possible cause | Correction |
|---|---|---|
| Trouble in cylinder head parts | Carbon deposits in combustion chamber | Remove carbon |
| | Carbon deposit on valve, valve seat and valve guide | Remove carbon |

## Engine Oil Consumption Excessive

| Condition | Possible cause | Correction |
|---|---|---|
| Oil leaking | Oil pan drain plug loose | Retighten or replace gasket |
| | Crankcase fixing bolts loosened | Retighten |
| | Oil pan setting bolts loosened | Retighten |
| | Oil pan gasket broken | Replace gasket |
| | Front cover retaining bolts loose or gasket broken | Retighten or replace gasket |
| | Head cover fixing bolts loose or gasket broken | Retighten or replace gasket |
| | Oil filter adapter cracked | Replace |
| | Oil filter attachings bolt loose or rubber gasket broken | Retighten or replace oil filter |
| | Crankshaft front or rear oil seal defective | Replace oil seal |
| | Oil pressure unit loose or broken | Retighten or replace |
| | Blow–by gas hose broken | Replace hose |
| | Positive Crankcase Ventilation Valve clogged | Clean |
| | Engine/Transmission coupling failed | Replace oil seal |
| Oil leaking into combustion chambers due to poor seal in valve system | Valve stem oil seal defective | Replace |
| | Valve stem or valve guide worn | Replace valve and valve guide |
| Oil leaking into combustion chambers due to poor seal in cylinder parts | Cylinders and pistons worn excessively | Replace cylinder body assembly and pistons |
| | Piston ring gaps incorrectly positioned | Correct |
| | Piston rings set with wrong side up | Correct |
| | Piston ring sticking | Replace cylinder body assembly and pistons |
| | Piston ring and ring groove worn | Replace pistons and others |
| | Return ports in oil rings clogged | Clean piston and replace rings |
| Positive Crankcase Ventilation System malfunctioning | Positive Crankcase Ventilation Valve clogged | Clean |
| Others | Improper oil viscosity | Use oil of recommended S.A.E. viscosity |
| | Continuous high speed driving and/or severe usage such as trailer towing | Continuous high speed operation and/or severe usage will normally cause increased oil consumption |

## Fuel Consumption Excessive

| Condition | Possible cause | Correction |
|---|---|---|
| Trouble in fuel system | Mixture too rich or too lean due to trouble in fuel injection system | Refer to “Abnormal Combustion” |
| | Fuel cut function does not work | Refer to “Abnormal Combustion” |
| Trouble in ignition system | Misfiring or abnormal combustion due to trouble in ignition system | Refer to “Hard Start” or “Abnormal Combustion” |
| Others | Engine idle speed too high | Reset Idle Air Control Valve |
| | Fuel system leakage | Correct or replace |
| | Clutch slipping | Correct |
| | Brake drag | Correct |
| | Selection of transmission gear incorrect | Caution operator of incorrect gear selection |
| | Excessive Exhaust Gas Recirculation flow due to trouble in Exhaust Gas Recirculation system | Refer to “Abnormal Combustion” |

## Lubrication Problems

| Condition | Possible cause | Correction |
|---|---|---|
| Oil pressure too low | Wrong oil in use | Replace with correct engine oil |
| | Relief valve sticking | Replace |
| | Oil pump not operating properly | Correct or replace |
| | Oil pump strainer clogged | Clean or replace strainer |
| | Oil pump worn | Replace |
| | Oil pressure gauge defective | Correct or replace |
| | Crankshaft bearing or connecting rod bearing worn | Replace |
| Oil contamination | Wrong oil in use | Replace with correct engine oil |
| | Oil filter clogged | Replace oil filter |
| | Cylinder head gasket damage | Replace gasket |
| | Burned gases leaking | Replace piston and piston rings or cylinder body assembly |
| Oil not reaching valve system | Oil passage in cylinder head or cylinder body clogged | Clean or correct |

## Engine Oil Pressure Check

1. Check for dirt, gasoline or water in the engine oil.
   a. Check the viscosity of the oil.
   b. Check the viscosity of the oil.
   c. Change the oil if the viscosity is outside the specified standard.
   d. Refer to the “Maintenance and Lubrication” section of this manual.
2. Check the engine oil level.
   The level should fall somewhere between the “ADD” and the “FULL” marks on the oil level dipstick.
   If the oil level does not reach the “ADD” mark on the oil level dipstick, engine oil must be added.
3. Remove the oil pressure unit.
4. Install an oil pressure gauge.
5. Start the engine and allow the engine to reach normal operating temperature (About 80°C).
6. Measure the oil pressure.
   **Oil pressure should be:**
   **392–550 kPa (56.9–80.4 psi) at 3000 rpm.**
7. Stop the engine.
8. Remove the oil pressure gauge.
9. Install the oil pressure unit.
10. Start the engine and check for leaks.

## Malfunction Indicator Lamp

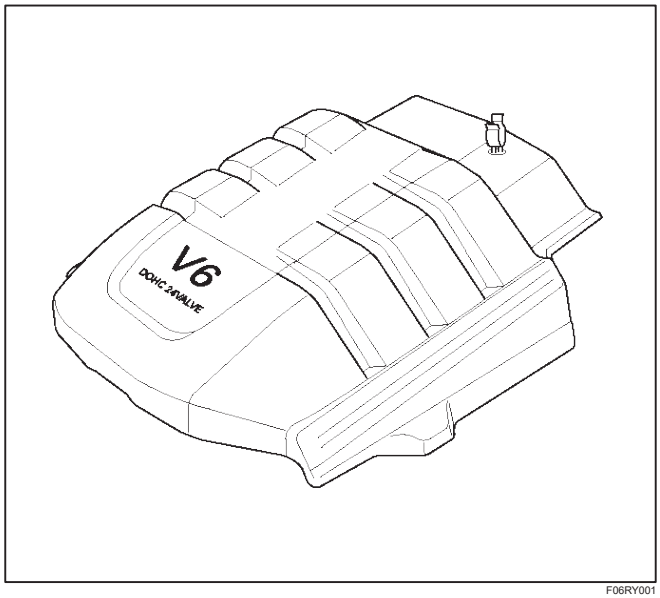
The instrument panel “CHECK ENGINE” Malfunction Indicator Lamp (MIL) illuminates by self diagnostic system when the system checks the starting of engine, or senses malfunctions.

| Condition | Possible cause | Correction |
|---|---|---|
| “CHECK ENGINE” MIL does not illuminate at the starting of engine | Bulb defective | Replace |
| | MIL circuit open | Correct or replace |
| | Command signal circuit to operate self diagnostic system shorted | Correct or replace |
| | Powertrain Control Module (PCM) cable loosely connected, disconnected or defective | Correct or replace |
| | PCM defective | Replace |
| “CHECK ENGINE” MIL illuminates, and stays on | Deterioration of heated oxygen sensor internal element | Replace |
| | Heated oxygen sensor connector terminal improper contact | Reconnect properly |
| | Heated oxygen sensor lead wire shorted | Correct |
| | Heated oxygen sensor circuit open | Correct or replace |
| | Deterioration of engine coolant temperature sensor internal element | Replace |
| | Engine coolant temperature sensor connector terminal improper contact | Reconnect properly |
| | Engine coolant temperature sensor lead wire shorted | Correct |
| | Engine coolant temperature sensor circuit open | Correct or replace |
| | Throttle position sensor open or shorted circuits | Correct or replace |
| | Deterioration of crankshaft position sensor | Replace |
| | Crankshaft position sensor circuit open or shorted | Correct or replace |
| | Vehicle speed sensor circuit open | Correct or replace |
| | Manifold absolute pressure sensor circuit open or shorted | Correct or replace |
| | Intake air temperature sensor circuit open or shorted | Correct or replace |
| | Fuel injector circuit open or shorted | Correct or replace |
| | PCM driver transistor defective | Replace PCM |
| | Malfunctioning of PCM RAM (Random Access Memory) or ROM (Read Only Memory) | Replace PCM |

# Cylinder Head Cover LH

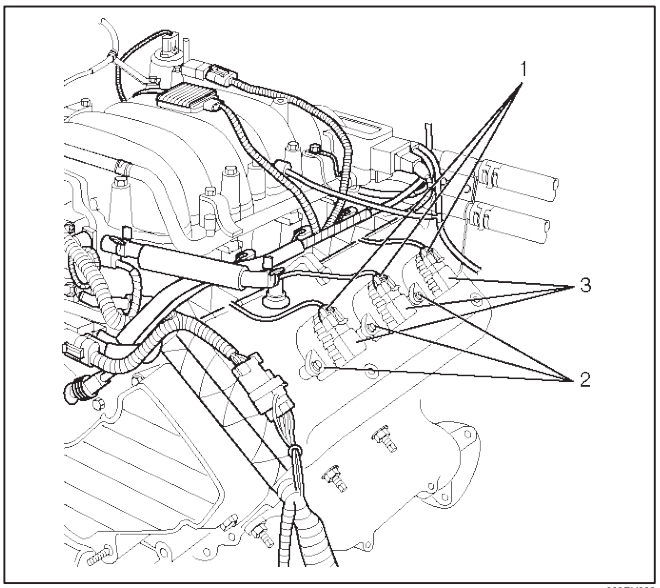
## Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowels on the common chamber.




F06RY001

3. Disconnect positive crankcase ventilation hose.
4. Remove ground cable fixing bolt on cylinder head cover.
5. Ignition coil connector and ignition coil.
   - Disconnect the three connectors from the ignition coils.
   - Remove harness bracket bolt on cylinder head cover.
   - Remove fixing bolts on ignition coils.

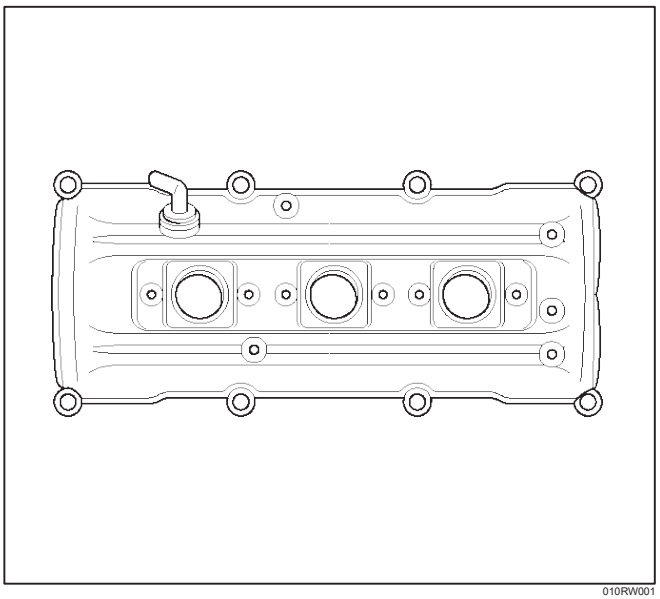



060RY022

**Legend**

(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assemblies

6. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
7. Remove eight fixing bolts, then the cylinder head cover.



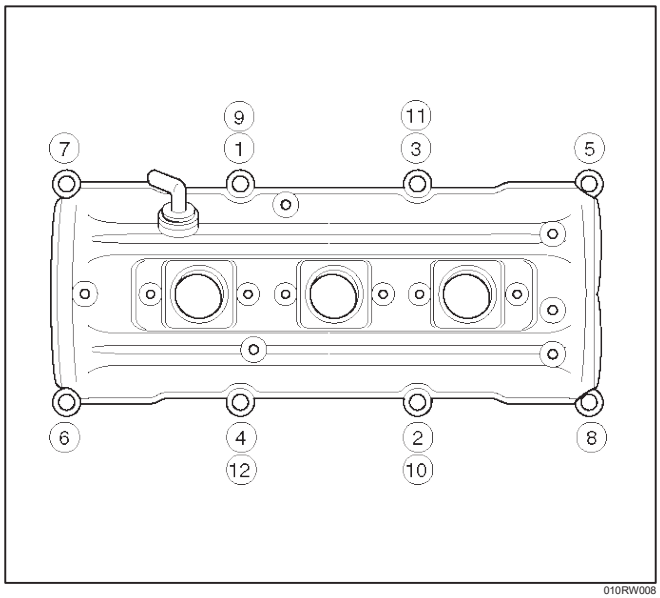
010RW001

NOTE: Where do you refer the tech in case of bolt removal difficulties.

## Installation

1. Install cylinder head cover.
   - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
   - Apply sealant (TB-1207B or equivalent) of bead diameter 2-3 mm at eight place of arched area of camshaft bearing cap on front and rear sides.
   - The cylinder head cover must be installed with in 5 minutes after sealant application to prevent hardening of sealant.
   - Tighten bolts to the specified torque.

   **Torque : 9 N·m (78 lb in)**



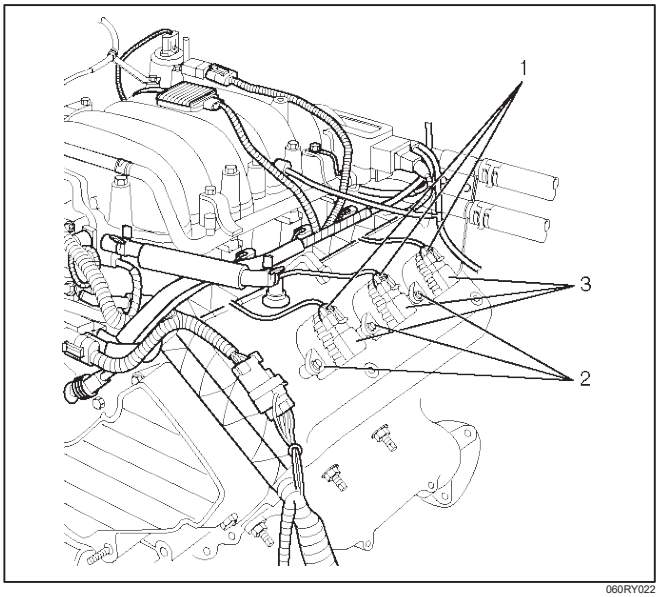
010RW008

2. Install fuel injection harness bracket and tighten bolt to the specified torque.

   **Torque : 9 N·m (78 lb in)**

3. Connect ignition coil connector and ignition coil, then tighten bolt to the specified torque.

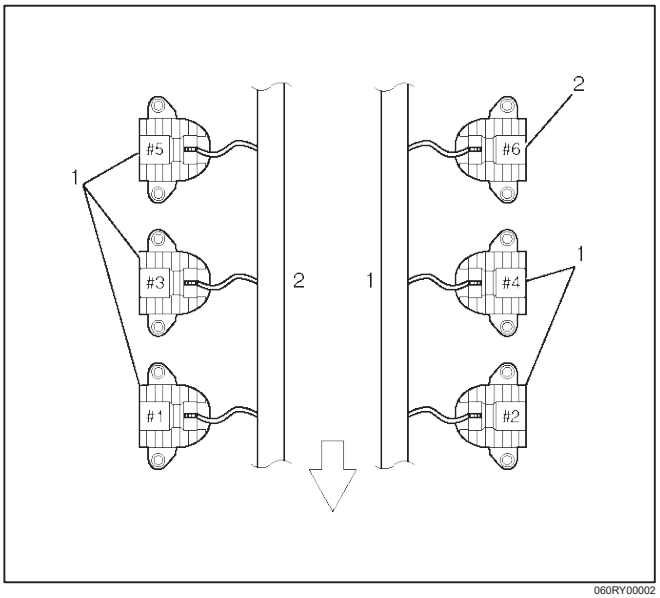
   **Torque : 4 N·m (35 lb in)**



060RY022

**Legend**
(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

**CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.**



060RY00002

**Legend**
(1) Long Type Ignition Coil Assemblies (# 1 ~ # 5)
(2) Short Type Ignition Coil Assembly (# 6)

4. Connect ground cable and tighten bolts to the specified torque.

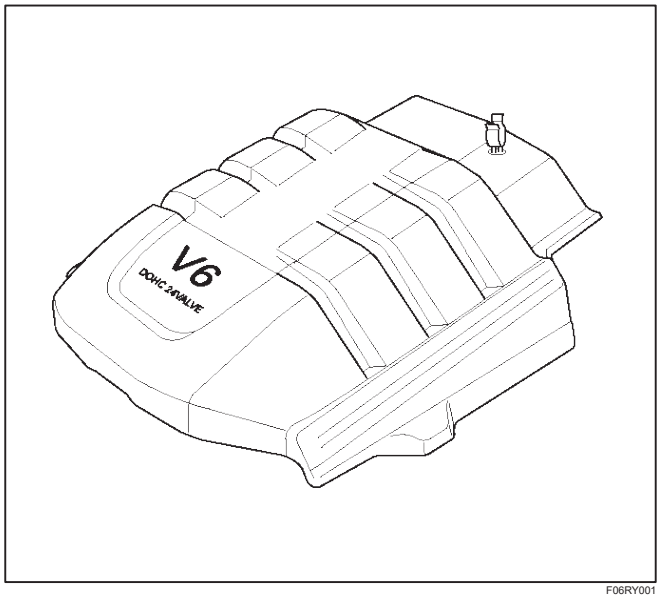
   **Torque : 9 N·m (78 lb in)**

5. Install positive crankcase ventilation hose.
6. Install engine cover mating with the dowels.

# Cylinder Head Cover RH

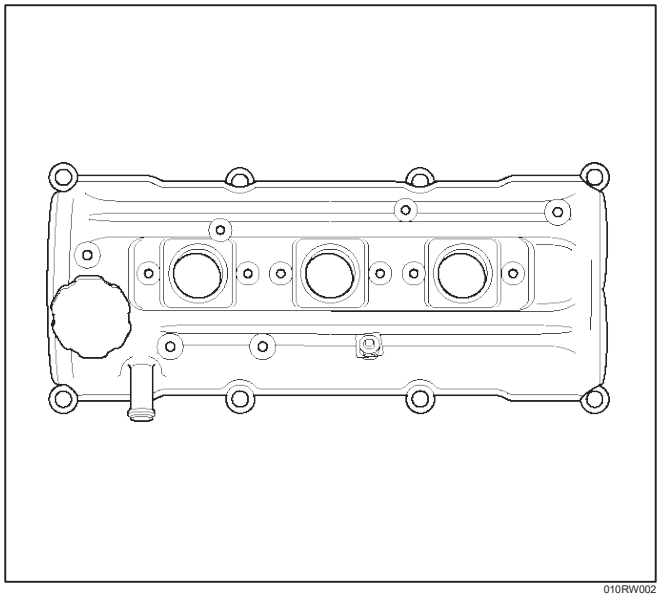
## Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowele on the common chamber.




F06RY001

3. Disconnect ventilation hose from cylinder head cover.
4. Disconnect three ignition coil connectors from ignition coils and remove harness bracket bolts on cylinder head cover then remove ignition coil fixing bolts on ignition coils and remove ignition coils.
5. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
6. Remove eight fixing bolts then the cylinder head cover.

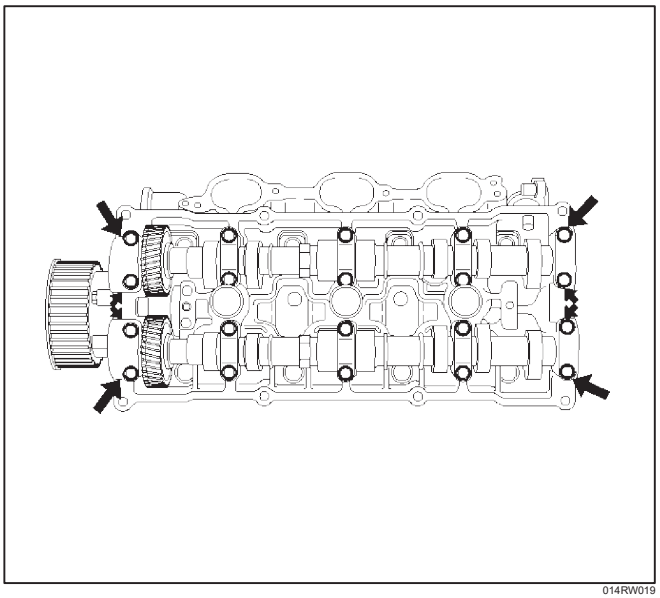


010RW002

## Installation

1. Install cylinder head cover.
   - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
     Apply sealant (TB-1207B or equivalent) bead (diameter 2-3 mm) at eight places of arched areas of camshaft bracket on front and rear sides.
   - The cylinder head cover must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
   - Tighten bolts to the specified torque.

   **Torque : 9 N·m (78 lb in)**



014RW019

2. Tighten fuel injector harness bracket bolts to specified torque then reconnect fuel injector harness connector.

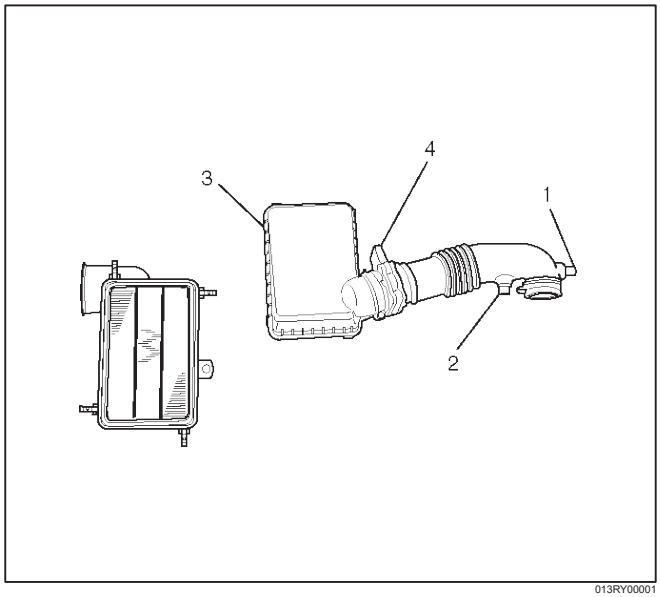
   **Torque : 7.8 N·m (69 lb in)**
3. Connect ignition coil connector and tighten ignition coil fixing bolts to specified torque.

   **Torque : 4 N·m (35 lb in)**
4. Connect ventilation hose to cylinder head.
5. Install engine cover mating with the dowels.

# Common Chamber

## Removal

1. Disconnect battery ground cable.
2. Remove air cleaner duct assembly.

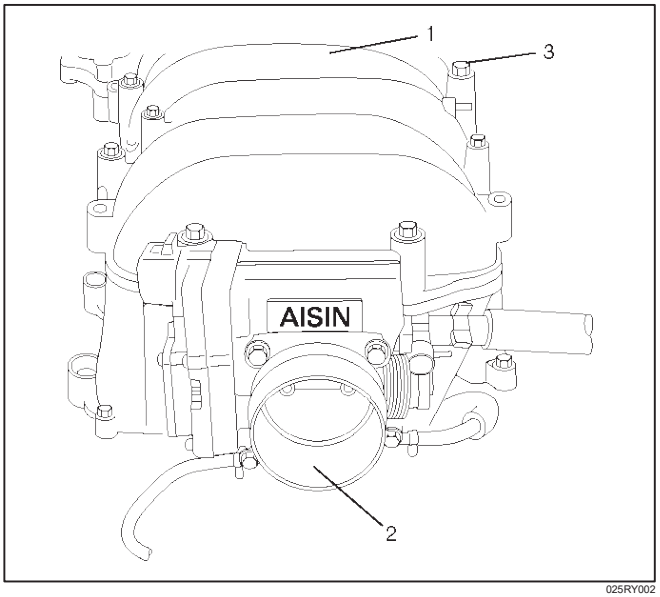


013RY00001

**Legend**

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Air Flow Sensor

3. Disconnect vacuum booster hose from common chamber.
4. Disconnect connector from manifold absolute pressure sensor, Ion sensing module, throttle position sensor, solenoid valve, electric vacuum sensing valve, and EGR valve.
5. Disconnect vacuum hose on canister VSV and positive crankcase ventilation hose, fuel rail assembly with pressure control valve bracket.
6. Remove ventilation hose from throttle valve and intake duct and remove water hose.
7. Remove the four throttle body fixing bolts.
8. Remove exhaust gas recirculation valve assembly fixing bolt and nut on common chamber and remove EGR valve assembly.
9. Remove two bolts from common chamber rear side to remove fuel hose bracket.
10. Remove common chamber four bolts and four nuts then remove the common chamber.



025RY002

**Legend**

(1) Common Chamber
(2) Throttle Valve Assembly
(3) Bolt

## Installation

1. Install common chamber and tighten bolts and nuts to the specified torque.

   **Torque :**

   **Bolt : 25 N·m (18 lb ft)**

   **Nut : 25 N·m (18 lb ft)**
2. Install fuel hose bracket and tighten bolts to specified torque.

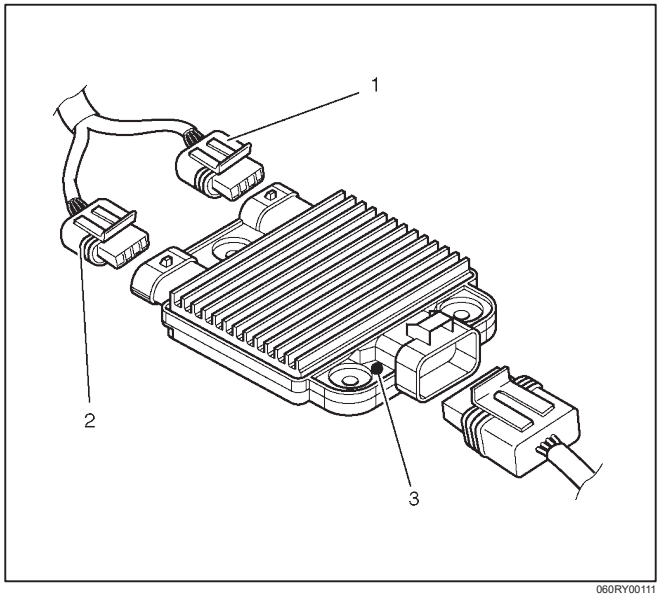
   **Torque : 10 N·m (87 lb in)**
3. Install exhaust gas recirculation valve assembly and tighten bolt and nut to the specified torque.

   **Torque : 25 N·m (18 lb ft)**
4. Install throttle body and tighten bolts to the specified torque.

   **Torque : 25 N·m (18 lb ft)**
5. Install ventilating hose to throttle valve and intake duct.
6. Connect vacuum hoses on canister VSV and positive crankcase ventilation hose. Tighten bolts for fuel rail assembly with pressure control valve bracket.

   **Torque : 25 N·m (18 lb ft)**

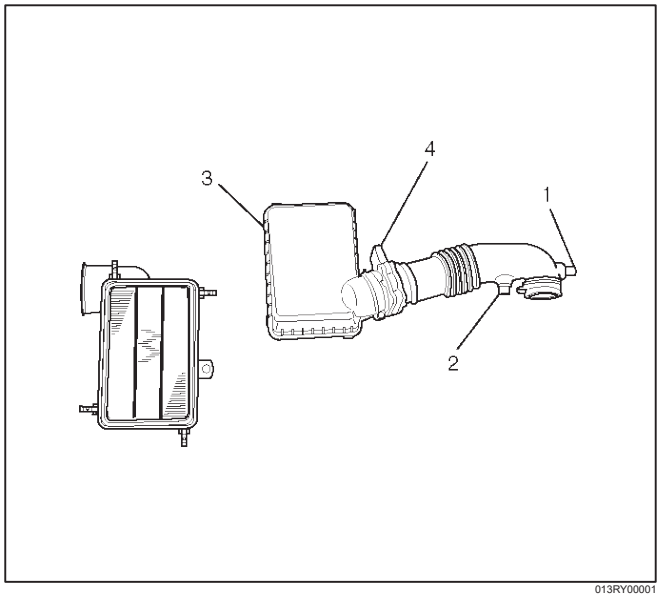
7. Connect each connector.
8. Connect vacuum booster hose.
9. Connect the Ion sensing module connectors as shown in the illustration.



060RY00111

**Legend**
(1) Green Connector
(2) Blue Connector
(3) Identification Mark (6VE1 Engine Only)

10. Install air cleaner duct assembly.



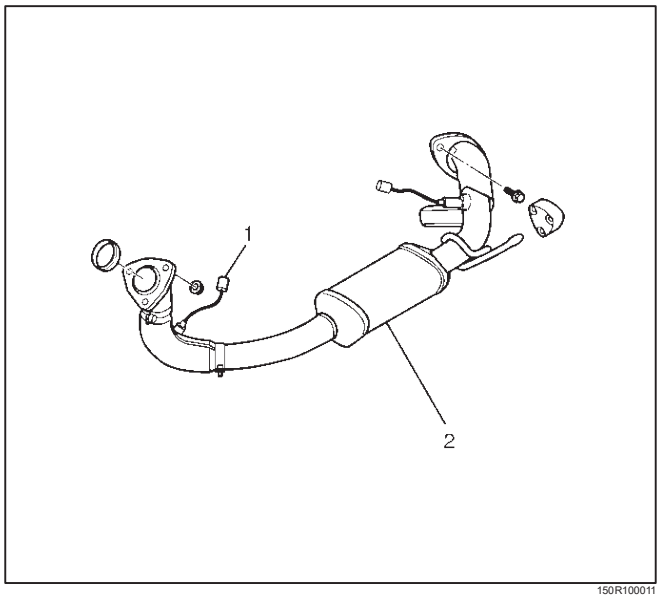
013RY00001

**Legend**
(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Mass Air Flow Sensor

# Exhaust Manifold LH

## Removal

1. Disconnect battery ground cable.
2. Disconnect $O_2$ sensor connector.
3. Remove exhaust front pipe three stud nuts from exhaust side and two bolts from rear end of exhaust front pipe.




150R100011

**Legend**

(1) Exhaust Front Pipe LH
(2) $O_2$ Sensor

4. Remove exhaust manifold eight fixing nuts and remove exhaust manifold from the engine.

## Installation

1. Install exhaust manifold and tighten exhaust manifold fixing nuts to the specified torque with new nuts.

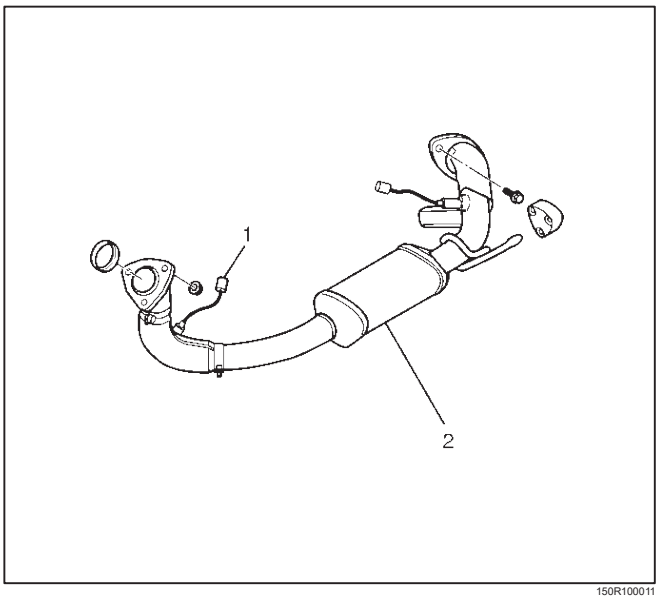
   **Torque: 57 N·m (42 lb ft)**

2. Install exhaust front pipe and tighten three stud nuts and two bolts to the specified torque.

   **Torque :**

   **Stud nuts: 67 N·m (49 lb ft)**

   **Bolts: 43 N·m (32 lb ft)**




150R100011

**Legend**

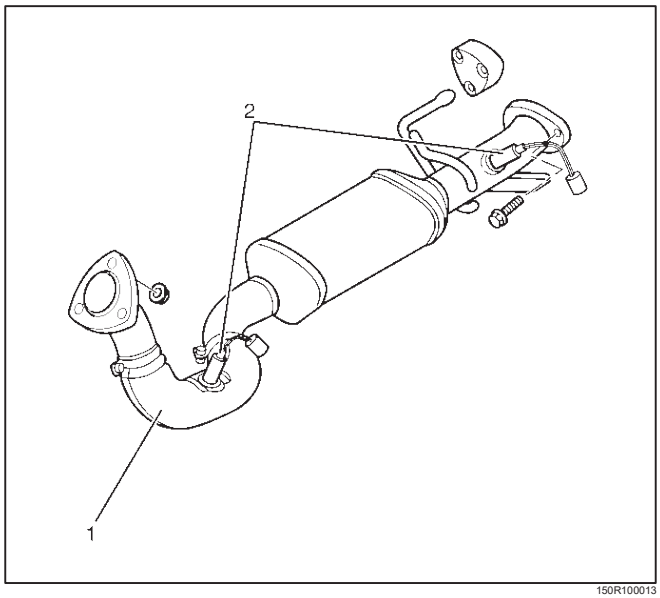
(1) $O_2$ Sensor
(2) Exhaust Front Pipe LH

3. Reconnect $O_2$ sensor connector.

# Exhaust Manifold RH

## Removal

1. Disconnect battery ground cable.
2. Remove torsion bar. Refer to removal procedure in Front Suspension section.
3. Remove exhaust front pipe three stud nuts and two bolts then disconnect exhaust front pipe.




150R100013

**Legend**

(1) Exhaust Front Pipe RH
(2) $O_2$ Sensor

4. Remove exhaust manifold eight fixing nuts then the exhaust manifold.

## Installation

1. Install exhaust manifold and tighten nuts to the specified torque.

   **Torque : 57 N·m (42 lb ft)**

2. Install exhaust front pipe and tighten three stud nuts and two bolts to the specified torque.

   **Torque:**

   **Stud nuts: 67 N·m (49 lb ft)**

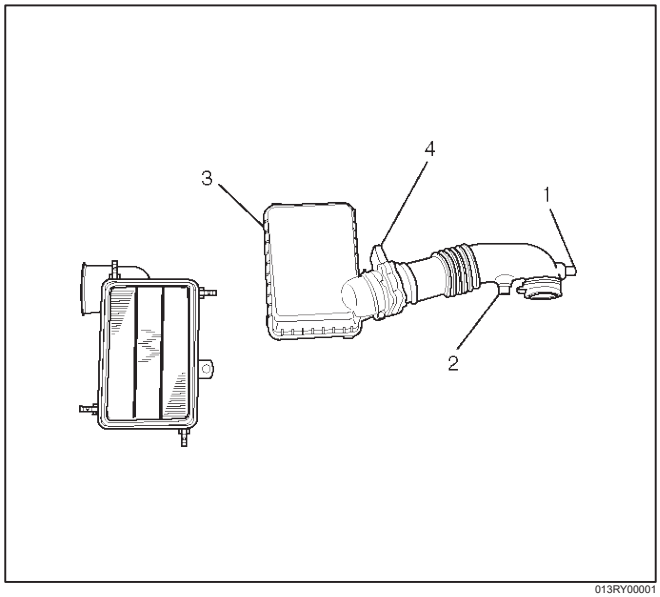
   **Bolts: 43 N·m (32 lb ft)**

3. Install the torsion bar and readjust the vehicle height. Refer to installation and vehicle height adjustment procedure for front suspension.

# Crankshaft Pulley

## Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.

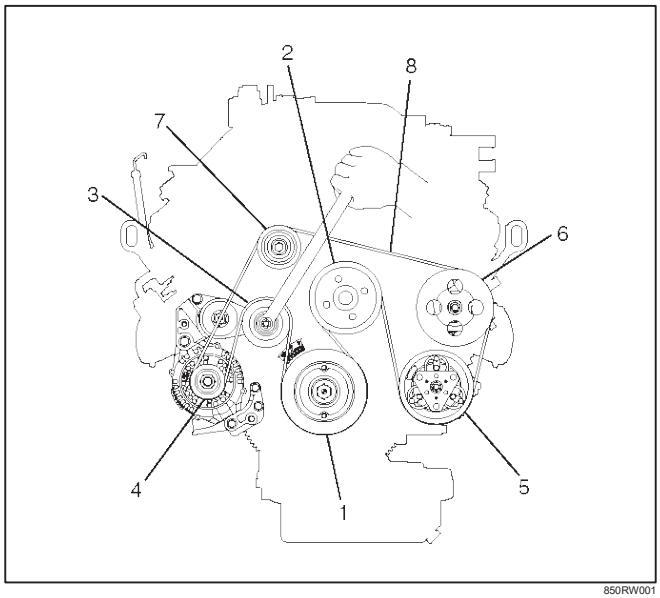



013RY00001

**Legend**

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Air Flow Sensor

3. Remove radiator upper fan shroud from radiator.
4. Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.




850RW001

**Legend**

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Driver Belt

5. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
6. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley then remove center bolt and pulley.

## Installation

1. Install crankshaft pulley using J-8614-01 crankshaft holder, hold the crankshaft pulley and tighten center bolt to the specified torque.

   **Torque : 167 N·m (123 lb ft)**

2. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   **Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.**

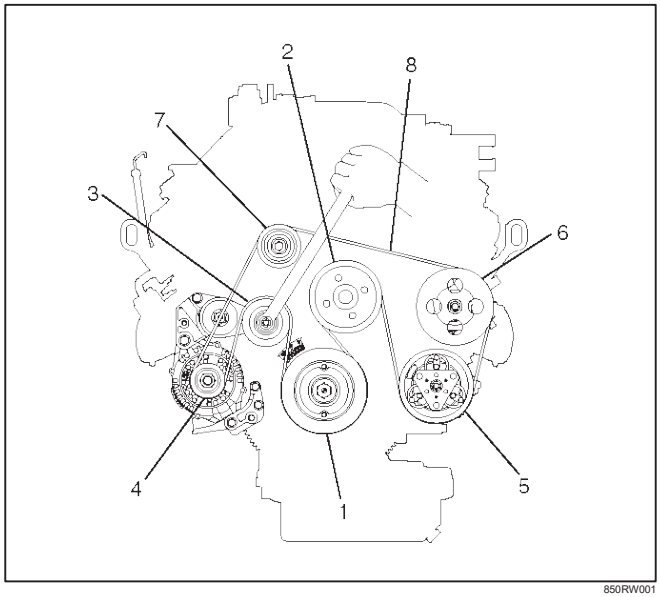
   **Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.**

3. Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Install radiator upper fan shroud.
5. Install air cleaner assembly.

# Timing Belt

## Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.
3. Remove radiator upper fan shroud from radiator.
4. Move drive belt tensioner to loose side using wrench then remove drive belt.



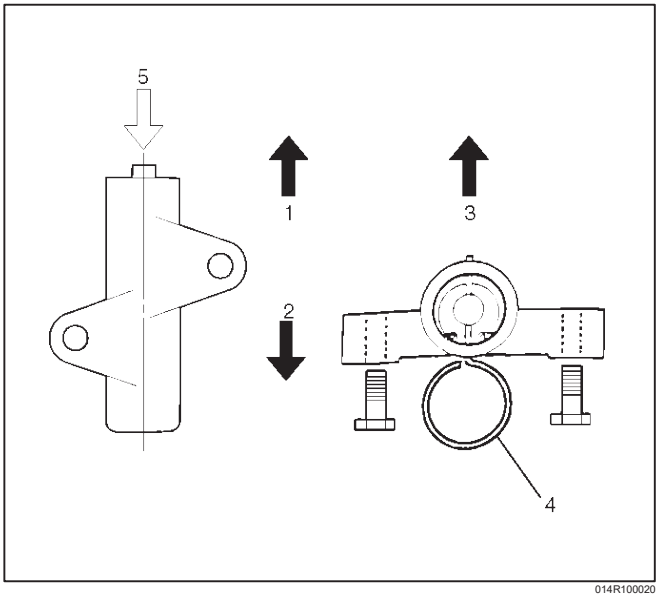

850RW001

**Legend**

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

5. Remove cooling fan assembly four nuts, then the cooling fan assembly.
6. Remove cooling fan drive pulley assembly.
7. Remove idle pulley assembly.
8. Remove serpentine belt tensioner assembly.
9. Remove power steering pump assembly.
10. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley remove center bolt, then the pulley.
11. Remove right side timing belt cover then left side timing belt cover.
12. Remove lower timing belt cover
13. Remove pusher.

**CAUTION: The pusher prevents air from entering the oil chamber. Its rod must always be facing upward.**




014R100020

**Legend**

(1) Up Side
(2) Down Side
(3) Direction For Installation
(4) Locking Pin
(5) Apply a force of 980 N (220 lb) when compressing the pusher rod.

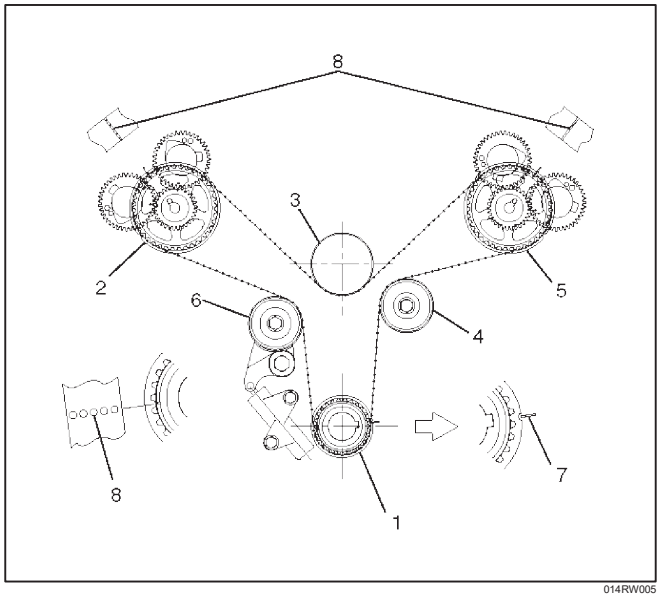
14. Remove timing belt.

**CAUTION:**

1. **Do not bend or twist the belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm (1.1811 in).**
2. **Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.**
3. **Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.**
4. **Store timing belt in a cool and dark place. Never expose the belt direct sunlight or heat.**

## Installation

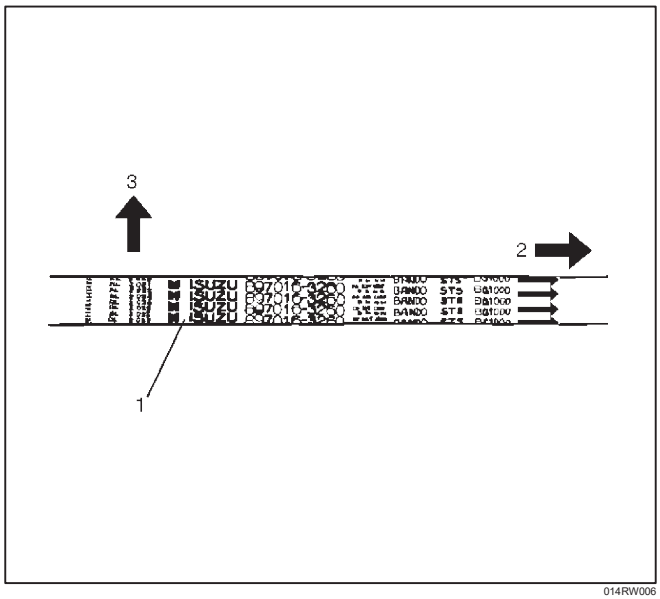
NOTE: For correct belt installation, the letter on the belt must be able to be read as viewed from the front of the vehicle.




014RW005

**Legend**

(1) Crankshaft Timing Pulley
(2) RH Bank Camshaft Drive Gear Pulley
(3) Water Pump Pulley
(4) Idle Pulley
(5) LH Bank Camshaft Drive Gear Pulley
(6) Tension Pulley
(7) Alignment Mark on Oil Pump.
(8) Alignment Mark on Timing Belt



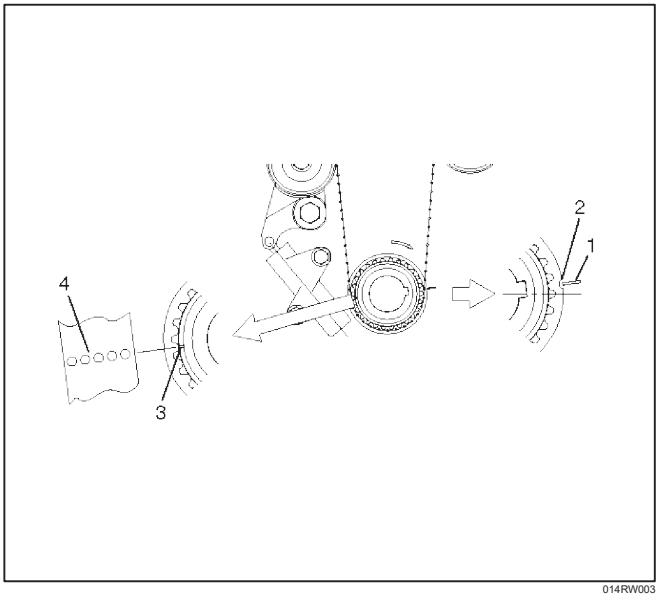

014RW006

**Legend**

(1) Timing Belt
(2) Engine Rotation Direction
(3) Cylinder Head Side

1. Install timing belt.
   1. Align groove of crankshaft timing pulley (2) with mark on oil pump (1).
      Align the mark on the crankshaft timing pulley (3) with alignment mark (white dotted line) on the timing belt (4).
      Secure the belt with a double clip or equivalent clip.

NOTE: When timing marks are aligned, No.2 piston will be on Top Dead Center.




014RW003

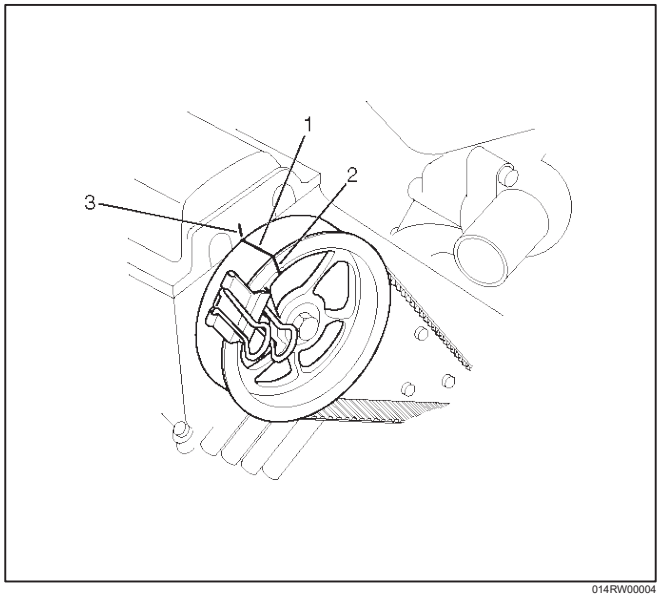
**Legend**

(1) Alignment Mark on Oil Pump
(2) Groove on Crankshaft Timing Pulley
(3) Alignment Mark on Crankshaft Timing Pulley
(4) Alignment Mark on Timing Belt

   2. Align the alignment mark on the RH bank camshaft drive pulley (2) to the alignment mark of the cylinder head cover RH (3).
      The camshaft pulley is not 1:1 with the camshafts. It is necessary to rotate the camshaft pulley until the camshaft lobes are in the position as shown in the diagram on page 6A–34.
      The camshaft pulley alignment mark should also align with alignment mark on the cylinder head cover.
      It may require up to four revolutions of the camshaft pulley to achieve alignment of all marks.

3. Align the alignment mark (white line) on the timing belt (1) with alignment mark on the RH bank camshaft drive pulley (2) (on the left side as viewed from the front of the vehicle) and put the timing belt on the camshaft drive pulley.

   Secure the belt with a double clip or equivalent clip.




014RW00004

**Legend**

(1) Alignment Mark on Timing Belt (White line).
(2) Alignment Mark on Camshaft Drive Pulley.
(3) Alignment Mark on Cylinder Head Cover RH.

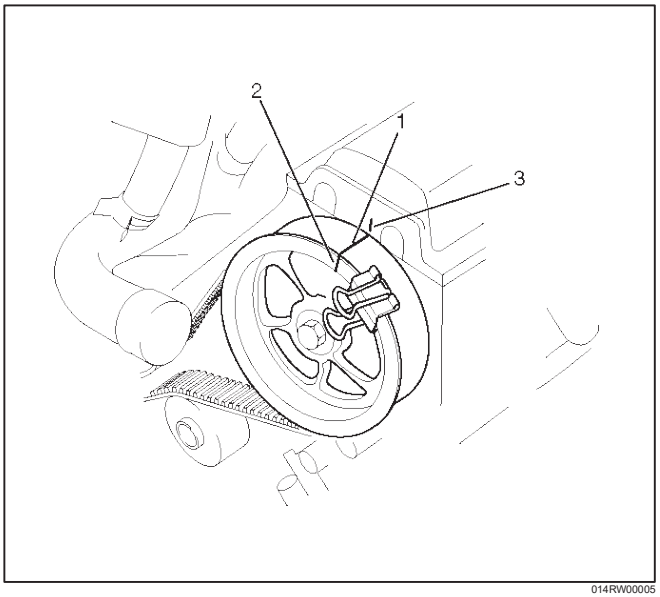
4. Align the alignment mark on the LH bank camshaft drive pulley (2) to the alignment mark of the cylinder head cover LH (3).

   The camshaft pulley is not 1:1 with the camshafts. It is necessary to rotate the camshaft pulley until the camshaft lobes are in the position as shown in the diagram on page 6A–34.
   The camshaft pulley alignment mark should also align with alignment mark on the cylinder head cover.
   It may require up to four revolutions of the camshaft pulley to achieve alignment of all marks.

5. Align the alignment mark (white line) on the timing belt (1) with the alignment mark on the LH bank camshaft drive pulley (2).

   When aligning the timing marks, use a wrench to turn the camshaft drive pulley, then set the timing mark between timing belt and camshaft drive pulley and put the timing belt on the camshaft drive pulley.
   Secure the belt with a double clip or equivalent clip.

NOTE: It is recommended for easy installation that the belt be secured with a double clip or equivalent clips after it is installed to each pulley.




014RW00005

**Legend**

(1) Alignment Mark on Timing Belt (White line).
(2) Alignment Mark on Camshaft Drive Pulley.
(3) Alignment Mark on Cylinder Head Cover LH.

6. Install crankshaft pulley temporarily and tighten center bolt by hand (do not use a wrench).

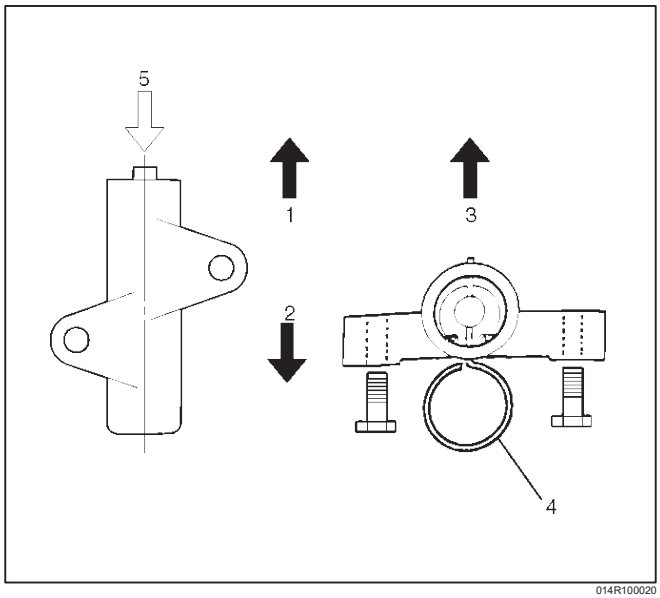
   Turn the crankshaft pulley clockwise to give some belt slack between the crankshaft timing pulley and the RH bank camshaft drive pulley.

2. Install pusher and tighten bolt to the specified torque.

   **Torque : 25 N·m (2.5 kg·m/18 lb ft)**

   1. Install the pusher while pushing the tension pulley to the belt.
   2. Pull out pin from the pusher.

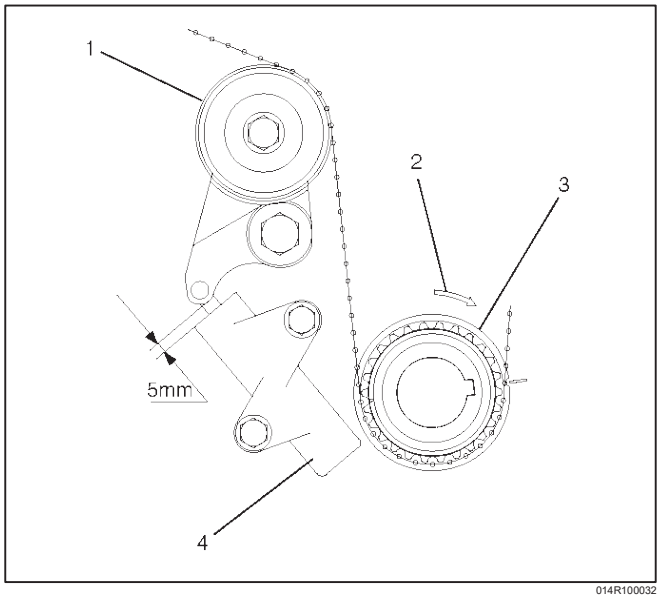
NOTE: When reusing the pusher, press the pusher with approximately 100Kg to retract the rod, and insert a pin (1.4 mm (0.055 in) piano wire).



014R100020

**Legend**
(1) Up Side
(2) Down Side
(3) Direction for Installation
(4) Locking Pin
(5) Apply a force of 980 N (220 lb) when compressing the pusher rod.

After release the push rod from the locking pin, the rod projection is approximate 5 mm (0.1969 in).



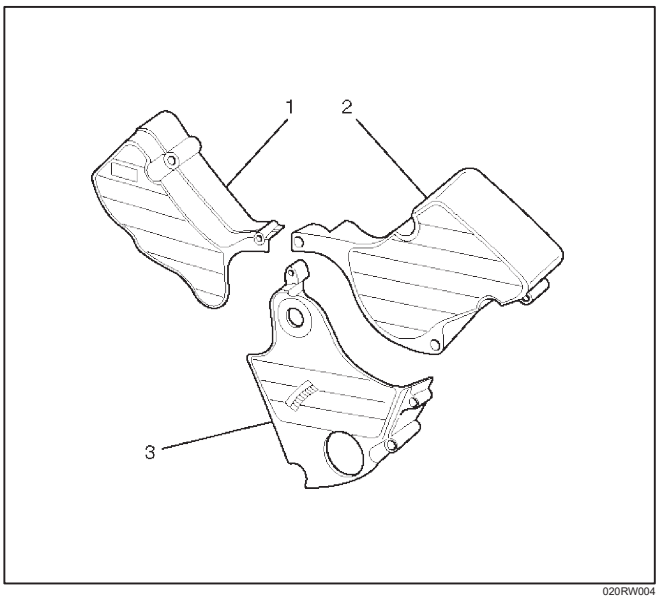
014R100032

**Legend**
(1) Tensioner Pulley
(2) Crankshaft Pulley Rotation Direction
(3) Crankshaft Pulley
(4) Pusher Assembly

3. Remove double clips or equivalent clips from timing belt pulleys.
   Turn the crankshaft pulley by six turns and check for timing mark alignment.

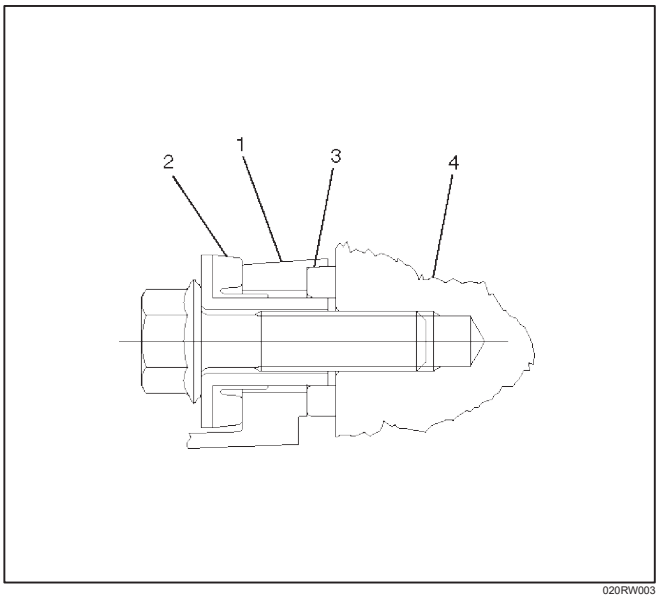
3. Install timing belt cover.
   Remove crankshaft pulley that was installed in step 1 item 5.
   Tighten bolts to the specified torque.

**Torque: 19 N·m (14 lb ft)**



020RW004

**Legend**
(1) Timing Belt Cover RH
(2) Timing Belt Cover LH
(3) Timing Belt Cover Lower



020RW003

**Legend**
(1) Timing Belt Cover
(2) Rubber Bushing
(3) Sealing Rubber
(4) Cylinder Body

4. Install crankshaft pulley using J-8614-01, hold the crankshaft pulley and tighten center bolt to the specified torque.

**Torque : 167 N·m (123 lb ft)**

5. Install fan pulley bracket and tighten fixing bolts to the specified torque.

   **Torque : 22 N·m (16 lb ft)**

6. Install power steering pump assembly and tighten to the specified torque.

   **Torque :**

   **M8 bolt : 22 N·m (16 lb ft)**

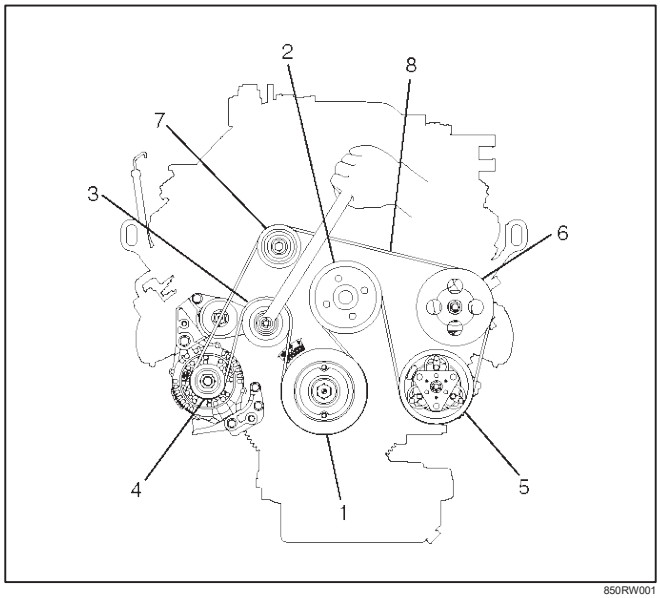
   **M10 bolt : 46 N·m (34 lb ft)**

7. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   **Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.**

   **Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.**

8. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.




850RW001

**Legend**

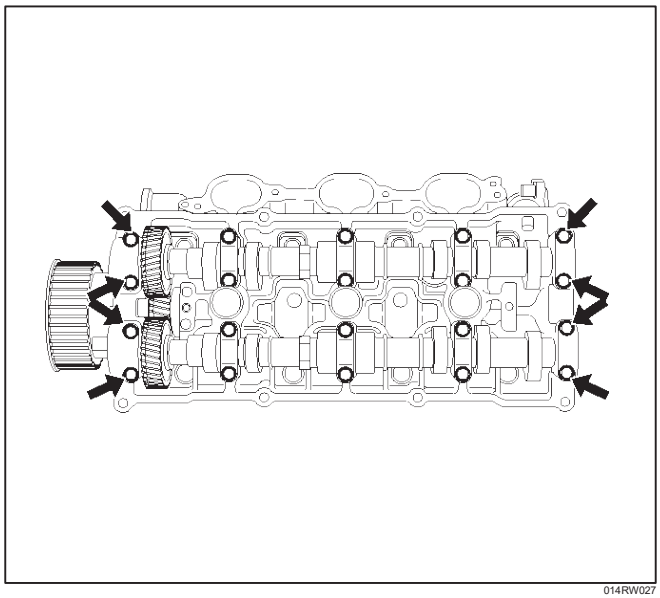
(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

9. Install radiator upper fan shroud.
10. Install air cleaner assembly.

# Camshaft

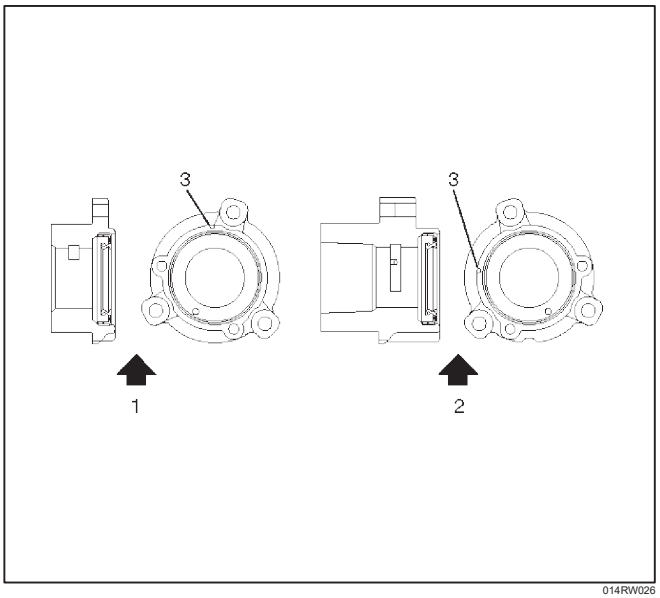
## Removal

1. Disconnect battery ground cable.
2. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
3. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
4. Remove cylinder head cover LH.
   - Refer to removal procedure for Cylinder Head Cover LH in this manual.
5. Remove cylinder head cover RH.
   - Refer to removal procedure for Cylinder Head Cover RH in this manual.
6. Remove twenty fixing bolts from inlet and exhaust camshaft bearing cap on one side bank, then camshaft bearing cap.



014RW027

7. Remove camshaft assembly.
8. Remove fixing bolt for camshaft drive gear pulley.
9. Remove three fixing bolts from camshaft drive gear retainer, then camshaft drive gear assembly.




014RW026

**Legend**

(1) Right Bank
(2) Left Bank
(3) Timing Mark on Retainer

## Installation

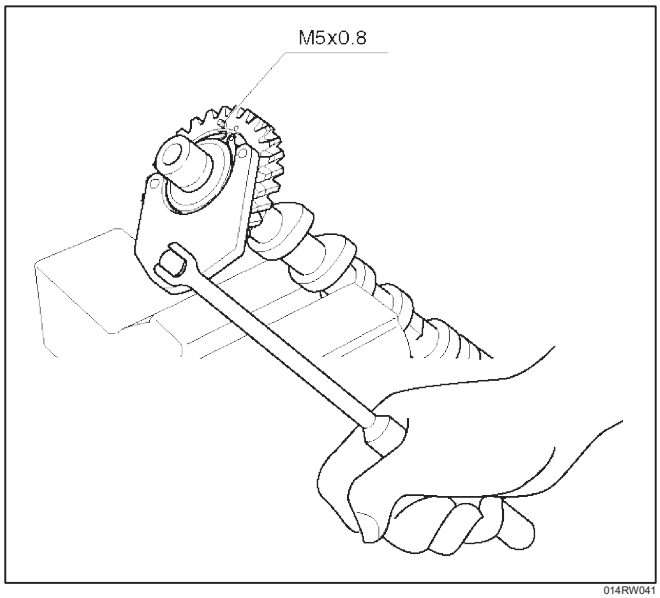
1. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

   **Torque : 10 N·m (87 lb in)**

2. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

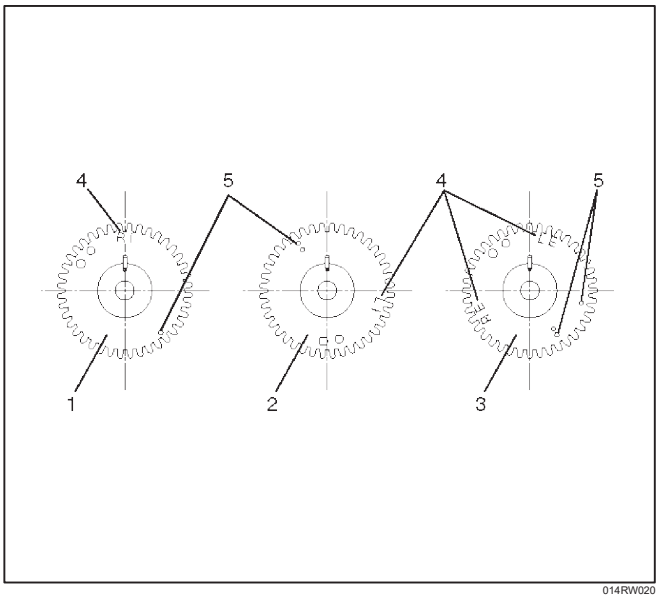
   **Torque : 98 N·m (72 lb ft)**

3. Tighten sub gear setting bolt.
   1. Use J-42686 to turn sub gear to right direction until it aligns with the M5 bolt hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.



014RW041

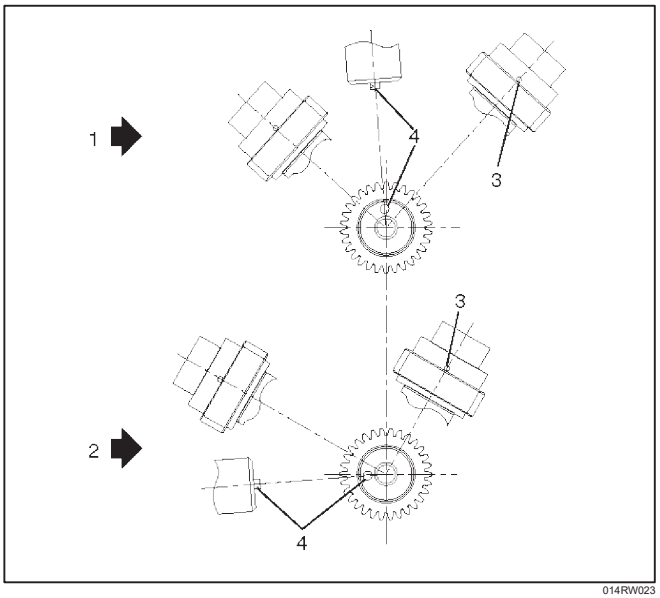
4. Install camshaft assembly and camshaft bearing caps, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing caps.
   2. Align timing mark on intake camshaft (one dot for right bank, two dot for left bank) and exhaust camshaft (one dots for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

**Legend**

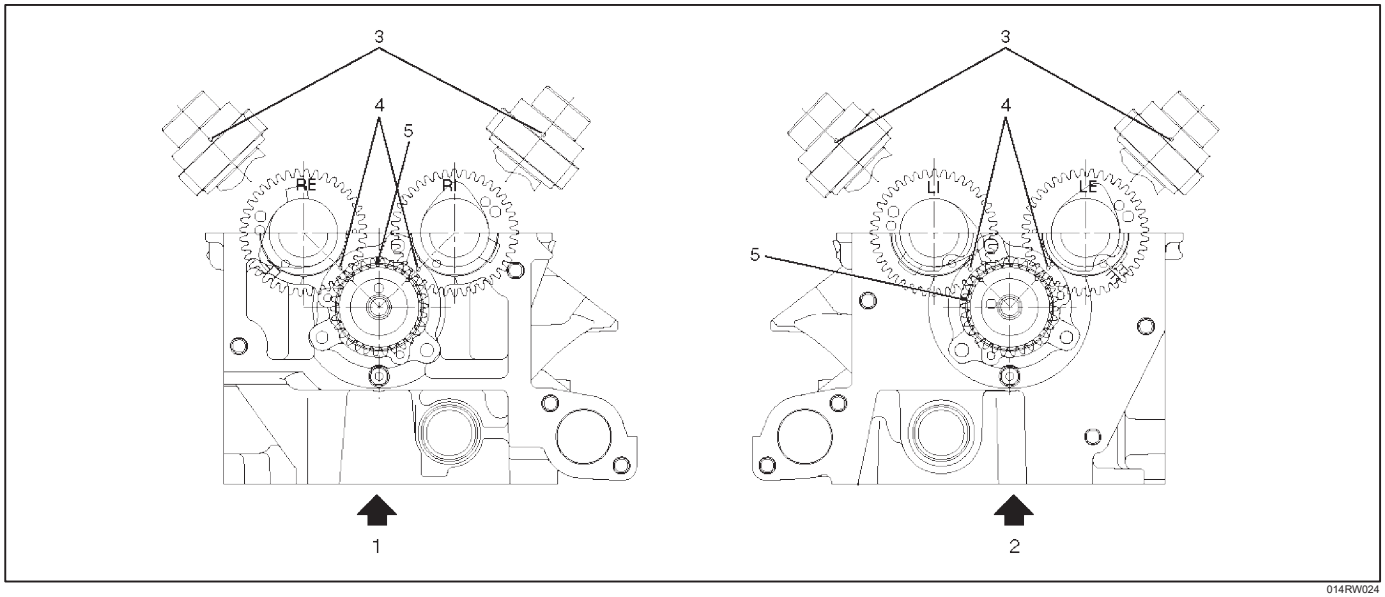
(1) Intake Camshaft Timing Gear for Right Bank
(2) Intake Camshaft Timing Gear for Left Bank
(3) Exhaust Camshaft Timing Gear
(4) Discrimination Mark
(LI: Left bank intake, RI: Right bank intake)
(LE: Left bank exhaust, RE: Right bank exhaust)



014RW023

**Legend**

(1) Right Bank Camshaft Drive Gear
(2) Left Bank Camshaft Drive Gear
(3) Timing Mark on Drive Gear
(4) Dowel Pin



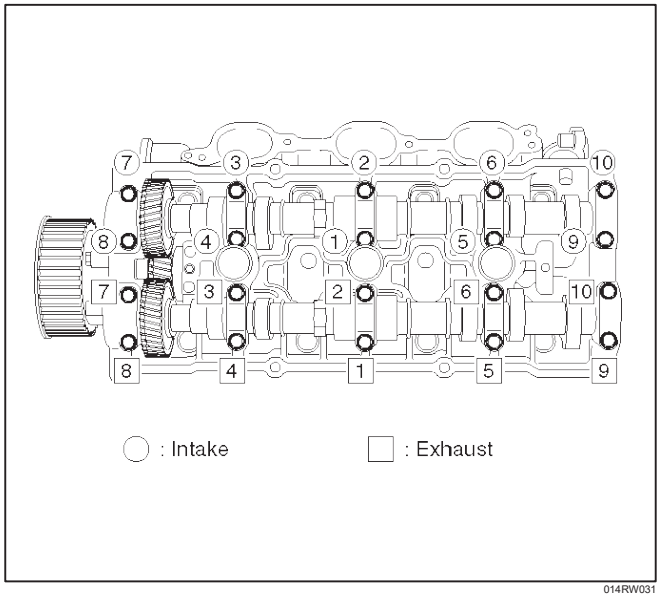

014RW024

**Legend**

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts on numerical order an one side bank as shown in the illustration.

**Torque : 10 N·m (87 lb in)**



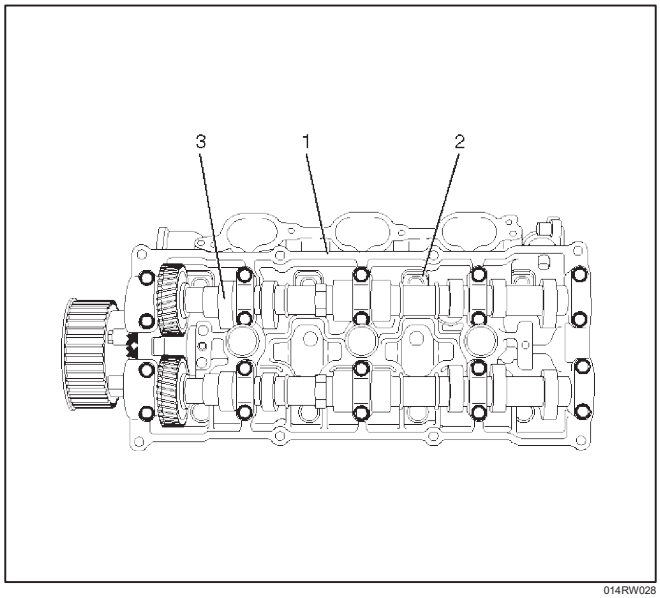

014RW031

5. Install cylinder head cover RH.
   - Refer to installation procedure for CYLINDER HEAD COVER RH in this manual.
6. Install cylinder head cover LH.
   - Refer to installation procedure for CYLINDER HEAD COVER LH in this manual.
7. Install timing belt.
   - Refer to installation procedure for TIMING BELT in this manual.
8. Install crankshaft pulley.
   - Refer to installation procedure for CRANKSHAFT PULLEY in this manual.

# Cylinder Head

## Removal

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Drain radiator coolant.
4. Drain engine oil.
5. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
6. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
7. Remove cylinder head cover LH.
   - Refer to removal procedure for Cylinder Head Cover LH in this manual.
8. Remove cylinder head cover RH.
   - Refer to removal procedure for Cylinder Head Cover RH in this manual.
9. Remove common chamber.
   - Refer to removal procedure for Common Chamber in this manual.
10. Remove cylinder head assembly.
    1. Loosen head bolts in reverse of tightening sequence.
    2. Remove cylinder head assembly.




014RW028

**Legend**

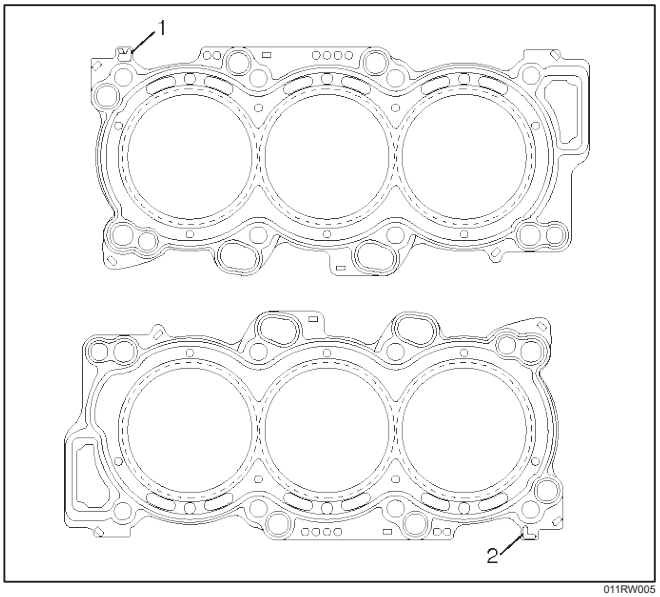
(1) Cylinder Head
(2) Cylinder Head Bolt
(3) Camshaft

## Installation

1. Install cylinder head assembly to cylinder block.
   A. Put cylinder head gasket on the cylinder block.

NOTE: There is discrimination mark “R” for right bank and “L” for left bank on the cylinder head gasket as shown in the illustration.

Do not reuse cylinder head gasket.

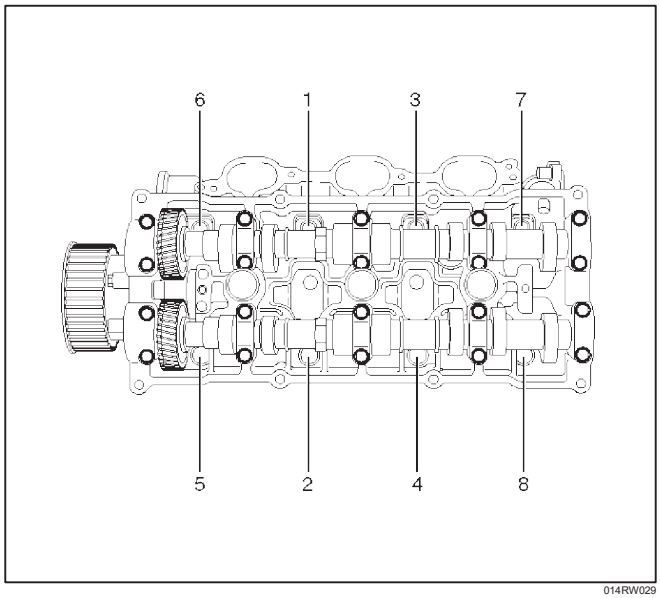



011RW005

B. Align dowel pin hole to dowel pin on the cylinder block.
C. Position cylinder head on the cylinder block.
D. Tighten two bolts temporarily by hand to prevent the cylinder head assembly from moving.
E. Using J-24239-01 cylinder head bolt wrench, tighten bolts in numerical order as shown in the illustration to the specified torque.

NOTE: Do not reuse cylinder head bolts.
Do not apply any lubricant to the cylinder head bolts.

**Torque :**
**Temporary : 29 N·m (22 lb ft)**
**Final : 64 N·m (47 lb ft)**



014RW029

2. Install common chamber.
   - Refer to installation procedure for Common Chamber in this manual.
3. Install cylinder head cover RH.
   - Refer to installation procedure for Cylinder Head Cover RH in this manual.
4. Install cylinder head cover LH.
   - Refer to installation procedure for Cylinder Head Cover LH in this manual.
5. Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   - Refer to installation procedure for Crankshaft Pulley in this manual.

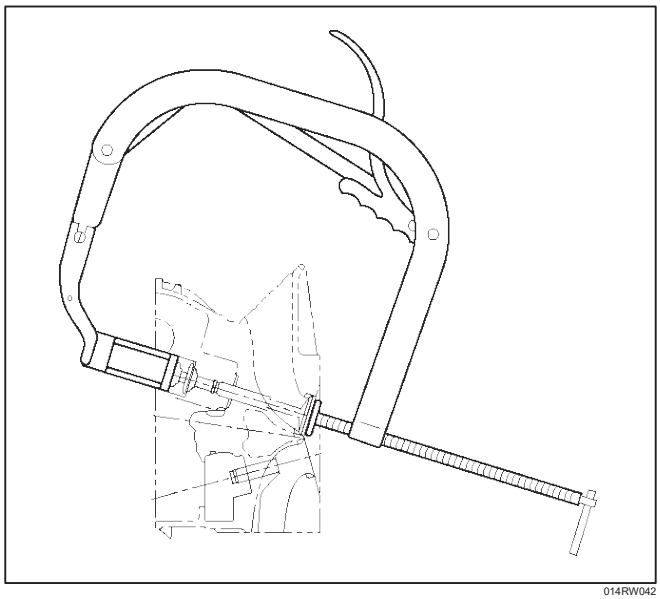
# Valve Stem Oil Controller , Valve Spring and Valve Guide

## Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
   - Drain engine coolant.
3. Remove cylinder head assembly.
   - Refer to removal procedure for Cylinder Head in this manual.
4. Remove camshaft.
   - Refer to removal procedure for Camshaft in this manual.
5. Remove tappets with shim.

NOTE: Do not damage shim surface.

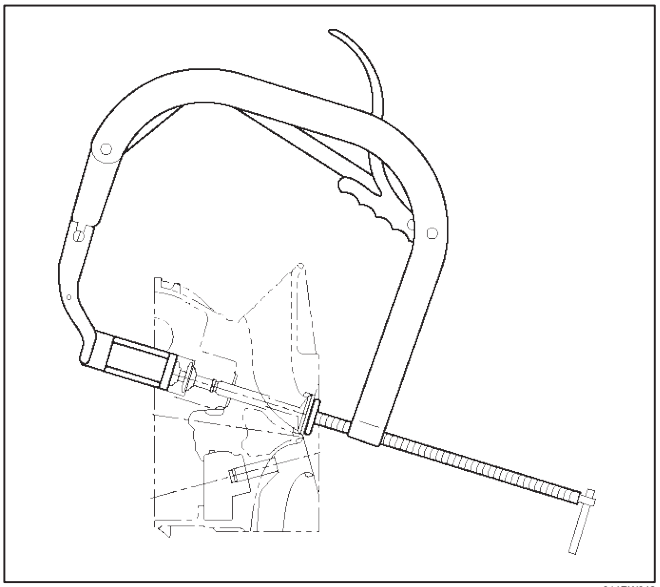
6. Remove valve springs using J-8062 valve spring compressor and J-42898 valve spring compressor adapter then remove upper valve spring seat and lower seat.




7. Remove oil controller using J-37281 oil controller remover, remove each valve stem oil controller.
8. Remove valve guide using J-37985 valve guide replacer.

## Installation

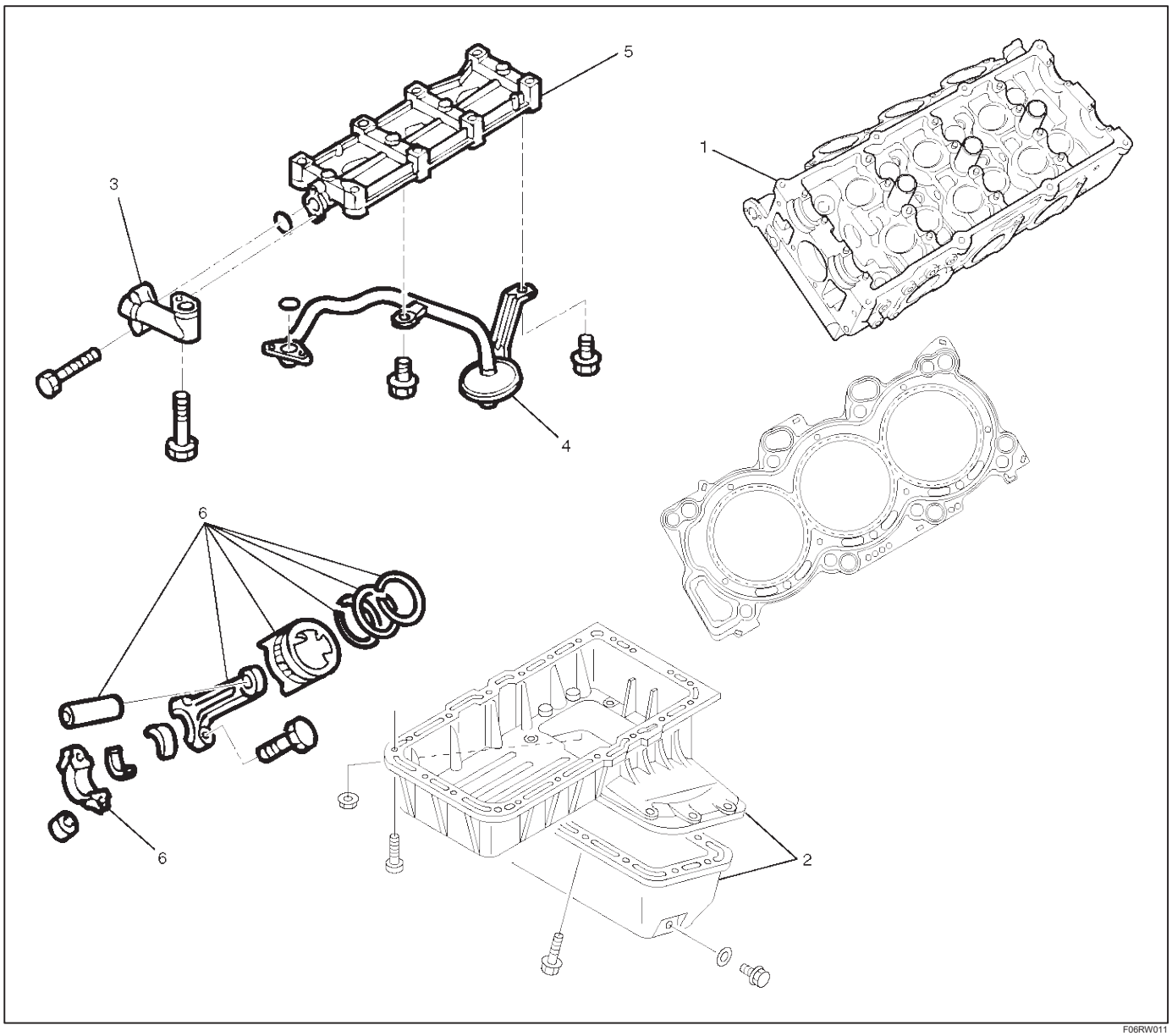
1. Install valve guide using J-42899 valve guide installer.
2. Install oil controller using J-38537 oil controller installer.
3. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using J-8062 valve spring compressor and J-42898 valve spring compressor adapter to install the split collars.




4. Install tappet with shim.
5. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.
6. Install cylinder head assembly.
   - Refer to installation procedure for Cylinder Head in this manual.
7. Fill engine oil until full level.
8. Fill engine coolant.

# Piston, Piston Ring and Connecting Rod

## Removal



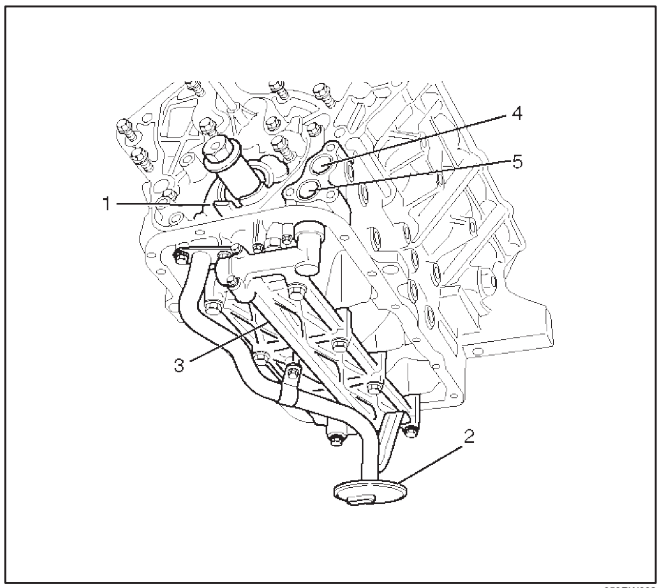

F06RW011

**Legend**

(1) Cylinder Head
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Gallery
(6) Piston with Connecting Rod Assembly

1. Remove cylinder head assembly.
   - Refer to removal procedure for Cylinder Head in this manual.
2. Remove crankcase with oil pan.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.

3. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.



050RW002

**Legend**
(1) Oil Pump
(2) Oil Strainer
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

4. Remove three fixing bolts, oil pipe with O-ring.
5. Remove eight fixing bolts, oil gallery.
6. Remove piston with connecting rod assembly. (before removing the bearing cap, remove carbon on the top of cylinder bore and push piston with connecting rod out from the top of cylinder bore.)

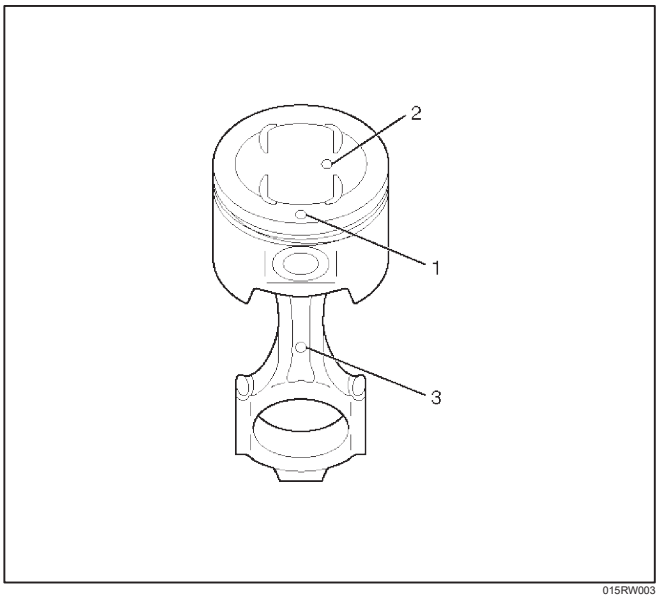
## Installation

1. Install piston with connecting rod assembly.
   - Apply engine oil to cylinder bore, connecting rod bearing and crank pin.
     When installing the piston, its front mark must face the engine front side.
   - The bearing cap number must be the same as connecting rod number.
   - Apply engine oil to the thread and seating surface of each nut.
   - Tighten nuts to the specified torque.

   **Torque : 54 N·m (40 lb ft)**

   - After tightening the nuts, make sure that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces and connecting rod bearing fitting surfaces.

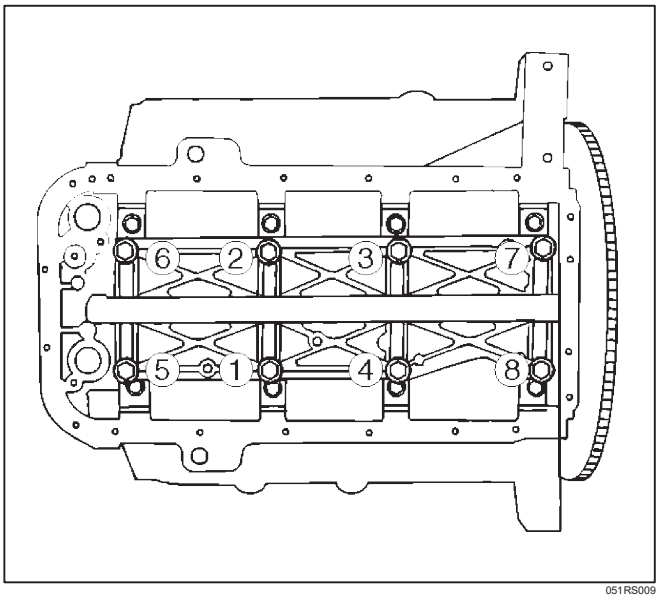


015RW003

**Legend**
(1) Piston Front Mark
(2) Piston Grade
(3) Connecting Rod Front Mark

2. Install oil gallery and tighten the bolts in two steps, in the order shown in illustration.

   **Torque :**
   **1st step : 29 N·m (22 lb ft)**
   **2nd step : 55°–65°**



051RS009

3. Install oil pipe with O-ring.

   **Torque : 10 N·m (87 lb in)**

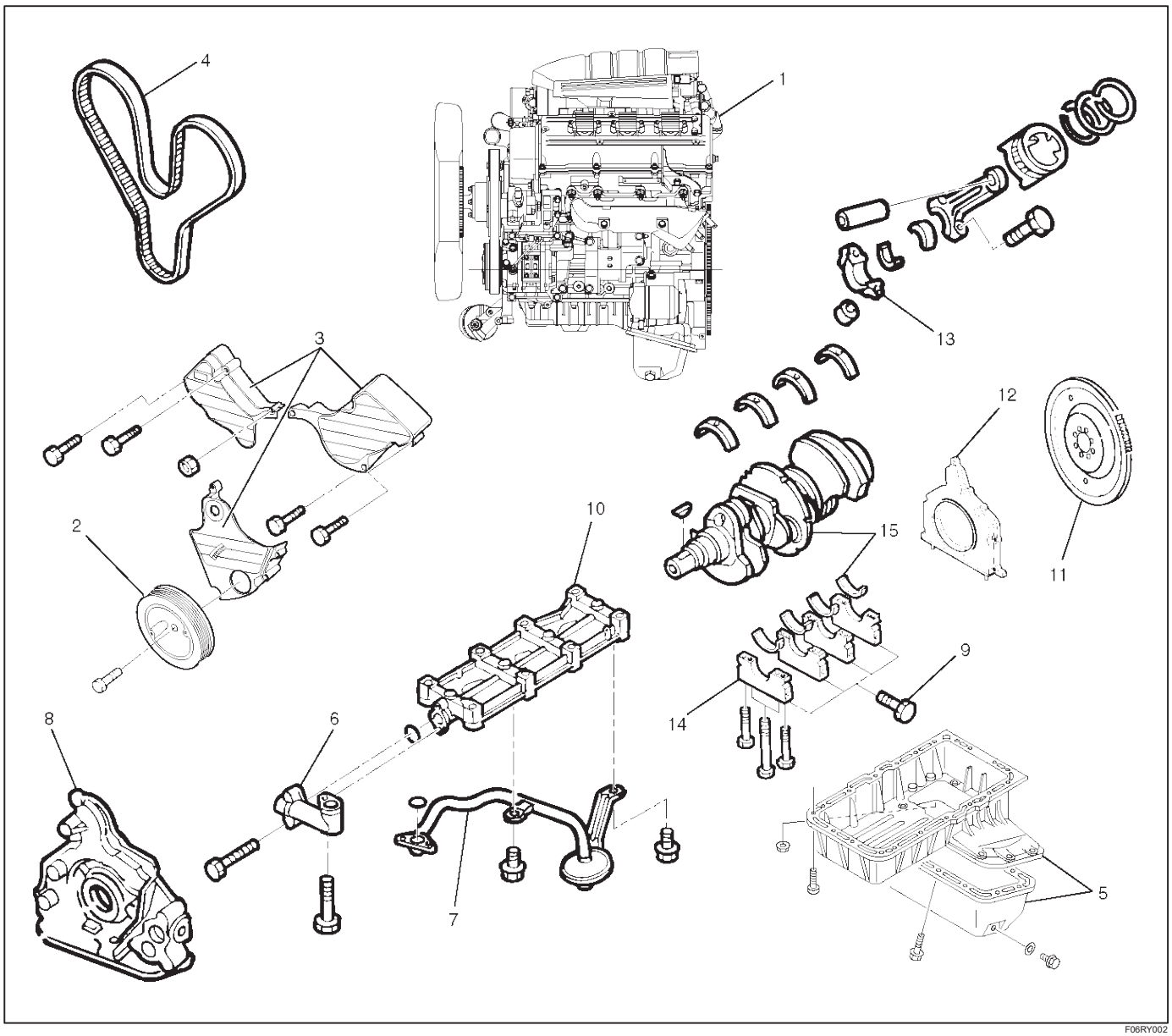
4. Install oil strainer assembly with O-ring.

   **Torque : 25 N·m (18 lb ft)**

5. Install crankcase with oil pan.
   - Refer to installation procedure for Oil Pan and Crankcase in this manual.
6. Install cylinder head assembly.
   - Refer to installation procedure for Cylinder Head in this manual.

# Crankshaft and Main Bearings

## Removal




F06RY002

**Legend**

(1) Engine Assembly
(2) Crankshaft Pulley
(3) Timing Belt Cover
(4) Timing Belt
(5) Crankcase with Oil Pan
(6) Oil Pipe
(7) Oil Strainer
(8) Oil Pump Assembly
(9) Cylinder Body Side Bolt
(10) Oil Gallery
(11) Flywheel
(12) Rear Oil Seal Retainer
(13) Connecting Rod Cap
(14) Crankshaft Main Bearing Cap
(15) Crankshaft and Main Bearing

1. Remove engine assembly.
   - Refer to removal procedure for Engine Assembly in this manual.
2. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
3. Remove oil pan and crankcase.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove oil pipe with O-ring.
5. Remove oil strainer assembly with O-ring.

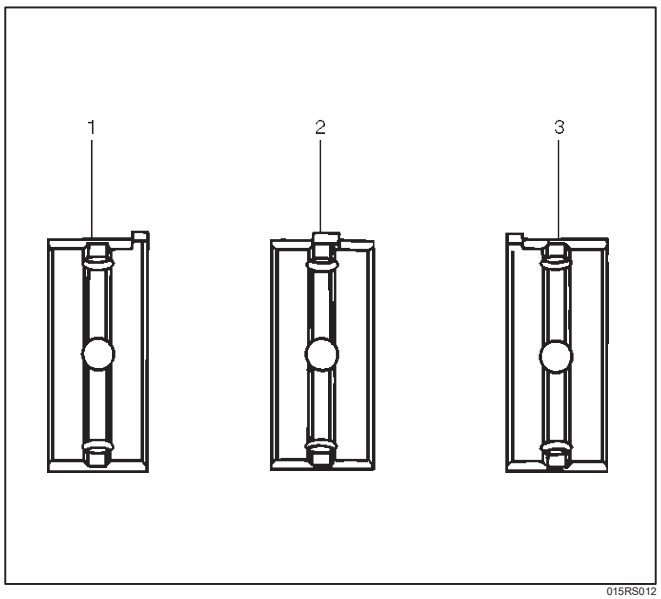
6. Remove oil pump assembly.
   - Refer to removal procedure for Oil Pump in this manual.
7. Remove cylinder body side bolts.
8. Remove oil gallery.
9. Remove flywheel.
10. Remove rear oil seal retainer.
    - Refer to removal procedure for Rear Oil Seal in this manual.
11. Remove connecting rod caps.
12. Remove crankshaft main bearing caps.
13. Remove crankshaft and main bearings.

## Installation

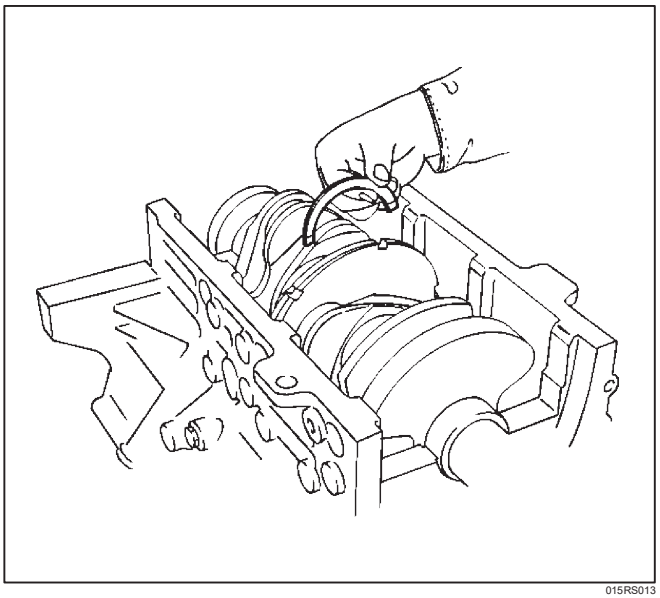
1. Install crankshaft and main bearings.
   - Install main bearing in the cylinder block and main bearing cap respectively.
     Apply new engine oil to upper and lower main bearings.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Make sure that main bearings are in correct position.
- Install crankshaft with care.
- Apply engine oil to the thrust washer.
- Install thrust washer on No.3 journal.
- Oil grooves in thrust washer must face the crankshaft.



015RS012


015RS013

2. Install crankshaft main bearing caps.
   - Apply engine oil to the thread and seating surface of each bearing cap fixing bolt.

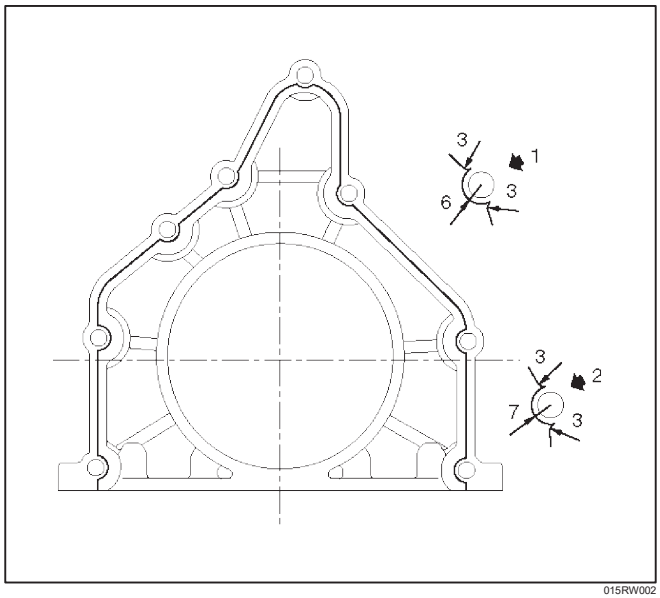
NOTE:

- Do not apply engine oil to the bearing back faces.
- Install bearing caps, starting with cylinder block front side.
- Tighten main bearing fixing bolts to the specified torque.

  **Torque : 39 N·m (29 lb ft)**
- After tightening the bolts, make sure that the crankshaft rotates smoothly.

3. Install connecting rod caps.
   - The cap number must be same as connecting rod number.
   - Apply engine oil to the thread and seating surface of each nut.
   - Tighten nuts to the specified torque.

   **Torque : 54 N·m (40 lb ft)**
   - After tightening the nuts, make sure that the crankshaft rotates smoothly.
4. Install rear oil seal retainer.
   - Remove oil on cylinder block and retainer fitting surface.
   - Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   - The oil seal retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

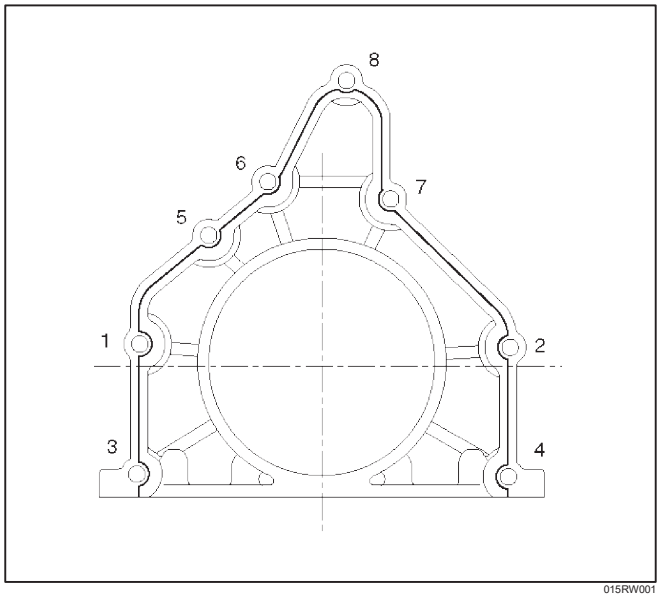


015RW002

**Legend**
(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

**Torque : 18 N·m (13 lb ft)**

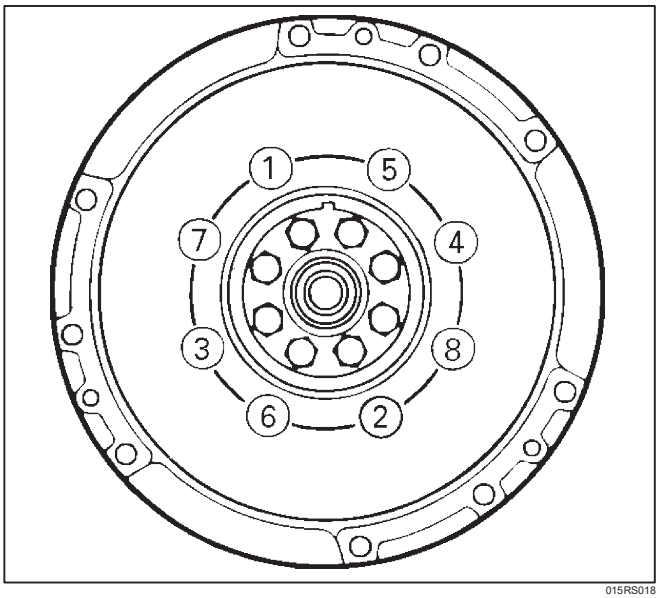


015RW001

5. Install flywheel.
   - Clean tapped holes in the crankshaft.
   - Remove oil on crankshaft and flywheel fitting surface.

NOTE:
- Do not reuse the bolts.
- Do not apply oil or thread lock to the bolts.
- Tighten fixing bolts to the specified torque.

**Torque : 54 N·m (40 lb ft)**



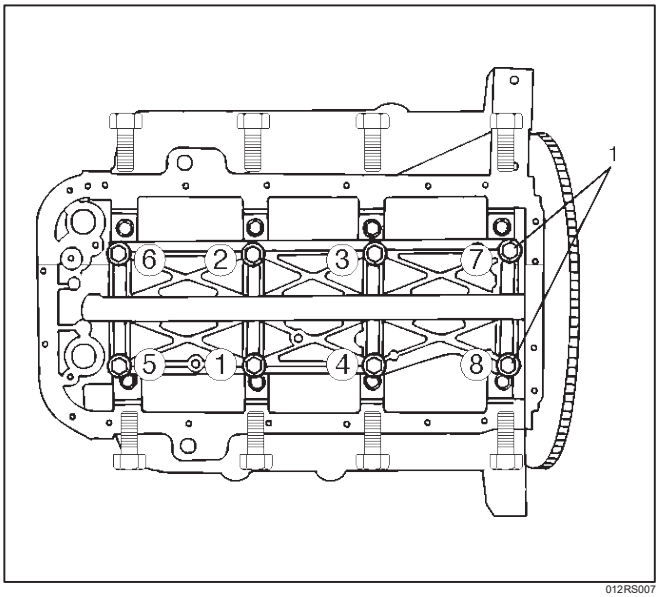
015RS018

6. Install oil gallery.
   - Clean contact surface of oil gallery and main bearing cap.
     Apply engine oil to oil gallery fixing bolts and tighten the bolts in two steps, in the order shown.

   **Torque :**
   **1st step : 29 N·m (22 lb ft)**
   **2nd step : 55˚–65˚**
7. Install cylinder body side bolts and tighten bolts in order to the specified torque.

   **Torque : 39 N·m (29 lb ft)**

NOTE: Do not apply the oil to the bolts.

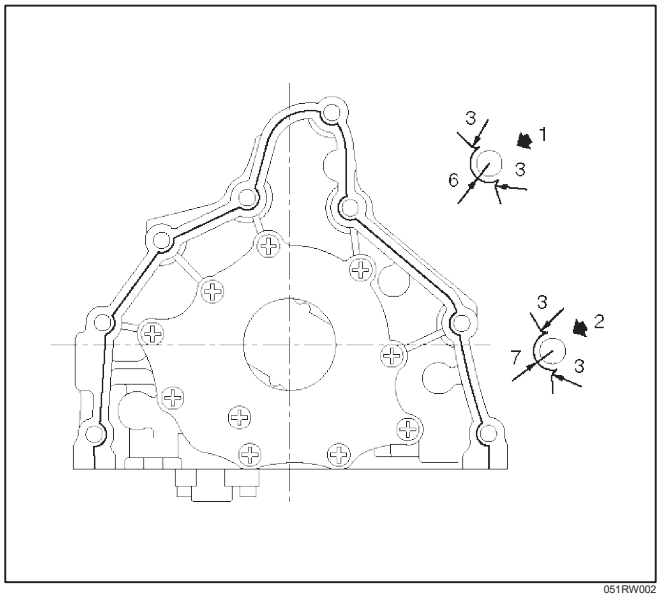


012RS007

8. Install oil pump assembly.
   - Remove oil on cylinder block and oil pump mounting surface.
   - Apply sealant (TB1207B or equivalent) to the oil pump mounting surface.
   - The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

- Apply engine oil to oil seal lip.
- Install oil pump in the cylinder block and tighten fixing bolts to the specified torque.

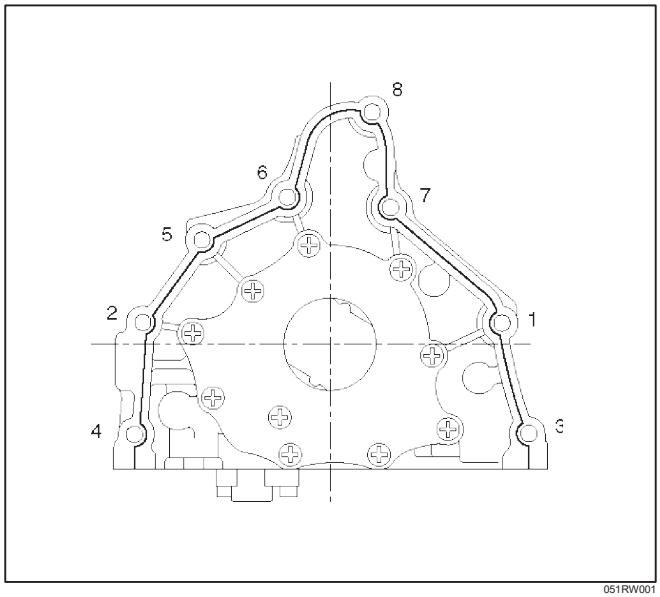
**Torque : 25 N·m (18 lb ft)**




051RW002

**Legend**

(1) Around Bolt Holes
(2) Around Dowel Pin




051RW001

9. Install oil strainer with O-ring, tighten to the specified torque.

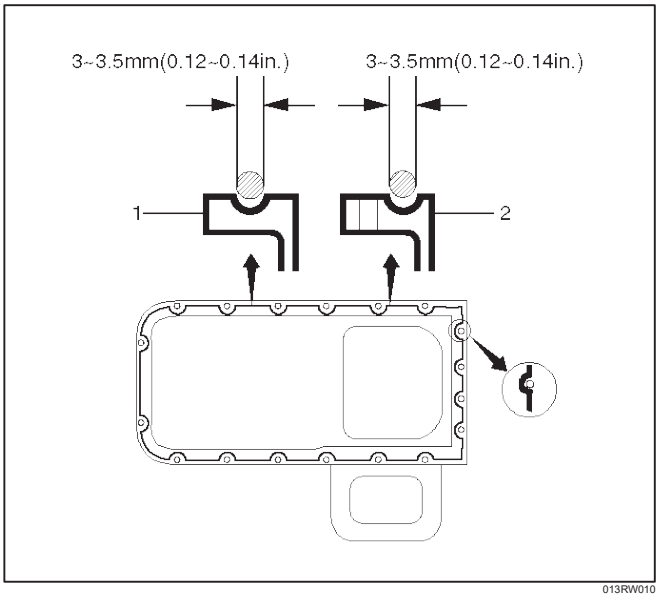
**Torque : 25 N·m (18 lb ft)**

10. Install oil pipe with O-ring, tighten fixing bolts to the specified torque.

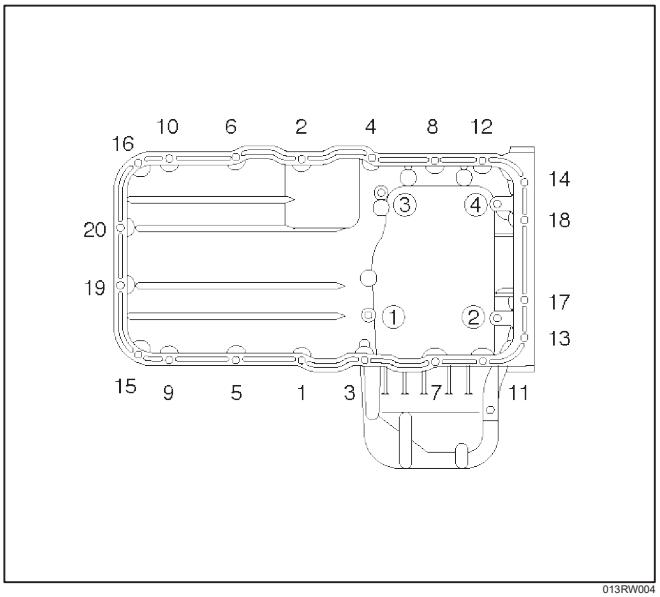
**Torque : 25 N·m (18 lb ft)**

11. Install crankcase.
    - Remove oil on crankcase mounting surface and dry the surface.
    - Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
    - The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    - Tighten fixing bolts to the specified torque.

**Torque : 10 N·m (87 lb in)**




013RW010

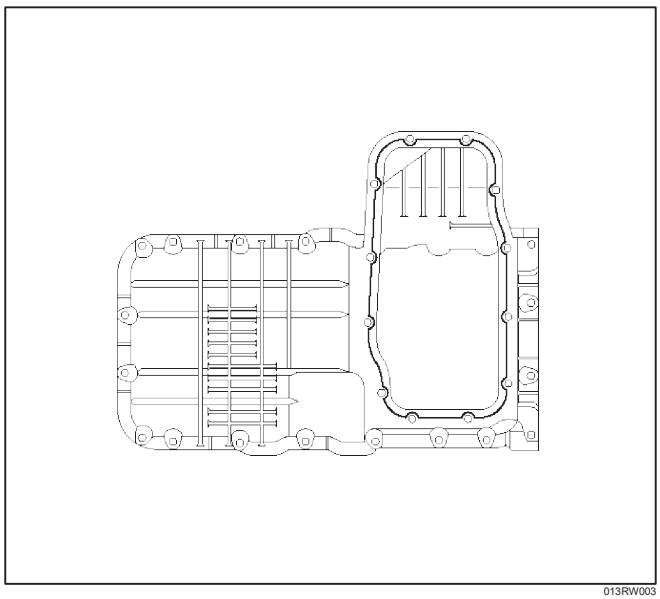



013RW004

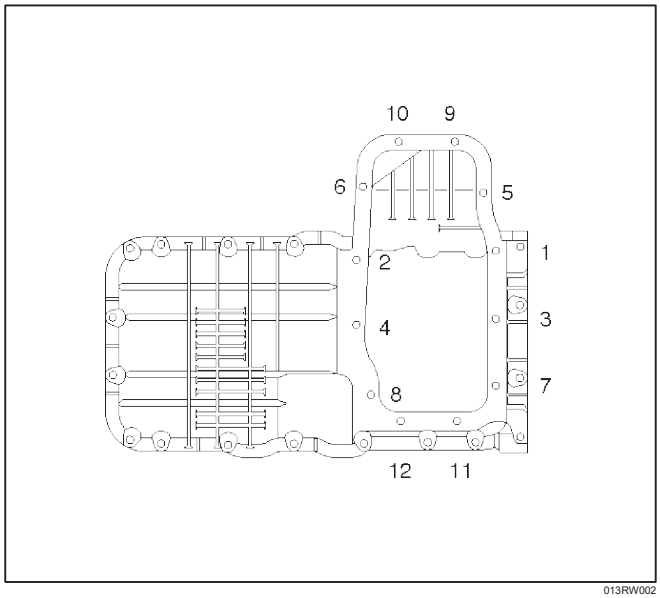
12. Install oil pan
    - Remove oil on oil pan mounting surface and dry the surface.
    - Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the oil pan mounting surface. The bead must be continuous.
    - The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

- Tighten fixing bolts to the specified torque.

**Torque : 25 N·m (18 lb ft)**



013RW003




013RW002

13. Install timing belt.
    - Refer to installation procedure for Timing Belt in this manual.
14. Install engine assembly.
    - Refer to installation procedure for Engine Assembly in this manual.

# Rear Oil Seal

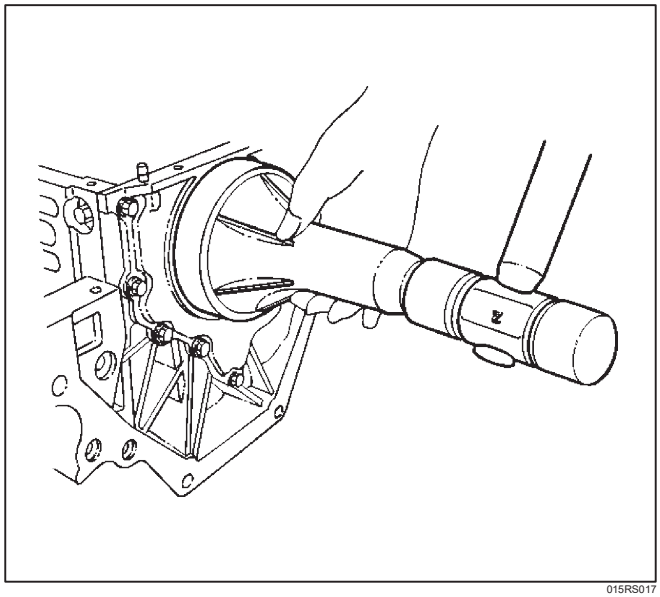
## Removal

1. Remove transmission assembly.
   - See Transmission section in this manual.
2. Remove flywheel.
3. Remove rear oil seal using a seal remover.

NOTE: Take care not to damage the crankshaft or oil seal retainer when removing oil seal.

## Installation

1. Apply engine oil to oil seal lip and install oil seal using J-39201.

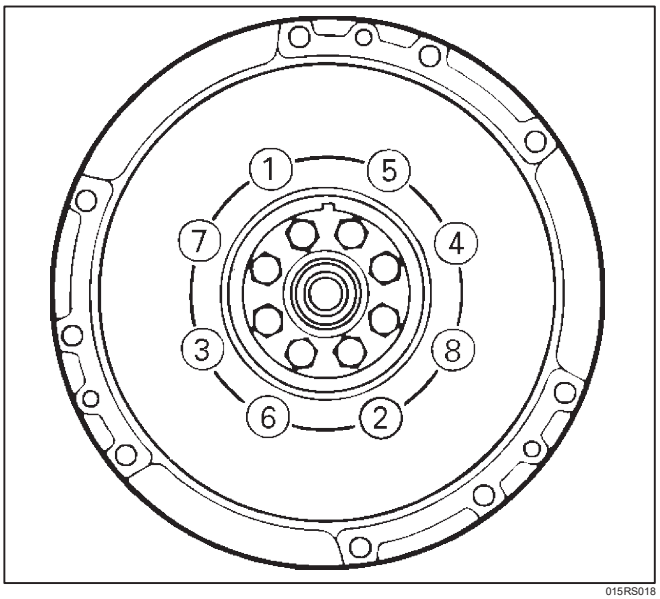


015RS017

2. Install flywheel.
   - Clean tapped holes in the crankshaft.
   - Remove oil on the crankshaft and flywheel mounting surface.
   - Tighten fixing bolts to the specified torque.

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

**Torque : 54 N·m (40 lb ft)**



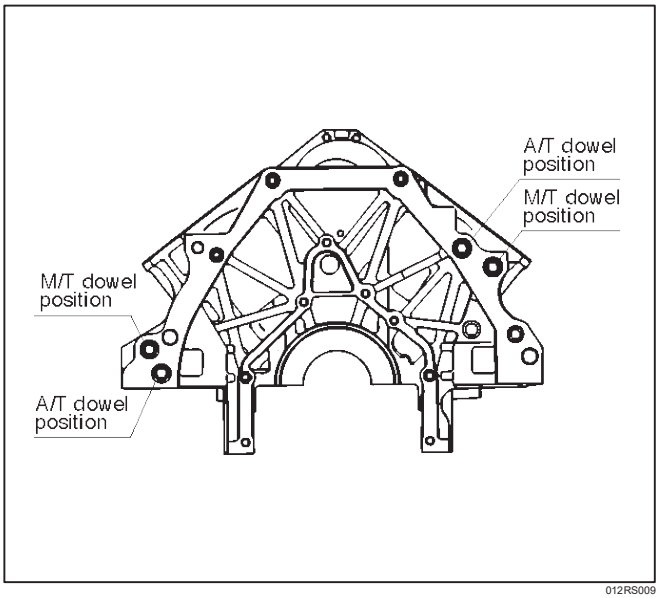

015RS018

3. Install transmission.
   - See Transmission section in this manual.

**CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.**

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

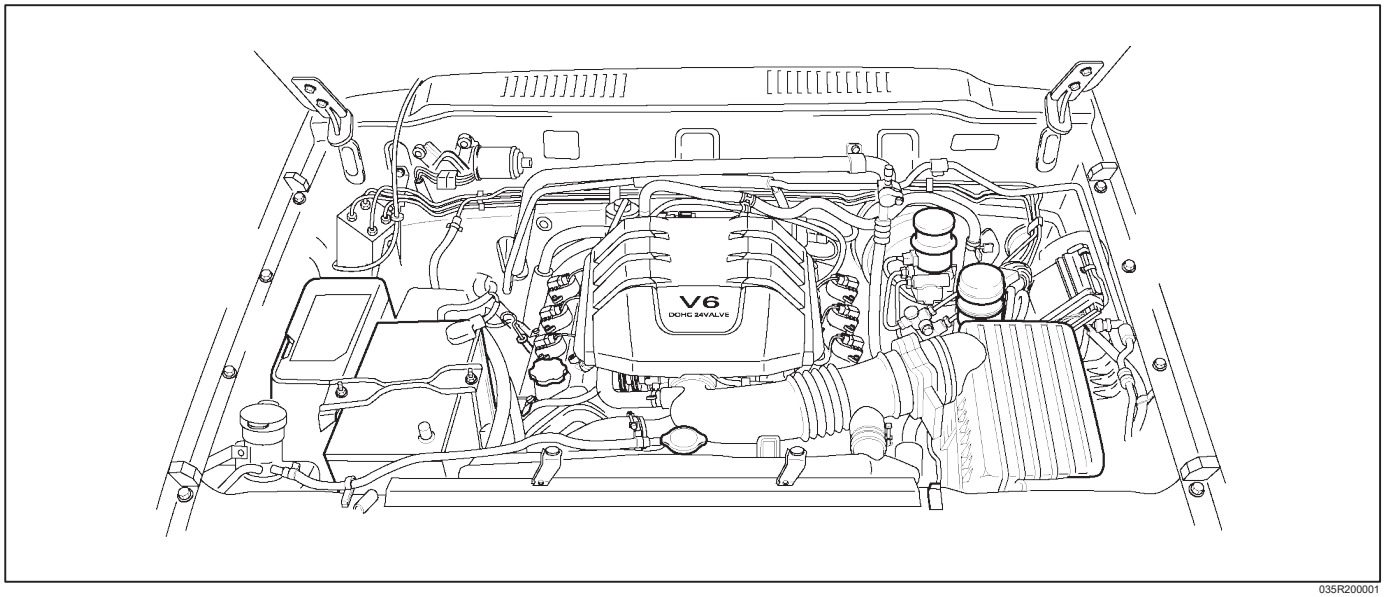
Otherwise, the transmission may be damaged.




012RS009

# Engine Assembly

## Removal




035R200001

1. Disconnect battery ground and positive cable.
2. Remove battery.
3. Make alignment mark on the engine hood and hinges before removal in order to return the hood to original position exactly.
4. Remove engine hood.
5. Drain radiator coolant.
6. Disconnect Ion sensing module harness connectors, and manifold absolute pressure sensor harness connectors from sensor on common chamber.
7. Disconnect throttle position sensor harness connectors from throttle body.
8. Disconnect air duct with air cleaner cover.
9. Remove air cleaner assembly.
10. Disconnect canister vacuum hose.
11. Disconnect vacuum booster hose.
12. Disconnect three engine harness connectors.
13. Disconnect harness connector to transmission (left front side of engine compartment), disconnect shift on the fly harness connector from front side of front axle and remove transmission harness bracket from engine left side.
14. Disconnect ground cable between engine and frame.
15. Disconnect bonding cable connector on the back of right dash panel.
16. Disconnect bonding cable terminal on the left bank.
17. Disconnect starter harness connector from starter.
18. Disconnect generator harness connector from generator.
19. Disconnect coolant reserve tank hose from radiator.
20. Remove radiator upper and lower hoses.
21. Remove upper fan shroud.
22. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
23. Move drive belt tensioner to loose side using wrench then remove drive belt.
24. Remove power steering pump fixing bolts, then power steering pump. Place the power steering pump along with piping on the body side.
25. Remove air conditioning compressor fixing bolts from bracket and place the compressor along with piping on the body side.
26. Remove four $O_2$ sensor harness connectors (two each bank) from exhaust front pipe.
27. Remove three exhaust pipe fixing nuts from each bank.
28. Remove two exhaust pipe fixing nuts from each exhaust pipe, then move exhaust pipe to rear side of vehicle.
29. Remove flywheel dust covers.
30. Disconnect two heater hoses from engine.
31. Disconnect fuel hoses from right side of transmission.

**CAUTION: Plug fuel pipes on engine side and fuel hoses from fuel tank.**

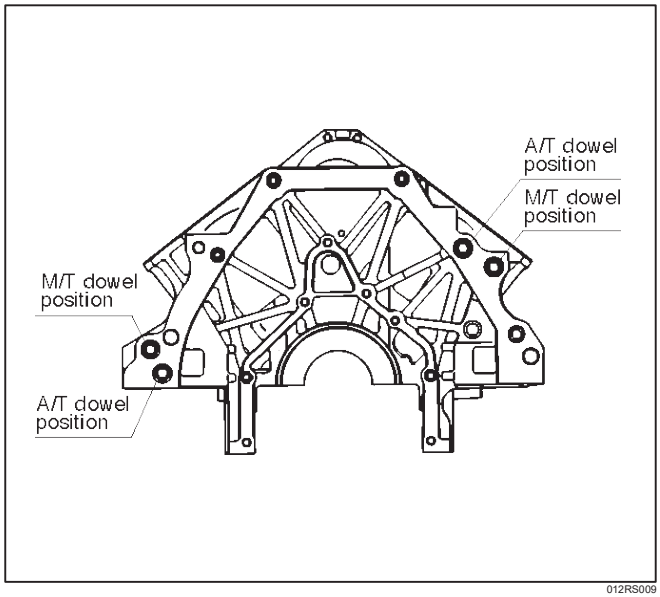
32. Remove transmission assembly. Refer to Transmission section in this manual.
33. Support the engine by engine hoist.
34. Remove two left side engine mount fixing bolts from engine mount on chassis side.
35. Remove two right side engine mount fixing bolts from engine mount on chassis side.
36. Remove engine assembly.

## Installation

**CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.**

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

If the engine is assembled in the condition that the dowels have not been mounted in the specified positions, the transmission may be damaged.



012RS009

1. Install engine assembly. Tighten engine mount fixing bolts to frame to the specified torque.

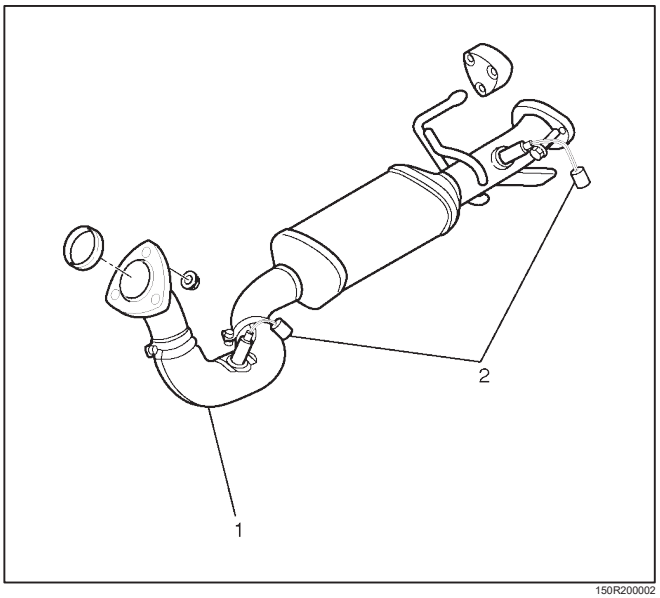
   **Torque: 41 N·m (30 lb ft)**

2. Reconnect fuel hose to fuel pipe on engine.
3. Install transmission assembly. Refer to Transmission section in this manual.
4. Reconnect two heater hoses to engine.
5. Install flywheel dust covers.
6. Install exhaust pipe and temporally tighten two (each bank) rear exhaust flange nuts then tighten three stud nuts (each bank) between exhaust manifold and exhaust pipe, finally tighten rear side nuts to the specified torque.

   **Torque:**

   **Nuts: 43 N·m (32 lb ft)**

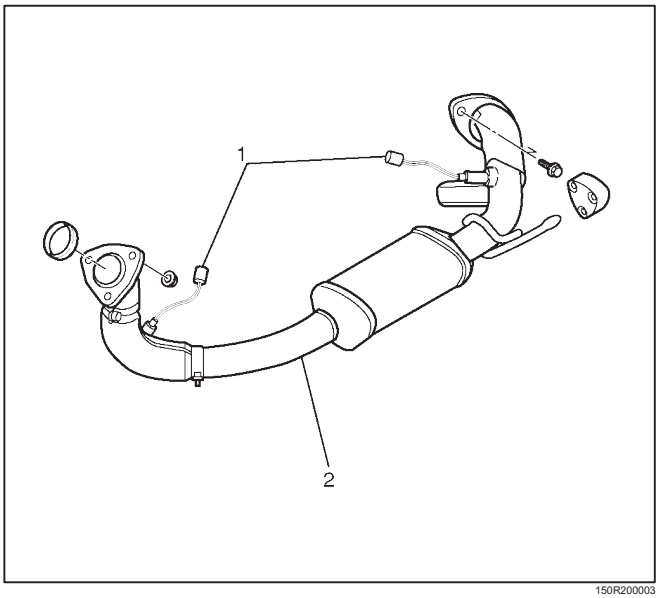
   **Stud nuts: 67 N·m (49 lb ft)**



150R200002

**Legend**

(1) Exhaust Front Pipe RH
(2) $O_2$ Sensor



150R200003

**Legend**

(1) $O_2$ Sensor
(2) Exhaust Front Pipe LH

7. Reconnect $O_2$ sensor connector.
8. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   **Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.**

   **Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.**

9. Install air conditioner compressor to engine and tighten to the specified torque.

   **Torque :**

   **M8 bolts : 22 N·m (16 lb ft)**

   **M10 bolts : 43 N·m (32 lb ft)**

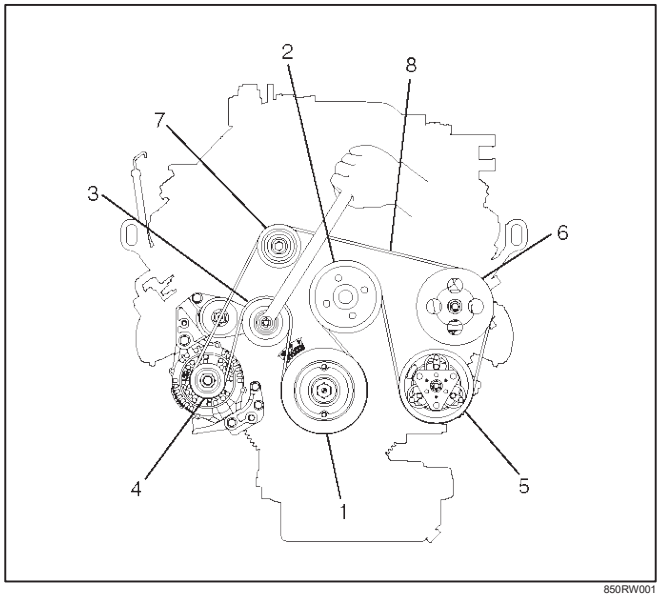
10. Install power steering pump, tighten fixing bolt to the specified torque.

    **Torque :**

    **M8 bolts : 22N·m (16 lb ft)**

    **M10 bolts : 46 N·m (34 lb ft)**

11. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.

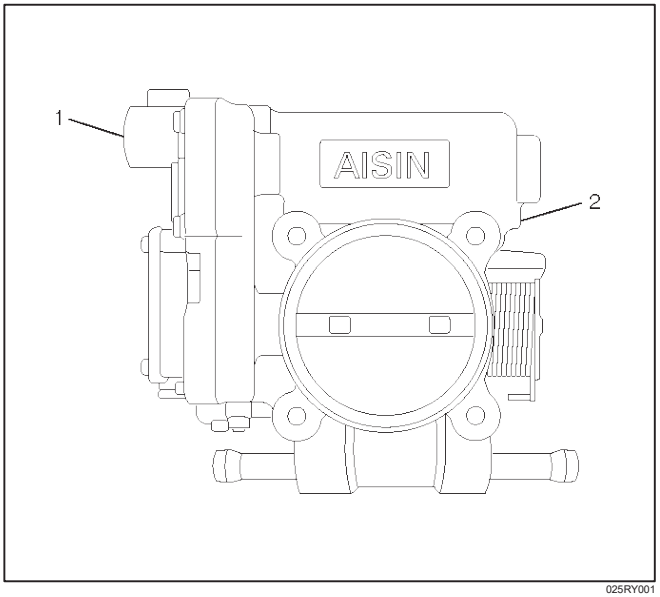



850RW001

**Legend**

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

12. Install upper fan shroud.
13. Reconnect radiator upper and lower hoses.
14. Reconnect coolant reserve tank hose to radiator.
15. Reconnect generator harness connector.
16. Reconnect starter harness connector.
17. Reconnect bonding cable terminal on left bank
18. Reconnect bonding cable terminal on the back of right dash panel.
19. Reconnect ground cable between engine and chassis.
20. Reconnect harness connector to transmission and install transmission harness bracket on engine left side.
21. Reconnect three engine harness connectors.
22. Reconnect vacuum booster hose.
23. Reconnect canister vacuum hose.
24. Install air cleaner assembly.
25. Reconnect air duct.
26. Reconnect throttle position sensor harness connector.

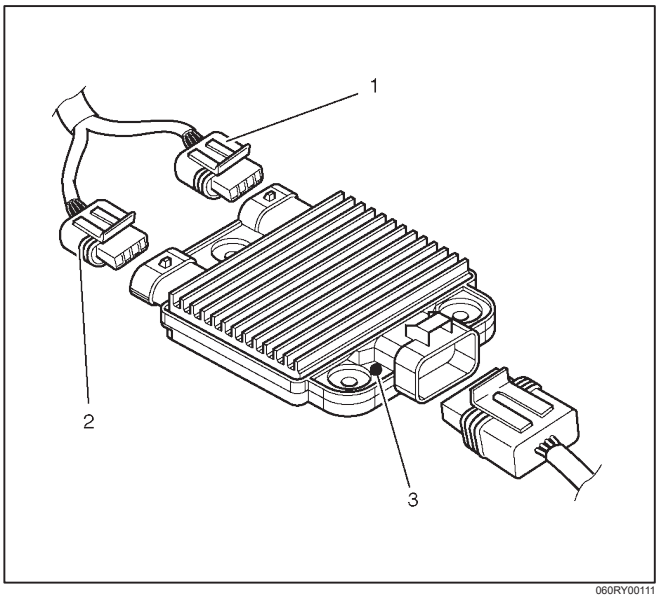



025RY001

**Legend**

(1) Throttle Position Sensor Connector
(2) Throttle Valve Assembly

27. Reconnect manifold absolute pressure sensor harness connectors.
28. Reconnect ion sensing module connectors as shown in the illustration.




060RY00111

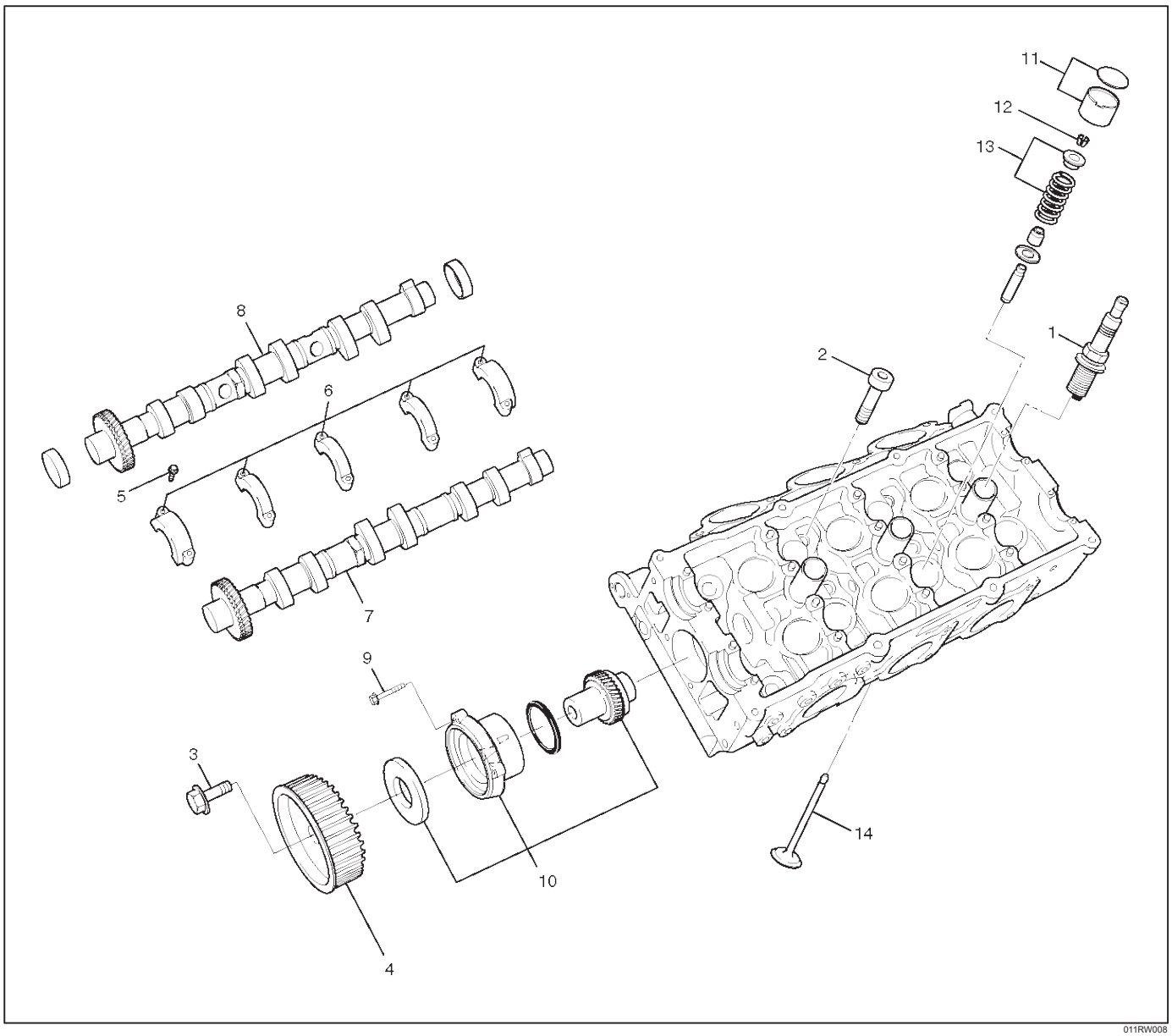
**Legend**

(1) Green Connector
(2) Blue Connector
(3) Identification Mark (6VE1 Engine Only)

29. Install engine hood to the original position.
    - Refer to installation procedure for Body section in this manual.

# Cylinder Head

## Cylinder Head and Associated Parts




011RW008

**Legend**

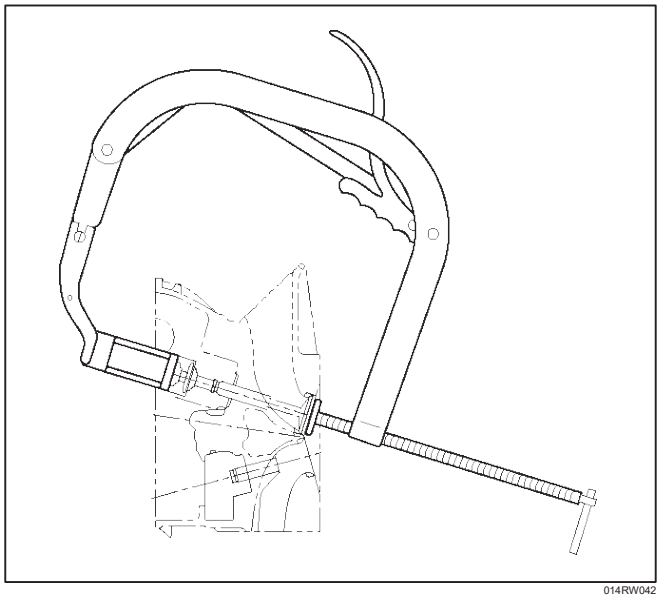
(1) Spark Plug
(2) Cylinder Head Bolt
(3) Camshaft Drive Gear Pulley Fixing Bolt
(4) Camshaft Drive Gear Pulley
(5) Camshaft Bearing Cap Fixing Bolt
(6) Camshaft Bearing Cap
(7) Camshaft Exhaust
(8) Camshaft Intake
(9) Retainer Fixing Bolt
(10) Retainer Assembly
(11) Tappet with Shim
(12) Split Collar
(13) Valve Spring and Spring Upper Seat
(14) Valve

## Disassembly

NOTE:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be reinstalled in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, perform a compression test and note the results.

1. Remove camshaft drive gear pulley fixing bolt (3), then pulley (4).
2. Remove camshaft bearing cap fixing bolt (5), camshaft bearing cap (6), then camshaft exhaust (7), and intake side (8).
3. Remove tappet with shim (11).
4. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove the split collar (12), valve spring with upper seat (13) and valve (14).


014RW042

5. Remove spark plug (1).

**CAUTION: Do not remove the spark plugs when the head and plugs are hot. Clean dirt and debris from spark plug recess areas before removal.**

## Clean

### Cylinder head

Carefully remove all varnish, soot and carbon from the bare metal. Do not use surface conditioning disc on any gasket sealing surface.

## Inspection and Repair

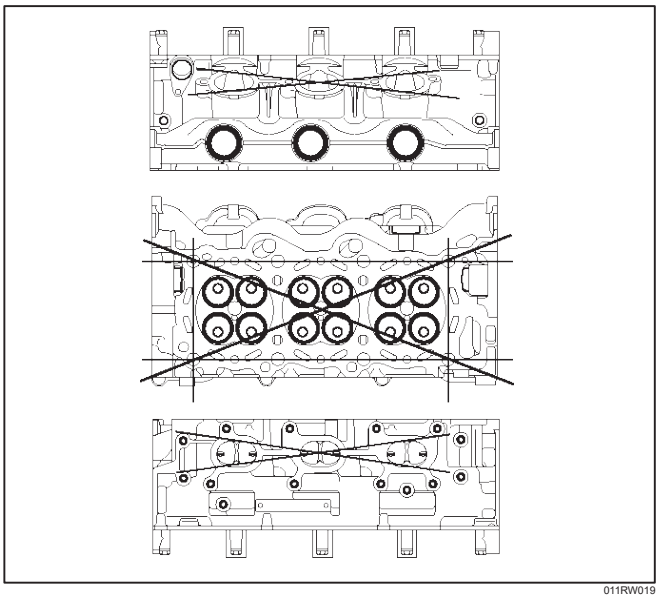
1. Inspect cylinder head gasket and mating surfaces for leaks, corrosion and blow–by. If the gasket has failed, determine the cause.
   - Insufficient torque on head bolts
   - Improper installation
   - Loose or warped cylinder head
   - Missing dowel pins
   - Warped case surface
2. Inspect cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Inspect cylinder head deck for corrosion, sand particles in head and porosity.

**CAUTION:**

- **Do not attempt to weld the cylinder head. Replace it.**
- **Do not reuse cylinder head bolts.**

4. Inspect cylinder head deck, common chamber and exhaust manifold mating surfaces for flatness. These surfaces may be reconditioned by milling. If the surfaces are “out of flat” with “round” by more than specification, the surface should be ground to within specifications. Replace the head if it requires machining beyond the repairable limit.

**Head surface and manifold surface**
**Standard: 0.05 mm (0.002 in) or less**
**Warpage limit: 0.2 mm (0.0079 in)**
**Maximum Repairable limit: 0.2 mm (0.0079 in)**
**Head height**
**Standard height : 133.2 mm (5.2441 in)**
**Warpage limit : 0.2 mm (0.0079 in)**
**Maximum Repairable limit : 133.0 mm (5.2362 in)**


011RW019

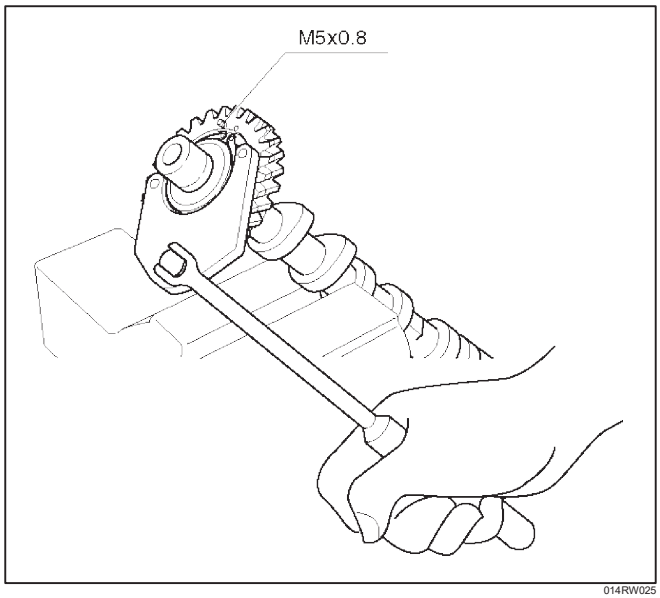
5. Water jacket sealing plugs seating surfaces.

## Reassembly

1. Install Spark plug and tighten all the spark plugs to specified torque.

   **Torque: 18 N·m (13 lb ft)**

2. Tighten sub gear setting bolt.
   1. Use J–42686 gear spring lever to turn sub gear to right direction until the M5 bolt aligns with the hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.

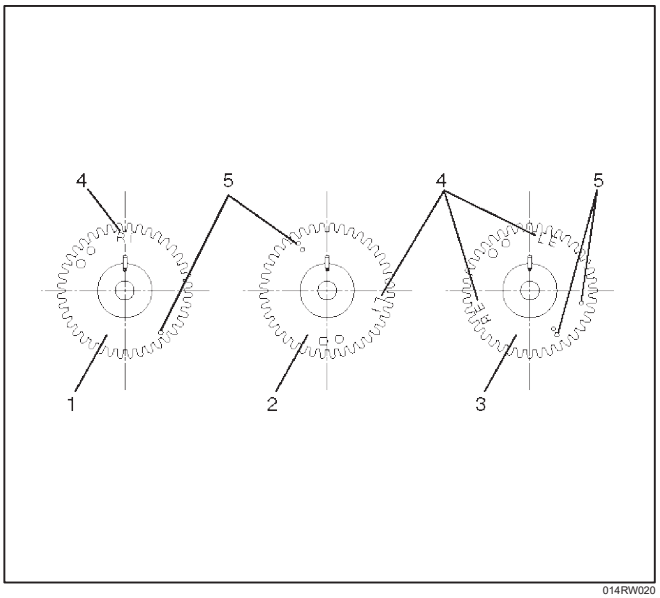


014RW025

3. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

   **Torque: 10 N·m (87 lb in)**

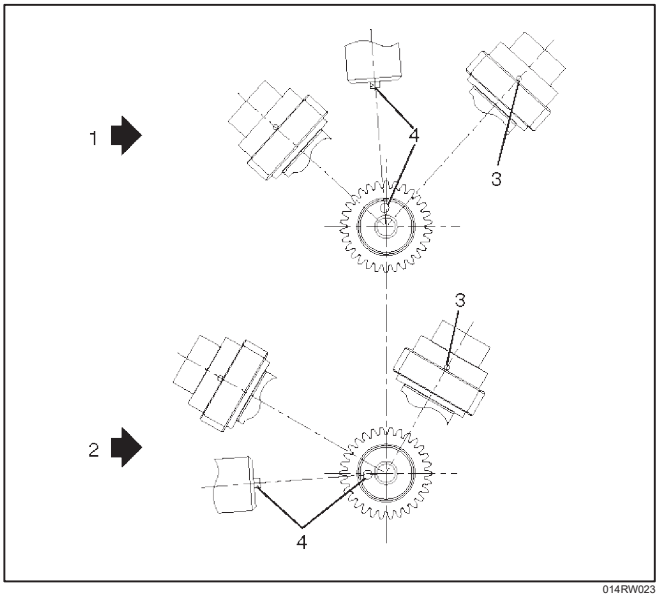
4. Install camshaft assembly and camshaft bearing cap, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

**Legend**

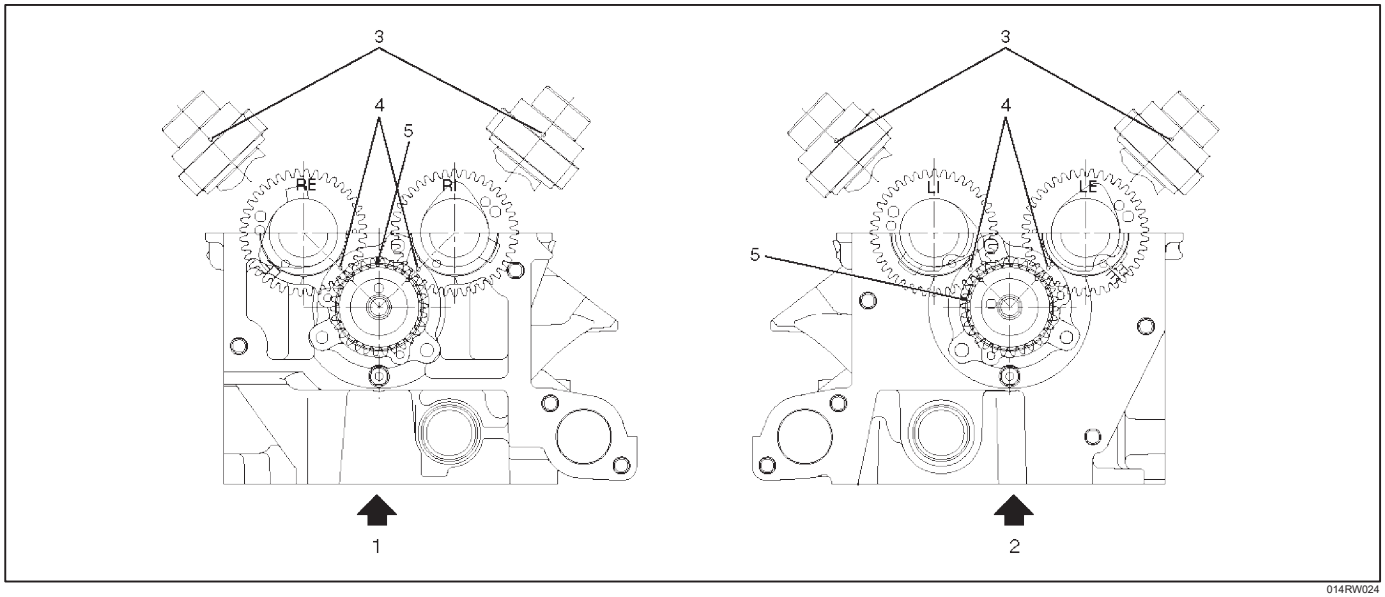
(1) Intake Camshaft Timing Gear for Right Bank
(2) Intake Camshaft Timing Gear for Left Bank
(3) Exhaust Camshaft Timing Gear
(4) Discrimination Mark
LI: Left Bank Intake
RI: Right Bank Intake
LE: Left Bank Exhaust
RE: Right Bank Exhaust



014RW023

**Legend**

(1) Right Bank Camshaft Drive Gear
(2) Left Bank Camshaft Drive Gear
(3) Timing Mark on Drive Gear
(4) Dowel Pin



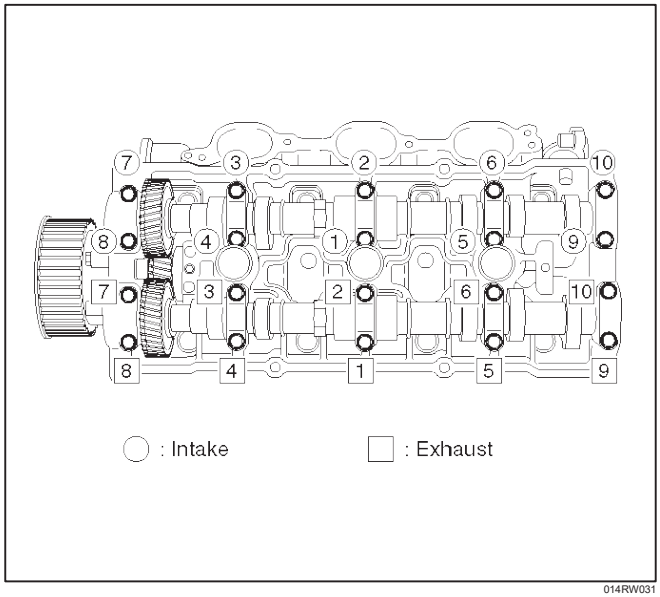

014RW024

**Legend**

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts in numerical order on each bank as shown in the illustration.

**Torque: 10 N·m (87 lb in)**



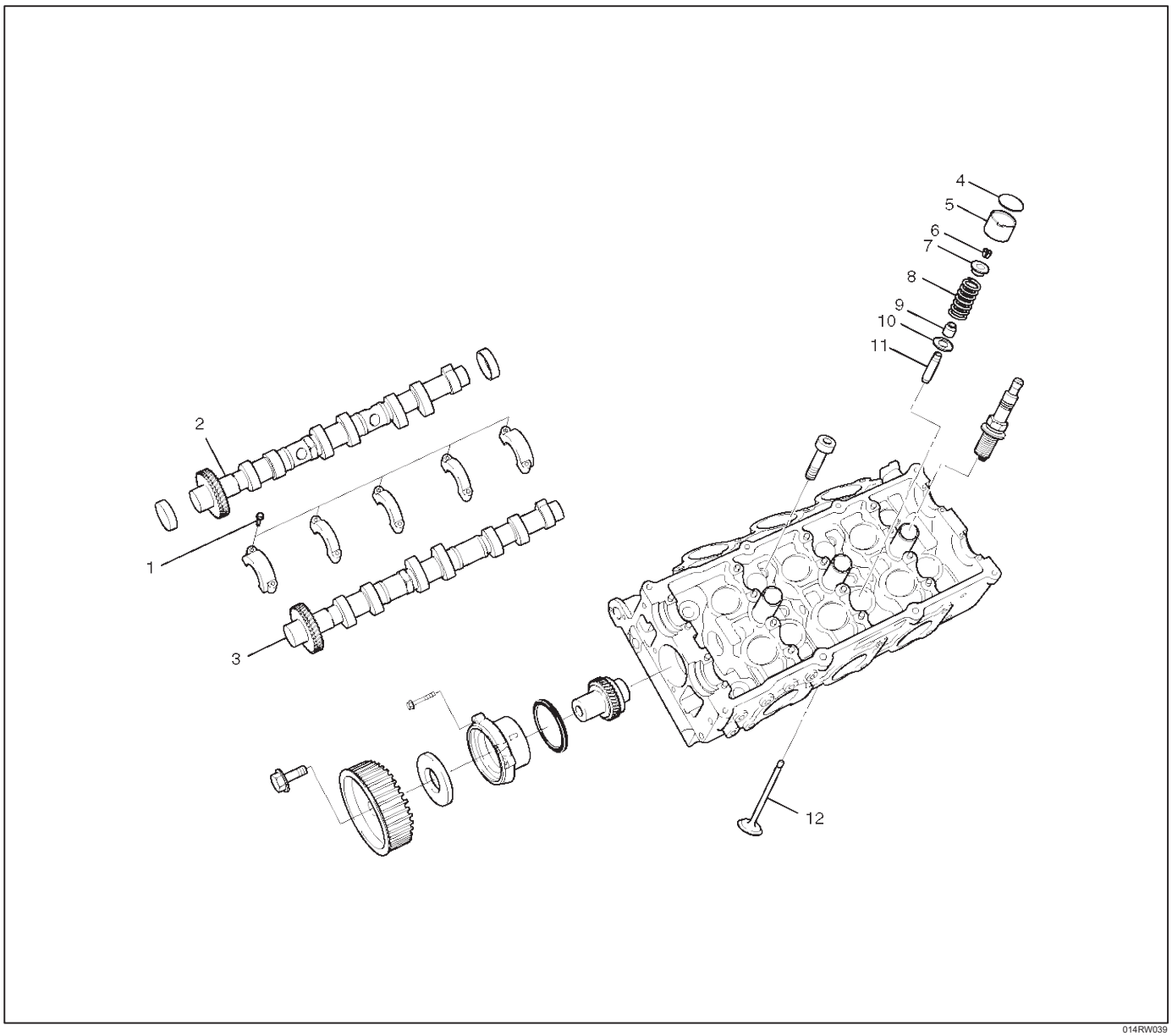

014RW031

5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

**Torque: 98 N·m (72 lb ft)**

# Valve Spring, Oil Controller, Valve, Valve Guide

## Valve Spring, Oil Controller, Valve, Valve Guide and Associated Parts




014RW039

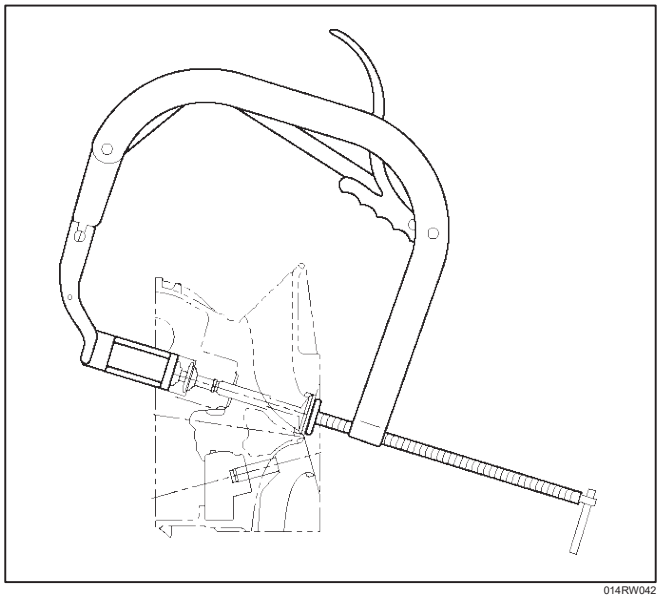
**Legend**

(1) Camshaft Bearing Cap Fixing Bolts
(2) Camshaft Assembly Inlet
(3) Camshaft Assembly Exhaust
(4) Shim
(5) Tappet
(6) Split Collar
(7) Spring Upper Seat
(8) Valve Spring
(9) Oil Controller
(10) Spring Lower Seat
(11) Valve Guide
(12) Valve

## Disassembly

1. Remove camshaft bearing cap fixing bolts (1).
2. Remove camshaft assembly (intake).
3. Remove camshaft assembly (Exhaust side).
4. Remove shim (4) and tappet (5).

5. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove split collar.


014RW042

6. Remove valve spring.
7. Remove valve.
8. Remove oil controller and spring lower seat.
9. Remove the valve guide using the J–42899 valve guide replacer.

## Inspection and Repair

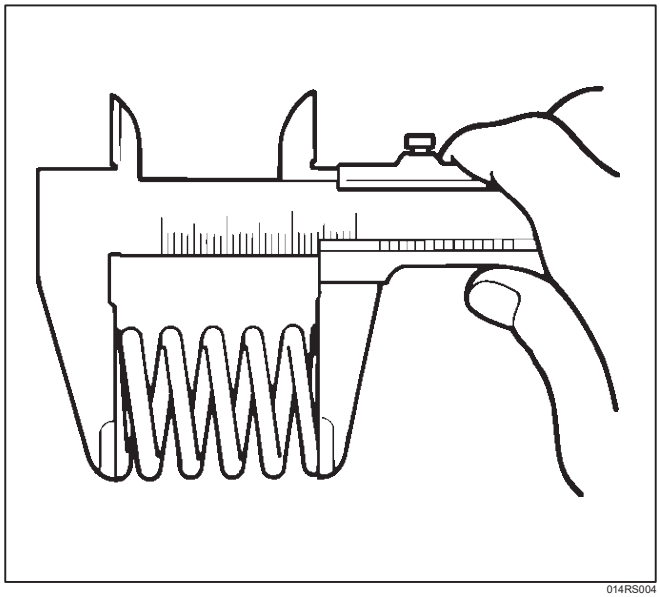
### Valve Spring

**CAUTION: Visually inspect the valve springs and replace them if damage or abnormal wear is evident.**

1. Measure the free height of the springs. The springs must be replaced if the free height is below the specified limit.

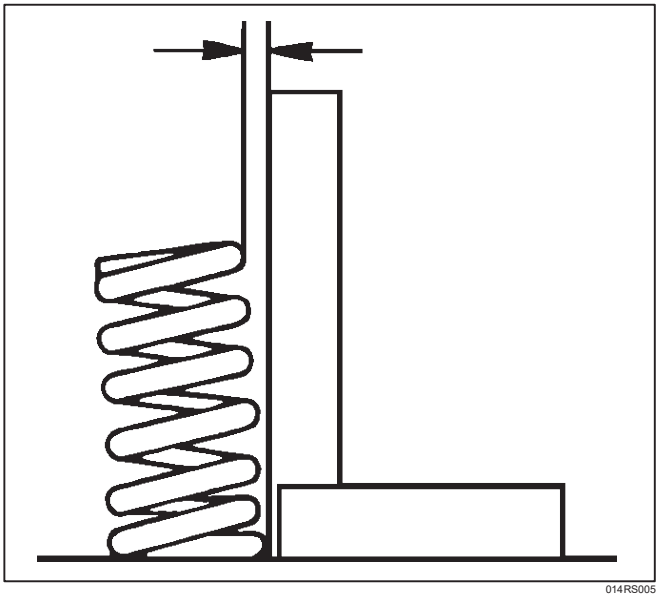
**Standard : 44.6 mm (1.756 in)**

**Limit : 43.6 mm (1.717 in)**


014RS004

2. Measure the valve spring squareness with a steel square and replace the valve springs if the measured value exceeds the specified limit.

**Limit : 2 mm (0.079 in)**

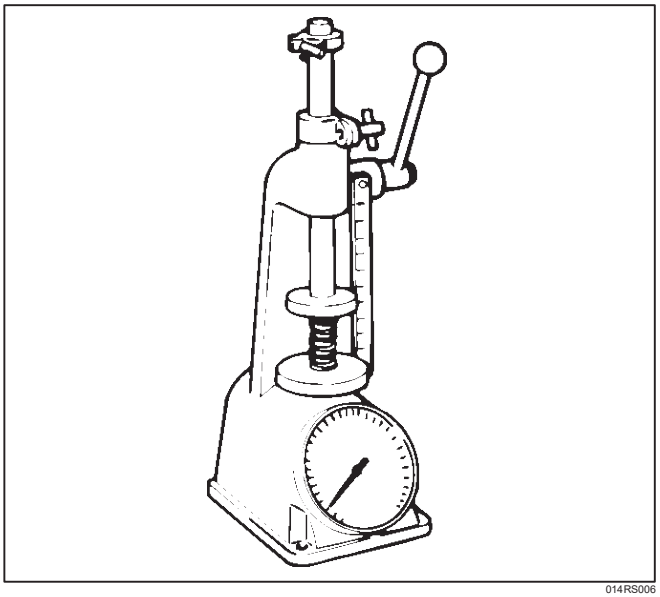

014RS005

3. Using a spring tester to compress the springs to the installed height, measure the compressed spring tension, and replace the springs if the measured tension is below the specified limit.

**At installed height: 35.0 mm (1.38 in)**

**Standard: 196 N (44 lb)**

**Limit: Less than 181 N (41 lb)**


014RS006

### Valve Guide

**CAUTION: Take care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratches or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.**

1. Measure the valve stem diameter with a micrometer. If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

**Diameter of Valve Stem**

**Intake**

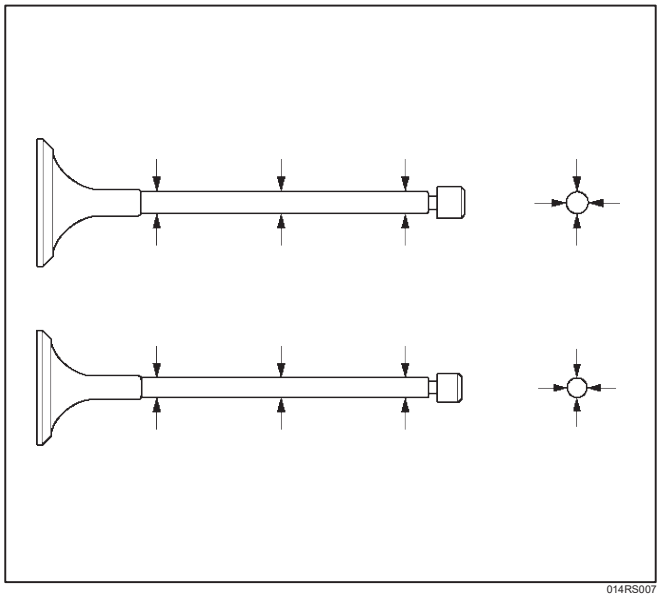
**Standard : 5.977 mm–5.959 mm (0.2353 in–0.2346 in)**

**Limit : 5.90 mm (0.2323 in)**

**Exhaust**

**Standard : 5.952 mm–5.970 mm (0.2343 in–0.2350 in)**

**Limit : 5.90 mm (0.2323 in)**



014RS007

2. Measure the inside diameter of the valve guide with a micrometer. Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the value exceeds the specified limit, the valve and the valve guide must be replaced as a set.

**Inside Diameter of the Vale Guide**

**Inlet clearance**

**Standard : 0.023 mm–0.056 mm (0.0009 in–0.0002 in)**

**Limit : 0.20 mm (0.00787 in)**

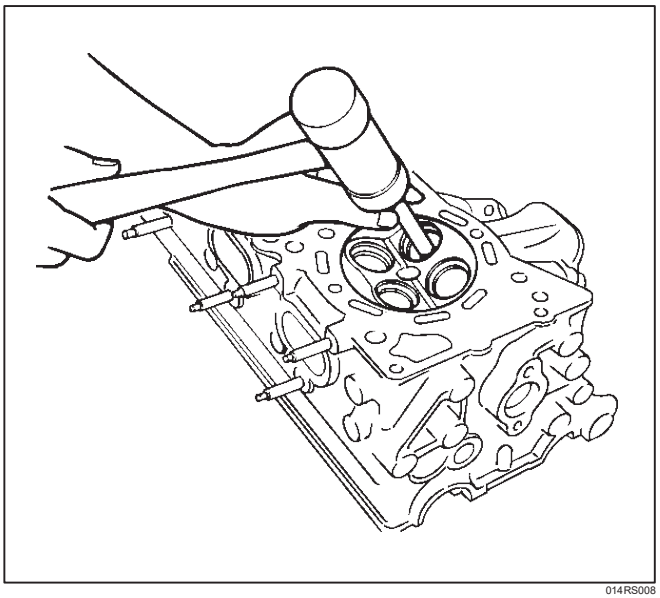
**Exhaust clearance**

**Standard : 0.030 mm–0.063 mm (0.0012 in–0.0025 in)**

**Limit : 0.20 mm (0.00787 in)**

## Valve Guide Replacement

1. Using Valve guide replacer: J–42899, drive out the valve guide from the combustion chamber side.

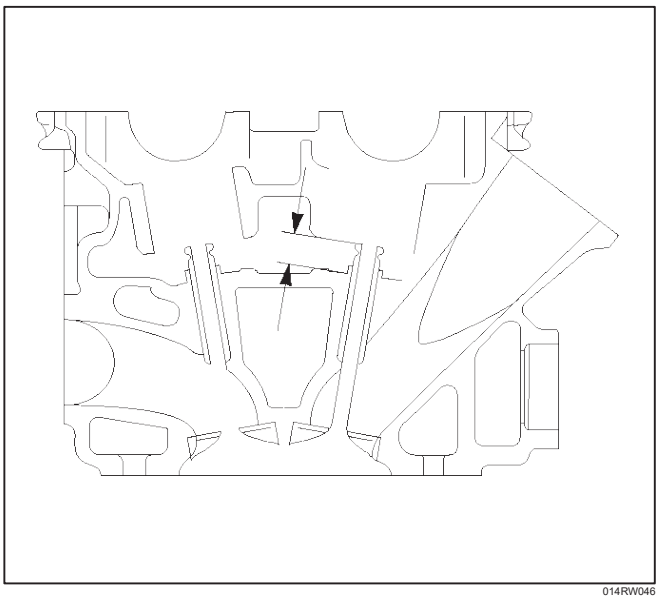


014RS008

2. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side, and check the valve guide height.

**Valve guide upper end height: 13.0 mm (0.5118 in)**

**(Measured from the cylinder head upper face)**



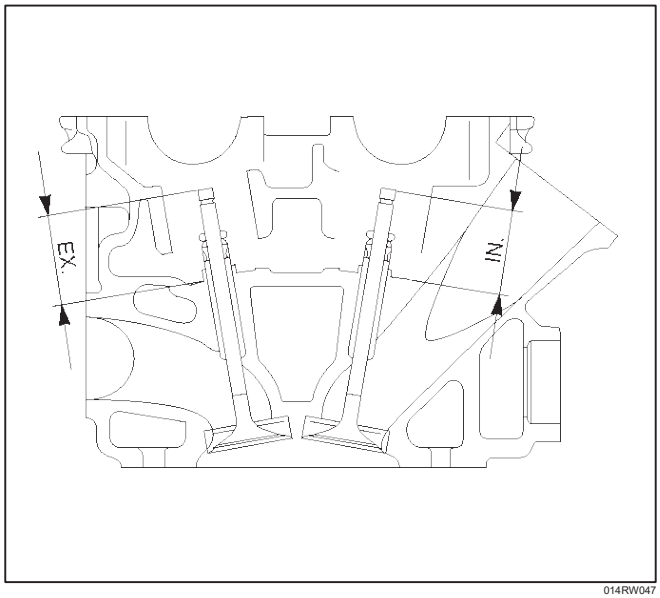
014RW046

3. Check the clearance. If the clearance is less than the specified value, ream the inside diameter of valve guide. Using a sharp 6 mm reamer, ream the valve guide to obtain the specified clearance.

## Valve Seat

1. Measure the protrusion of the valve stem when a new valve is installed in the cylinder head. If the protrusion of the valve stem exceeds the limit, replace the valve seat insert or the cylinder head assembly.

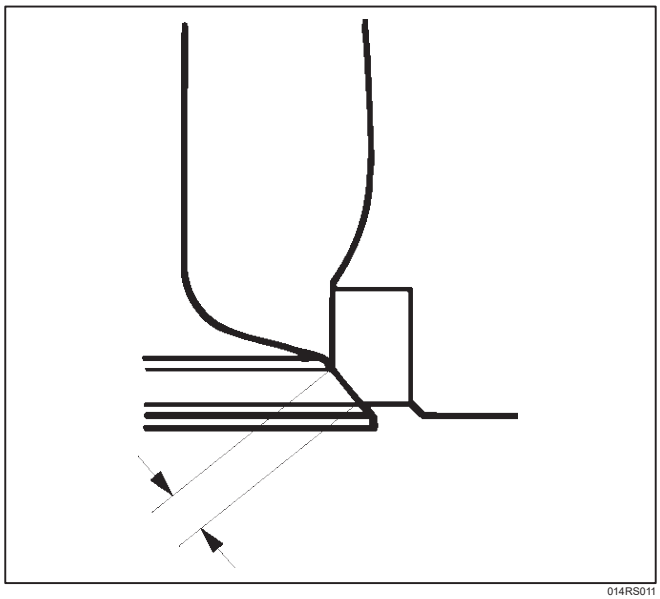
**Protrusion of valve stem**
**Intake**
**Standard: 39.32 mm (1.5480 in)**
**Limit: 39.47 mm (1.5539 in)**
**Exhaust**
**Standard: 39.3 mm (1.5472 in)**
**Limit: 39.45 mm (1.5531 in)**



014RW047

2. Measure the valve seat contact width. Make the necessary corrections if the seat contact surface is damaged or rough or if the contact width wear exceeds the limit.

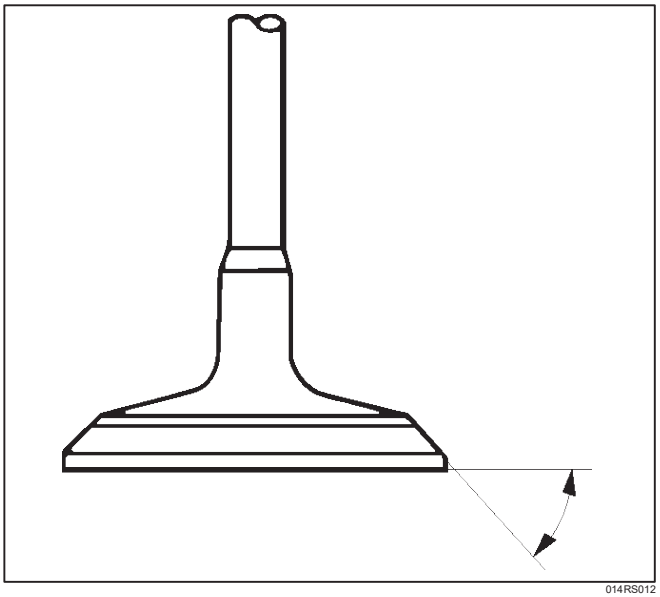
**Valve seat contact width**
**Standard: 1.1 mm (0.0433 in)**
**Limit: 1.7 mm (0.0669 in)**


014RS011

## Contact Surface Angle on Valve Seat on Valve

1. Measure contact surface angle on valve seat.
2. If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

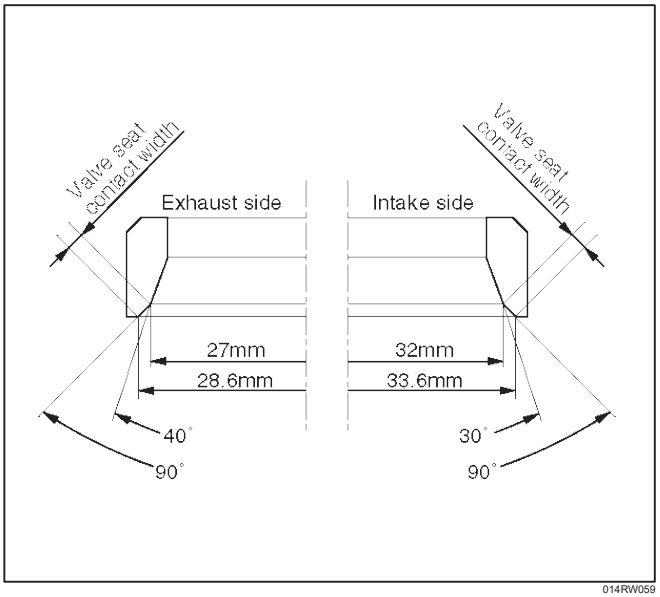
**Valve contact surface angle: 45˚**


014RS012

## Valve Seat Insert Correction

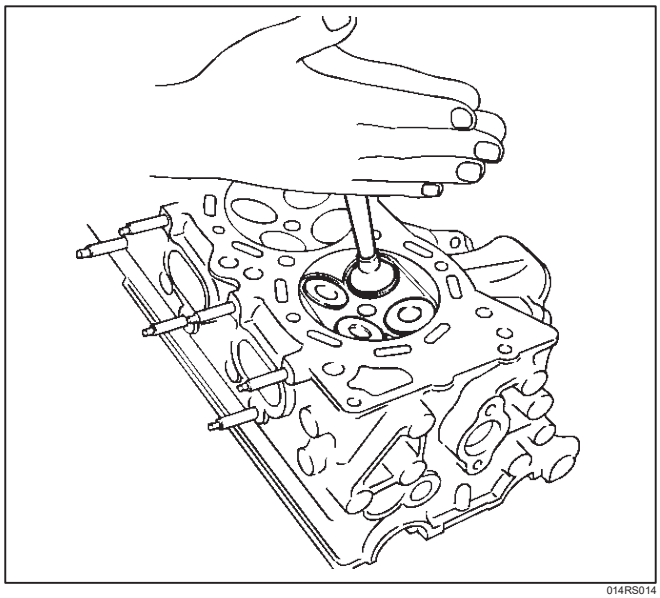
1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

**Valve seat angle degree: 90˚**



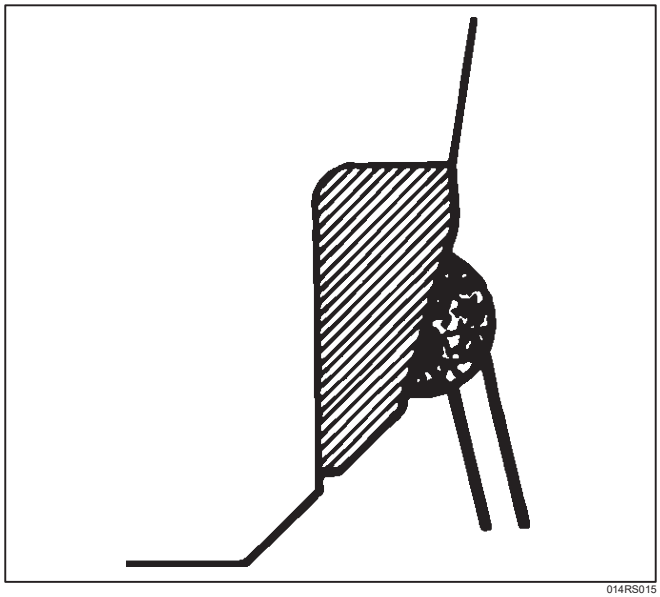
014RW059

3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while lapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.


014RS014

### Valve Seat Insert Replacement

1. Arc weld the rod at several points. Be careful not to damage the aluminum section.
2. Allow the rod to cool for a few minutes. This will cause the valve seat to shrink.
3. Strike the rod and pull it out.


014RS015

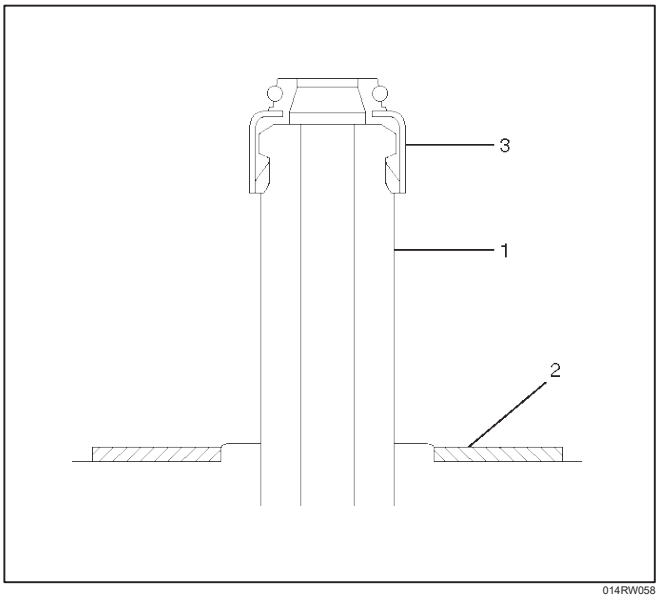
4. Carefully clean the valve seat press–fit section on the cylinder head side.
5. Heat the press–fit section with steam or some other means to cause expansion. Cool the valve seat with dry ice or some other means.
6. Insert the press–fit section into the valve seat horizontally.

**Standard fitting interference: 0.14 mm–0.09 mm (0.0055 in–0.0035 in)**

7. After insertion, use a seat grinder to grind finish the seating face. Carefully note the seating angle, the contact width, and the depression.
8. Lap the valve and the seat.

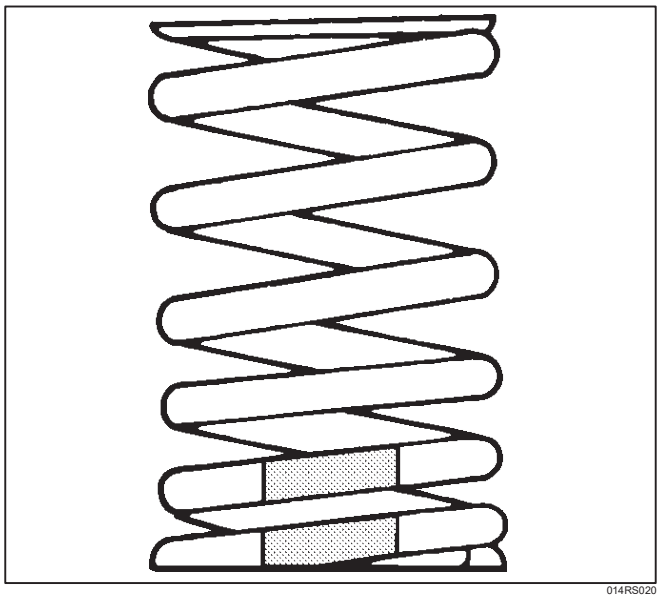
## Reassembly

1. Install valve guide (1) to cylinder head. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side.
2. Install oil controller (3) and spring lower seat (2). Using oil controller replacer J–37281, drive in a new oil controller.

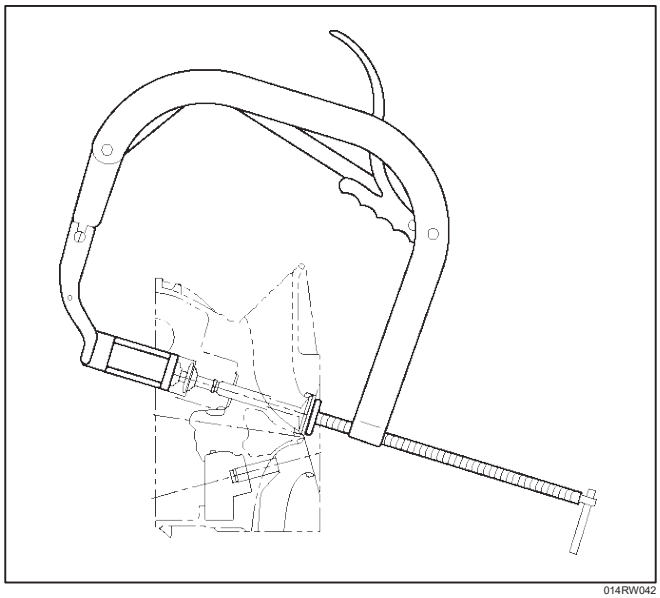


014RW058

3. Install valve to valve guide. Before installing valve guide apply engine oil to the outside of the valve stem.
4. Install valve spring to cylinder head. Attach the valve spring to the lower spring seat. The painted area of the valve spring should be facing downward.


014RS020

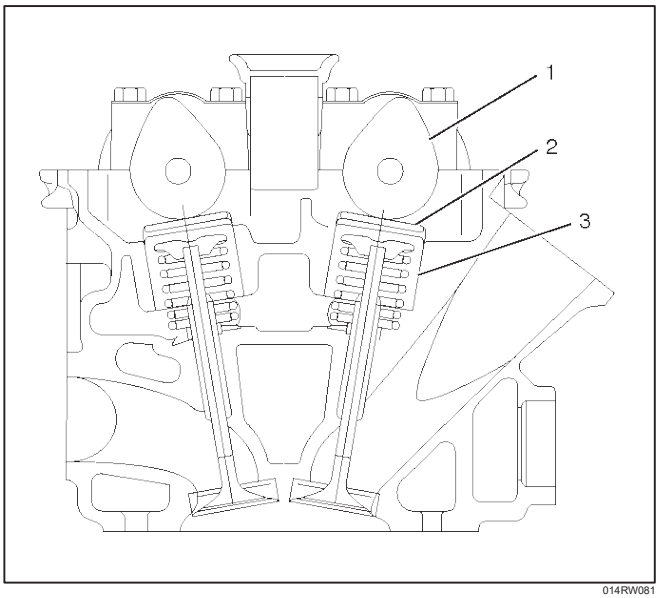
5. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to install the split collars.


014RW042

6. Install tappet with shim.
7. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.

## Valve Clearance Adjustments

NOTE: To adjust valve clearance, apply engine oil to the cam as well as to the adjusting shim (2) with the cylinder head built on the cylinder block, give a few turns to the camshaft by means of timing pulley tightening bolt, and measure valve clearance when the nose of cam is just opposite of maximum cam lift (1) as shown in illustration below.



014RW081

**Legend**
(1) Cam
(2) Shim
(3) Tappet

## Valve Clearance Standard Value (cold)

**Intake: 0.23 mm–0.33 mm (0.0091 in–0.0130 in)**

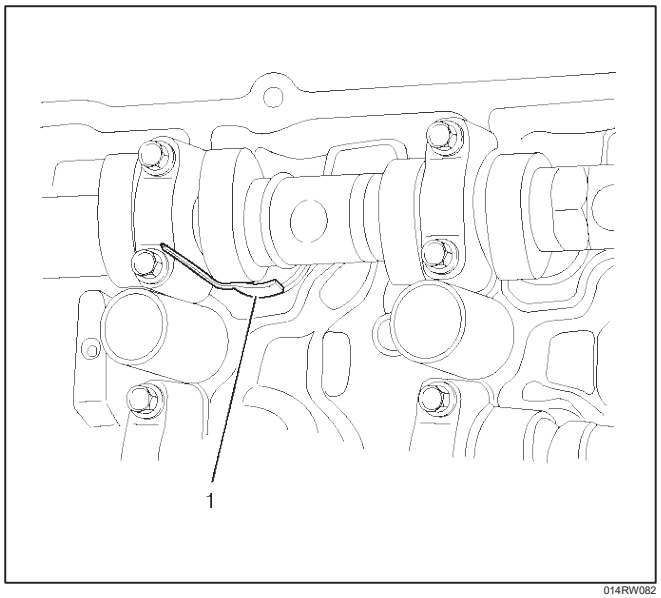
**Exhaust: 0.25 mm–0.35 mm (0.0098 in–0.0138 in)**

## Selection of Adjusting Shim

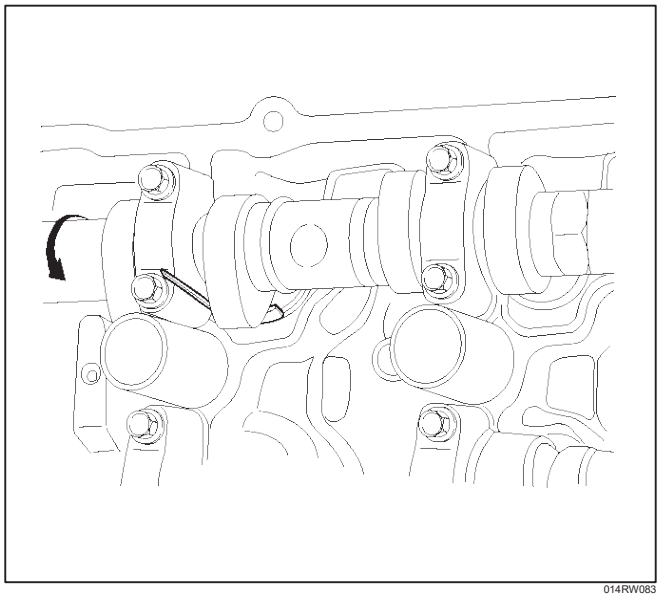
Shim to be selected = (Thickness of removed shim) + (Valve clearance measurement – Standard value)
Based on the above formula, the best suited shim should be selected from 41 types of shim (differently thick at 0.02mm (0.0008 in) intervals from 2.40mm (0.0945 in) through 3.2mm (0.1260 in) thick). Install the shim and check valve clearance.

## Replacement of Shim

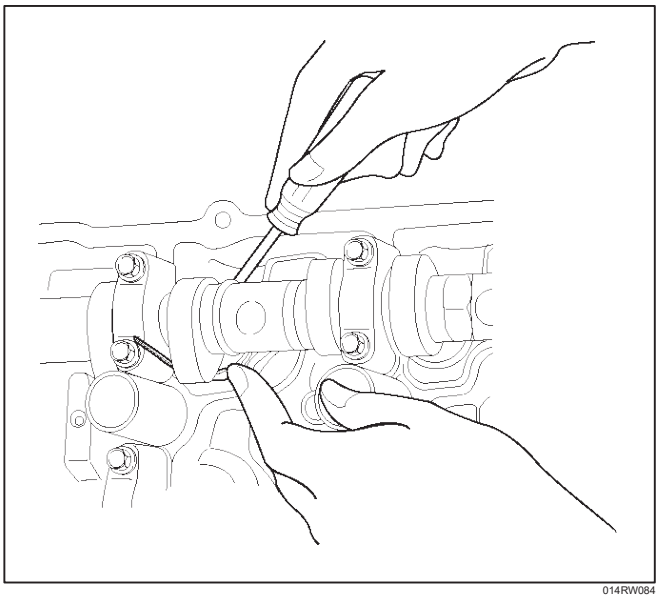
Let the cam push down the edge of tappet by using J–42689 valve clearance adjusting tool and push out the shim with a flat blade screw driver as shown in illustrations below.




014RW082



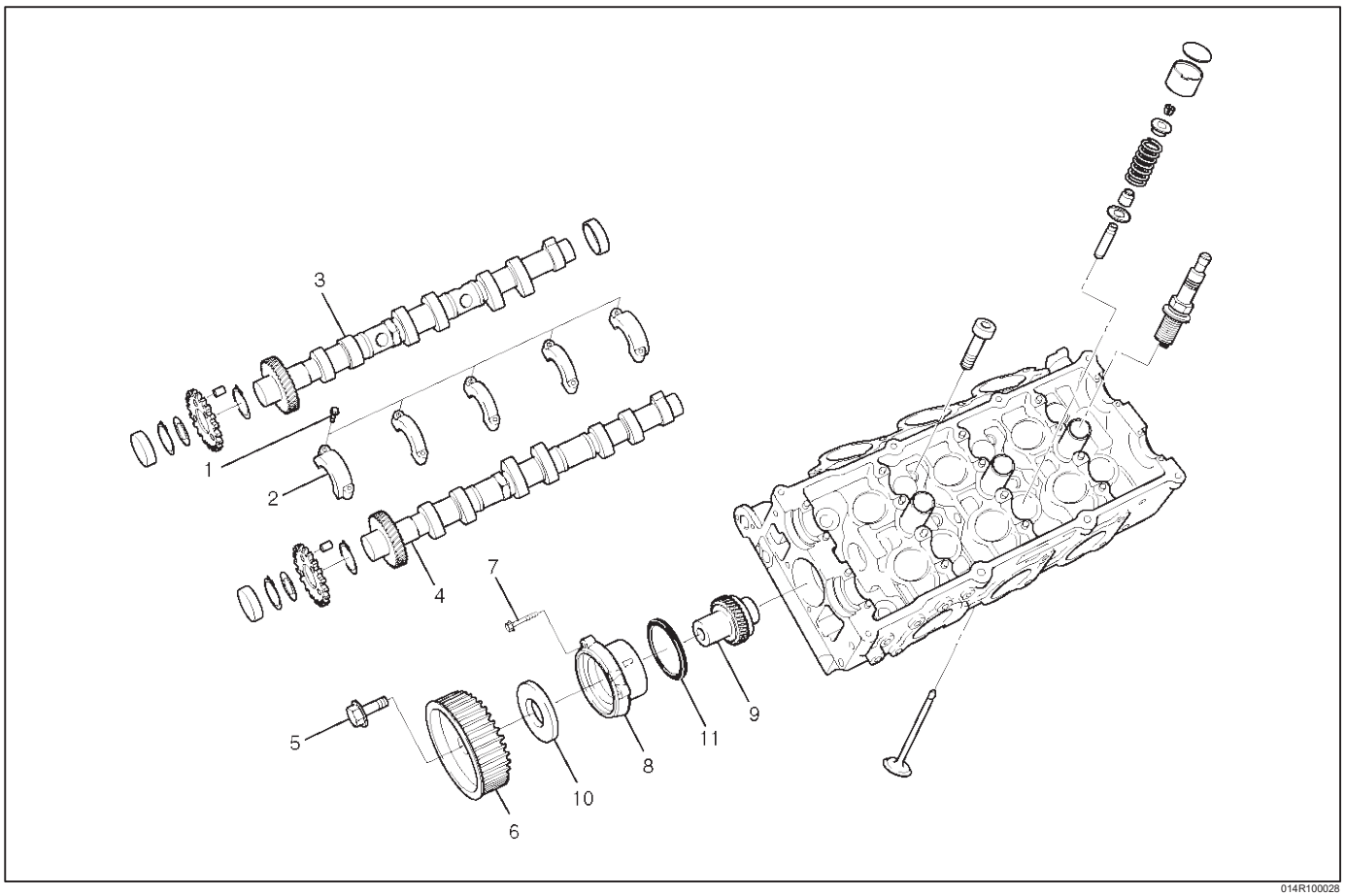
014RW083



014RW084

# Camshaft

## Camshaft and Associated Parts



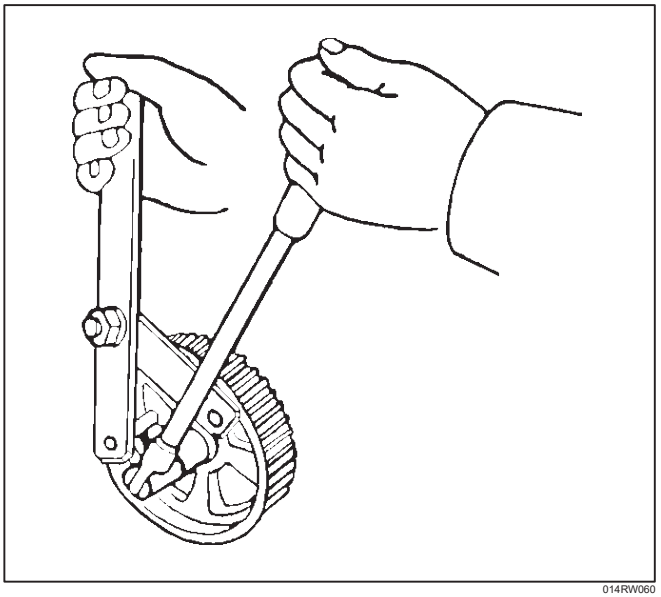

014R100028

**Legend**

(1) Camshaft Bracket Fixing Bolt
(2) Camshaft Bracket
(3) Camshaft Assembly Intake
(4) Camshaft Assembly Exhaust
(5) Pulley Fixing Bolt
(6) Camshaft Drive Gear Pulley
(7) Retainer Fixing Bolt
(8) Retainer
(9) Camshaft Drive Gear
(10) Oil Seal
(11) O–ring

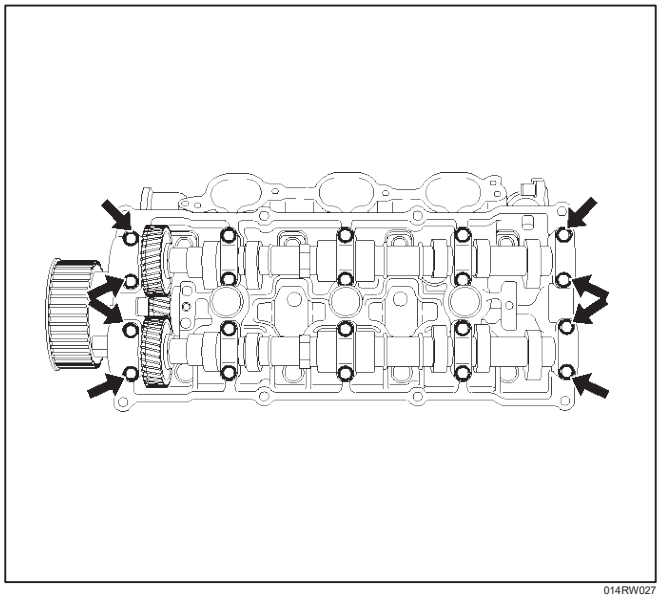
## Disassembly

1. Remove fixing bolt (5) for camshaft drive gear pulley using the J–43041 universal holder.

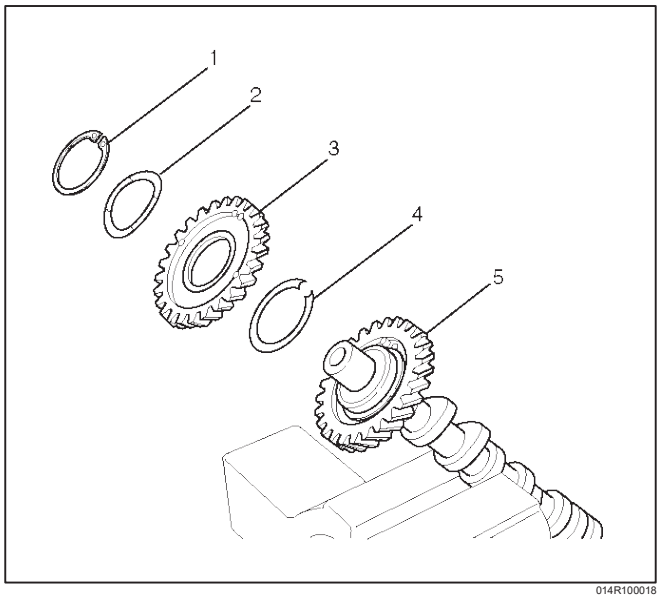


014RW060

2. Remove twenty fixing bolts from intake and exhaust camshaft bracket on one side bank, then camshaft brackets (2).


014RW027

3. Remove camshaft assembly (3), (4) with camshaft end plug.
4. Remove three fixing bolts (7) from camshaft drive gear retainer (8), then camshaft drive gear assembly.
5. Use the snap ring pliers to remove the snap ring(1).
6. Remove the wave washer(2), sub gear(3) and spring camshaft gear(4) from the camshaft assembly(5).



014R100018

**Legend**

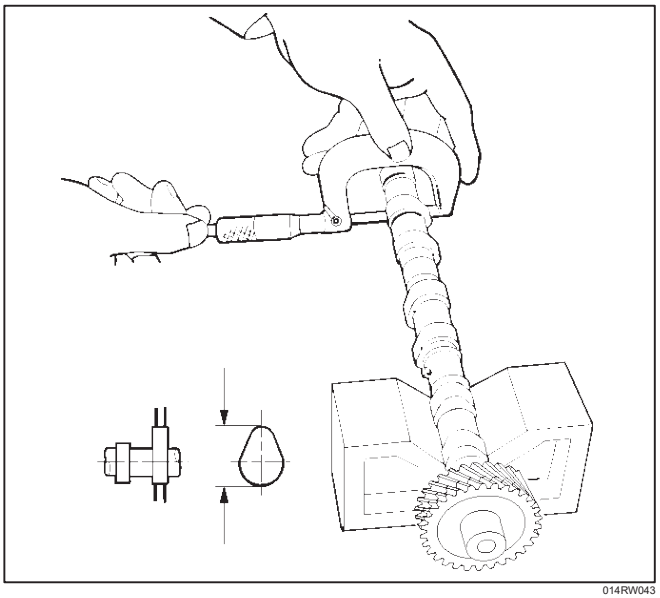
(1) Snap Ring
(2) Wave Washer
(3) Sub Gear
(4) Spring; Camshaft Gear
(5) Camshaft Assembly

## Inspection and Repair

1. Use a micrometer to measure the cam lobe height and uneven wear. Replace the camshaft if either the lobe height or the uneven wear exceeds the specified limit.

**Lobe height : 44.709 mm (1.7602 in)**

**Uneven wear : 0.05 mm (0.0020 in)**


014RW043

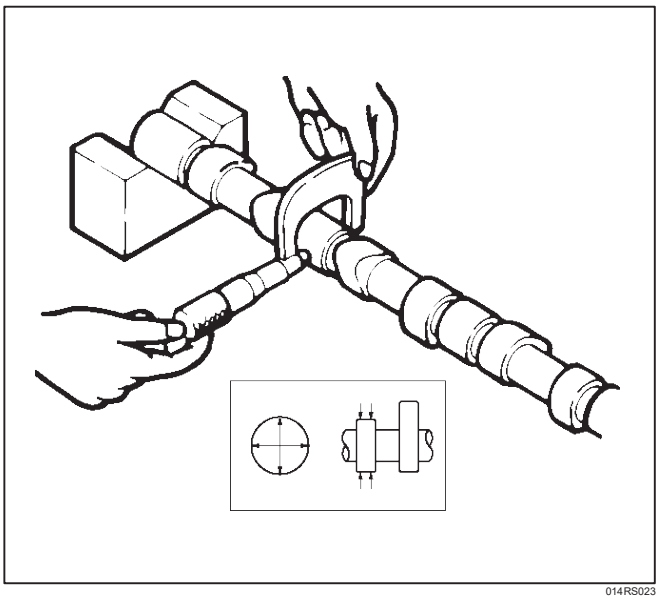
2. Use a micrometer to measure the diameter and the uneven wear of the camshaft journals.
   Replace the camshaft if the diameter or the uneven wear exceeds the specified limit.

**Journal Diameter**

**Standard : 25.972 mm–25.993 mm (1.0225 in–1.0233 in)**

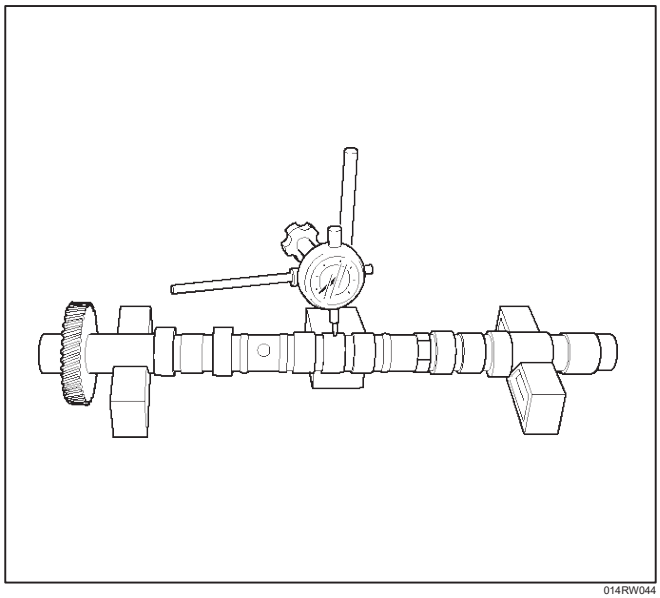
**Limit : 25.8 mm (1.0157 in)**

**Uneven wear : 0.05 mm (0.0020 in)**


014RS023

3. Place the camshaft on V–blocks.
   Slowly rotate the camshaft and measure the runout with a dial indicator.
   Replace the camshaft if the runout exceeds the specified limit.

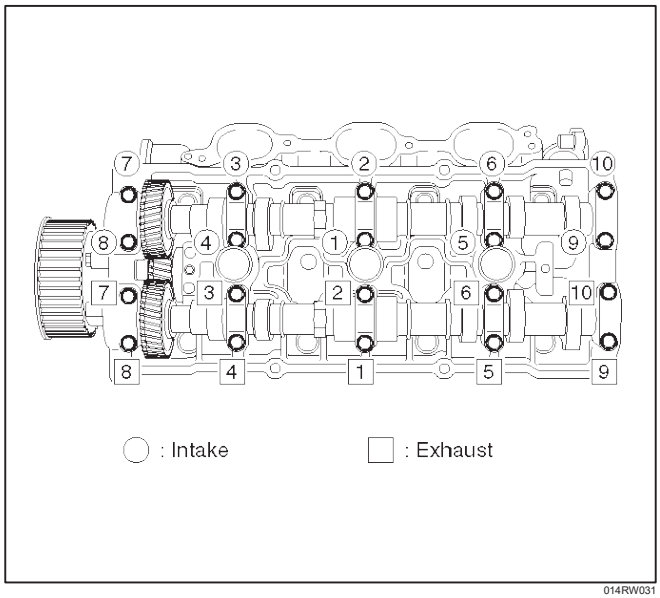
**Runout**
**Limit : 0.1 mm (0.0039 in)**


014RW044

4. Measure the camshaft journal oil clearance.
   1. Measure the camshaft bracket housing inside diameter.

NOTE: Tighten camshaft bracket (2) to specified torque before measuring the camshaft bracket inside diameter.

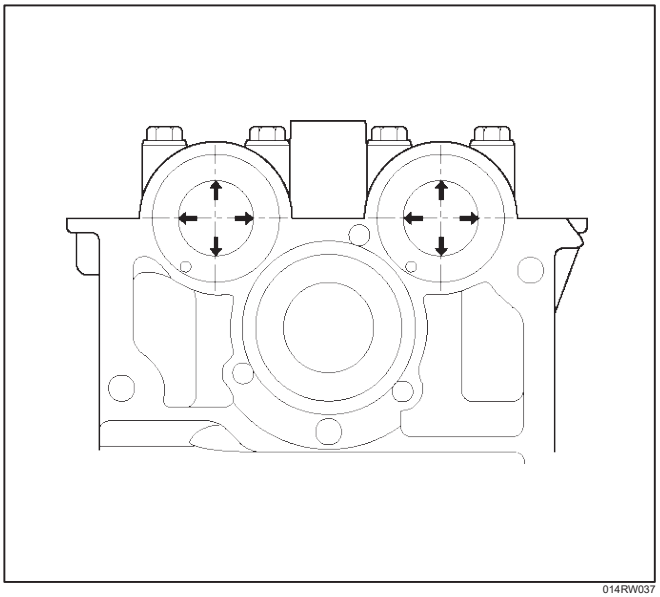
**Torque : 10 N·m (89 lb in)**



014RW031

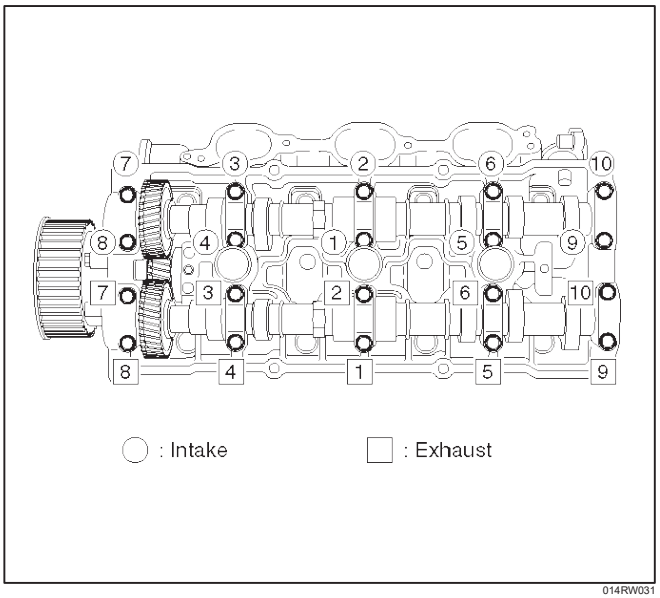
   2. Subtract the camshaft outside diameter from the camshaft bracket housing inside diameter.

**Oil Clearance**
**Standard : 0.027 mm–0.078 mm (0.0011 in–0.0031 in)**
**Limit : 0.11 mm (0.0043 in)**


014RW037

5. Replace the cylinder head and/or camshaft if the measured oil clearance exceeds the specified limit.
   1. Carefully clean the camshaft journal, the camshaft bracket, and the cylinder head.
   2. Install camshaft assembly and camshaft brackets (2), tighten twenty bolts (1) on one side bank to the specified torque.

**Torque: 10 N·m (89 lb in)**



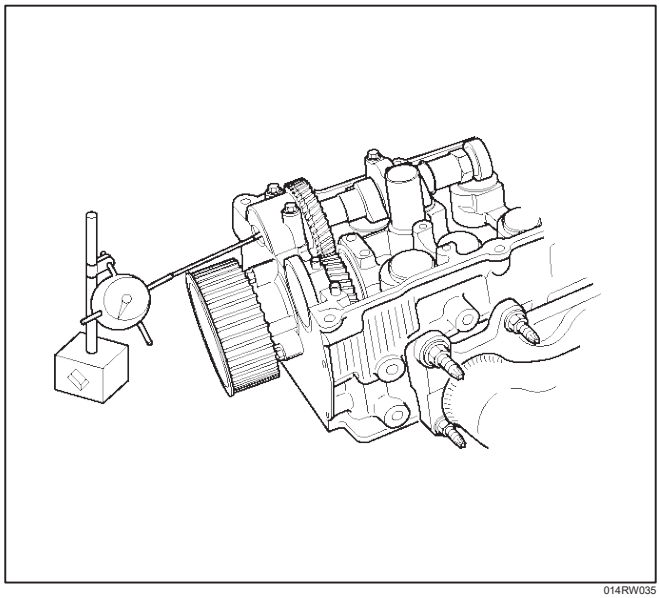
014RW031

3. Measure the camshaft thrust clearance with a dial indicator. Replace the camshaft and/or the cylinder head if the camshaft thrust clearance exceeds the specified limit.

**Camshaft thrust Clearance**

**Standard : 0.03 mm–0.08 mm (0.0012 in.–0.0031 in.)**

**Limit : 0.12 mm (0.0047 mm)**



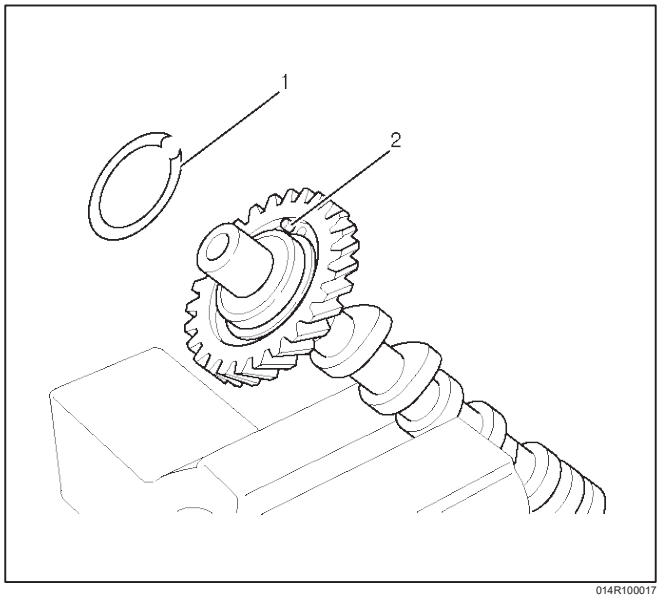
014RW035

## Reassembly

1. Install camshaft drive gear assembly and tighten three bolts to specified torque.

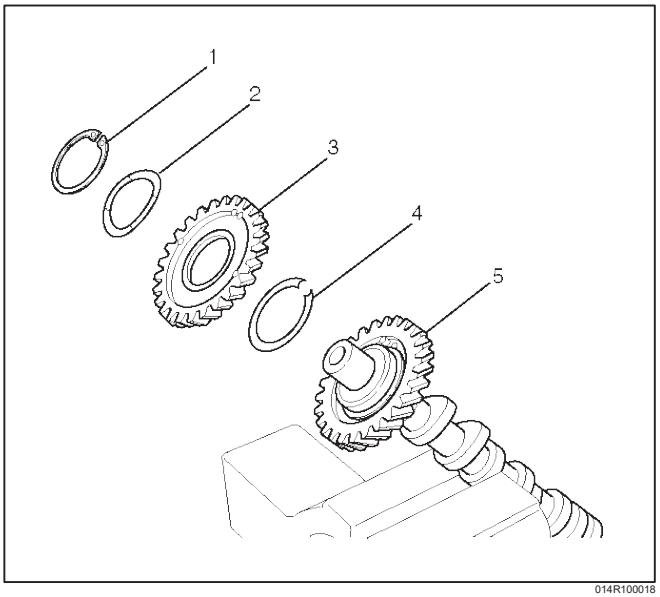
   **Torque: 10 N·m (89 lb in)**

2. Install the spring ; camshaft gear(1) into the camshaft assembly.
   Ensure the clearance is between the right side of the spring; camshaft gear (1) and the dowel pin (2).



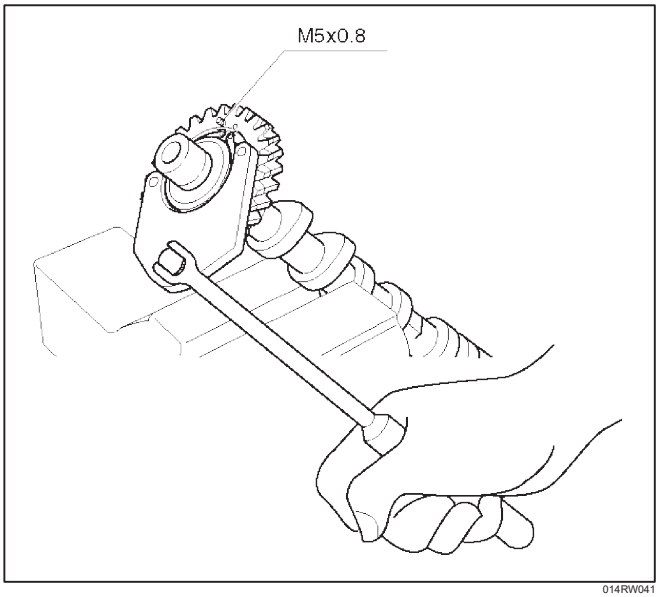

014R100017

3. Align the dowel pin on the sub gear to the clearance of the spring ; camshaft gear made in step 2 and install the sub gear (3).
4. Install the wave washer (2). Use snap ring pliers to install the snap ring (1).




014R100018

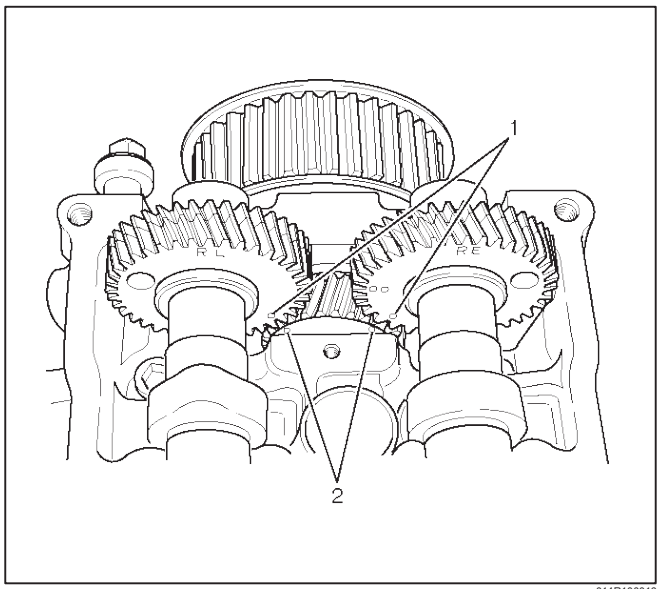
5. Tighten sub gear setting bolt.
   a. Use J–42686 gear spring lever to pre-load the sub gear. Turn the sub gear in a clockwise direction until the M5 bolt hole aligns with the hole in the camshaft driven gear.
   b. Install the M5 bolt and tighten to a suitable torque to prevent the sub gear from moving.




014RW041

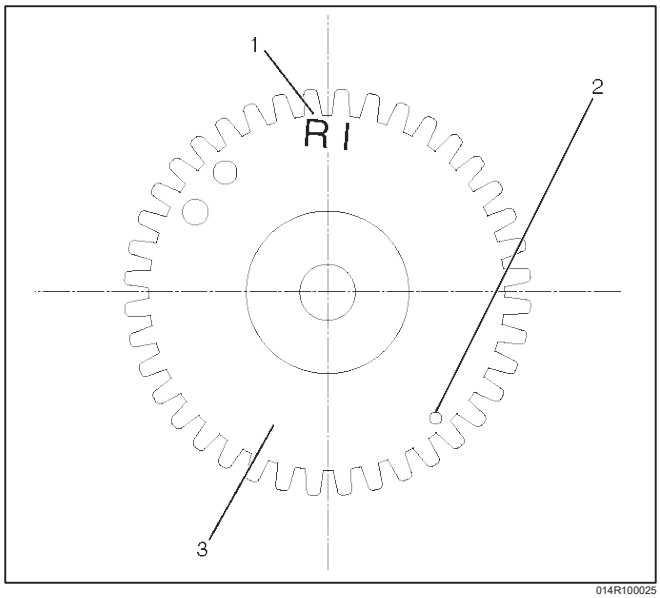
6. Align the timing mark on the retainer and dowel pin of the camshaft drive gear.
7. Install camshaft assembly and camshaft brackets, tighten twenty bolts on one side bank to the specified torque.

a. Apply engine oil to camshaft journal and bearing surface of camshaft bracket.
b. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



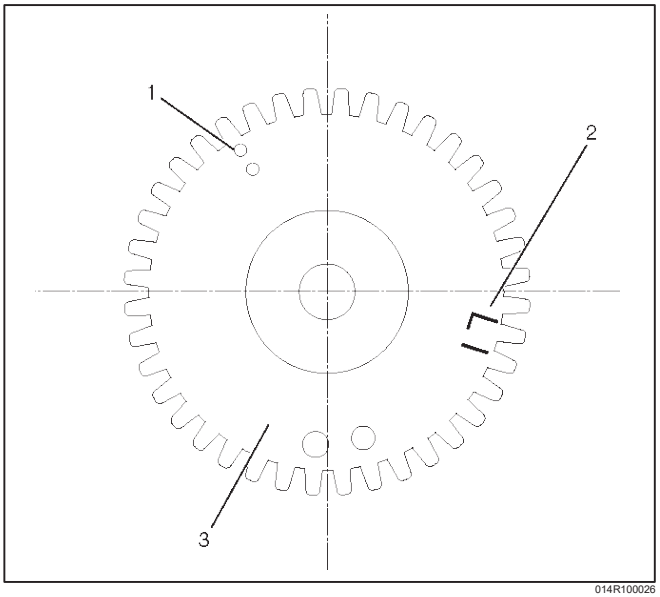
014R100016

**Legend**
(1) Alignment Mark on the Camshaft Gear
(2) Alignment Mark on the Camshaft Drive Gear



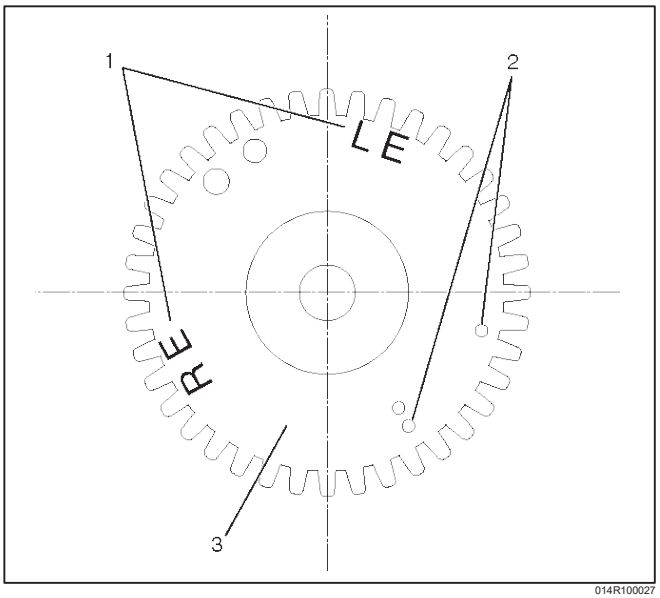
014R100025

**Legend**
(1) Discrimination Mark for Right Bank Intake Camshaft Gear
(2) Alignment Mark for Right Bank (One Dot)
(3) Camshaft Timing Gear for Right Bank Intake



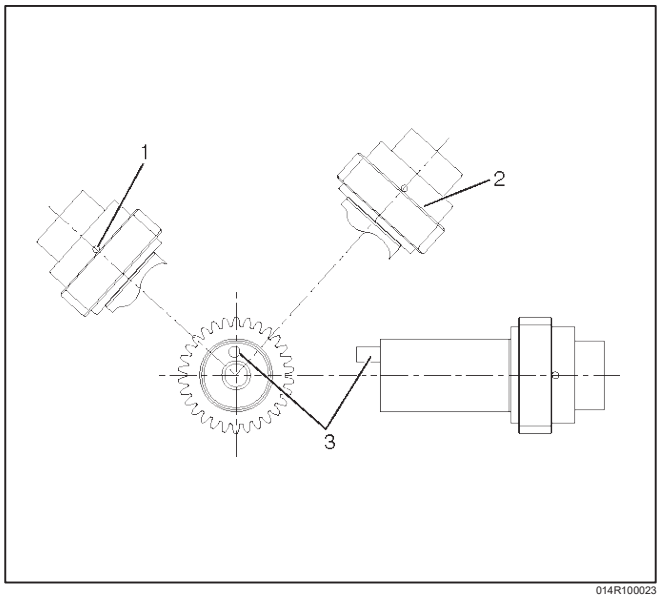
014R100026

**Legend**
(1) Alignment Mark for Left Bank (Two Dots)
(2) Discrimination Mark for Left Bank Intake Camshaft Gear
(3) Camshaft Timing Gear for Left Bank Intake



014R100027

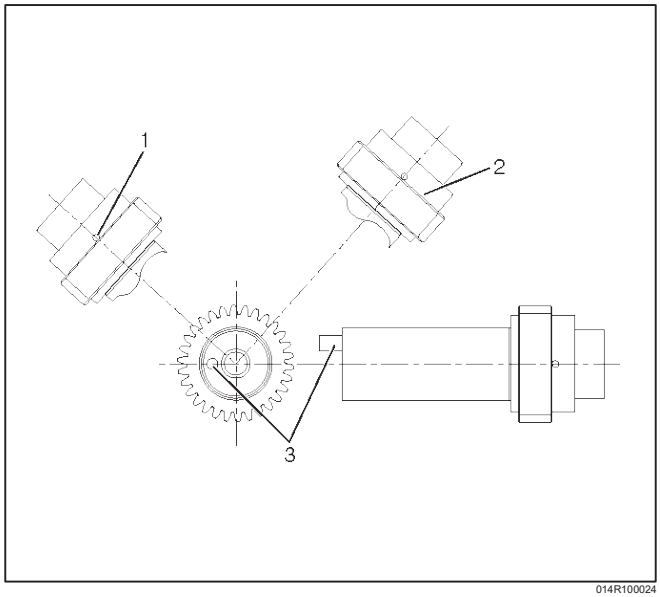
**Legend**
(1) Discrimination Mark
LE : Left Bank Exhaust
RE : Right Bank Exhaust
(2) Alignment Mark
One Dot for Right Bank
Two Dots for Left Bank
(3) Camshaft Timing Gear for Exhaust




014R100023

**Legend**

(1) Timing Mark on the Camshaft Drive Gear for Right Bank Exhaust Camshaft
(2) Timing Mark on the Camshaft Drive Gear for Right Bank Intake Camshaft
(3) Dowel Pin



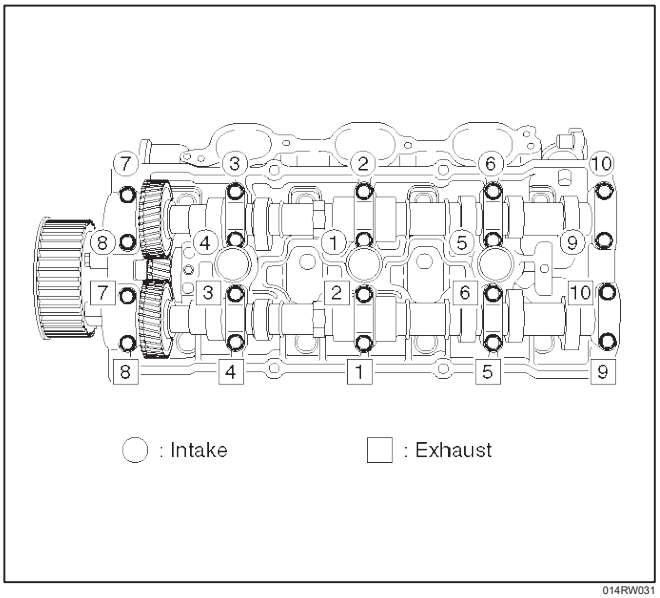

014R100024

**Legend**

(1) Timing Mark on the Camshaft Drive Gear for Left Bank Intake Camshaft
(2) Timing Mark on the Camshaft Drive Gear for Left Bank Exhaust Camshaft
(3) Dowel Pin

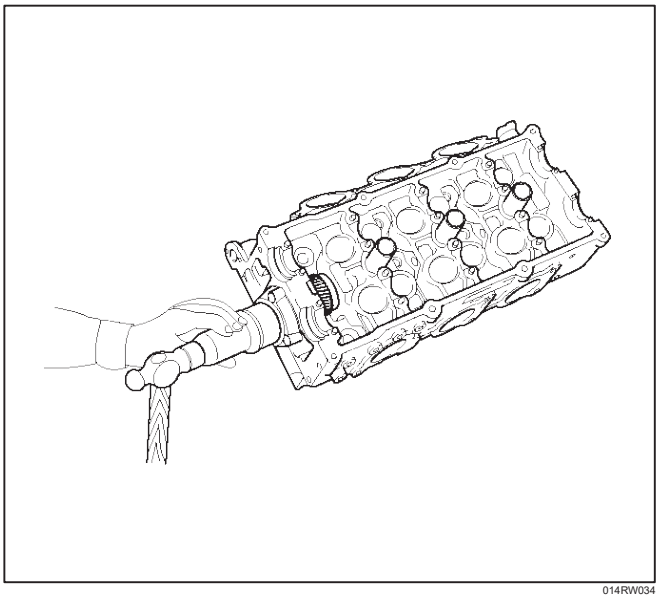
c. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

**Torque: 10 N·m (89 lb in)**



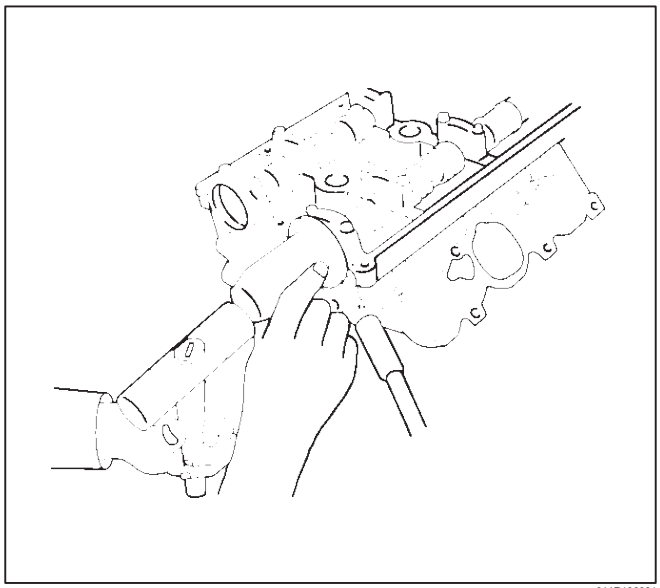

014RW031

8. If the oil seal requires replacement, use the J–42985 to install the oil seal.



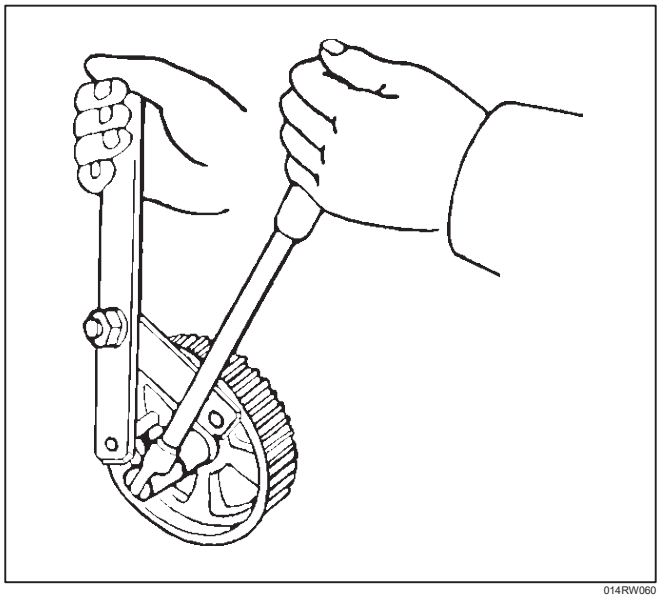
014RW034

9. If the camshaft end plug requires replacement, use the J–42985 to install the camshaft end plug.


014R100031

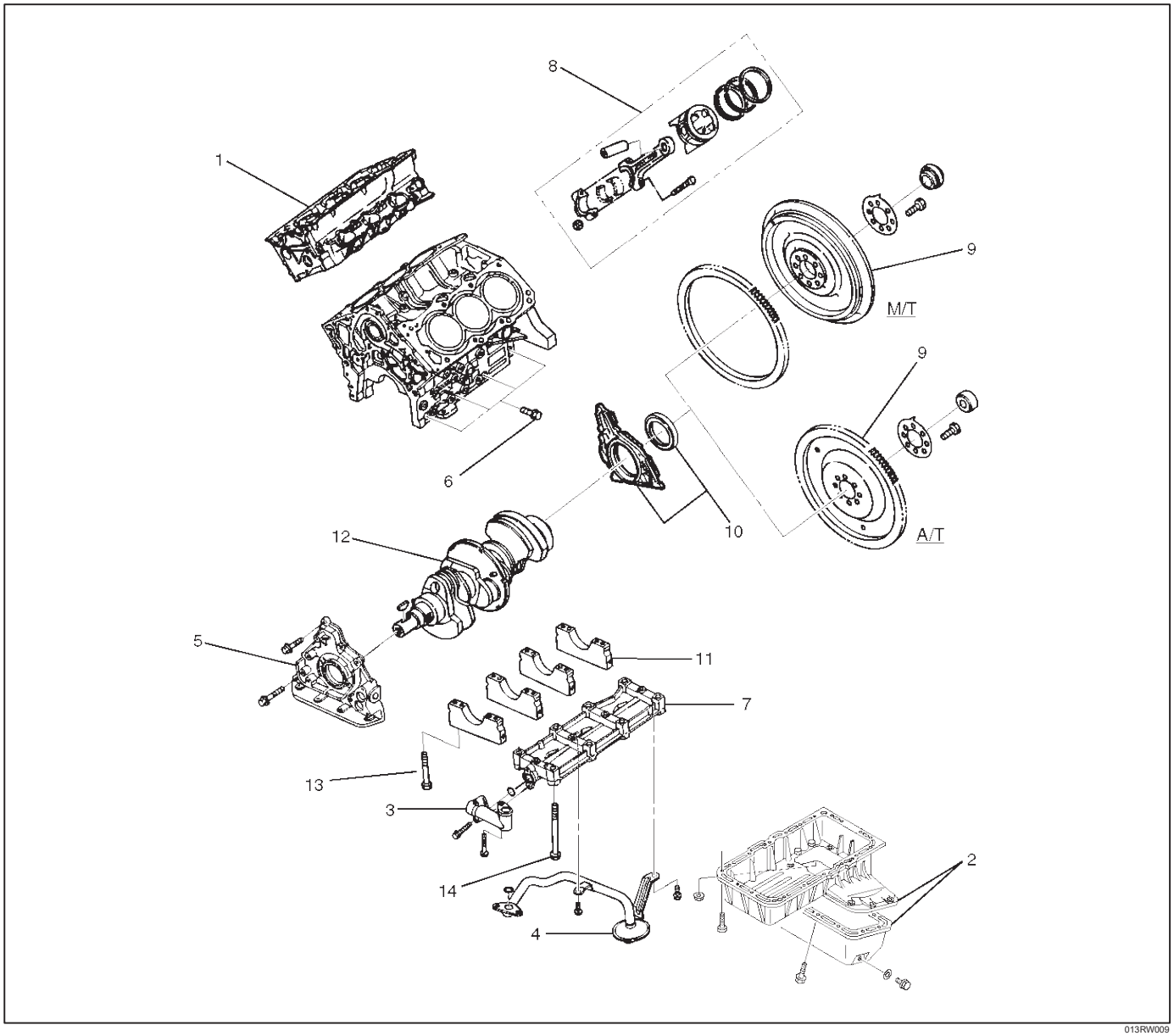
10. Tighten bolt for camshaft drive gear pulley to the specified torque using the J–43041 universal holder.

**Torque: 98 N·m (72 lb ft)**


014RW060

# Crankshaft

## Crankshaft and Associated Parts




013RW009

**Legend**

(1) Cylinder Head Assembly
(2) Crankcase with Oil Pan
(3) Oil Pipe and O-ring
(4) Oil Strainer and O-ring
(5) Oil Pump Assembly
(6) Cylinder Block Side Bolts
(7) Oil Gallery
(8) Piston and Connecting Rod Assembly
(9) Flywheel
(10) Rear Oil Seal Retainer and Oil Seal
(11) Main Bearing Cap
(12) Crankshaft
(13) Main Bearing Cap Fixing Bolts
(14) Oil Gallery Fixing Bolts

## Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder Head” in this manual.
2. Remove crankcase with oil pan (2). Refer to “Oil Pan and Crankcase” in this manual.

**CAUTION: Take care not to damage or deform the sealing flange surface of crankcase.**

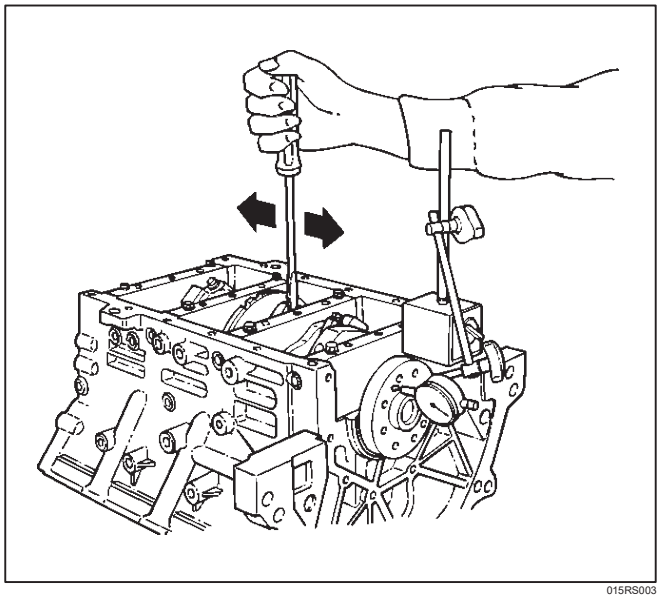
3. Remove oil pipe and O-ring (3).
4. Remove oil strainer and O-ring (4).
5. Remove oil pump assembly (5).
6. Remove crankcase side bolts (6).

7. Remove oil gallery (7).
8. Remove piston and connecting rod assembly (8). Refer to “Piston, Piston Ring and Connecting Rod” in this manual.
9. Remove flywheel (9).
10. Remove rear oil seal retainer (10).
11. Remove main bearing cap (11).
12. Remove crankshaft (12).

## Inspection and Repair for Bearings

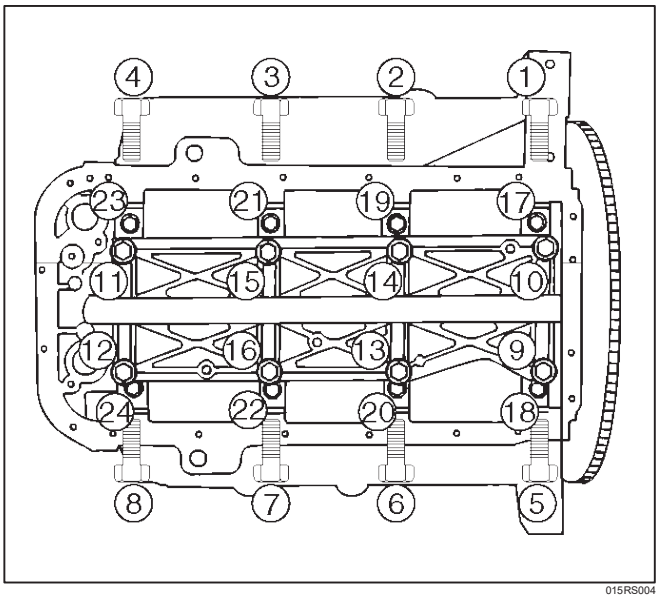
1. Inspect Crankshaft
   Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance. If the thrust clearance exceeds the specified limit, replace the thrust bearings as a set.

   **Thrust Clearance**
   **Standard : 0.06 mm–0.24 mm (0.0024 in–0.0094 in)**
   **Limit : 0.30 mm (0.0118 in)**


015RS003

### Main Bearing Clearance

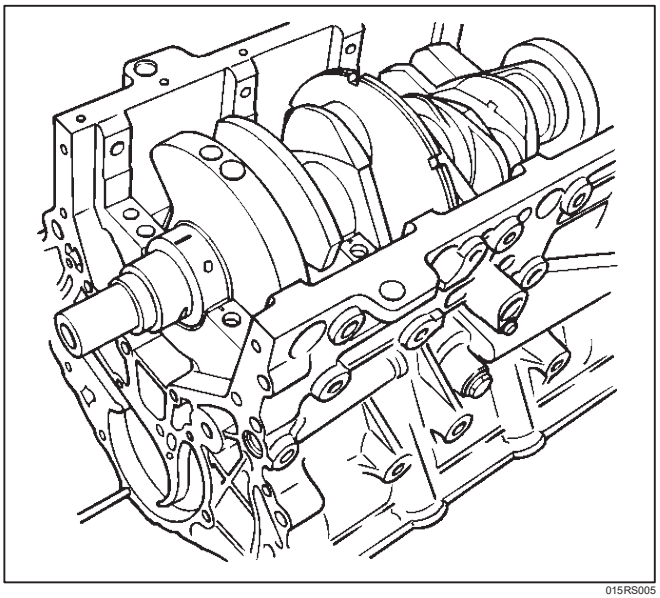
1. Remove the bearing caps and measure the oil clearance.
2. Remove the main bearing cap fixing bolts in the sequence shown in the illustration.
   Arrange the removed main bearing caps in the cylinder number order.
   Remove the main bearings.



015RS004

3. Remove the crankshaft.
   Remove the main bearings.
4. Clean the upper and lower bearings as well as the crankshaft main journal.
5. Check the bearings for damage or excessive wear.
   The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
6. Set the upper bearings and the thrust washers to their original positions.
   Carefully install the crankshaft.
7. Set the lower bearings to the bearing cap original position.
8. Apply plastigage to the crankshaft journal unit as shown in the illustration.

NOTE: Do not set the plastigage on the oil hole.


015RS005

9. Install main bearing caps, oil gallery and crank case bolts in the order shown, and tighten each bolt to the specified torque.

NOTE: Do not apply engine oil to the crank case side bolts.

**Main bearing cap bolts.**

**Torque: 39 N·m (29lb ft)**

**Oil gallery fixing bolts.**

**Torque:**

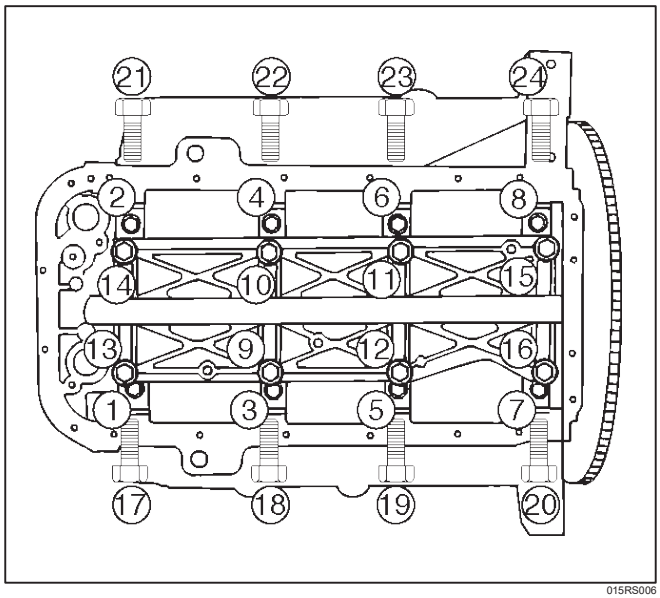
**1st step: 29 N·m (22 lb ft)**

**2nd step 55°～65°**

**Crank case side bolts**

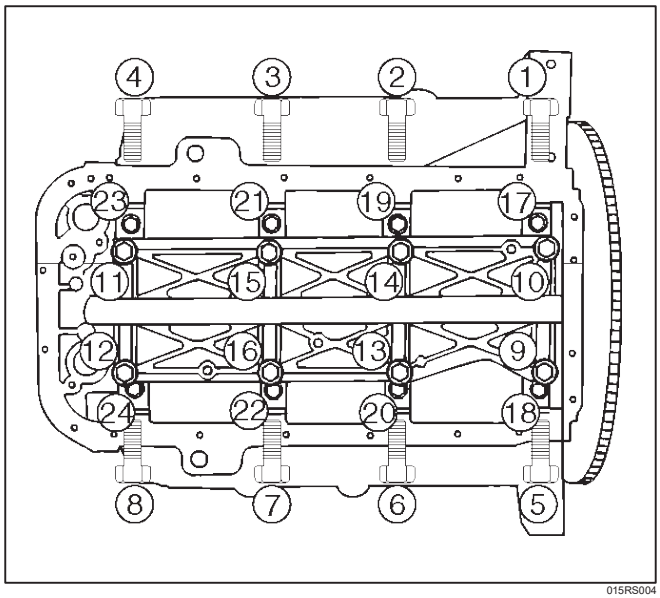
**Torque : 39 N·m (29lb ft)**

NOTE: Do not allow the crankshaft to rotate.



015RS006

10. Remove the main bearing caps in the sequence shown in the illustration.

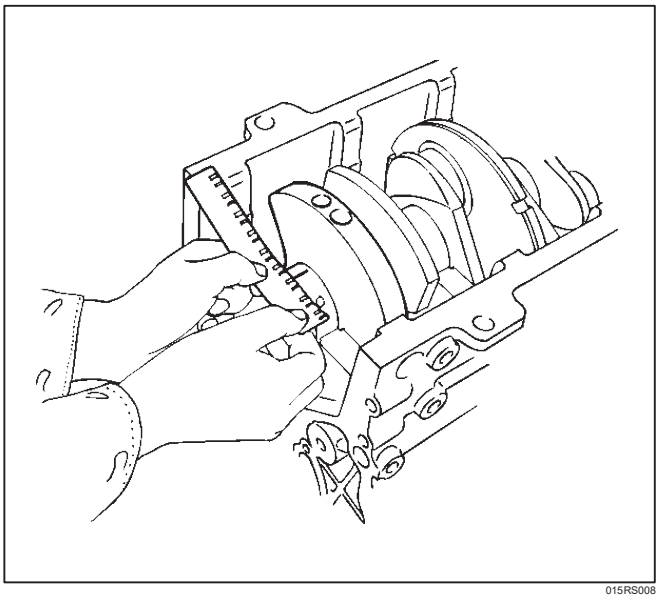


015RS004

11. Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.

**Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)**

**Limit : 0.08 mm (0.0031 in)**


015RS008

12. Clean the plastigage from the bearings and the crankshaft.
    Remove the crankshaft and the bearings.

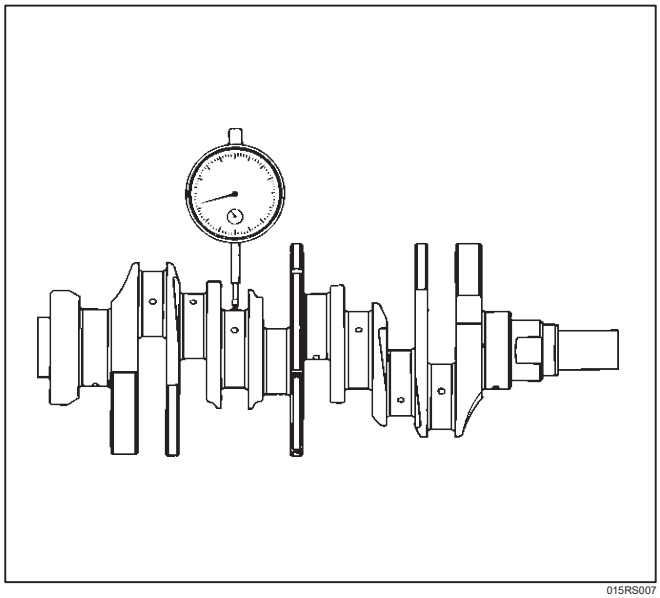
## Crankshaft Inspection

Inspect the surface of the crankshaft journal and crank pins for excessive wear and damage. Inspect the oil seal fitting surfaces for excessive wear and damage. Inspect the oil ports for obstructions.

## Inspection and Repair for Crankshaft

1. Carefully set the crankshaft on the V–blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

**Runout : 0.04 mm (0.0016 in)**

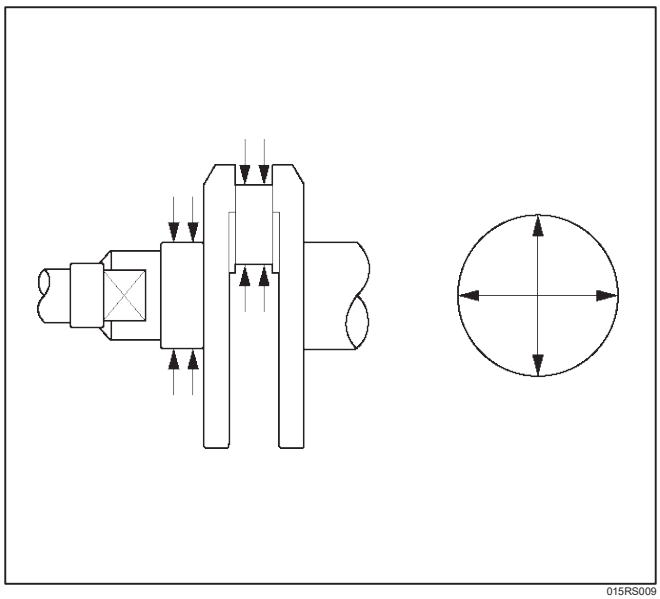



2. Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

**Main journal diameter : 63.918 mm–63.933 mm (2.5165 in–2.5170 in)**

**Crank pin diameter : 53.922 mm–53.937 mm (2.1229 in.–2.1235 in.)**

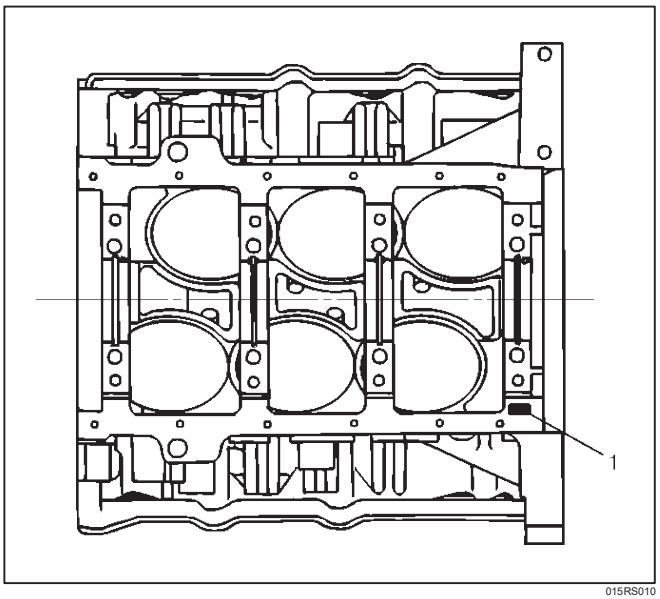
**Uneven wear limit : 0.005 mm (0.0002 in)**



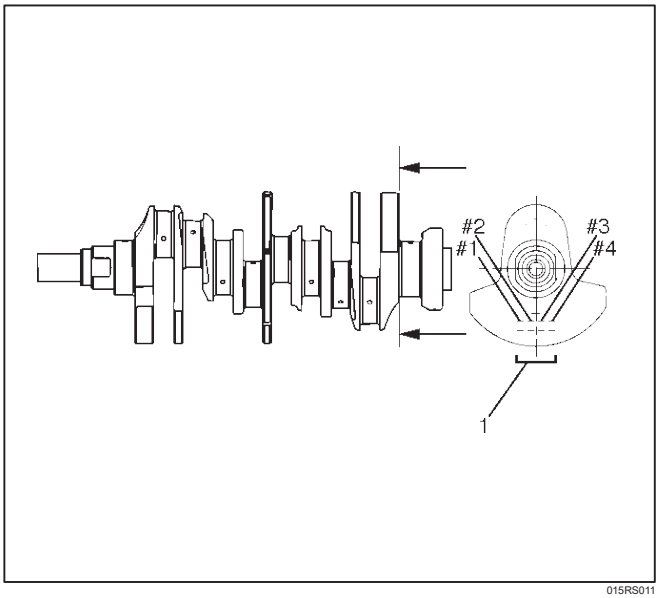

### Crankshaft Bearing Selection

When installing new crankshaft bearings or replacing bearings, refer to the selection table below. Select and install the new crankshaft bearings, paying close attention to the cylinder block journal hole.

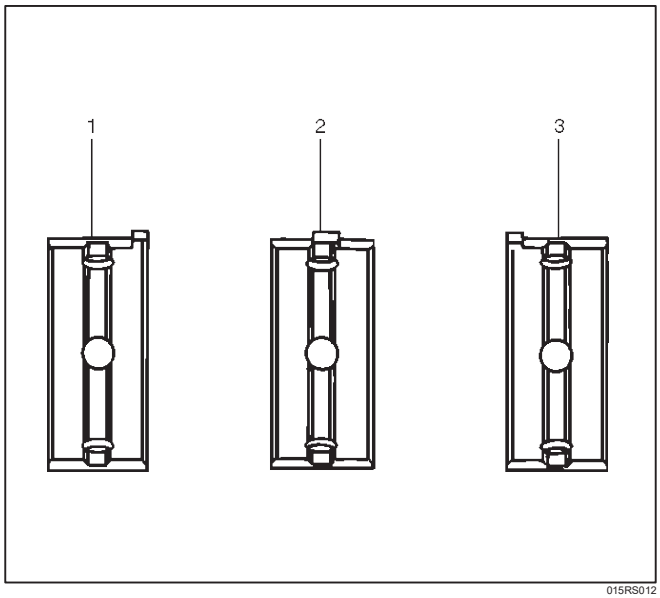
1. Diameter size mark (1) and the crankshaft journal.




2. Diameter size mark (1).
   The diameter size marks are stamped on the No.1 crankshaft balancer as shown in the illustration.




NOTE: Take care to ensure the bearings are positioned correctly.




**Legend**

(1) Number 1 and 4 main bearing upper and lower
(2) Number 2 and 3 main bearing upper
(3) Number 2 and 3 main bearing lower

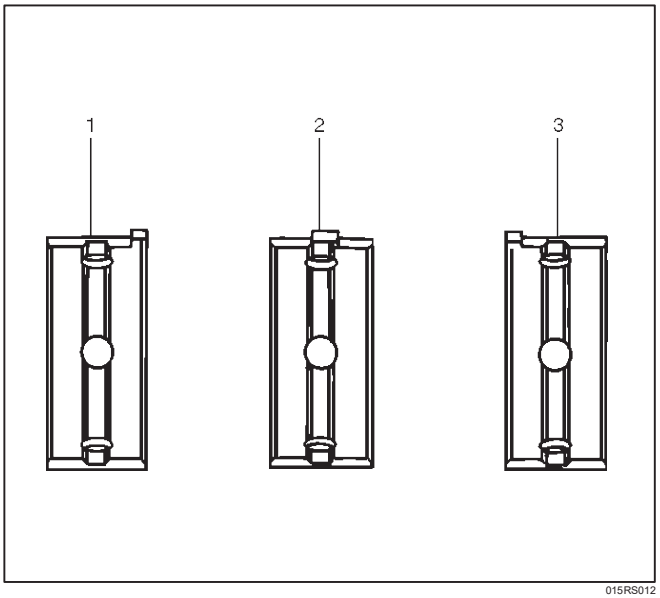
mm ( in)

| 1 Size Mark | Main Bearing Bore Diameter | Crank Shaft Main Journal Diameter | 2 Size Mark | Crank Shaft Bearing Size Mark (Upper Side) | Crank Shaft Bearing Size Mark (Lower Side) | Oil Clearance (Reference) |
|---|---|---|---|---|---|---|
| 1 | 68.994-69.000 (2.7163-2.7165) | 63.918-63.925 (2.5165-2.5167) | 2 | Blue | Blue | 0.030-0.049 (0.0012-0.0019) |
| | | 63.926-63.933 (2.5168-2.5170) | 1 | Brown | Brown | 0.028-0.047 (0.0011-0.0019) |
| 2 | 68.987-68.993 (2.7160-2.7163) | 63.918-63.925 (2.5165-2.5167) | 2 | | | 0.029-0.048 (0.0011-0.0019) |
| | | 63.926-63.933 (2.5168-2.5170) | 1 | Green | Green | 0.027-0.046 (0.0011-0.0018) |
| 3 | 68.980-68.986 (2.7157-2.7160) | 63.918-63.925 (2.5165-2.5167) | 2 | | | 0.028-0.047 (0.0011-0.0019) |
| | | 63.926-63.933 (2.5168-2.5170) | 1 | Yellow | Yellow | 0.026-0.045 (0.0010-0.0018) |

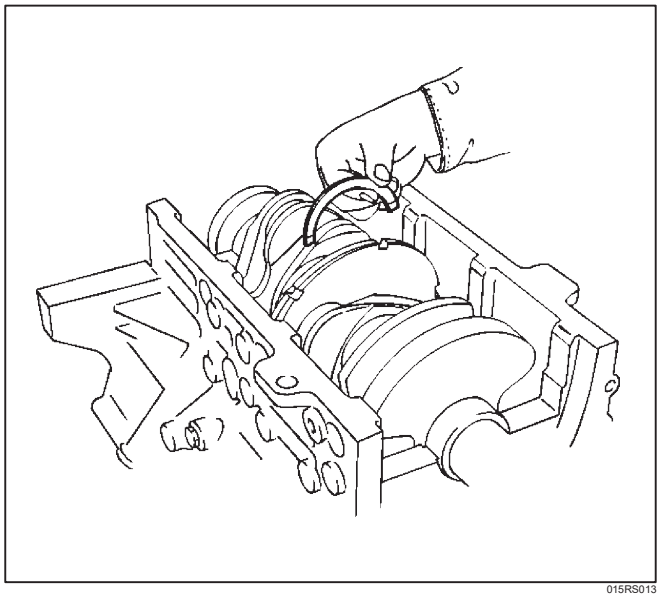
## Reassembly

1. Crankshaft (12)
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the main bearing back faces.

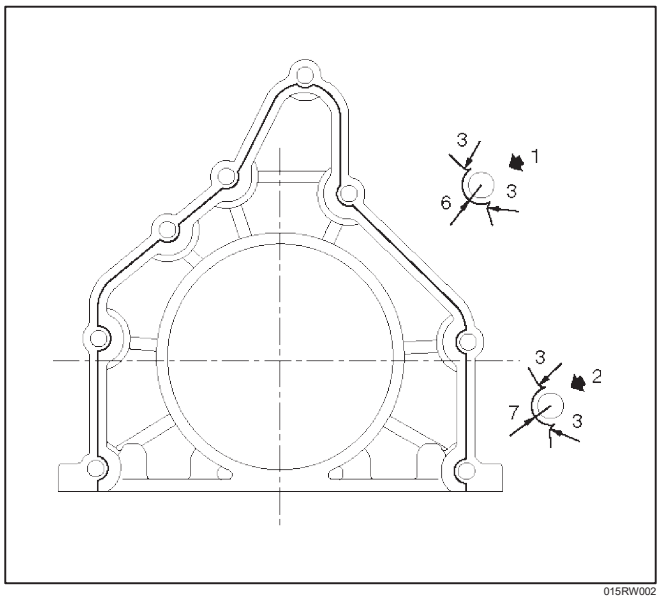


- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.




2. Rear oil seal (10)
   - Remove the oil from the cylinder block and the retainer mounting surface.
   - Apply sealant (TB–1207B or equivalent) to the retainer mounting surface, following the pattern shown in the illustration.

     The retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.




**Legend**

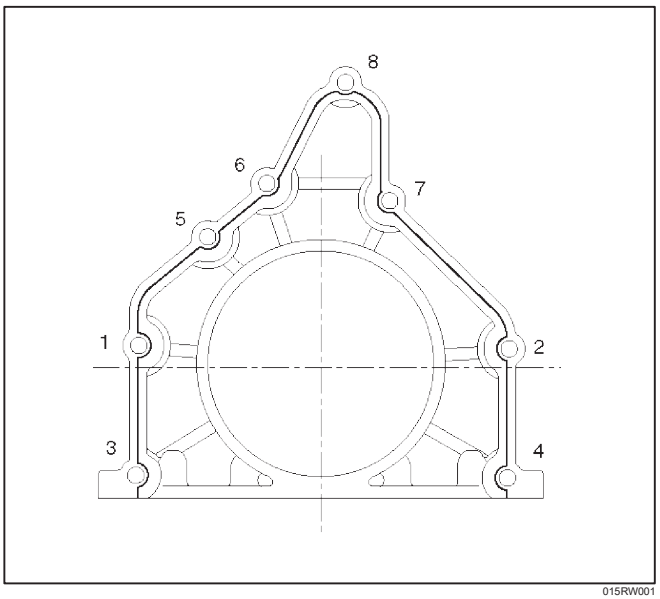
(1) Around Bolt Holes
(2) Around Dowel Pin

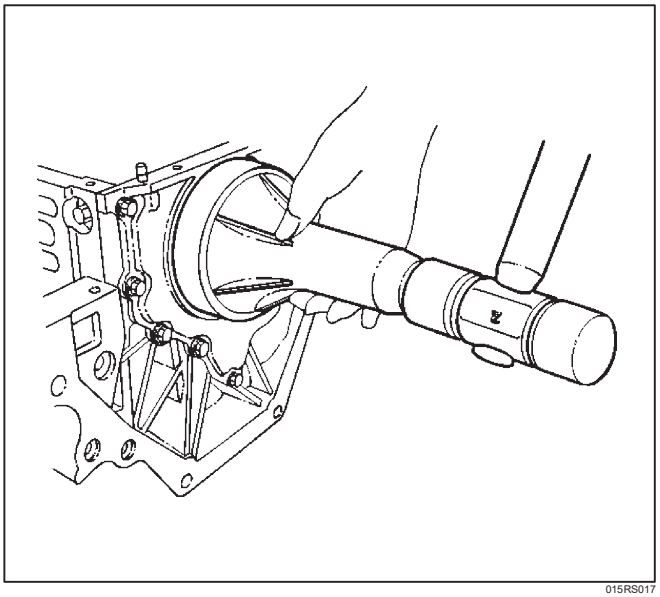
- Apply engine oil to the oil seal lip.
- Align the cylinder block dowel pin holes with the rear retainer dowel pins.
- Tighten the rear retainer fixing bolts. New bolts should be used when installing rear retainer.

**Torque: 18 N·m (13 lb ft)**

NOTE: Be very careful not to disengage the oil seal garter spring during installation of the rear retainer.

If the seal was removed from retainer for replacement, apply engine oil to the oil seal lip and install the oil seal using J–39201 oil seal installer.



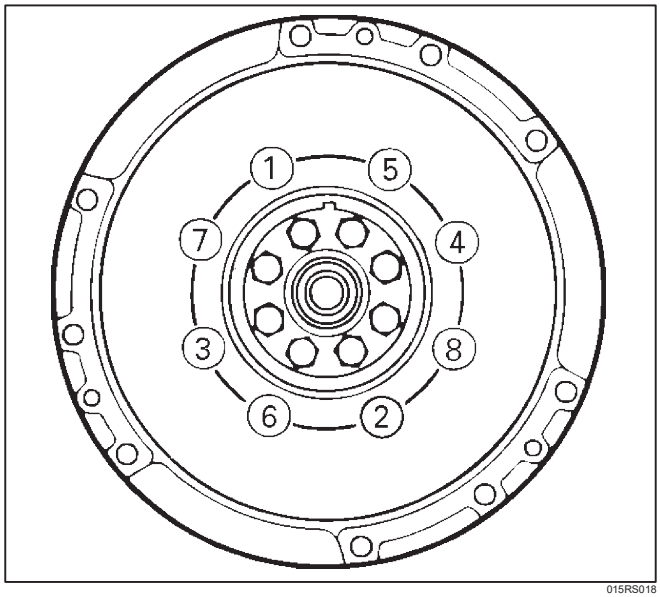




3. Flywheel (9)
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.

4. Hold the crankshaft to prevent from rotating then install the bolts in the order shown to the specified torque.

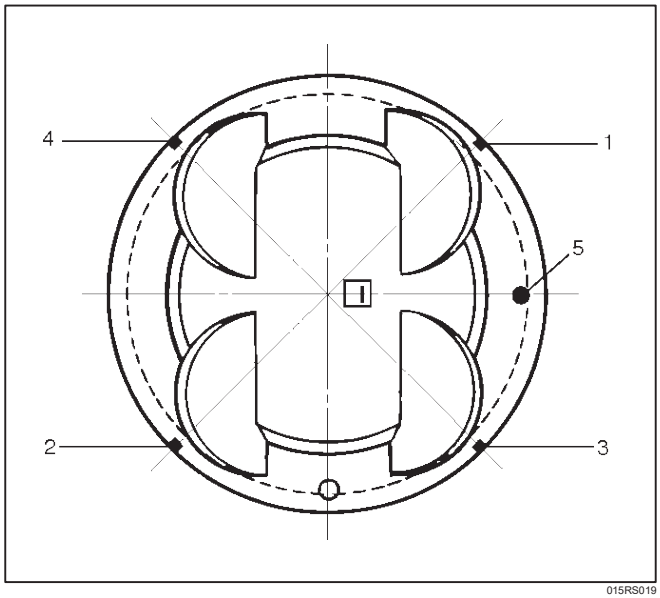
**Torque: 54 N·m (40 lb ft)**

NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS018

4. Piston and connecting rod assembly (8)
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins. Check to see that the piston ring end gaps are correctly positioned.



015RS019

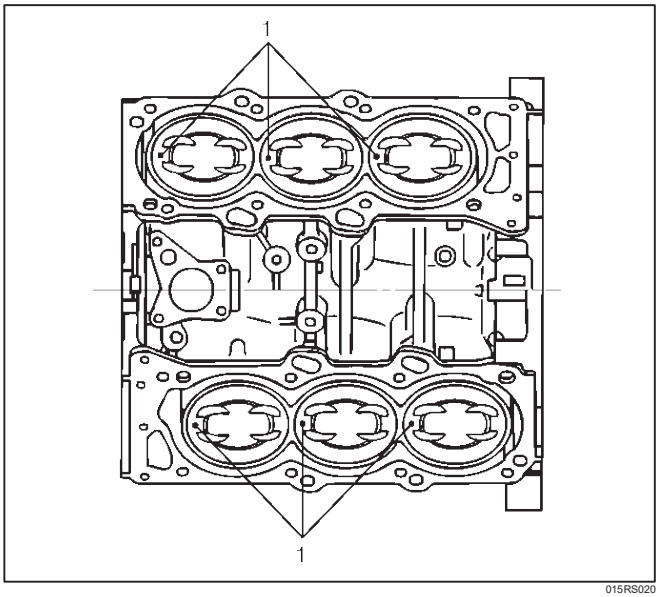
**Legend**
(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

   - Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.
   - Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
   - Apply engine oil to the threads and seating faces of the nuts.
   - Tighten the nuts.

**Torque: 54 N·m (40 lb ft)**

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces.

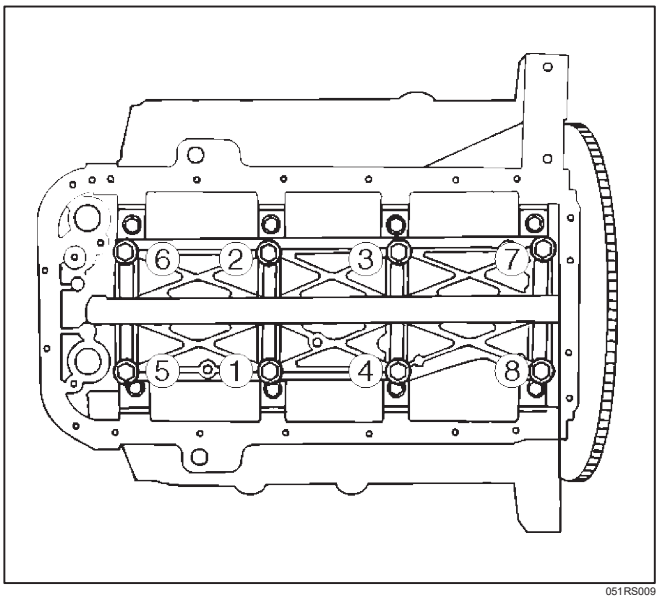


015RS020

5. Install oil gallery (7) and tighten the bolts in 2 steps, in the order shown.

**1st step: 29 N·m (22 lb ft)**

**2nd step: 55°~ 65°**

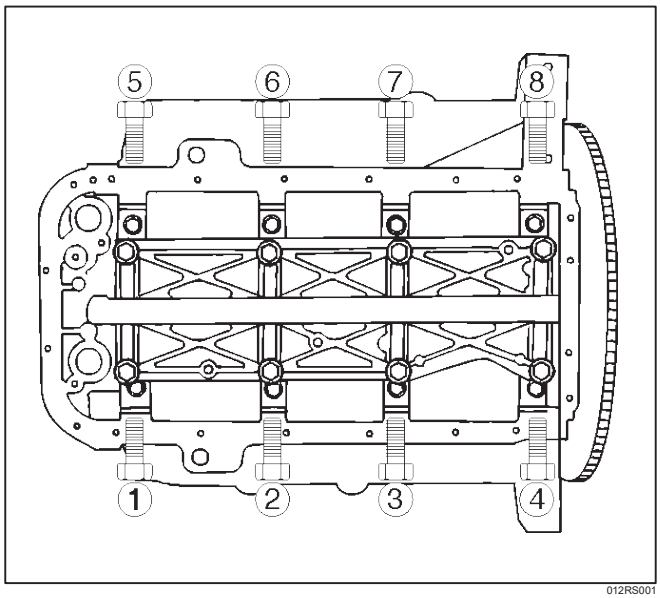


051RS009

6. Cylinder block side bolts (6)
   - Tighten all the bolts to the specified torque in the order shown.

NOTE: Do not apply engine oil to the crank case side bolts.

**Torque: 39 N·m (29 lb ft)**



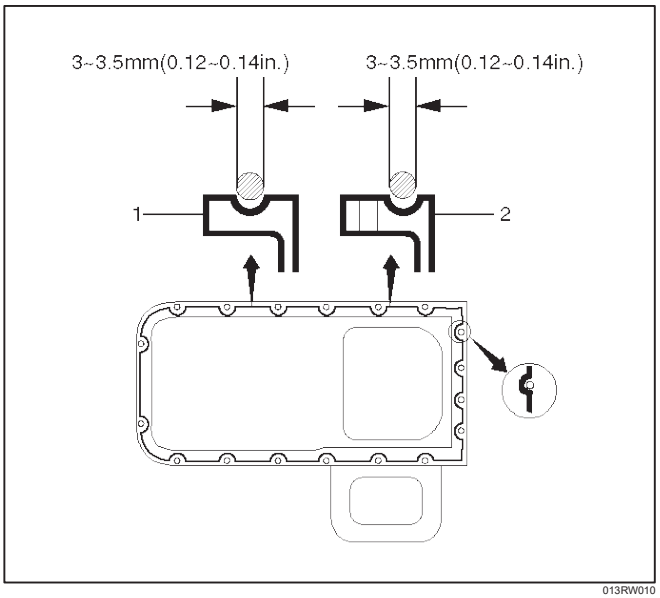
012RS001

7. Install oil pump assembly (5), refer to “Oil pump” in this manual.
8. Install oil strainer and O-ring (4).
9. Install oil pipe and O-ring (3) and tighten the bolts.

**Torque: 25 N·m (18 lb ft)**

10. Install crankcase with oil pan (2).
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB—1207C or its equivalent) to the contact surfaces of the oil pan. There must be no gaps in the bead.
    3. The crankcase assembly must be installed within 5 minutes after sealant application.
    4. Tighten the bolts and nuts to the specified torque.

**Torque : 10 N·m (87 lb in)**



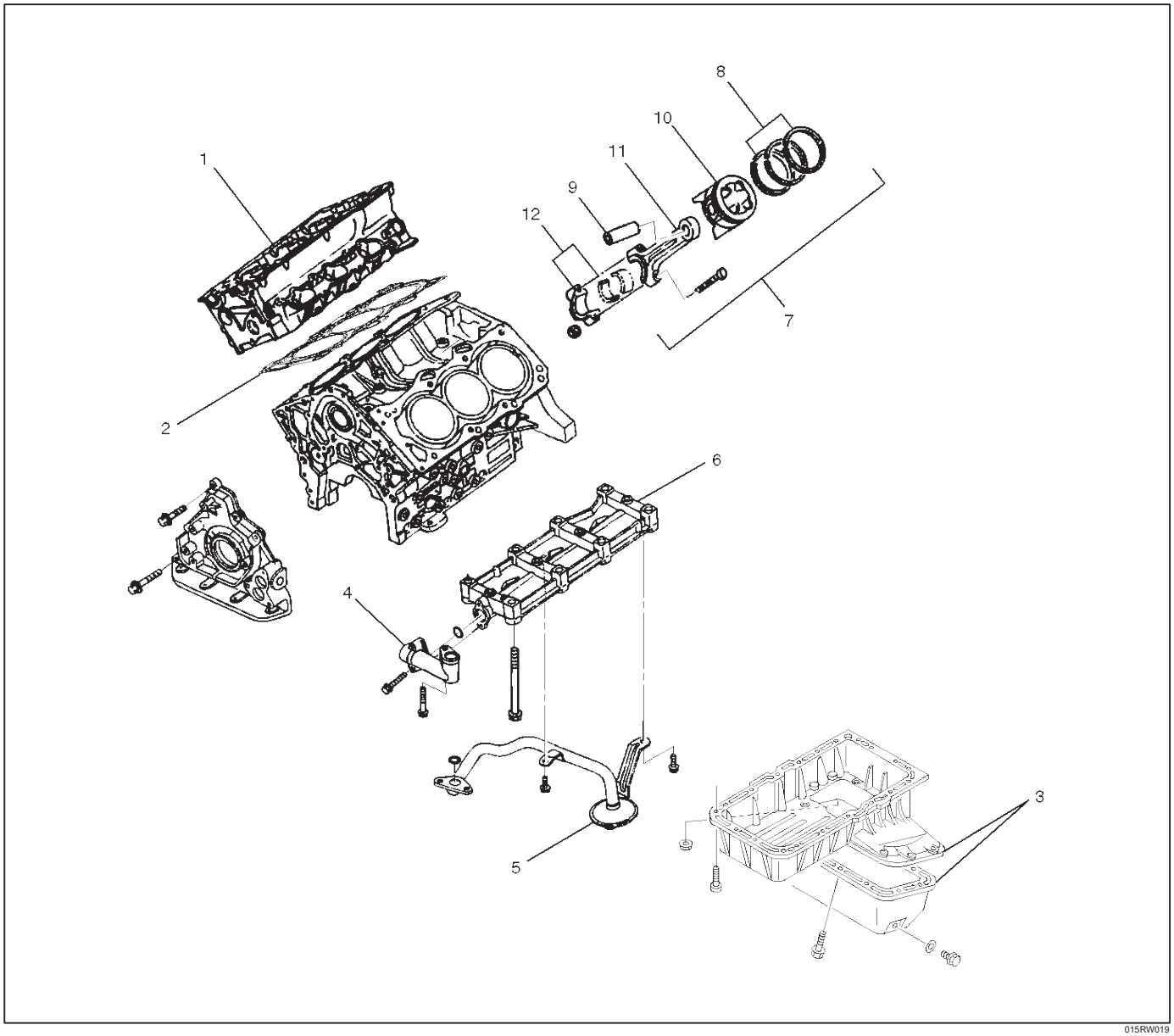
013RW010

**Legend**
(1) Portion Between Bolt Holes
(2) Bolt Hole Portion

11. Install cylinder head assembly, refer to “Cylinder head” in this manual.

# Piston and Connecting Rod

## Piston, Connecting Rod and Associate Parts




015RW019

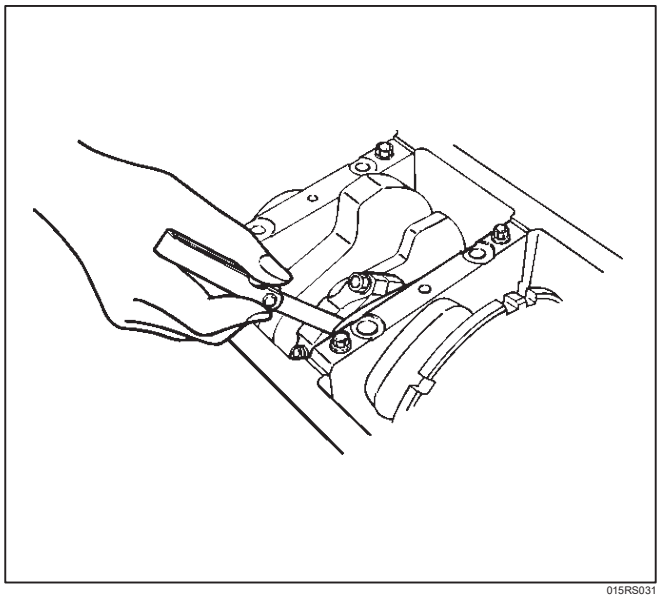
**Legend**

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-ring
(5) Oil Strainer and O-ring
(6) Oil Gallery
(7) Piston and Connecting Rod Assembly
(8) Piston Ring
(9) Piston Pin
(10) Piston
(11) Connecting Rod
(12) Connecting Rod Cap

## Disassembly

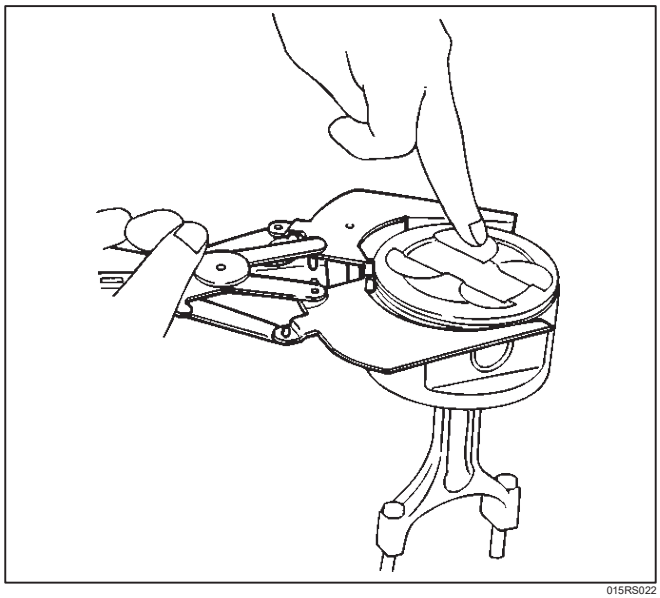
1. Remove cylinder head assembly (1). Refer to “Cylinder Head Removal” in this manual.
2. Remove cylinder head gasket (2).
3. Remove crankcase with oil pan (3). Refer to“Oil Pan and Crankcase” in this manual.
4. Remove oil pipe and O-ring (4).
5. Remove oil strainer and O-ring (5).
6. Remove oil gallery (6).
7. Remove connecting rod cap with connecting rod lower bearing (12).
8. Remove piston and connecting rod assembly (7).

NOTE: Before removing piston and connecting rod assembly, measure thrust clearance.


015RS031

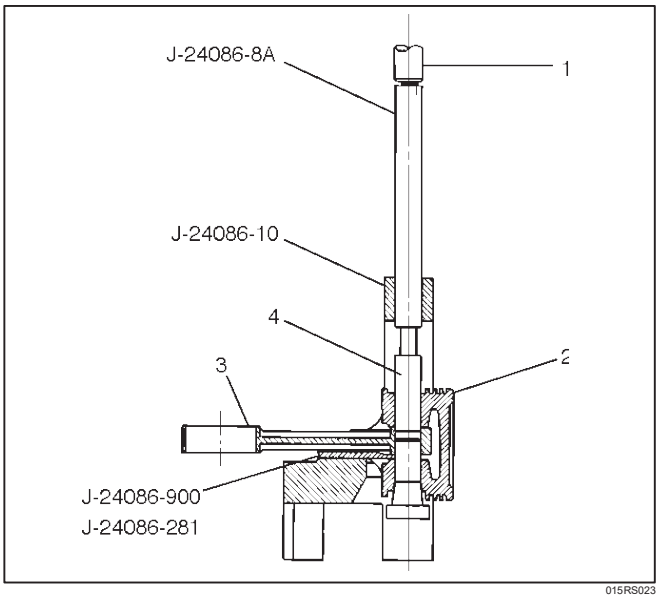
- Remove any ridge or carbon build up from the top end of the cylinder.

9. Remove the piston rings (8) with a piston ring expander. Arrange the removed piston rings in the cylinder number order.


015RS022

10. Remove the piston pin (9) using J–24086–C piston pin service set and piston support with a press.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions. Heating the connecting rod will permit easy removal of the piston pin.



015RS023

**Legend**
(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

11. Piston (10)
12. Connecting rod (11)

# Inspection and Repair

## Pistons

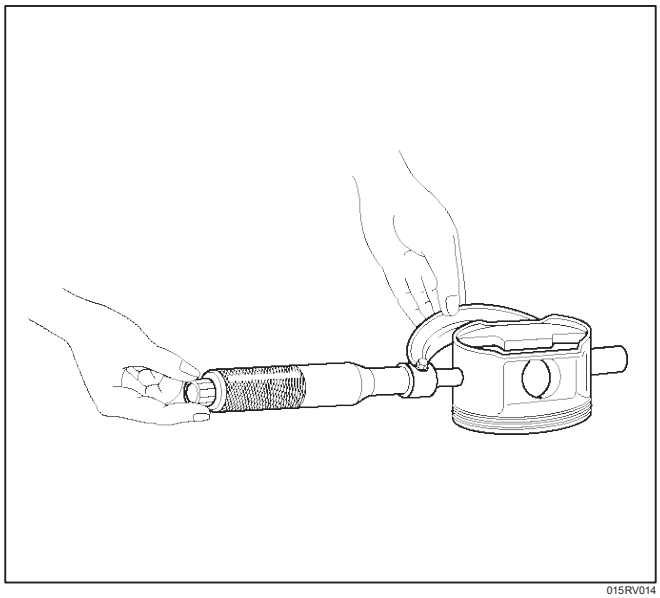
Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are found, the piston must be replaced.

## Piston Diameter

1. Measure the piston outside diameter with micrometer at the piston grading position and a right angle to the piston pin.
   Piston grading position (from piston head)

   **Piston grading position : 43.0 mm (1.6929 in)**


015RV014

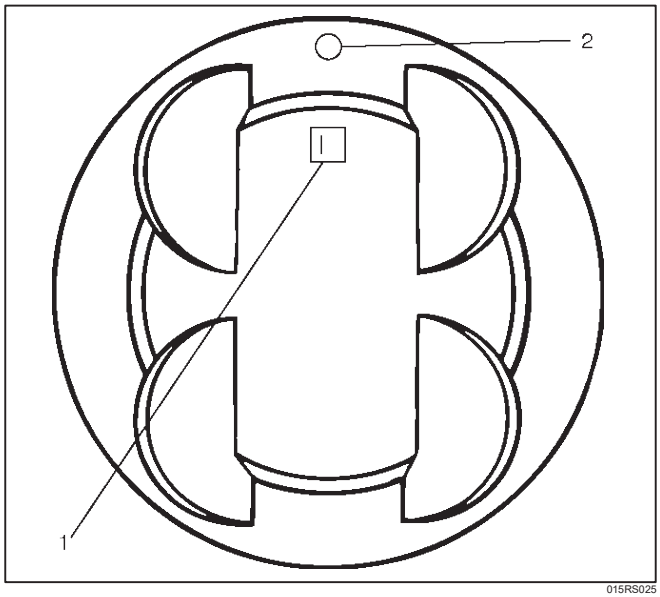
The size mark (1) for piston outside diameter is represented as shown in Figure.

**Outside Diameter**

**Size Mark A : 93.360 mm–93.370 mm (3.6756 in–3.6760 in)**

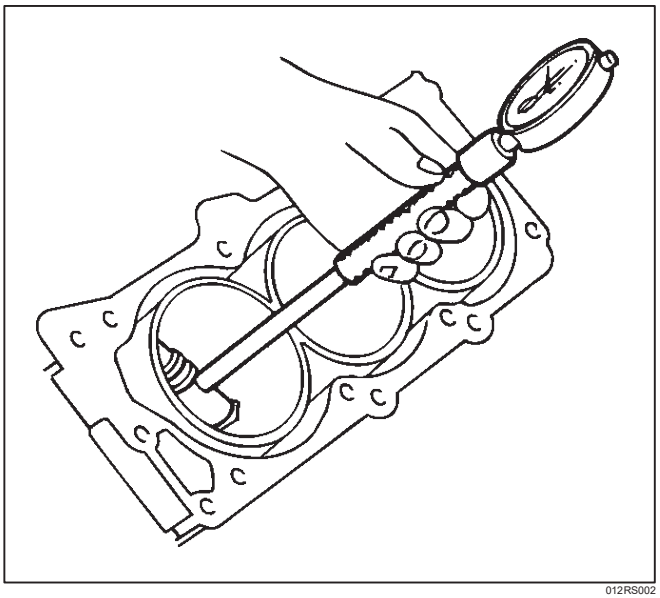
**Size Mark B : 93.371 mm–93.380 mm (3.6760 in–3.6764 in)**

**Size Mark C : 93.381 mm–93.390 mm (3.6764 in–3.6768 in)**



015RS025

Measure the cylinder bore inside diameter (refer to “Cylinder Block” in this manual).


012RS002

## Piston Rings

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement
   - Insert the piston ring into the bore.
   - Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
   - Measure the ring end gap.

**Compression Ring**

**1st ring**

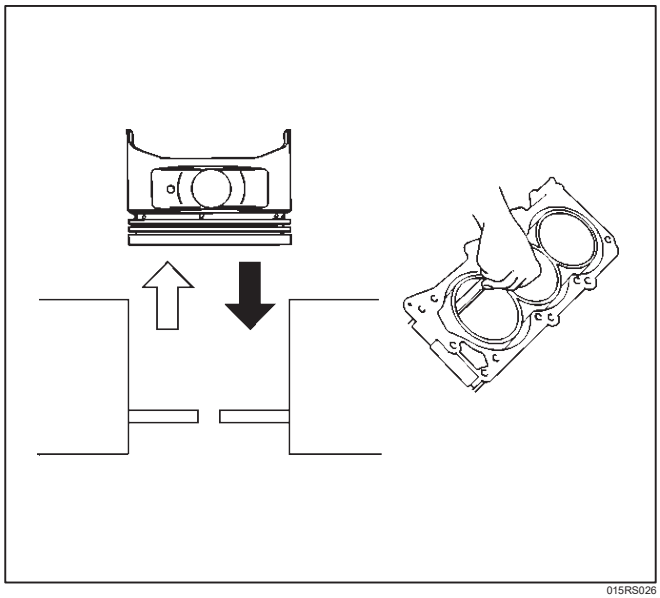
| | |
|---|---|
| **Standard:** | **0.300 mm–0.400 mm (0.0118 in–0.0157 in)** |
| **Limit:** | **1.0 mm (0.0394 in)** |

**2nd ring**

| | |
|---|---|
| **Standard:** | **0.450 mm–0.600 mm (0.0177 in–0.0236 in)** |
| **Limit:** | **1.2 mm (0.0472 in)** |

**Oil ring**

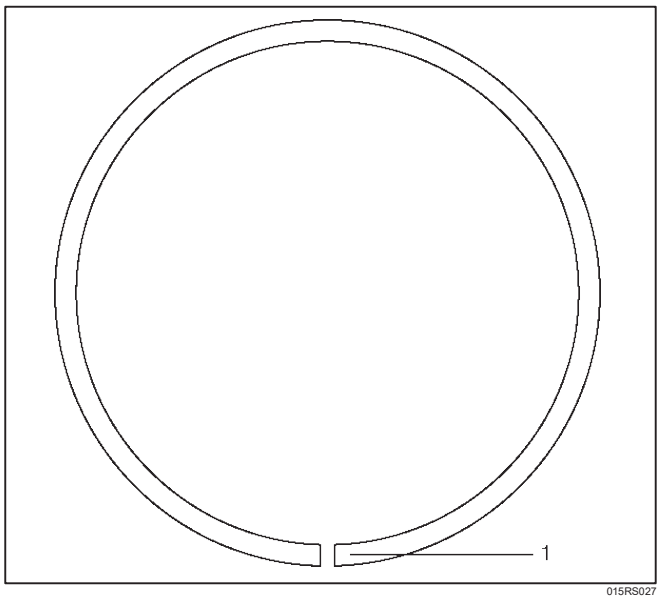
| | |
|---|---|
| **Standard:** | **0.150 mm–0.450 mm (0.0059 in–0.0177 in)** |
| **Limit:** | **1.05 mm (0.0413 in)** |


015RS026

- Positioning mark (1) is painted as shown in the illustration.

**Marked T : No.1 Compression ring**

**Marked T2 : No.2 Compression ring**



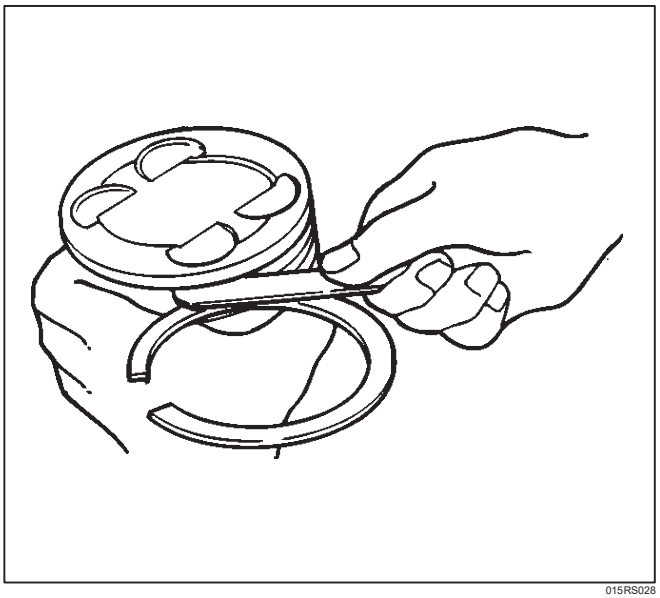
015RS027

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove / piston ring clearance exceeds the specified limit, the piston must be replaced.

**Compression Ring Clearance**

**Standard : 0.025 mm–0.065 mm (0.0006 in.–0.0015 in)**

**Limit : 0.1mm (0.0059 in)**

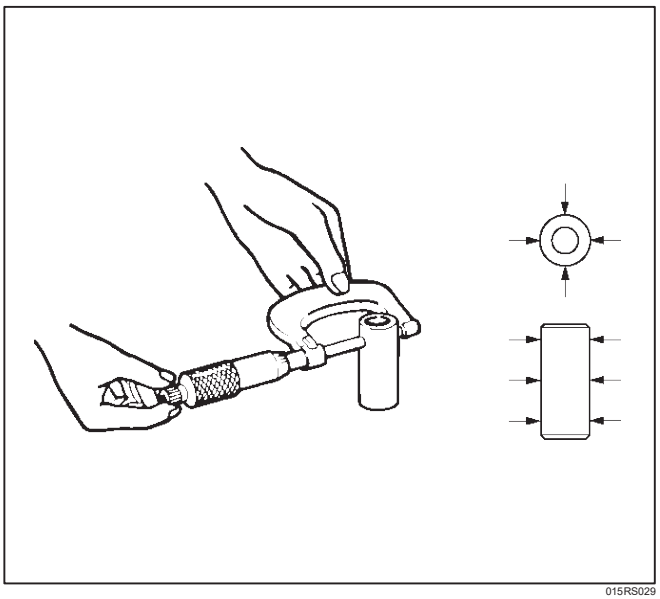

015RS028

## Piston Pin

NOTE: Do not reuse the old piston pin.

1. Use a micrometer to measure the new piston pin outside diameter in both directions at three different positions.
2. Measure the inside diameter of the connecting rod small end. If the fitting interference between the small end and pin does not conform to the specified value, the connecting rod must be replaced.

**Standard : 0.023 mm–0.038 mm (0.0009 in–0.0015 in)**


015RS029

3. Insert the new pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston must be replaced.

**Clearance**

**Standard : 0.010 mm–0.017 mm (0.0004 in.–0.0007 in)**

**Limit : 0.040 mm (0.0016 in)**

## Connecting Rods

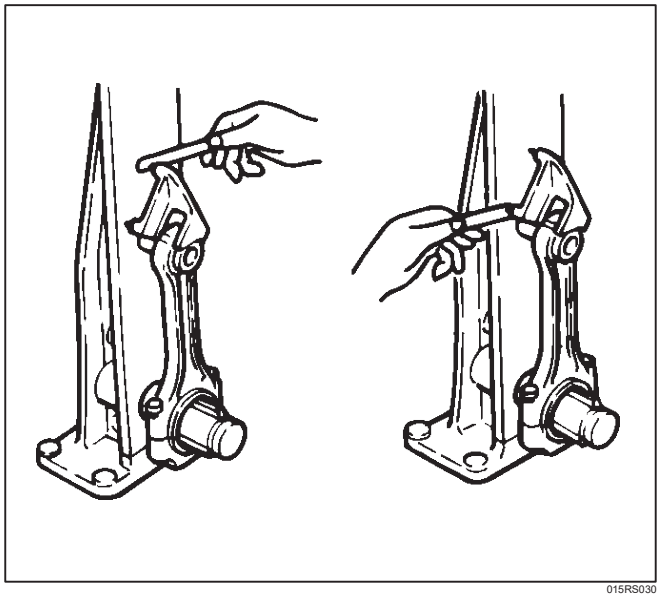
1. Check the connecting rod alignment If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

**Bend per 100 mm (3.937 in)**

**Limit: 0.15 (0.0059)**

**Twist per 100 mm (3.937 in)**

**Limit: 0.20 (0.0078)**

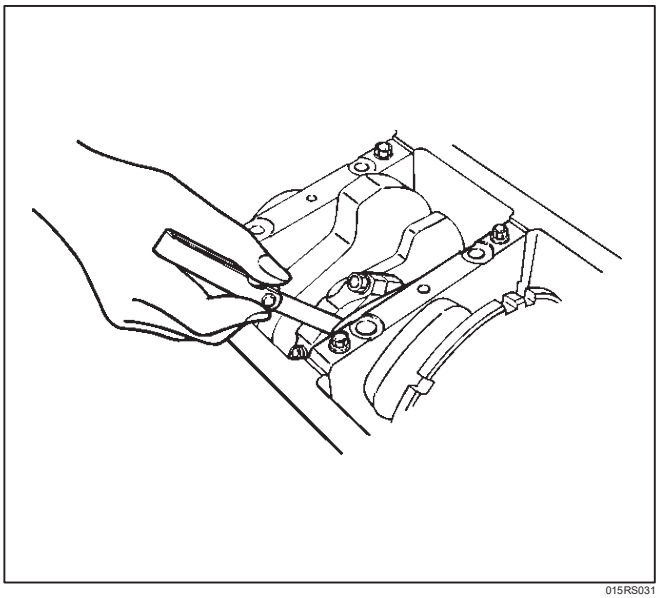


015RS030

2. Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the large end of the connecting rod If the clearance exceeds the specified limit, the connecting rod must be replaced.

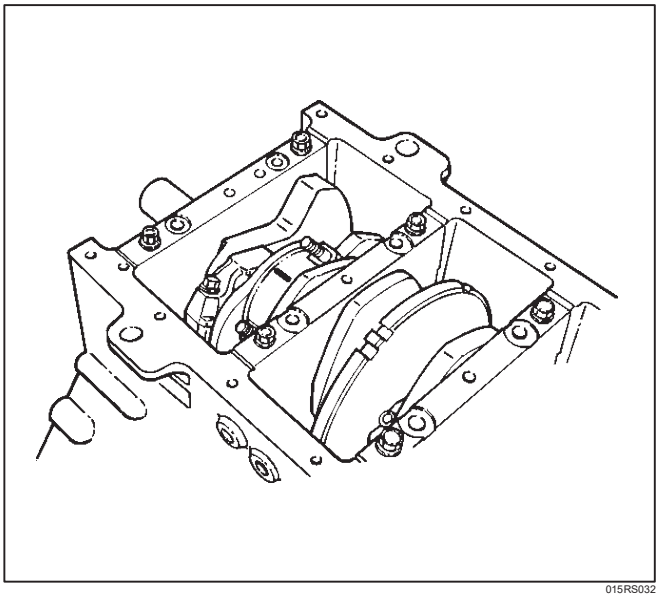
**Standard : 0.16 mm–0.35 mm (0.0063 in.–0.0138 in)**

**Limit : 0.40 mm (0.0157 in)**



015RS031

3. Measure the oil clearance between the connecting rod and the crankshaft.
   1. Remove the connecting rod cap nuts and the rod caps (12).
      Arrange the removed rod caps in the cylinder number order.
   2. Clean the rod bearings and the crankshaft pins.
   3. Carefully check the rod bearings. If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions. Apply plastigage to the crank pin.



015RS032

   4. Reinstall the rod caps (12) to their original positions.
      Tighten the rod cap nuts.

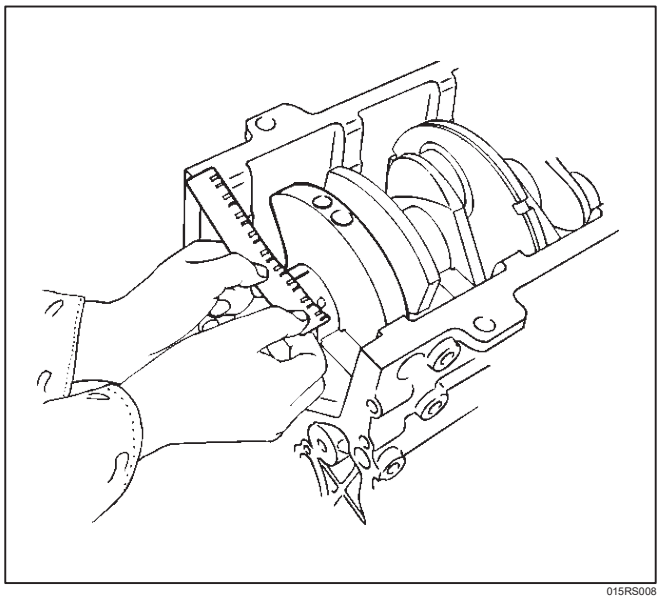
**Torque: 54 N·m (40 lb ft)**

NOTE: Do not allow the crankshaft to rotate.

5. Remove the rod caps.
6. Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearing as a set.

**Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)**

**Limit : 0.08 mm (0.0031 in)**



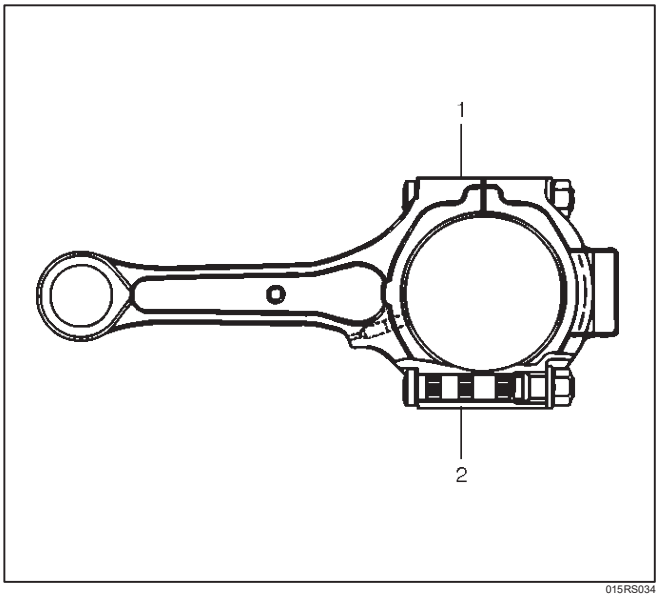
015RS008

7. Clean the plastigage from the bearings and the crankshaft pins.

### Con–rod Bearing Selection

Select and install the new connecting rod bearings, paying close attention to the connecting rod big end diameter size mark (1).

NOTE: Take care not to confuse the alignment mark (2) and the size mark (1) during the installation procedure.




015RS034

mm ( in)

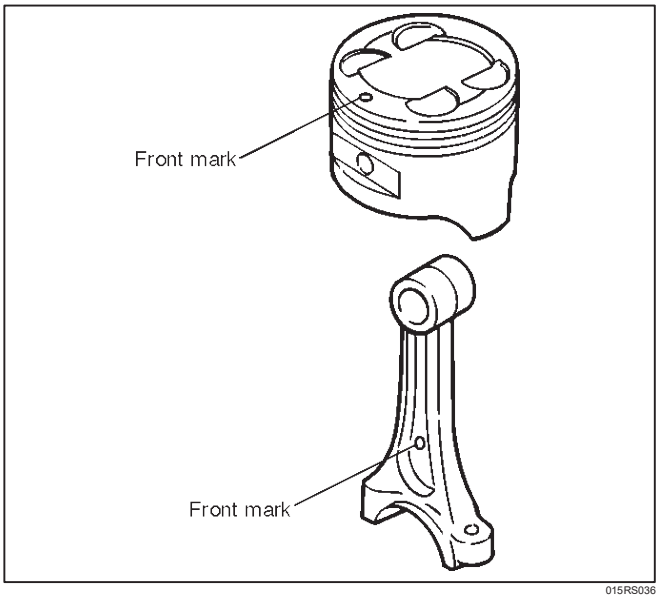
| 1 Size Mark | Big end Bore Diameter | Crankshaft Pin Diameter | Connecting Rod Bearing Thickness (Reference) | Color of Size Mark | Oil Clearance (Reference) |
|---|---|---|---|---|---|
| A | 56.994-57.000 (2.2439-2.2441) | 53.922-53.937 (2.1229-2.1235) | 1.512-1.516 (0.0595-0.0597) | Yellow | 0.025-0.054 (0.0010-0.0021) |
| B | 56.988-56.994 (2.2436-2.2439) | | 1.508-1.512 (0.0594-0.0595) | Green | 0.027-0.056 (0.0011-0.0022) |
| C | 56.982-56.988 (2.2434-2.2436) | | 1.504-1.508 (0.0592-0.0594) | Pink | 0.029-0.058 (0.0011-0.0023) |

## Reassembly

1. Install connecting rod
2. Install piston
3. Install piston pin
   - Apply a thin coat of engine oil to the piston pin. Try to insert the piston pin into the piston pin hole with normal finger pressure.

NOTE: When changing piston / connecting rod combinations, do not change the piston / piston pin combination and do not reuse the old piston pin.

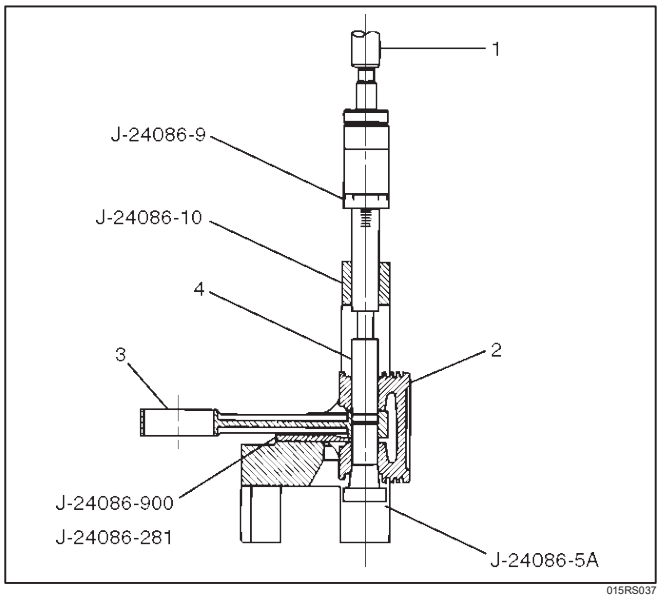
- Attach the piston to the connecting rod with the piston front mark and the connecting rod front mark on the same side.




015RS036

- With J–24086–C Piston pin service set and a press, press fit the piston pin.

NOTE: Heat the connecting rod small end to a suitable temperature to ensure smooth installation.

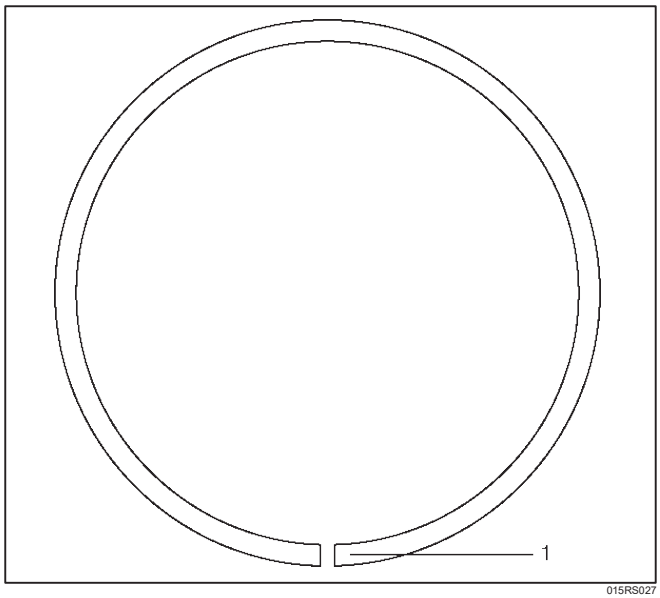



**Legend**
(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

4. Install piston ring with the piston ring expander.
   The compression ring must be set with the T mark (1) facing up.

   **Marked T : No.1 Compression ring**

   **Marked T2 : No.2 Compression ring**




- Install piston rings in the following sequence.

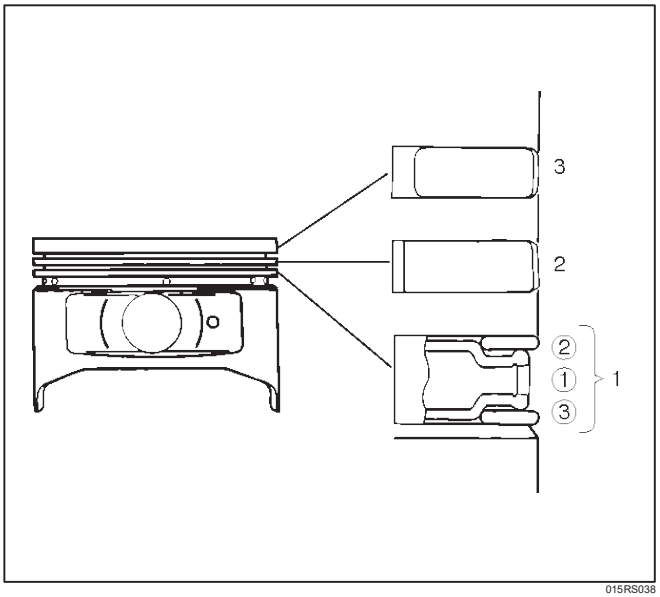
1. Oil ring
   1. Expander ring
   2. Upper side rail
   3. Lower side rail
2. 2nd compression ring
3. 1st compression ring

- The compression rings must be set with the T or T2 mark facing up.

**Marked T : No.1 Compression ring**

**Marked T2 : No.2 Compression ring**

- After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.




5. Install piston and connecting rod assembly.
   - Insert the bearings into the connecting rods and caps. Apply new engine oil to the bearing faces and nuts.
   - Tighten the connecting rod cap nuts

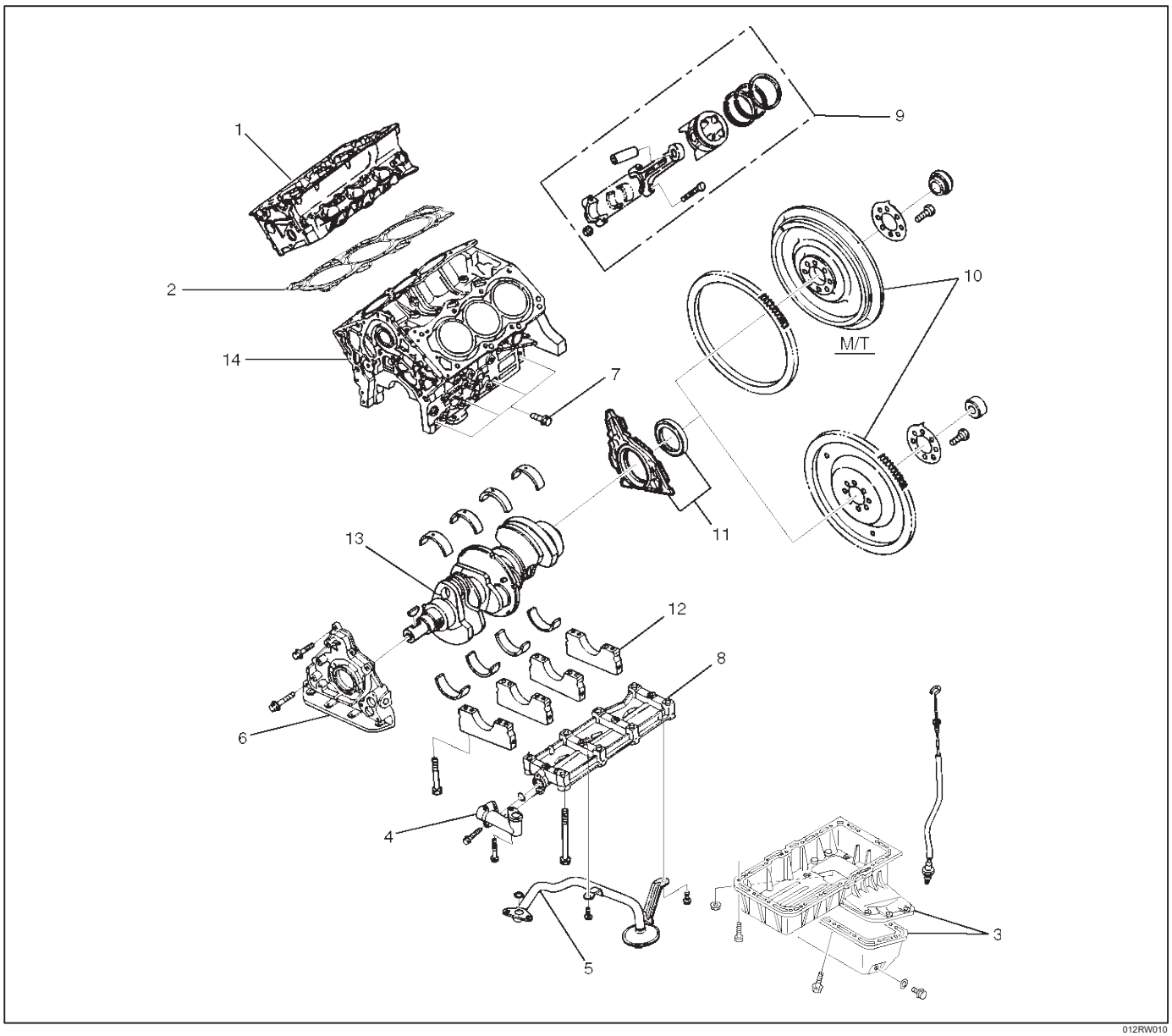
   **Torque : 54 N·m (40 lb ft)**

NOTE: Do not apply engine oil to the bearing back faces.

6. Oil gallery, refer to “Crankshaft and main bearing” in this manual.
7. Oil strainer and O-ring.
8. Oil pipe and O-ring.
9. Install crankcase with oil pan, refer to “Oil pan and Crankcase” in this manual.
10. Install cylinder head gasket.
11. Install Cylinder head assembly.
    - Refer to “Cylinder head” in this manual.

# Cylinder Block

## Cylinder Block and Associated Parts




012RW010

**Legend**

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-ring
(5) Oil Strainer and O-ring
(6) Oil Pump Assembly
(7) Cylinder Block Side Bolts
(8) Oil Gallery
(9) Piston and Connecting Rod Assembly
(10) Flywheel
(11) Rear Oil Seal Retainer Assembly
(12) Main Bearing Cap
(13) Crankshaft
(14) Cylinder Block

## Disassembly

1. Remove cylinder head assembly.
2. Remove cylinder head gasket.
3. Remove crankcase with oil pan.
4. Remove oil pipe and O-ring.
5. Remove oil strainer and O-ring.
6. Remove oil pump assembly.
7. Remove crankcase side bolts.
8. Remove oil gallery.
9. Remove piston and connecting rod assembly.
10. Remove flywheel.

11. Remove rear oil seal retainer assembly.
12. Remove main bearing cap.
13. Remove crankshaft.
14. Remove cylinder block.

## Inspection and Repair

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block. Be very careful not to allow any material to accidentally drop into the cylinder block. Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal retainer, and crankcase assembly installation surface seal.
3. Wipe the cylinder block clean.
4. Visually inspect the cylinder block. If necessary, use a flaw detector to perform a dye penetrate and hydraulic (or air pressure) test. If cracking or other damage is discovered, the cylinder block must either be repaired or replaced.

### Flatness

1. Using a straight–edge and feeler gauge, check that the upper surface of the cylinder block is not warped.

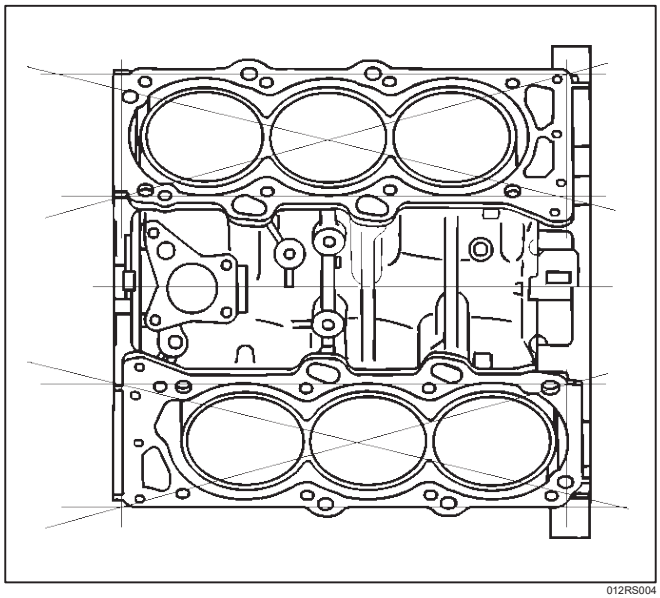
**CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.**

2. The cylinder block must be reground or replaced if the warpage exceeds the limit.

**Warpage**

**Limit : 0.15 mm (0.0059 in)**

**Maximum repairable limit: 0.15 mm (0.0059 in)**



012RS004

### Cylinder Bore

Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at six points.

**CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.**

**Cylinder Bore Inside Diameter**

**Limit : 93.530 mm (3.6823 in)**

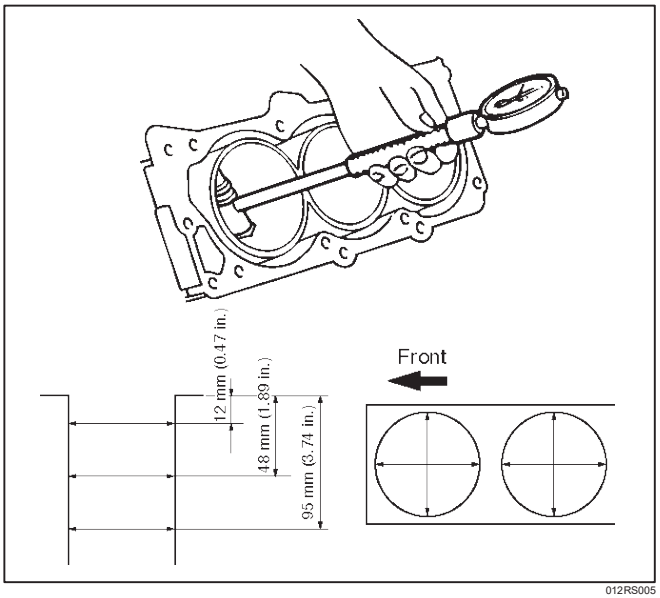
If the measurement exceed the specified limit, the cylinder block must be replaced.

**Diameter**

**Grade A : 93.400 mm–93.410 mm (3.6772 in–3.6776 in)**

**Grade B : 93.411 mm–93.420 mm (3.6776 in–3.6779 in)**

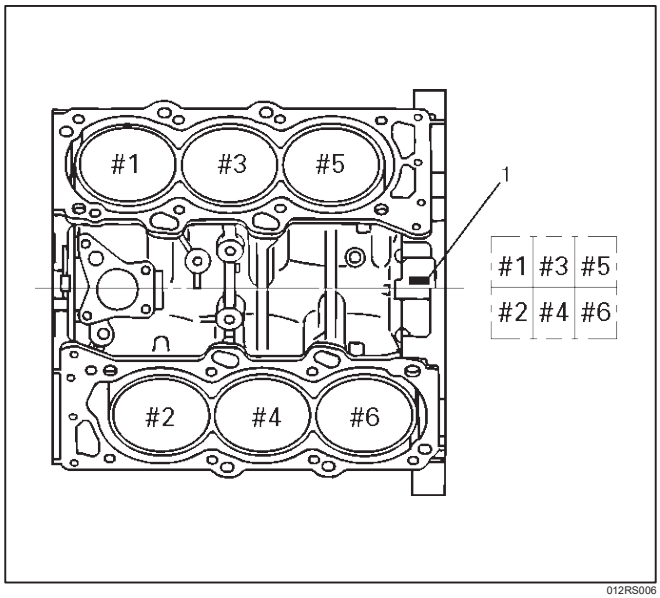
**Grade C : 93.421 mm–93.430 mm (3.6780 in–3.6783 in)**




012RS005

NOTE: For information on piston diameter, please refer to the section ”Inspection of the Piston and Connecting Rod Assembly” in this manual.

- The ”Grade” mark (1) is stamped at the position illustrated.

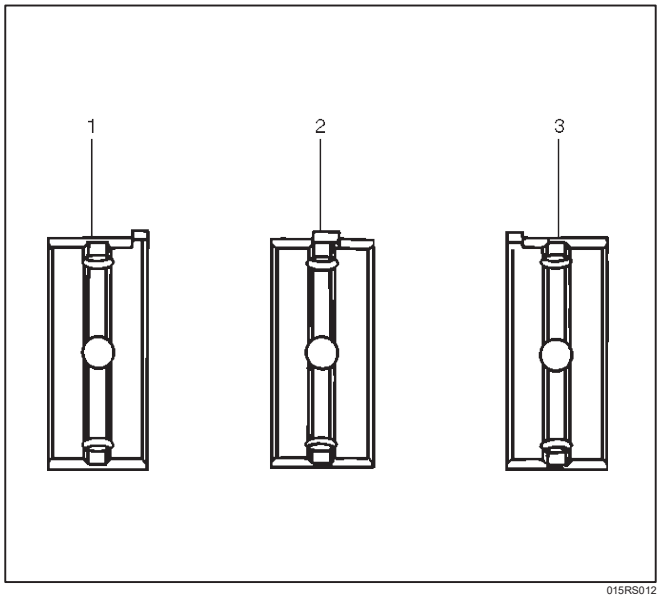


012RS006

## Reassembly

1. Install cylinder block.
2. Install crankshaft.
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

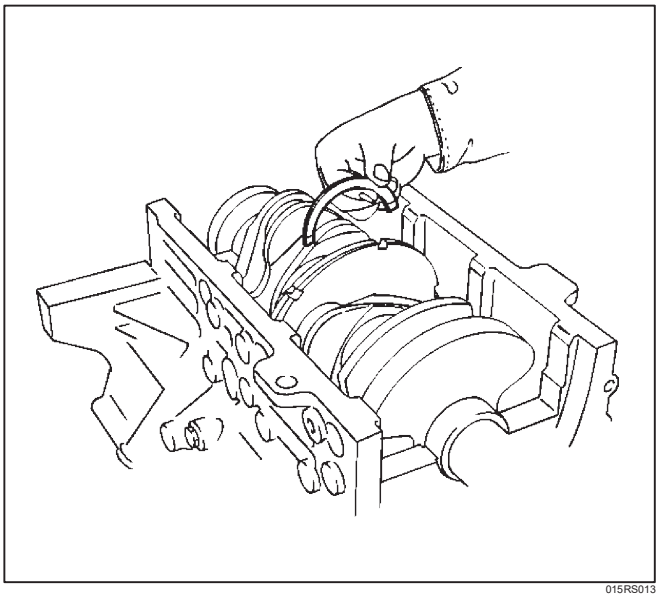
NOTE: Do not apply engine oil to the bearing back faces.



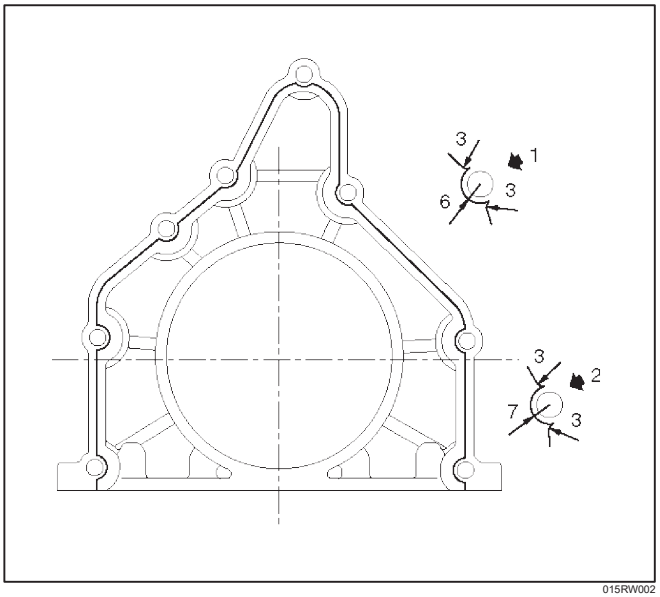
015RS012

**Legend**
(1) Number 1 and 4 main bearing upper and lower.
(2) Number 2 and 3 main bearing upper.
(3) Number 2 and 3 main bearing lower.

- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.


015RS013

3. Install rear oil seal retainer.
   - Remove oil on cylinder block and retainer fitting surface.
   - Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   - The oil seal retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

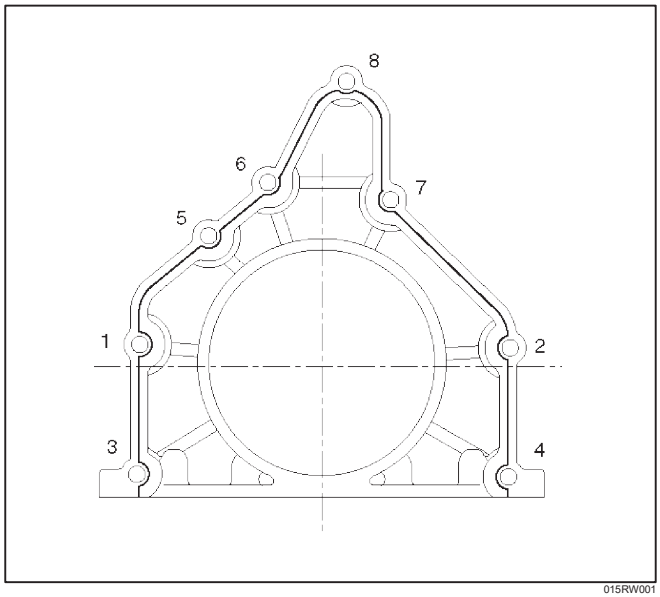


015RW002

**Legend**
(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

**Torque: 25 N·m (18 lb ft)**

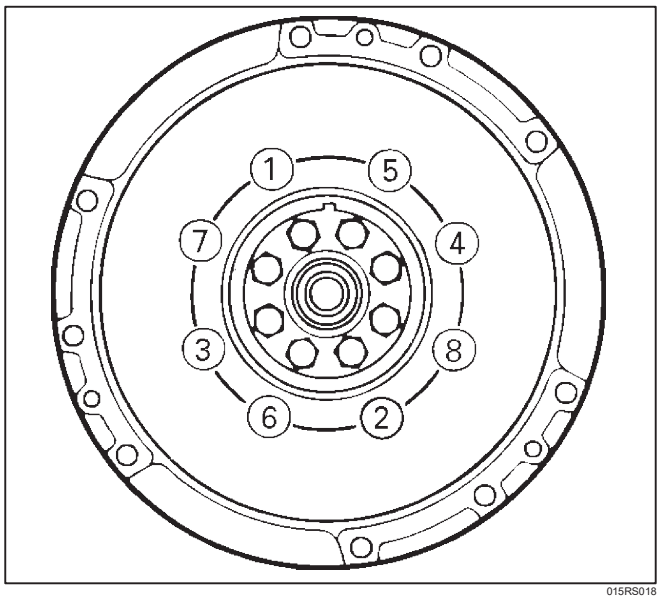


015RW001

4. Install flywheel
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Holding the crankshaft stationary, tighten the flywheel bolts in the order shown.

**Torque: 54 N·m (40 lb ft)**

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

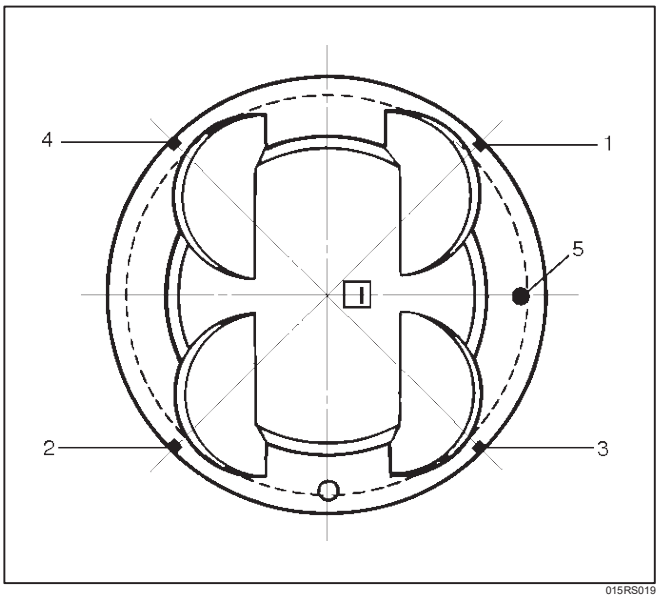


015RS018

5. Install piston and connecting rod assembly.
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.

NOTE: Do not apply engine oil to the bearing back faces.

- Check to see that the piston ring end gaps are correctly positioned.

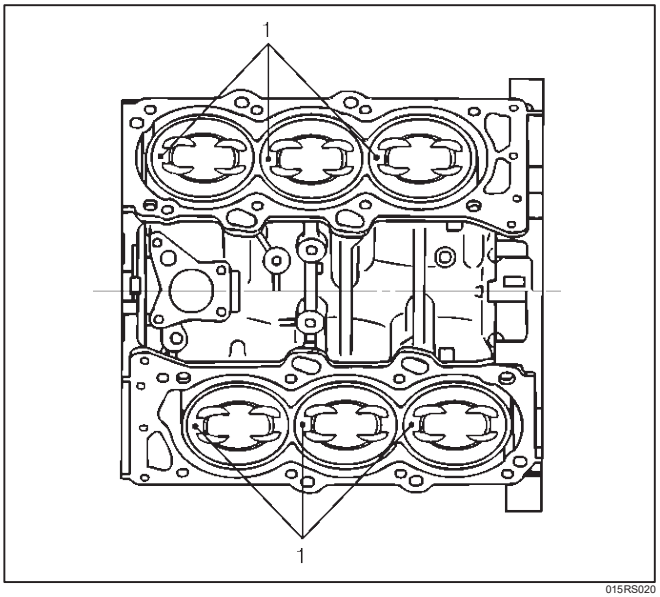


015RS019

**Legend**

(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- The front marks (1) must be facing the front of the engine.

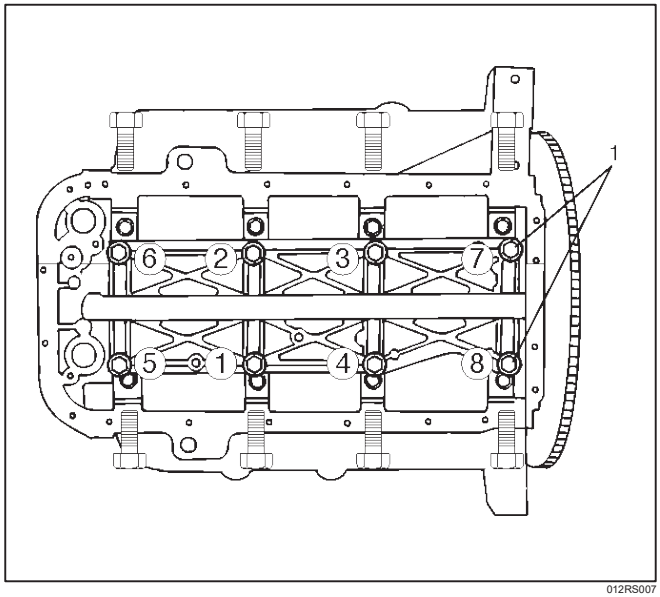


015RS020

6. Install oil gallery and tighten the bolts in 2 steps in the order shown.

**1st step : 29 N·m (22 lb ft)**

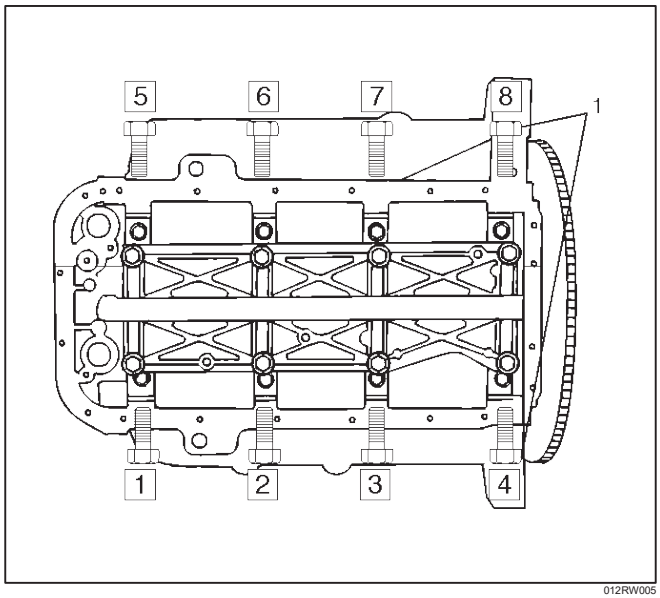
**2nd step : 55°~ 65°**




012RS007

7. Install cylinder block side bolts (1) and tighten crankcase bolts in sequence shown in the illustration.

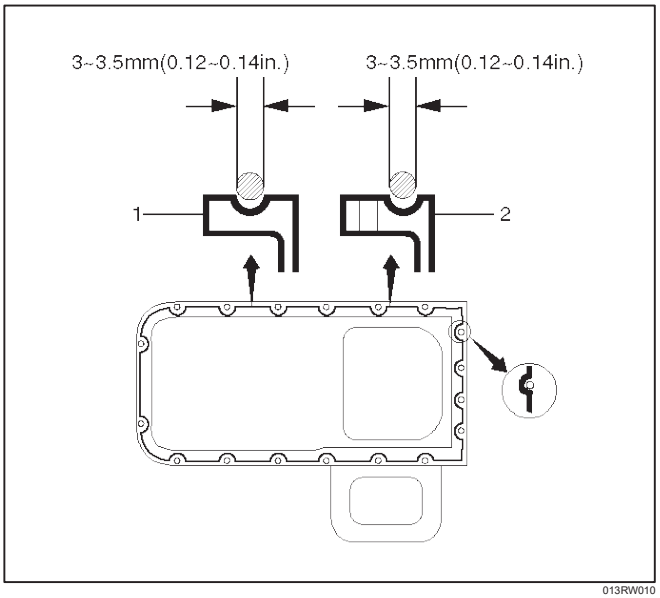
**Torque : 39 N·m (29 lb ft)**




012RW005

8. Install oil pump assembly. Refer to “Oil Pump” in this manual.
9. Install oil strainer and O-ring.
10. Install oil pipe and O-ring.
11. Install crankcase with oil pan.
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB– 1207C or its equivalent) to the contact surfaces of the crankcase. There must be no gaps in the bead.
    3. The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    4. Tighten the bolts and nuts to the specified torque.

**Torque : 10 N·m (87 lb in)**




013RW010

**Legend**

(1) Portion Between Both Holes
(2) Bolt Hole Portions

12. Install cylinder head gasket.
13. Install cylinder head assembly. Refer to “Cylinder Head” in this manual.

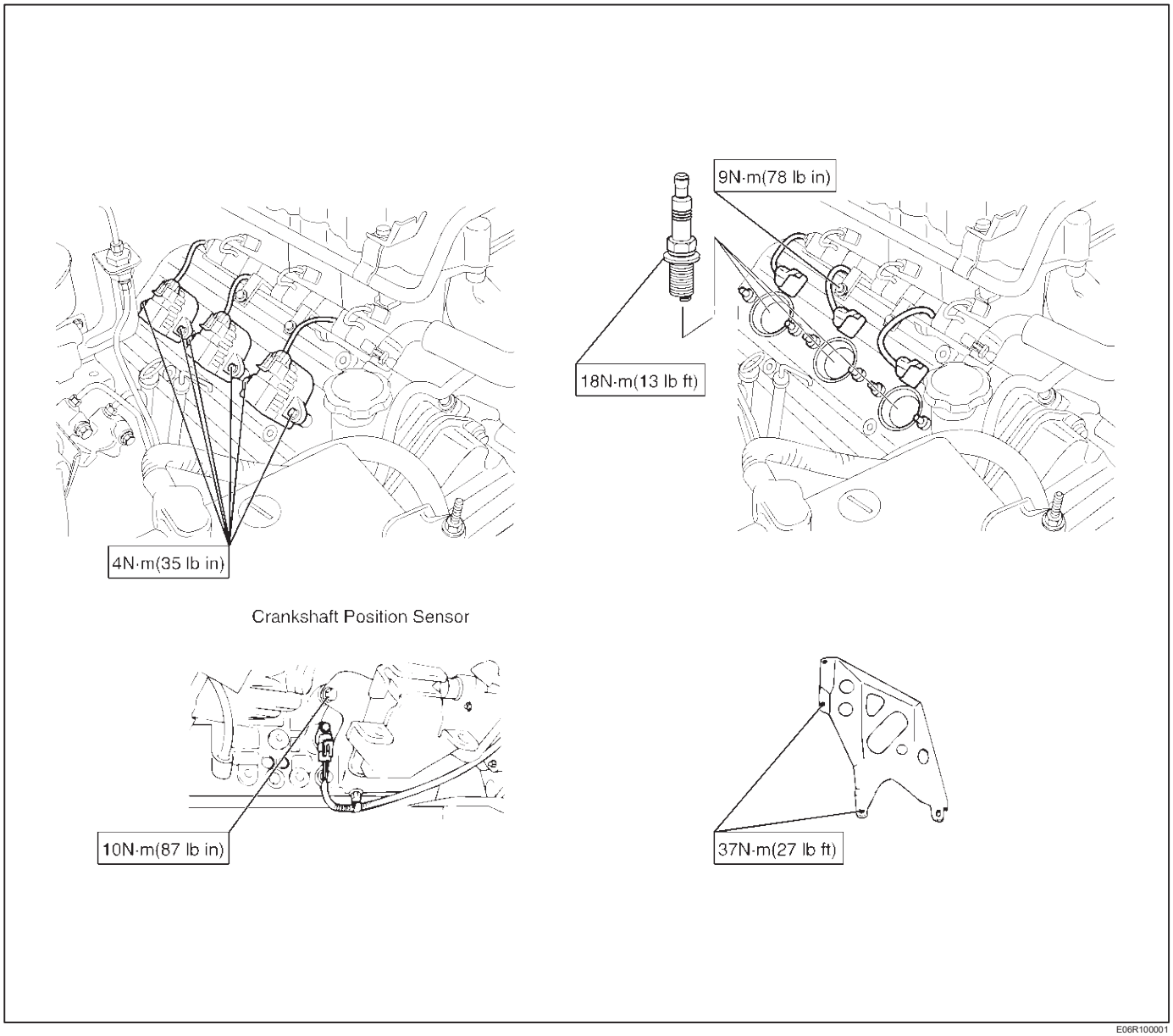
# Main Data and Specification

## General Specification

| Item | Specifications |
|---|---|
| | 6VE1 |
| Engine type, number of cylinders and arrangement | Water cooled, four cycle V6 |
| Form of combustion chamber | Pent-roof type |
| Valve mechanism | 4-Cams, 4-Valves, DOHC Gear & Belt Drive |
| Cylinder liner type | Casted in cylinder drive |
| Total piston displacement | 3494 cc |
| Cylinder bore x stroke | 93.4mm x 85mm<br>(3.677 in x 3.346 in) |
| Compression ratio | 9.1 |
| Compression pressure at 300rpm | 1.37 MPa (14.0 Kg/cm$^2$) |
| Engine idling speed rpm | Non adjustable (750) |
| Valve clearance | Intake: 0.28 mm (0.11 in) |
| | Exhaust: 0.30mm (0.12in) |
| Oil capacity | 5.3 liters |
| Ignition timing | Non adjustable (20° BTDC at idle rpm) |
| Spark plug | PK16PR11, RC10PYP4, K16PR-P11 |
| Plug gap | 1.0 mm–1.1 mm(0.0394 in – 0.0433 in) |

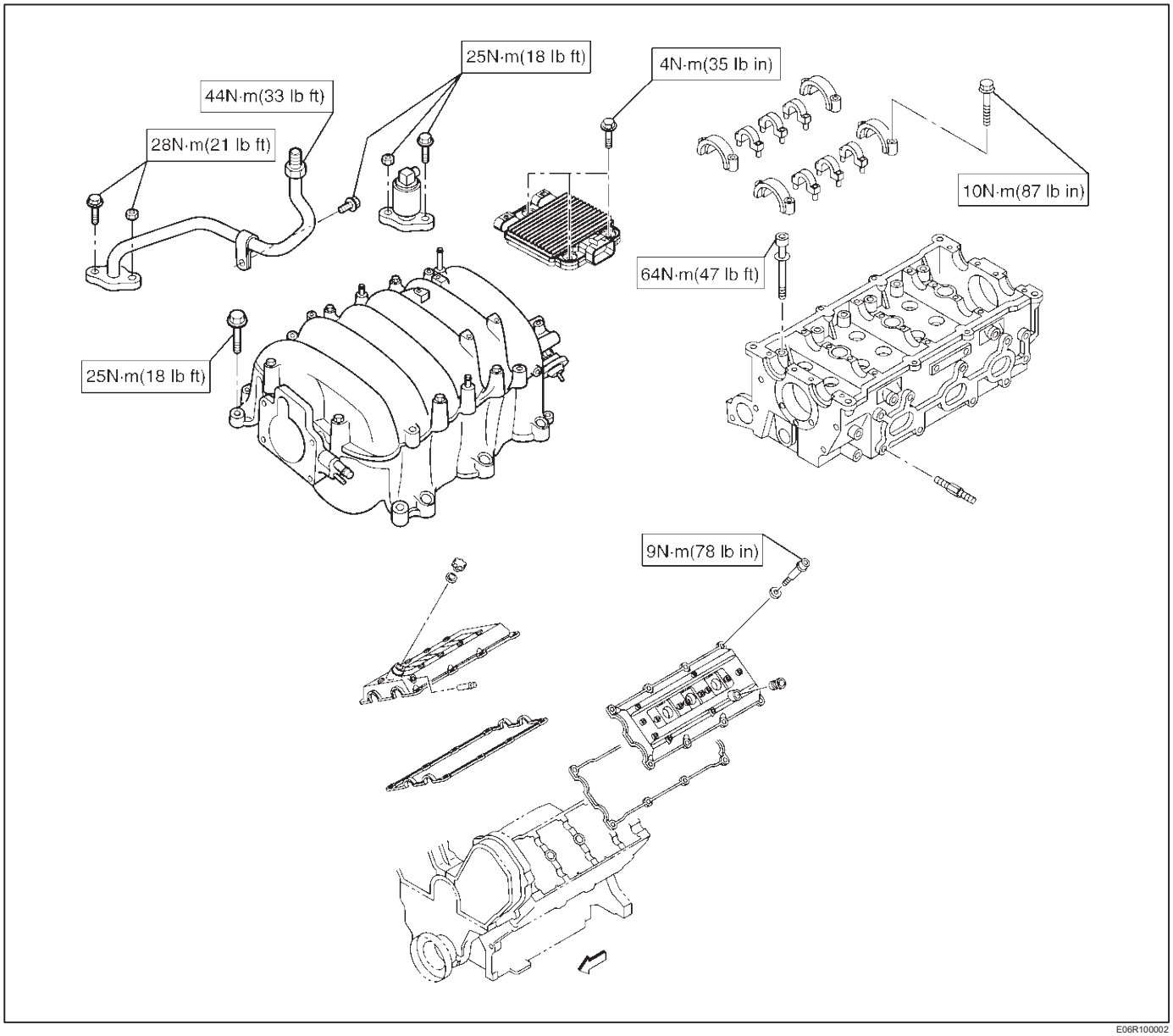
## Torque Specifications

### Ignition coil, Spark plug, Crankshaft position sensor and Under cover



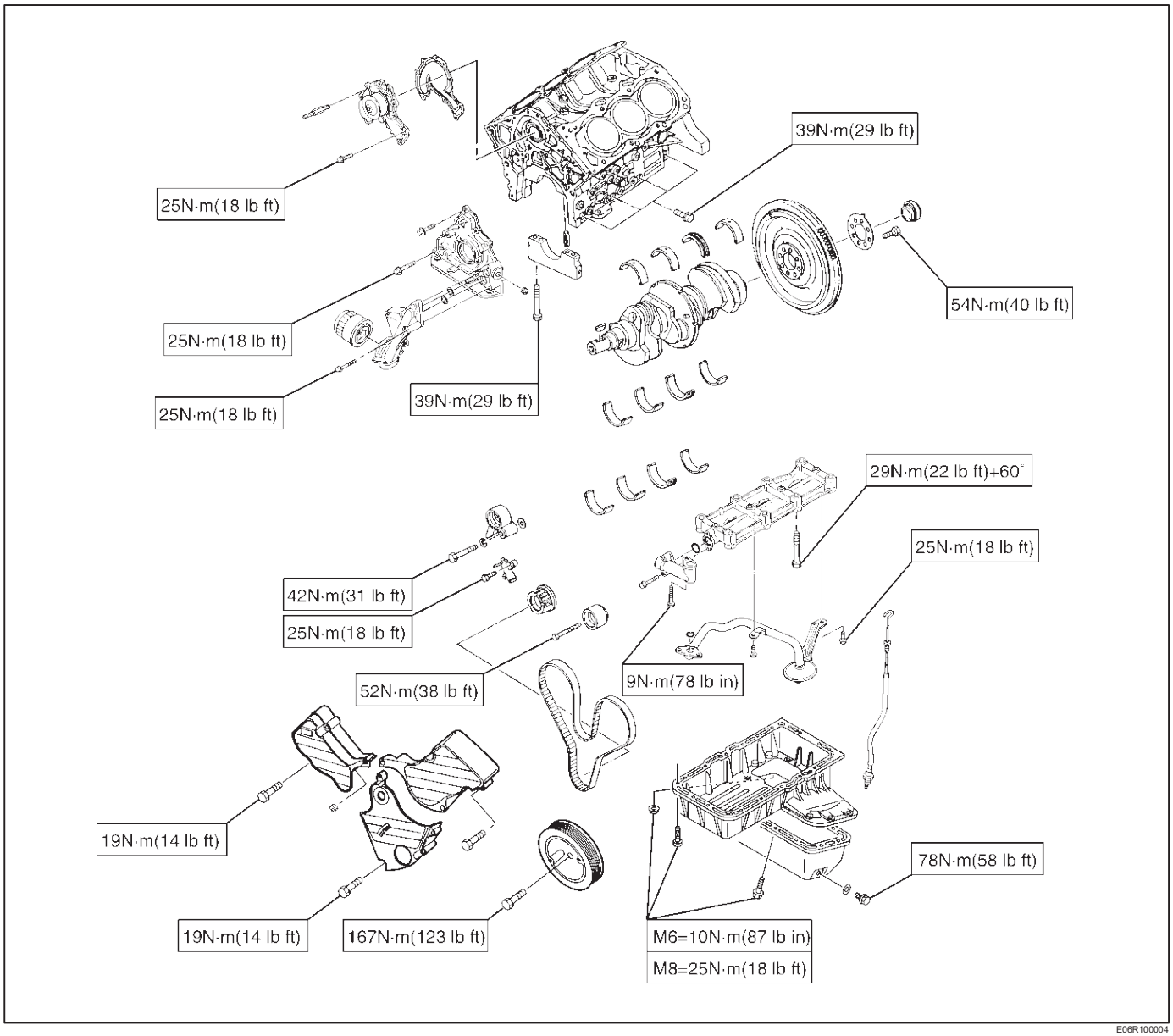

E06R100001

**Cylinder head cover, Cylinder head, Camshaft bearing cap, Common chamber, EGR valve and EGR pipe, Ion sensing module**



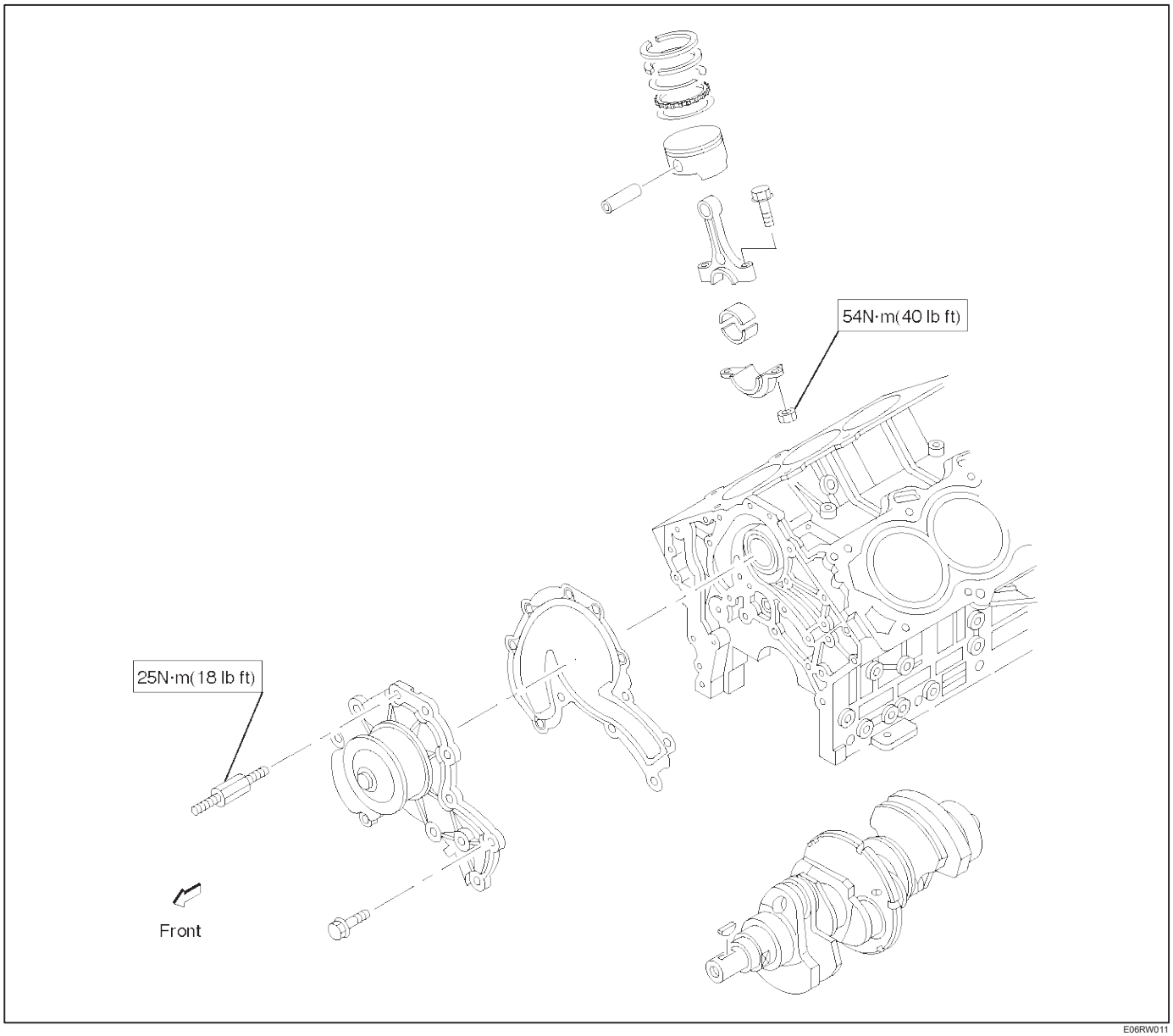

E06R100002

**Crankshaft main bearing, Flywheel, Crankcase, Oil pan, Timing belt tensioner, Timing pulley, Timing belt cover, Oil pump, Oil gallery, Oil strainer and water pump**



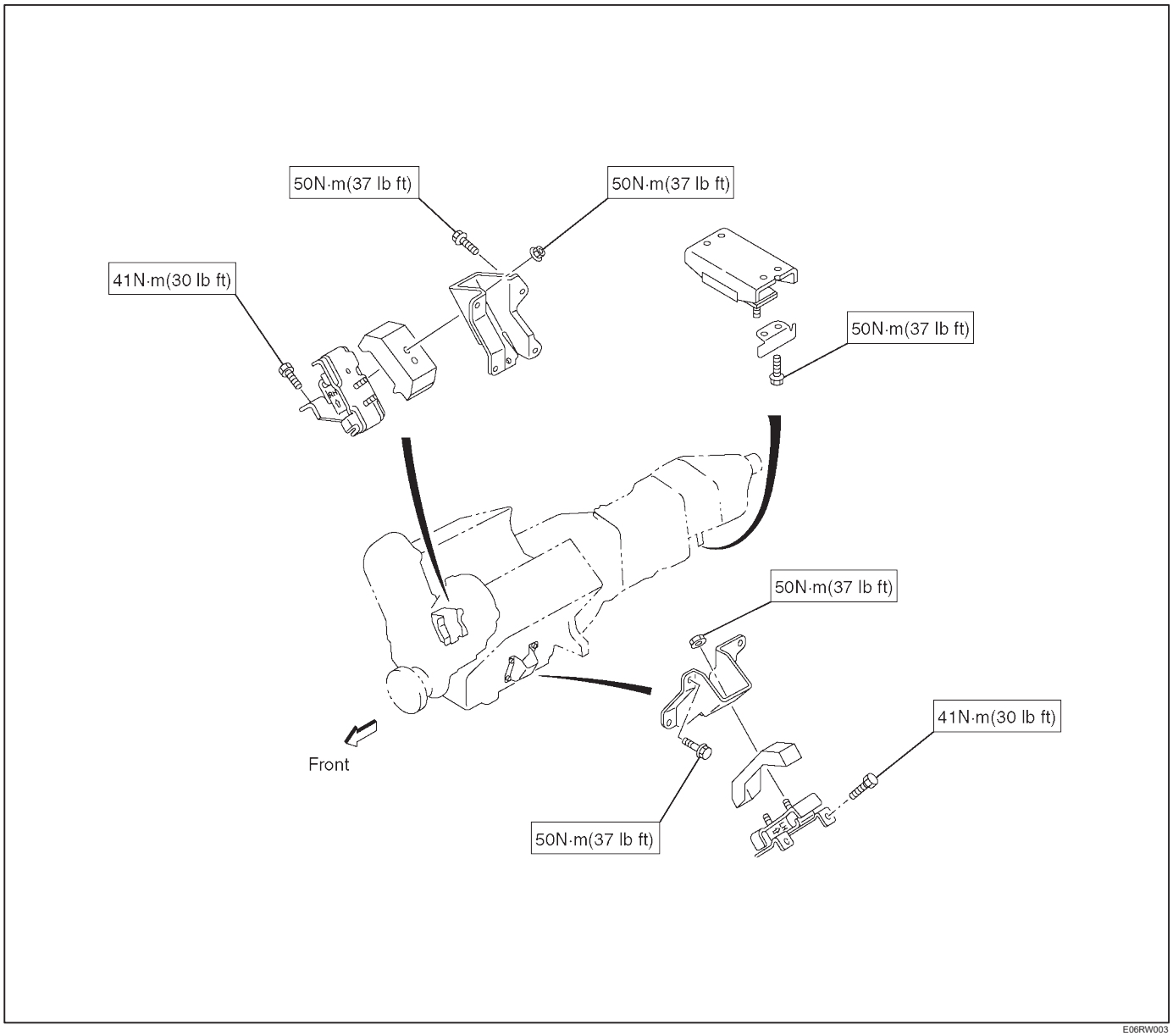

E06R100004

**Connecting rod and Water pump**



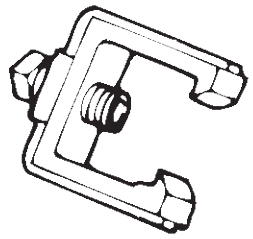
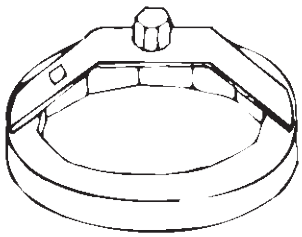
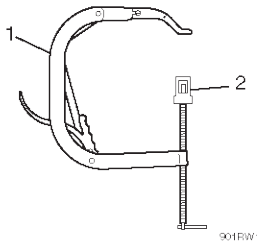
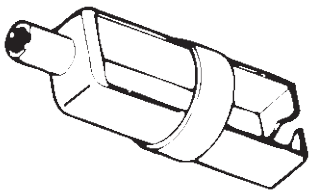
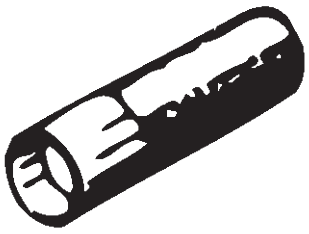
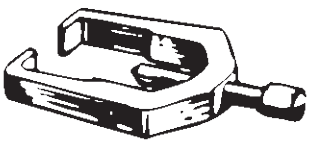

E06RW011

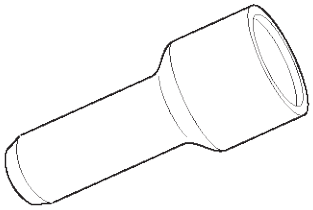
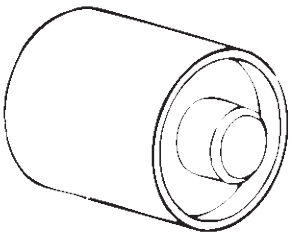
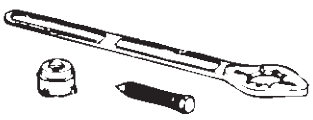
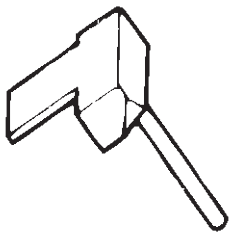
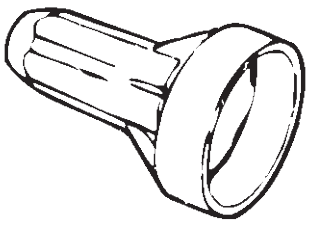
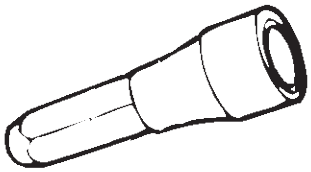
## Engine mount

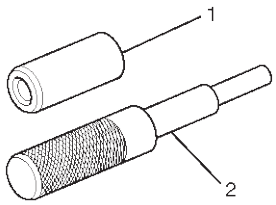
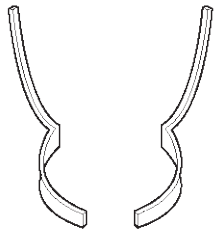
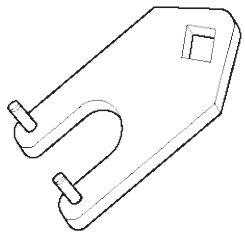
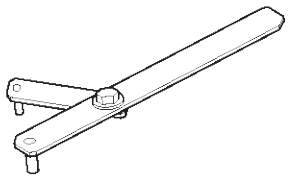



E06RW003

## Special Tool

| ILLUSTRATION | TOOL NO.<br>TOOL NAME |
|---|---|
|  <br>901RT033 | **J–21687–02**<br>Remover; tie rod end |
|  <br>901RT034 | **J–36390**<br>Wrench; Oil filter |
|  <br><br>901RW106 | **J–8062**<br>Compressor; Valve spring (1)<br>**J–42898**<br>Adapter; Compressor, Valve spring (2) |
|  <br>901RT036 | **J–37281**<br>Remover; Oil controller |
|  <br>901RT037 | **J–38537**<br>Installer; Oil controller |
|  <br>901RT038 | **J–29107**<br>Universal pitman arm puller |

| ILLUSTRATION | TOOL NO.<br>TOOL NAME |
|---|---|
|  <br>901RW171 | **J–42985**<br>Installer; Camshaft oil seal |
|  <br>901RT040 | **J–39206**<br>Installer; Pilot bearing |
|  <br>901RT041 | **J–8614–01**<br>Holder; Crankshaft |
|  <br>901RT042 | **J–37228**<br>Seal cutter |
|  <br>901RT043 | **J–39201**<br>Installer; Real oil seal |
|  <br>901RT044 | **J–39202**<br>Installer; Oil pump oil seal |

| ILLUSTRATION | **TOOL NO.**<br>TOOL NAME |
|---|---|
|  <br>901RT046 | **J–24239–1**<br>Cylinder head bolt wrench |
|  <br>901RW182 | **J–42899**<br>Replacer; Valve guide (1,2)<br>**J–42687**<br>Installer; Valve guide (1)<br>**J–37985–1**<br>Remover; Valve guide (2) |
|  <br>901RW109 | **J–42689**<br>Adjusting Tool; Valve clearance |
|  <br>901RW110 | **J–42686**<br>Lever; Gear spring |
|  <br>901RW115 | **J–43041**<br>Holder; Universal |

AXIOM

# ENGINE

## ENGINE COOLING (6VE1 3.5L)

### CONTENTS

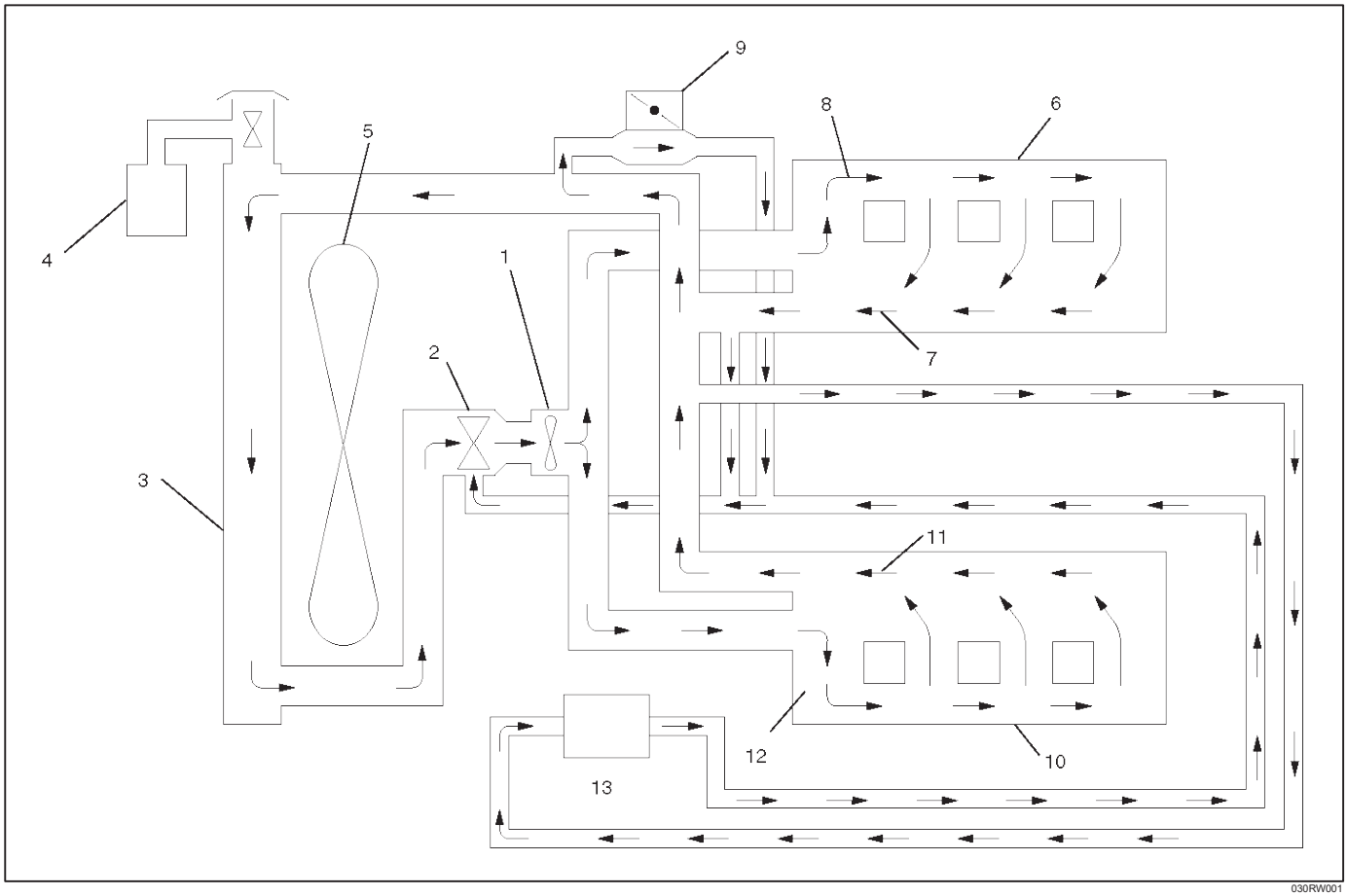

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## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# General Description




030RW001

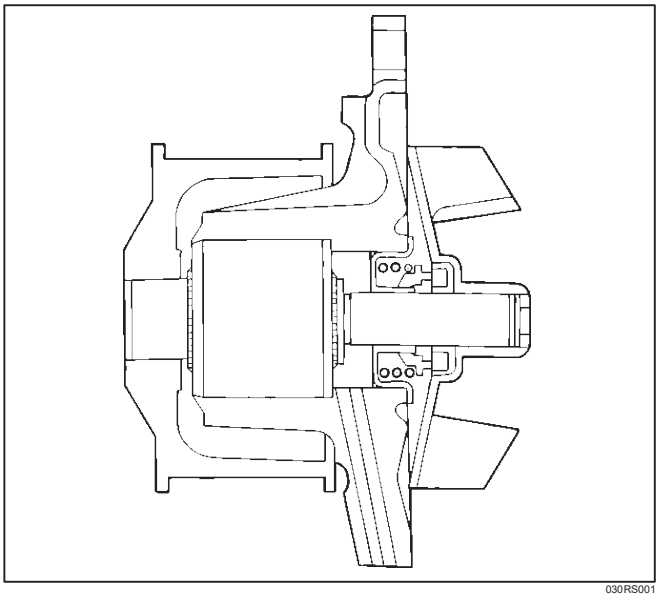
**Legend**

(1) Water Pump
(2) Thermostat
(3) Radiator
(4) Reserve Tank
(5) Cooling Fan
(6) Cylinder Block
(7) Cylinder Head
(8) Right Bank
(9) Throttle Body
(10) Cylinder Block
(11) Cylinder Head
(12) Left Bank
(13) Heater

The cooling system is a pressurized Engine Coolant (EC) forced circulation type which consists of a water pump, thermostat cooling fan, radiator and other components. The automatic transmission fluid is cooled by the EC in the radiator.

## Water Pump

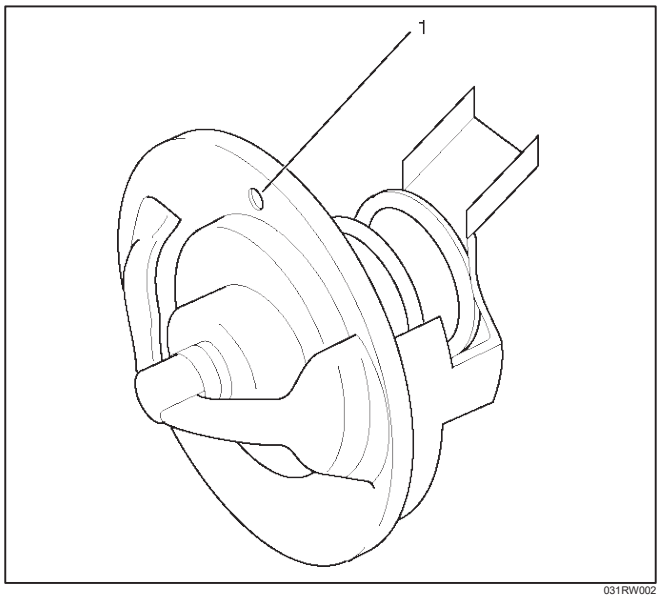
The EC pump is a centrifugal impeller type and is driven by a timing belt.



030RS001

## Thermostat

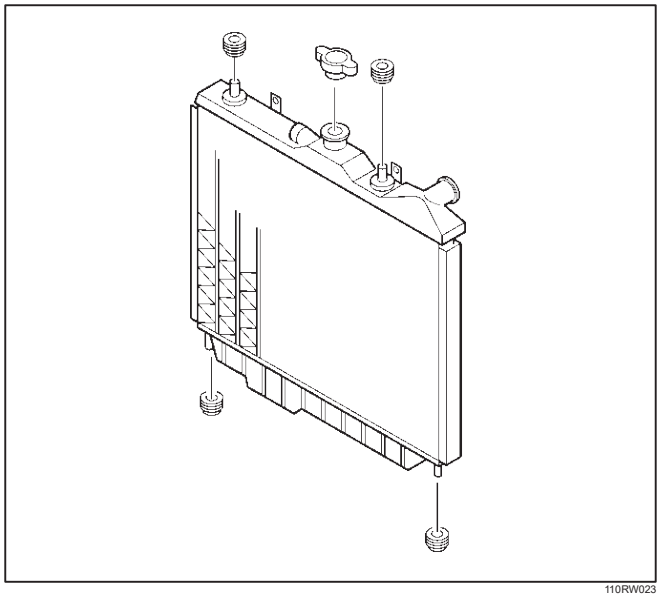
The thermostat is a wax pellet type with a air hole(1) and is installed in the thermostat housing.




031RW002

## Radiator

The radiator is a tube type with corrugated fins. In order to raise the boiling point of the coolant, the radiator is fitted with a cap in which the valve is operated at 88.2 ~ 117.6 kPa (12.8 ~ 17.0 psi) pressure. (No oil cooler provided for M/T)



110RW023

## Antifreeze Solution

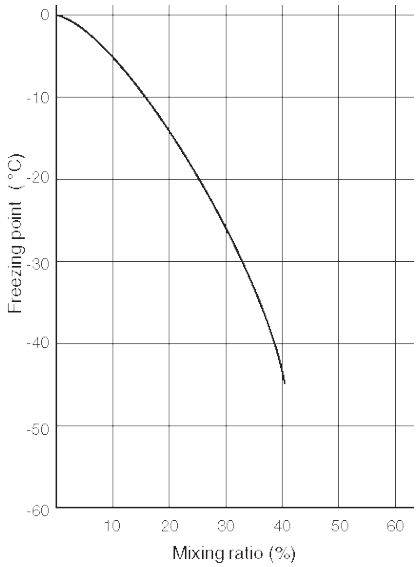
- Relation between the mixing ratio and freezing temperature of the EC varies with the ratio of anti–freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.
- Calculating mixing ratio

$$\text{Mixing ratio} = \frac{\text{Anti freeze solution (Lit/gal.)}}{\text{Anti freeze solution (Lit/gal.)} + \text{Water (Lit/gal.)}}$$

F06RW005

NOTE: Antifreeze solution + Water = Total cooling system capacity.

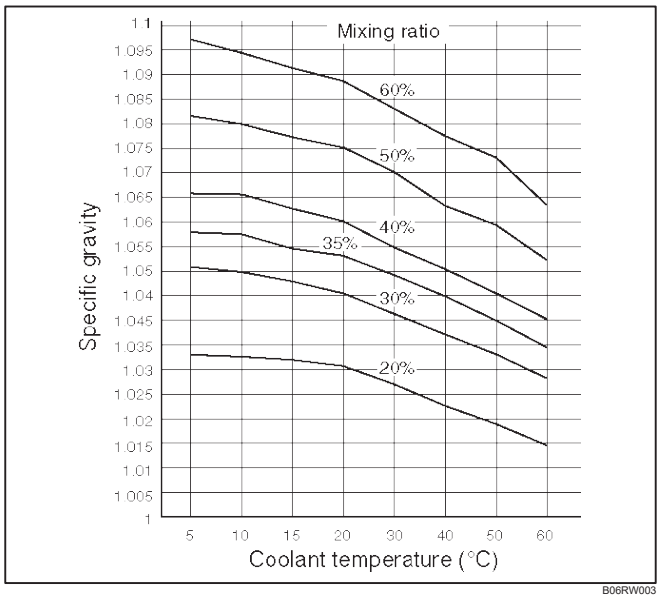
- **Total Cooling System Capacity**
- **A/T 10.0Lit (2.64Us gal)**




B06RW002

- Mixing ratio

  Check the specific gravity of engine coolant in the cooling system temperature ranges from 0 °C to 50 °C using a suction type hydrometer, then determine the density of the engine coolant by referring to the table.




# Diagnosis

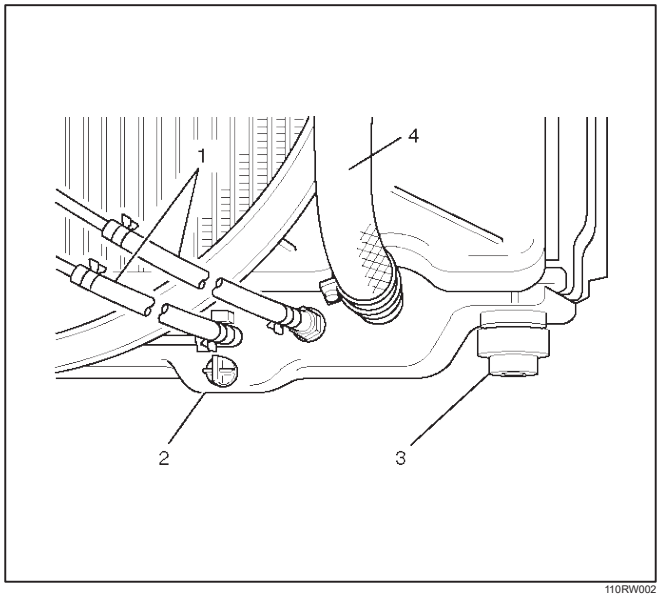
## Engine Cooling Trouble

| Condition | Possible cause | Correction |
|---|---|---|
| Engine overheating | Low Engine Coolant level | Replenish |
| | Incorrect fan installed | Replace |
| | Thermo meter unit faulty | Replace |
| | Faulty thermostat | Replace |
| | Faulty Engine Coolant temperature sensor | Repair or replace |
| | Clogged radiator | Clean or replace |
| | Faulty radiator cap | Replace |
| | Low engine oil level or use of improper engine oil | Replenish or change oil |
| | Clogged exhaust system | Clean exhaust system or replace faulty parts |
| | Faulty Throttle Position sensor | Replace throttle valve assembly |
| | Open or shorted Throttle Position sensor circuit | Repair or replace |
| | Damaged cylinder head gasket | Replace |
| Engine overcooling | Faulty thermostat | Replace |
| Engine slow to warm–up | Faulty thermostat | Replace |
| | Thermo unit faulty | Replace |

## Draining and Refilling Cooling System

Before draining the cooling system, inspect the system and perform any necessary service to ensure that it is clean, does not leak and is in proper working order. The engine coolant (EC) level should be between the “MIN” and “MAX” lines of reserve tank when the engine is cold. If low, check for leakage and add EC up to the “MAX” line. There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the EC should also be free from oil.
Replace the EC if excessively dirty.

1. Completely drain the cooling system by opening the drain plug (2) at the bottom of the radiator.



110RW002

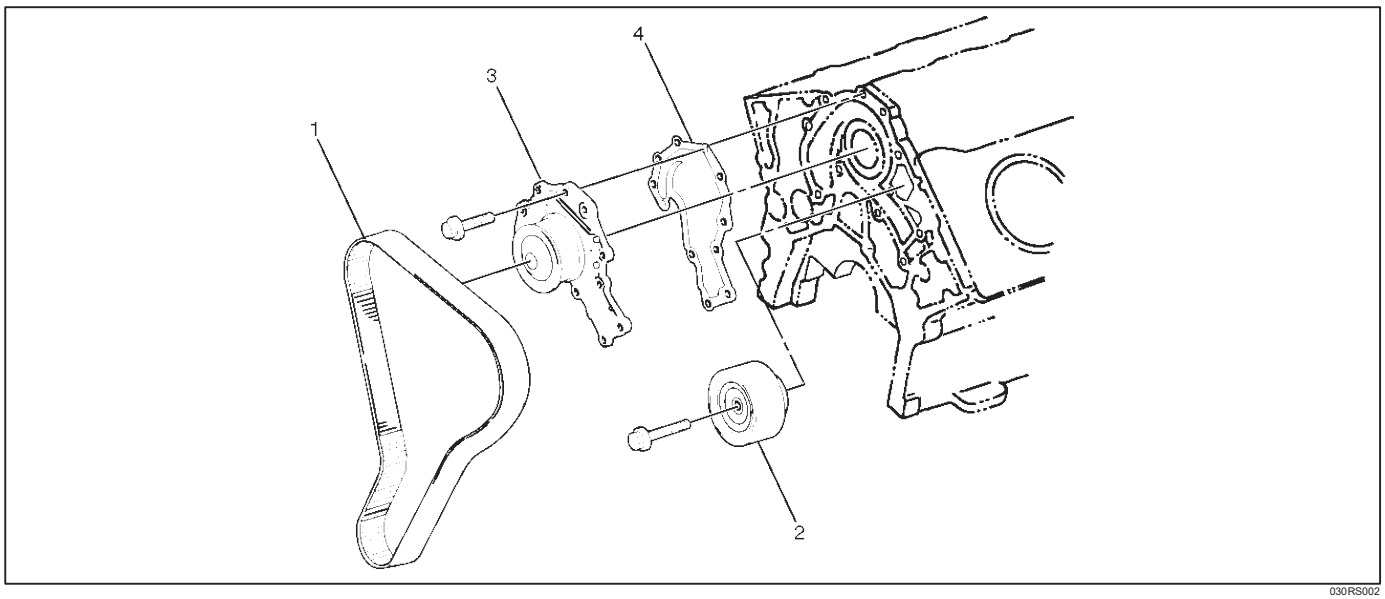
2. Remove the radiator cap.

**WARNING: TO AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE.**

3. Disconnect all hoses from the EC reserve tank.
   Scrub and clean the inside of the reserve tank with soap and water. Flush it well with clean water, then drain it. Install the reserve tank and hoses.
4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.
5. Fill the radiator to the base of the filler neck.
   Fill the EC reserve tank to “MAX” line when the engine is cold.
6. Block the drive wheels and firmly apply the parking brake. Shift an automatic transmission to “P” (Park) or a manual transmission to neutral.
7. Remove the radiator cap. Start the engine and warm it up at 2,500 ~ 3,000 rpm for about 30 minutes.
8. When the air comes out from the radiator filler neck and the EC level has gone down, replenish with the EC. Repeat this procedure until the EC level does not go down. Then stop the engine and install the radiator cap. Let the engine cool down.
9. After the engine has cooled, replenish with EC up to the “MAX” line of the reserve tank.
10. Start the engine. With the engine running at 3,000 rpm, make sure there is no running water sound from the heater core (behind the center console).
11. If the running water sound is heard, repeat steps 8 to 10.

# Water Pump

## Water Pump and Associated Parts




030RS002

**Legend**
(1) Timing Belt
(2) Idle Pulley
(3) Water Pump Assembly
(4) Gasket

## Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Radiator hose (on inlet pipe side).
4. Remove timing belt. Refer to “Timing Belt” in this manual.
5. Remove Idle pulley.
6. Remove water pump assembly.
7. Remove gasket.

## Inspection

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced.

- Crack in the water pump body
- EC leakage from the seal unit
- Play or abnormal noise in the bearing
- Cracks or corrosion in the impeller

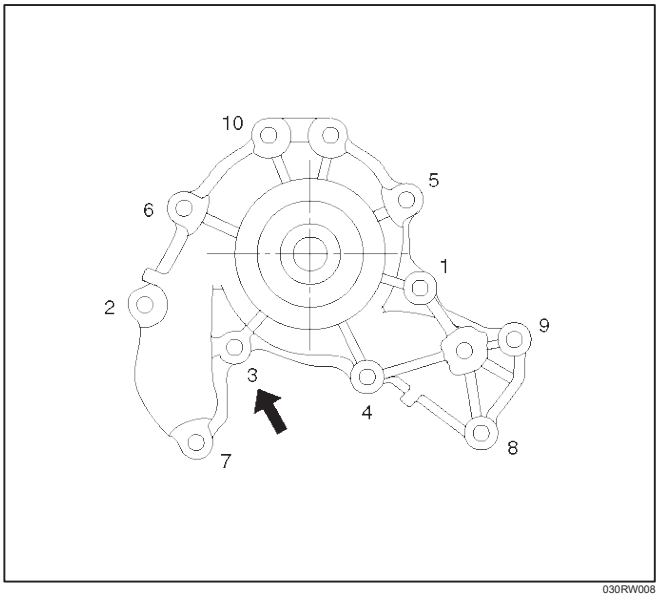
## Installation

1. Install gasket, clean the mating surface of gasket before installation.
2. Install water pump assembly and tighten bolts to the specified torque.

   **Torque: 25 N·m (18 lb ft)**

   - Tightening order
     The tightening order are in the illustrate.

NOTE: To prevent the oil leakage, apply the LOCTITE 262 or an equivalent, to the arrow marked fixing bolt thread.



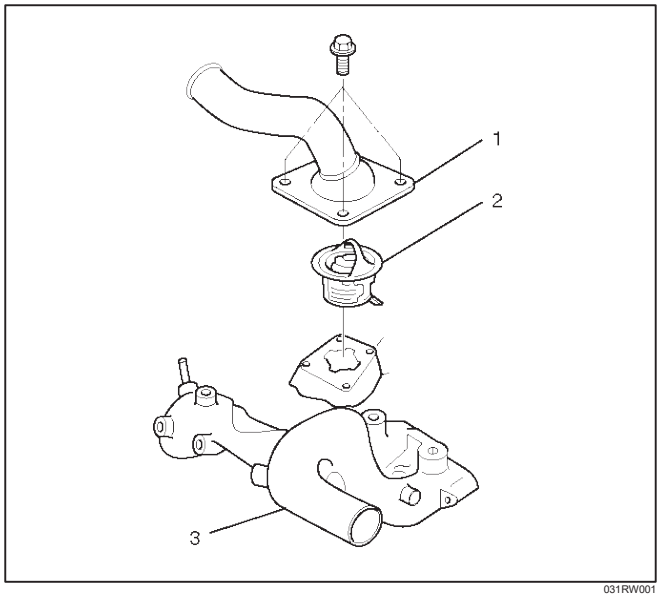

030RW008

3. Idle pulley
   - Install idle pulley and tighten bolt to the specified torque.

   **Torque: 52 N·m (38 lb ft)**
4. Timing belt
   - Install timing belt. Refer to timing belt installation step in “Timing Belt” in this manual.
5. Connect radiator inlet hose and replenish EC.
6. Connect battery ground cable.

# Thermostat

## Thermostat and Associated Parts



031RW001

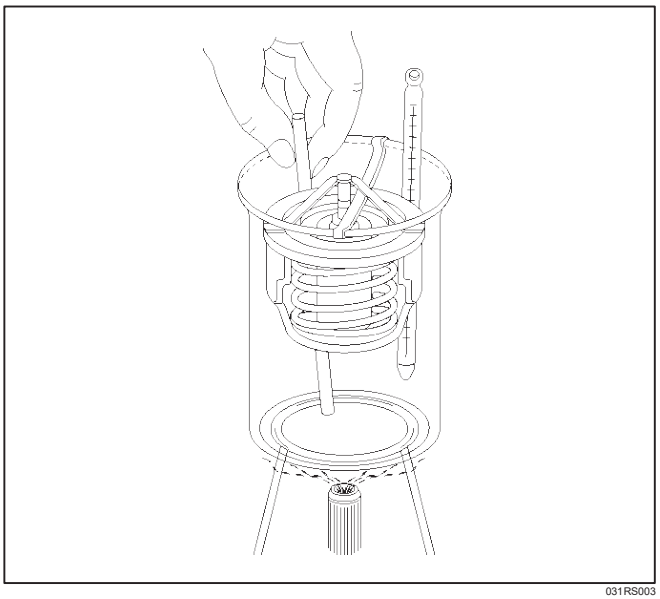
**Legend**
(1) Thermostat Housing
(2) Thermostat
(3) Outlet Pipe

## Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from the radiator and engine.
3. Disconnect radiator hose from the inlet pipe.
4. Remove thermostat housing.
5. Remove thermostat(2).

## Inspection

Suspend the thermostat in a water–filled container using thin wire. Place a thermometer next to the thermostat. Do not directly heat the thermostat.
Gradually increase the water temperature. Stir the water so that the entire water is same temperature.


031RS003

Confirm the temperature when the valve first begins to open.

**Valve opening temperature 74.5C ~ 78.5˚C (166.1˚F ~ 173.3˚F)**

Confirm the temperature when the valve is fully opened.

**Valve full open temperature and lift More than 8.5mm (0.33 in) at 90˚C (194˚F)**

Make necessary repair and parts replacement if extreme wear or damage is found during inspection.

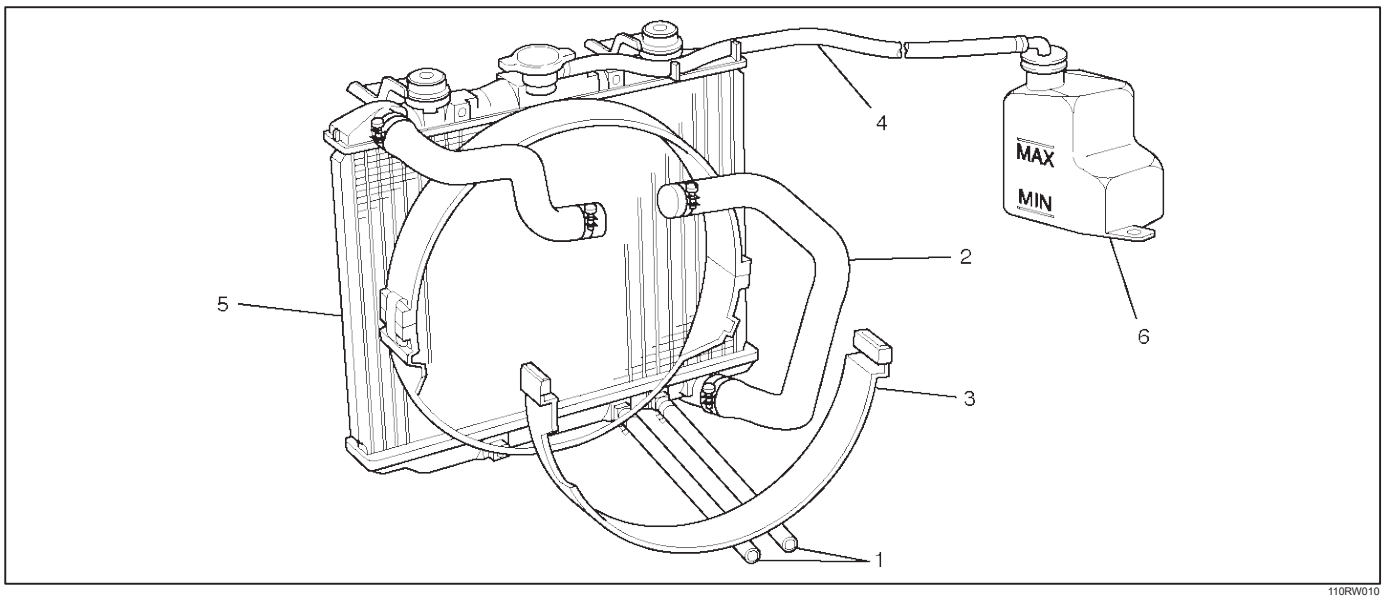
## Installation

1. Install thermostat into the outlet pipe(4) making sure that the air hole is in the up position.
2. Install thermostat housing and tighten bolts to the specified torque.

   **Torque: 25 N·m (18 lb ft)**
3. Installation rubber hose.
4. Replenish engine coolant (EC).
5. Start engine and check for EC leakage.

# Radiator

## Radiator and Associated Parts



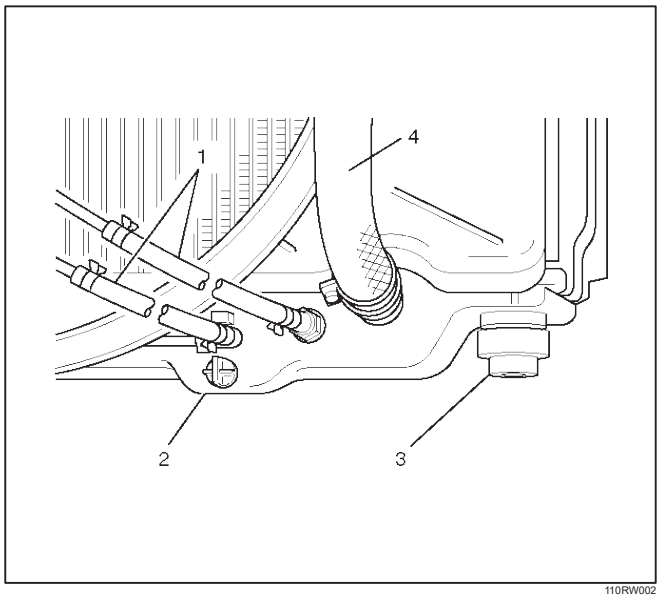

110RW010

**Legend**

(1) Oil Cooler Hose For Automatic Transmission
(2) Radiator Hose
(3) Fan Guide, Lower
(4) Reserve Tank Hose
(5) Radiator Assembly
(6) Reserve Tank

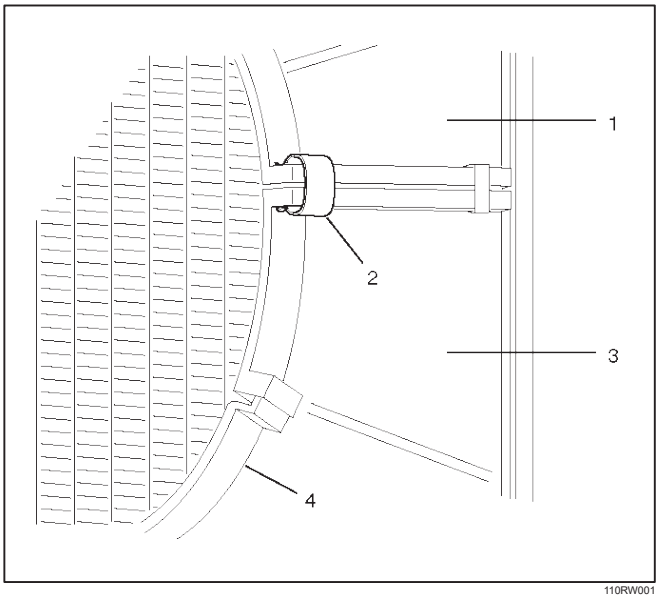
## Removal

1. Disconnect battery ground cable.
2. Loosen a drain plug(2) to drain EC.
3. Disconnect oil cooler hose(1) on automatic transmission (A/T).
4. Disconnect radiator inlet hose and outlet hose from the engine.



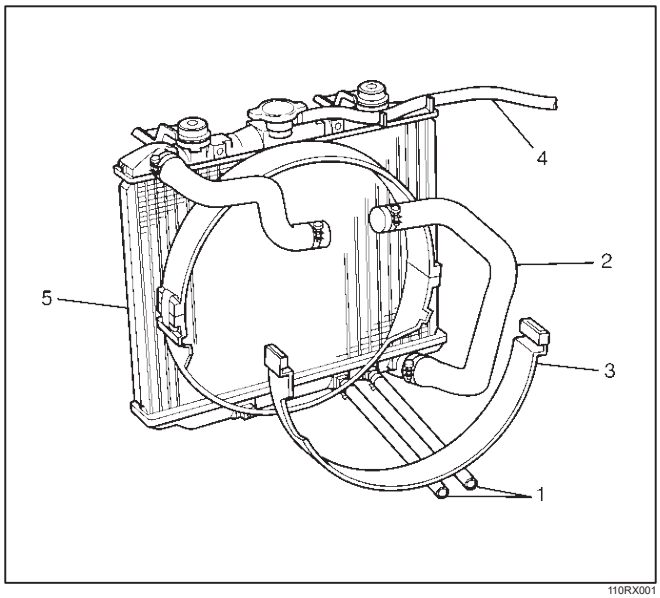

110RW002

5. Remove fan guide(1), clips(3) on both sides and the bottom lock, then remove fan guide lower(3) with fan shroud(4).




110RW001

6. Disconnect the reserve tank hose(4) from radiator.



110RX001

7. Lift up and remove the radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
8. Remove rubber cushions on both sides at the bottom.

# Inspection

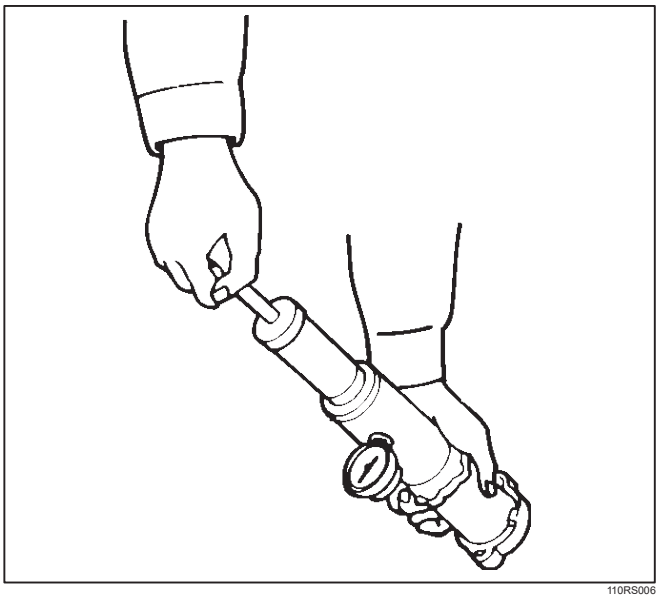
## Radiator Cap

Measure the valve opening pressure of the pressurizing valve with a radiator filler cap tester.
Replace the cap if the valve opening pressure is outside the standard range.

**Valve opening pressure kPa (psi) 93.3 ~ 122.7 (13.5 ~17.8)**

Cap tester: J–24460–01
Adapter: J–33984–A
Check the condition of the vacuum valve in the center of the valve seat side of the cap. If considerable rust or dirt is found, or if the valve seat cannot be moved by hand, clean or replace the cap.

**Valve opening vacuum kPa (psi) 0 ~ 6.9 (0 ~ 1.0)**


110RS006

## Radiator Core

1. A bent fin may result in reduced ventilation and overheating may occur. All bent fins must be straightened. Pay close attention to the base of the fin when it is being straightened.
2. Remove all dust, bugs and other foreign material.

## Flushing the Radiator

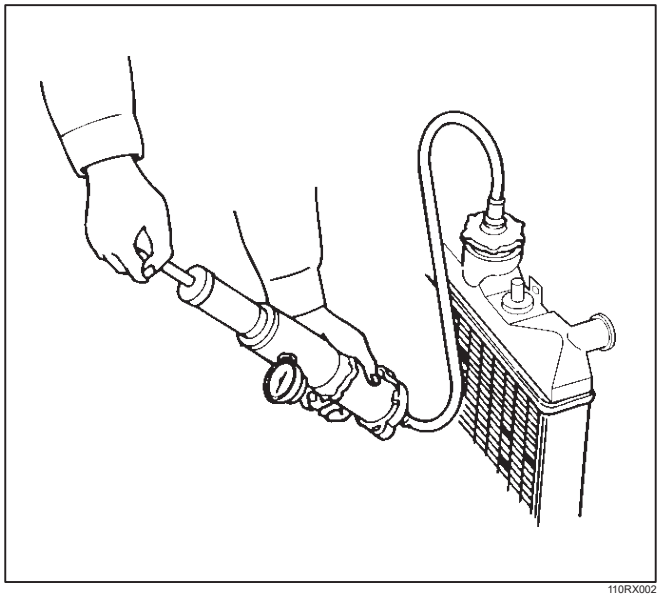
Thoroughly wash the inside of the radiator and the engine coolant passages with cold water and mild detergent. Remove all signs of scale and rust.

## Cooling System Leakage Check

Use a radiator cap tester to force air into the radiator through the filler neck at the specified pressure of 150 kPa (22 psi) with a cap tester:

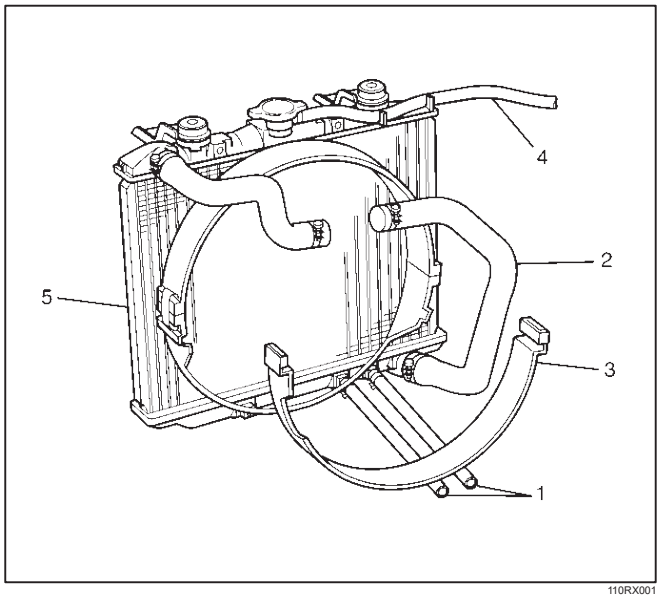
- Leakage from the radiator
- Leakage from the coolant pump
- Leakage from the water hoses
- Check the rubber hoses for swelling.

Cap tester: J–24460–01
Adapter: J–33984–A


110RX002

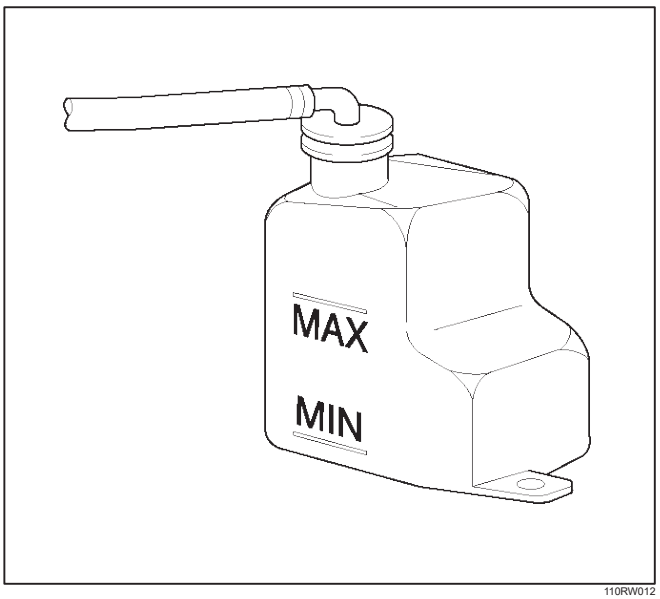
## Installation

1. Install rubber cushions on both sides of radiator bottom.
2. Install radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
3. Connect reserve tank hose (4).
4. Install lower fan guide (3).
5. Connect radiator inlet hose and outlet hose to the engine.
6. Connect oil cooler hose (1) to automatic transmission.



110RX001

7. Connect battery ground cable.
8. Pour engine coolant up to filler neck of radiator, and up to MAX mark of reserve tank.



110RW012

Important operation (in case of 100% engine coolant change) procedure for filling with engine coolant.

### Engine Coolant Filling Up Procedure

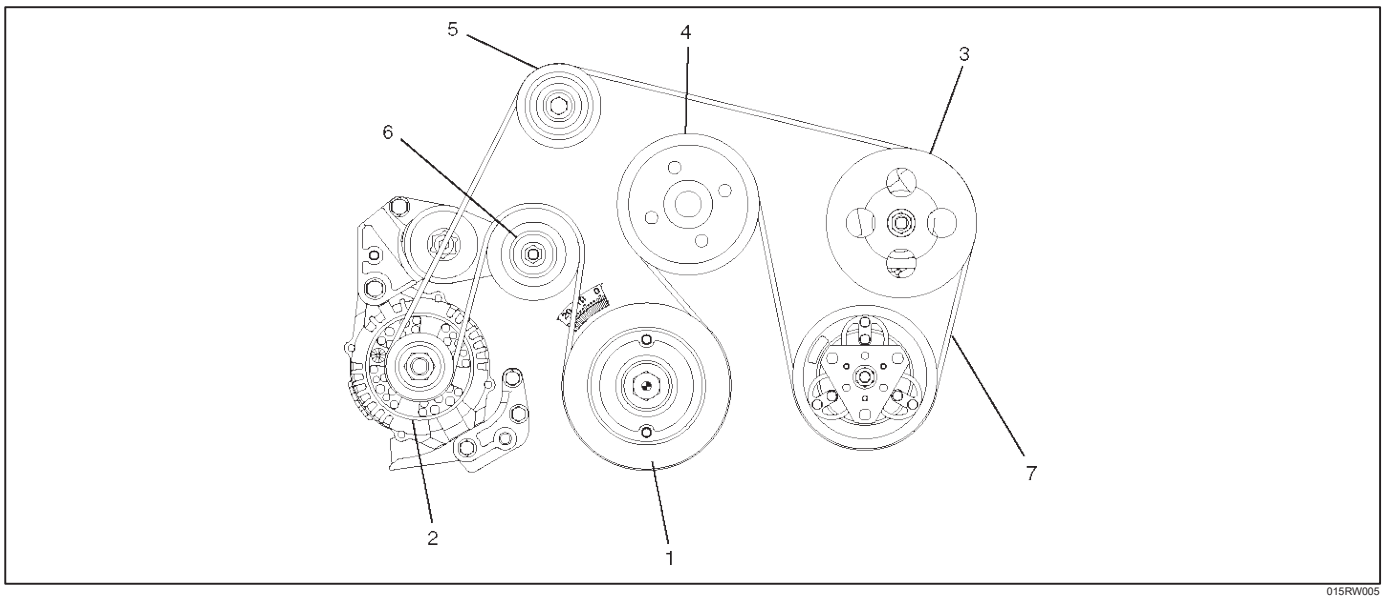
1. Make sure that the engine is cool.

**WARNING: WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.**

2. Open radiator cap pour coolant up to filler neck.
3. Pour coolant into reservoir tank up to “MAX” line.
4. Tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.
5. After replenishing with coolant tighten radiator cap, warm up the engine at about 2000 rpm. Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
6. Check to see the thermometer, continuously idle for 5 minutes and stop the engine.
7. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant is found, check the coolant system and reservoir tank hose for leakage.
8. Pour coolant into the reservoir tank up to “MAX” line.

# Drive Belt and Cooling Fan

## Drive Belt and Associated Parts




015RW005

**Legend**

(1) Crankshaft Pulley
(2) Generator
(3) Power Steering Pump
(4) Water Pump and Cooling Fan Pulley
(5) Idle Pulley
(6) Tension Pulley
(7) Drive Belt

The drive belt adjustment is not required as automatic drive belt tensioner is equipped.

## Removal

Move the tension pulley drive belt loosen side, remove the drive belt.

## Inspection

Check drive belt for wear or damage, and replace with a new one as necessary.

## Installation

Install cooling fan assembly and tighten bolts/nuts to the specified torque.

**Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.**

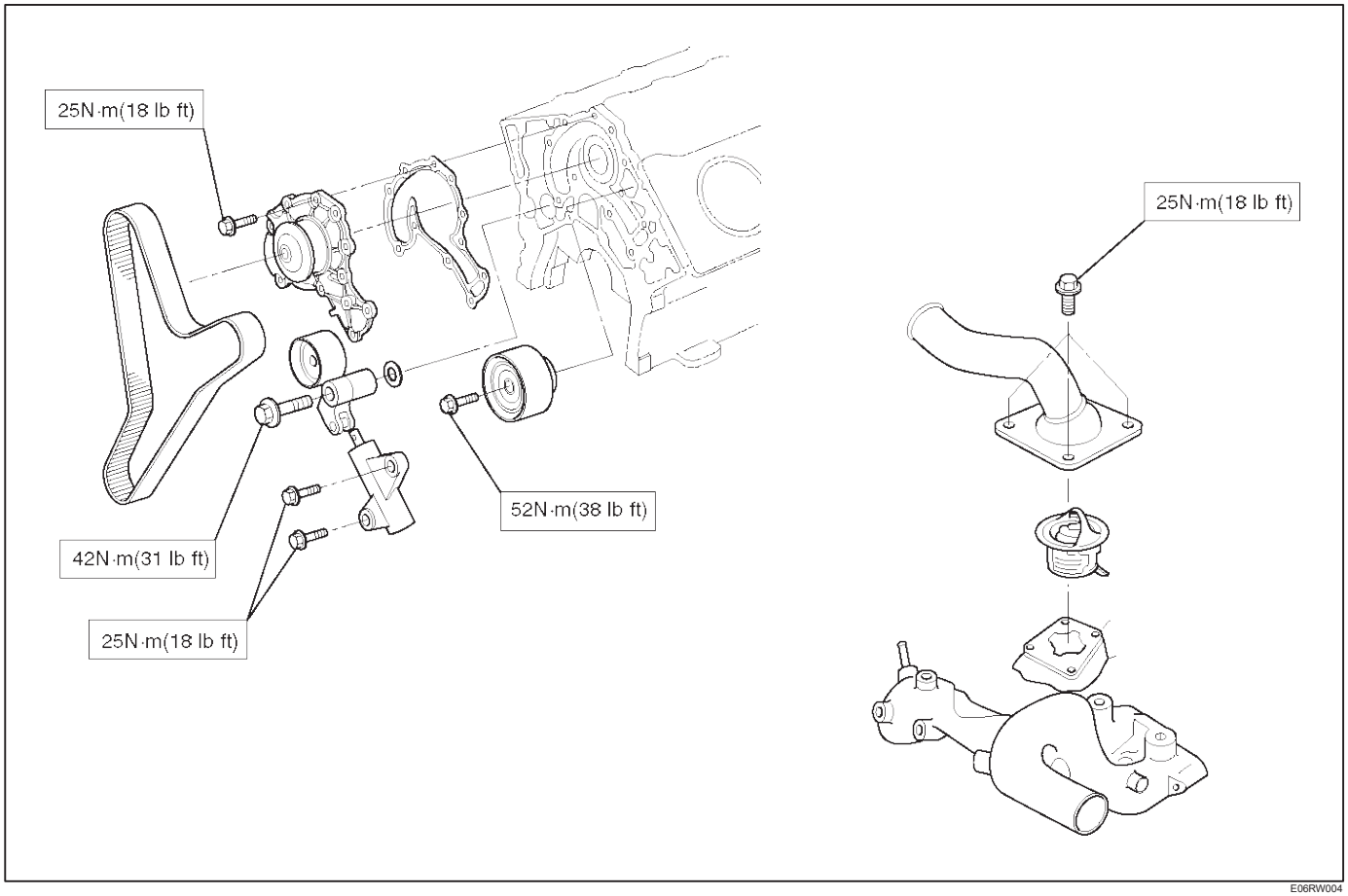
**Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.**

# Main Data and Specifications

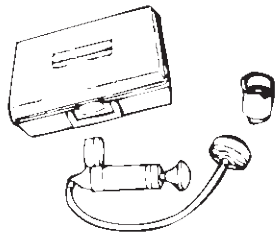
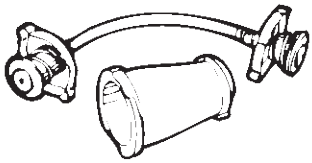
## General Specifications

| | A/T |
|---|---|
| Cooling system | Engine coolant forced circulation |
| Radiator | Tube type corrugated (2 tube in row) |
| Heat radiation capacity | 85,500 kcal/h |
| Heat radiation area | 14.02m2 (150.9ft2) |
| Radiator front area | 0.263m2 (2.83ft2) |
| Radiator dry weight | 56N (12.6lb) |
| Radiator cap valve opening pressure | 93.3 ~ 122.7kpa (13.5 ~ 17.8psi) |
| Engine coolant capacity | 2.4lit (0.6 US gal) |
| Engine coolant pump | Centrifugal impeller type |
| Delivery | 300 (317) or more |
| Pump speed | 5000 ± 50 rpm |
| Thermostat | Wax pellet type with air hole |
| Valve opening temperature | 74.5 ~ 78.5˚C (166.1 ~ 173.3˚F) |
| Engine coolant total capacity | 10.0lit (2.64 US gal) |

## Torque Specifications



## Special Tool

| ILLUSTRATION | **TOOL NO.**<br>TOOL NAME |
|---|---|
|  <br>901RW072 | **J–24460–01**<br>Tester; radiator cap |
|  <br>901RW073 | **J–33984–A**<br>Adapter; radiator cap |

AXIOM

# ENGINE

# ENGINE FUEL

## CONTENTS

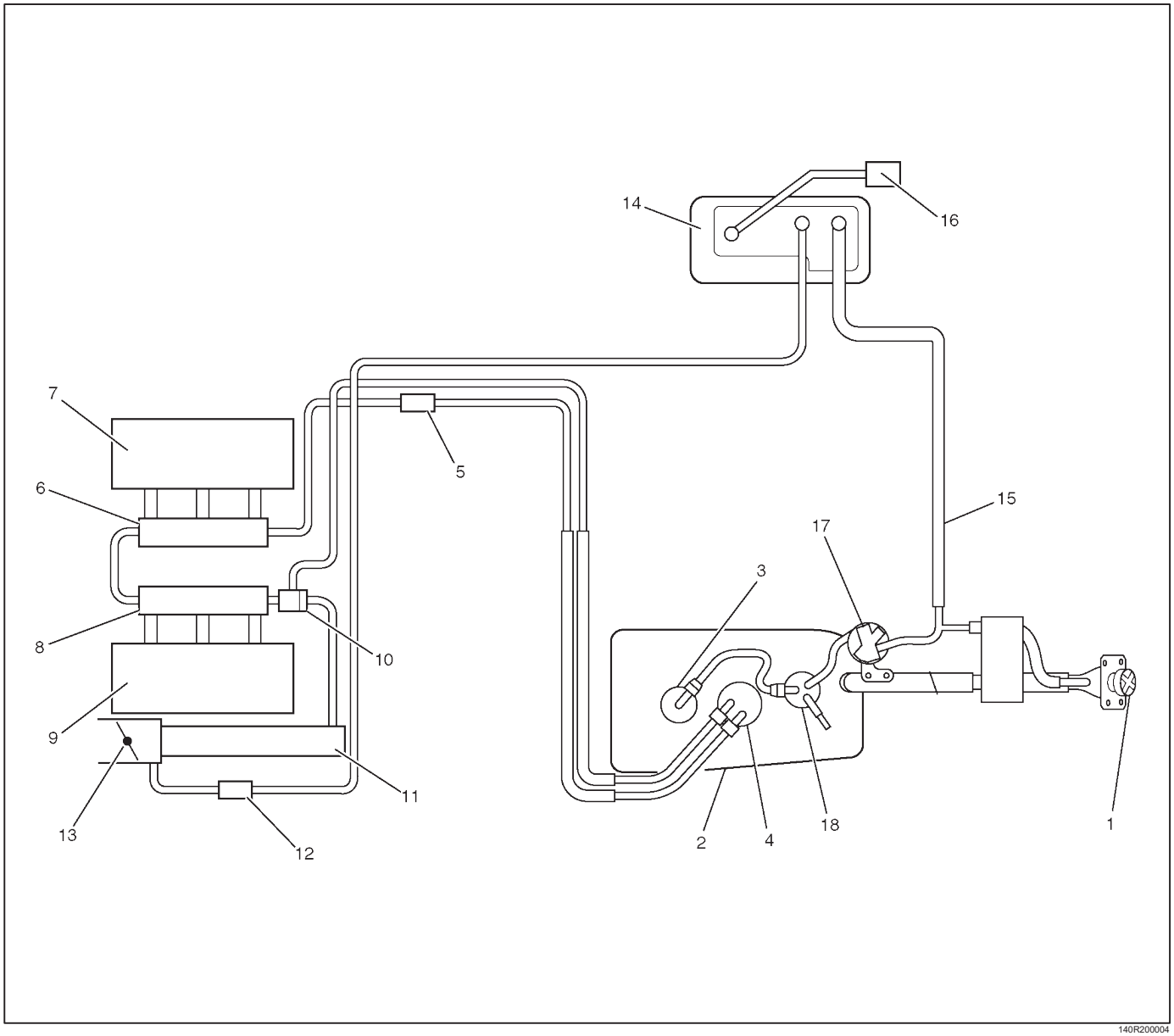

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## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# General Description




140R200004

**Legend**

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Vent Hose
(16) Vent Solenoid Valve
(17) Separator
(18) Shut off Valve (With Over Pressure Relief Valve)

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the battery ground cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect “O” rings. Replace if required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Adhere to all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation.
Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.
The vapor pressure sensor and vent solenoid valve for vapor pressure sensor are used to detect abnormalities in the evaporative emission control system.
The PCM decides whether there is an abnormality in the evaporative emission control system based on vapor pressure sensor signal.

## Fuel Metering

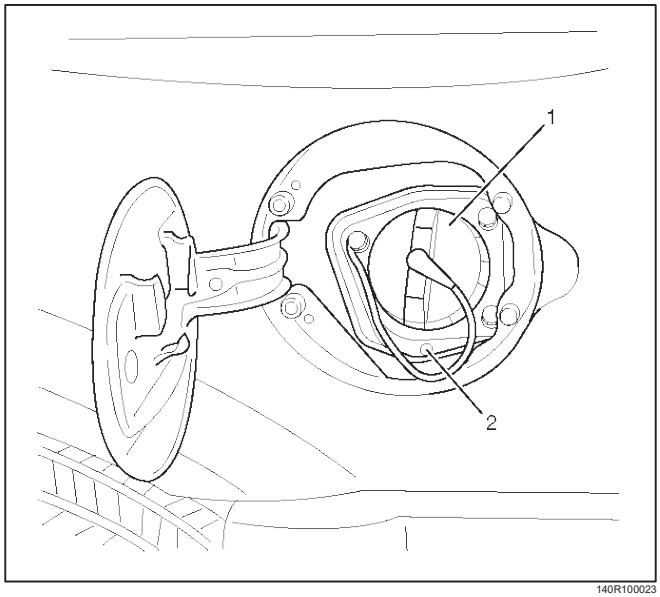
The Powertrain Control Module (PCM) is in complete control of this fuel delivery system during normal driving conditions.
The intake manifold function, like that of a diesel, is used only to let air into the engine. The fuel is injected by separate injectors that are mounted over the intake manifold.
The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes, which the MAP sensor converts to a voltage output.
This sensor generates the voltage to change corresponding to the flow of the air drawn into the engine. The changing voltage is transformed into an electric signal and provided to the PCM.
With receipt of the signals sent from the MAP sensor, Intake Air Temperature sensor and others, the PCM determines an appropriate fuel injection pulse width feeding such information to the fuel injector valves to affect an appropriate air/fuel ratio.
The Multiport Fuel Injection system utilizes an injection system where the injectors turn on at every crankshaft revolution. The PCM controls the injector on time so that the correct amount of fuel is metered depending on driving conditions.
Two interchangeable “O” rings are used on the injector that must be replaced when the injectors are removed.
The fuel rail is attached to the top of the intake manifold and supplies fuel to all the injectors.
Fuel is recirculated through the rail continually while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operation.
The fuel pressure control valve that is mounted on the fuel rail maintains a pressure differential across the injectors under all operating conditions. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank based on engine demand.
See Section “Driveability and Emission” for more information and diagnosis.

# Fuel Filter

## Removal

**CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".**

1. Disconnect battery ground cable.
2. Remove Fuel filler cap(1).

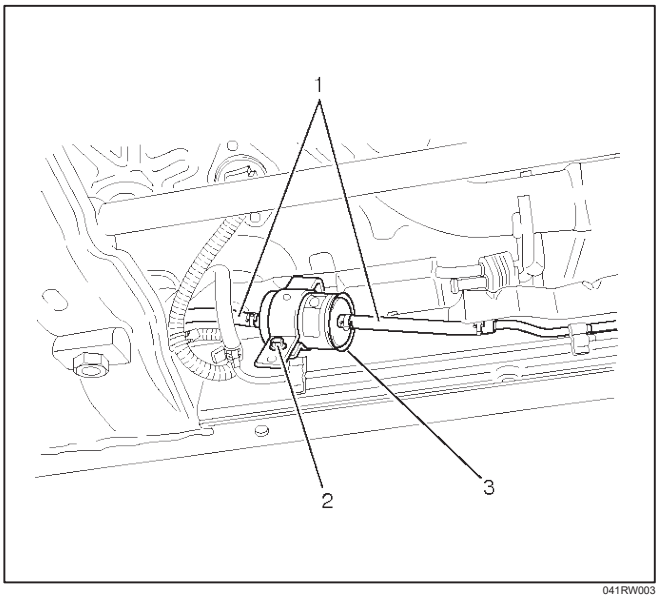


140R100023

**Legend**

(1) Fuel Filler Cap
(2) Receive Rubber Drain

3. Disconnect fuel hoses(1) from fuel filter on both engine side and fuel tank side.
4. Fuel filter fixing bolt(2).
   - Remove the fuel filter fixing bolt(2) on fuel filter holder.
5. Remove fuel filter(3).



041RW003

**Legend**

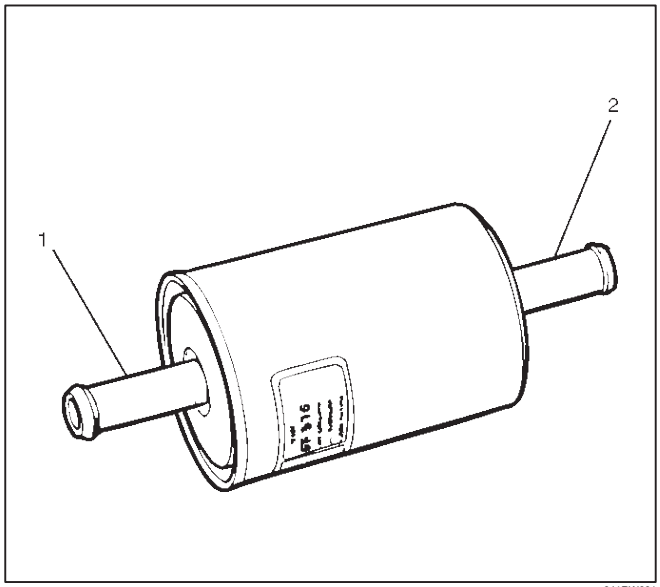
(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

## Inspection

1. Replace the fuel filter if the fuel leaks from fuel filter body or if the fuel filter body itself is damaged.
2. Replace the filter if it is clogged with dirt or sediment.
3. Check clogged drain port of the receive rubber by the foreign material, repair or clear if found clog it.

## Installation

1. Install the fuel filter in the proper direction.
2. Install fuel filter holder fixing bolt.
3. Connect fuel hoses on engine side(1) and fuel tank side(2).




041RW001

4. Install fuel filler cap
5. Connect the battery ground cable.

## Inspection

After installation, start engine and check for fuel leakage.

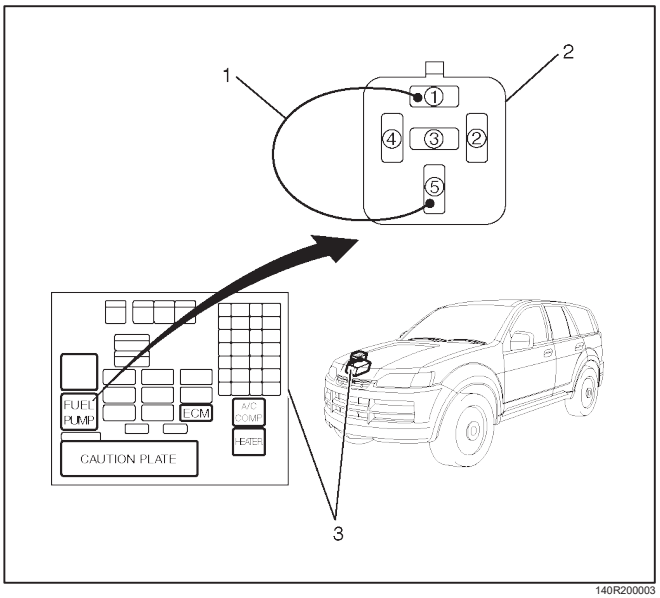
## In–Tank Fuel Filter

The filter is located on the lower end of fuel pickup tube in the fuel tank. The fuel filter prevents dirt and water the fuel system not unless the filter is submerged in water. The fuel filter is maintenance free, that requires no maintenance. Excess water and sediment in the tank restricts fuel supply to the engine, resulting in engine stall. If this happens, the fuel tank would need to be cleaned thoroughly.

## Fuel Pump Flow Test

If reduction of fuel supply is suspected, perform the following checks.

1. Make sure that there is fuel in the tank.
2. With the engine running, check the fuel feed pipe and hose from fuel tank to injector for evidence of leakage. Retighten, if pipe or hose connection is loose. Also, inspect bent or kink fuel pipes and hoses.
3. Insert the hose from fuel feed pipe into a clean container, and check for fuel pump flow rate.
4. Connect the pump relay terminals with a jumper wire(1) as shown and start the fuel pump to measure delivery.




140R200003

**CAUTION: Never generate sparks when connecting a jumper wire.**

| Delivery Times | Delivery |
|---|---|
| 15 seconds | 0.38 liters minimum |

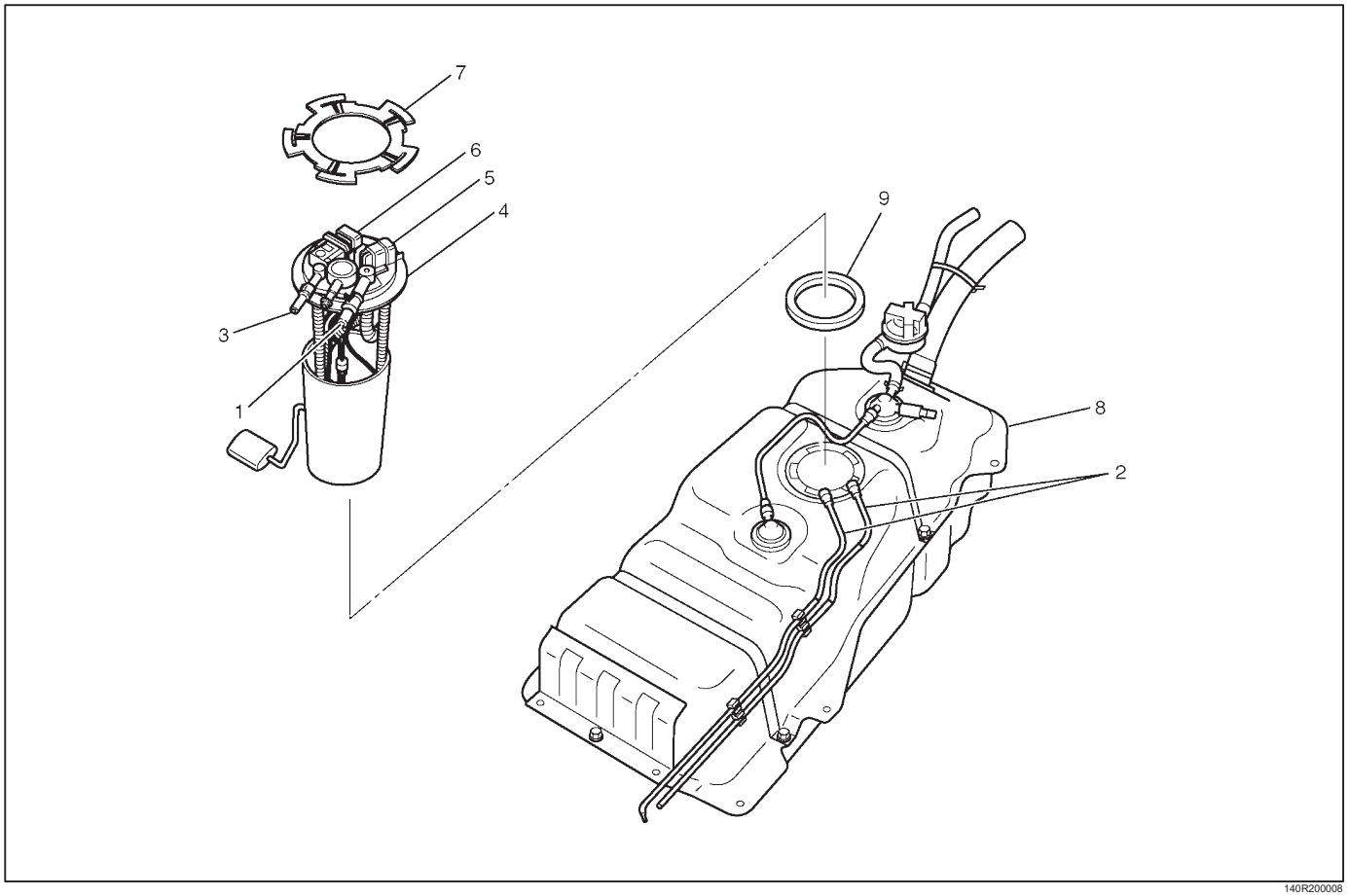
If the measure value is out of standard, conduct the pressure test.

### Pressure test

For the pressure test to the fuel system, see Section 6E “Fuel Control System”.

# Fuel Pump

## Fuel Pump and Associated Parts




**Legend**

(1) Fuel Feed Port
(2) Fuel Tube/Quick Connector
(3) Fuel Return Port
(4) Fuel Pump and Sender (FPS) Assembly
(5) Connector; Fuel Feed Pump
(6) Connector; Fuel Tank Pressure Sensor
(7) Retainer (Fuel Pump Lock)
(8) Fuel Tank Assembly
(9) Seal; Fuel Pump

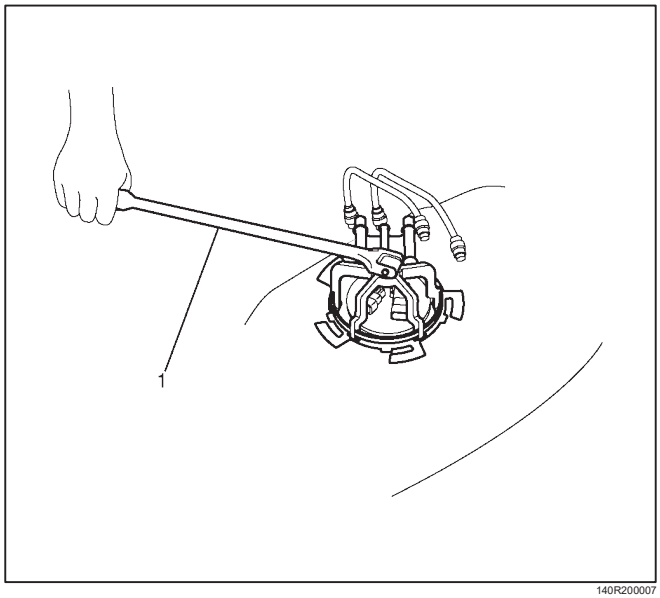
## Removal

**CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".**

1. Remove fuel tank assembly(8). Refer to "Fuel Tank Removal" in this section.
2. Remove Fuel Tube/Quick Connector (2).

NOTE: Refer to "Fuel Tube/Quick Connector Fittings" in this section when performing any repairs.

3. Remove the retainer (7) with tool J–39765 and remove the fuel pump and sender (FPS) assembly (4).




NOTE: After removing pump assembly (4), cover fuel tank to prevent any dust entering.

## Installation

1. Install FPS assembly(4) with retainer (7) and new seal; fuel pump (9) by J–39765.
2. Install Fuel Tube/Quick Connector (2).

NOTE: Refer to “Fuel Tube/Quick Connector Fittings” in this section when performing any repairs.

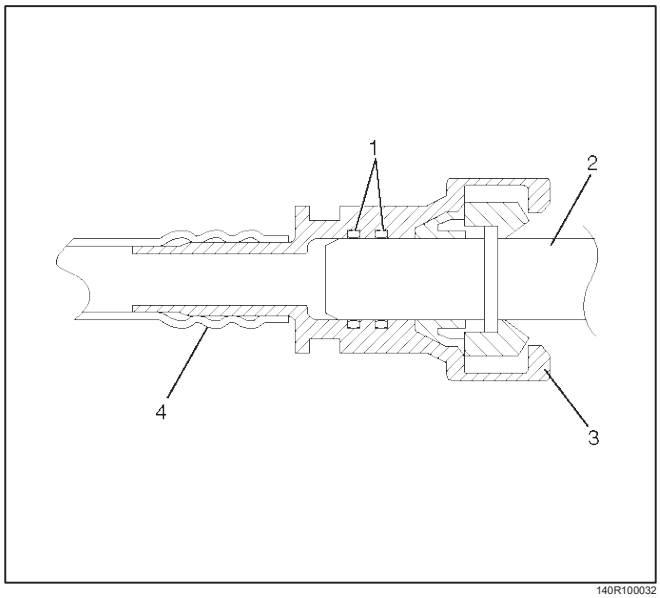
3. Install fuel tank assembly(8). Refer to “Fuel Tank Installation”.

# Fuel Tube / Quick – Connector Fittings

## Precautions

- Do not light a match or create a flame.
- Keep flames away from your work area to prevent flammable materials from catching fire.
- Disconnect battery ground cable to prevent electrical shorts.
- Pre-treat piping system or associated parts from thermal damage or from spattering when welding or similar heat-generating work.

## Cautions During Work




140R100032

**Legend**

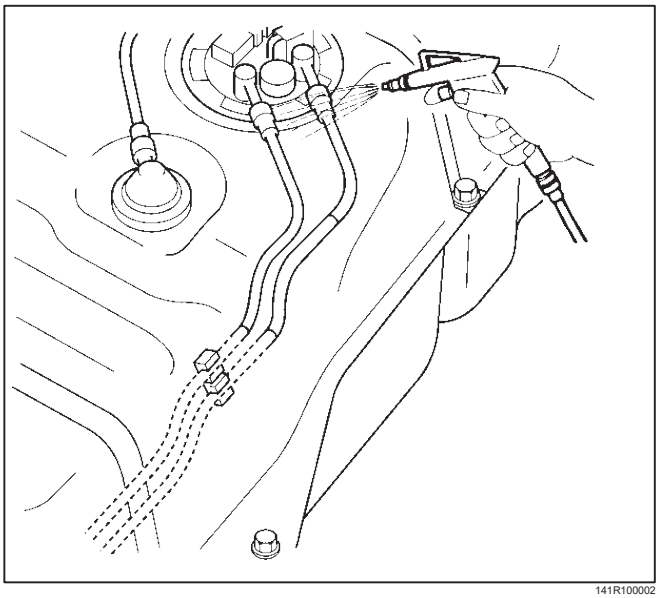
(1) O-ring
(2) Port
(3) Connector
(4) Plastic Tube

NOTE: An O-ring inside the quick connector provides the seal between the quick connector and the port. Be careful not to damage the mating surfaces and O-ring when attaching the connector. Do not allow foreign material to enter the connector or the port.

Do not expose the assembly to battery electrolyte or do not wipe the assembly with a cloth used to wipe off spilt battery electrolyte.
Piping that has been splattered with battery electrolyte or battery electrolyte soaked cloth that was wiped on the piping cannot be used.

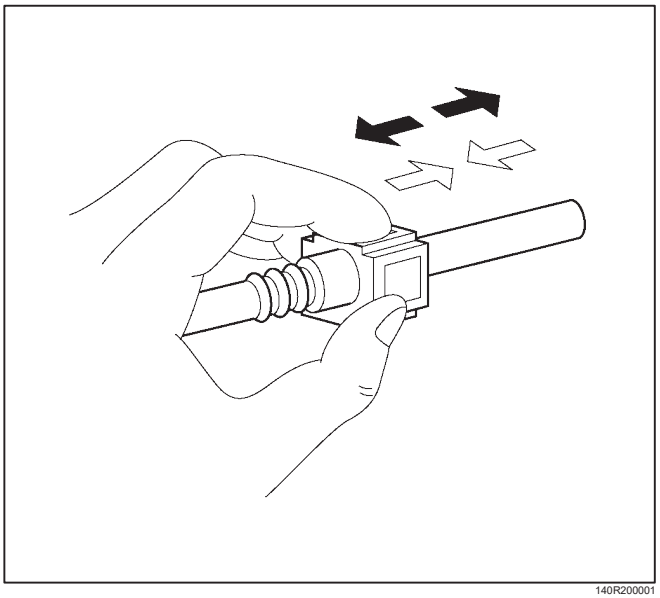
## Removal

1. Open the fuel cap to relieve the fuel pressure in the tank.
   Use compressed air to remove any dirt on the fuel quick connect fittings prior to disconnecting the fittings.



141R100002

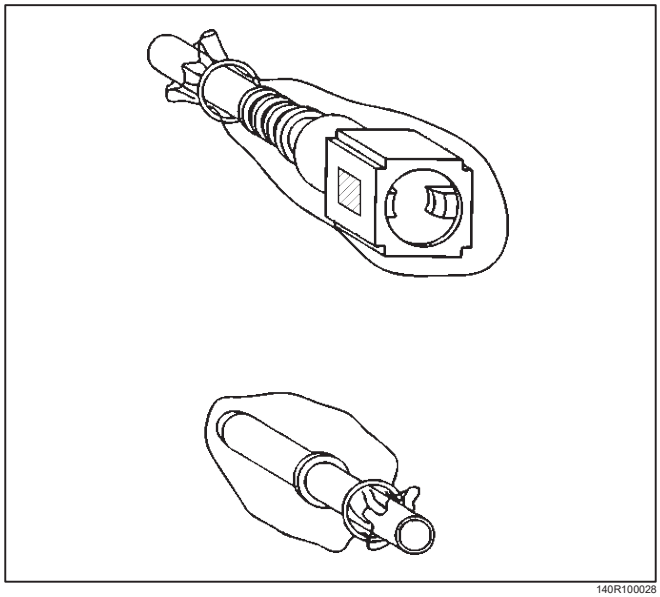
   When disconnecting the fuel pipe, cover the area with a cloth to prevent fuel from splashing as the fuel pipe may still have some pressure in it.
2. For removal of the quick connector, pull out the connector with the other hand while pressing the square relieve button of the connector, as illustrated.



140R200001

NOTE: Do not use tools of any kind. Only use bare hands when disconnecting the connector. Use a lubricant (light oil) and/or push and pull the connector until the pipe is disconnected.

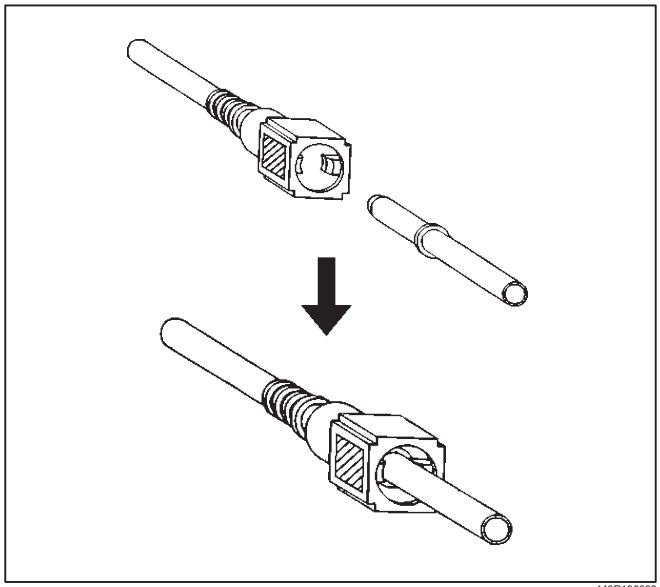
Cover the connectors that was removed with a plastic bag, to prevent dust or rain water from entering.



140R100028

## Reuse of Quick–Connector

- Replace the port and connector if scratch, dent or crack is found.
- Remove any dirt build up on the port when installing the connector. Replace the connector, if there is any forms of rust, dent, scratch.
- After cleaning the port, insert it straight into the connector until it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.



140R100036

## Assembling Advice

By applying engine oil or light oil to the pipe, port makes pipe assembly easier. The pipe assembly should take place immediately after applying oil (to prevent dust from sticking to the pipe surface – which may decrease sealing ability).

**Test/Inspection After Assembling**

1. Reconnect the battery negative cable.
2. Turn the ignition key to the “ON” position and listen for pump start-up sound. Inspect for leaks, the fuel pressure will increase as the fuel pump is actuated.
3. Perform leak inspection (step 2) several times.
4. Start the engine and observe the engine idle speed. The presence of dirt in the fuel system may affect the fuel injection system.

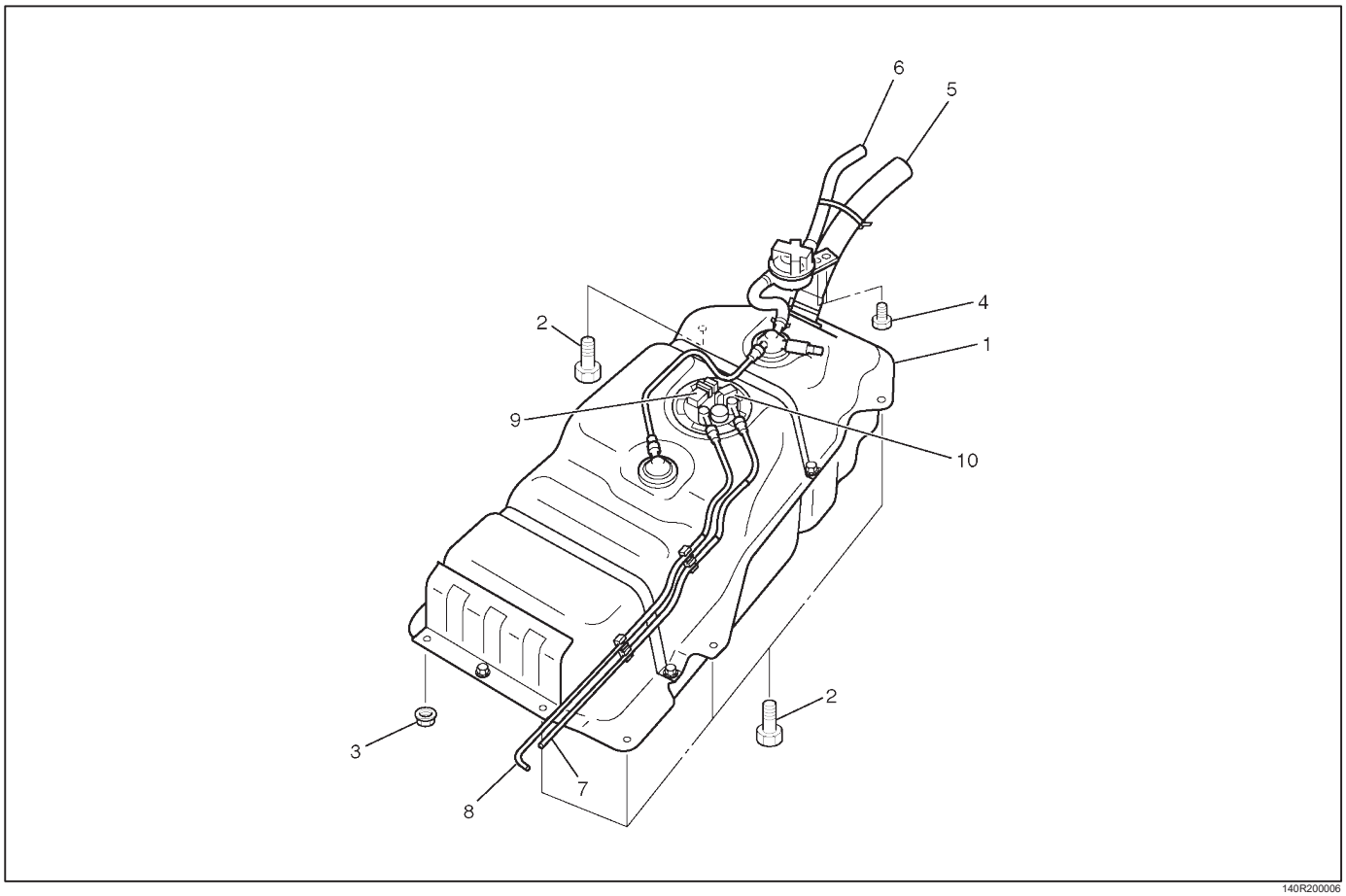
# Fuel Pump Relay

## General Description

In order to control the fuel pump and sender (FPS) operation, the FPS relay is provided. When the starter switch is turned to “ON” position, the FPS relay operates the FPS for 2 seconds.
When the key is turned to “START” position, the Engine Control Module receives the reference pulse from the Ignition Control Module and it operates the relay, again causing the FPS to feed fuel.

# Fuel Tank

## Fuel Tank and Associated Parts




140R200006

**Legend**

(1) Fuel Tank Assembly
(2) Fuel Tank Fixing Bolt (QTY: 5)
(3) Fuel Tank Fixing Nut (QTY: 1)
(4) Separator Fixing Bolt (QTY: 2)
(5) Fuel Filler Hose
(6) Fuel Vent Hose
(7) Fuel Feed Hose
(8) Fuel Return Hose
(9) Vapor Pressure Sensor Connector
(10) Fuel Feed Pump Connector

## Removal

**CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".**

1. Drain the fuel from the fuel tank, refer to the "Fuel Pump Flow Test" in this section.
2. Disconnect battery ground cable.
3. Loosen fuel filler cap to reduce the pressure in fuel tank.
4. Support underneath of the fuel tank assembly (1) with a lifter.
5. Disconnect fuel feed hose (7) and fuel return hose (8) near the fuel filter.

NOTE: Plug both ends of the fuel hoses to prevent fuel leakage.

6. Disconnect fuel filler hose (5) and fuel vent hose (6) at the fuel filler neck.

NOTE: Cover fuel hoses to prevent any dust entering.

7. Remove two bolts (4) and remove separator.
8. Remove the five fuel tank assembly fixing bolts (2) and one nut (3).
9. Lower the tank and disconnect the wiring connectors (9, 10).

## Installation

1. Raise the fuel tank assembly (1) and connect the wiring connectors (9, 10).
2. Install fuel tank assembly along with protectors and tighten the five fixing bolts (2) and one nut (3) to the specified torque.

   **Torque: 68 N·m (50 lb ft)**

3. Install the separator and tighten two bolts (4).

   **Torque: 10 N·m (95 lb in)**

4. Connect fuel filler hose (5) and fuel vent hose and clip them firmly.
5. Connect fuel feed hose (7) and fuel return hose(8), and clip them firmly.
6. Tighten fuel filler cap until at least three clicks are heard.
7. Connect battery ground cable.

# Fuel Gauge Unit

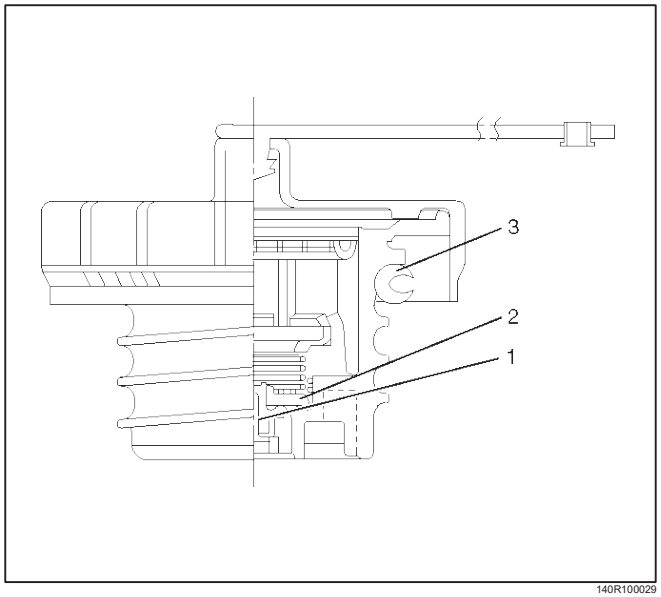
## Removal and Installation

Refer to “Fuel Pump” in this section for removal and installation of the Fuel Gauge Unit, since the fuel gauge unit is linked to the fuel pump and sender assembly.

# Fuel Filler Cap

## General Description

A vacuum valve and pressure valve are built into the fuel filler cap which adjusts the fuel pressure in the fuel tank to prevent fuel tank damage.




140R100029

**Legend**

(1) Vacuum Valve
(2) Pressure Valve
(3) Seal Ring

## Inspection

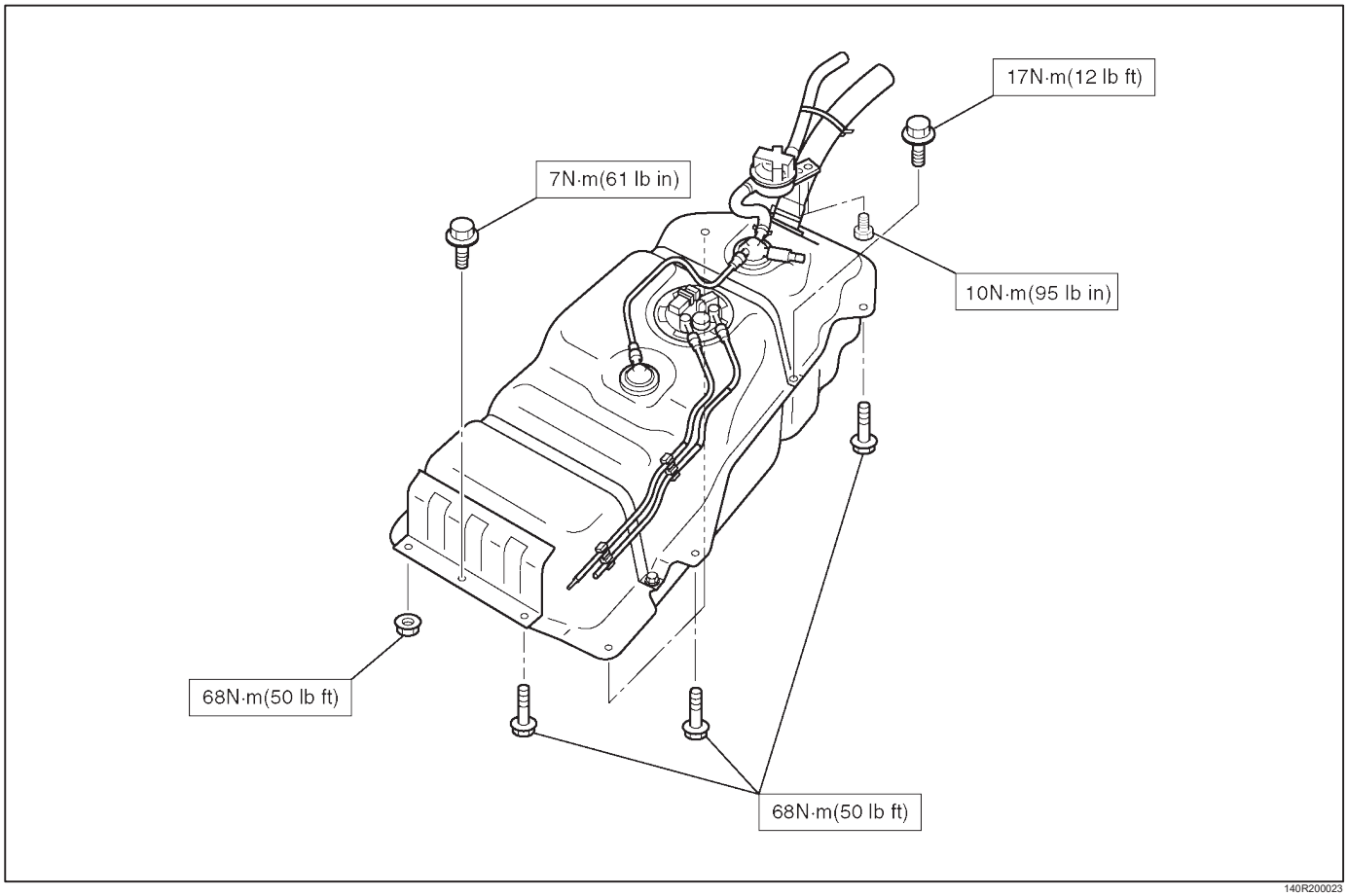
The fuel filler cap must be inspected for seal condition. The fuel filler cap must be replaced if found defective.

**CAUTION:**

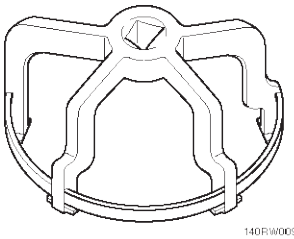
**A replacement fuel filler cap must be the same as the original. The fuel filler cap valve was designed primarily for this application and must be replaced with the same type or decreased engine performance may occur.**

# Main Data and Specifications

## Torque Specification




## Special Tool

| ILLUSTRATION | **TOOL NO.** TOOL NAME |
|---|---|
|  140RW009 | **J–39765** Remover; fuel pump retainer |

AXIOM

# ENGINE

## ENGINE ELECTRICAL (6VE1 3.5L)

### CONTENTS


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General Description . . . . . 6D1–2
Diagnosis . . . . . 6D1–2
Battery Charging . . . . . 6D1–3
Jump Starting . . . . . 6D1–3
Battery Removal . . . . . 6D1–4
Battery Installation . . . . . 6D1–4
Main Data and Specifications . . . . . 6D1–5


## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# Battery

## General Description

The battery is completely sealed except for the two small vent holes (2) on the side. These vent holes (2) permit the escape of small amounts of gas generated by the battery. This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery is much less vulnerable to self discharge than a conventional type battery.

## Diagnosis

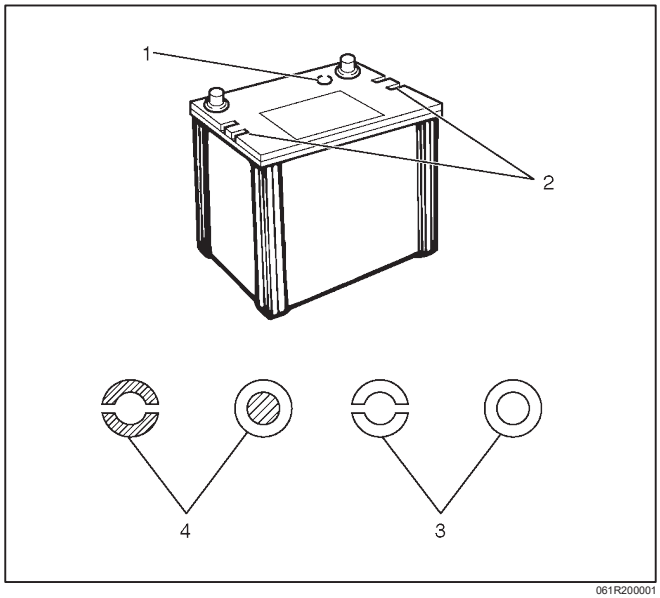
### 1. Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.
Replace the battery if obvious physical damage is discovered during inspection.
Check for any other physical damage and correct it as necessary.

### 2. Hydrometer Check

There is a built–in hydrometer (Charge test indicator(1)) at the top of the battery. It is designed to be used during diagnostic procedures.
Before trying to read the hydrometer, carefully clean the upper battery surface.
If your work area is poorly lit, additional light may be necessary to read the hydrometer.

a. BLUE RING OR DOT VISIBLE(4) – Go to Step 3.
b. BLUE RING OR DOT NOT VISIBLE(3) – Replace the battery.



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### 3. Voltage Check

1. Put voltmeter test leads to battery terminals.
   a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 4 Load Test.
   b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section).
   Fast charge battery for 30 minutes at amperage rate no higher than specified value.
   Take voltage and amperage readings after charge.
   a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.
   b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10 – 15 hours. Then go to Step 4 Load Test.
   c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3–1/2 hours. Then go to Step 4 Load Test.
   d. VOLTAGE BELOW 12V – Replace the Battery.

### 4. Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).
   Read voltage after 15 seconds, then remove load.
   a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN THE TABLE – The battery is good and should be returned to service.
   b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace the battery.

| ESTIMATED TEMPERATURE | | MINIMUM VOLTAGE |
|---|---|---|
| ˚F | ˚C | V |
| 70 | 21 | 9.6 |
| 60 | 16 | 9.5 |
| 50 | 10 | 9.4 |
| 40 | 4 | 9.3 |
| 30 | –1 | 9.1 |
| 20 | –7 | 8.9 |
| 10 | –12 | 8.7 |
| 0 | –18 | 8.5 |
| The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours. | | |

# Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during charging procedure.
   Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
   Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick charged or slow charged in the same manner as other batteries.
   Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

# Jump Starting

## Jump Starting with an Auxiliary (Booster) Battery

**CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.**

**Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.**

**WARNING: FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:**

1. Serous personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.
Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.
Never allow battery fluid to come in contact with your eyes or skin.
Never allow battery fluid to come in contact with fabrics or painted surfaces.
Battery fluid is a highly corrosive acid.
Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.
Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.
Always keep batteries out of reach of young children.

### Jump Starting Procedure

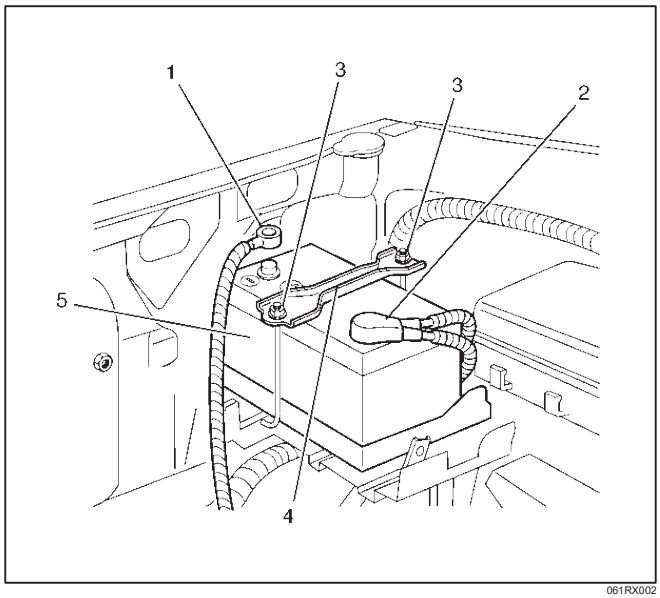
1. Set the vehicle parking brake.
   If the vehicle is equipped with an automatic transmission, place the selector level in the “PARK” position.
   If the vehicle is equipped with a manual transmission, place the shift lever in the “NEUTRAL” position.
   Turn “OFF” the ignition.
   Turn “OFF” all lights and any other accessory requiring electrical power.
2. Look at the built–in hydrometer.
   If the indication area of the built–in hydrometer is completely clear, do not try to jump start.
3. Attach the end of one jumper cable to the positive terminal of the booster battery.
   Attach the other end of the same cable to the positive terminal of the discharged battery.
   Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.
   Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.
   Attach the other end of the same cable to a solid engine ground (such as the air conditioning compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.
   The ground connection must be at least 450 mm (18 in.) from the battery of the vehicle whose battery is being charged.

**WARNING: NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.**

5. Start the engine of the vehicle with the good battery.
   Make sure that all unnecessary electrical accessories have been turned “OFF”.
6. Start the engine of the vehicle with the dead battery.

7. To remove the jumper cables, follow the above directions in reverse order.
   Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

## Battery Removal




1. Remove negative cable (1).
2. Remove positive cable (2).
3. Remove retainer screw and rods (3).
4. Remove retainer (4).
5. Remove battery (5).

## Battery Installation

1. Install battery (5).
2. Install retainer (4).
3. Install retainer screw and rods (3).

NOTE: Make sure that the rod is hooked on the body side.

4. Install positive cable (2).
5. Install negative cable (1).

# Main Data and Specifications

## General Specifications

| | |
|---|---|
| Model | 24R–600 |
| Voltage (V) | 12 |
| Cold–Cranking Performance (Amp) | 600 |
| Reserve Capacity (Min) | 118 |
| Load Test (Amp) | 300 |
| BCI Group No. | 24 |

AXIOM

# ENGINE

## IGNITION SYSTEM (6VE1 3.5L)

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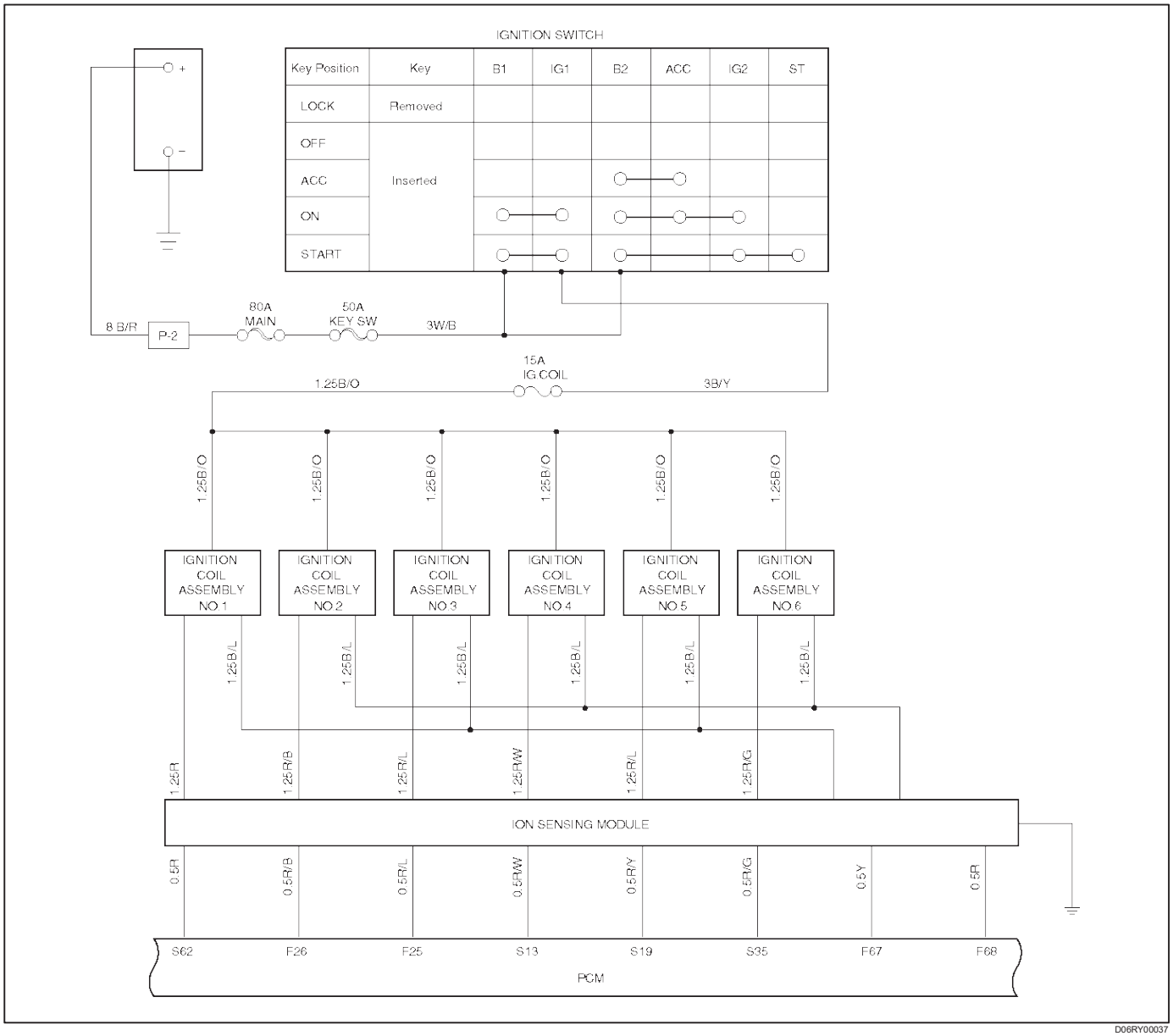

## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

## General Description

Ignition is done by the electronic ignition (EI) that directly fires the spark plugs from ignition coils through spark plug wires without using a distributor. The firing orders are selected No.1, No.2, No.3, No.4, No.5, and No6.
Since the cylinder on exhaust stroke requires less energy to fire its ignition plug, energy from the ignition coils can be utilized to fire the mating cylinder on compression stroke. After additional 360˚ rotation, respective cylinder strokes are reversed.
The EI consists of six ignition coils,ignition control module, crank position sensor, powertrain control module (PCM) and other components.
The ignition coils are connected with the PCM by means of a 80 pin connector.
The ignition control module turns on/off the primary circuit of ignition coils, and also it controls the ignition timing at the engine speed below 538 rpm.
A notch in the timing disc on the crankshaft activates the crank position sensor which then sends information such as firing order and starting timing of each ignition coil to the PCM.
Further, the EI employs ignition control (IC) to control similar to a distributor system.
By receiving signals such as crank position,engine speed, water temperature and Manifold Absolute Pressure (MAP), the PCM controls the ignition timing.



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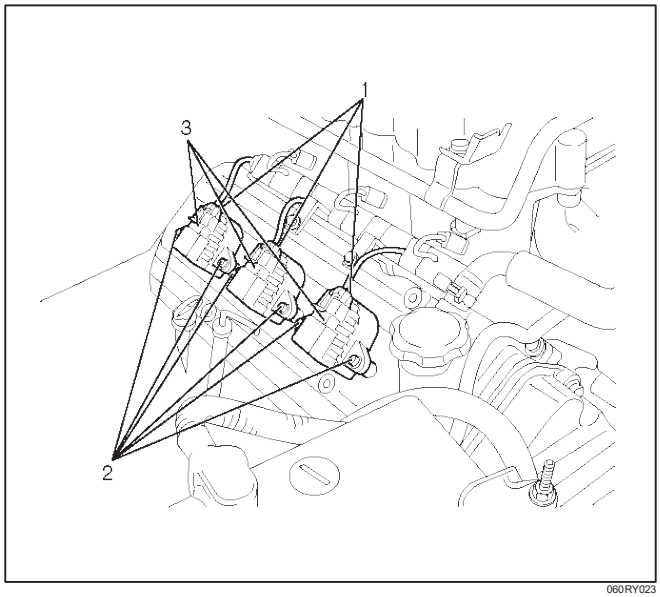
## Diagnosis

Refer to Section Drivability and Emissions for the diagnosis to electronic ignition system (EI system).

# Ignition Coil

## Removal

1. Disconnect battery ground cable.
2. Ignition coil connector and ignition coil.
   - Disconnect three connector from ignition coil.
   - Remove harness bracket bolt on cylinder head cover.
   - Remove fixing bolts on ignition coil.




060RY023

**Legend**

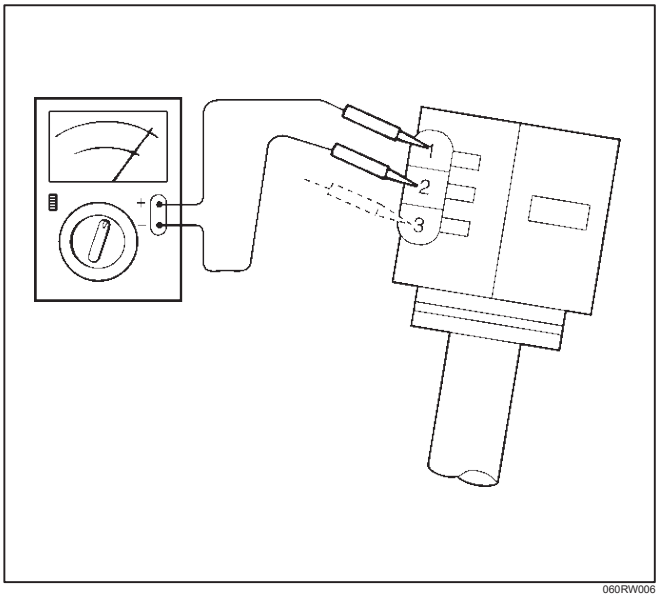
(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

## Inspection and Repair

Check the ignition coil assembly for insulation. Check terminals for corrosion or damage, and replace as necessary.
Measuring resistance of ignition coil assembly.

| Terminal No. | Limit |
|---|---|
| 1 to 2 | Without 0 ohm or infinity maximum ohm. |
| 1 to 3 | Same as above |
| 2 to 3 | Same as above |

Measure resistance of ignition coil assembly, and replace the ignition coil assembly if its value exceeds the standard.

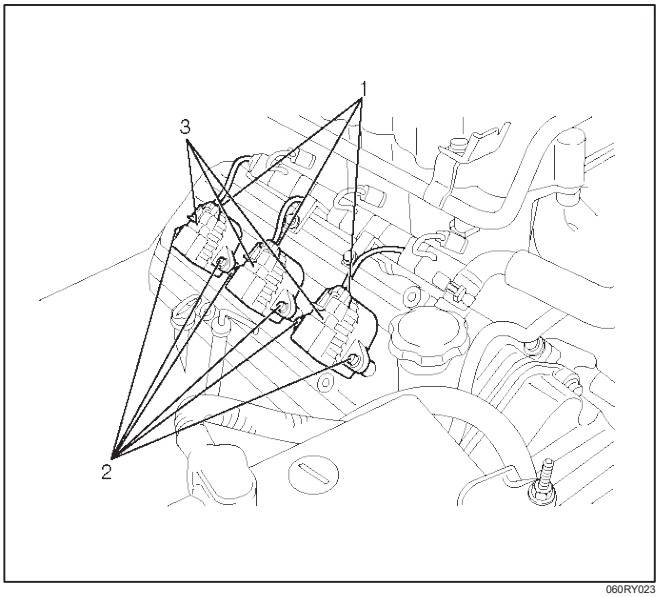



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## Installation

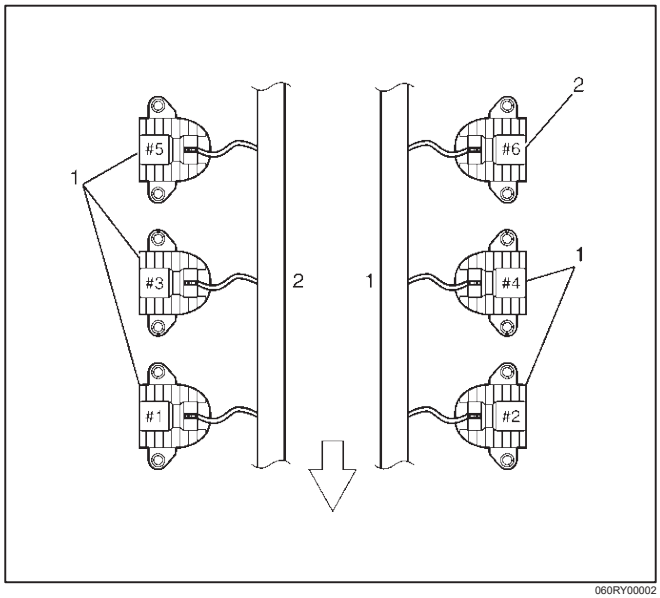
1. Install the ignition coil assembly (3).
   Connect ignition coil connector (1) and ignition coil (3), then tighten bolt (2) to the specified torque.

   **Torque: 4 N·m (35 lb in)**




060RY023

**CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.**




**Legend**

(1) Long type Ignition Coil Assemblies (#1 ~ #5)
(2) Short type Ignition Coil Assembly (#6)

2. Connect battery ground cable.

# Spark Plug

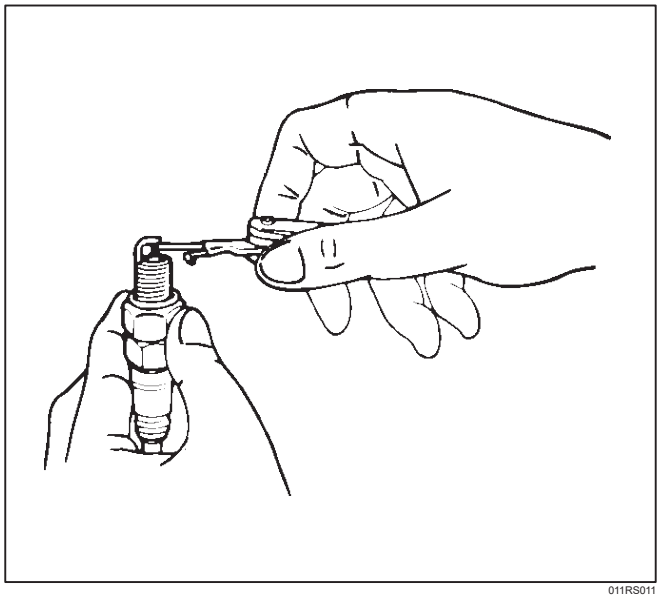
## Removal

1. Remove spark plugs.

## Inspection and Repair

The spark plug affects entire engine performance and therefore its inspection is very important.

- Check electrode and insulator for presence of cracks, and replace if any.
- Check electrode for wear, and replace if necessary.
- Check gasket for damage, and replace if necessary.
- Measure insulation resistance with an ohmmeter, and replace if faulty.
- Adjust spark plug gap to 1.0 mm – 1.1 mm (0.0394 in – 0.0433 in).



011RS011

NOTE:

– Do not adjust the spark plugs gap without new spark plugs.
– Do not damage to tip of spark plugs.
– Do not cleaning the spark plugs. If require the cleaning it due to heavy dirt, it is allowed only 20 seconds to be used spark plug cleaner.

- Check fuel and electrical systems if spark plug is extremely dirty.
- Use spark plugs having low heat value (hot type plug) if fuel and electrical systems are normal.
- Use spark plugs having high heat value (cold type plug) if insulator and electrode are extremely burned.

### Sooty Spark Plugs

Much deposit of carbon or oil on the electrode and insulator of spark plug reduces the engine performance.

**Possible causes:**

- Too rich mixture
- Presence of oil in combustion chamber
- Incorrectly adjusted spark plug gap

### Burning Electrodes

This fault is characterized by scorched or heavily oxidized electrode or blistered insulator nose.

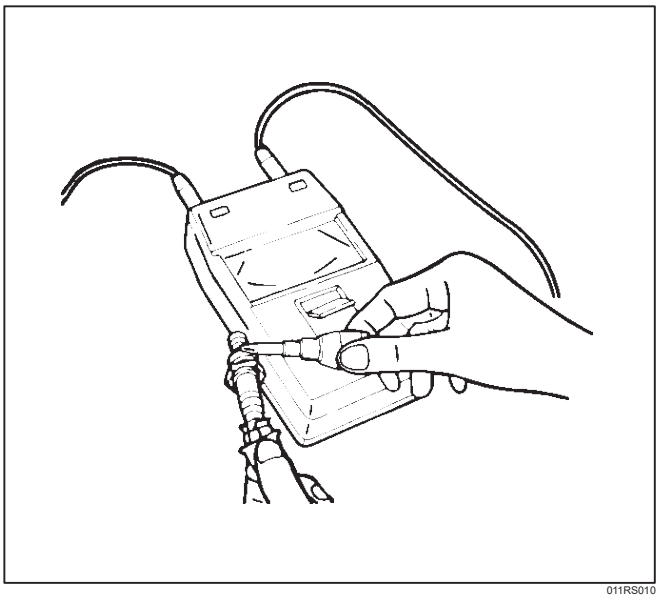
**Possible causes:**

- Too lean mixture
- Improper heat value

### Measuring Insulation Resistance

- Measure insulation resistance using a 500 volt megaohm meter.
- Replace spark plugs if measured value is out of standard.

**Insulation resistance: 50 MΩ or more**



011RS010

## Installation

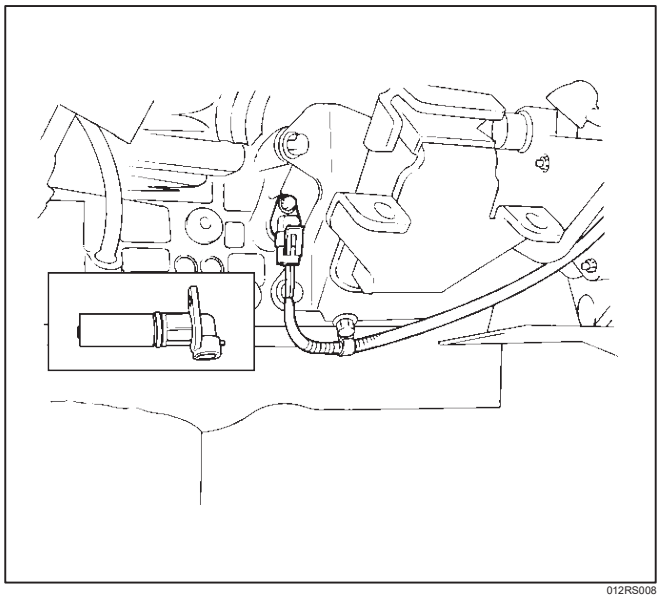
1. Spark plugs
   - Tighten spark plugs to the specified torque.

   **Torque: 18 N·m (13 lb ft)**

# Crankshaft Position Sensor

## Removal

1. Disconnect battery ground cable
2. Wiring connector from crankshaft position sensor.
3. Remove crankshaft position sensor from cylinder block.



012RS008

## Installation

1. Install crankshaft position sensor into the cylinder block.
   Before installation,apply small amount of engine oil to the O–ring.

   **Torque: 10 N·m (87 lb in)**

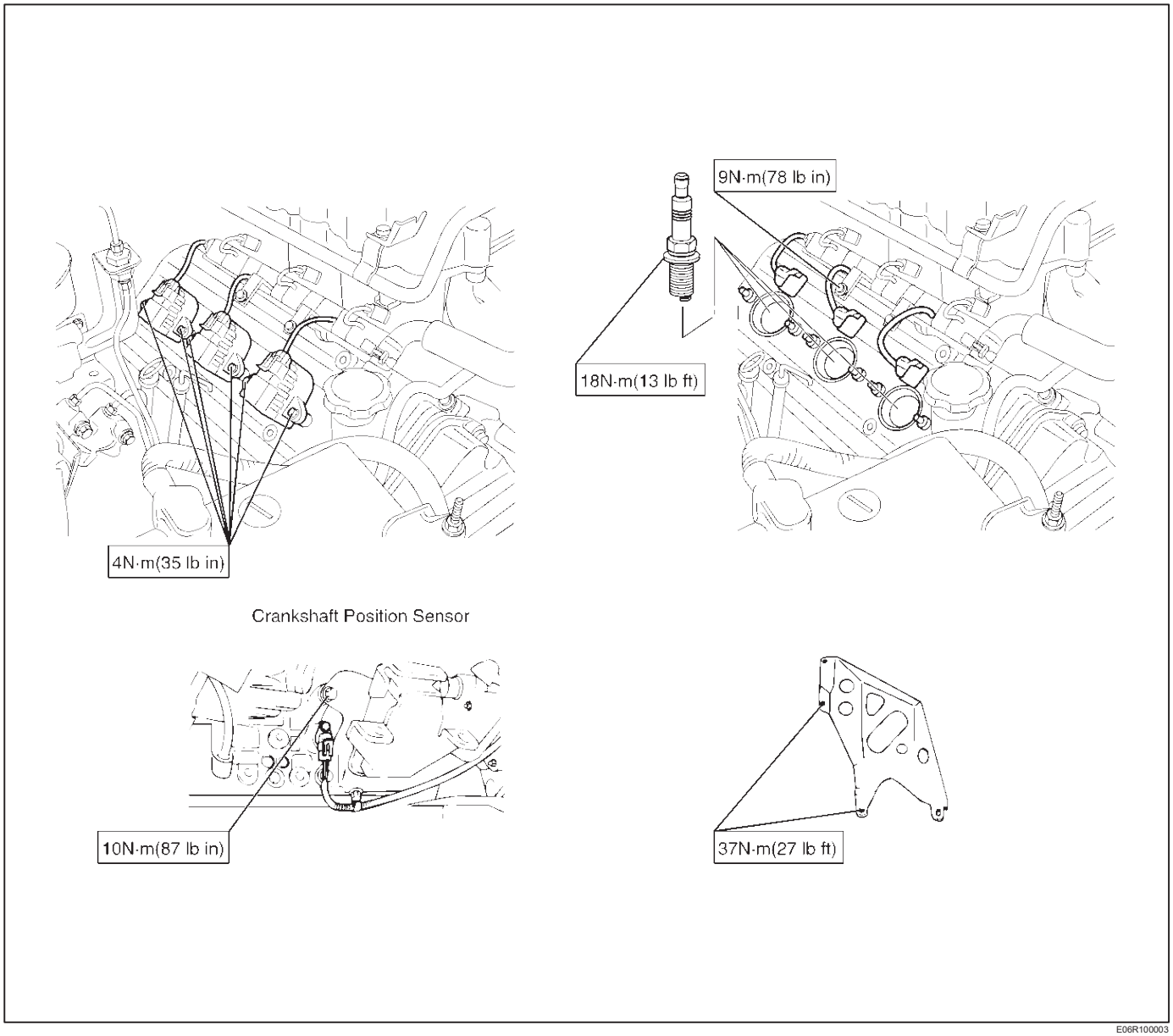
2. Reconnect wiring connector to crankshaft position sensor.

# Main Data and Specifications

## General Specifications

| | |
|---|---|
| **Ignition System** | |
| Ignition Form | Electronic Ignition System (EI system) with Crankshaft position Sensor |
| **Spark Plug** | |
| Type | K16PR–P11<br>RC10PYP4<br>PK16PR11 |
| Plug gap | 1.0 mm – 1.1 mm (0.0394 in – 0.0433 in) |
| Torque | 18 N·m (13lb ft) |

## Torque Specifications




E06R100003

AXIOM

# ENGINE

## STARTING AND CHARGING SYSTEM (6VE1 3.5L)

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## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# Starting System

## General Description

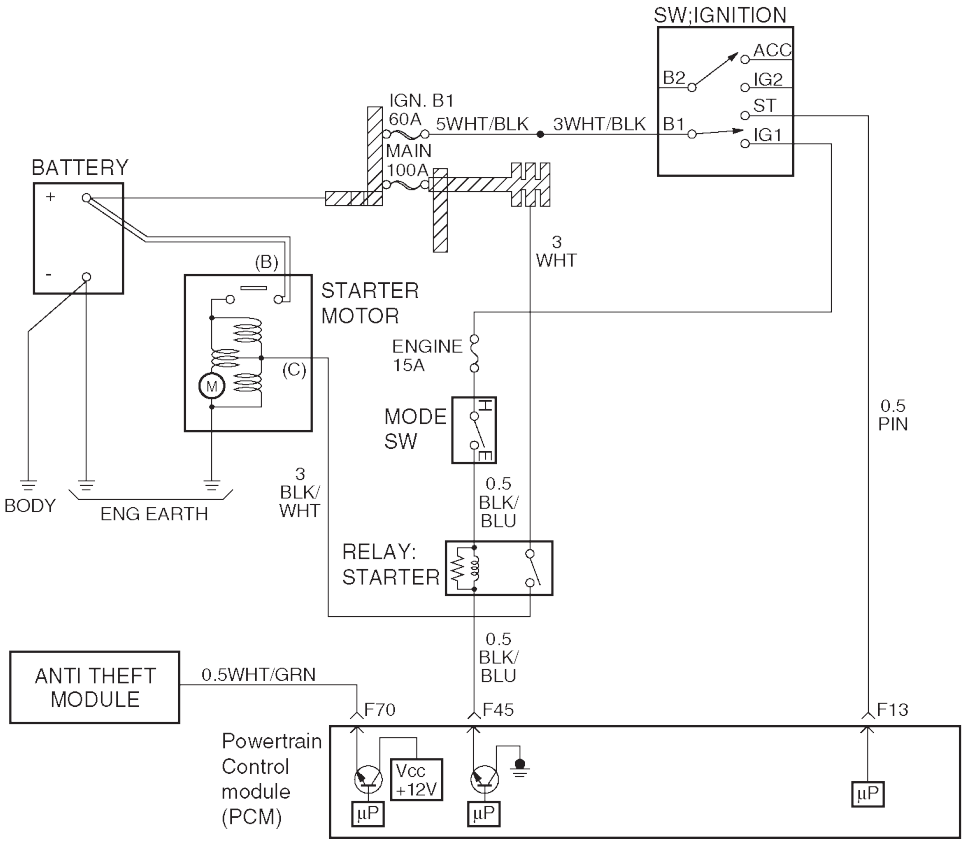
### Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

### Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.


SW;IGNITION
ACC
B2
IG2
ST
B1
IG1
IGN. B1
60A
5WHT/BLK
3WHT/BLK
MAIN
100A
BATTERY
+
-
(B)
STARTER
MOTOR
(C)
M
3
WHT
ENGINE
15A
MODE
SW
H
L
0.5
PIN
BODY
ENG EARTH
3
BLK/
WHT
0.5
BLK/
BLU
RELAY:
STARTER
0.5
BLK/
BLU
ANTI THEFT
MODULE
0.5WHT/GRN
F70
F45
F13
Powertrain
Control
module
(PCM)
Vcc
+12V
µP
µP
µP

060R200062

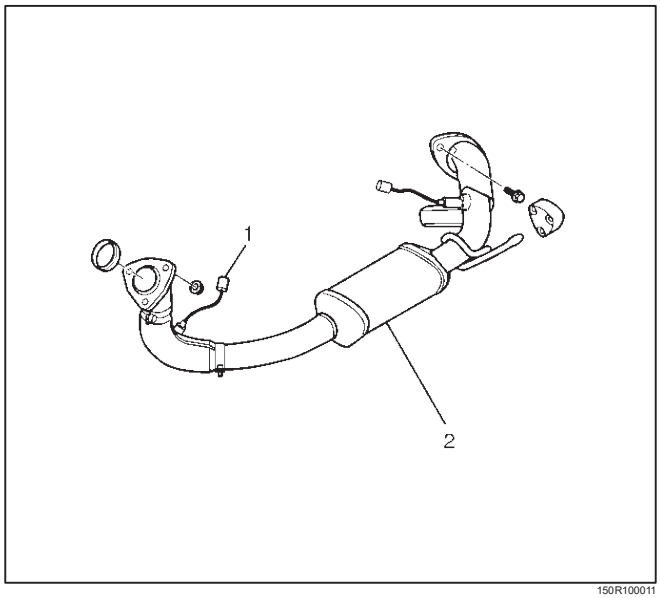
## Diagnosis

| Condition | Possible cause | Correction |
|---|---|---|
| Starter does not run | Charging failure | Repair charging system |
| | Battery Failure | Replace Battery |
| | Terminal connection failure | Repair or replace terminal connector and/or wiring harness |
| | Starter switch failure | Repair or replace starter switch |
| | Starter relay failure | Replace |
| | Starter failure | Repair or replace starter |

# Starter

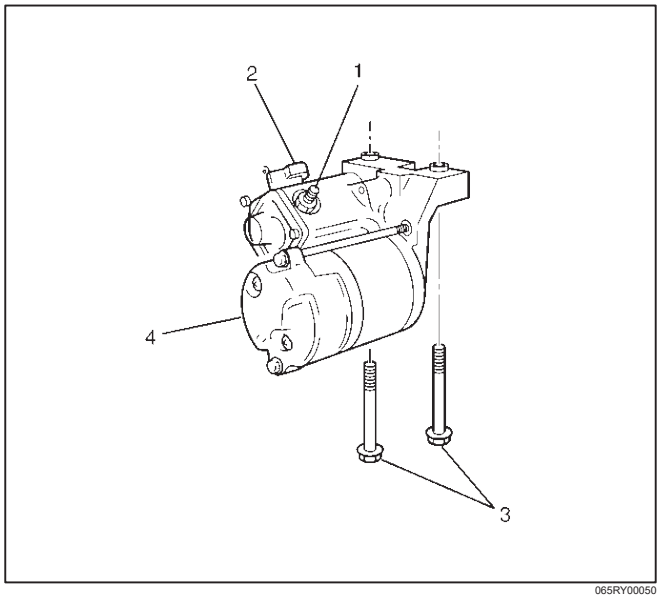
## Removal

1. Battery ground cable.
2. Disconnect Heated $O_2$ Sensor connector (1).
3. Remove exhaust front left pipe(2).




150R100011

4. Disconnect starter wiring connector from terminals “30” (1) and “50” (2).
5. Remove starter assembly mounting bolts on inside and outside(3).
6. Remove starter assembly (4) toward the bottom of engine.




065RY00050

**Legend**

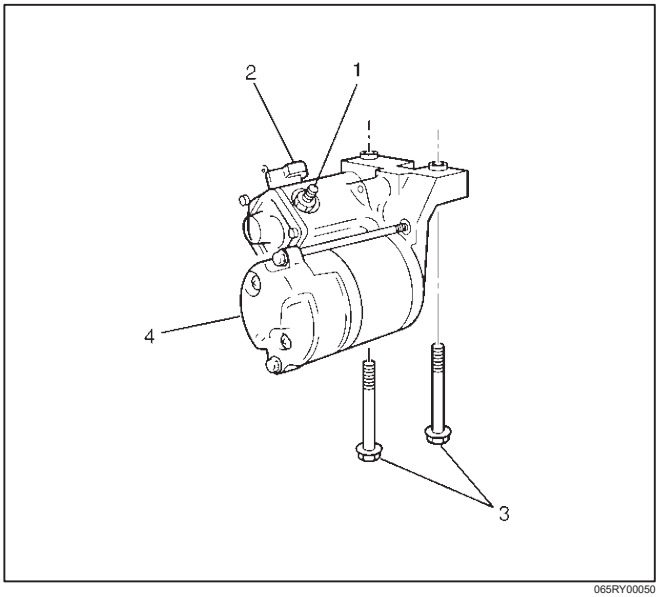
(1) Terminal “30”
(2) Terminal “50”
(3) Fixing Bolts
(4) Starter Assembly

## Installation

1. Install starter assembly(4).
2. Install mounting bolts and tighten bolts to specified torque(3).

   **Torque: 40 N·m (30 lb ft)**
3. Reconnect the connectors to terminals “50” (2) tighten terminals “30” (1) to specified torque.

   **Torque: 9 N·m (78 lb in)**




065RY00050

**Legend**

(1) Terminal “30”
(2) Terminal “50”
(3) Fixing Bolts
(4) Starter Assembly

4. Install exhaust front left pipe (2) and tighten bolts and nuts to specified torque.

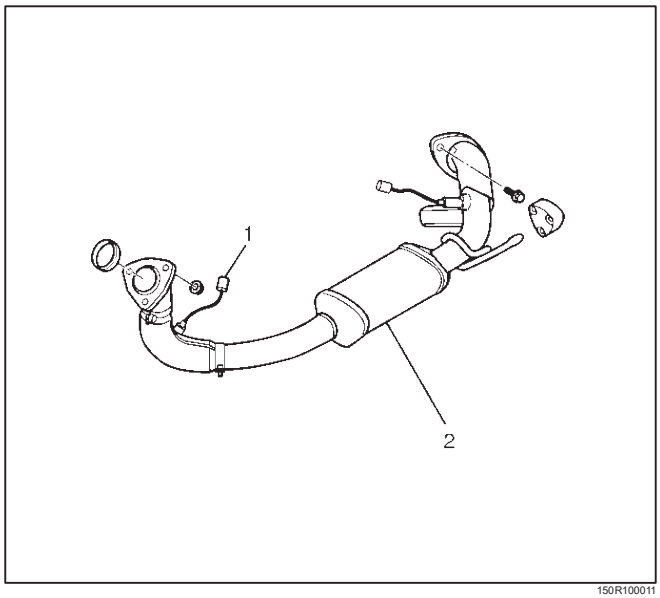
   **Stud Nuts**

   **Torque: 67 N·m (49 lb ft)**

   **Bolts**

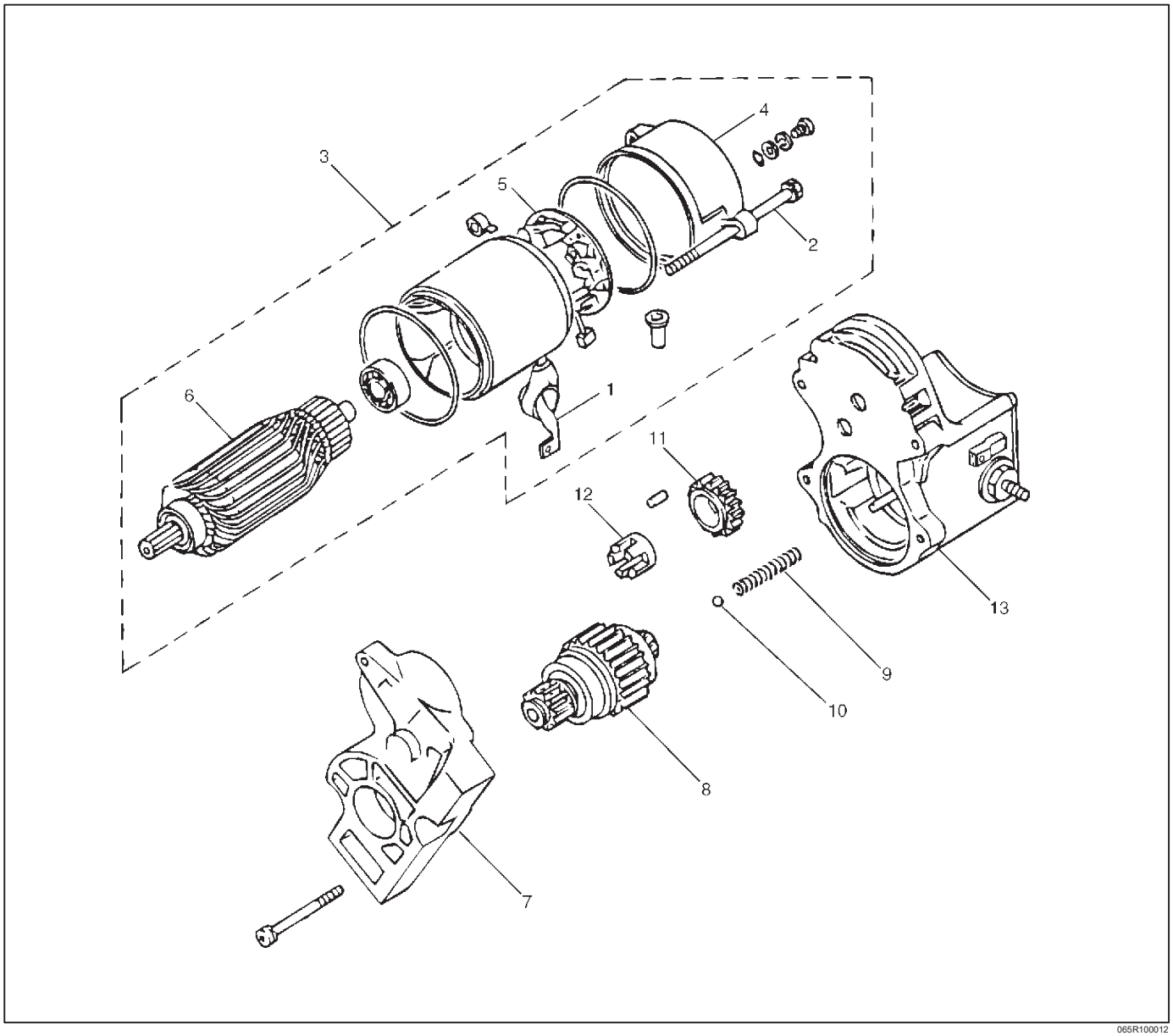
   **Torque: 43 N·m (32 lb ft)**

5. Connect two Heated $O_2$ Sensor connector (1).




6. Reconnect the battery ground cable.

## Disassembled View



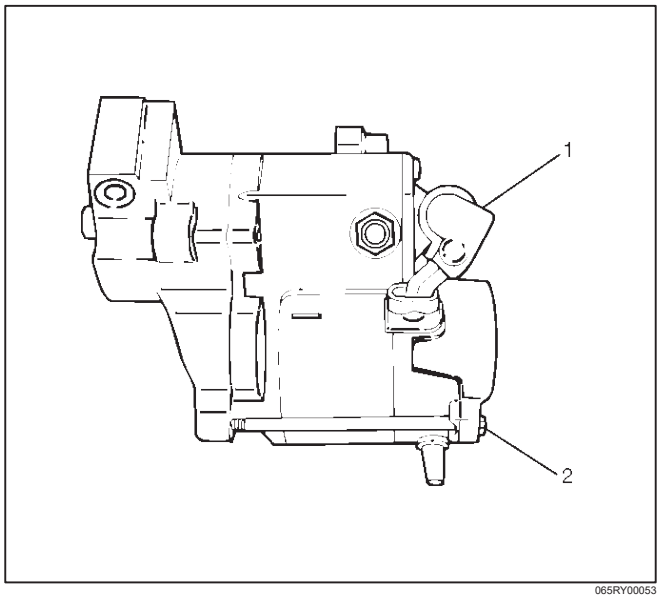

065R100012

**Legend**

(1) Lead Wire
(2) Through Bolt
(3) Yoke Assembly
(4) Yoke Cover
(5) Brush and Brush Holder
(6) Armature
(7) Housing
(8) Over Running Clutch
(9) Return Spring
(10) Steel Ball
(11) Idle Pinion
(12) Retainer
(13) Magnetic Switch

## Disassembly

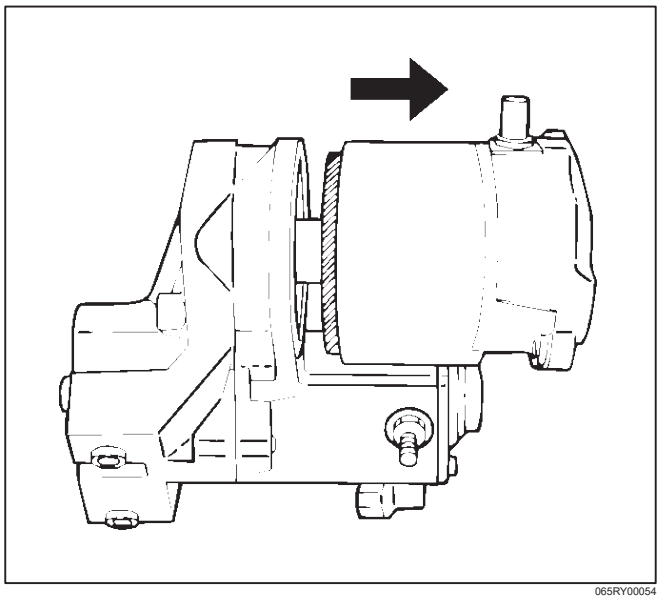
1. Remove the lead wire (1) from the magnetic switch.
2. Remove the through bolts (2).



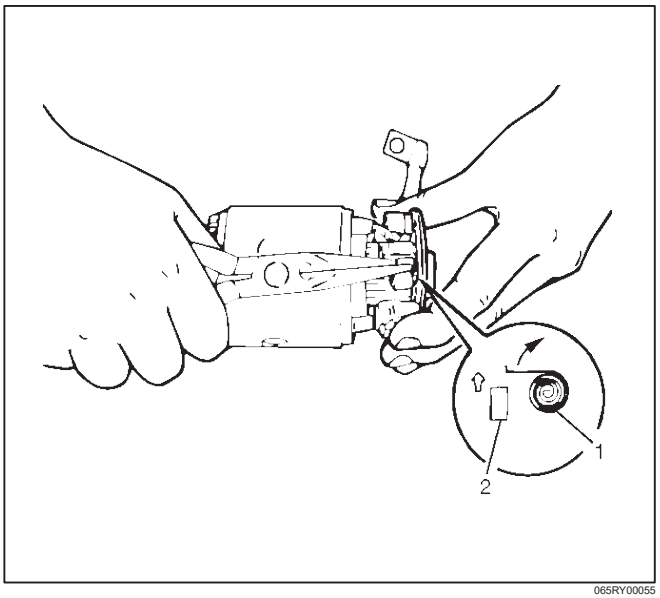

065RY00053

**Legend**
(1) Lead Wire
(2) Through Bolt

3. Remove the yoke from the magnetic.
4. Remove the yoke cover.
5. Use the long nose pliers to remove the brush and brush holder.



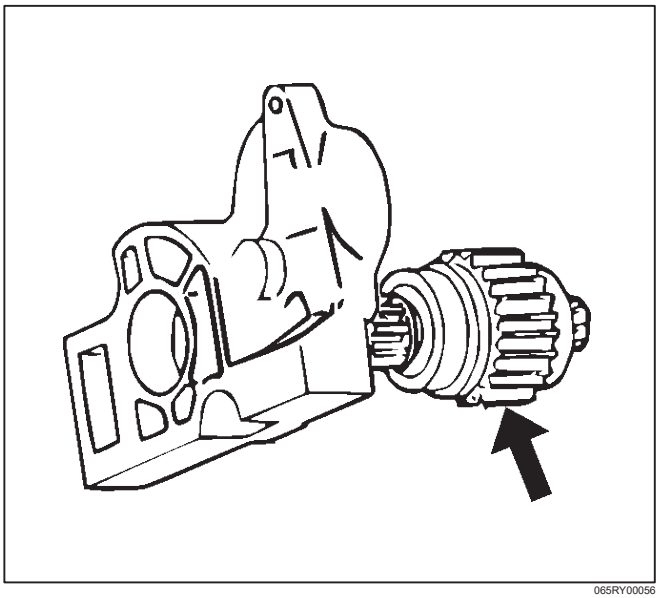
065RY00054




065RY00055

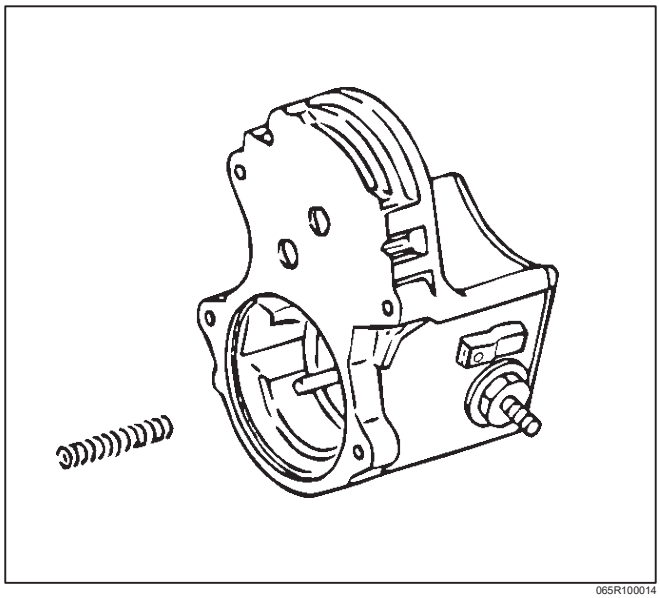
**Legend**
(1) Spring
(2) Brush

6. Remove the armature.
7. Remove the housing.
8. Remove the overrunning clutch from the housing.

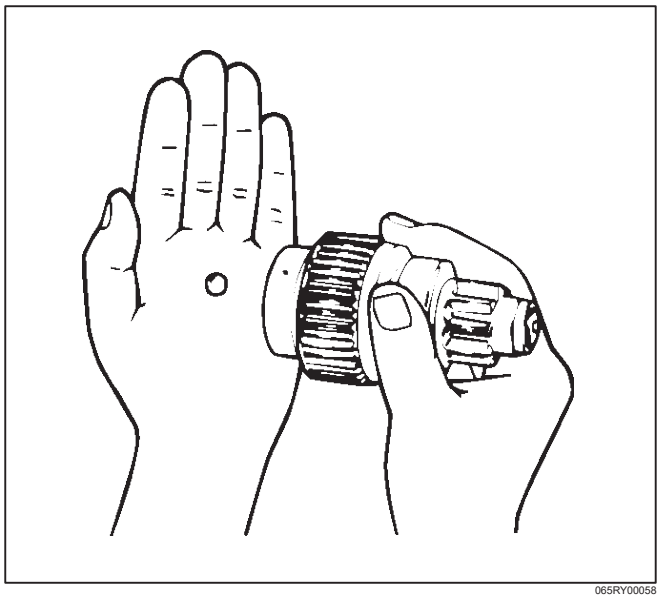


065RY00056

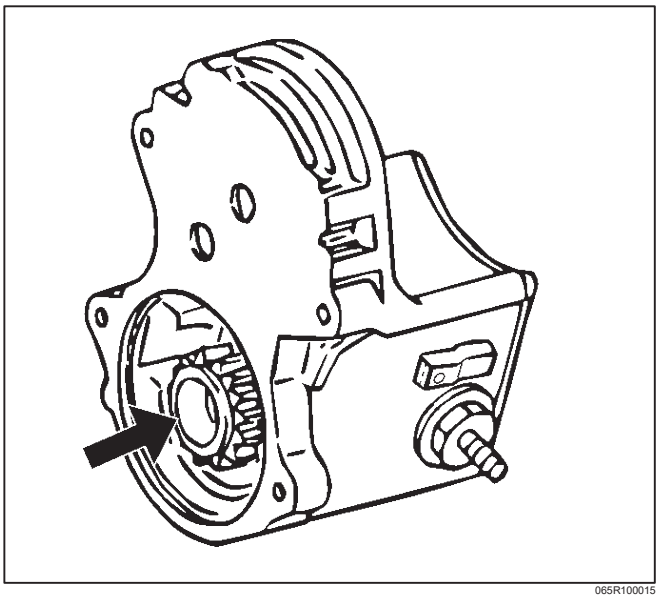
9. Remove the return spring from the magnetic switch.



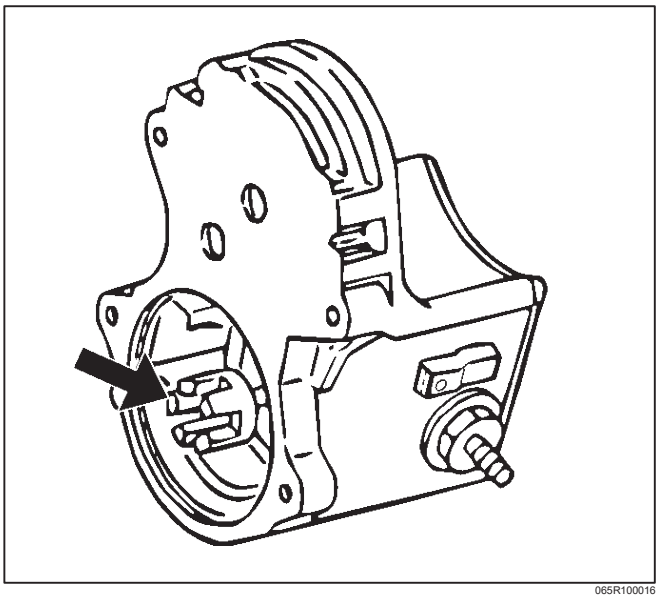

10. Remove the steel ball from the overrunning clutch.




11. Remove the idle pinion from the magnetic switch.




12. Remove the retainer from the magnetic switch.




13. Remove the magnetic switch.

## Inspection and Repair

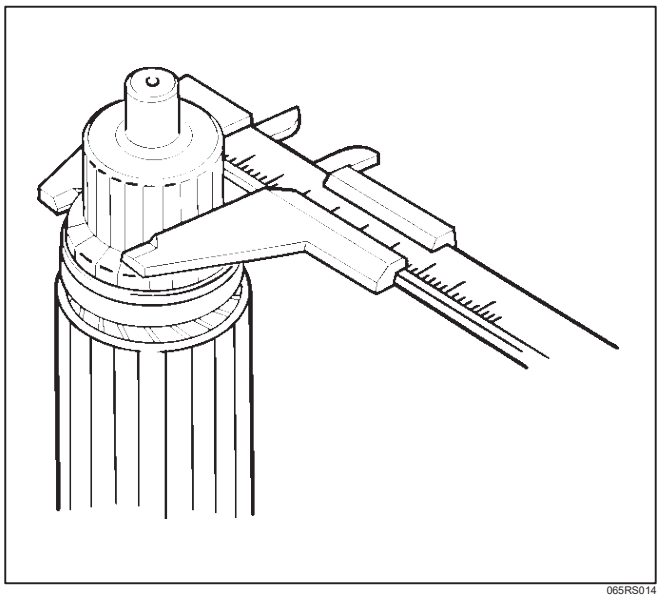
Repair or replace necessary parts if extreme wear or damage is found during inspection.

### Armature

Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

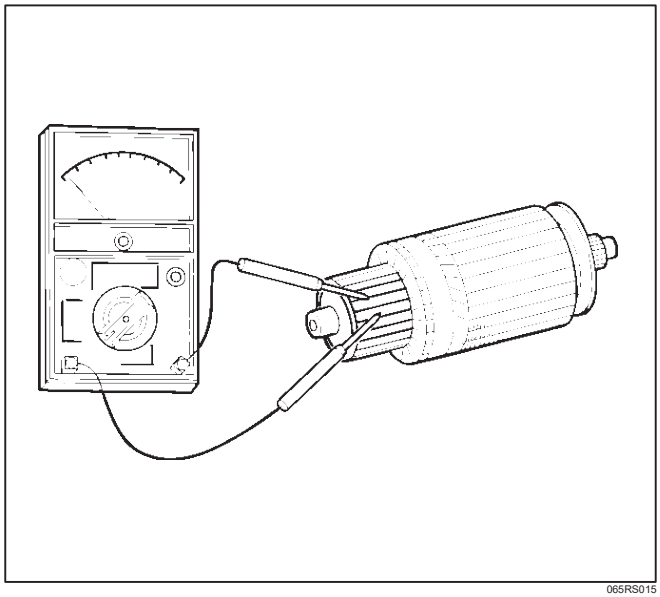
**Standard: 30 mm (1.1811 in)**

**Limit: 29 mm (1.1417 in)**



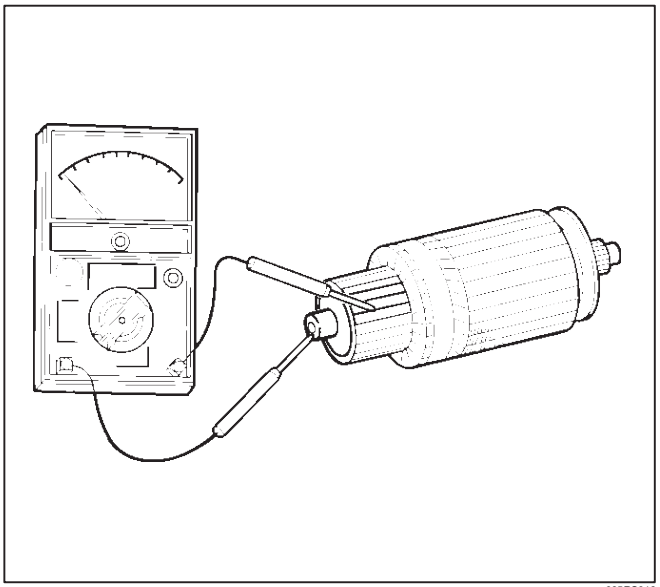
065RS014

Check for continuity between segment and segment on the commutator. Replace commutator if there is no continuity (i.e., disconnected).



065RS015

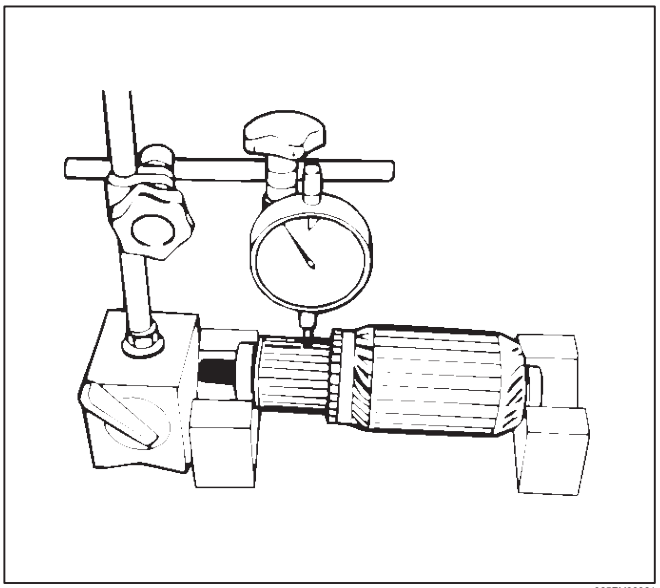
Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core, armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



065RS016

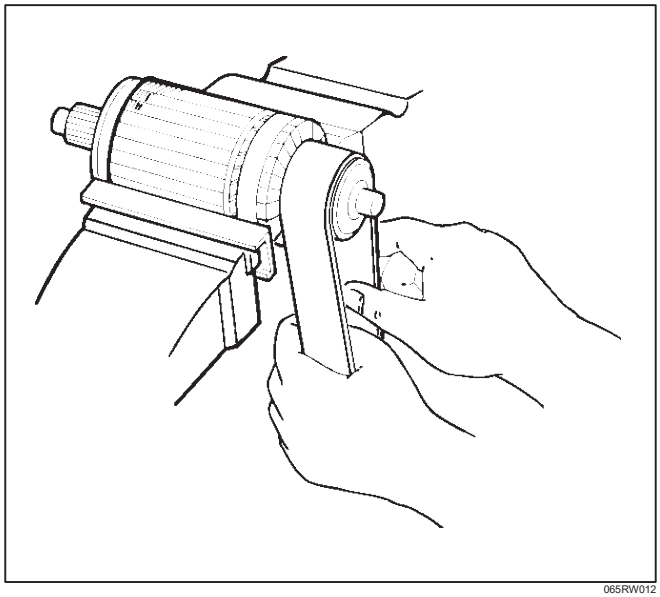
Measure runout of the commutator with a dial gauge. Repair or replace, if it exceeds the limit.

**Limit: 0.4 mm (0.0157 in)**



065RY00061

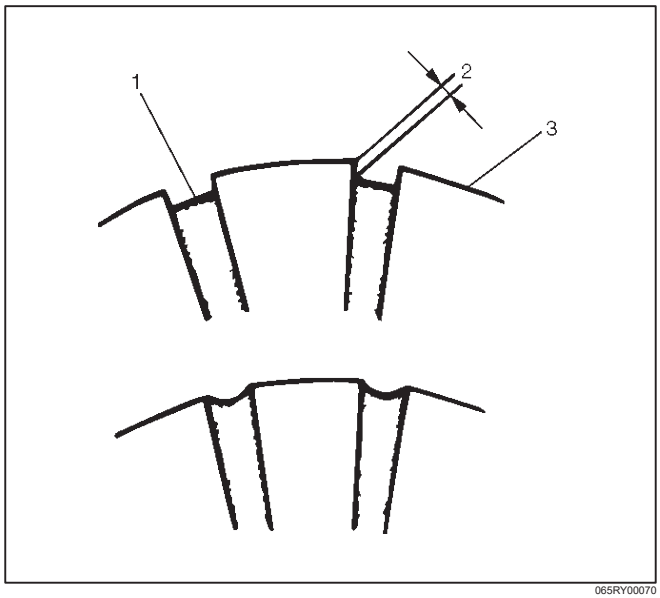
Polish the commutator surface with sandpaper #500 to #600 if it is rough.


065RW012

Measure the depth of insulator in commutator. Replace, if it is below the limit.

**Standard: 0.45 mm to 0.75 mm (0.0177 in to 0.0295 in)**

**Limit: 0.2 mm (0.008 in)**



065RY00070

**Legend**

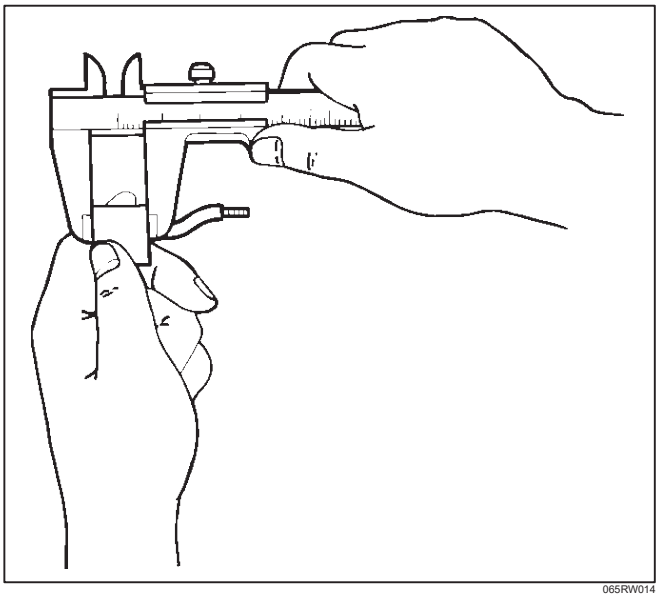
(1) Insulator
(2) Depth of Insulator
(3) Commutator Segments

## Brush

Measure the length of brush.
Replace with a new one, if it is below the limit.

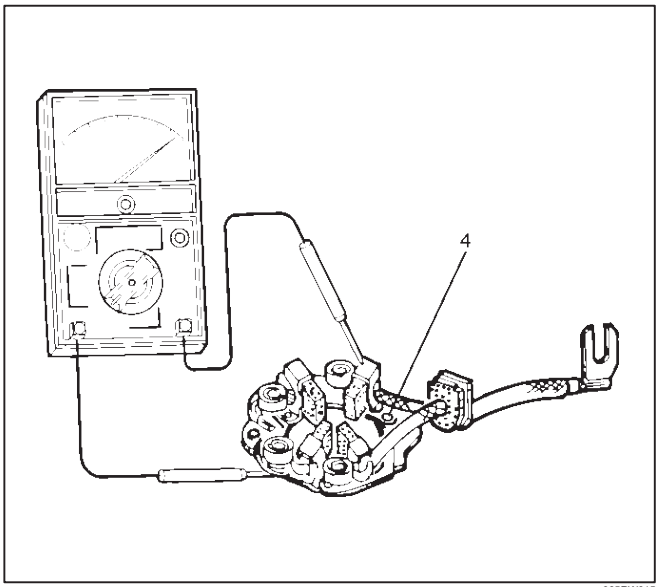
**Standard: 15 mm (0.5906 in)**

**Limit: 11 mm (0.43 in)**


065RW014

## Brush Holder

Check for continuity between brush holder (+) (4) and base (–). Replace, if there is continuity (i.e., insulation is broken).



065RW015

## Brush Spring

Use spring balancer to measure the spring setting force when remove the spring from the brush.

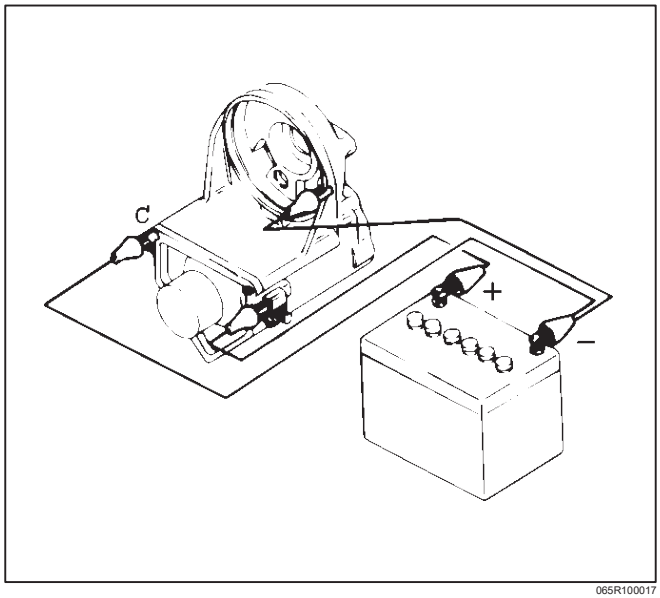
**Standard: 17.65–23.54 N (38.9–51.9 lb)**

**Limit: 11.77 N (25.9 lb)**

## Magnetic Switch

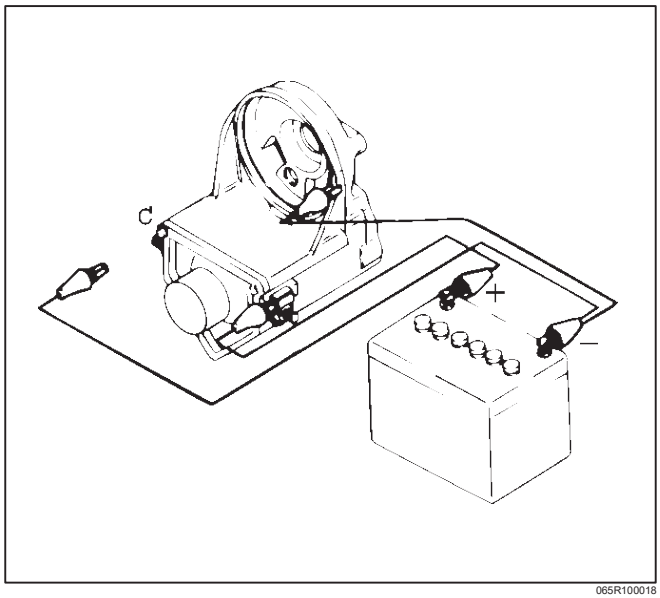
Temporarilly connect the magnetic switch between the overrunning clutch and housing.
Perform the steps described below in 3 to 5 seconds.

1. Pull in test
   Connect the ground (–) to terminal C and magnetic switch body.
   Verify that the pinion pulls out when the battery (+) pole is connected to terminal 50.



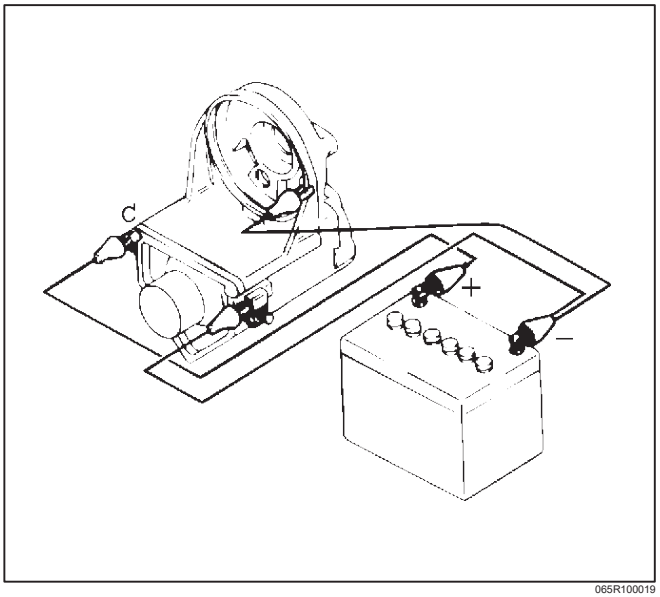
065R100017

2. Hold in test
   Observe that the pinion stays when the lead wire is disconnected from terminal C.



065R100018

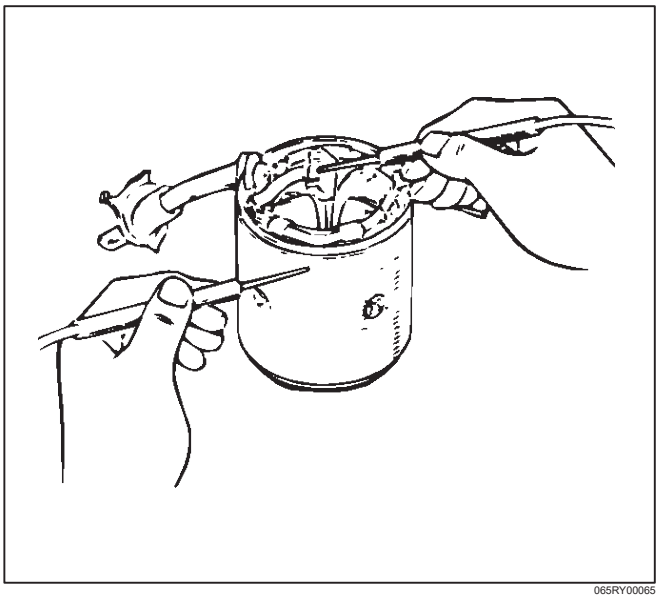
3. Return test
   Connect the ground (–) to terminal 50 and magnetic switch body.
   Verify that the pinion pulls out when the battery (+) pole is connected to terminal C and the pinion pulls away when the lead wire is disconnected from terminal 50.



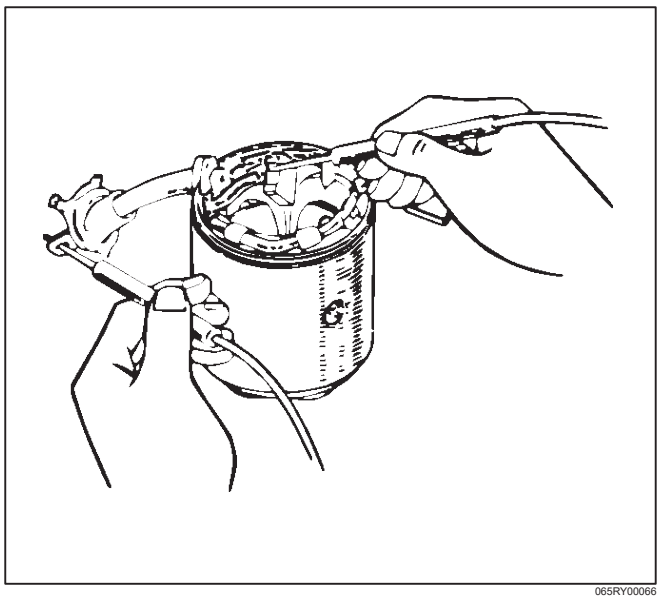
065R100019

## Field Coil

1. Check for continuity between the end of the field coil and yoke body.
   Replace the field coil, if there is continuity.


065RY00065

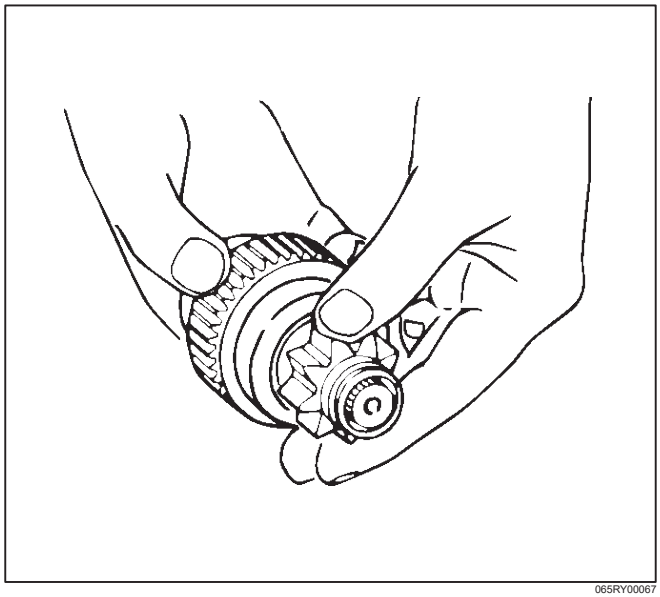
2. Check continuity between the lead wire of terminal C and brush.
   Replace the yoke assembly, if there is no continuity.




065RY00066

## Overrunning Clutch

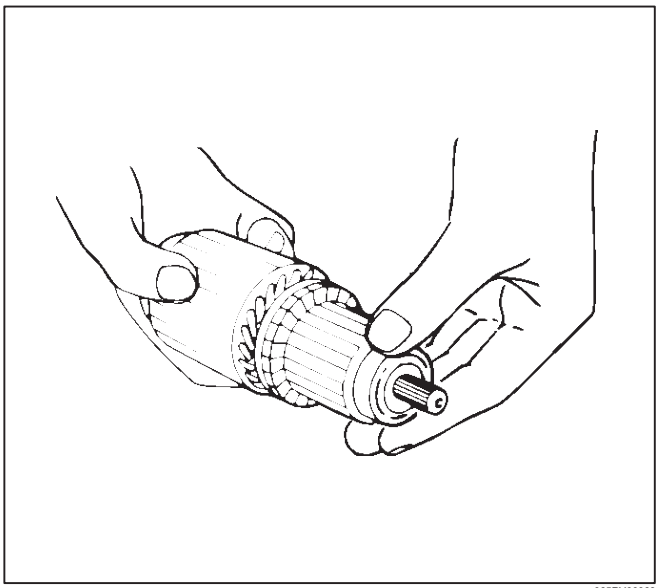
1. Visual check for excessive wear or damage.
2. Test the pinion rotation, it must rotate smoothly when rotated clockwise and it shouldn't rotate when turned counterclockwise.



065RY00067

## Bearing

1. Inspect excessive wear or damage.
   Replace the bearing if an abnormal noise is heard under normal operating condition.



065RY00068

# Reassembly

To install, follow the removal steps in the reverse order, noting the following points:

**Grease application places**

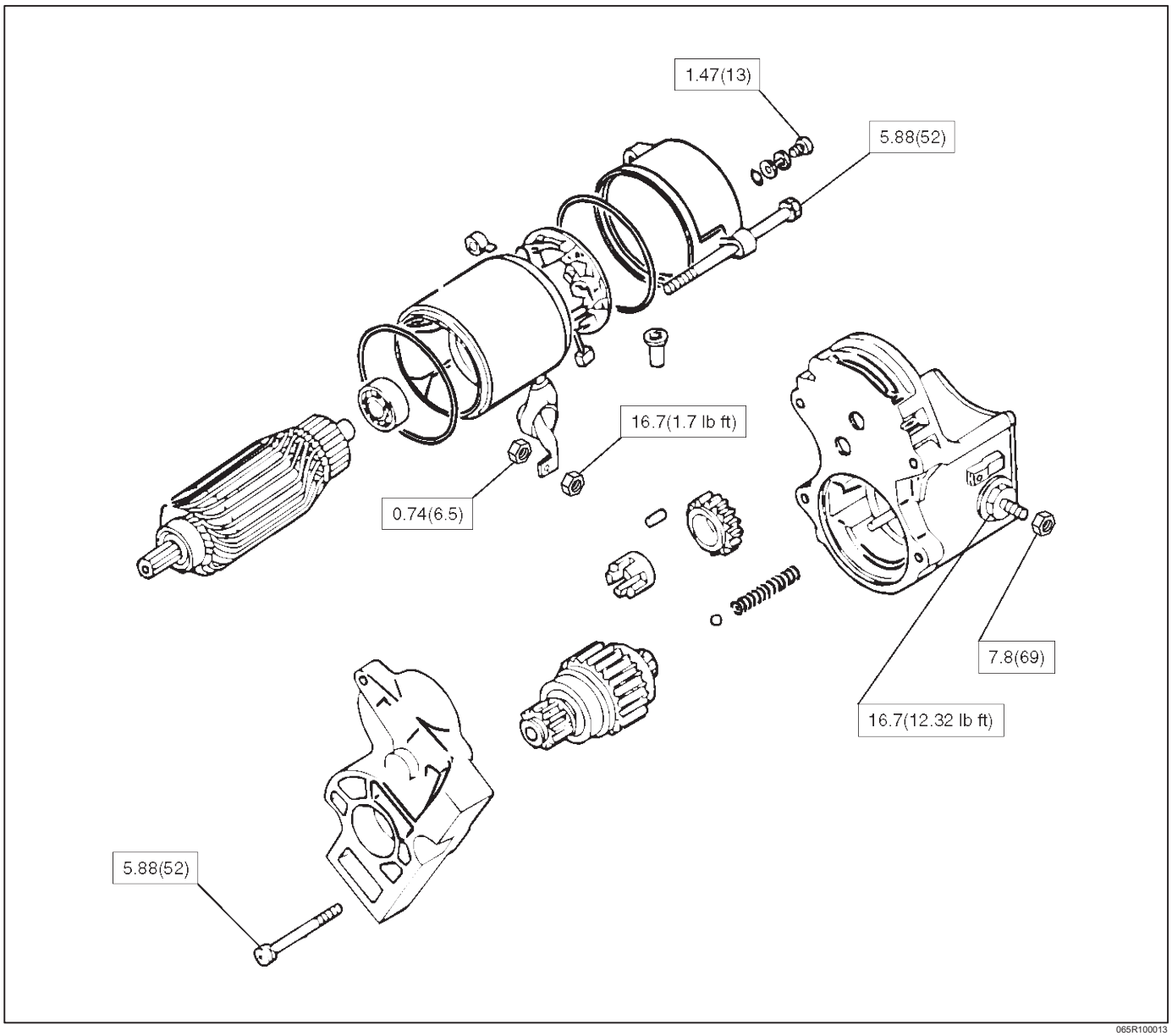
- Bearing in rear cover
- Gears in reduction gear
- Sliding portion of pinion

# Main Data and Specifications

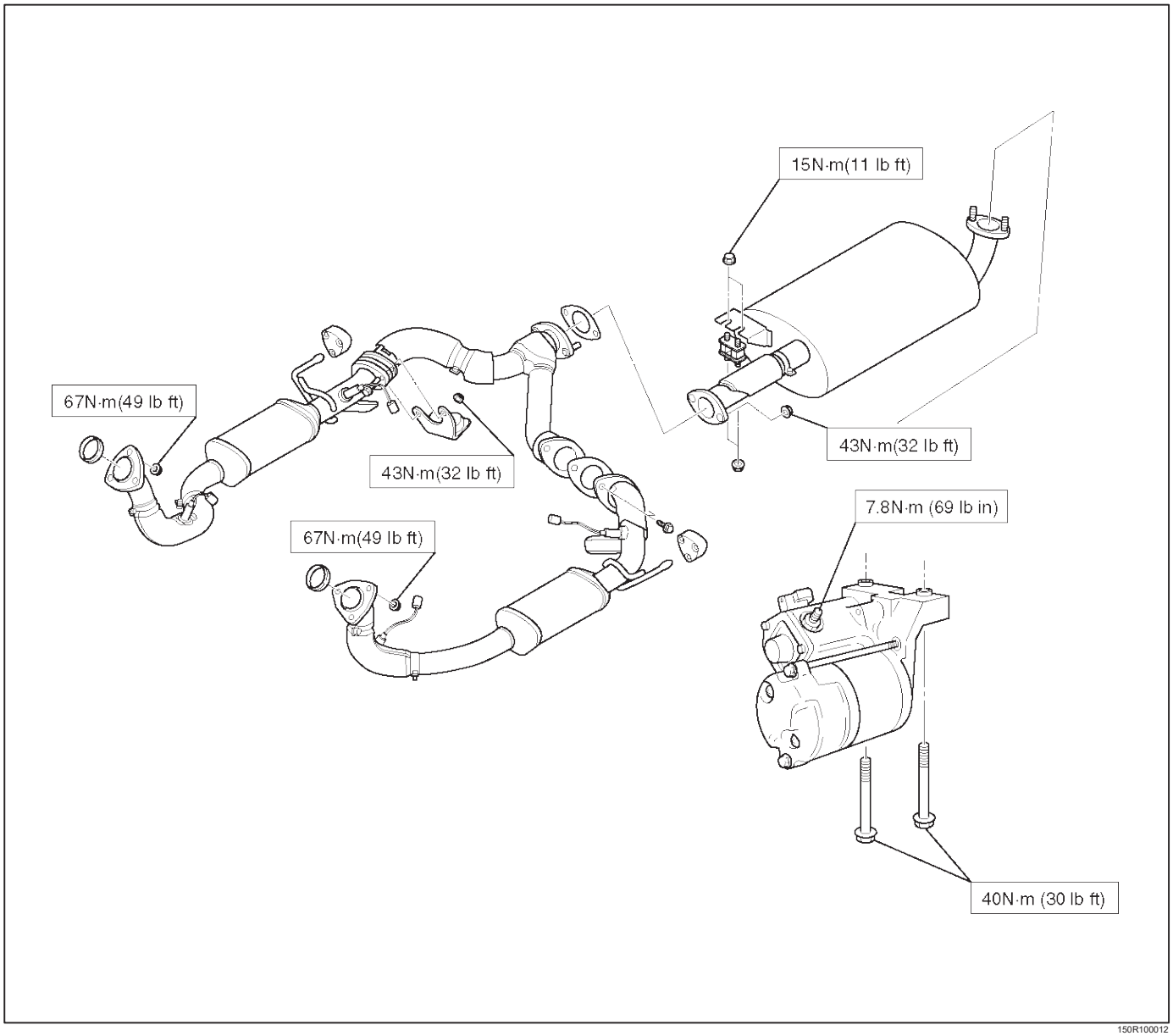
## General Specifications

| Model | Specification |
|---|---|
| Rating | |
| Voltage | 12 V |
| Output | 1.4 Kw |
| Time | 30 sec |
| Number of teeth of pinion | 9 |
| Rotating direction(as viewed from pinion) | Clockwise |
| Weight(approx.) | 37 N |
| No–load characteristics | |
| Condition: Voltage | 11.5V |
| Current | 90A or less |
| Speed | 3000rpm or more |
| Load characteristics | |
| Condition: Voltage/Torque | 8.5V/13.2 N·m (113 lb in) |
| Current | Maximum 350A |
| Speed | 1000rpm or more |
| Locking characteristics | |
| Condition: Voltage | 2.4V |
| Current | Maximum 500A |
| Torque | 11.8N·m or more |

## Torque Specifications




065R100013

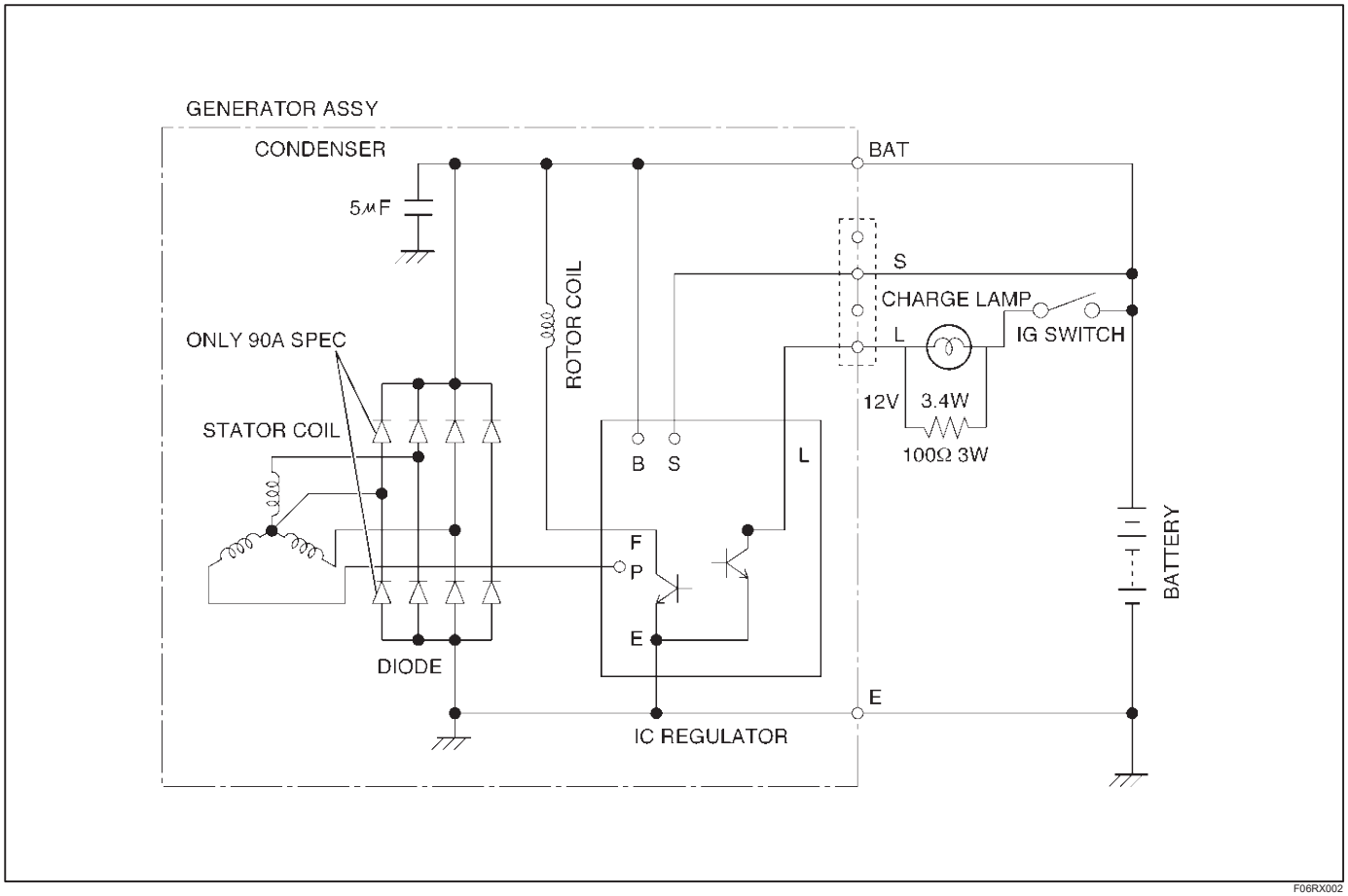

15N·m(11 lb ft)
67N·m(49 lb ft)
43N·m(32 lb ft)
43N·m(32 lb ft)
67N·m(49 lb ft)
7.8N·m (69 lb in)
40N·m (30 lb ft)
150R100012

# Charging System

## General Description

The IC integral regulator charging system and its main components are connected as shown in illustration.
The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.
The generator does not require particular maintenance such as voltage adjustment.

The rectifier connected to the stator coil has diodes to transform AC voltage into DC voltage.
This DC voltage is connected to the output terminal of generator.




F06RX002

## General On–Vehicle Inspection

A basic wiring diagram is shown in the illustration. When operating normally, the indicator bulb will come on when the switch is turned on, and will then go out when the engine starts. If the indicator operates abnormally, or if an undercharged or overcharged battery condition occurs, the following procedure may be used to diagnose the charging system. Remember that an undercharged battery is often caused by accessories being left on overnight, or by a defective switch which allows a bulb, such as a trunk or glove box light, to stay on.

### Observe the following procedure:

1. Visually check belt and wiring.
2. Go to step 5. for vehicles without charge indicator light.
3. Switch on, engine stopped, light should be on. If not, detach harness at generator, ground “L” terminal lead.
   a. Lamp lights, replace or repair generator.
   b. Lamp dose not light, locate open circuit between grounding lead and ignition switch. Bulb may be open.
4. Switch on, engine running at moderate speed. Light should be off. If not, detach wiring harness at generator.
   a. If light goes off, replace or repair generator.
   b. If light stays on, check for grounded “L” terminal wire in harness.
5. Battery undercharged or overcharged.
   a. Detach wiring harness connector from generator.
   b. With switch on, engine not running connect voltmeter from ground to “L” terminal in wiring harness, and to “IG” terminal. If used. Wiring harness may connect to either “L” or “IG” or both.
   c. Zero reading indicates open circuit between terminal and battery. Connect as required.

d. Re-connect harness connector to generator, run engine at moderate speed, with electrical accessories turned off.

e. Measure voltage across battery. If above 16.0V, replace or repair generator.

f. Connect ammeter at generator output terminal. Turn on accessories, load battery with carbon pile to obtain maximum amperes output.

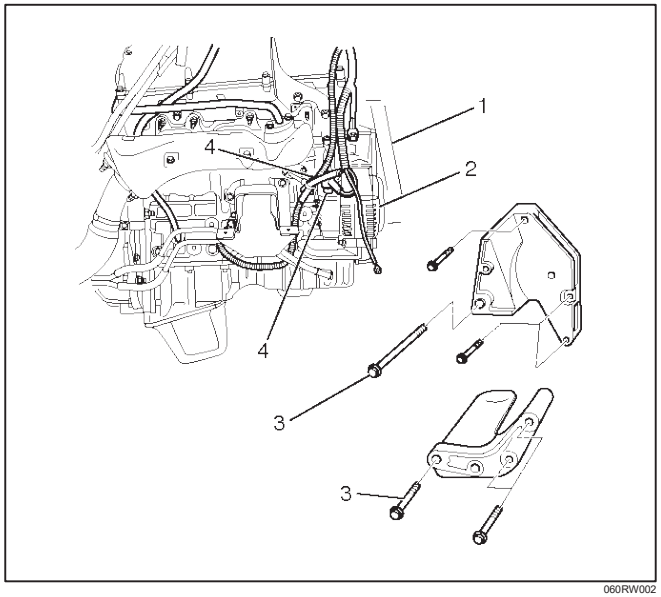
Maintain voltage at 13.0V or above.

1. If within 15 amperes of rated output, generator is OK.
2. If not within 15 amperes of rated output, replace or repair generator.

# Generator

## Removal

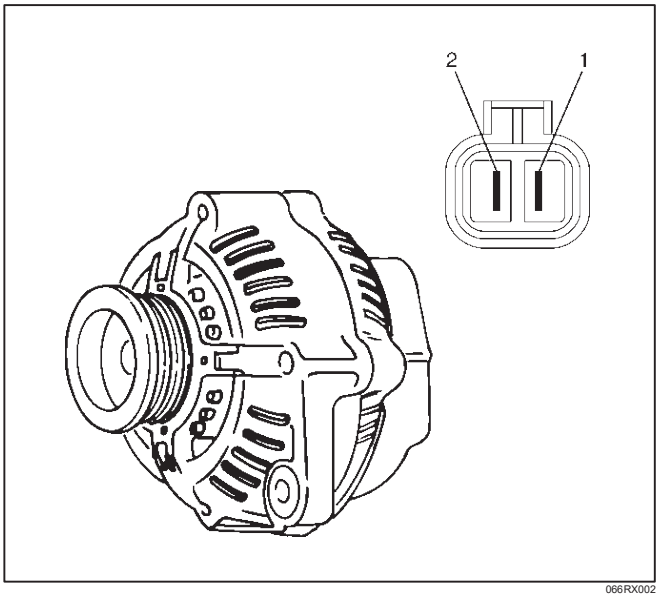
1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt (1).
3. Disconnect the wire from terminal “B” and disconnect the connector (4).
4. Remove generator fixing bolt (3).
5. Remove generator assembly (2).



060RW002

## Inspection

1. Disconnect the wiring connector from generator.
2. With the engine stopped, turn starter switch to “on” and connect a voltmeter between connector terminal L (1) and ground or between terminal S (2) and ground.



066RX002

If there is no voltage present, then perform appropriate repair.

3. Reconnect the wiring connector to the generator, run the engine at must indicate idle speed, and turn off all electrical devices other than engine.
4. Measure battery voltage. If it exceeds 16V, repair or replace the generator.
5. Connect an ammeter to output terminal of generator, and measure output current under load by turning on the other electrical devices (eg., headlights). At this time the amperes must not be less than 15A and the voltage must not be less than 13V.

## Installation

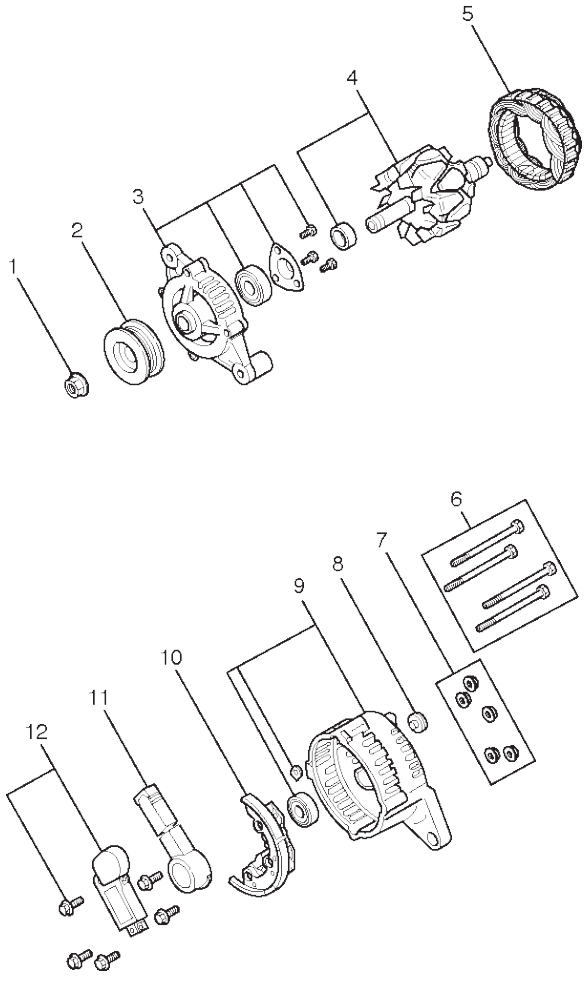
1. Install generator assembly to the position.
2. Install generator assembly and tighten the fixing bolts to the specified torque.

   **Torque:**

   **M10 bolt: 41 N·m (30 lb ft)**

   **M8 bolt: 21 N·m (15 lb ft)**
3. Connect wiring harness connector and direct terminal "B".
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

## Disassembled View




066RW022

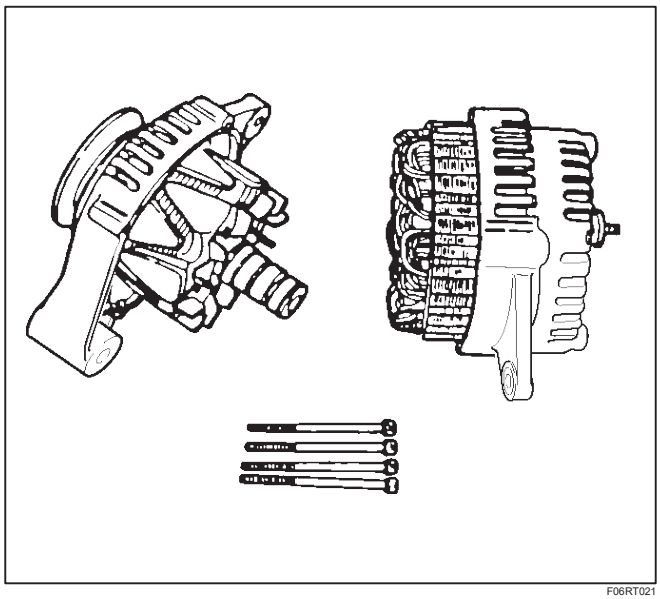
**Legend**

(1) Pulley Nut
(2) Pulley
(3) Front Cover Assembly
(4) Rotor Assembly
(5) Stator Assembly
(6) Through Bolt
(7) Nut
(8) Terminal Insulator
(9) Rear Cover Assembly
(10) Rectifier
(11) Brush Holder Assembly
(12) Regulator Assembly

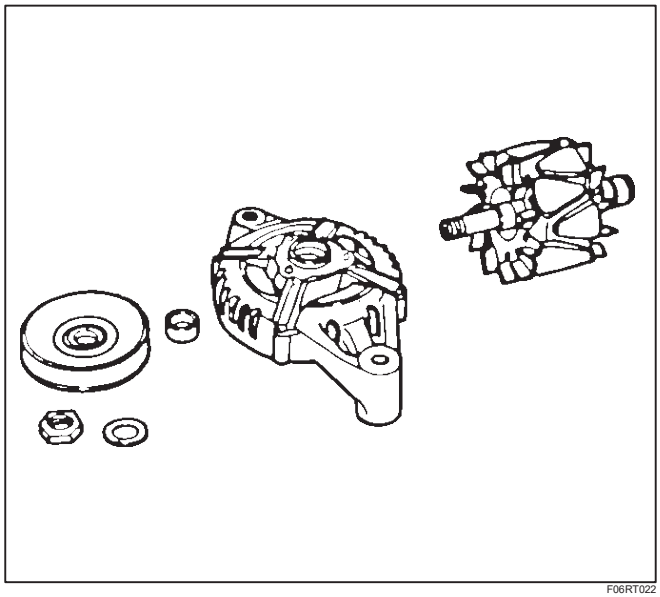
## Disassembly

1. Remove the through bolt.
   Insert the tip of a pry bar into the gaps between the front cover and the stator core.
   Pry apart and separate the front cover, rotor, the rear cover and stator.

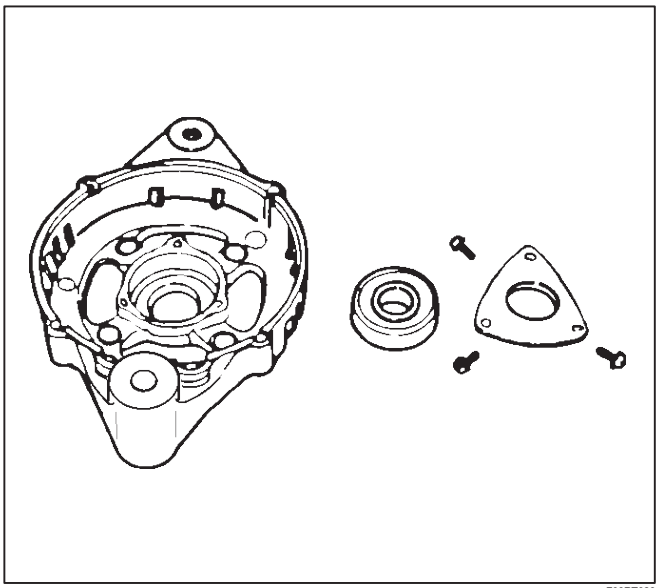
NOTE: Take care not to scratch or otherwise damage the stator coil with pry bar.


F06RT021

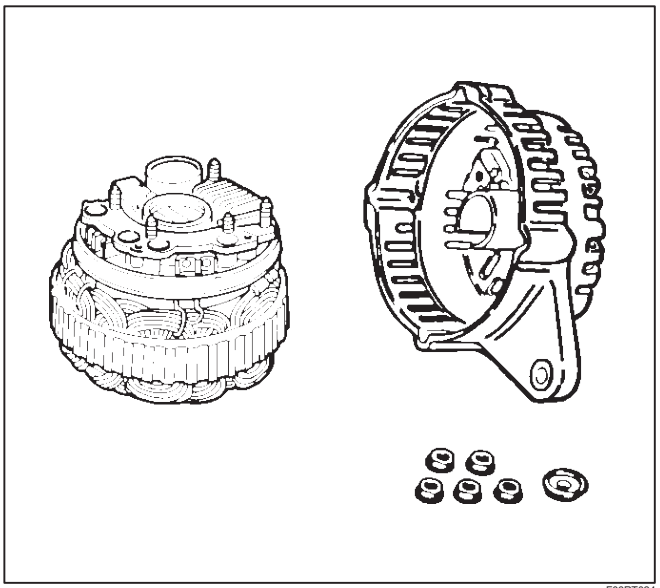
2. Clamp the rotor in a vise and then remove the nut and pulley.
3. Remove the rotor assembly from the front cover.


F06RT022

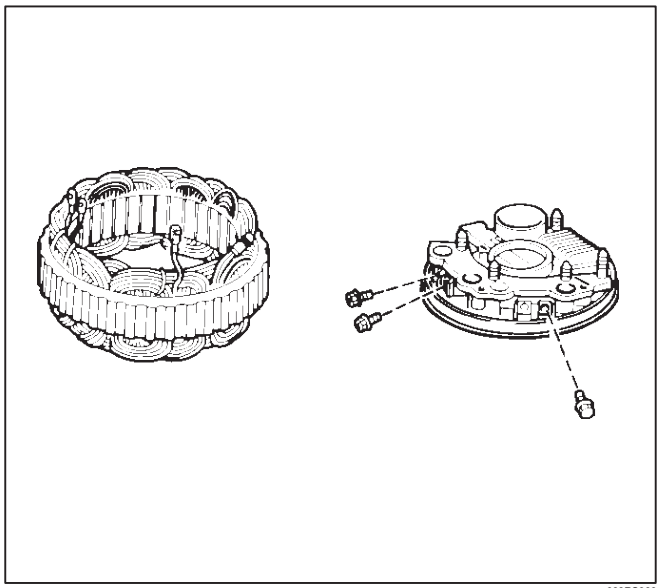
4. Remove the screws with bearing retainer from front cover and remove bearing.


F06RT023

5. Remove the mounting nuts holding the “B” terminal, the diode, and the brush holder.
6. Separate the rear cover from the stator.


F06RT024

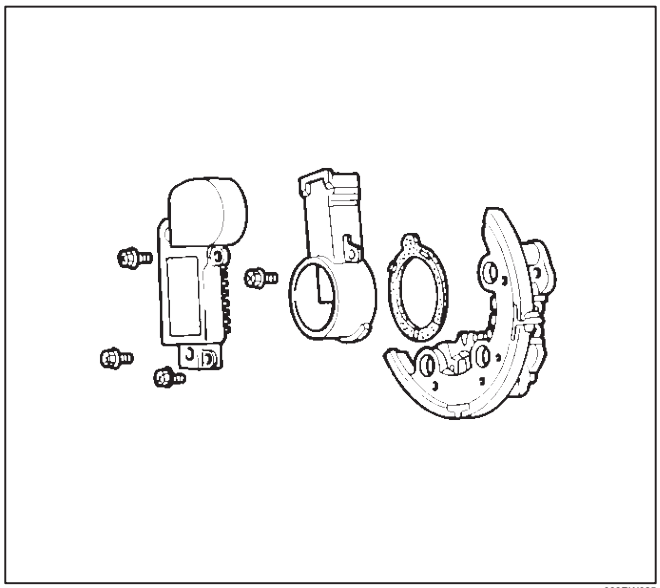
7. Remove bolts which secure stator terminal to rectifier terminal, and remove stator.



066RS030

8. Remove Bolts which secure regulator, rectifier and brush-holder, and separate these parts.

NOTE: Do not apply a shock or load to regulator, rectifier and brush holder.



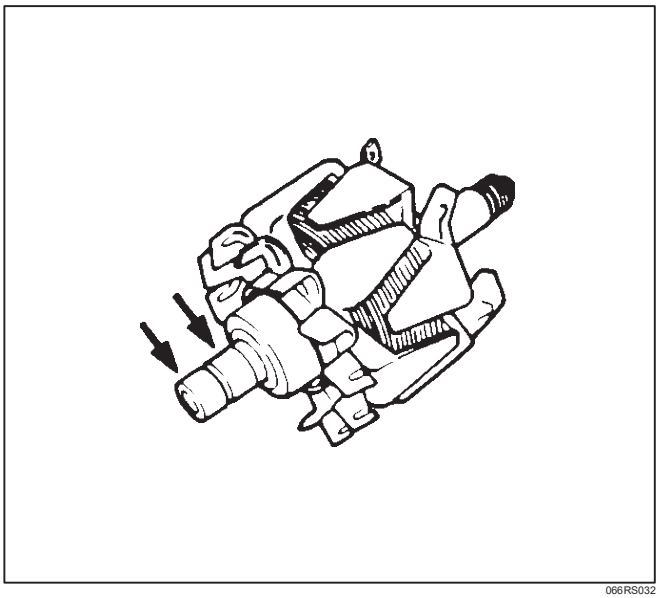
066RW025

## Inspection and Repair

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

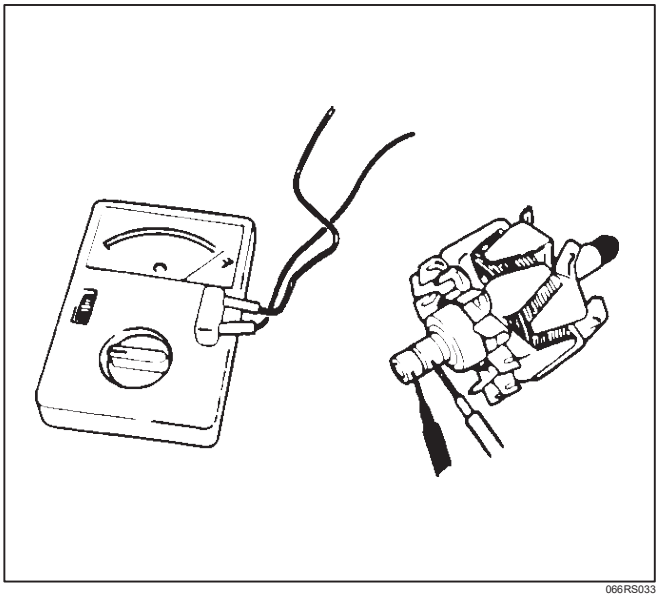
### Rotor Assembly

1. Check the face of the slip rings for contamination and roughness. If found to be scored, dress with a fine sandpaper (#500 –600). If found to be contaminated, clean with a cloth saturated with alcohol.
2. Measure the outside diameter of the slip rings.
   **Standard: 27mm (1.06in)**
   **Limit: 26mm (1.02in)**



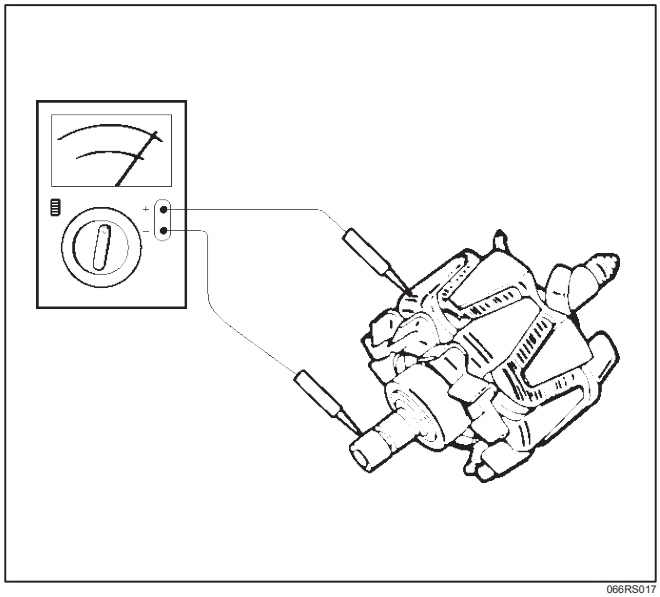
066RS032

3. Check resistance between slip rings, and replace if there is no continuity.
   **Standard: 3.75Ω or less**



066RS033

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

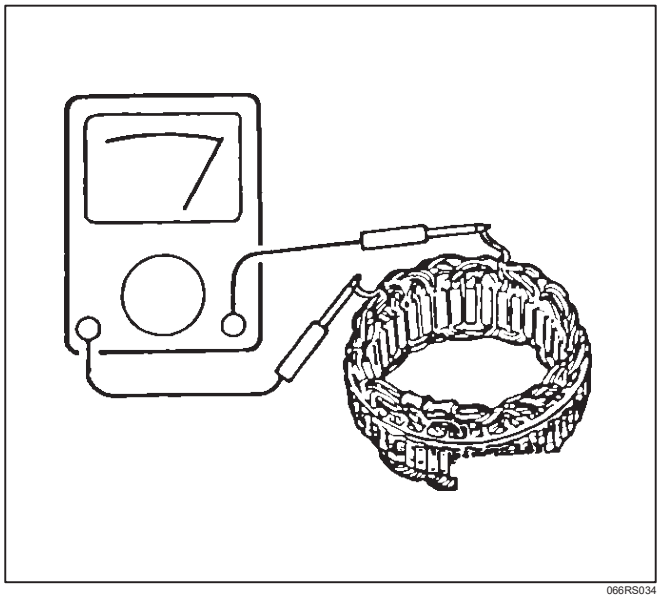


066RS017

## Stator Coil

1. Check for continuity across the stator coils. If no continuity exists, replace the coils.
   Resistance value at 20°C.

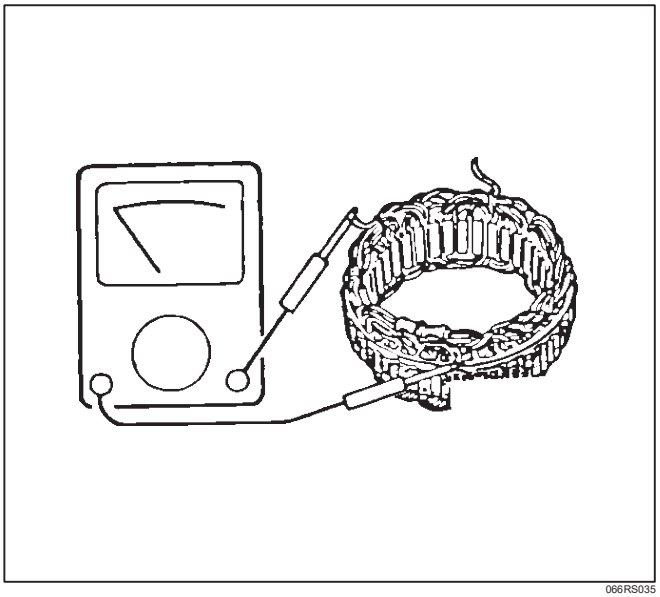
   **Standard: Approx. 0.07Ω**



066RS034

2. Check for continuity across one of the stator coils and stator core. If a continuity exists, replace the coil.

   **Standard: More than 1MΩ**



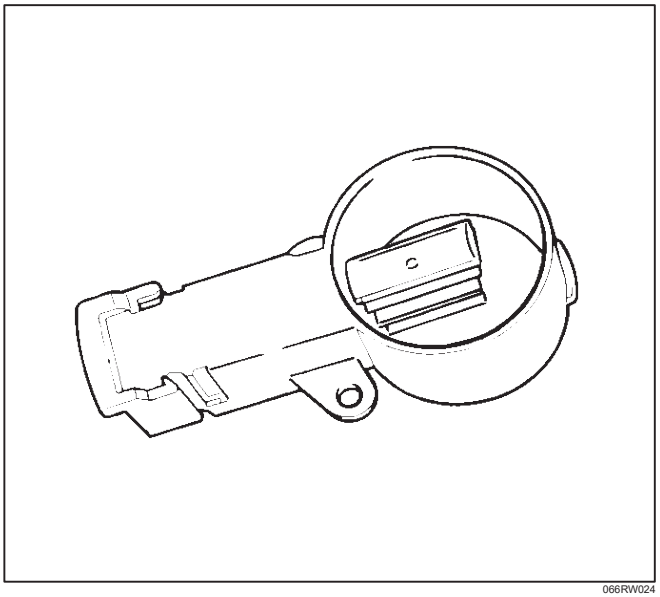
066RS035

## Brush

Measure the brush length.
Replace the brush if it exceeds the limit.

**Standard: 18.0mm (0.709in)**

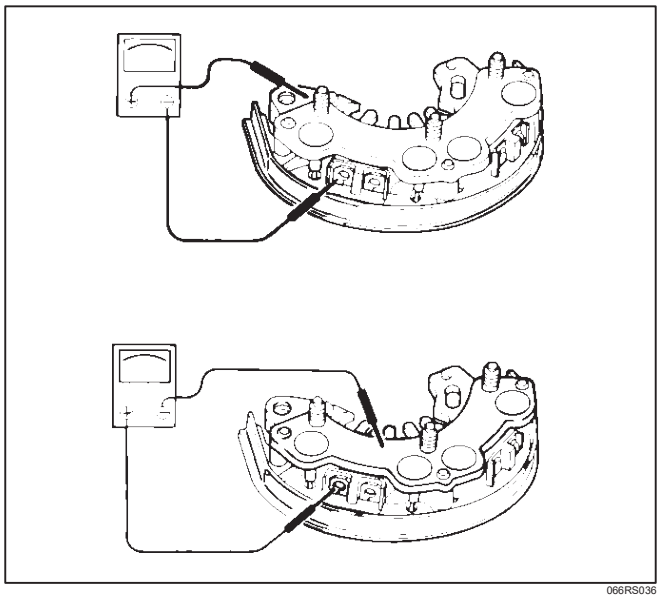
**Limit: 5.5mm (0.217in)**



066RW024

## Rectifier Assembly

1. Measure the resistance between each diode terminal and aluminum diode fin in forward and reverse directions with the connection of the tester leads switched. The diodes are normal if resistance is nearly zero ohms in one direction and is infinitely high in the other direction.
2. If a diode has no resistance or equal resistance in both directions, it is defective and should be replaced together with the holder.




## IC Regulator Assembly

Connect a variable resistor, two 12V batteries, a fixed resistor, and a voltmeter to the IC regulator as shown in illustration.

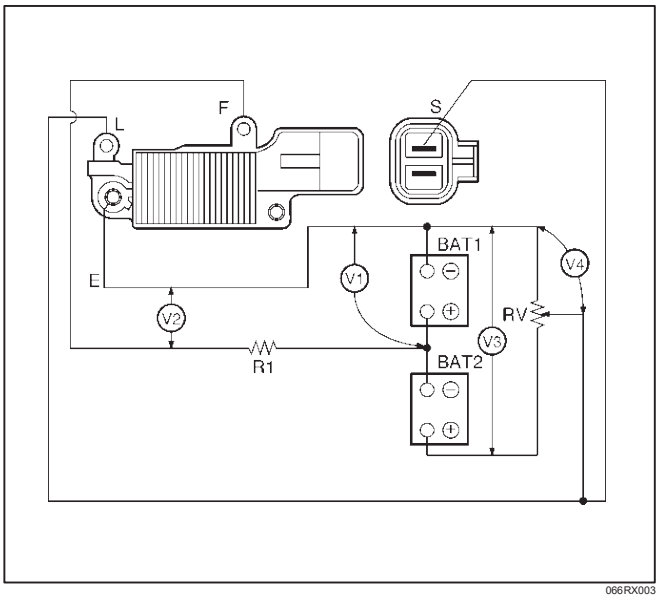
a. Measuring equipment specifications

1. Fixed resistor (R1) : 10 Ohms /3W
2. Variable resistor (Rv) : 0-300 Ohms/12W
3. Batteries (BAT1, BAT2) : 12V (2 Batteries)
4. DC voltmeter : 0-50V/0.5 steps (4 Check points)

b. Measuring procedure

1. Measure the voltage “V1” across the first battery (BAT1). If the reading is between 10 and 13 volts, the battery is normal.
2. Measure the voltage “V3” across both the batteries (BAT1, BAT2). If the reading is between 20 and 26 bolts, the batteries are normal.
3. Gradually increase the resistance of the variable resistor from zero. Measure the voltage “V2” (the voltage across the F and E terminals).

   Check to see that the voltage across “V1” changes at this time. If there is no change, the voltage regulator is faulty and must be replaced.
4. Measure the voltage at “V4” (the voltage across the variable resistor center tap and terminal E with the variable resistor resistance held constant). The measured voltage should be within the specified (14.4±0.3 volts) limits. If it is not, the regulator must be replaced.



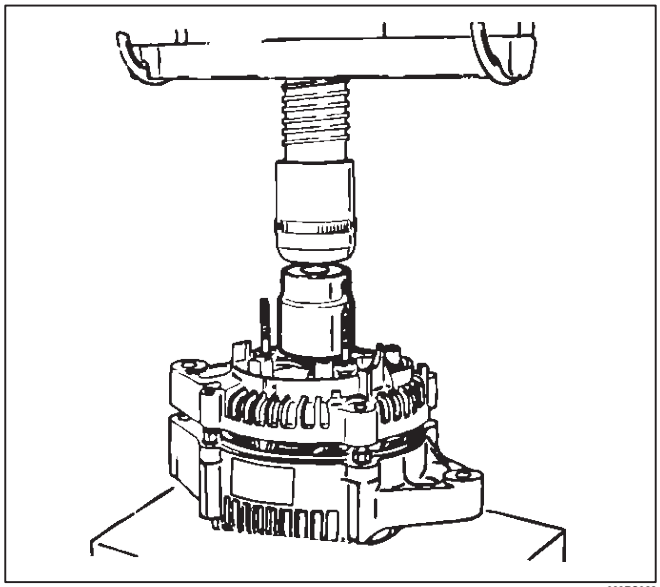

## Reassembly

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

NOTE:

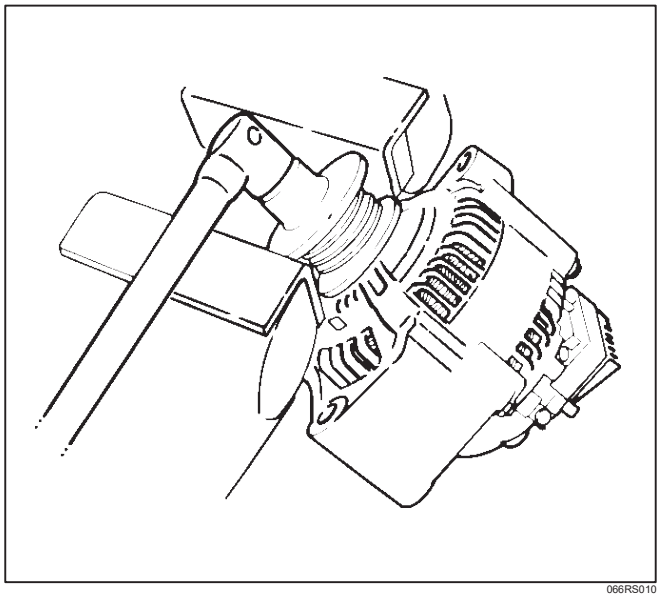
- Never make battery connections with polarities reversed, or battery will be shorted via the diodes. This will cause damage to the diodes.
- Do not connect generator B terminal to ground; it is connected directly to the battery. This cable will burn if it is connected to ground.
- Make sure to disconnect the positive (+) terminal of the battery when quick-charging battery . Diodes may be damaged due to abnormal pulse voltage generated by the quick charger.
- When reassembling the front section to rear section, insert a stiff wire into hole in the rear face of the rear cover from the outboard side to support the brush in raised position, then insert the front section to which rotor is assembled.
- Reassemble parts carefully to be sure they fit into their original position, paying attention to the insulated portions.
- Wipe insulating tubes, washers and plates clean and install them in position carefully to avoid getting oil or grease on them.

1. Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.


066RS022

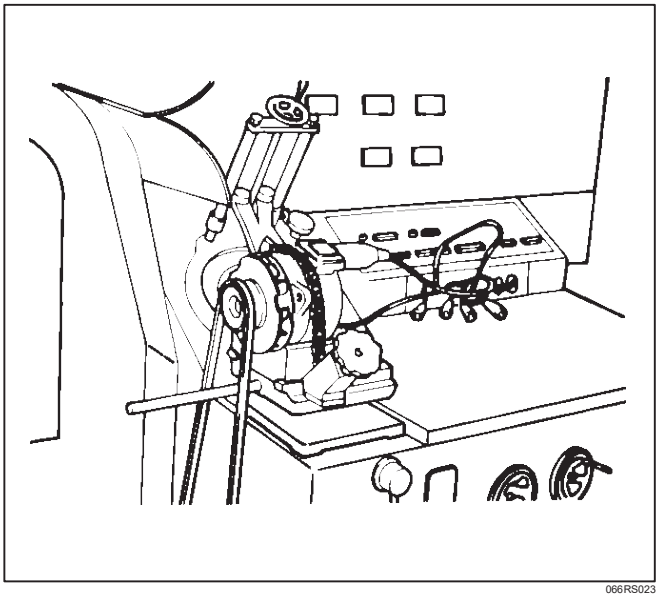
2. Install pulley on the rotor.
   Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

   **Torque: 111 N·m (82 lb ft)**


066RS010

## Bench Test

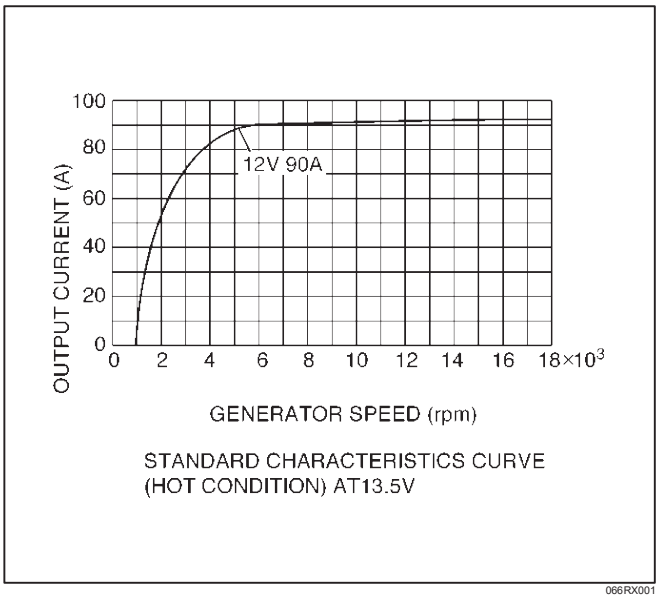
Conduct a bench test of the generator.


066RS023

### Preparation

Remove generator from the vehicle (see “Generator removal”).

1. Secure generator to the bench test equipment and connect wires.
   Terminal “IG” for energization
   Terminal “L” for neutral (warning lamp)
   Terminal “B” for output
2. Conduct the generator characteristic test.
   Characteristics of generator are shown in illustration.
   Repair or replace the generator if its outputs are abnormal.



066RX001

# Main Data and Specifications

## General Specifications

| | | |
|---|---|---|
| Battery voltage | V | 12 |
| Rated output | A | 90 |
| Direction of rotation (as viewed from pulley side) | | Clockwise |
| Rated rotation speed | rpm | 5000 |
| Maximum speed | rpm | 18000 |

AXIOM

# ENGINE

## 6VE1 3.5L ENGINE DRIVEABILITY AND EMISSIONS

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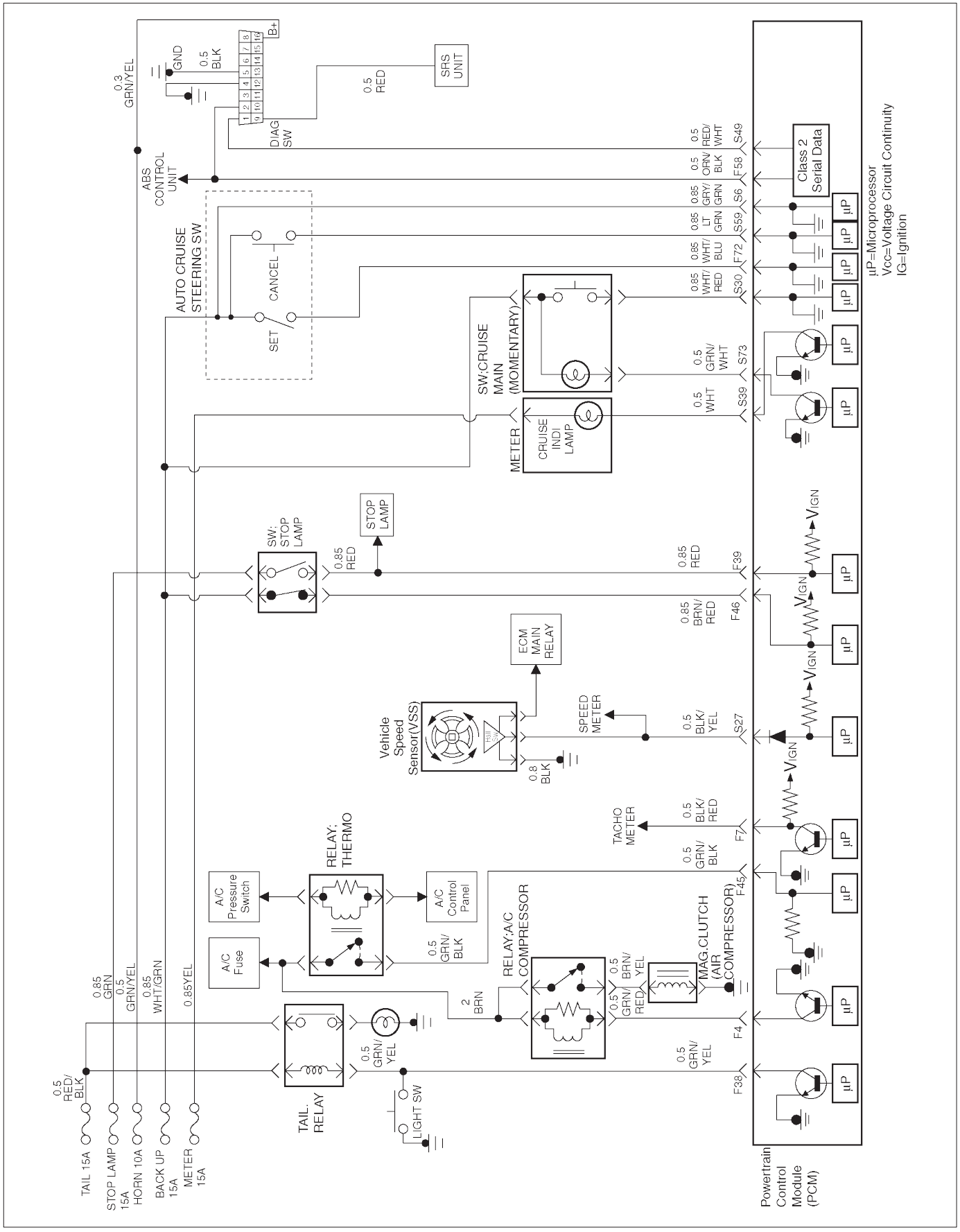
# Specifications

## Tightening Specifications

| Application | N·m | Lb Ft. | Lb In. |
|---|---|---|---|
| EGR Bolt | 25 | 18 | — |
| Engine Coolant Temperature Sensor | 30 | 22 | — |
| Fuel Drain Plug | 20 | 14 | — |
| Fuel Pressure Regulator Attaching Screw | 3 | — | 26 |
| Fuel Rail Bolts | 25 | 18 | — |
| Fuel Tank Undercover Retaining Bolts | 36 | 27 | — |
| Heated Oxygen Sensor | 55 | 40 | — |
| Lower Intake Manifold to Engine Block Bolts | 25 | 18 | — |
| Lower Intake Manifold to Engine Block Nuts | 25 | 18 | — |
| Spark Plugs | 18 | 13 | — |
| Throttle Body Mounting Bolts | 10 | — | 87 |
| Common Chamber to Lower Intake Manifold Bolts | 25 | 18 | — |
| VSS Retaining Bolt | 16 | 12 | — |

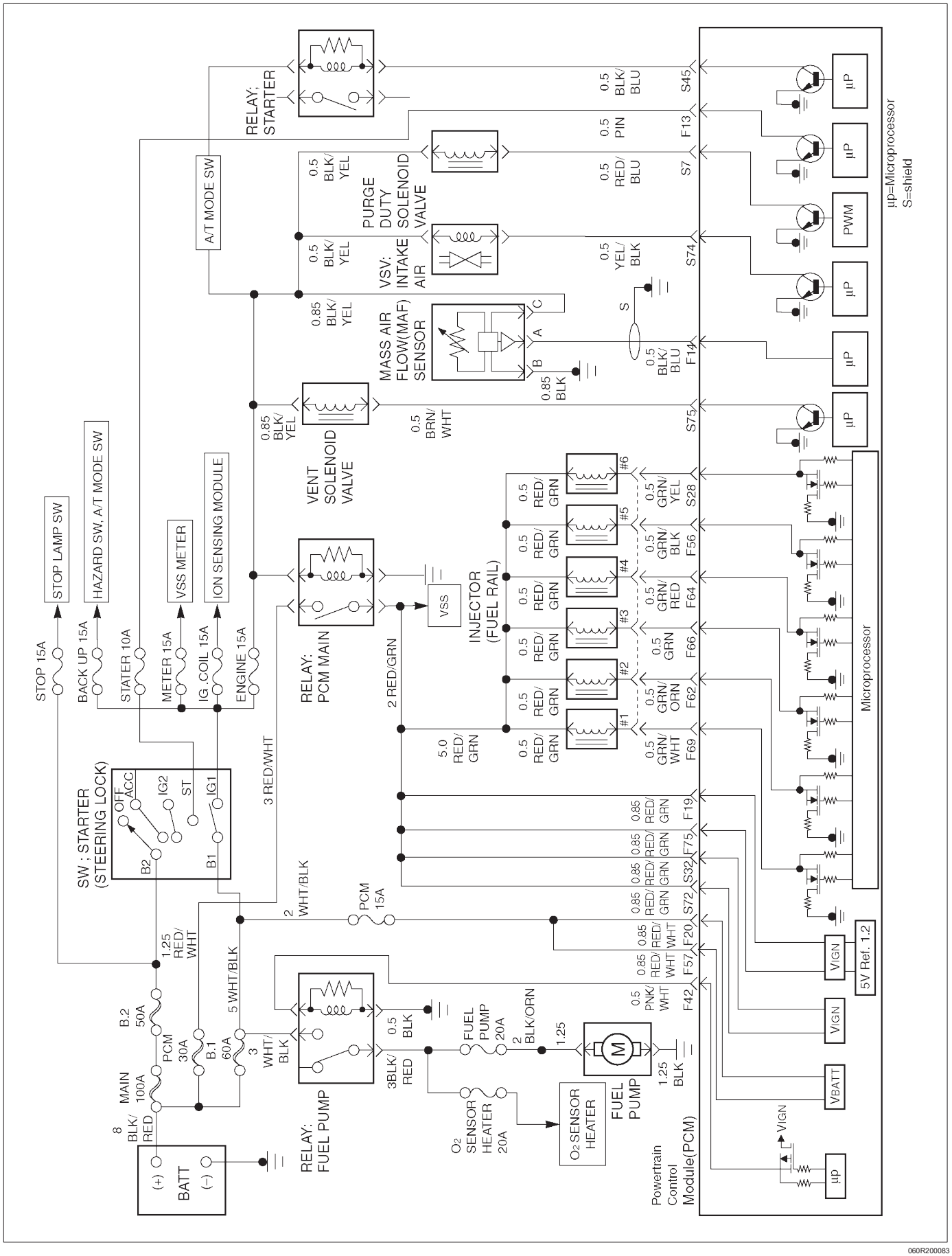
# Diagrams and Schematics

## PCM Wiring Diagram (1 of 7)



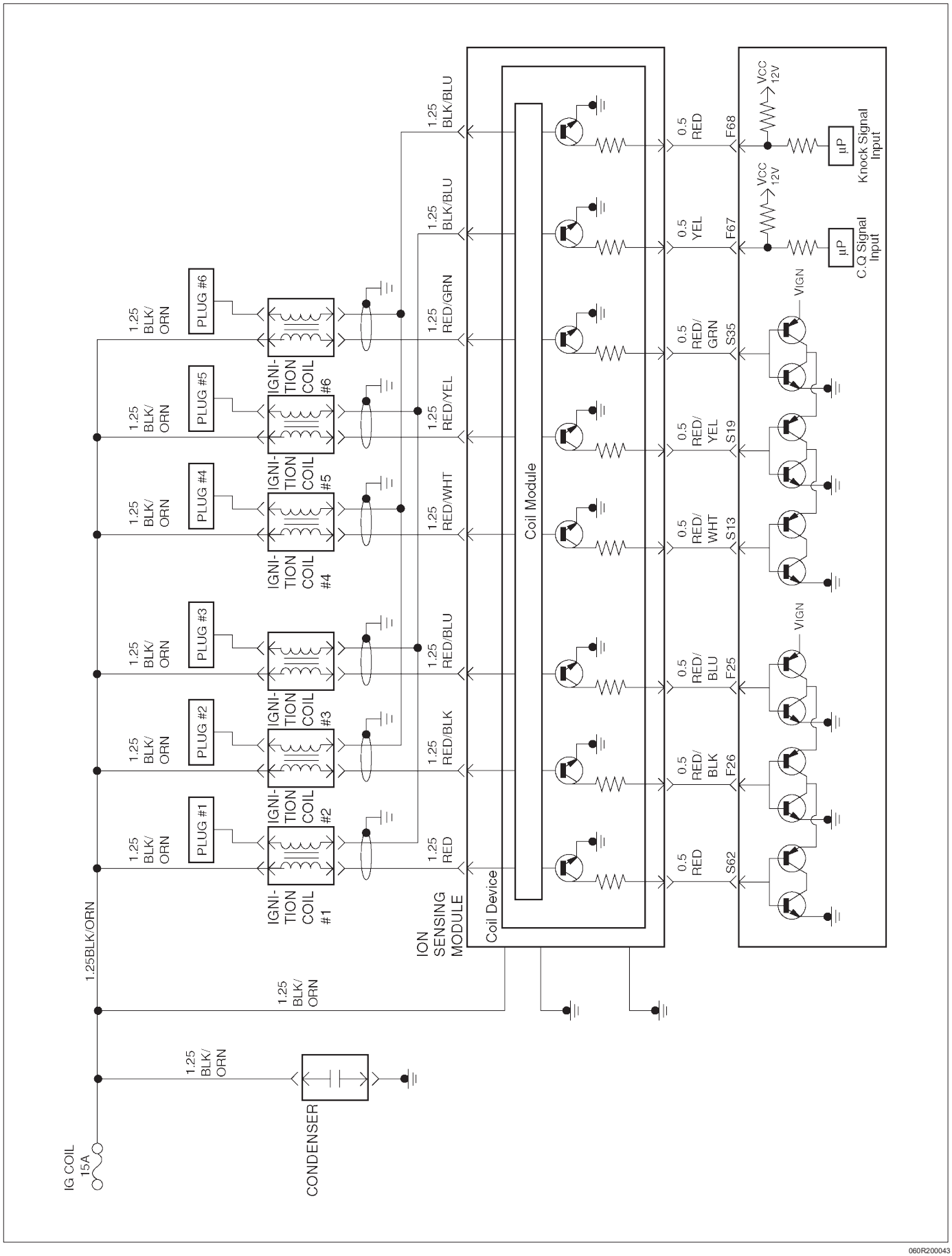

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## PCM Wiring Diagram (2 of 7)



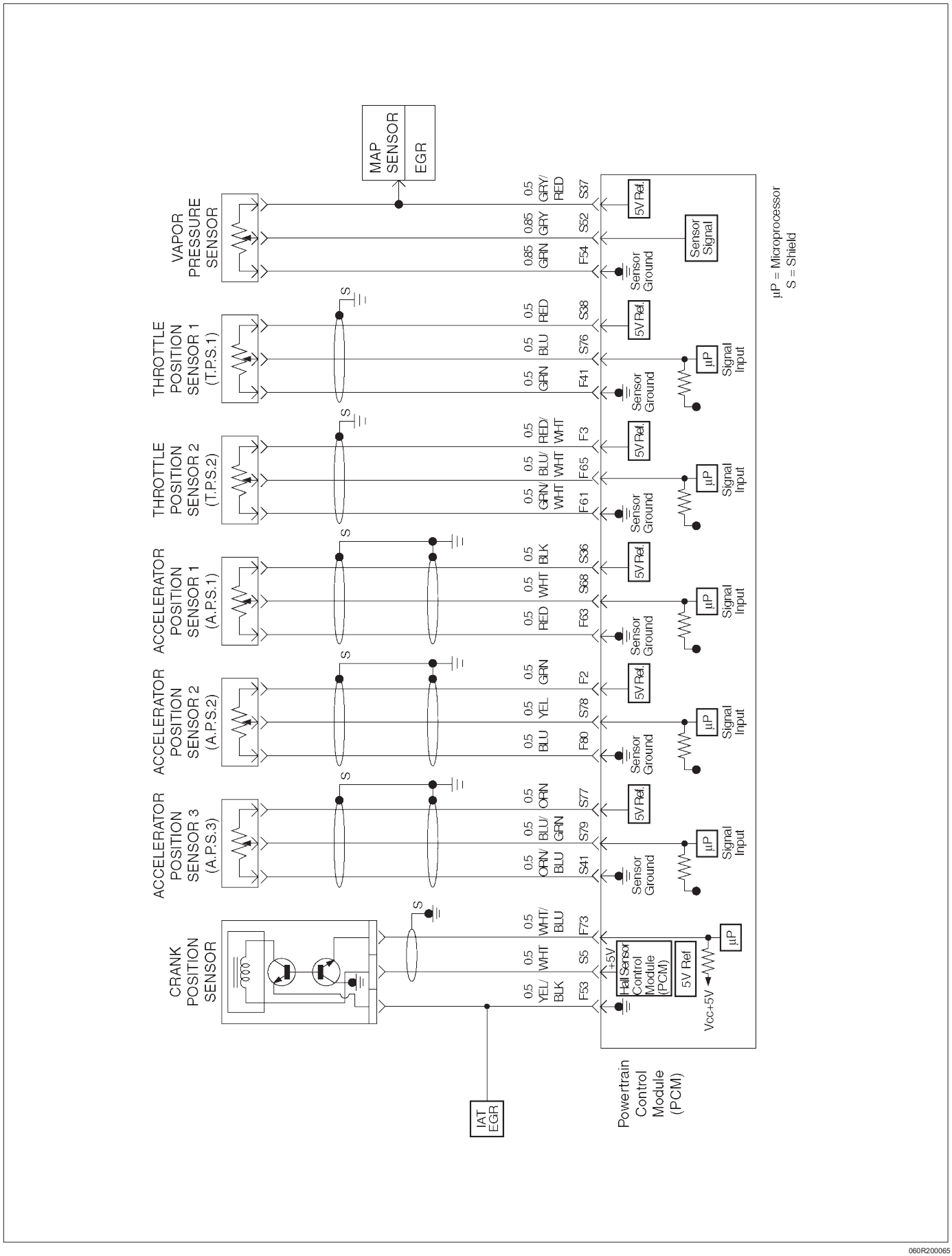

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## PCM Wiring Diagram (3 of 7)



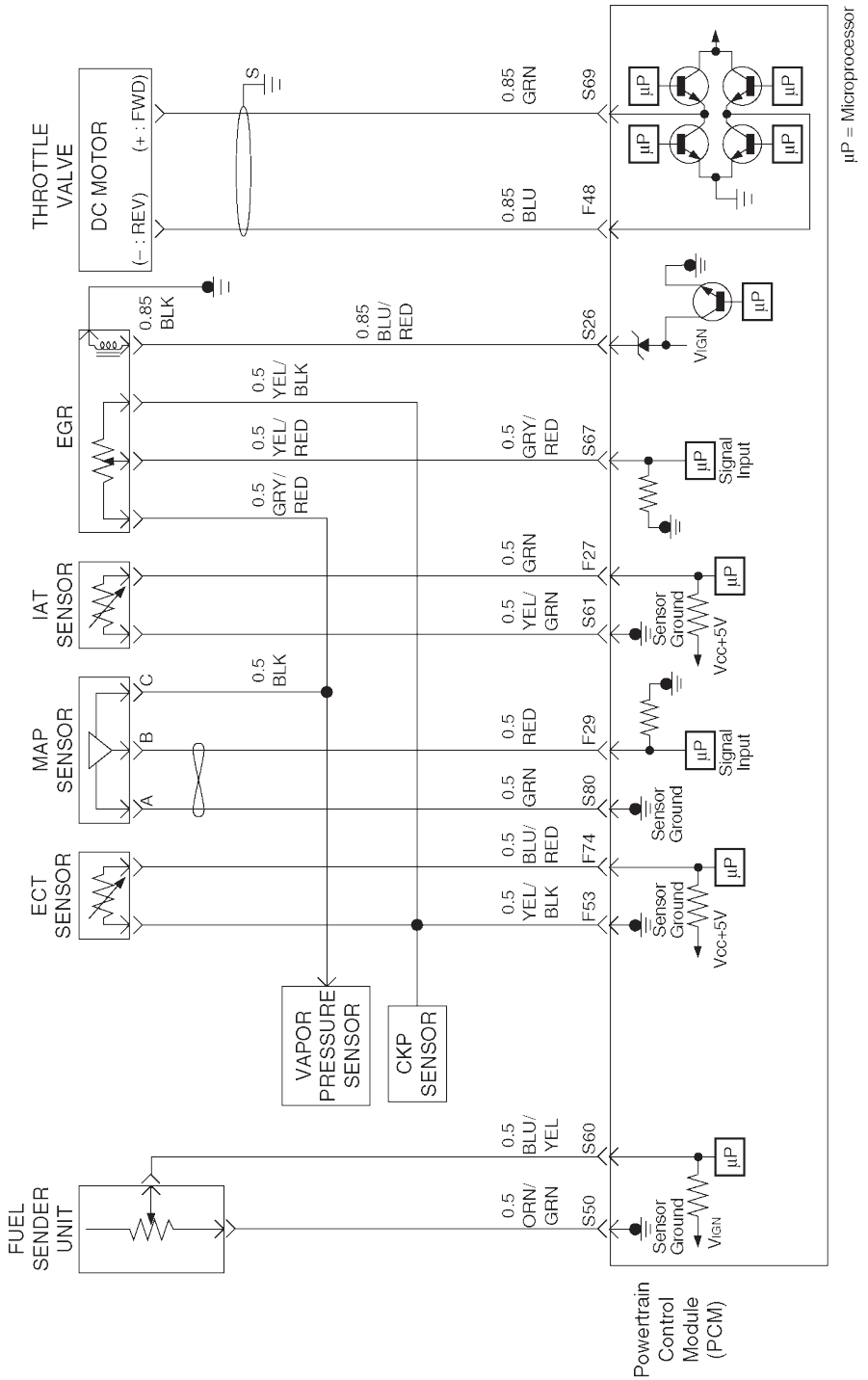

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## PCM Wiring Diagram (4 of 7)



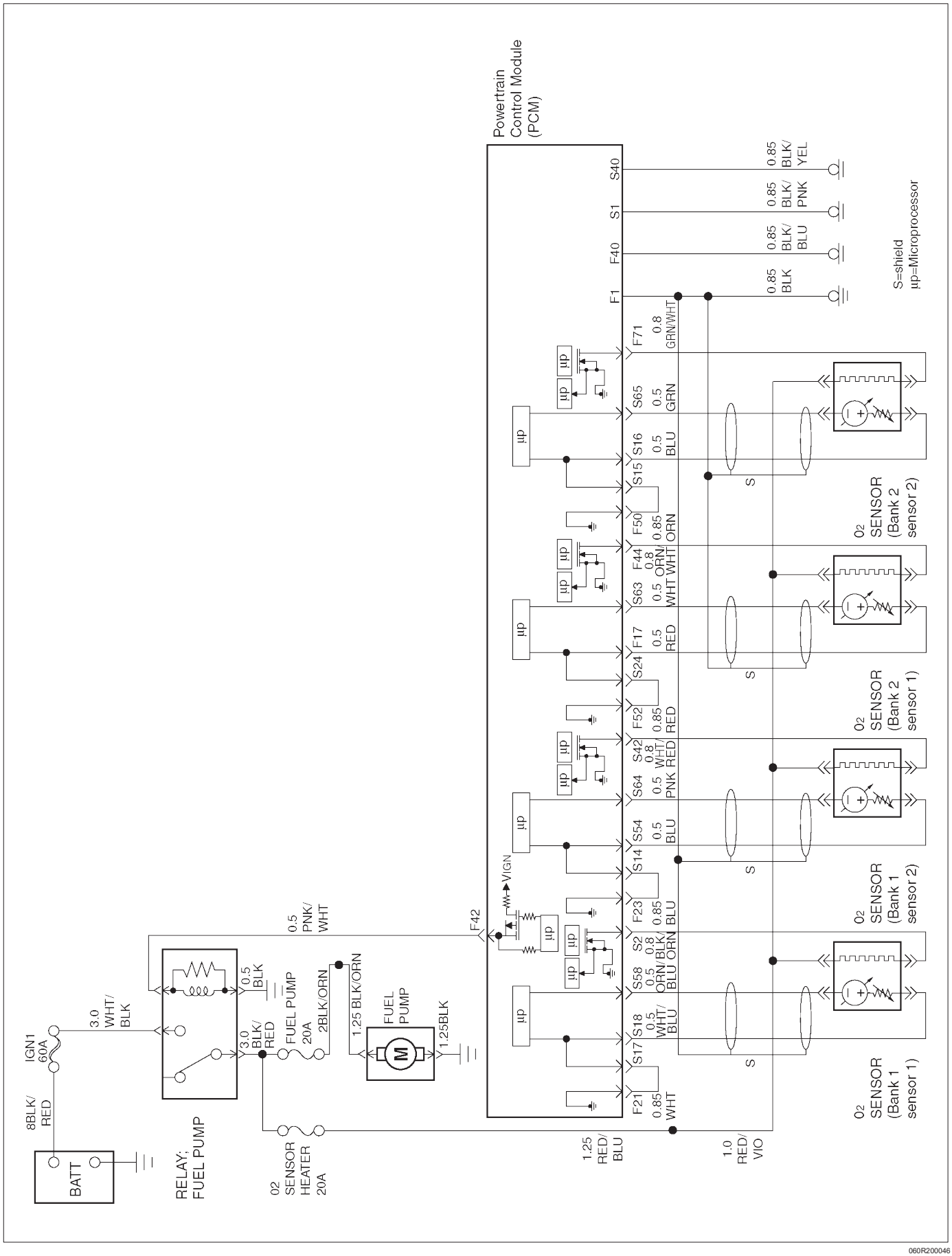

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## PCM Wiring Diagram (5 of 7)



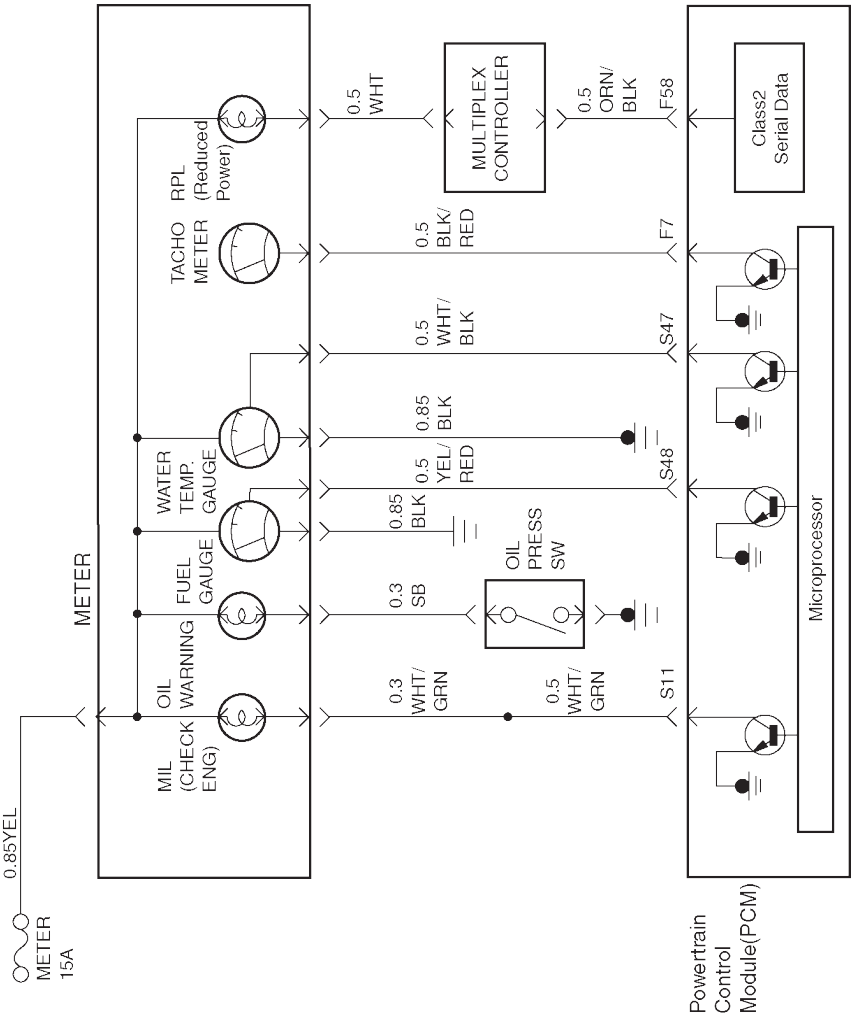

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## PCM Wiring Diagram (6 of 7)




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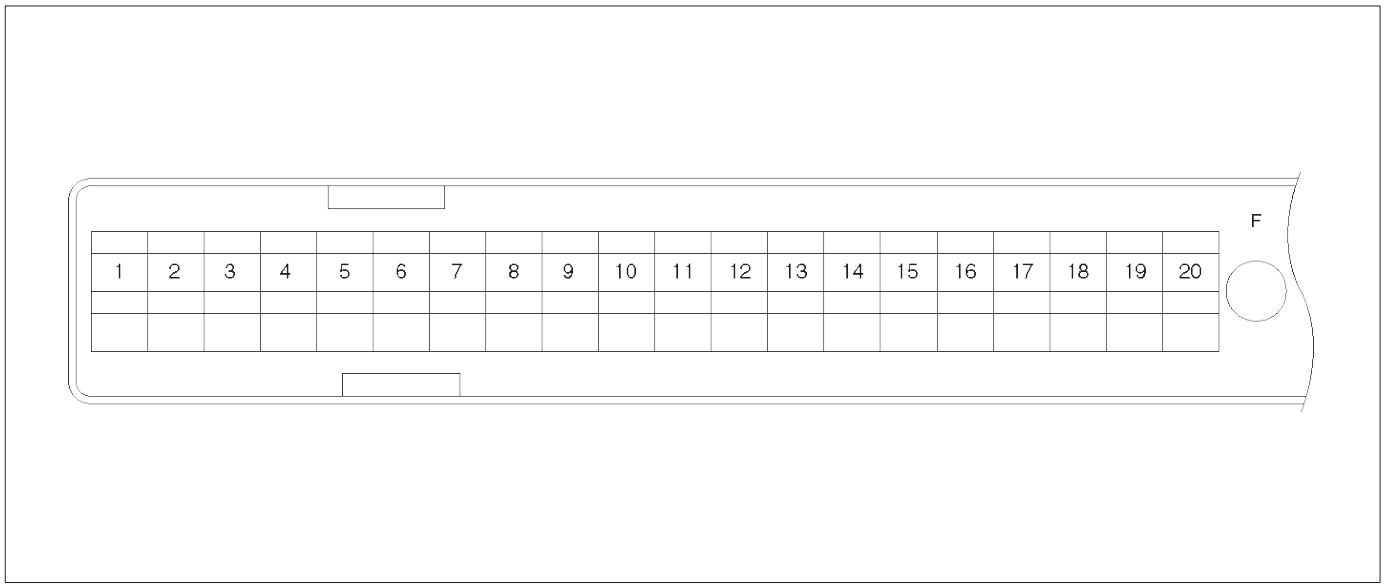
## PCM Wiring Diagram (7 of 7)




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# PCM Pinouts

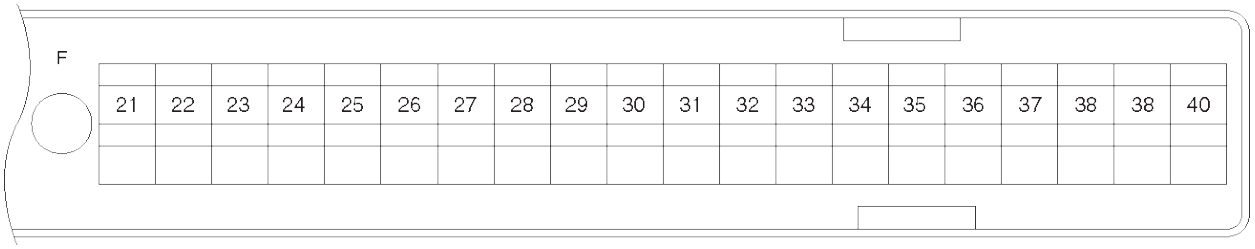
## PCM Pinout Table, 80-Way Blue Connector – Row “F1 ~ 20”




060RY00045

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| F1 | PCM Ground | BLK | 0.0V | 0.0V | Chassis Electrical |
| F2 | 5Volt Reference“2” (AP Sensor 2) | GRN | 5.0V | 5.0V | Accelerator Position (AP) Sensor |
| F3 | 5Volt Reference“2” (TP Sensor 2) | RED/WHT | 5.0V | 5.0V | Throttle Position (TP) Sensor |
| F4 | A/C Clutch | GRY/RED | B+(A/C off) | B+(A/C off) | General Description and Operation, A/C Clutch Circuit Operation |
| F5 | Relay Shift Solenoid | GRN/RED | 0.0V | 0.0V | 4L30E T/Mission |
| F6 | Not Used | — | — | — | — |
| F7 | Tachometer | BLK/RED | 8.8V | 10.0V (at idle) | Chassis Electrical |
| F8 | Not Used | — | — | — | — |
| F9 | Not Used | — | — | — | — |
| F10 | Not Used | — | — | — | — |
| F11 | T.O.D | RED/WHT | — | — | — |
| F12 | Not Used | — | — | — | — |
| F13 | Starter Feed | PNK | — | — | — |
| F14 | Mass Air Flow(MAF) | BLK/BLU | 4.9V | 4.2V | General Description, Mass Air Flow Sensor |
| F15 | Not Used | — | — | — | — |
| F16 | Not Used | — | — | — | — |
| F17 | Bank 1 HO2S Low | RED | 0.3V | 0.1–0.9V | General Description and Operation, Catalyst Monitor HO2S 2 |
| F18 | Not Used | — | — | — | — |
| F19 | Ignition Feed | RED/GRN | B+ | B+ | 6D Section |
| F20 | Ignition Feed | RED/WHT | B+ | B+ | 6D Section |

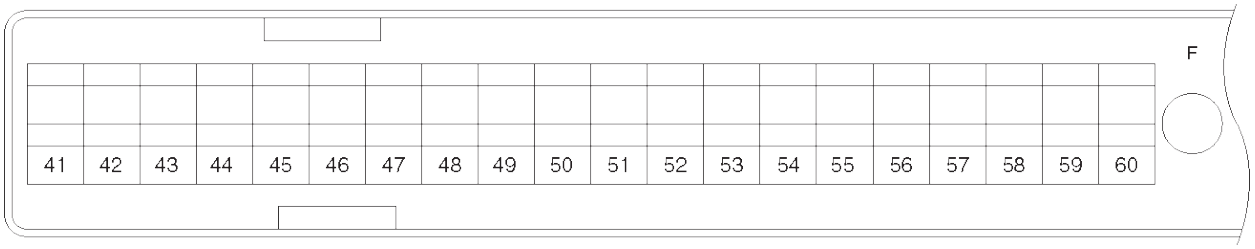
## PCM Pinout Table, 80-Way Blue Connector – Row "F20 ~ 40"




060RY00156

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| F21 | Bank 1 HO2S 1 Ground | WHT | 0.0V | 0.0V | — |
| F22 | Not Used | — | — | — | — |
| F23 | Bank 2 HO2S 1 Ground | BLU | 0.0V | 0.0V | General Description |
| F24 | Not Used | — | — | — | — |
| F25 | ION Sensing Module | RED/BLU | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| F26 | ION Sensing Module | RED/BLK | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| F27 | Intake Air Temperature (IAT) Sensor Signal | GRN | 0.5–4.9V | 0.5–4.9V | General Description and Operation, IAT |
| F28 | Not Used | — | — | — | — |
| F29 | Manifold Absolute Pressure (MAP) Sensor Signal | RED | 3.5V–4.9V (depends on altitude and barometric pressure) | 0.6-1.3V | General Description and Operation, Manifold Absolute Pressure |
| F30 | Not Used | — | — | — | — |
| F31 | Not Used | — | — | — | — |
| F32 | Not Used | — | — | — | — |
| F33 | Not Used | — | — | — | — |
| F34 | Not Used | — | — | — | — |
| F35 | Not Used | — | — | — | — |
| F36 | Not Used | — | — | — | — |
| F37 | Power Steering Pressure (PSP) | GRN/YEL | B+ | B+ | Power Steering |
| F38 | Illuminated Switch | GRN/YEL | B+ | B+ | Chassis Electrical |
| F39 | Brake Switch | RED | 0.0V | 0.0V | 4L30E T/Mission |
| F40 | PCM Ground | BLK/BLU | 0.0V | 0.0V | Chassis Electrical |

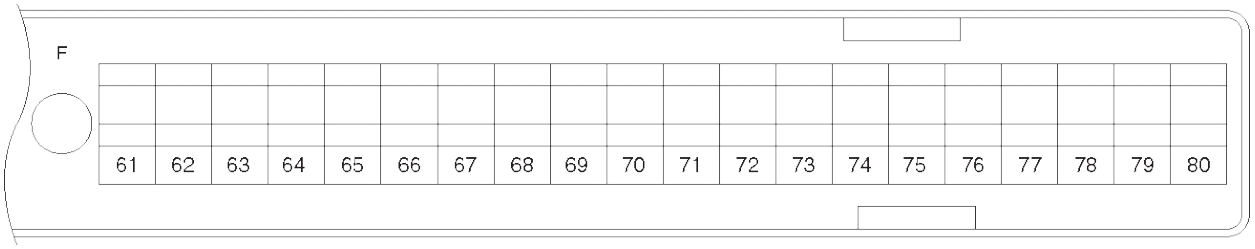
## PCM Pinout Table, 80-Way Blue Connector – Row “F41 ~ 60”




060RY00046

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| F41 | Throttle Position(TP) 1 Sensor Ground | GRN | 0.0V | 0.0V | General Description and Operation, TPS |
| F42 | Fuel Pump Relay | PNK/WHT | 0.0V | B+ | On Vehicle Service, Fuel Pump Relay |
| F43 | Adaptor Case | VIO/RED | 0.0V | 0.0V | 4L30E T/Mission |
| F44 | Bank 1 HO2S 2 Heater Ground | ORN/WHT | 0.0V | 0.0V | General Description and Operation, Catalyst Monitor HO2S 2 |
| F45 | A/C Request | GRN/BLK | 0.0V | 0.0V | Chassis Electrical |
| F46 | Stop Lamp Switch | BRN/RED | 0.0V | 0.0V | Chassis Electrical |
| F47 | Adaptor Case | VIO/WHT | B+ | B+ | 4L30E T/Mission |
| F48 | Throttle Valve DC Motor(–: REV) | BLU | Duty Cycle | Duty Cycle | General Description and Operation, ETC |
| F49 | Not Used | — | — | — | — |
| F50 | Bank 2 HO2S 2 Ground | ORN | 0.0V | 0.0V | — |
| F51 | Not Used | — | — | — | — |
| F52 | Bank 1 HO2S 2 Ground | RED | 0.0V | 0.0V | — |
| F53 | ECT Ground | YEL/BLK | 0.0V | 0.0V | General Description and Operation, ECT Sensor |
| F54 | Vapor Pressure (Fuel Tank Pressure) Sensor Ground | GRN | 0.0V | 0.0V | General Description and Operation, VP Sensor |
| F55 | Not Used | — | — | — | — |
| F56 | Injector Cylinder #5 | GRN/BLK | B+ | B+ | General Description and Operation, Fuel Injector |
| F57 | Ignition Feed | RED/WHT | B+ | B+ | Chassis Electrical |
| F58 | Class 2 Data | ORN/BLK | 0.0V | 0.0V | General Description |
| F59 | Not Used | — | — | — | — |
| F60 | Not Used | — | — | — | — |

## PCM Pinout Table, 80-Way Blue Connector – Row “F61 ~ 80”

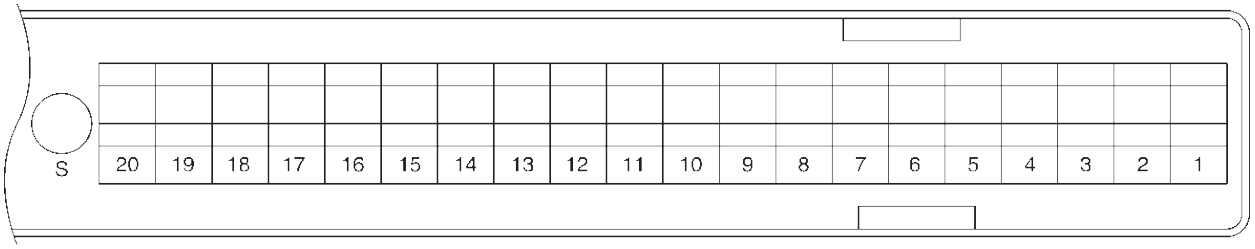



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| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| F61 | Throttle Position(TP) 2 Sensor Ground | GRN/WHT | 0.0V | 0.0V | General Description and Operation, TPS |
| F62 | Injector Cylinder #2 | GRN/ORN | B+ | B+ | General Description and Operation, Fuel Injector |
| F63 | AP Sensor 1 Sensor Ground | RED | 0.0V | 0.0V | On-Vehicle Service |
| F64 | Injector Cylinder #4 | GRN/RED | B+ | B+ | General Description and Operation, Fuel Injector |
| F65 | Throttle Position(TP) 2 Sensor Signal | BLU/WHT | 0.5–0.8V | 0.8–0.8V (at idle) | General Description and Operation, TPS |
| F66 | Injector Cylinder #3 | GRN | B+ | B+ | General Description and Operation, Fuel Injector |
| F67 | ION Sensing Module | YEL | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| F68 | ION Sensing Module | RED | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| F69 | Injector Cylinder #1 | GRN/WHT | B+ | B+ | General Description and Operation, Fuel Injector |
| F70 | ANTI Theft | WHT/GRN | — | — | — |
| F71 | Bank 2 HO2S 2 Heater Ground | GRN/WHT | 0.0V | 0.0V | General Description and Operation, Catalyst Monitor HO2S 1 |
| F72 | Auto Cruise Switch Resume | WHT/BLU | 0.0V | 0.0V | Chassis Electrical |
| F73 | Crankshaft Position Sensor | WHT/BLU | 0.3V | 2.2V | General Description and Operation, CKP sensor |
| F74 | ECT Sensor | BLU/RED | 0.5–4.9V | 0.5–4.9V | General Description and Operation, ECT Sensor |
| F75 | Ignition Feed | RED/GRN | B+ | B+ | Chassis Electrical |
| F76 | Mode Switch | PNK/BLK | B+ | B+ | 4L30E T/Mission |
| F77 | Mode Switch | PNK/BLU | B+ | B+ | 4L30E T/Mission |

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| F78 | Mode Switch | PNK/YEL | 0.0V | 0.0V | 4L30E T/Mission |
| F79 | Mode Switch | PNK | 0.0V | 0.0V | 4L30E T/Mission |
| F80 | AP Sensor 2 Ground | BLU | 0.0V | 0.0V | On-Vehicle Service |

## PCM Pinout Table, 80-Way Red Connector – Row “S1 ~ 20”

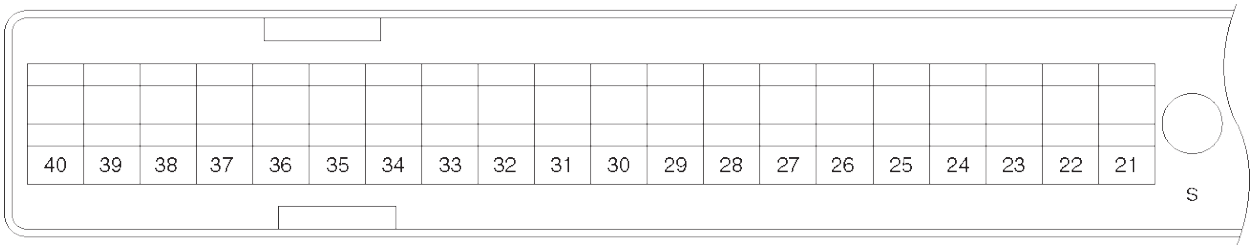



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| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S1 | PCM Ground | BLK/PNK | 0.0V | 0.0V | Chassis Electrical |
| S2 | Bank 1 HO2S 1 Heater Ground | BLK/ORN | 0.0V | 0.0V | General Description and Operation, Catalyst Monitor HO2S |
| S3 | Not Used | — | — | — | — |
| S4 | Not Used | — | — | — | — |
| S5 | 5Volt Reference“2” (CKP Sensor) | WHT | 5.0V | 5.0V | Appropriate Sensor (CKP Sensor, AP2 Sensor) |
| S6 | Auto Cruise Switch Cancel | GRY/GRN | 0.0V | 0.0V | Chassis Electrical |
| S7 | Purge Duty Solenoid Valve | RED/BLU | B+ | B+ | EVAP Emission Control System |
| S8 | M.I.D | 0.5 GRN | — | — | — |
| S9 | Not Used | — | — | — | — |
| S10 | Shift High (Band Apply) | BRN/YEL | B+ | B+ | 4L30E T/Mission |
| S11 | Malfunction Indicator (Check Engine) Lamp | WHT/GRN | 0.0V | B+ | Chassis Electrical |
| S12 | Not Used | — | — | — | — |
| S13 | ION Sensing Module | RED/WHT | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| S14 | Bank 2 HO2S 1 Ground | BLU | 0.0V | 0.0V | — |
| S15 | Bank 2 HO2S 2 Ground | ORN | 0.0V | 0.0V | — |
| S16 | Bank 2 HO2S 2 Low | BLU | 0.0V | 0.1V | General Description and Operation, Catalyst Monitor HO2S |
| S17 | Bank 1 HO2S 1 Ground | WHT | 0.0V | 0.0V | — |
| S18 | Bank 1 HO2S 1 Low | WHT/BLU | 0.0V | 0.1V | General Description and Operation, Catalyst Monitor HO2S |

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S19 | ION Sensing Module | RED/YEL | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| S20 | Transmission Fluid Temperature Sensor Ground | RED/WHT | 0.0V | 0.0V | 4L30E T/Mission |

## PCM Pinout Table, 80-Way Red Connector – Row "S21 ~ 40"

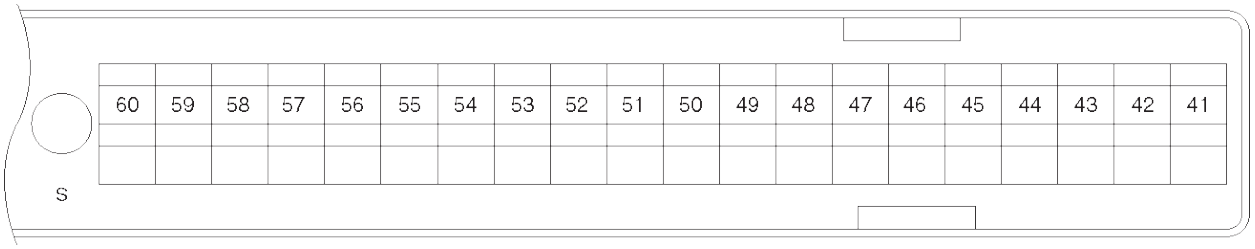



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| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S21 | Audio | YEL/GRN | — | — | Chassis Electrical |
| S22 | Transmission Output Speed Sensor | BLU/YEL | 0.0V | 0.0V | 4L30E T/Mission |
| S23 | PCM Ground | BLK | 0.0V | 0.0V | Chassis Electrical |
| S24 | Bank 1 HO2S 2 Ground | RED | 0.0V | 0.0V | — |
| S25 | Not Used | — | — | — | — |
| S26 | EGR Control High | BLU/RED | B+ | B+ | General Description and Operation, EGR Control |
| S27 | VSS Input | BLK/YEL | 0.0V | 0.1V (at rest) | Chassis Electrical |
| S28 | Injector Cylinder #6 | GRN/YEL | B+ | B+ | General Description and Operation, Fuel Injector |
| S29 | Winter Switch | VIO/GRN | B+ | B+ | 4L30E T/Mission |
| S30 | Auto Cruise Main Switch | WHT/RED | 0.0V | 0.0V | Chassis Electrical |
| S31 | Shift Solenoid | GRN | 0.0V | 0.0V | 4L30E T/Mission |
| S32 | Ignition Feed | RED/GRN | B+ | B+ | Chassis Electrical |
| S33 | TCC Solenoid | BRN/WHT | 0.0V | 0.0V | T/Mission |
| S34 | Not Used | — | — | — | — |
| S35 | ION Sensing Module | RED/GRN | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| S36 | 5Volt Reference (AP Sensor 1) | BLK | 5.0V | 5.0V | AP Sensor |
| S37 | 5Volt Reference (Vapor Pressure {Fuel Tank Pressure} Sensor/MAP Sensor/EGR Position Sensor) | GRY/RED | 5.0V | 5.0V | (Fuel Tank Pressure Sensor/MAP Sensor/EGR Position Sensor) Sensor |
| S38 | 5Volt Reference (TP Sensor 1) | RED | 5.0V | 5.0V | TP Sensor |

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S39 | Auto Cruise Set Lamp | WHT | 0.0V | 0.0V | Chassis Electrical |
| S40 | PCM Ground | BLK/YEL | 0.0V | 0.0V | Chassis Electrical |

## PCM Pinout Table, 80-Way Red Connector – Row "S41 ~ 60"

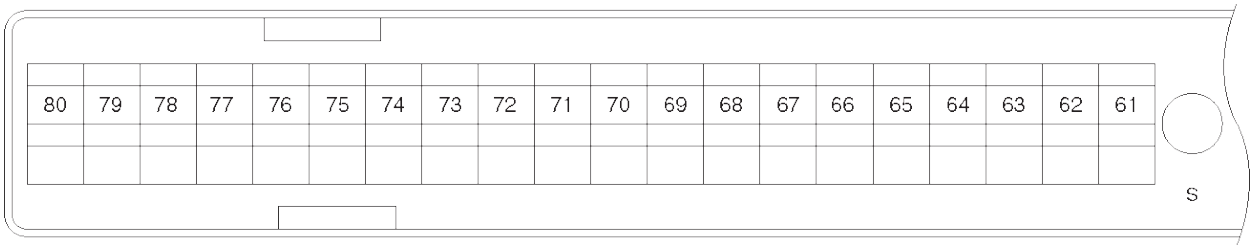



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| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S41 | AP Sensor 3 Sensor Ground | ORN/BLU | 0.0V | 0.0V | On-Vehicle Service |
| S42 | Bank 2 HO2S 1 Heater Ground | WHT/RED | 0.0V | 0.0V | General Description and Operation, Catalyst Monitor HO2S |
| S43 | Solenoid Power Supply | GRY/WHT | B+ | B+ | 4L30E T/Mission |
| S44 | Rr Def. Relay | RED/WHT | — | — | — |
| S45 | Starter Relay | BLK/BLU | — | — | — |
| S46 | Fuel Gauge | YEL/RED | B+ | B+ | Chassis Electrical |
| S47 | Water Temp. Gauge | WHT/BLK | B+ | B+ | 4L30E T/Mission |
| S48 | Fuel Gauge | YEL/RED | B+ | B+ | General Description and Chassis Electrical |
| S49 | DLC | RED/WHT | B+ | B+ | General Description |
| S50 | Fuel Sender Unit | ORN/GRN | 0.0V | 0.0V | — |
| S51 | TCC Solenoid | BRN/BLU | 0.0V | 0.0V | T/Mission |
| S52 | Vapor Pressure (Fuel Tank Pressure) Sensor Signal | GRY | 0.2–4.8V | 0.2–4.8V | General Description and Operation, VP Sensor |
| S53 | Power Switch | VIO/RED | B+ | B+ | 4L30E T/Mission |
| S54 | Bank 2 HO2S 1 Low | BLU | 0.0V | 0.1V | General Description and Operation, Catalyst Monitor HO2S |
| S55 | Transmission Output Speed Sensor | BLU/GRN | 0.0V | 0.0V | 4L30E T/Mission |
| S56 | Not Used | — | — | — | — |
| S57 | Not Used | — | — | — | — |
| S58 | Bank 1 HO2S 1 High | ORN/BLU | 0.3V | 0.1–0.9V | General Description and Operation, Catalyst Monitor HO2S |

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S59 | Auto Cruise Set Switch | Light GRN | 0.0V | 0.0V | Chassis Electrical |
| S60 | Fuel Sender Unit | BLU/YEL | 0.5–4.9V | 0.5–4.9V | On-Vehicle Service PCM and Sensors |

## PCM Pinout Table, 80-Way Red Connector – Row “S61 ~ 80”



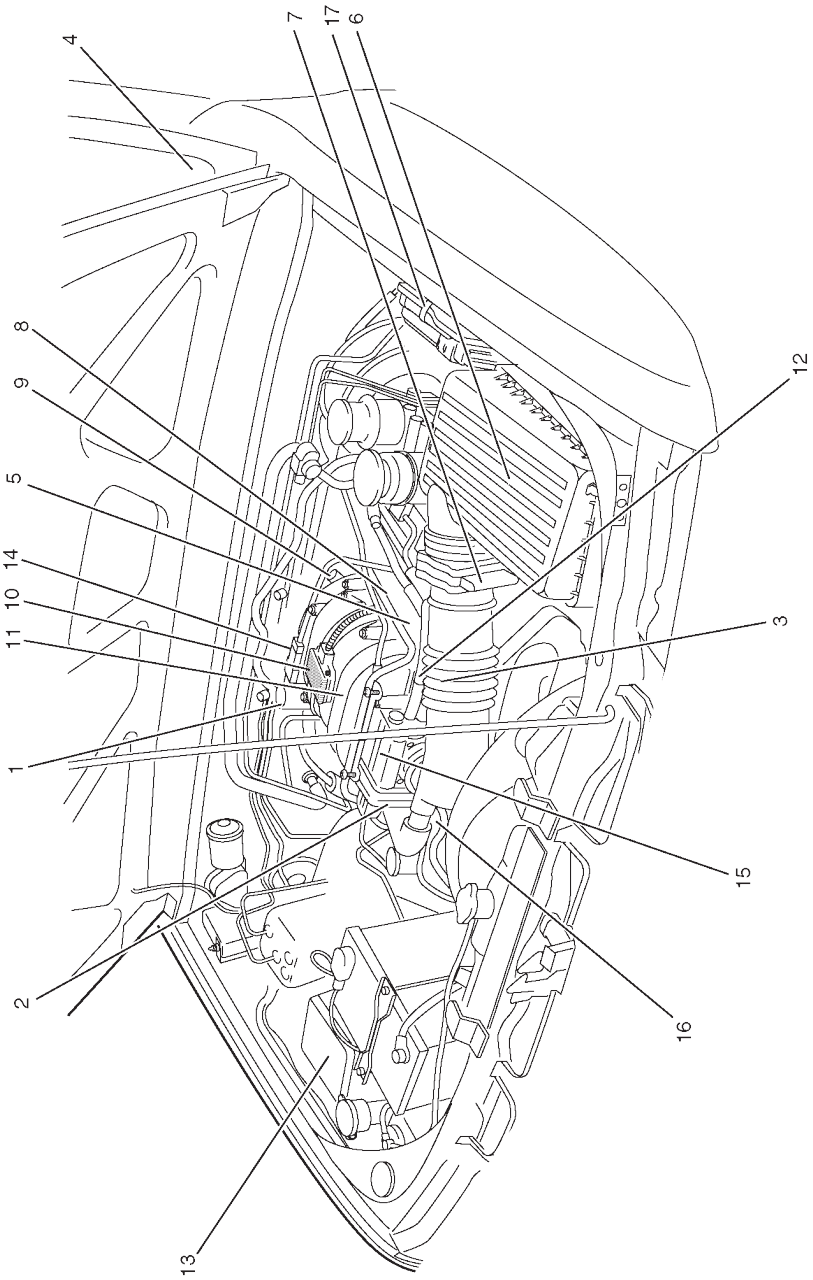

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| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S61 | Intake Air Temperature (IAT) Sensor Ground | YEL/GRN | 0.0V | 0.0V | General Description and Operation, IAT |
| S62 | ION Sensing Module | RED | 1.555V | 1.555V | General Description and Operation, ION Sensing Module |
| S63 | Bank 1 HO2S 2 High | WHT | 0.3V | 0.1–0.9V | General Description and Operation, Catalyst Monitor HO2S |
| S64 | Bank 2 HO2S 1 High | PNK | 0.3V | 0.1–0.9V | General Description and Operation, Catalyst Monitor HO2S |
| S65 | Bank 2 HO2S 2 High | GRN | 0.3V | 0.1–0.9V | General Description and Operation, Catalyst Monitor HO2S |
| S66 | Transmission Fluid Temperature Sensor | RED/BLK | 0.5–4.9V (depends on temperature) | 0.5–4.9V (depends on temperature) | 4L30E T/Mission |
| S67 | Exhaust Gas Recirculation (EGR) Position Signal | GRY/RED | 0.6V | 0.6V | General Description and Operation, EGR Control |
| S68 | Accelerator Position (AP) Sensor 1 | WHT | 0.41–0.45V | 0.41–0.45V | On-Vehicle Service |
| S69 | Throttle Valve DC Motor(+: FWD) | GRN | Duty Cycle | Duty Cycle | General Description and Operation, ETC |
| S70 | Not Used | — | — | — | — |
| S71 | Not Used | — | — | — | — |
| S72 | Ignition Feed | RED/GRN | B+ | B+ | Chassis Electrical |
| S73 | Auto Cruise Main Lamp | GRN/WHT | B+ | B+ | Chassis Electrical |
| S74 | Variable Intake Manifold | YEL/BLK | 0.0V | B+ (rpm 3600 over) | General Description |
| S75 | Canister Purge Cut Solenoid Valve | RED/WHT | 6.0V Tank empty | 5.7V Tank empty | General Description and Operation, EVAP |
| S76 | Throttle Position (TP) 1 Sensor Signal | BLU | 0.5–0.8V | 0.5–0.8V (at idle) | General Description and Operation, TPS |

| PIN | PIN Function | Wire Color | IGN ON | ENG RUN | Refer To |
|---|---|---|---|---|---|
| S77 | 5Volt Reference (AP Sensor 3) | ORN | 5.0V | 5.0V | AP Sensor |
| S78 | Accelerator Position (AP) Sensor 2 | YEL | 0.41–0.45V | 0.41–0.45V | On-Vehicle Service |
| S79 | Accelerator Position (AP) Sensor 3 | BLU/GRN | 4.55–4.99V | 0.41–0.45V | On-Vehicle Service |
| S80 | Manifold Absolute Pressure (MAP) Sensor Ground | GRN | 0V | 0V | General Description and Operation, Manifold Absolute Pressure |

# Component Locators

## Engine Component Locator

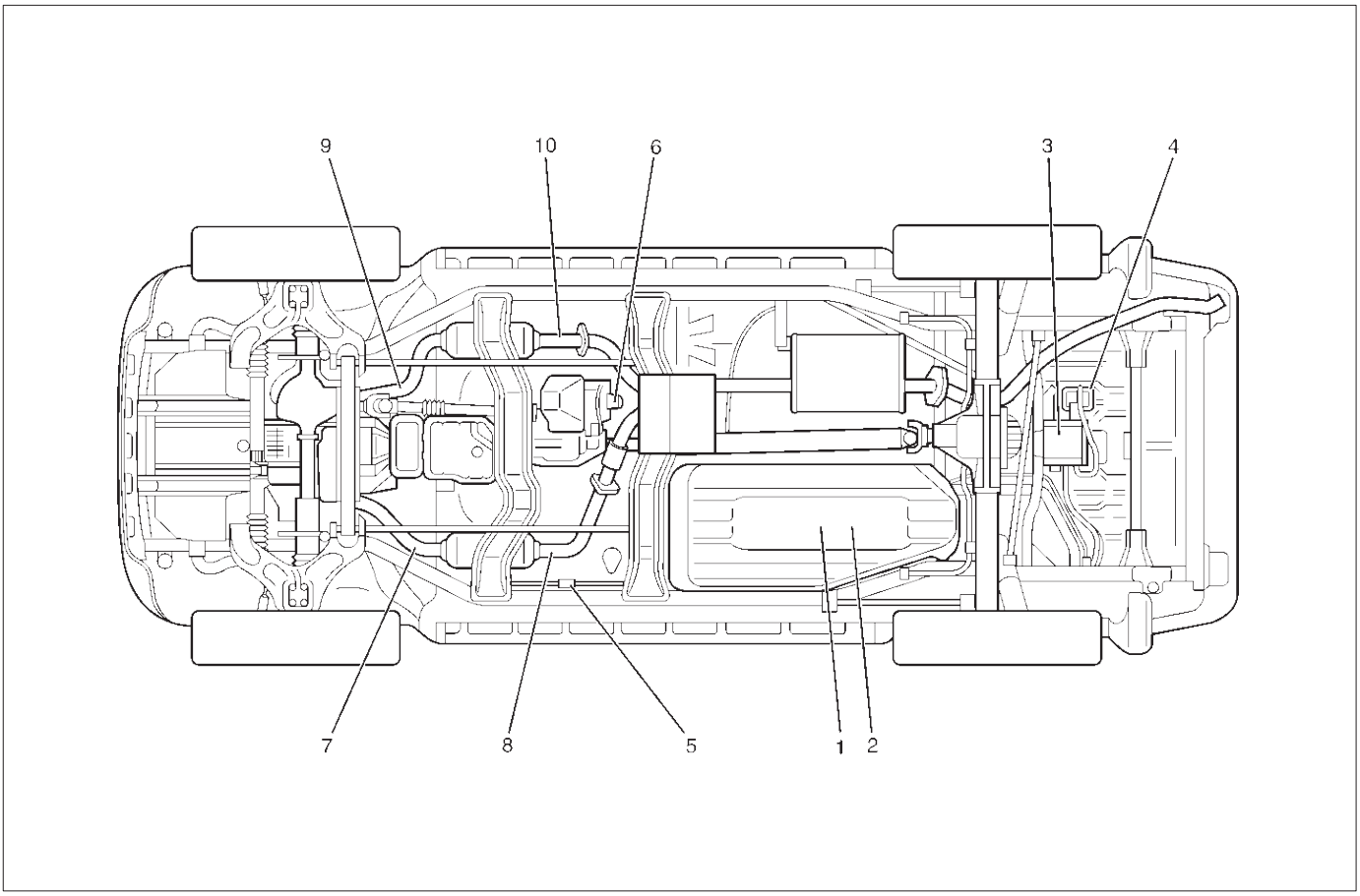



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**Engine Component Locator Table**

| Number | Name | Location |
|---|---|---|
| 1 | Linear Exhaust Gas Recirculation (EGR) Valve | Rear right side of the engine |
| 2 | Throttle Position (TP) Sensor | On the throttle body |
| 3 | Intake Air Temperature (IAT) Sensor | On the intake air duct near the throttle body |
| 4 | Check Engine (MIL) Light | On the instrument panel beneath the tachometer |
| 5 | Positive Crankcase Ventilation (PCV) Valve | On the left of the cylinder head cover |
| 6 | Air Cleaner | Left front of the engine bay |
| 7 | Mass Air Flow (MAF) Sensor | Attached to the air filter box |
| 8 | Fuel Rail | On the Common Chamber |
| 9 | Fuel Pressure Regulator | Rear side of the engine |
| 10 | ION Sensing module | Bolted to the top of the Common Chamber |
| 11 | Common Chamber | Top of the engine |
| 12 | EVAP Duty Solenoid Valve | Bolted to the front of the coolant pipe |
| 13 | Fuse/Relay Box | Along the inside of the right fender |
| 14 | Manifold Absolute Pressure (MAP) Sensor | Bolted to the top of the Common Chamber |
| 15 | Throttle Body | Between the intake air duct and the Common Chamber |
| 16 | Engine Coolant Temperature Sensor | On the coolant crossover pipe at the front of the engine, near the throttle body |
| 17 | Power Train Control Module (PCM) | Along the inside of the left fender |

## Undercarriage Component Locator

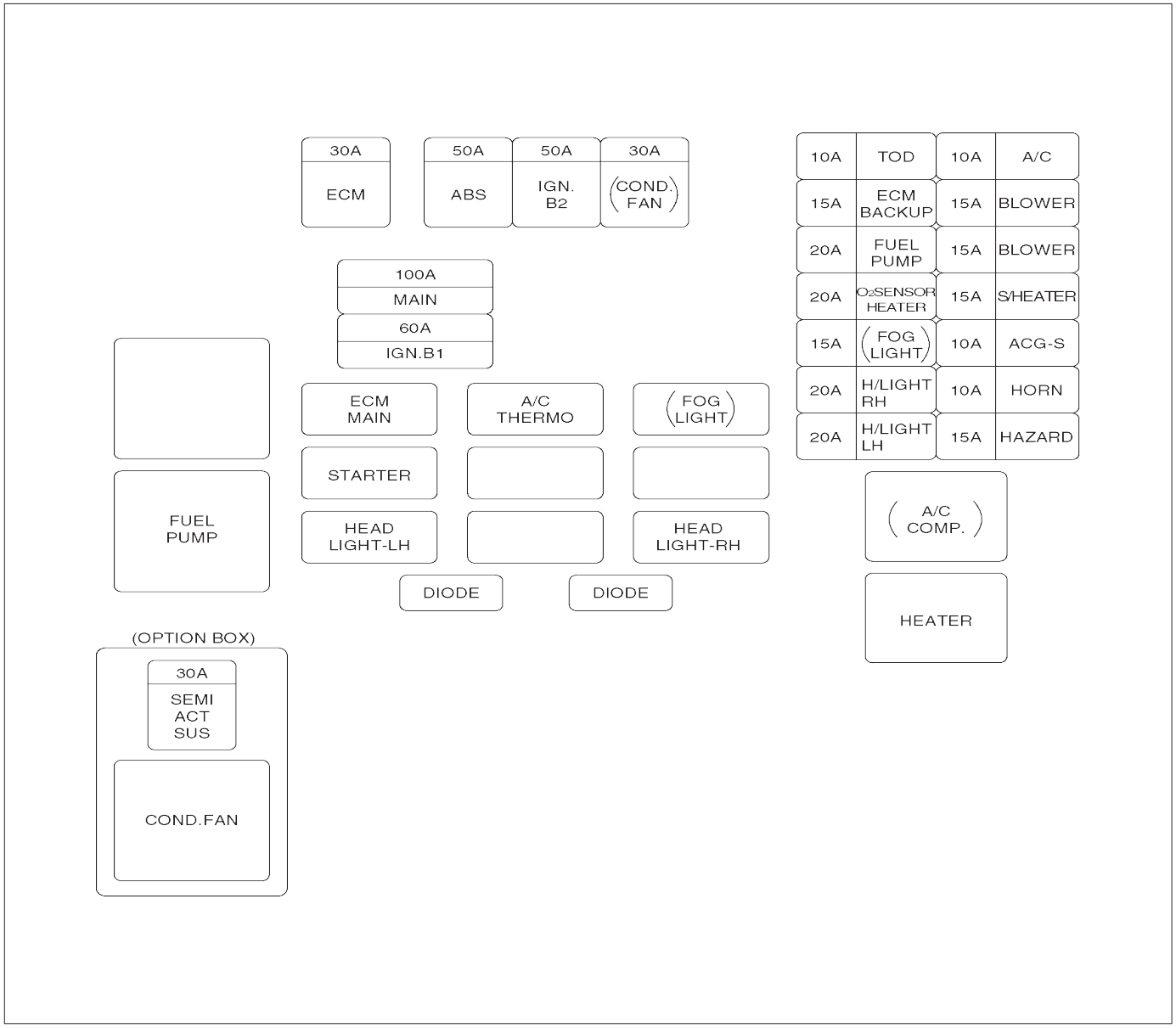



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**Undercarriage Component Locator Table**

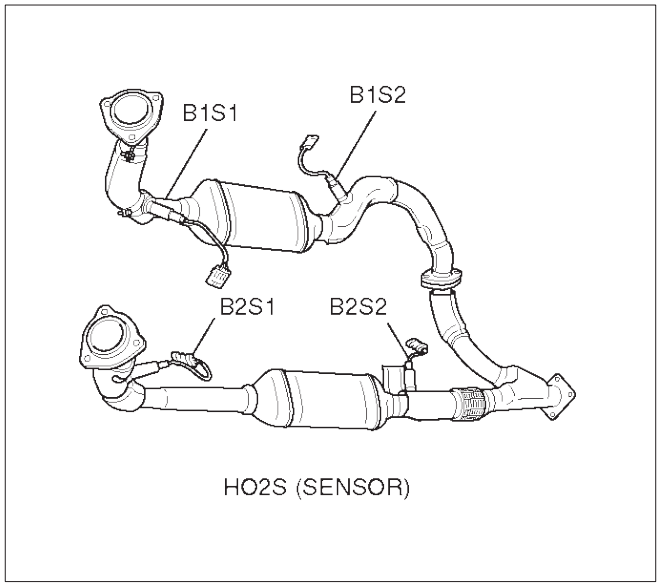
| Number | Name | Location |
|---|---|---|
| 1 | Fuel Pump Assembly and Vapor Pressure (Fuel Tank Pressure) Sensor | Installed in the top of the fuel tank |
| 2 | Fuel Gauge Unit | Installed in the top of the fuel tank |
| 3 | Evaporative (EVAP) Canister | On the top of the bracket that is located behind the cross member |
| 4 | Vent Solenoid (EVAP Canister) | On the top of the bracket that is located behind the cross member |
| 5 | Fuel Filter | Located along the inside of the right frame rail, ahead of the fuel tank |
| 6 | Vehicle Speed Sensor (VSS) | Protrudes from the transmission housing, just ahead of the propeller shaft |
| 7 | Heated Oxygen Sensor (Bank 1, HO2S 1) | Threaded into the exhaust pipe behind the right-hand catalytic converter |
| 8 | Heated Oxygen Sensor (Bank 1, HO2S 2) | Threaded into the exhaust pipe ahead of the right-hand catalytic converter |
| 9 | Heated Oxygen Sensor (Bank 2, HO2S 1) | Threaded into the exhaust pipe ahead of the left-hand catalytic converter |
| 10 | Heated Oxygen Sensor (Bank 2, HO2S 2) | Threaded into the exhaust pipe behind the left-hand catalytic converter |

## Fuse and Relay Panel (Underhood Electrical Center)

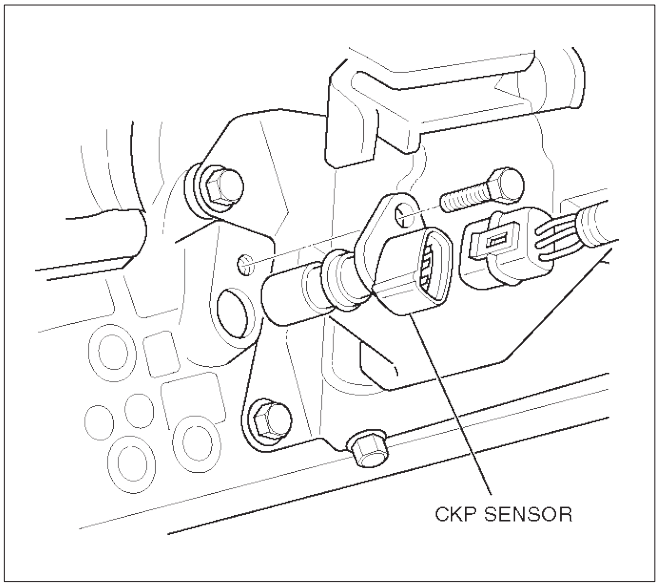



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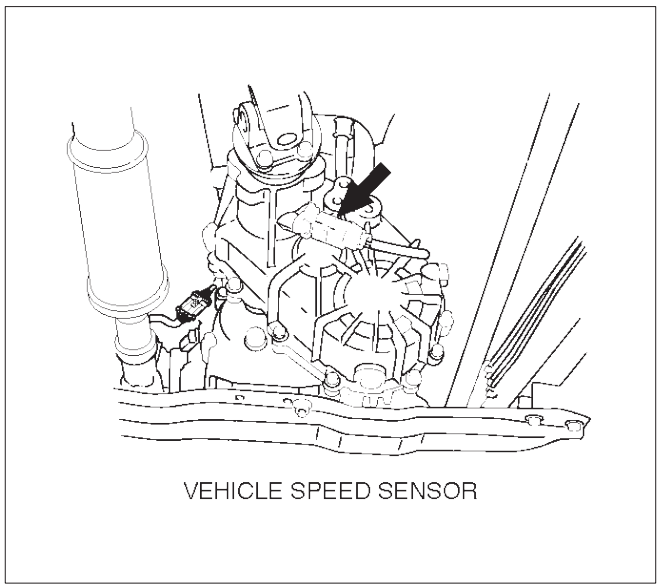
## Sensors and Miscellaneous Component Locators



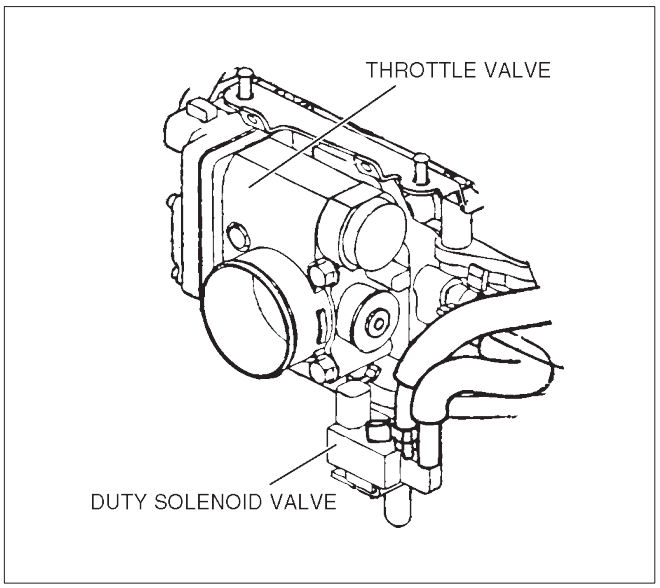

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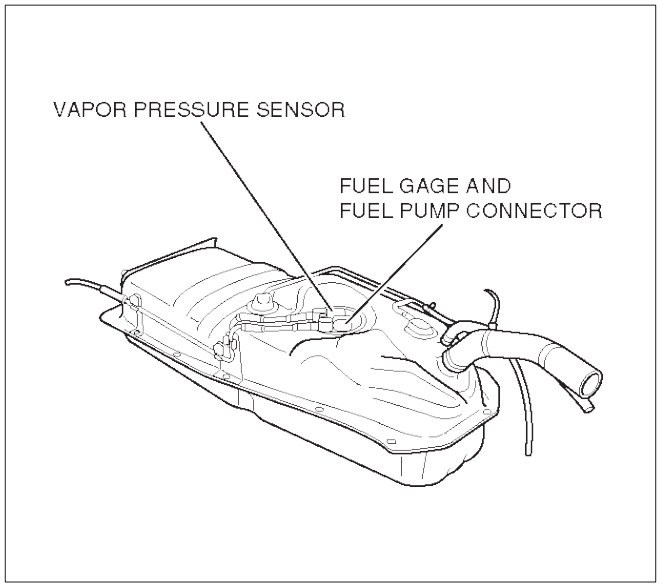

060RW111



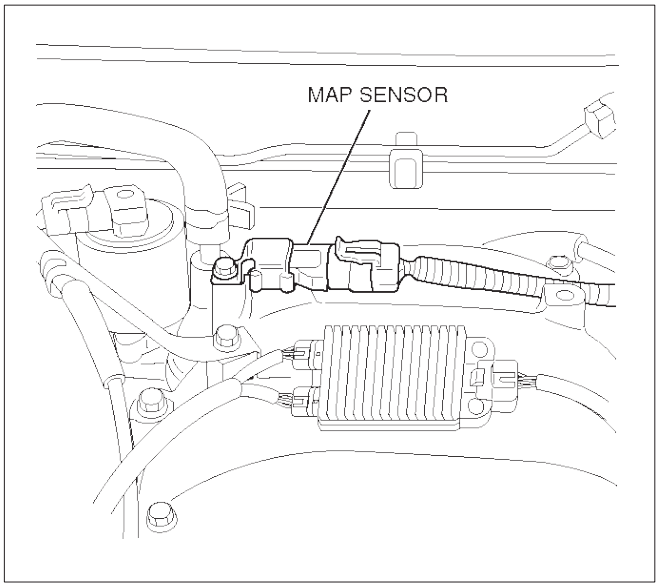

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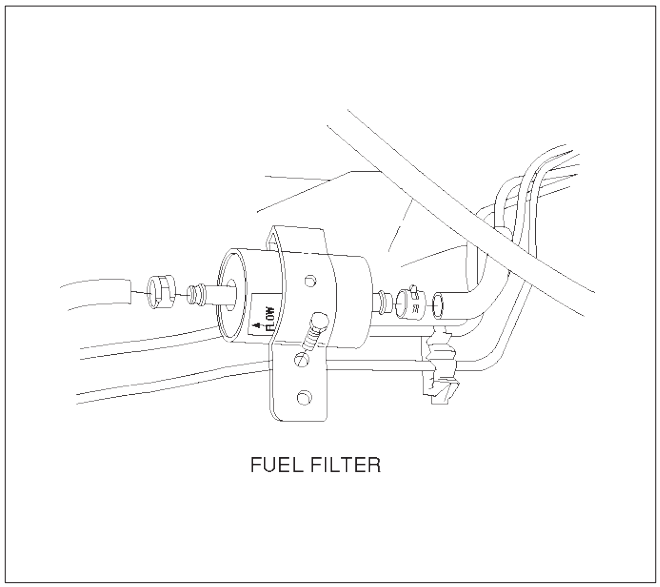

060R200080



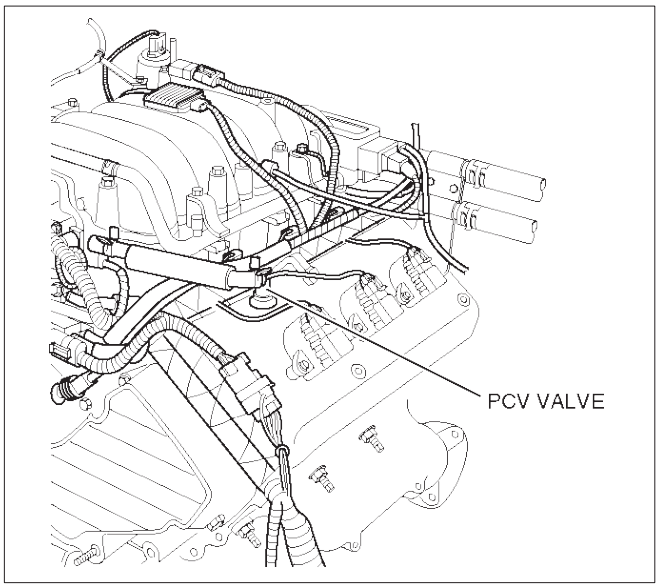

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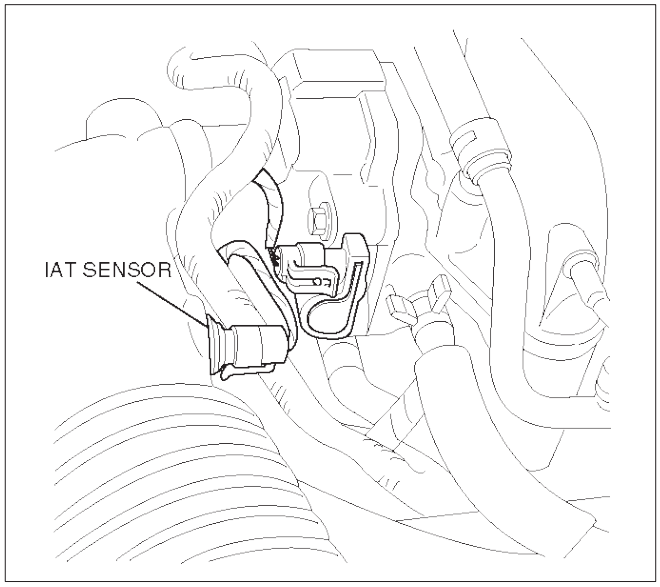

055RY00002



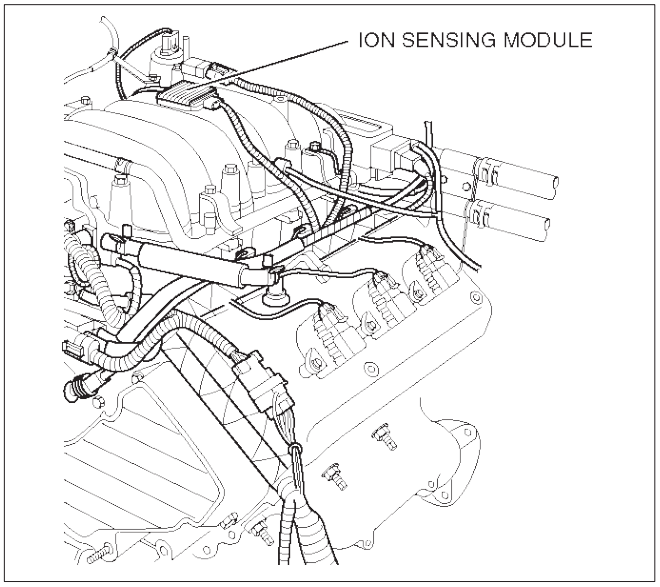

041RW004



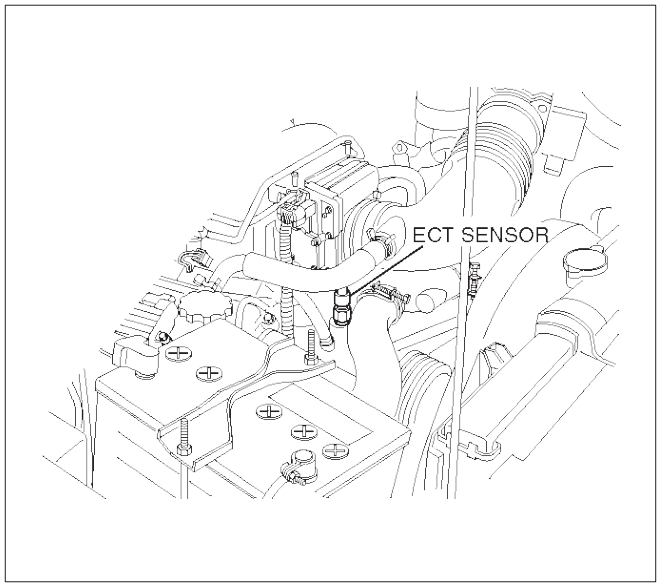

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# Diagnosis

## 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* section, 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 Frame 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 Serviceablity 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 Reed 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 Reed 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 the vehicle may cause driveability problems. Many of the major fuel companies advertise that using "premium" gasoline will improve the performance of the 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 transceivers, 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 fault and 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.

**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 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 Dealership.

## 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, disconnections, and proper 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 2 Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the "Class 2" 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 2 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 Scan tool manufacturers with the capability to access data from any make or model vehicle that is sold. The data displayed on other Scan tools 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. On this vehicle the Scan tool 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 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
- Manifold Absolute Pressure (MAP) sensor
- Mass Air Flow (MAF) 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 circuits:

- Control module controlled EVAP Canister Purge Valve
- Electronic Transmission controls
- A/C relays
- 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 Frame Data* in this section 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 6E 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
- MAF/MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- TCC enabled
- 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 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 the following:

- 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
- 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 complemented 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 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 within 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 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 function:

- It informs the driver that a fault 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 II) System Check must be performed. The procedures for these checks are given in On-Board Diagnostic (OBD) 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
  - 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
  - Non-Emissions related
  - 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 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
- AP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

**Intermittent Malfunction Indicator Lamp**

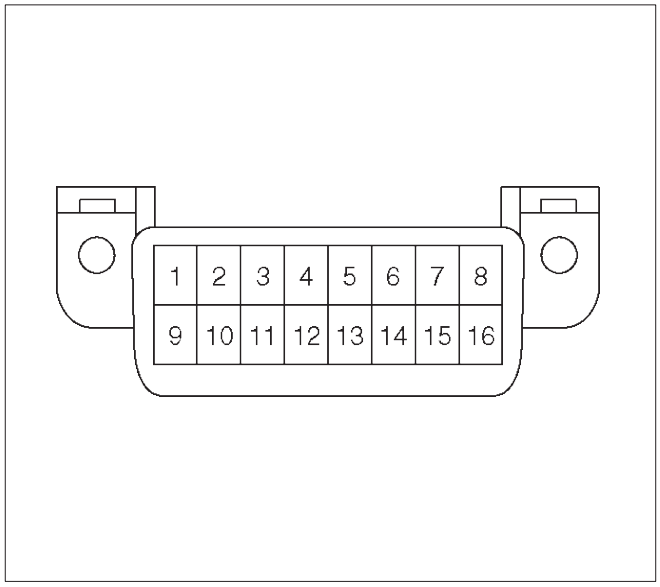
In the case of an "intermittent" fault, the MIL ("Check Engine" lamp) may illuminate and then (after three trips) go "OFF". However, the corresponding diagnostic trouble code will be stored in memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

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 communication with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel behind a small square cover. 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 diagnostic. 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 The 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.

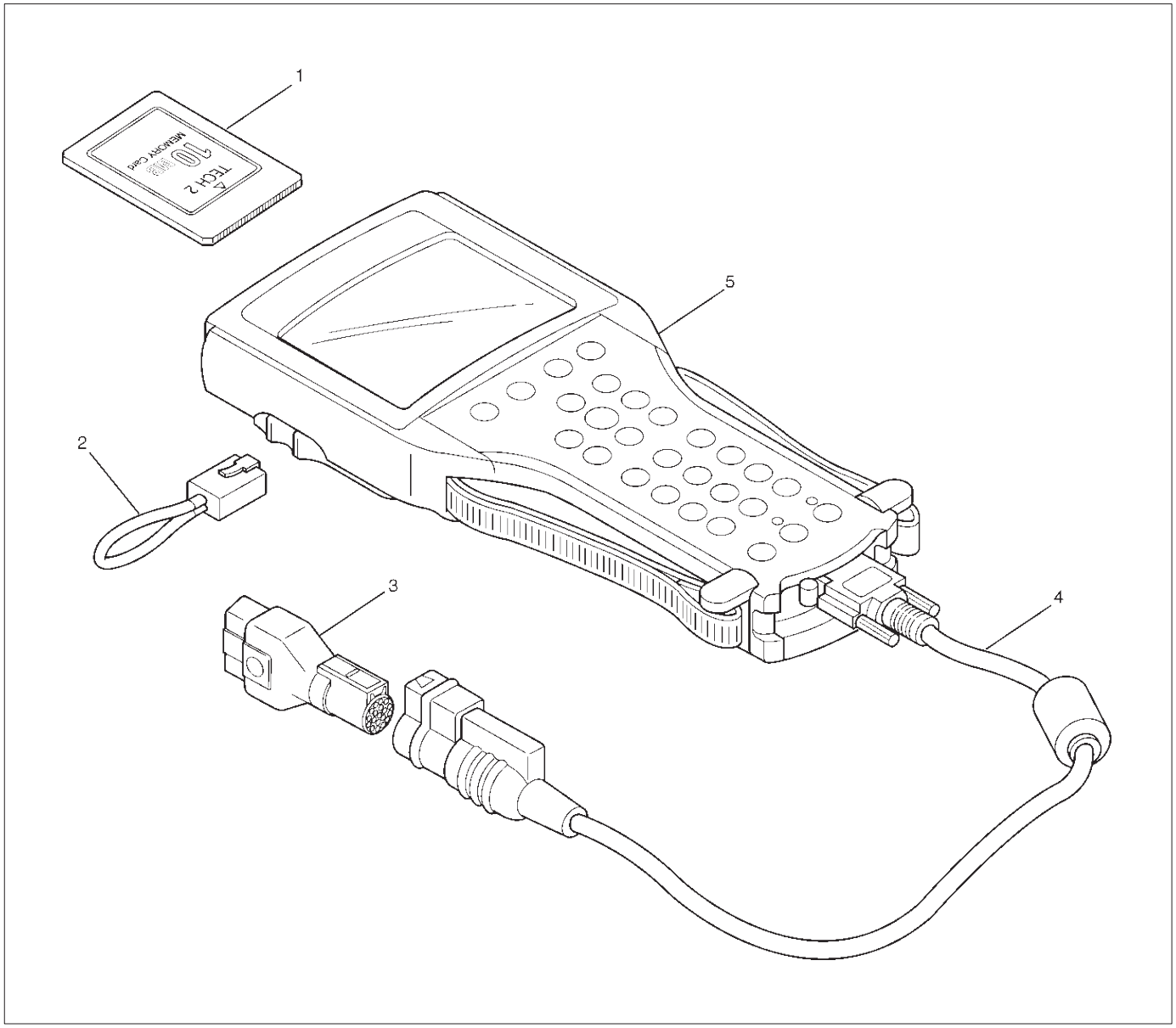
When a Scan Tool is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds.

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) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

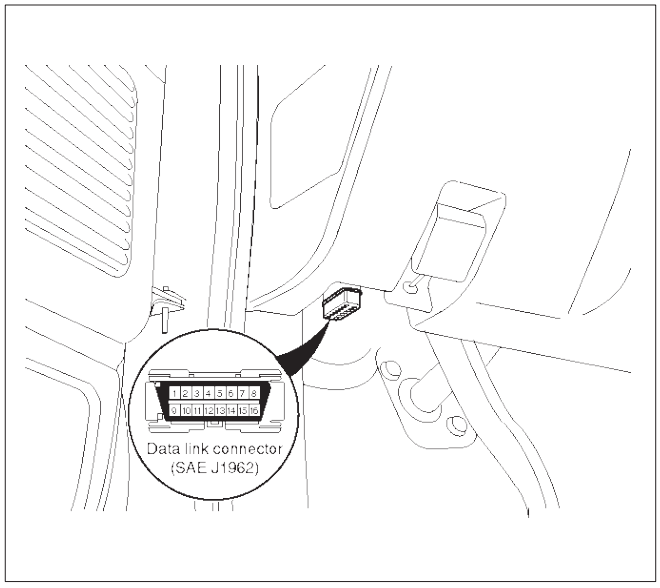
## Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volts.
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 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. Insert the Isuzu system PCMCIA card (1) 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.




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

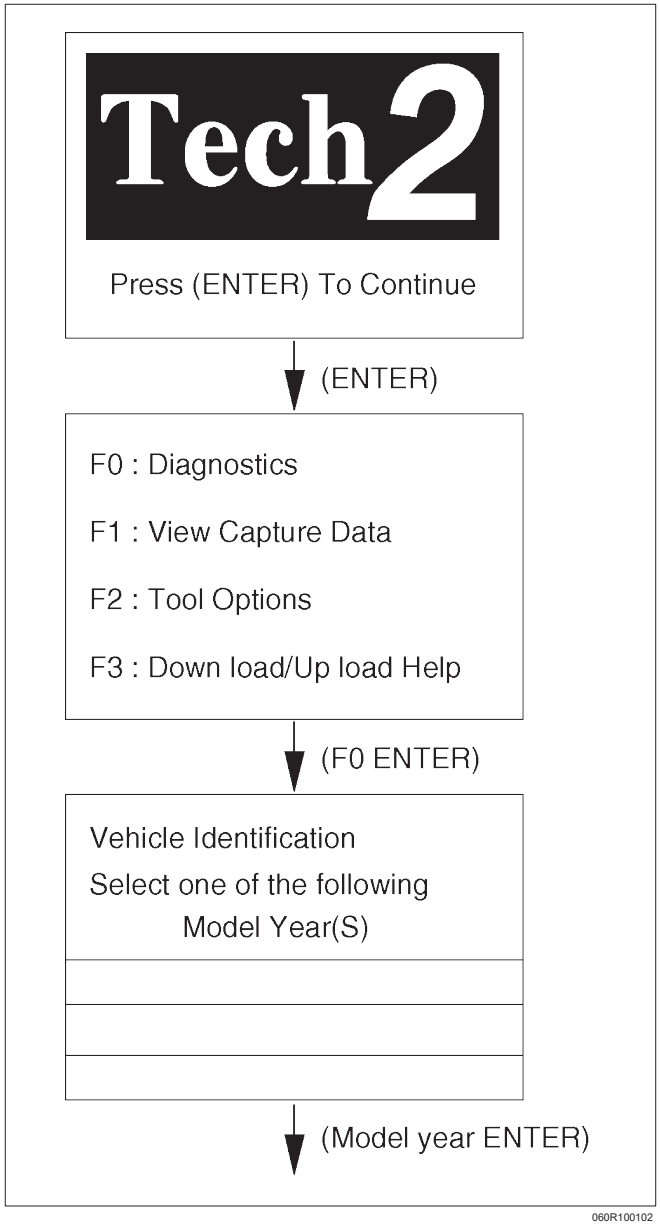


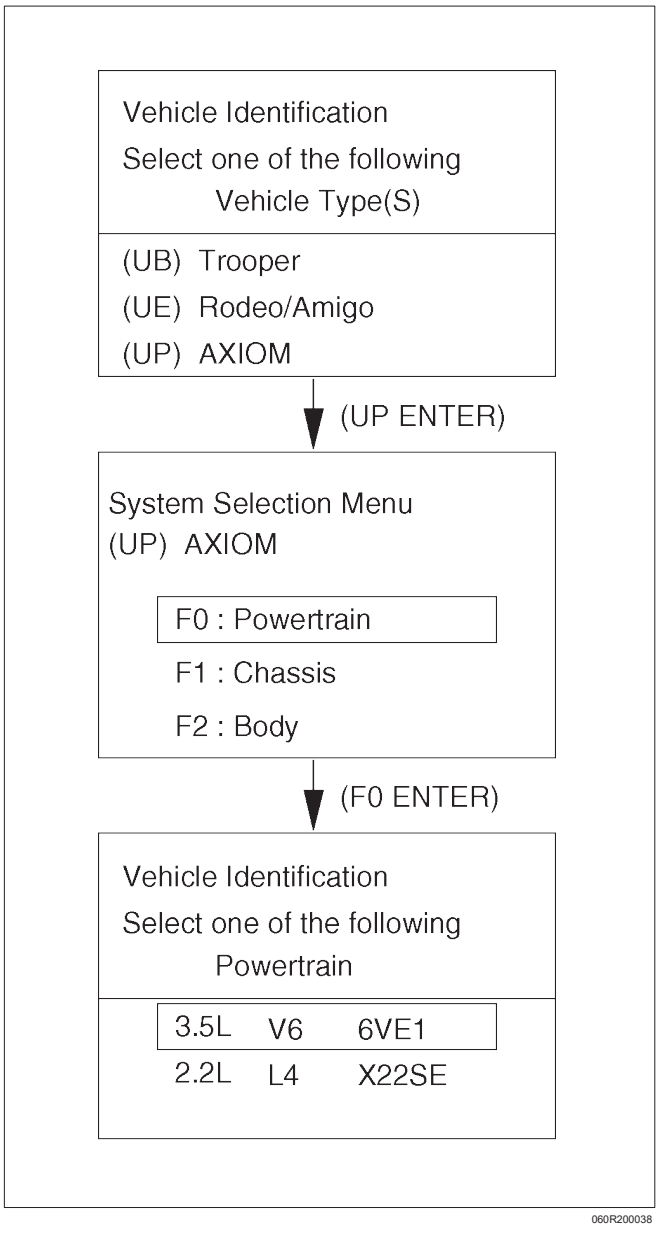

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NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2. Refer to user guide of the Tech 2.

## Operating Procedure (For Example)

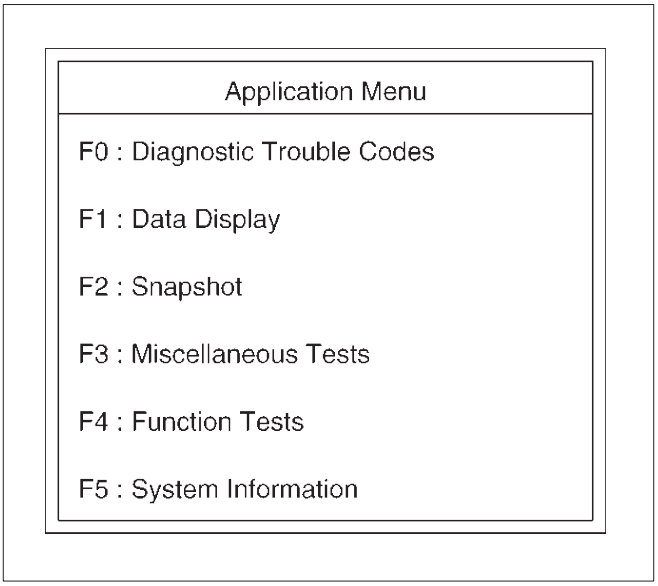
The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



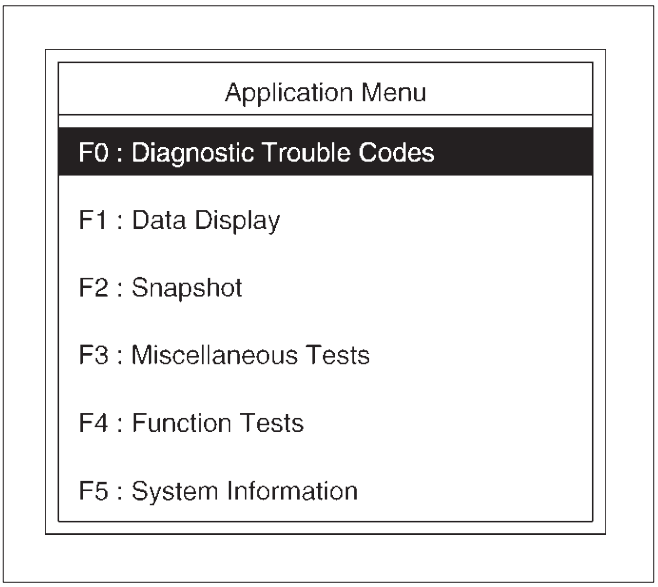
**Menu**

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




060R100018

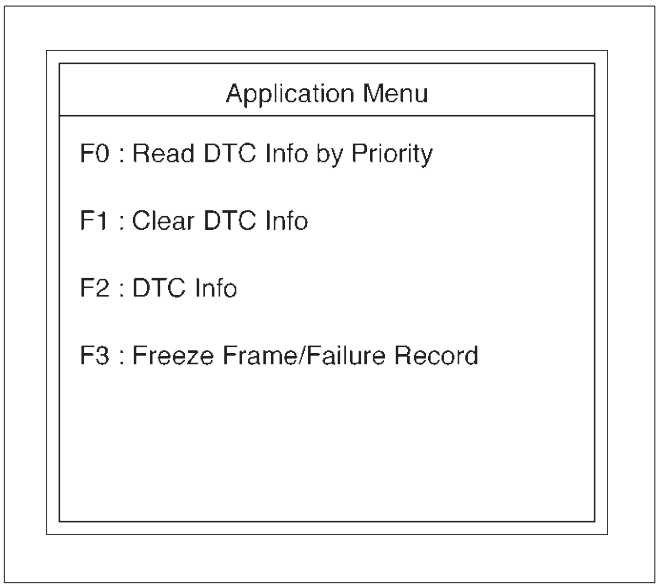
## DTC Modes




060R100077

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

1. Read DTC Info by Priority
2. Freeze Frame
3. Fail Records (not all applications)
4. DTC Info
5. 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.

**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 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 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

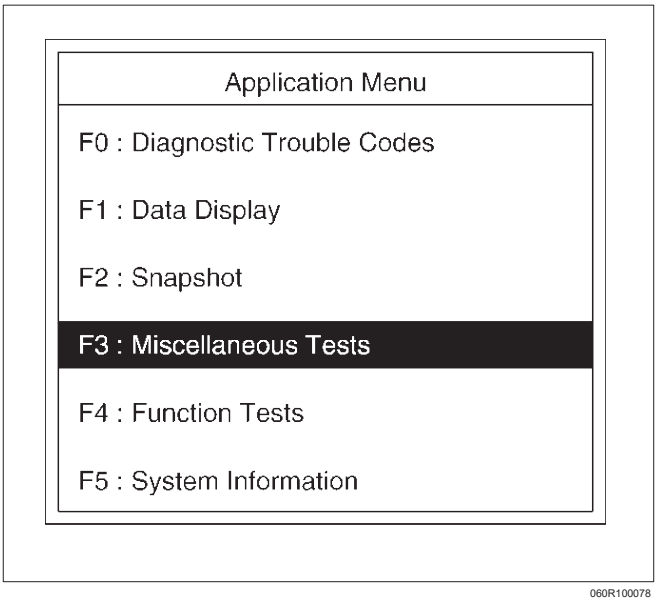
This test consists of eight menus-Lights, Relays, EVAP, Fuel System, Instruments, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.
In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.
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. Down load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

## Lamps Test

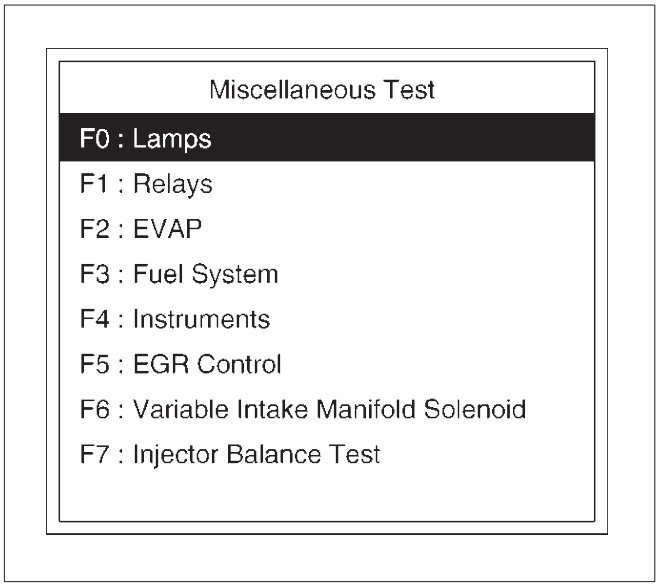
This test is conducted check MIL, Up Shift Lamp, Low Fuel Lamp, Reduced Power Lamp and Cruise Control Lamp for its working.
Tech2 must be used for this test.
Test Procedure:

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



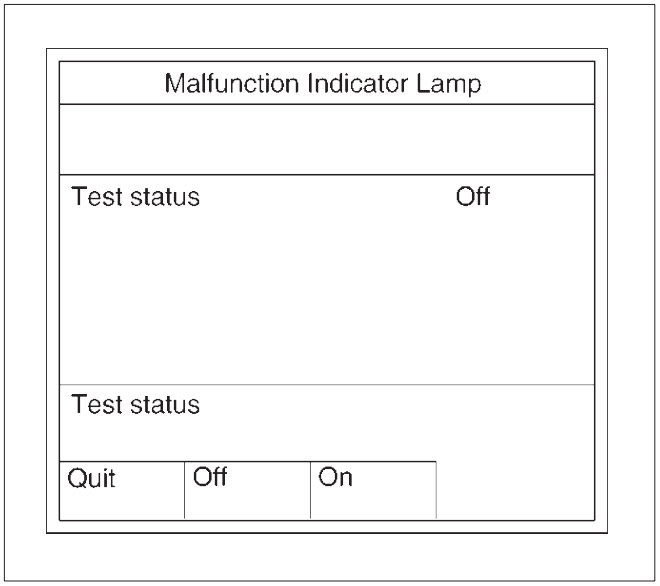

060R100078

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




060RY00080

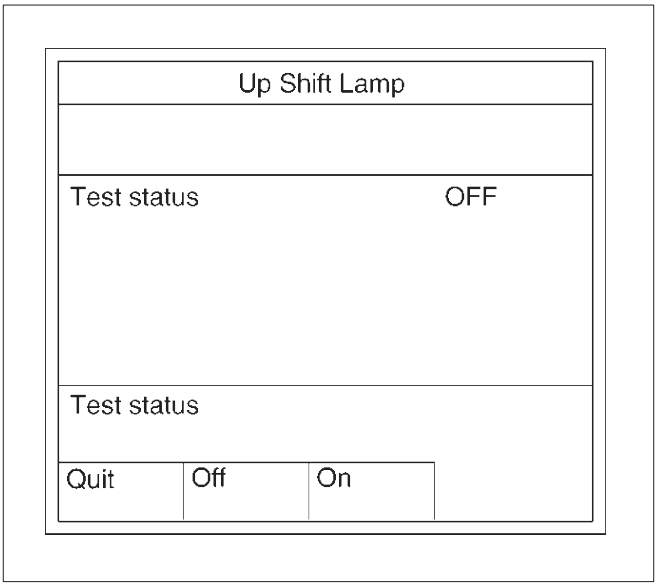
5. Select F0:Malfunction Indicator Lamp.




060RY00091

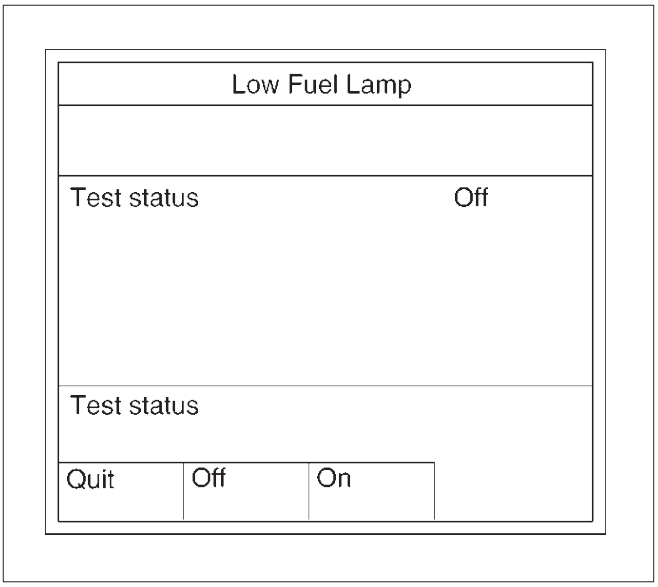
6. Push”On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.

9. Select F2: Up Shift Lamp




060RY00076

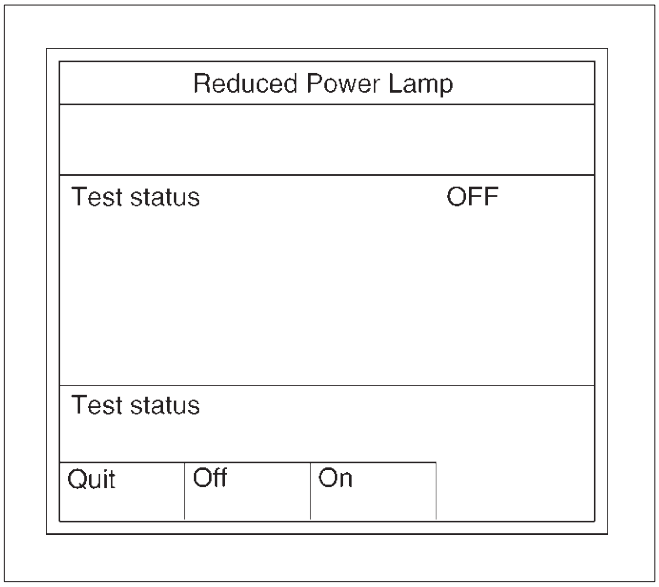
10. Push “On” soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operating correctly.
13. Select F2:Low Fuel Lamp




060RY00092

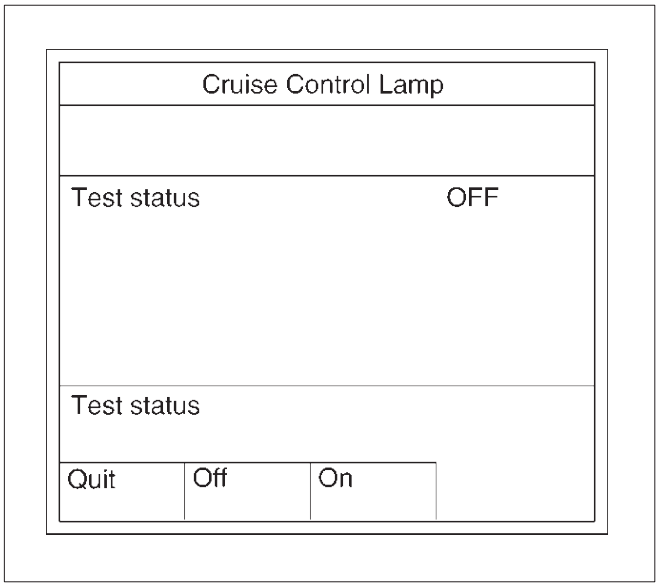
14. Push “On” soft key.
15. Make sure Lamp illuminates.
16. If Lamp illuminates, the Lamp is operating correctly.

17. Select F3:Reduced Power Lamp




060RY00077

18. Push “On” soft key.
19. Make sure Lamp illuminates.
20. If Lamp illuminates, the Lamp is operating correctly.
21. Select F5:Cruise Control Lamp



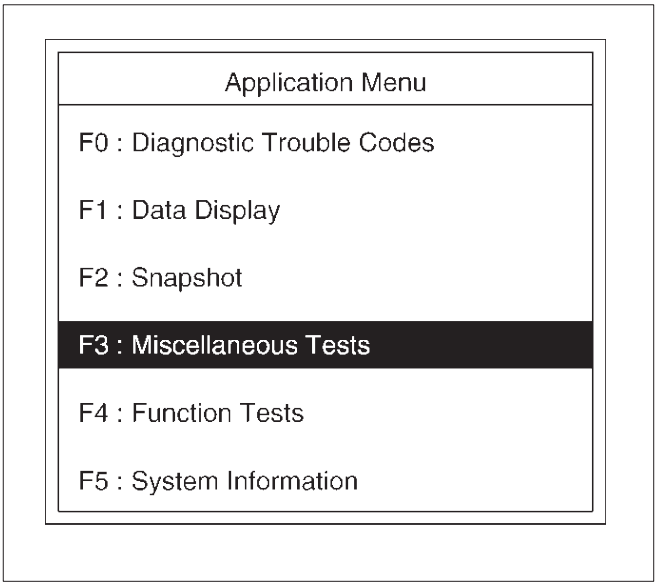

060RY00078

22. Push “On” soft key.
23. Make sure Lamp illuminates.
24. If Lamp illuminates, the Lamp is operating correctly.

## Relays Test

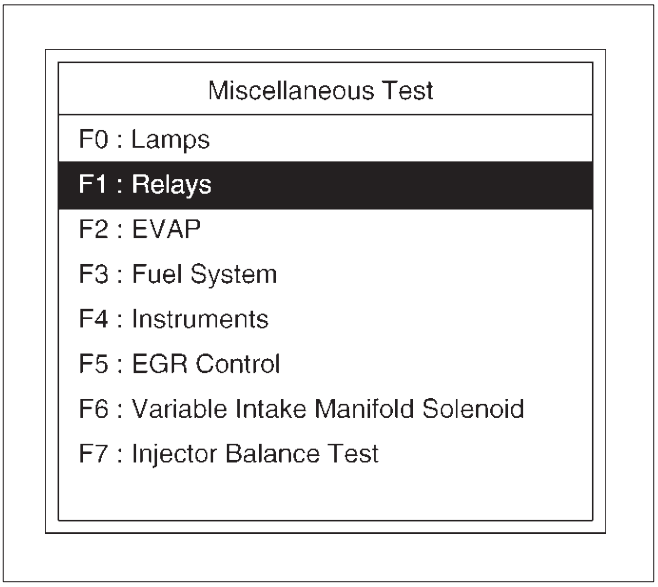
This test is conducted to check Fuel Pump Relay and A/C Clutch for proper operation.
Tech 2 must be used for this test.
Test Procedure:

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



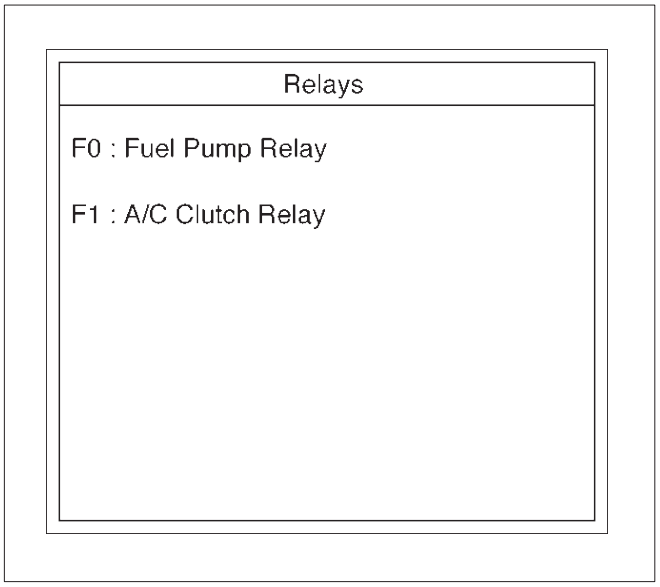

060R100078

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



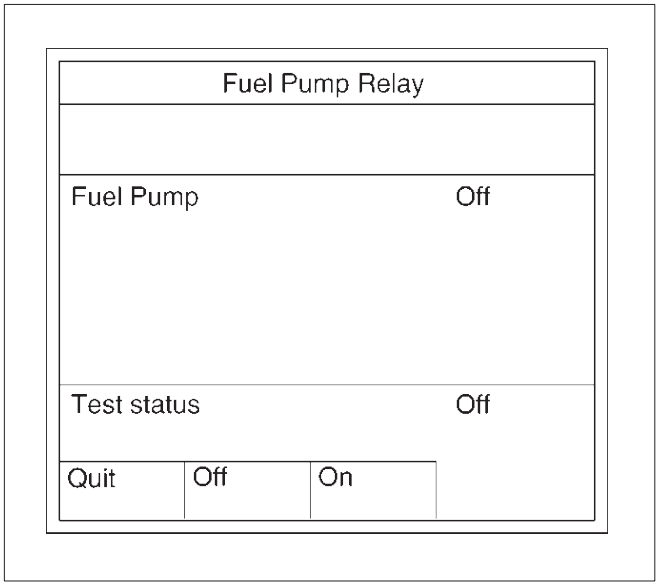

060RY00081

5. Select F0:Fuel Pump Relay.




060RX021

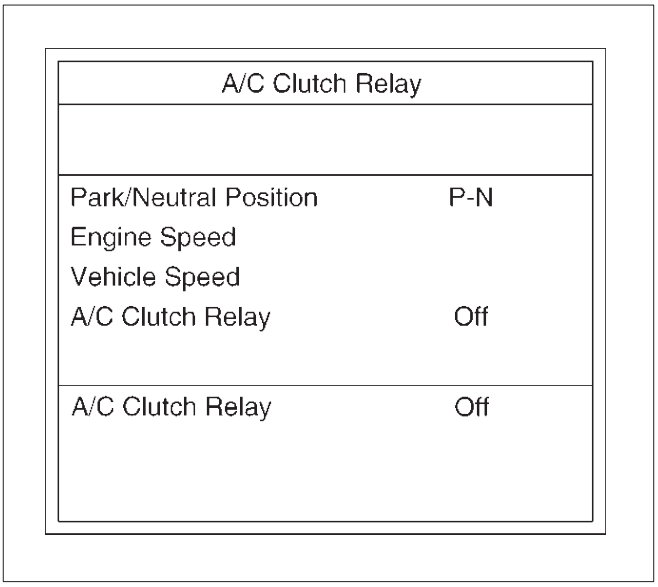
6. Push “On” soft key.




060RY00093

7. Control Fuel Pump Relay and check data list.
8. If the data list changes, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. Run the Engine at idle.

11. Turn on Air Conditioning.



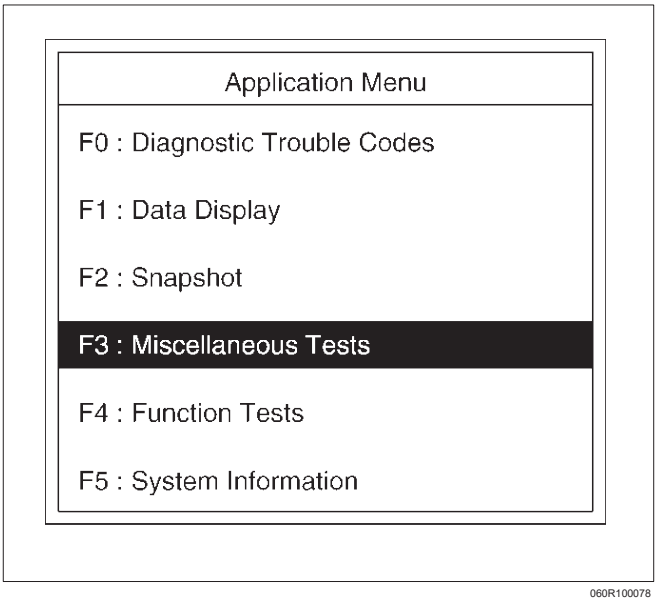

060RY00094

12. Turn “On” and “Off” A/C Switch.
13. Contol A/C Clutch Relay and check data list.
14. If the data list changes, the Fuel Pump Relay is normal.

## EVAP Test

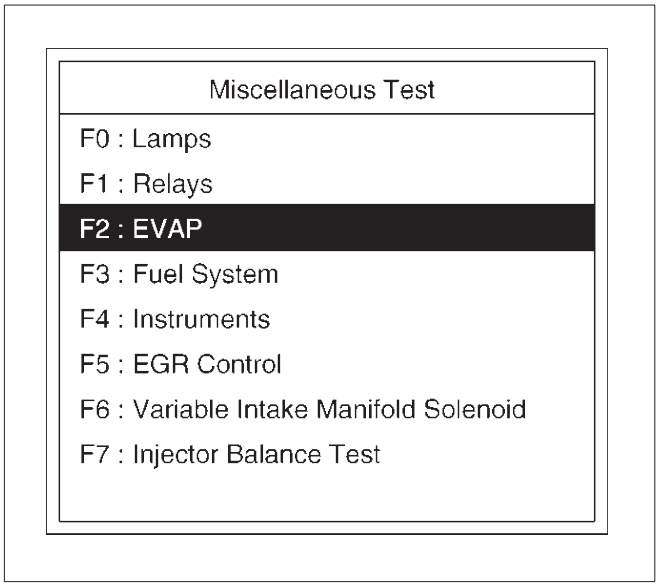
This test is conducted to check EVAP system for its power operation.
Tech 2 must be used for this test.
Test Procedure:

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



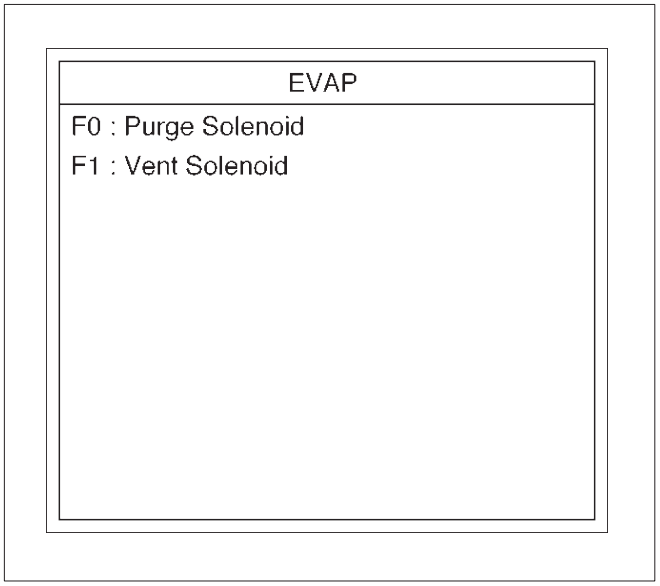

060R100078

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



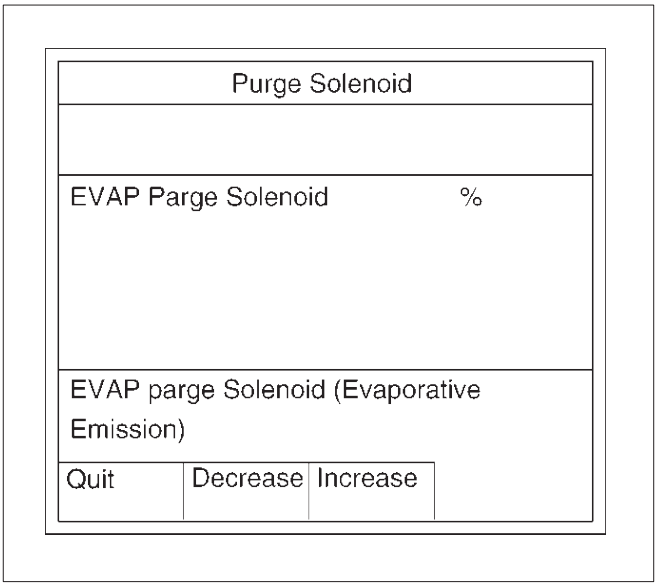

060RY00082

5. Select F0: Purge Solenoid.



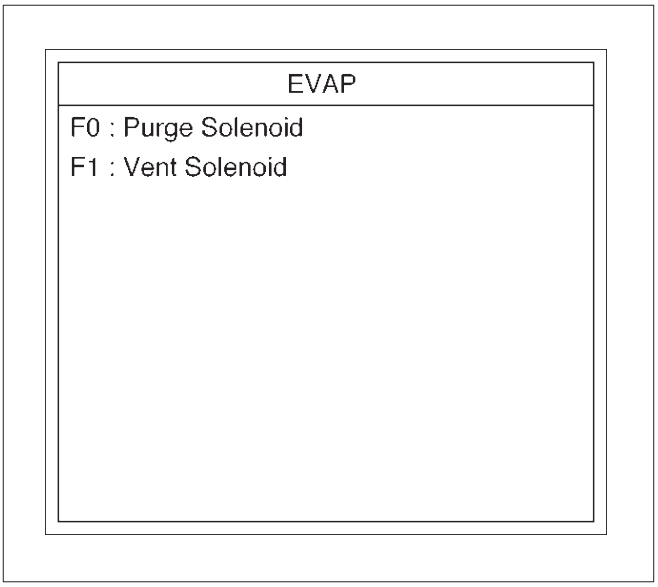

060RX025

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



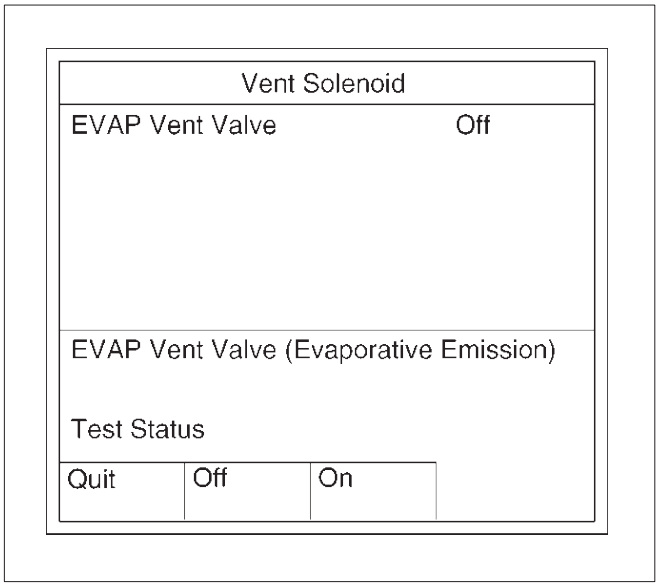

060RY00095

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




060RX025

11. Push “On” or “Off” soft key.



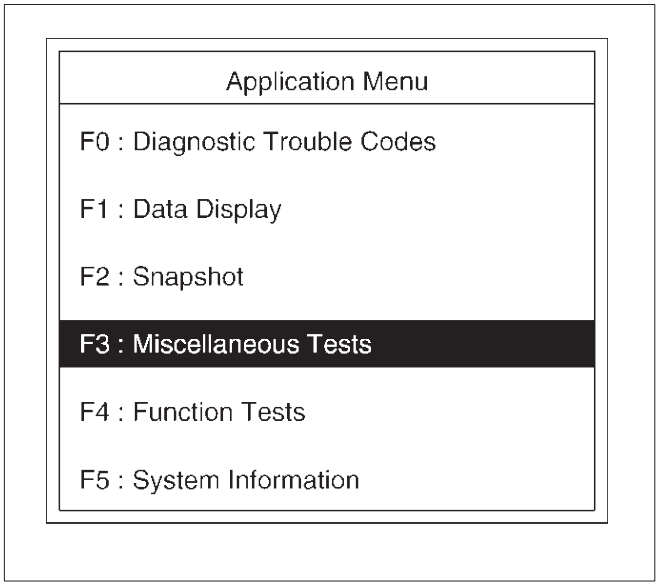

060RY00096

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

## Fuel System Test

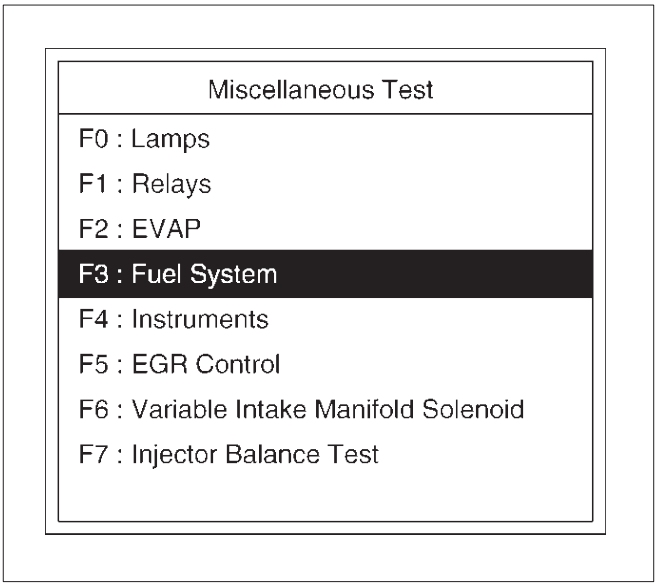
This test is conducted check Fuel system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

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



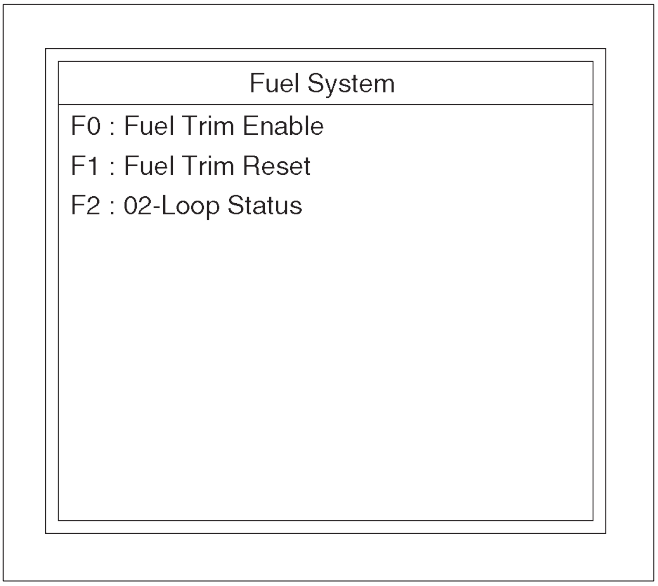

060R100078

4. Select F3: Fuel System in the Miscellaneous Menu.



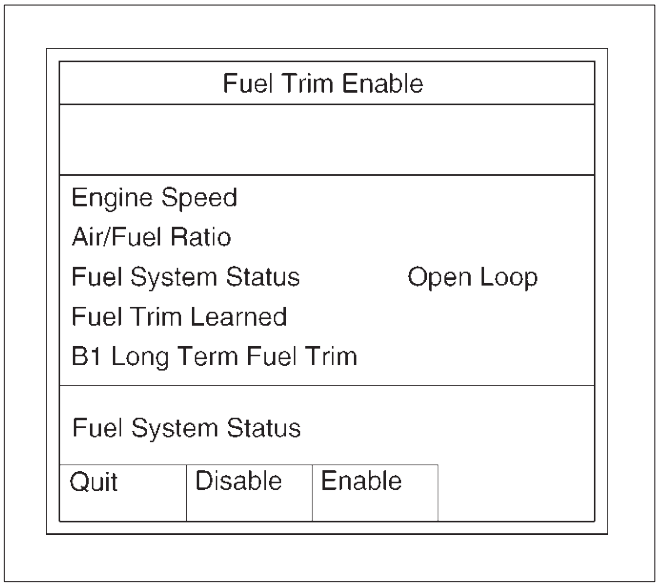

060RY00083

5. Select F0: Fuel Trim Enable.



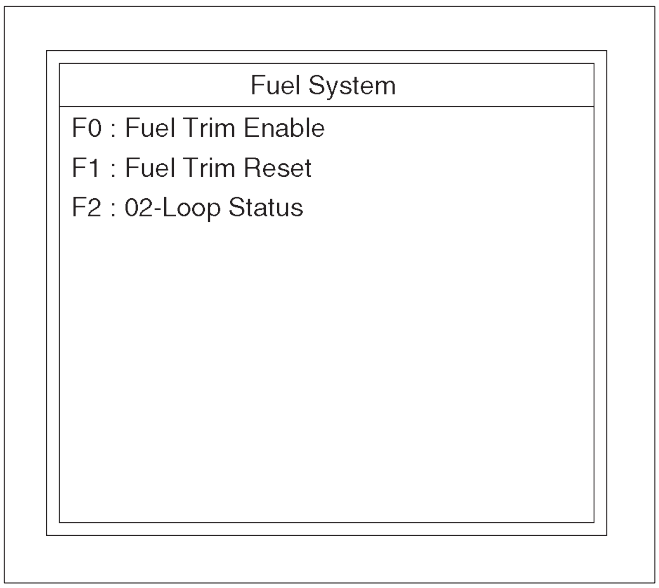

060R200071

6. Push “Disable” or “Enable” soft key.



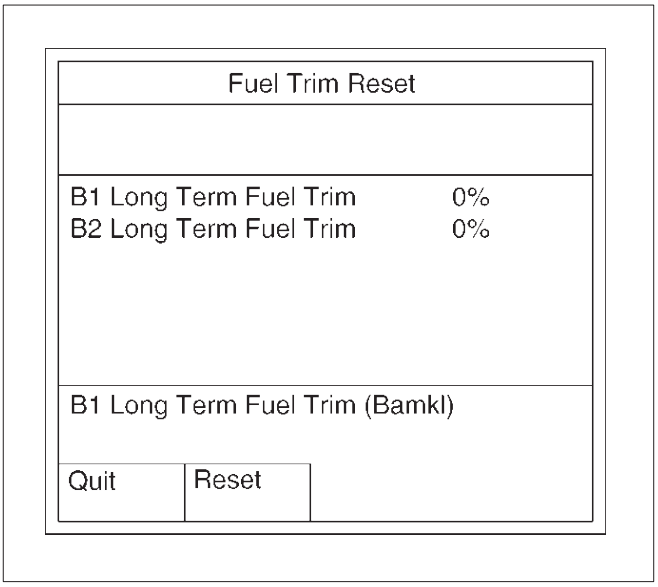

060RY00097

7. Control Fuel Trim and check data list.
8. If data list changes, the Fuel Trim is normal.
9. Select F1: Fuel Trim Reset.



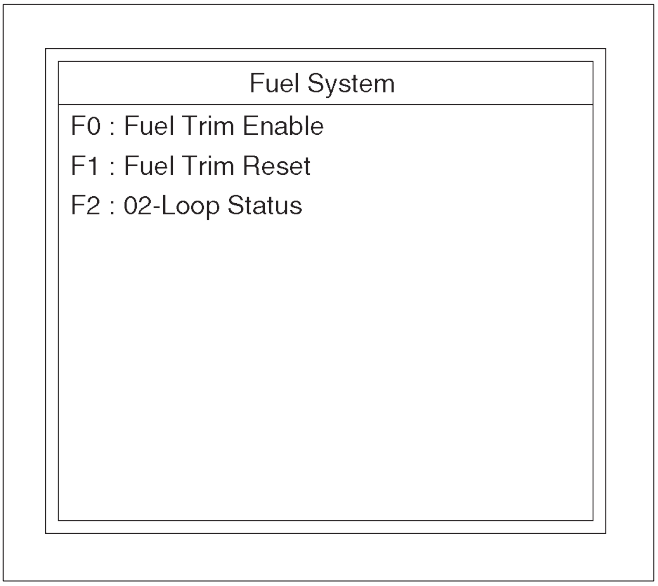

060R200071

10. Push “Reset” soft key.




060RY00098

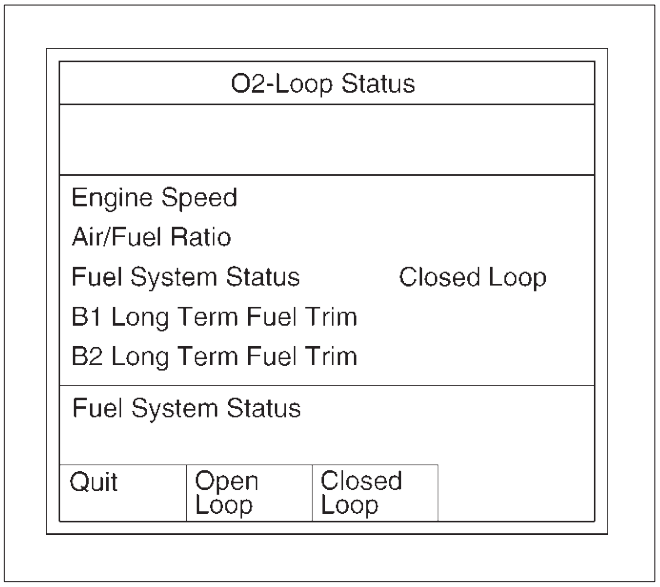
11. Select F2: O2-Loop status.




060R200071

12. This test is check the “Closed Loop Status” performance.

13. Push “Open Loop” or “Closed Loop” soft key.



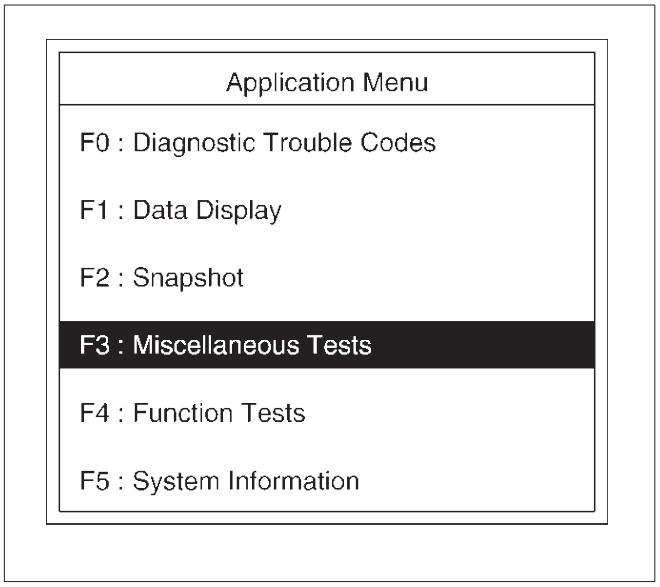

060RY00099

14. Control O2-Loop and check data list.
15. If data list changes, the O2-Loop is normal.

## Instruments Test

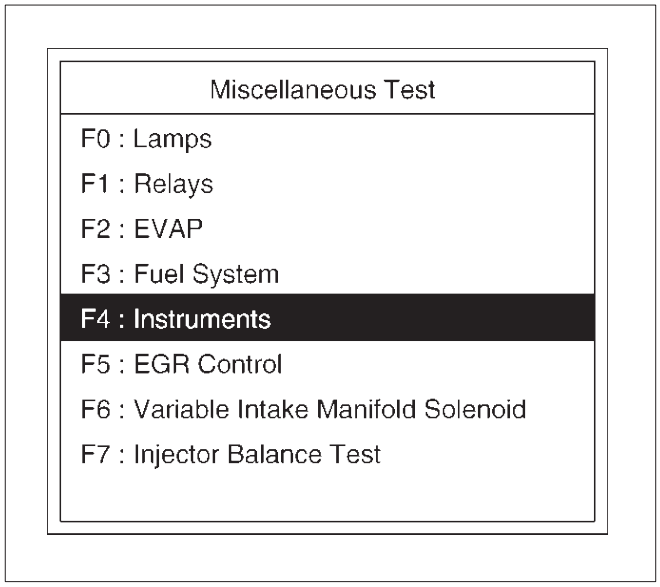
This test is conducted check Instruments for proper operation.
Tech 2 must be used for this test.
Test Procedure:

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



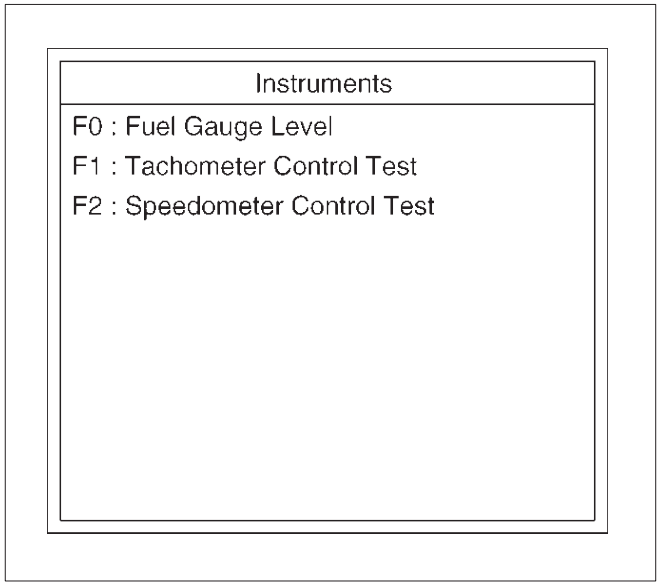

060R100078

4. Select F4: Instruments in the Miscellaneous Menu.



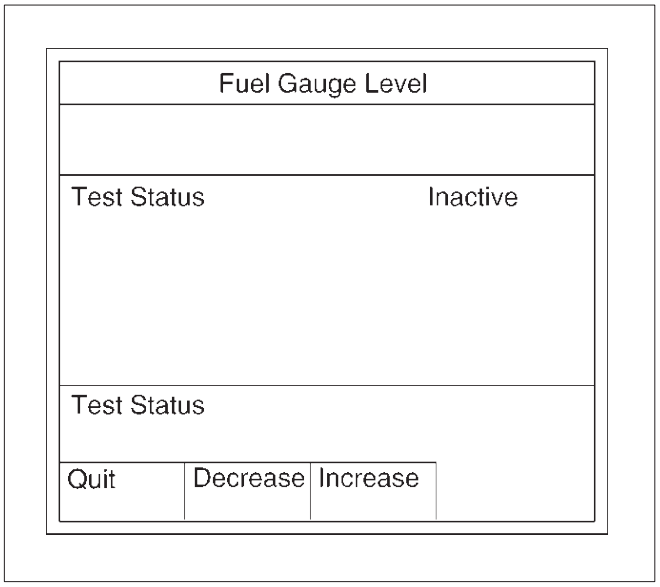

060RY00106

5. Select F0: Fuel Gauge level.



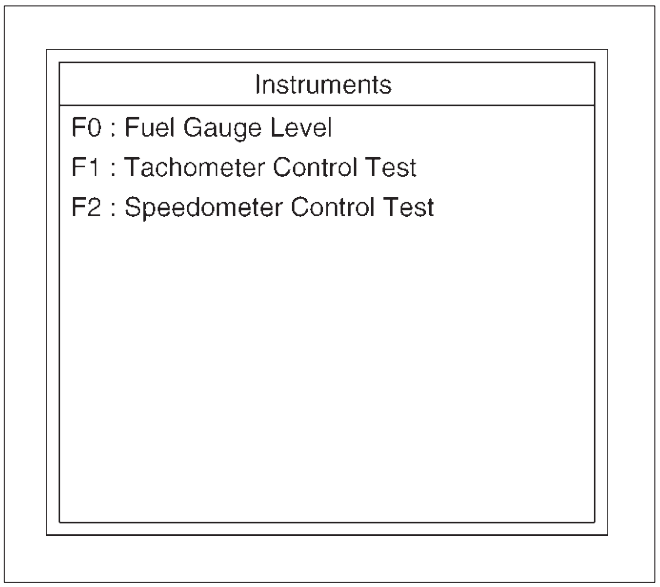

060RY00107

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



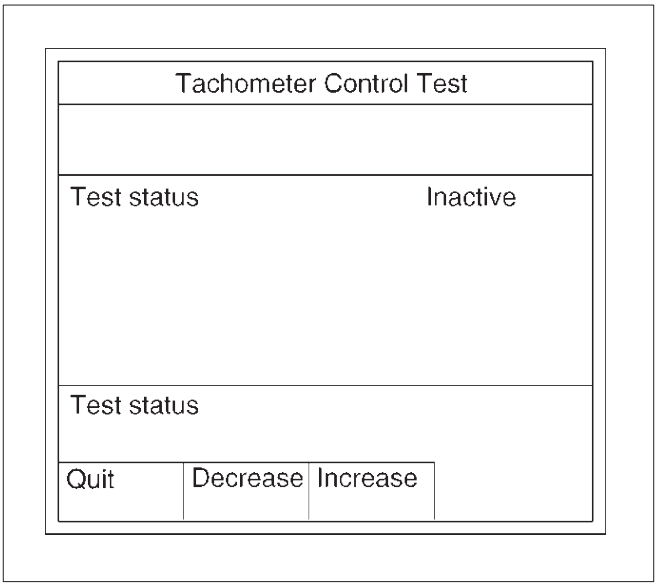

060RY00100

7. Control Fuel Level and check data list.
8. If data list and Fuel gauge meter changes, Fuel Gauge level is normal.
9. Select F1: Tachometer Control Test.




060RY00107

10. Push “Inactive” or “active” soft key.



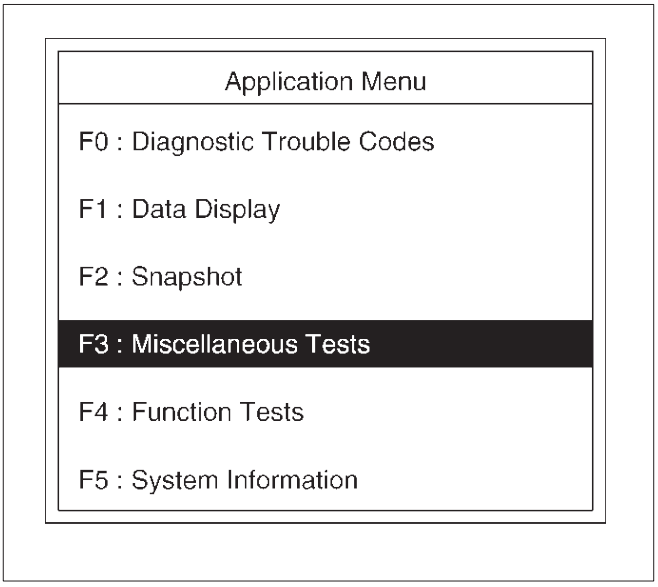

060RY00101

11. Control tachometer and data list.
12. If data list and meter changes, the tachometer control is normal.

## EGR Control Test

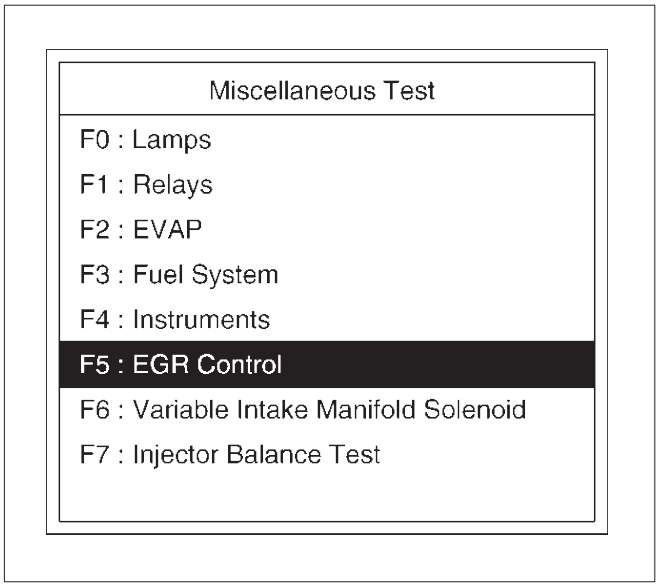
This test is conducted check EGR valve for proper operation.
Tech 2 must be used for this test.
Test Procedure:

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



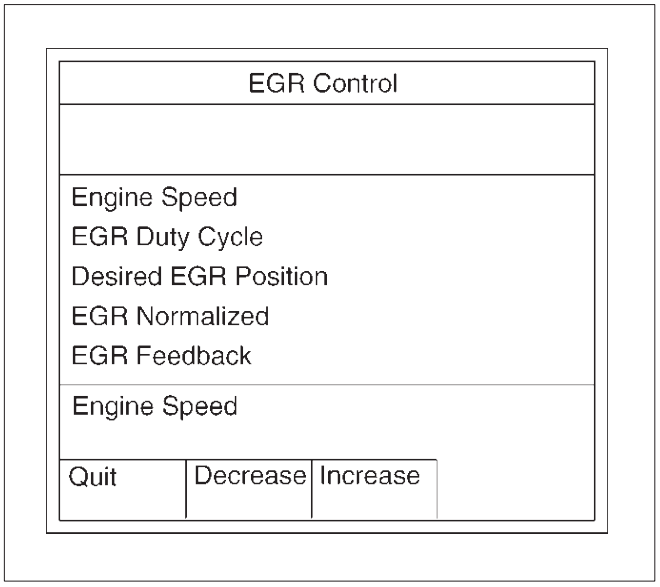

060R100078

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




060RY00084

5. Control EGR Valve and check data list.




060RY00103

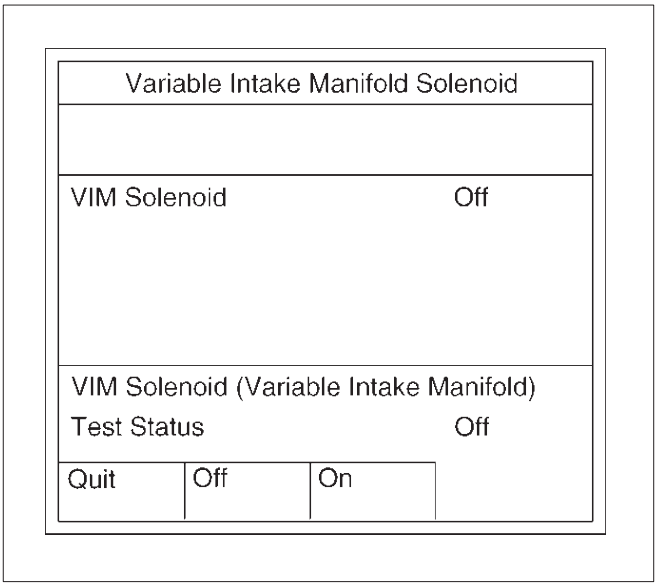
6. If data list changes, the EGR Control is normal.

## Variable Intake Manifold Solenoid Test

This test is conducted check VIM Solenoid for proper operation.
Tech 2 must be used for this test.
Test Procedure:

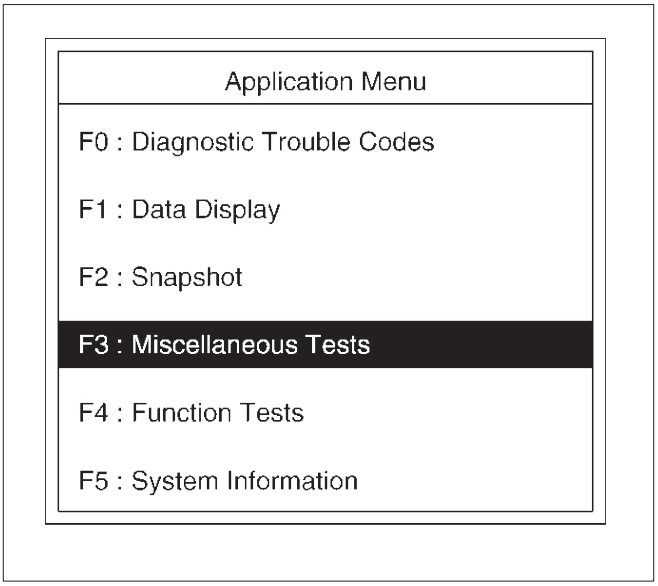
1. Connect Tech 2 to the vehicle DLC.

2. Ignition SW is “On”.



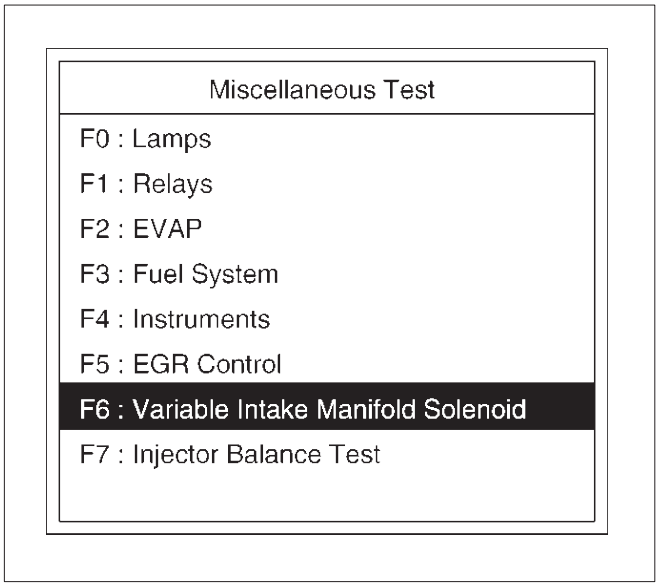

060RY00104

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



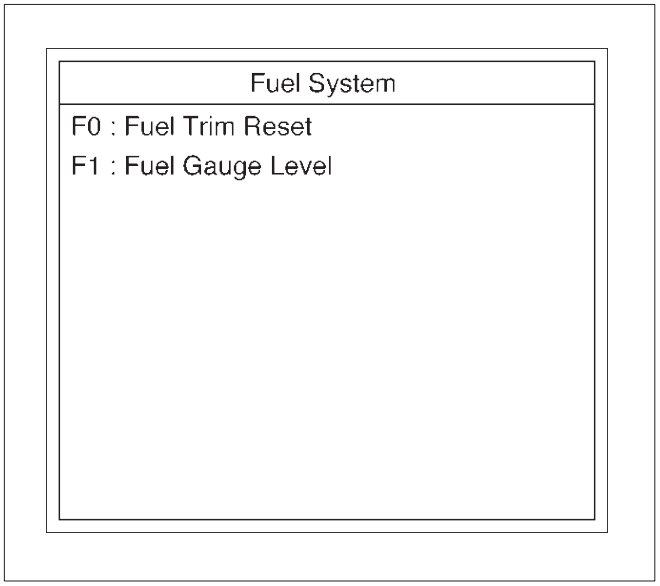

060R100078

4. Select F6: Variable Intake Manifold Solenoid Test.




060RY00085

5. Push “On” or “Off” soft key.



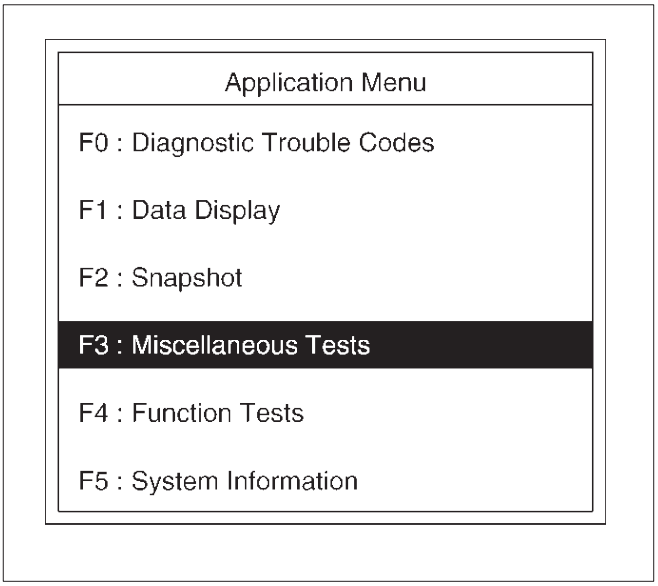

060RX028

6. Control VIM Solenoid check data list.
7. If data list changes, the VIM Solenoid is normal.

## Injector Balance Test

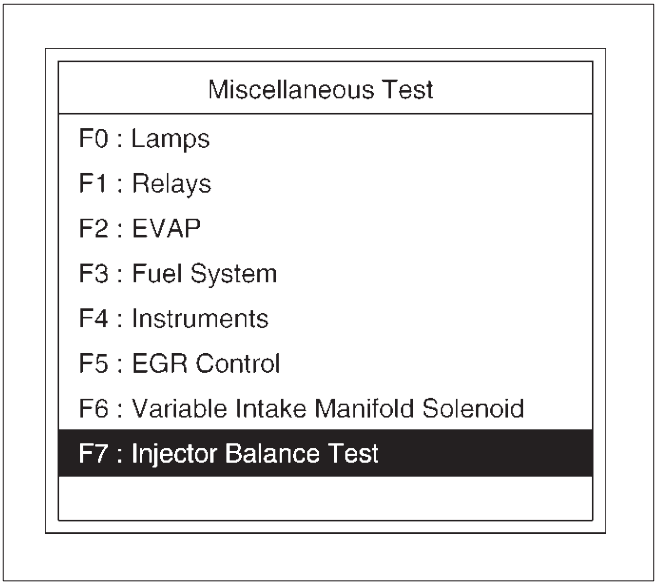
This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6. Tech 2 must be used for this test.
Test Procedure:

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



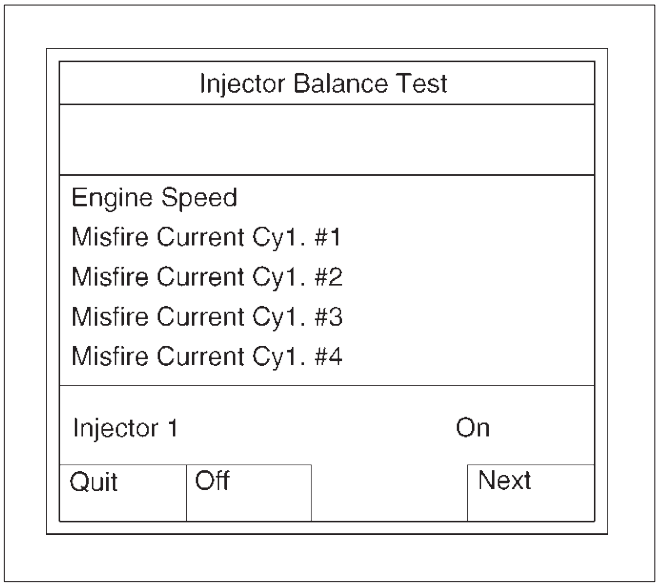

060R100078

4. Select F7: Injector Balance Test in the Miscellaneous Test.




060RY00086

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

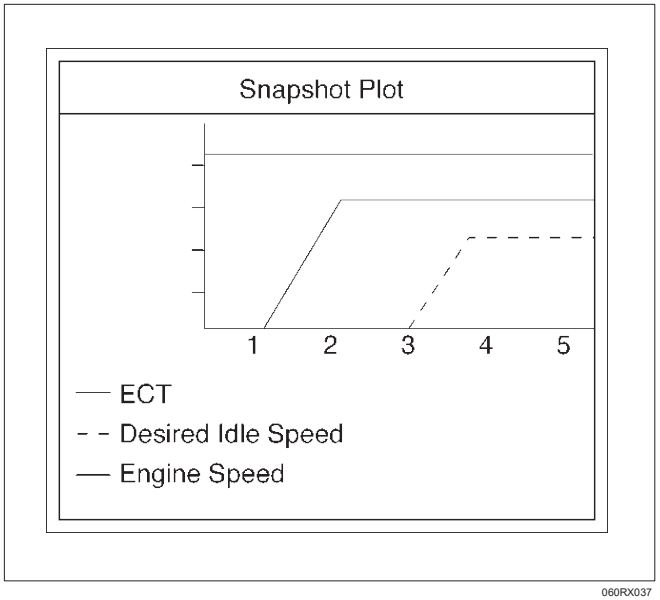



060RY00105

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

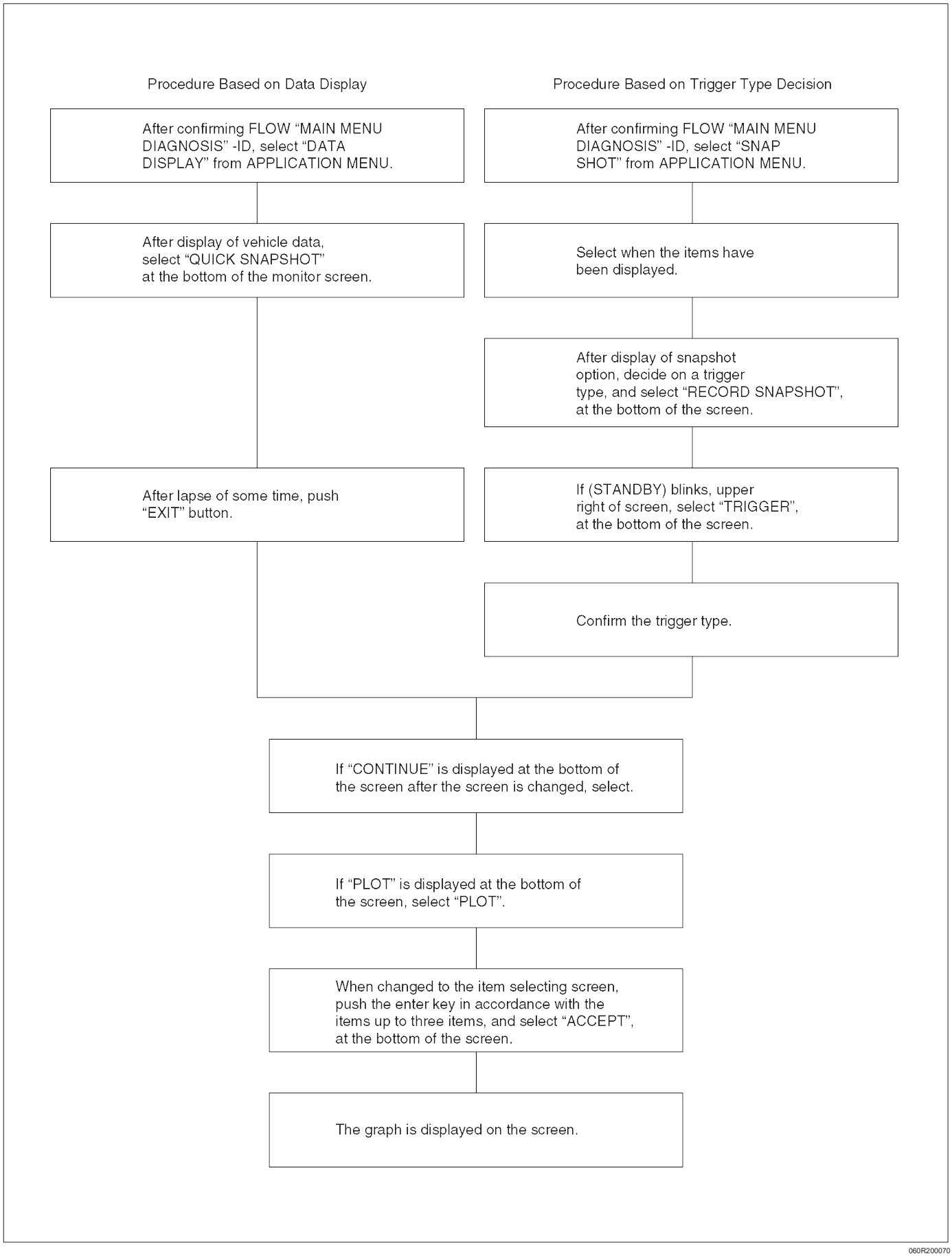
This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.




060RX037

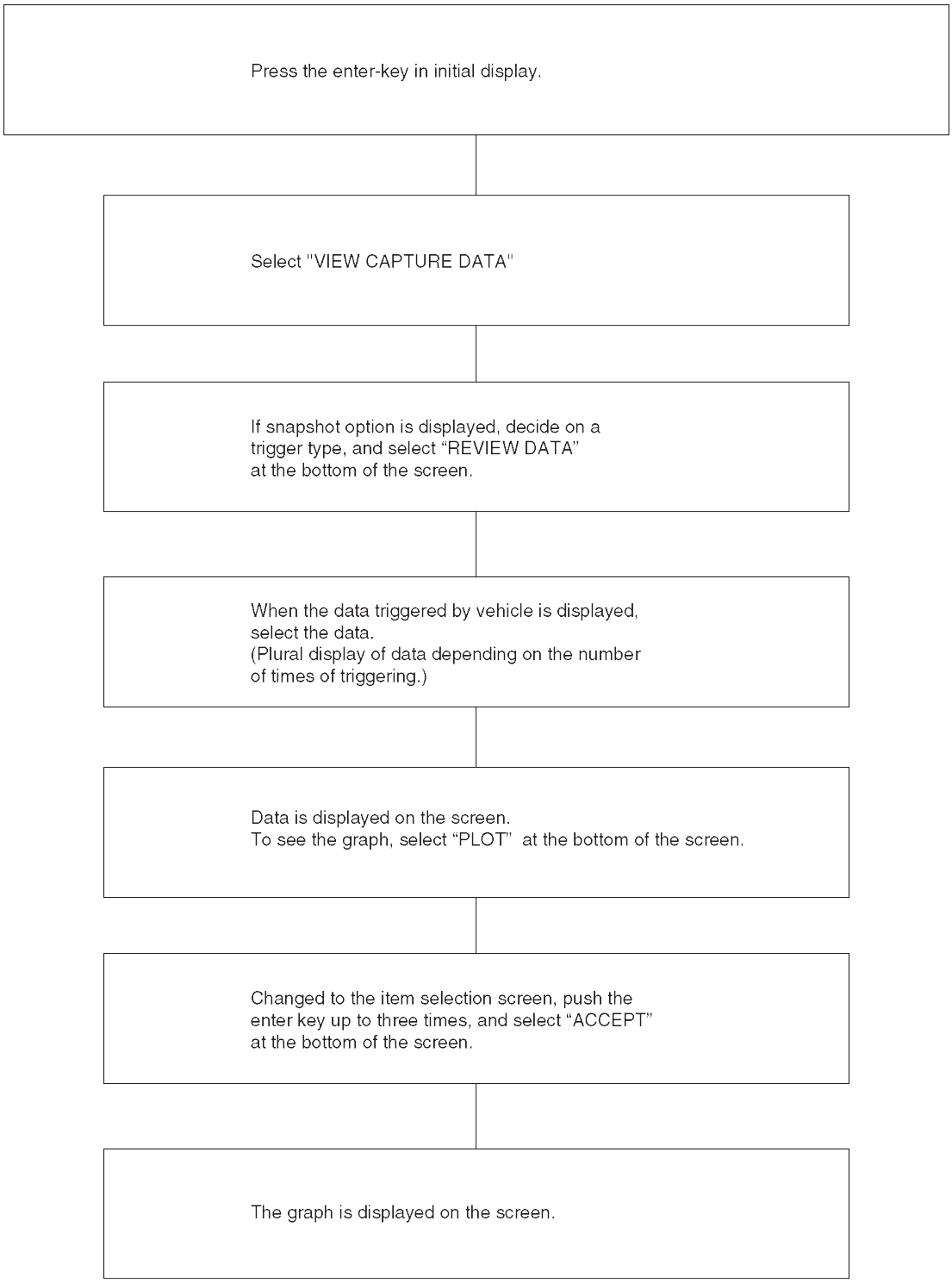
For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.
You can replay the snapshot data as needed. Therefore, accurate diagnosis is possible, even though the vehicle is not available.

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




060R200070

## Flow Chart for Snapshot Replay (Plotting Graph)




060R200072

# Primary System-Based Diagnostic

## Primary System-Based Diagnostic

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 sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are 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 sensors (Bank 1 HO2S 2 and Bank 2 HO2S 2) are 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* in this section.

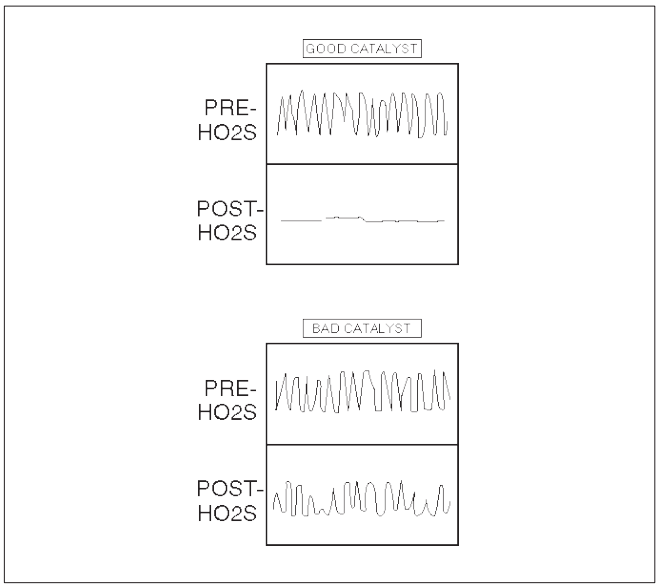
## Fuel Control Heated Oxygen Sensor

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 sensors (Bank 1 HO2S 1 and Bank2 HO2S 1) to become active. Oxygen sensor heaters are required by catalyst monitor and sensor (Bank 1 HO2S 2 and Bank 2 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




TS24067

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 3.5L w/automatic transmission, the pre-catalyst sensors are designated Bank 1 HO2S 1 and Bank 2 HO2S 1. The post-catalyst sensors are Bank 1 HO2S 2 and Bank 2 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 seconds stage then looks at the inputs for 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

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

The misfire ratio is calculated once every 100 engine cycles. For example, on a 6-cylinder engine, 600 ignition plug sparks occur every 100 cycles and if a misfire occurs 12 times during that time, the misfire is $12/600 \times 100 = 2$ %.

## 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 #1-6) indicate the number of firing events out of the last 100 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 #1-6) 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 100 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 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. Misfires are counted from more than one cylinder. Cylinder #1 has the majority of counted misfires. In this case, the Misfire Counters would identify cylinder #1 as the misfiring cylinder. The misfires in the other counters were just background noise caused by the erratic misfire rotation of the crankshaft. If the number of accumulated misfires is sufficient for the diagnostic to identify a true misfire, the diagnostic will set DTC P0300 – Misfire Detected.

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 counter 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 “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

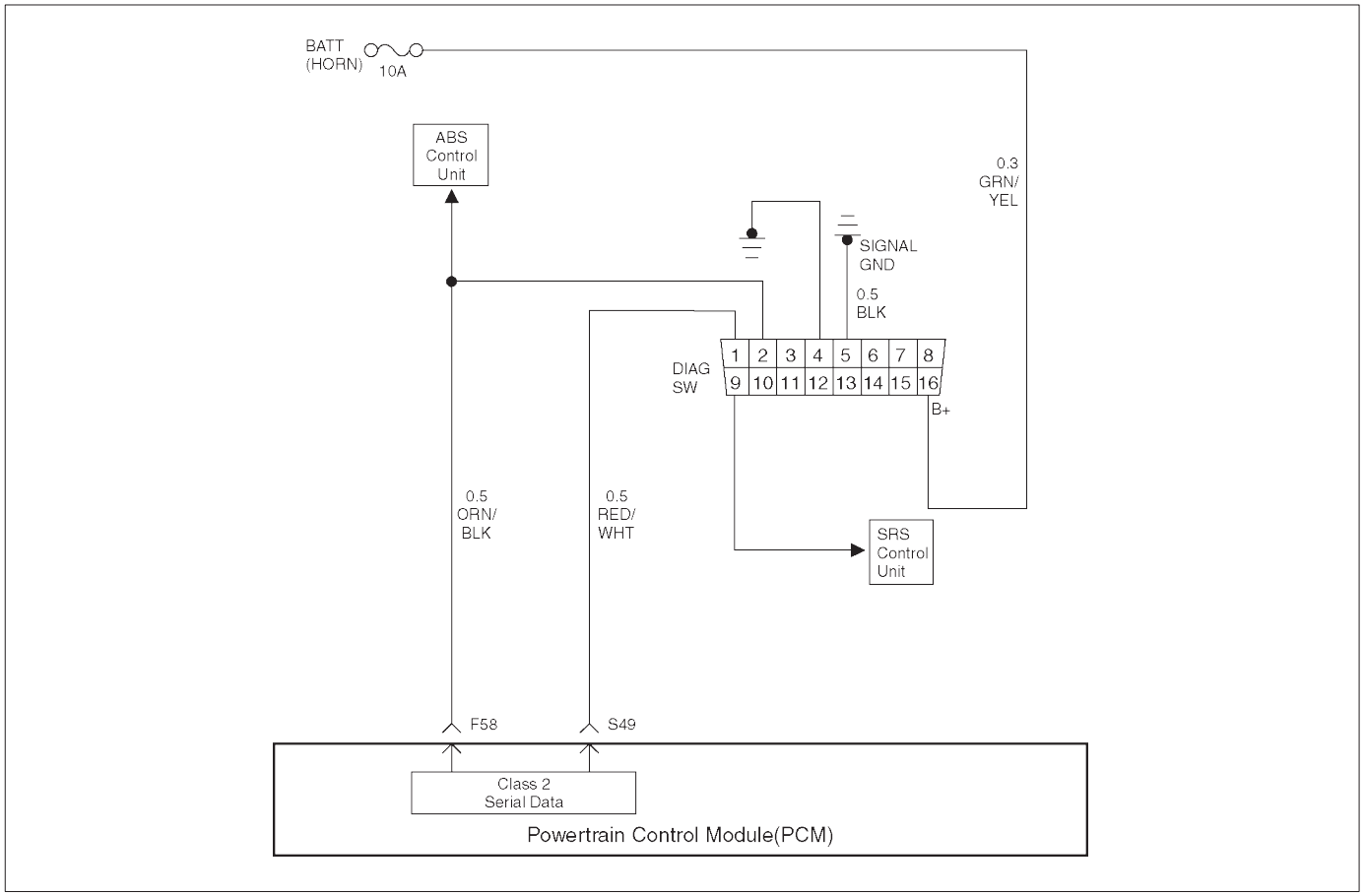
## Fuel Trim System Monitor Diagnostic Operation

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




060R200048

## 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 connector 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 ” and the engine “OFF”. If not, the “No MIL” chart should be used to isolate the malfunction.
2. The RPL (“Reduced Power lamp”) should be “ON” steady with the ignition “ON ”and the engine “OFF”. If not, the “No RPL”chart should be used to isolate the malfunction.
3. Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.
4. This test ensures that the PCM is capable of controlling the MIL (“Check Engine lamp”) and the MIL (“Check Engine lamp”) driver circuit is not shorted to ground.
5. This test ensures that the PCM is capable of controlling the RPL (“Reduced Power lamp”) and the RPL (“Reduced Power lamp”) driver circuit is not shorted to ground.
7. Check the DTCs (System ,Volts Supply circuit).
8. Check the DTCs (PCM{Software} detect Errors).
11. If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.
14. A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.
15. 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* of this section.
10. If the starter motor will not start, the starter control system chart should be used to diagnose the condition.

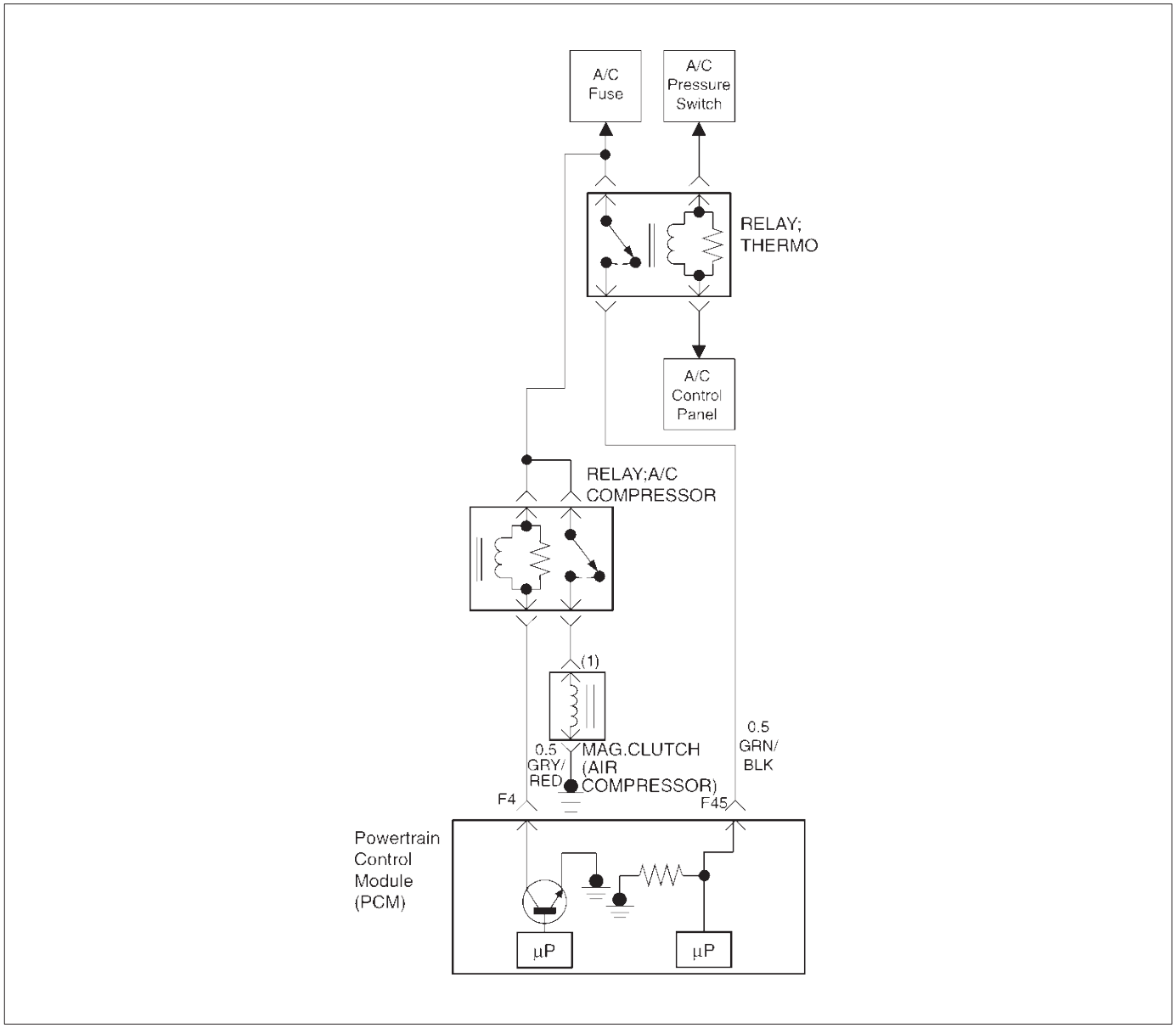
# On-Board Diagnostic (OBD II) System Check

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | 1. Ignition “ON”, engine “OFF”.<br>2. Observe the malfunction indicator lamp (MIL or “Check Engine lamp”).<br>Is the MIL (“Check Engine lamp”)“ON”? | — | Go to *Step 2* | Go to *No MIL(“Check Engine lamp”)* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Observe the “Reduced Power lamp”.<br>Is the RPL (“Reduced Power lamp”) “ON”? | — | Go to *Step 3* | Go to *No RPL(“Reduce d Power lamp”)* |
| 3 | 1. Ignition “OFF”.<br>2. Install Tech 2.<br>3. Ignition “ON”.<br>4. Attempt to display PCM engine data with the Tech 2.<br>Does the Tech 2 display PCM data? | — | Go to *Step 4* | Go to *Step 12* |
| 4 | 1. Using the Tech 2 output tests function, select MIL (“Check Engine lamp”) control and command the MIL (“Check Engine Lamp”) “OFF”.<br>2. Observe the MIL (“Check Engine lamp”).<br>Did the MIL (“Check Engine lamp”) turn “OFF”? | — | Go to *Step 5* | Go to *MIL(“Check Engine lamp”) On Steady* |
| 5 | 1. Using the Tech 2 output tests function, select MIL (“Check Engine lamp”) control and command the RPL (“Reduced Power lamp”) “OFF”.<br>2. Observe the RPL (“Reduced Power lamp”).<br>Did the MIL (“Reduced Power lamp”) turn “OFF”? | — | Go to *Step 6* | Go to *RPL(“Reduce d Power lamp”) On Steady* |
| 6 | Select “Display DTCs” with the Tech 2.<br>Are any DTCs stored? | — | Go to *Step 7* | Go to *Step 11* |
| 7 | Stored DTCs.<br>P0562, P0563, P0601, P0602, P0604, P0606, P1625, P1635, P1639, P1640, P1650<br>Are the applicable DTCs stored? | — | Go to *applicable DTC table* | Go to *Step 8* |
| 8 | Stored DTCs.<br>P1514, P1515, P1516, P1523, P1125, P1290, P1295, P1299<br>Are the applicable DTCs stored? | — | Go to *applicable DTC table* | Go to *Step 9* |
| 9 | Stored DTCs.<br>1. P0425, P0106, P0107, P1107, P0401, P1404, P0405, P1120, P1221, P1515, P1516, P1275, P1635, P1271, P1273, P1285, P1272<br>2. P0336, P0337, P1220, P1515, P1221, P1516, P1280, P1639, P1271, P1272<br>Are the applicable DTCs stored? | — | Go to *“Multiple PCM Information sensor DTCs Set”* | Go to *Step 10* |
| 10 | Attempt to crank the starter motor<br>Did the starter motor crank? | — | Go to *Step 10* | Go to *Starter control system* |
| 11 | Attempt to start the engine.<br>Did the engine start and continue to run? | — | Go to *Step 6* | Go to *Cranks But Will Not Run* |

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

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | Compare PCM data values displayed on the Tech 2 to the typical engine scan data values.<br>Are the displayed values normal or close to the typical values? | — | Go to *Symptom* | Refer to *indicated Component System Checks* |
| 13 | 1. Ignition "OFF", disconnect the PCM.<br>2. Ignition "ON", engine "OFF".<br>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 circuit for an open.<br>4. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 2* | Go to *Step 14* |
| 14 | 1. Attempt to reprogram the PCM. Refer to *Powertrain Control Module (PCM) in On-Vehicle Service.*<br>2. Attempt to display PCM data with the Tech 2.<br>Does the Tech 2 display PCM engine data? | — | Go to *Step 2* | Go to *Step 15* |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>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.<br>Is the action complete? | — | Go to *Step 2* | — |

# A/C Clutch Control Circuit Diagnosis




060R100063

## Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerant 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 canceled during system operation by the electronic thermostat in the evaporator case. 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, 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.

## Diagnostic Aids

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

- Poor connection at the PCM–Inspect 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. If the harness appears to OK, observe the A/C clutch while moving connectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent fault.

## 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 commanded 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.

## Test Description

**IMPORTANT:** Do not engage the A/C compressor clutch with the engine running if an A/C mode is not selected at the A/C control switch.

The numbers below refer to the step numbers on the Diagnostic Chart:

3. This a test determine is the problem is with the refrigerant system. If the switch is open, A/C pressure gauges will be used to determine if the pressure switch is faulty or if the system is partially discharged or empty.
4. Although the normal complaint will be the A/C clutch failing to engage, it is possible for a short circuit to cause the clutch to run when A/C has not been selected. This step is a test for that condition.
7. There is an extremely low probability that both relays will fail at the same time, so the substitution process is one way to check the A/C Thermostat relay. Use a known good relay to do a substitution check.

## 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 | Are any other DTCs stored? | — | Go to the other DTC chart(s) first | Go to *Step 3* |
| 3 | 1. Disconnect the electrical connector at the pressure switch located on the receiver/drier.<br>2. Use an ohmmeter to check continuity across the pressure switch.<br>Is the pressure switch open? | — | Go to Air *Conditioning* to diagnose the cause of the open pressure switch | Go to *Step 4* |
| 4 | **IMPORTANT:** Before continuing with the diagnosis, the following conditions must be met:<br>• The intake air temperature must be greater than 15˚C. (60˚F).<br>• The engine coolant temperature must be less than 119˚C (246˚F).<br>1. A/C "OFF".<br>2. Start the engine and idle for 1 minute.<br>3. Observe the A/C compressor.<br>Is the A/C compressor clutch engaged even though A/C has not been requested? | — | Go to *Step 37* | Go to *Step 5* |
| 5 | 1. Idle the engine.<br>2. A/C "ON".<br>3. Blower "ON".<br>4. Observe the A/C compressor.<br>Is the A/C compressor magnetic clutch engaged? | — | Refer to *Diagnostic Aids* | Go to *Step 6* |
| 6 | 1. Engine idling.<br>2. A/C "ON".<br>3. Blower "ON".<br>4. Observe the "A/C Request" display on the Tech 2. (Refer to the Miscellaneous test)<br>Does the tool "A/C Request" display indicate "Yes"? | — | Go to *Step 26* | Go to *Step 7* |

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

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | Temporarily substitute the A/C compressor relay in place of the A/C thermostat relay, then repeat Step 5.<br>Did the "A/C Request" display indicate "Yes"? | — | Go to *Step 8* | Go to *Step 9* |
| 8 | Replace the original A/C thermostat relay.<br>Is the action complete? | — | Verify repair | — |
| 9 | Does the blower operate? | — | Go to *Step 10* | Go to *Step 11* |
| 10 | Repair the blower.<br>Is the action complete? | — | Verify repair | — |
| 11 | Check for a faulty 10A A/C fuse in the underdash fuse panel.<br>Was the 10A fuse OK? | — | Go to *Step 13* | Go to *Step 12* |
| 12 | Check for short circuit and make repairs if necessary. Replace the 10A A/C fuse.<br>Is the action complete? | — | Verify repair | — |
| 13 | 1. Remove the glove box to gain access to the A/C thermostat.<br>2. Disconnect the thermostat connector.<br>3. Attach a fused jumper between ground and the thermostat wire.<br>4. A/C "ON".<br>5. Blower "ON".<br>Dose A/C request indicate "YES" on the Tech 2? | — | Go to *Step 14* | Go to *Step 17* |
| 14 | 1. Ignition "ON".<br>2. Use a DVM to check voltage at the electronic A/C thermostat.<br>Was voltage equal to the specified value? | B+ | Go to *Step 17* | Go to *Step 15* |
| 15 | Check for open wire between the thermostat and the A/C switch.<br>Was the wire open? | — | Go to *Step 16* | Go to *Step 17* |
| 16 | Repair the open wire between the thermostat and the A/C switch.<br>Is the action complete? | — | Verify repair | — |
| 17 | Check for an open circuit between A/C thermostat relay and PCM A/C request terminal (F45).<br>Was there an open circuit? | — | Go to *Step 18* | Go to *Step 19* |
| 18 | Repair the open circuit between the PCM and A/C thermostat relay.<br>Is the action complete? | — | Verify repair | — |
| 19 | 1. Ignition "ON".<br>2. Use a DVM to check voltage at the A/C pressure switch.<br>Was voltage equal to the specified value? | B+ | Go to *Step 21* | Go to *Step 20* |
| 20 | Repair the open circuit between the 10A A/C fuse and the pressure switch.<br>Is the action complete? | — | Verify repair | — |

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

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 21 | Use an ohmmeter to check continuity between the pressure switch and the A/C thermostat relay.<br>Was the circuit open? | — | Go to *Step 22* | Go to *Step 23* |
| 22 | Repair the open circuit between the pressure switch and the A/C thermostat relay.<br>Is the action complete? | — | Verify repair | — |
| 23 | Check for damaged pin or terminal at F45 of the PCM.<br>Was a damaged pin or terminal found? | — | Go to *Step 24* | Go to *Step 25* |
| 24 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | — |
| 25 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 26 | 1. Remove the A/C compressor relay.<br>2. Ignition "ON".<br>3. Use a DVM to check voltage at both of the wires at the A/C compressor relay socket.<br>Is the voltage equal to the specified value? | B+ | Go to *Step 28* | Go to *Step 27* |
| 27 | Repair the faulty wire between the A/C fuse and the A/C compressor relay .<br>Is the action complete? | — | Verify repair | — |
| 28 | 1. A/C compressor relay removed.<br>2. Engine idling.<br>3. A/C "ON".<br>4. Blower "ON".<br>5. Use a DVM to measure voltage between the wire at the A/C compressor relay socket and battery±.<br>Did the DVM indicate the specified value? | B+ | Go to *Step 32* | Go to *Step 29* |
| 29 | Check for an open wire between PCM terminal F4 and the A/C compressor relay.<br>Was the wire open? | — | Go to *Step 30* | Go to *Step 31* |
| 30 | Repair the open wire between the PCM and the A/C compressor relay.<br>Is the action complete? | — | Verify repair | — |
| 31 | Check for a damaged pin or terminal at F4 of the PCM.<br>Was a damaged pin or a terminal found? | — | Go to *Step 24* | Go to *Step 25* |

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

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 32 | 1. A/C compressor relay removed.<br>2. Connect a fused jumper at the A/C compressor relay socket with either wire.<br>3. Engine idling.<br>4. A/C "ON".<br>5. Blower "ON".<br>Did the compressor magnetic clutch engage? | — | Go to *Step 33* | Go to *Step 34* |
| 33 | Repair the A/C compressor relay.<br>Is the action complete? | — | Verify repair | — |
| 34 | Check for an open circuit between the A/C compressor relay and the A/C clutch.<br>Was an open circuit found? | — | Go to *Step 35* | Go to *Step 36* |
| 35 | Repair the open circuit between the compressor Clutch and the A/C compressor relay.<br>Is the action complete? | — | Verify repair | — |
| 36 | Service the compressor clutch or replace the compressor due to a faulty internal overheat switch.<br>Is the action complete? | — | Verify repair | — |
| 37 | 1. Remove the A/C compressor relay.<br>2. Idle the engine.<br>Is the compressor clutch still engaged when A/C is not selected? | — | Go to *Step 38* | Go to *Step 39* |
| 38 | Repair the short to voltage between the A/C clutch and A/C compressor relay.<br>Is the action complete? | — | Verify repair | — |
| 39 | 1. Reinstall the A/C compressor relay.<br>2. Remove the A/C thermostat relay.<br>3. Engine idling.<br>Is the compressor clutch still engaged when A/C is not selected? | — | Go to *Step 40* | Go to *Step 42* |
| 40 | Use a DVM to check for a short to ground between the A/C compressor relay and F4 of the PCM.<br>Was a short detected? | — | Go to *Step 41* | Go to *Step 25* |
| 41 | Repair the short to ground between the PCM and A/C compressor relay.<br>Is the action complete? | — | Verify repair | — |
| 42 | Repair the short to ground between the A/C thermostat relay and the electronic thermostat.<br>Is the action complete? | — | 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 through P0306, P0341, 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, refer to the *Symptoms* section for diagnosis.

## EVAP Canister Purge Solenoid and EVAP Vent Solenoid Valve

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. Refer to the DTC charts for further information.

## Visual Check of The Evaporative Emission Canister

- 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.

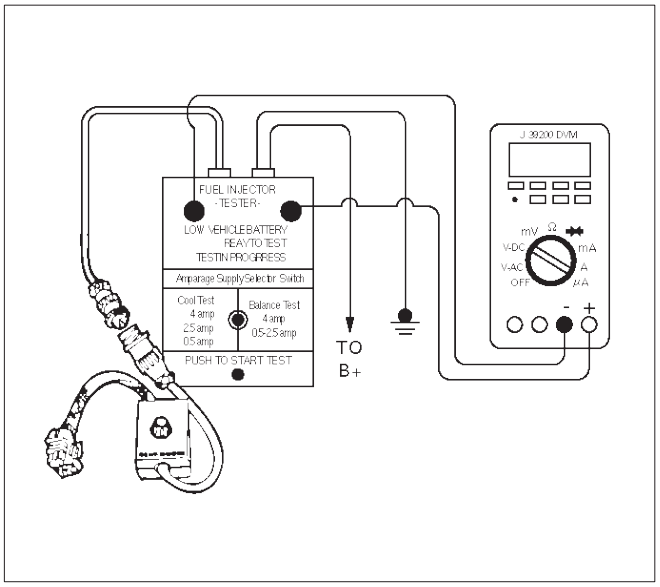
## Fuel Metering System Check

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.
Refer to *Fuel System Electrical Test* for the fuel system wiring schematic.
If there is a fuel delivery problem, refer to *Fuel System Diagnosis*, which diagnoses the fuel injectors, the fuel pressure regulator, and the fuel pump. 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 fuel trim may be as low as –38%. If the fuel trim values are greater than +23%, refer to *DTC P0131, DTC P0151, DTC P0171, and DTC 1171* for items which can cause a lean HO2S signal.

## 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 Systems Diagnosis.*

## 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.

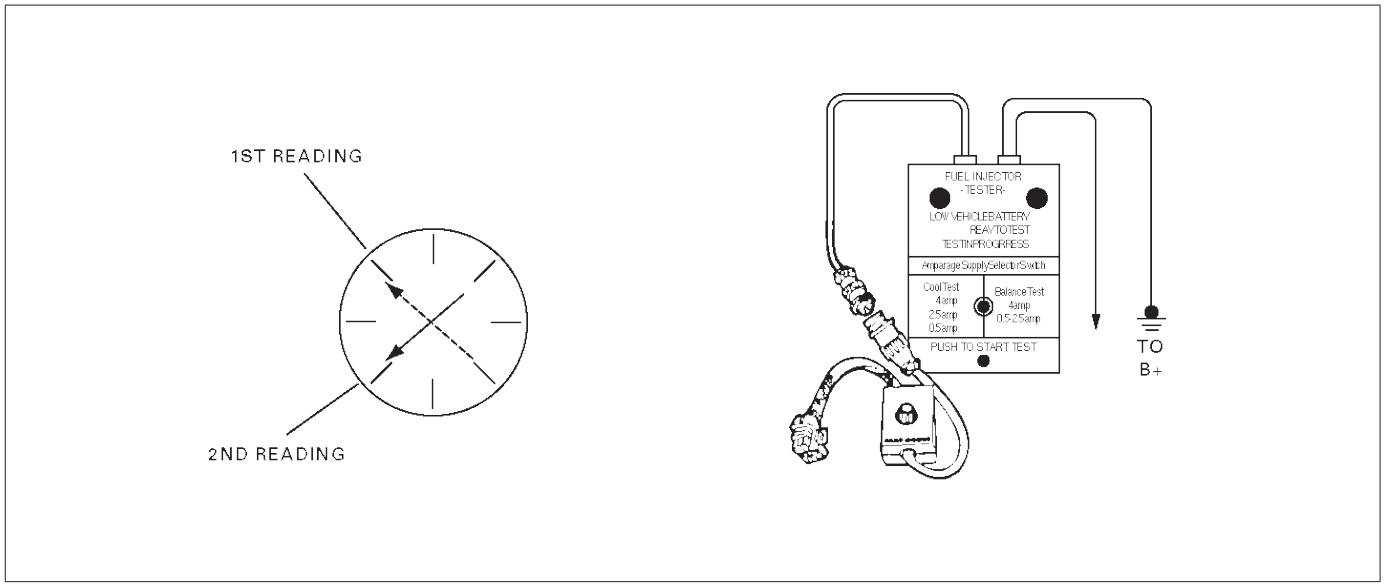
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

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 Volts |

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 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1st Reading (1) | 296 kPa (43 psi) | 296 kPa (43 psi) | 296 kPa (43 psi) | 296 kPa (43 psi) | 296 kPa (43 psi) | 296 kPa (43 psi) |
| 2nd Reading (2) | 131 kPa (19 psi) | 117 kPa (17 psi) | 124 kPa (18 psi) | 145 kPa (21 psi) | 131 kPa (19 psi) | 130 kPa (19 psi) |
| Amount of Drop (1st Reading–2nd Reading) | 165 kPa (24 psi) | 179 kPa (26 psi) | 172 kPa (25 psi) | 151 kPa (22 psi) | 165 kPa (24 psi) | 166 kPa (24 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) | OK | OK |

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”.<br>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.<br>2. Relieve the fuel pressure. Refer to *Test Description Number 2.*<br>3. Connect the J 39021-5V Fuel Injector Tester to B+ and ground, and to the J 39021-90 Injector Switch Box.<br>4. Connect the injector switch box to the grey fuel injector harness connector located on the front of the EVAP canister bracket.<br>5. Set the amperage supply selector switch on the fuel injector tester to the “Coil Test” 0.5 amp position.<br>6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the injector tester. Refer to the illustrations associated with the test description.<br>7. Set the DVM to the tenths scale (0.0).<br>8. Observe the engine coolant temperature.<br>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 injector switch box injector #1.<br>2. Press the “Push to Start Test” button on the fuel injector tester.<br>3. Observe the voltage reading on the DVM.<br>**IMPORTANT:** The voltage reading may rise during the test.<br>4. Record the lowest voltage observed after the first second of the test.<br>5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4.<br>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.*<br>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 injector switch box injector #1.<br>2. Press the "Push to Start Test" button on the fuel injector tester.<br>3. Observe the voltage reading on the DVM.<br>**IMPORTANT:** The voltage reading may rise during the test.<br>4. Record the lowest voltage observed after the first second of the test.<br>5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4.<br>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).<br>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.<br>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.**<br>1. Connect the J 34730-1 Fuel Pressure Gauge to the fuel pressure test port.<br>2. Energize the fuel pump using the Tech 2.<br>3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container.<br>4. Bleed the air out of the fuel pressure gauge.<br>5. With the fuel pump running, observe the reading on the fuel pressure gauge.<br>Is the fuel pressure within the specified values? | 296-376 kPa (43-55 psi) | Go to *Step 8* | Go to *Fuel System Diagnosis* |
| 8 | Turn the fuel pump "OFF".<br>Does the fuel pressure remain constant? | — | Go to *Step 9* | Go to *Fuel System Diagnosis* |

## Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | 1. Connect the J 39021-5V Fuel Injector Tester and J 39021-90 Injector Switch Box the fuel injector harness connector.<br>2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position.<br>3. Using the Tech 2 turn the fuel pump "ON" then "OFF" in order to pressurize the fuel system.<br>4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading.<br>5. Energize the fuel injector by depressing the "Push to Start Test" button on the fuel injector tester.<br>6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading.<br>7. Repeat steps 1 through 6 for each fuel injector.<br>8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value.<br>9. Obtain a pressure drop value for each fuel injector.<br>10. Add all of the individual pressure drop values. This is the total pressure drop.<br>11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop.<br>Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value? | 10 kPa (1.5 psi) | Go to *Step 10* | Go to *OBD System Check* |
| 10 | Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 9.<br>NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding.<br>Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value? | 10 kPa (1.5 psi) | Go to *Step 11* | Go to *Symptoms* |
| 11 | Replace the faulty fuel injector(s). Refer to *Fuel Injector.*<br>Is the action complete? | — | Verify repair | — |

# Powertrain Control Module (PCM) Diagnosis

To read and clear diagnostic trouble codes, use a Tech 2.

**IMPORTANT:** Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition “OFF” and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re-run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- EEPROM program is not correct for the application. Incorrect components or reprogramming the PCM with the wrong EEPROM program may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the *Symptoms* portion of the manual and make a careful physical inspection of all component and wiring associated with the affected system.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned “ON” and “OFF” by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

# Multiple PCM Information Sensor DTCs Set

## Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions.

The PCM controls fuel delivery, spark advance, transmission operation, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors.

The PCM applies 5 volts through a pull–up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5–volt supply and the resistor:

- The engine coolant temperature (ECT) sensor
- The intake air temperature (IAT) sensor
- The transmission fluid temperature (TFT) sensor

The PCM provides the following sensors with a 5–volt reference and a sensor ground signal:

**1**

- The exhaust gas recirculating (EGR) pintle position sensor
- The manifold absolute pressure (MAP) sensor
- The throttle position (TP) sensor 1
- The acceleration position (AP) sensor 1
- The acceleration position (AP) sensor 3
- The Vapor Pressure Sensor

**2**

- The Crank position (CKP) sensor
- The throttle position (TP) sensor 2
- The acceleration position (AP) sensor 2

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

## Diagnostic Aids

**IMPORTANT:** Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

**IMPORTANT:** If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

A short to ground in the 5–volt reference A or B circuit will cause one or more of the following DTCs to be set:

- P0453
- P0106, P0107, P1107
- P0401, P1404, P0405
- P1120, P1515, P1221, P1516, P1635

- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

Check for the following conditions:

- **Poor connection at PCM.** Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damage terminals, and a poor terminal–to–wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor fs displayed value on the Tech 2 with the ignition “ON” and the engine “OFF” while you move the connectors and the wiring harnesses related to the following sensors:
  - Vapor Pressure (Fuel Tank Pressure) Sensor
  - MAP Sensor
  - EGR
  - TPS1/TPS2
  - APS1/APS2/APS3
  - CKP

## Multiple PCM Information Sensor DTCs Set

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Turn the ignition “OFF”, disconnect the PCM.<br>2. Turn the ignition “ON”, check the 5 volt reference 1 and 2 circuit for the following conditions:<br>• A poor connection at the PCM.<br>• An open between the PCM connector and the splice.<br>• A short to ground.<br>• A short to voltage.<br>Is there an open or short? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | Repair the open or short.<br>Is the action complete? | — | Verify repair | — |
| 4 | Check the sensor ground circuit for the following conditions:<br>• A poor connection at the PCM or the affected sensors.<br>• An open between the PCM connector and the affected sensors.<br>Is there an open or a poor connection? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the open or the poor connection.<br>Is the action complete? | — | Verify repair | — |
| 6 | Following below the DTCs stored:<br>P1635, P1639 | — | Go to *applicable DTC table* | Go to *Step 7* |
| 7 | Measure the resistance below the items:<br>• Between EGR sensor supply circuit and Vapor Pressure Sensor supply circuit.<br>• Between MAP sensor supply circuit and Vapor Pressure Sensor supply circuit.<br>• Between Vapor Pressure Sensor supply circuit and PCM harness connector. (5Volt supply circuit)<br>Is the resistance near the specified value? | — | Go to *Step 9* | Go to *Step 8* |

## Multiple PCM Information Sensor DTCs Set (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Locate and repair the open circuit in the MAP or EGR or Vapor Pressure sensor supply circuit.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Disconnect the MAP, Vapor pressure sensor and EGR connector.<br>2. Ignition "ON".<br>3. Measure the resistance of the blow areas:<br>• MAP sensor GND circuit.<br>• EGR GND circuit.<br>• Vapor pressure sensor GND circuit.<br>Does the voltage resistance near the specified value? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Locate and repair the short circuit in the MAP or EGR or Vapor Pressure sensor signal or GND circuit.<br>Is the action complete? | — | Verify repair | — |
| 11 | Measure the resistance of the blow areas:<br>• Between CKP Sensor supply circuit and PCM harness connector. (5Volt supply circuit)<br>Does the voltage resistance near the specified value? | — | Go to *Step 13* | Go to *Step 12* |
| 12 | Locate and repair the open circuit in the CKP or CMP sensor supply circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | 1. Disconnect the CKP sensor connector.<br>2. Ignition "ON".<br>3. Measure the voltage of the blow areas:<br>• CKP sensor GND circuit and shield circuit.<br>Does the voltage resistance near the specified value? | — | Go to *Step 15* | Go to *Step 14* |
| 14 | Locate and repair the short circuit in the CKP sensor signal or GND circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Are more of the following items for DTCs stored? EGR, Vapor Pressure Sensor, MAP, CKP, TPS, APS | — | Go to *applicable DTC table* | Go to *Step 16* |
| 16 | Replace the PCM.<br>The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>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.<br>Is the action complete? | — | Go to *OBD System Check* | — |

## Exhaust Gas Recirculation (EGR) Diagnosis

An EGR flow check diagnosis of the linear EGR system is covered by DTC P0401. Pintle position error diagnosis is covered by DTC P0402, P0404, P1404, P0405, P0406. If EGR diagnostic trouble codes P0401 and/or P0402, P0404, P1404, P0405, P0406 are encountered, refer to the DTC charts.

## Engine Tech 2 Data Definitions and Ranges

**A/C CLUTCH – Tech 2 Displays ON or OFF –**
Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostic.

**A/C REQUEST — Tech 2 Displays YES or NO —**
Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

**AIR/FUEL RATIO — Tech 2 Range 0.0-25.5 —**
Air/fuel ratio indicates the PCM commanded value. In closed loop, the air/fuel ratio should normally be displayed around “14.2-14.7”. A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

**AP1 —Tech 2 Range 0%-100% —**
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “13%” at idle and “85-89%” at wide open throttle.

**AP2 —Tech 2 Range 0%-100% —**
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “11-15%” at wide open throttle.

**AP3 —Tech 2 Range 0%-100% —**
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “32-36%” at wide open throttle.

**BAROMETRIC PRESSURE — Tech 2 Range 10-105 kPa/0.00-5.00 Volts —**
The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around “61-104” depending on altitude and barometric pressure.

**CHECK TRANS LAMP — AUTO TRANSMISSION —**
Indicates the need to check for a DTC with the Tech 2 when the lamp is flashing 0.2 seconds ON and 0.2 seconds OFF.

**DESIRED EGR POS. — Tech 2 Range 0%-100% —**
Represents the EGR pintle position that the PCM is commanding.

**DESIRED IDLE — Tech 2 Range 0-3187 RPM —**
The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

**ECT — (Engine Coolant Temperature) Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —**
The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

**EGR DUTY CYCLE — Tech 2 Range 0%-100% —**
Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

**EGR FEEDBACK — Tech 2 Range 0.00-5.00 Volts —**
Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

**ENGINE LOAD — Tech 2 Range 0%-100% —**
Engine load is calculated by the PCM from engine speed and MAF sensor readings. Engine load should increase with an increase in RPM or air flow.

**ENGINE RUN TIME — Tech 2 Range 00:00:00-99:99:99 Hrs:Min:Sec —**
Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

**ENGINE SPEED — Range 0-9999 RPM —**
Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

**EVAP PURGE PWM — Tech 2 Range 0%-100% —**
Represents the PCM commanded PWM duty cycle of the EVAP purge solenoid valve. “0%” displayed indicates no purge; “100%” displayed indicates full purge.

**FUEL PUMP — Tech 2 Displays ON or OFF —**
Indicates the PCM commanded state of the fuel pump relay driver circuit.

**HO2S BANK 1, SEN. 1 — Tech 2 Range 0-1132 mV —**
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

**HO2S BANK 1, SEN. 2 — Tech 2 Range 0-1000mV —**
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will give a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0420 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

**HO2S BANK2, SEN. 1 —Tech 2 Range 0-1132 mV—**
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

**HO2S BANK 2, SEN. 2—Tech 2 Range 0-1000 mV—**
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will have a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0430 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

**HO2S BANK 1, SEN. 1—Tech 2 Displays NOT READY or READY—**
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

**HO2S BANK 2, SEN. 1 — Tech 2 Displays NOT READY or READY —**
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

**HO2S WARM UP TIME BANK 1, SEN. 1/BANK 1, SEN 2/BANK 2 SEN. 1/BANK 2 SEN. 2 — Tech 2 Range 00:00:00-99:99:99 HRS:MIN:SEC —**
Indicates warm-up time for each HO2S. The HO2S warm-up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that tool much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm-up will the display “00:00:00”.

**IAT (INTAKE AIR TEMPERATURE) — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —**
The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

**IGNITION 1 — Tech 2 Range 0-25.5 Volts —**
This represents the system voltage measured by the PCM at its ignition feed.

**INJ. PULSE BANK 1/INJ. PULSE BANK 2 — Tech 2 Range 0-1000 msec. —**
Indicates the amount of time the PCM is commanding each injector “ON” during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

**LONG TERM FUEL TRIM BANK 1/BANK 2 —**
The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

**Fuel System STATUS — Tech 2 Displays OPEN or CLOSED —**
“CLOSED” indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In “OPEN” the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

**MAF — Tech 2 Range 0.0-512 gm/s —**
MAF (mass air flow) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

**MAP**
**— Tech 2 Range 10-105 kPa (0.00-4.97 Volts) —**
The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

**MIL — Tech 2 Displays ON or OFF —**
Indicates the PCM commanded state of the malfunction indicator lamp.

**MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-255 Counts —**
The misfire current counters increase at a rate according to the number of the possible misfires being detected on each cylinder. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

**MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-65535 Counts —**
The misfire history counters display the relative level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC (P0300) has become active.

**MISFIRE FAILURES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —**
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a fail.

**MISFIRE PASSES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —**
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

**POWER ENRICHMENT — Tech 2 Displays ACTIVE or INACTIVE —**
"ACTIVE" displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in power enrichment mode, the PCM will increase the amount of fuel delivered by entering open loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

**SPARK — Tech 2 Range –64˚ to 64˚ —**
Displays the amount of spark advance being commanded by the PCM on the IC circuit.

**START-UP ECT — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —**
Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

**START-UP IAT — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —**
Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

**TOTAL MISFIRE CURRENT COUNT — Tech 2 Range 0-255 —**
Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

**TP — Tech 2 Range 0%-100% —**
TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display "3-5%" at idle and "100%" at wide open throttle.

**CATALYST PROTECTION MODE — Tech 2 Displays YES or NO —**
"YES" displayed indicates that the PCM has detected conditions appropriate to operate in TWC protection mode. The PCM will decrease the air/fuel ratio to a value that depends on mass air flow (higher mass air flow = lower air/fuel ratio).

**UPSHIFT LAMP (MANUAL TRANSMISSION) VEHICLE SPEED — Tech 2 Range 0-255 km/h (0-155 mph) —**
The vehicle speed sensor signal is converted into km/h and mph for display.

**WEAK CYLINDER — Tech 2 Displays Cylinder Number —**
This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

## Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the *Symptoms* section for diagnosis.

### Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, closed loop, accessories off, brake not applied and air conditioning off.

**3.5L V-6 Engine (Automatic and Manual Transmission)**

| Tech 2 Parameter | Data List | Units Displayed | Typical Data Values (IDLE) | Typical Data Values (2500 RPM) | Refer To |
|---|---|---|---|---|---|
| A/C Clutch Relay | Engine | On/Off | Off | Off | General Description and Operation, A/C Clutch Circuit Operation |
| A/C Request | Engine | Yes/No | No | No | General Description and Operation, A/C Request Signal |
| Air/Fuel Ratio | Engine | Ratio: _ to 1 | 14.7 | 14.7 | General Description and Operation, Fuel System Metering Purpose |
| APP Sensor1 | Engine | Percent | 11–13 | 35–40 | General Description and Operation |
| APP Sensor2 | Engine | Percent | 87–88 | 60–65 | General Description and Operation |
| APP Sensor3 | Engine | Percent | 87–88 | 50–57 | General Description and Operation |
| Barometric Pressure | Engine | kPa | 61-104 (depends on altitude and barometric pressure) | 61-104 (depends on altitude and barometric pressure) | General Description and Operation |
| Brake Light Switch | Engine | Open 0V/Closed 12V | Open 0V | Open 0V | Refer to Section 5 |
| Check Trans Lamp (**Auto Trans**) | Engine | On/Off | Off | Off | 4L30-E Automatic Transmission Diagnosis |
| Cruise Main Switch | Engine | Active/Inactive | Inactive | Inactive | Refer to Section 10 |
| Cruise Set Switch | Engine | Active/Inactive | Inactive | Inactive | Refer to Section 10 |
| Cruise Cancel Switch | Engine | Active/Inactive | Inactive | Inactive | Refer to Section 10 |
| Cruise Resume Switch | Engine | Active/Inactive | Inactive | Inactive | Refer to Section 10 |
| Decel Fuel Cutoff | Engine | Active/Inactive | Inactive | Inactive | General Description and Operation, Deceleration Mode |
| Desired EGR Position | Engine | Percent | 0% | 0% | General Description and Operation, EGR Pintle Position Sensor |
| Desired Idle Speed | Engine | RPM | 750 | 800 | General Description and Operation |
| ECT (Engine Coolant Temp) | Engine | Degrees C, Degrees F | 80-100˚C (176-212˚F) | 80-100˚C (176-212˚F) | General Description and Operation, Engine Coolant Temperature (ECT) Sensor |
| EGR Closed Pintle Position | Engine | Steps | 20-40 | 20-40 | General Description and Operation, EGR Pintle Position Sensor |

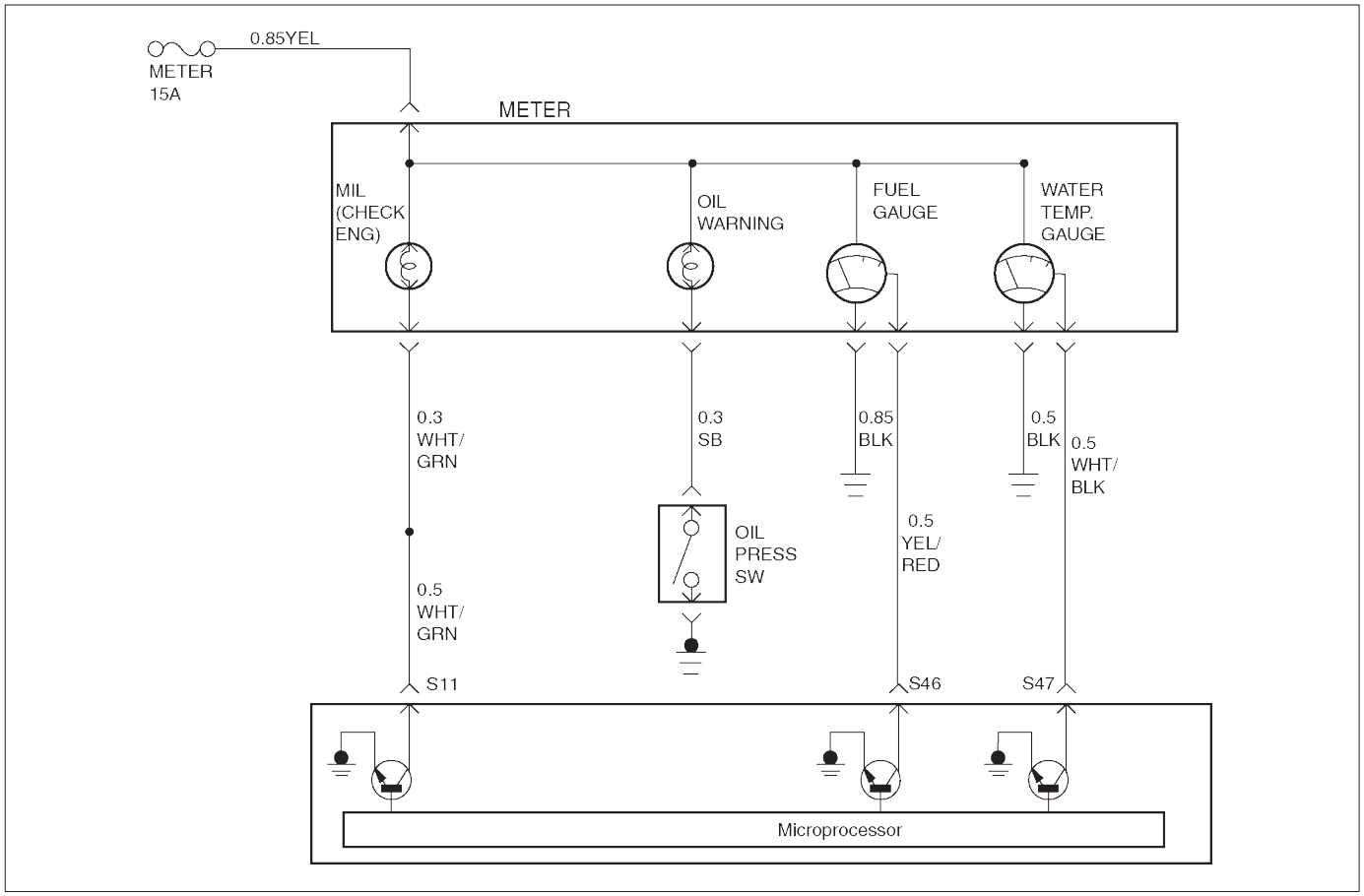
| Tech 2 Parameter | Data List | Units Displayed | Typical Data Values (IDLE) | Typical Data Values (2500 RPM) | Refer To |
|---|---|---|---|---|---|
| EGR Duty Cycle | Engine | Percent | 0% | 0% | General Description and Operation, Linear EGR Operation and Results of Incorrect Operation |
| EGR Feedback | Engine | Volts | 0.45-0.80 | 0.45-0.80 | — |
| EGR Normalized | Engine | Percent | 0% | 0% | — |
| Engine Load | Engine | Percent | 2.0% - 5.5% | 8.0% - 16.0% | General Description and Operation, Mass Air Flow (MAF) Sensor |
| Time From Start | Engine | Sec | Varies. Resets at each engine start. | Varies. Resets at each engine start. | — |
| Engine Speed | Engine | RPM | Within –50 to +100 of “Desired Idle” | Actual engine speed | — |
| EVAP Purge Solenoid | Engine | Percent | 0% | 0% | Diagnosis, EVAP Emission Canister Purge Valve Check |
| EVAP Vent Valve | Engine | On/Off | Off | Off | Diagnosis, EVAP Canister Purge Solenoid and EVAP Vacuum Switch and Visual Check; DTCs: P1441, P1442 |
| Fuel System Status | Engine | Open Loop/Closed Loop | Closed Loop | Closed Loop | General Description |
| Fuel Level | Engine | Percent | — | — | Engine Fuel |
| Fuel Level Sensor | Engine | Volts | — | — | Engine Fuel |
| Fuel Tank (Vapor) Pressure Sensor | Engine | Volts | 1.02 – 1.86 | 1.02 – 2.57 | General Description and Operation |
| | | in. H2O | — | — | |
| Fuel Pump | Engine | On/Off | On | On | Engine Fuel |
| HO2S Bank 1 Sen.1 (millivolts) | O2 Sensor Data | Millivolts | 50-950 changing quickly | 50-950, always changing quickly | General Description and Operation, Fuel control HO2S |
| HO2S Bank 1 Sen.2 (millivolts) (**Auto Trans**) | O2 Sensor Data | Millivolts | 200-700 changing slowly | 250-650 changing slowly | General Description and Operation, Fuel Metering System |
| HO2S Bank 1 Sen.2 (millivolts) (**Manual Trans**) | O2 Sensor Data | Millivolts | 50-950 changing quickly | 50-950 changing quickly | General Description and Operation, Fuel Metering System |
| HO2S Bank 1 Sen.3 (millivolts) (**Manual Trans**) | O2 Sensor Data | Millivolts | 200-700 changing slowly | 250-650 changing slowly | General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Manual Trans) |

| Tech 2 Parameter | Data List | Units Displayed | Typical Data Values (IDLE) | Typical Data Values (2500 RPM) | Refer To |
|---|---|---|---|---|---|
| HO2S Bank 2 Sen.1 (millivolts) | O2 Sensor Data | Millivolts | 50-950 changing quickly | 50-950 changing quickly | General Description and Operation, Fuel Control HO2S |
| HO2S Bank 2 Sen.2 (millivolts) (**Auto trans**) | O2 Sensor Data | Millivolts | 200-700 changing slowly | 250-650 changing slowly | General Description and Operation, Fuel Metering System |
| HO2S Bank 1 Sen.1 (ready/not ready) | O2 Sensor Data | Ready Yes/No | Ready Yes | Ready Yes | General Description and Operation, Fuel Control HO2S; DTC: P0135 |
| HO2S Bank 2 Sen.1 (ready/not ready) | O2 Sensor Data | Ready Yes/No | Ready Yes | Ready Yes | General Description and Operation, Fuel Control HO2S |
| HO2S Warm-Up Time Bank 1 Sen.1 | O2 Sensor Data | Seconds | 25-45 | 25-45 | General Description and Operation, Fuel Control HO2S |
| HO2S Warm-Up Time Bank 1 Sen.2 | O2 Sensor Data | Seconds | 60-100 | 60-100 | General Description and Operation, Fuel Control HO2S |
| HO2S Warm-Up Time Bank 2 Sen.1 | O2 Sensor Data | Seconds | 25-45 | 25-45 | General Description and Operation, Fuel Control HO2S |
| HO2S Warm-Up Time Bank 2 Sen.2 | O2 Sensor Data | Seconds | 60-100 | 60-100 | General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Auto Trans) |
| IAT (Intake Air Temp) | Engine | Degrees C, Degrees F | 0-100˚C, depends on underhood temperature | 0-80˚C, depends on underhood temperature | General Description and Operation, Intake Air Temperature (IAT) Sensor |
| Illumination Switch | Engine | Closed 0V/Open 12V | Closed 0V | Closed 0V | Refer to Section 8 |
| Ignition Voltage | Engine | Volts | 12.8-14.1 | 12.8-14.1 | General Description and Operation, Electronic Ignition System |
| Inj. Pulse Bank 1 | Engine | Milliseconds | 2.0-4.0 | 2.5-4.0 | General Description, Fuel Metering, Fuel Injector |
| Inj. Pulse Bank 2 | Engine | Milliseconds | 2.0-4.0 | 2.5-4.0 | General Description, Fuel Metering, Fuel Injector |
| Knock Present | Engine | No/Yes | No | No | General Description and ION Sensing Module |
| Knock Signal | Engine | Percent | 1~4 | 1~4 | General Description and ION Sensing Module |
| Knock Sensor Retard | Engine | ˚CA | 0 | 0 | General Description and ION Sensing Module |
| Knock Counter | Engine | Counts | — | — | General Description |
| Long Term FT Bank 1 (Long Term Fuel Trim) | Misfire | Counts and Percentage | 100 to 150 counts, –22% to +17% | 100 to 150 counts, –22% to +17% | Diagnosis, Fuel Trim System Monitor; DTCs: P0171, P0172 |

| Tech 2 Parameter | Data List | Units Displayed | Typical Data Values (IDLE) | Typical Data Values (2500 RPM) | Refer To |
|---|---|---|---|---|---|
| Long Term FT Bank 2 (Long Term Fuel Trim) | Misfire | Counts and Percentage | 100 to 150 counts, –22% to +17% | 100 to 150 counts, –22% to +17% | Diagnosis, Fuel Trim System Monitor; DTCs: P0171 |
| MAF (Mass Air Flow) | Engine | Grams per second | 2.85-6.65 | 9.5-16.5 | General Description and Operation, MAF; DTCs: P101, P0102, P0103 |
| MAP kPa (Manifold Absolute Pressure) | Engine | Kilopascals | 23-40 | 19-32 | General Description and Operation, Manifold Absolute Pressure (MAP) Sensor; DTCs: P0106, P0107, P0108 |
| | | Volts | 0.65-1.32 | 0.46-1.10 | |
| MIL | Engine | On/Off | Off | Off | On-Board Diagnostic System Check |
| Misfire Cur. Cyl #1 | Misfire | Counts | 0-2 | 0-2 | DTC P0300 |
| Misfire Cur. Cyl #2 | Misfire | Counts | 0-2 | 0-2 | DTC P0300 |
| Misfire Cur. Cyl #3 | Misfire | Counts | 0-2 | 0-2 | DTC P0300 |
| Misfire Cur. Cyl #4 | Misfire | Counts | 0-2 | 0-2 | DTC P0300 |
| Misfire Cur. Cyl #5 | Misfire | Counts | 0-2 | 0-2 | DTC P0300 |
| Misfire Cur. Cyl #6 | Misfire | Counts | 0-2 | 0-2 | DTC P0300 |
| Misfire Hist. Cyl #1 | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Hist. Cyl #2 | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Hist. Cyl #3 | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Hist. Cyl #4 | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Hist. Cyl #5 | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Hist. Cyl #6 | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Failures Since First Fail | Misfire | Counts | 0 | 0 | DTC P0300 |
| Misfire Passes Since First Fail | Misfire | Counts | 0 | 0 | DTC P0300 |
| PNP (Park/Neutral Position) | Engine | P-N / R-D-3-2-L | P-N | P-N | 4L30-E Automatic Transmission Diagnosis |
| Power Enrichment | Engine | NO/YES | NO | NO | General Description and Operation, Acceleration Mode |
| PSP Switch (Power Steering Pressure) | Engine | Normal/Hi | Normal Pressure | Normal Pressure | Refer to 2A Section |

| Tech 2 Parameter | Data List | Units Displayed | Typical Data Values (IDLE) | Typical Data Values (2500 RPM) | Refer To |
|---|---|---|---|---|---|
| Spark (Advance) | Engine | Degrees Before Top Dead Center | 15-22 | 34-44 | General Description and Operation, Electronic Ignition System |
| Start-Up ECT (Engine Coolant Temp) | Engine | Degrees C, Degrees F | Depends on engine coolant temperature at time of start-up | Depends on engine coolant temperature at time of start-up | General Description and Operation, Engine Coolant Temperature (ECT) Sensor |
| Start-Up IAT (Intake Air Temp) | Engine | Degrees C, Degrees F | Depends on intake air temperature at time of start-up | Depends on intake air temperature at time of start-up | General Description and Operation, Intake Air Temperature (IAT) Sensor |
| TCC Cruise Brake Switch | Engine | Active/Inactive | Active | Active | Refer to Section 10 |
| Total Misfire Current Count | Misfire | Counts | 0-5 | 0-5 | DTC P0300 |
| TP Sensor 1 (Throttle Position Sensor 1) | Engine | Percentage | 8–12 | 28–36 | General Description and Operation, Throttle Position (TP) Sensor |
| TP Sensor 2 (Throttle Position Sensor 2) | Engine | Percentage | 8–12 | 28–36 | General Description and Operation, Throttle Position (TP) Sensor |
| Throttle at Idle | Engine | No/Yes | Yes | No | General Description and Operation, Throttle Position (TP) Sensor |
| Upshift Lamp (manual trans) | Engine | On/Off | Off | Off | Manual Transmission |
| Vehicle Speed | Engine | MPH / km/h | 0 | 0 | 4L30-E Automatic Transmission Diagnosis |
| Weak Cylinder | Misfire | Cylinder # | — | — | DTC P0300 |

# No Malfunction Indicator Lamp (MIL)




060R200049

## Circuit Description

The “Check Engine” lamp (MIL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL “ON” by grounding the MIL driver circuit.

## Diagnostic Aids

An intermittent MIL may be cased by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

## Test Description

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

2. A “No MIL” condition accompanied by a no-start condition suggests a faulty PCM ignition feed or battery feed circuit.

9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to *PCM Terminal End View* for terminal locations of the PCM ground circuits.

12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as “good” simply by honking the horn. Replace the horn relay after completing this step.

17. 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 Powertrain Control Module (PCM) and Sensors.*

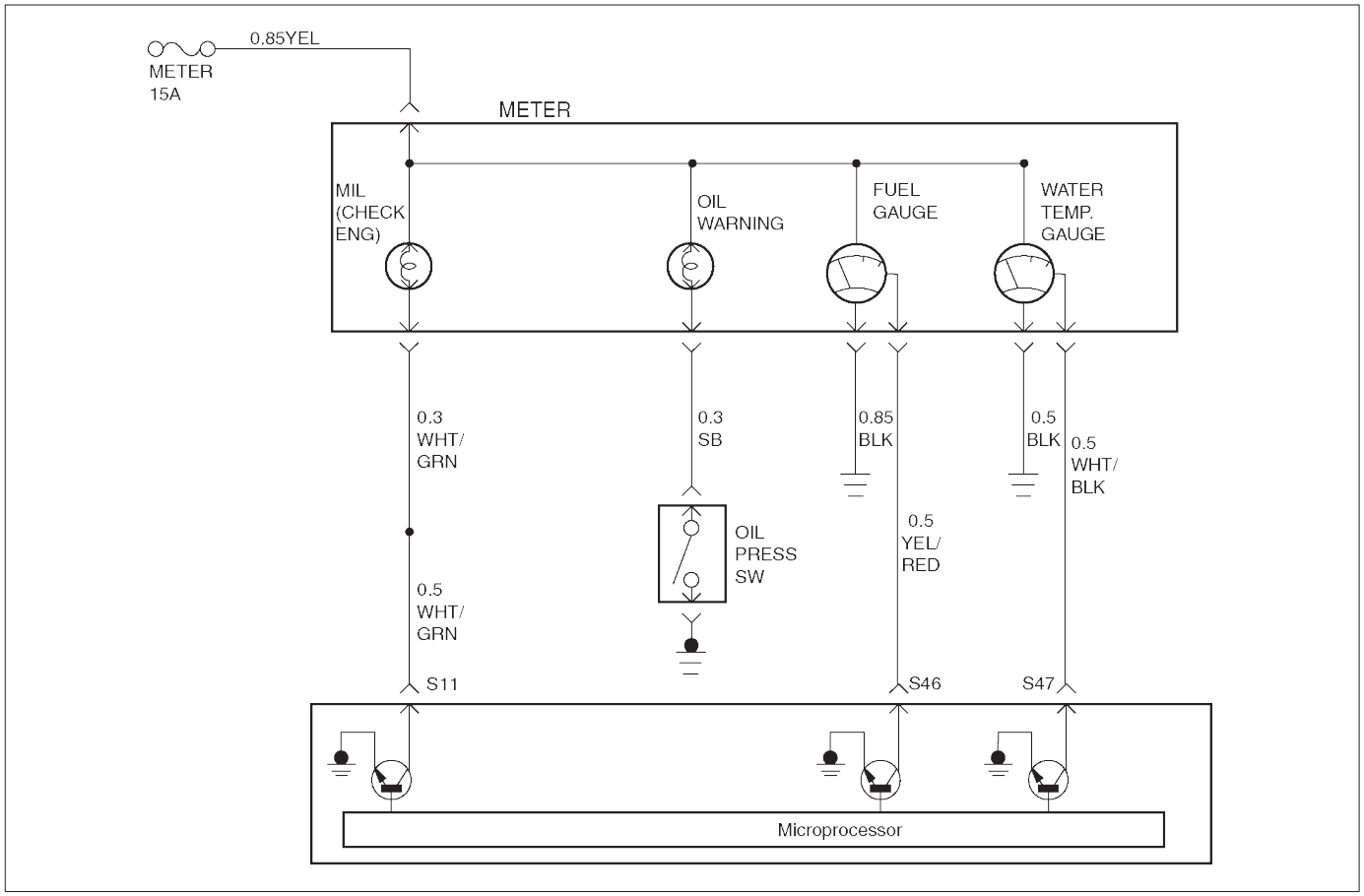
# No Malfunction Indicator Lamp (MIL)

| 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 | Attempt to start the engine.<br>Does the engine start? | — | Go to *Step 3* | Go to *Step 6* |
| 3 | Check the meter fuse for the instrument cluster ignition feed circuit.<br>Is the fuse OK? | — | Go to *Step 4* | Go to *Step 16* |
| 4 | Ignition “ON”, probe the ignition feed circuit at the cluster connector with a test light to ground.<br>Is the test light “ON”? | — | Go to *Step 5* | Go to *Step 13* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the PCM.<br>3. Jumper the MIL driver circuit at the PCM connector to ground.<br>4. Ignition “ON”.<br>Is the MIL “ON”? | — | Go to *Step 10* | Go to *Step 11* |
| 6 | Check the PCM ignition feed and battery feed fuses (15 A engine fuse and 15 A PCM fuse).<br>Are both fuses OK? | — | Go to *Step 7* | Go to *Step 15* |
| 7 | 1. Ignition “OFF”.<br>2. Disconnect the PCM.<br>3. Ignition “ON”.<br>4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground.<br>Is the test light “ON”? | — | Go to *Step 8* | Go to *Step 12* |
| 8 | Probe the battery feed circuit at the PCM harness connector with a test light to ground.<br>Is the test light “ON”? | — | Go to *Step 9* | Go to *Step 14* |
| 9 | Check for a faulty PCM ground connection.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check for damaged terminals at the PCM.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 11 | Check for an open MIL driver circuit between the PCM and the MIL.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 12 | Substitute a known “good” relay for the PCM main relay.<br>Was the malfunction fixed? | — | Verify repair | Go to *Step 13* |
| 13 | Repair the open in the ignition feed circuit.<br>Is the action complete? | — | Verify repair | — |
| 14 | Locate and repair the open PCM battery feed circuit.<br>Is the action complete? | — | Verify repair | — |

# No Malfunction Indicator Lamp (MIL) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 15 | Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit.<br>Is the action complete? | — | Verify repair | — |
| 16 | Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse.<br>Is the action complete? | — | Verify repair | — |
| 17 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *PCM* in *ON-Vehicle Service* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 18 | Check the MIL driver circuit for a poor connection at the instrument panel connector.<br>Was a problem found? | — | Verify repair | Go to *Instrument Panel* in *Electrical Diagnosis* |

# Malfunction Indicator Lamp (MIL) “ON” Steady




060R200049

## Circuit description

The malfunction indicator lamp (MIL) should always be illuminated and steady with ignition “ON” and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL “ON” by grounding the MIL driver circuit. The MIL should not remain “ON” with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

## Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or 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

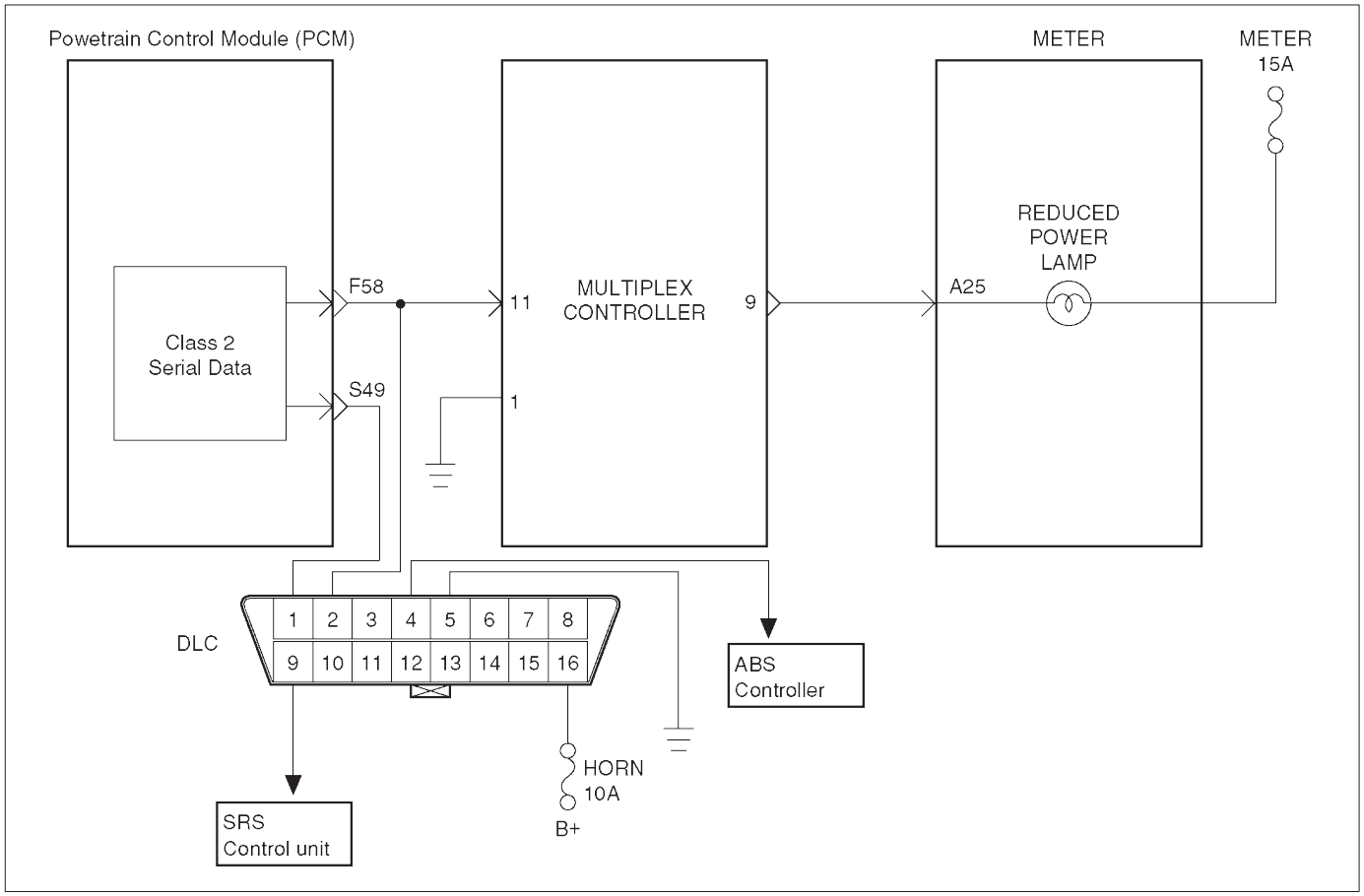
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the MIL does not remain “ON” when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. 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.*

# Malfunction Indicator Lamp (MIL) “ON” Steady

| 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 “OFF”, disconnect PCM.<br>2. Ignition “ON”, observe the MIL (Service Engine Soon lamp).<br>Is the MIL “ON”? | — | Go to *Step 3* | Go to *Step 5* |
| 3 | 1. Ignition “OFF”, disconnect the instrument panel cluster.<br>2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground.<br>3. If a problem is found, repair as necessary.<br>Was the MIL driver circuit shorted to ground? | — | Go to *OBD System Check* | Go to *Step 4* |
| 4 | Replace the instrument panel cluster.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 5 | 1. Ignition “OFF”, reconnect the PCM.<br>2. Ignition “ON”, reprogram the EEPROM. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL “OFF”. (Refer to the Miscellaneous test)<br>Did the MIL turn “OFF”? | — | Go to *OBD System Check* | Go to *Step 6* |
| 6 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Go to *OBD System Check* | — |

# No Reduced Power Lamp (RPL)




## Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) orders the RPL “ON” signal for Multiplex Control Unit. When Multiplex Control Unit is received RPL “ON” signal that turn RPL “ON” by grounding the RPL driver circuit.

## Diagnostic Aids

An intermittent RPL may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM and Multiplex Control Unit harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

## Test Description

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

2. A “No RPL” condition accompanied by a no–start condition suggests a faulty PCM ignition feed or battery feed circuit.

9. Using a test light connected to B+, probe each of the Multiplex Control Unit ground terminals to ensure that a good ground is present. Refer to Multiplex Control Unit Terminal End View for terminal locations of the Unit Terminal End View for terminal locations of the Multiplex Control Unit ground circuits.

12. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to PCM Terminal End View for terminal locations of the PCM ground circuits.

21. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as “good” simply by honking the horn. Replace the horn relay after completing this step.

24. 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.

# No Reduced Power Lamp (RPL)

| 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 | Attempt to start the engine.<br>Does the engine start? | — | Go to *Step 3* | Go to *Step 11* |
| 3 | Check the following fuses:<br>MAIN(100A), B+1(60A), B+2(50A), METER(15A), ECM(15A) , ENGINE(15A)<br>Was a problem found? | — | Go to *Step 14* | Go to *Step 4* |
| 4 | 1. Ignition ”OFF”.<br>2. Disconnect the cluster meter connector.<br>3. Ignition “ON”, Probe the ignition feed circuit at the cluster connector with a test light to ground.<br>Is the test light “ON”? | — | Go to *Step 5* | Go to *Step 15* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the Multiplex Control Unit.<br>3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit.<br>Was a problem found? | — | Go to *Step 16* | Go to *Step 6* |
| 6 | 1. Reconnect the cluster meter connector.<br>2. Disconnect the Multiplex Control Unit.<br>3. Jumper the RPL driver circuit at the Multiplex Control Unit connector to ground.<br>4. Ignition “ON”.<br>Is the RPL “ON”? | — | Go to *Step 7* | Go to *Instrument Panel in Electrical Diagnosis* |
| 7 | 1. Ignition “OFF”.<br>2. Probe the ignition feed circuit at the Multiplex Control Unit connector with a test light to ground.<br>3. Ignition “ON”.<br>Is the test light “ON”? | — | Go to *Step 8* | Go to *Step 17* |
| 8 | 1. Ignition “OFF”.<br>2. Disconnect the PCM.<br>3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit.<br>Was a problem found? | — | Go to *Step 18* | Go to *Step 9* |
| 9 | Check the Multiplex Control Unit ground connection and circuit.<br>Was a problem found? | — | Go to *Step 19* | Go to *Step 10* |
| 10 | Check for damaged terminals at the Multiplex Control Unit.<br>Was a problem found? | — | Go to *Step 20* | Go to *Step 11* |
| 11 | 1. Ignition “ON”.<br>2. Probe the ignition feed circuit at the PCM harness connector with a test light to ground.<br>Is the test light “ON”? | — | Go to *Step 12* | Go to *Step 21* |

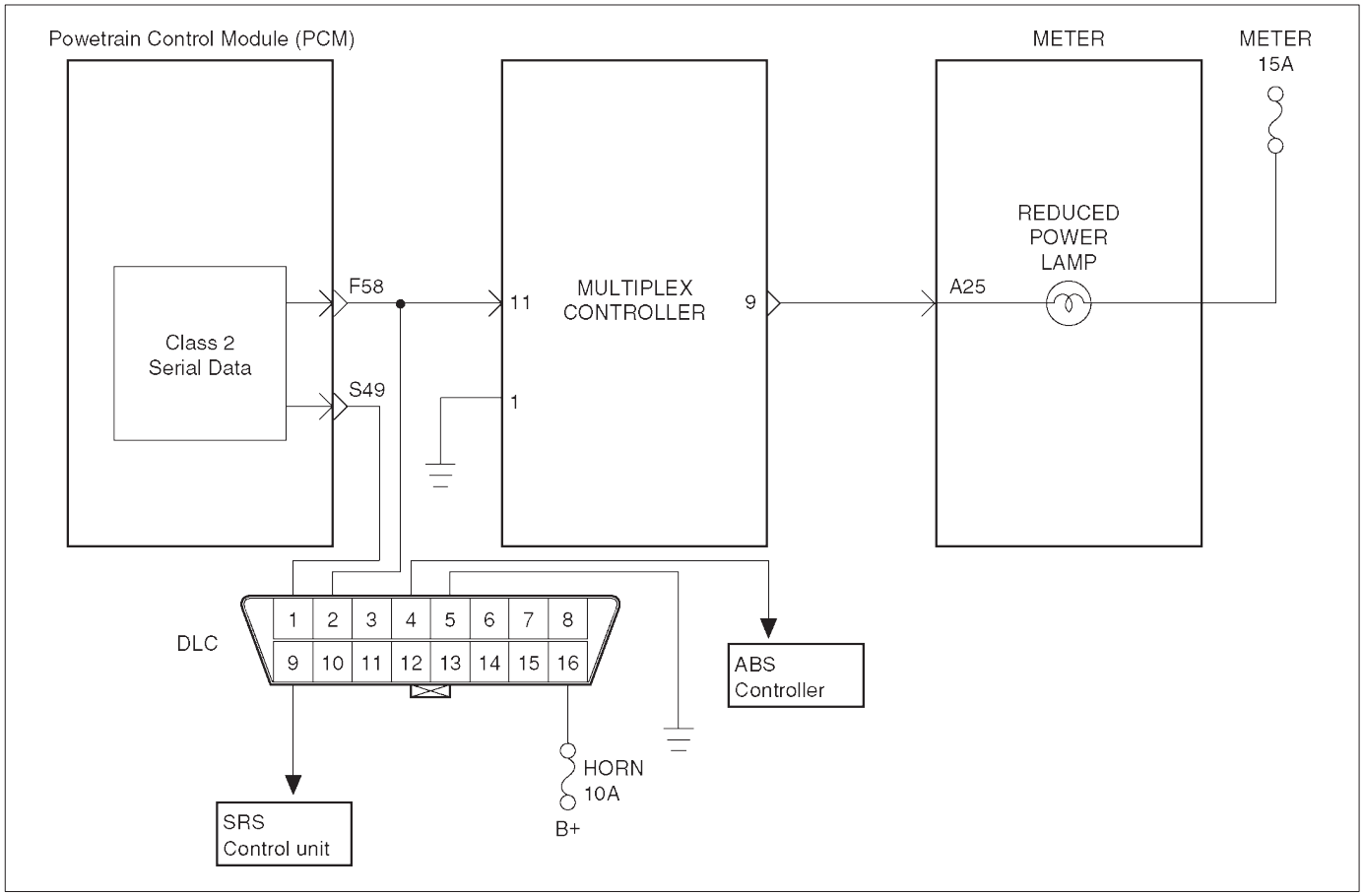
# No Reduced Power Lamp (RPL) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | 1. Ignition "OFF".<br>2. Check for a faulty PCM ground connection and Circuit.<br>Was a problem found? | — | Go to *Step 23* | Go to *Step 13* |
| 13 | Check for damaged terminals at the PCM.<br>Was a problem found? | — | Go to *Step 24* | Go to *Step 25* |
| 14 | Replace the fuse.<br>Is the action complete? | — | Verify repair | — |
| 15 | Locate and repair the cluster meter battery feed open circuit.<br>Is the action complete? | — | Verify repair | — |
| 16 | Locate and repair the circuit between cluster meter and Multiplex Control Unit open circuit.<br>Is the action complete? | — | Verify repair | — |
| 17 | Locate and repair the circuit Multiplex Control Unit battery feed open circuit.<br>Is the action complete? | — | Verify repair | — |
| 18 | Locate and repair the between Multiplex Control Unit and PCM open circuit.<br>Is the action complete? | — | Verify repair | — |
| 19 | Locate and repair the ground connection for Multiplex Control Unit circuit.<br>Is the action complete? | — | Verify repair | — |
| 20 | Reconnect the Multiplex Control Unit. circuit.<br>Is the action complete? | — | Verify repair | — |
| 21 | Substitute a known "good" relay for the PCM main relay.<br>Was the malfunction fixed? | — | Verify repair | Go to *Step 22* |
| 22 | Repair the open in the ignition feed circuit.<br>Is the action complete? | — | Verify repair | — |
| 23 | Locate and repair the ground connection for PCM circuit.<br>Is the action complete? | — | Verify repair | — |
| 24 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to ON-Vehicle Service in Power Control Module and Sensors for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# No Reduced Power Lamp (RPL) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 25 | 1. Ignition "OFF".<br>2. Reconnect all connectors.<br>3. Install the Tech 2.<br>4. Ignition "ON".<br>5. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL "ON". (Refer to the Miscellaneous test)<br>Did the RPL turn "ON"? | — | Verify repair | Go to *Step 26* |
| 26 | 1. Ignition "OFF".<br>2. Disconnect the PCM.<br>3. Check the circuit (DLC line) between PCM and DLC.<br>Was a problem found? | — | Go to *Step 27* | Go to *Step 24* |
| 27 | Locate and repair the circuit the between PCM and DLC.<br>Is the action complete? | — | Go to *Step 25* | — |

# Reduced Power Lamp (RPL) “ON” Steady




060R200073

## Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) orders the RPL “ON” signal for Multiplex Control Unit. When Multiplex Control Unit is received RPL “ON” signal that turn RPL “ON” by grounding the RPL driver circuit.

The RPL should not remain “ON” with the engine running and no DTC(s) set. A steady RPL with the engine running and no DTC(s) suggests a short to ground in the RPL driver circuit.

## Diagnostic Aids

An intermittent RPL may be caused by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or 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.

2. If the RPL does not remain “ON” when the Multiplex Control Unit is disconnected, the RPL driver wiring is not faulty.
3. If the RPL driver circuit is OK, the instrument panel cluster is faulty.
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.

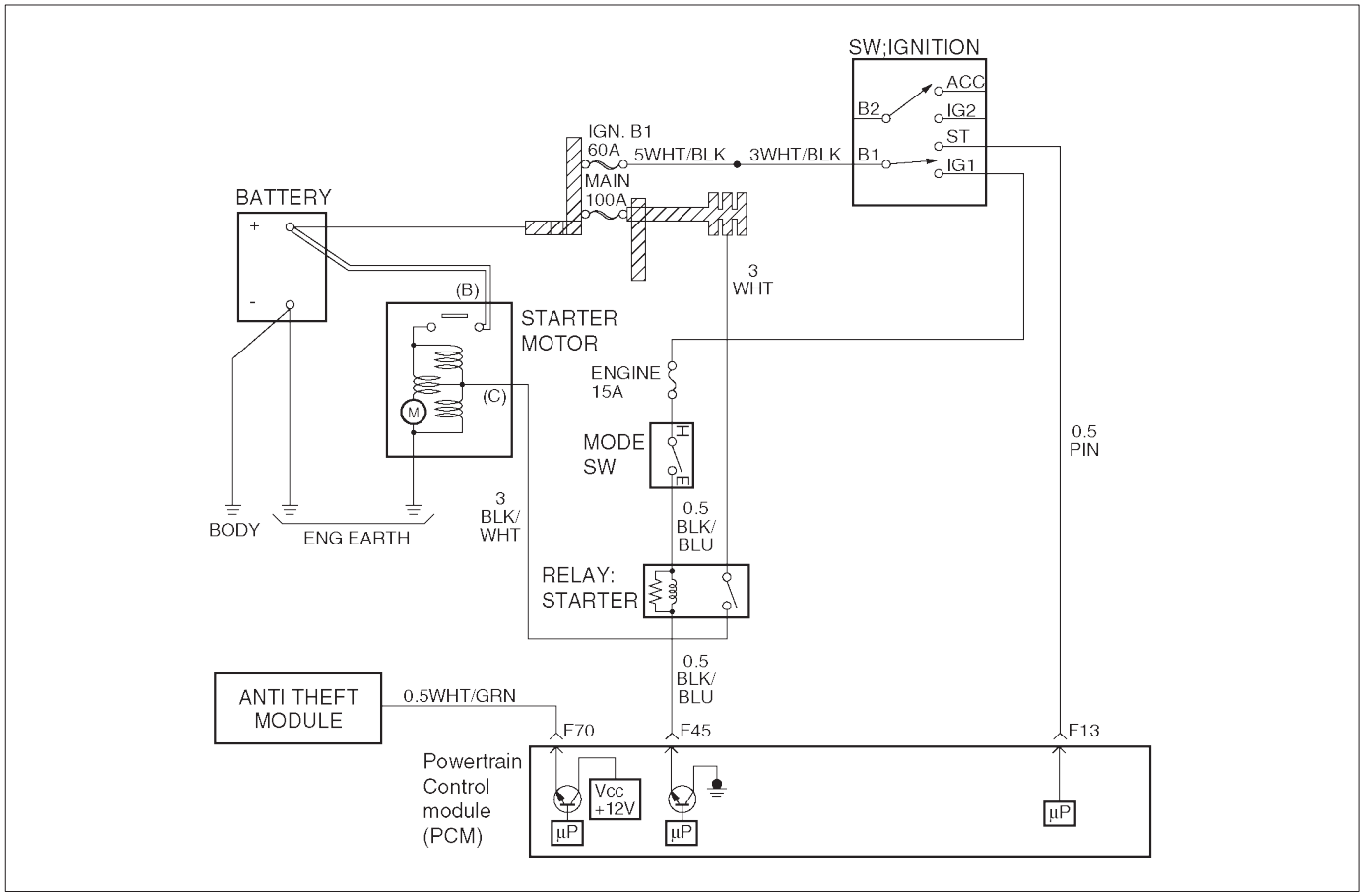
# Reduced Power Lamp (RPL) “ON” Steady

| 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 “OFF”, disconnect Multiplex Control Unit.<br>2. Ignition “ON”, observe the RPL (Reduced Power Lamp).<br>Is the RPL “ON”? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Ignition “OFF”, disconnect the instrument panel cluster.<br>2. Check the RPL driver circuit between the Multiplex Control Unit and the instrument panel cluster for a short to ground.<br>3. If a problem is found, repair as necessary.<br>Was the RPL driver circuit shorted to ground? | — | Verify repair | Go to *Step 4* |
| 4 | 1. Replace the Multiplex Control Unit.<br>2. Install the Tech 2<br>3. Ignition “ON”.<br>4. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL “OFF”. (Refer to the Miscellaneous test)<br>Did the MIL turn “OFF”? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the PCM.<br>3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit.<br>Was a problem found? | — | Go to *Step 6* | Go to *Step 7* |
| 6 | Locate and repair the circuit between Multiplex Control Unit and PCM open circuit.<br>Is the action complete? | — | Go to *Step 7* | — |
| 7 | 1. Install the Tech 2<br>2. Ignition “ON”.<br>3. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL “OFF”. (Refer to the Miscellaneous test)<br>Did the MIL turn “OFF”? | — | Go to *Verify repair* | Go to *Step 8* |
| 8 | 1. Ignition ”OFF”.<br>2. Disconnect the PCM.<br>3. Check the circuit (DLC line) between PCM and DLC.<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 10* |

# Reduced Power Lamp (RPL) “ON” Steady (Cont’d)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | Locate and repair the circuit between PCM and DLC.<br>Is the action complete? | — | Go to *Step 2* | — |
| 10 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to ON-Vehicle Service in Power Control<br>Module and Sensors for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Go to *OBD System Check* | — |

# Starter Control System Check




060R200062

## Circuit Description

Starter control system is controlled by the Power Train Control Module (PCM). The PCM monitors starter switch signal (“START”position ) and MODE switch (park or neutral) signal. PCM is operated by the ignition switch. Ignition feed voltage is supplied to the MODE switch and starter relay through the engine fuse. PCM turns the starter relay “ON” by grounding the starter relay driver circuit.

The starter motor is operated until 30 seconds based on starter relay signal.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

## Test Description

2.If Anti-theft system is “ON”, PCM does not operate starter control system.

19.Refer to *6D section.*

21.Refer to *6D section.*

24.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.*

# Starter Control System Check

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Anti-theft System” normally? Refer to *Owner’s Manual.* | — | Go to *Step 3* | Go to *Step 7* |

## Starter Control System Check (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 3 | 1. Gear position is "park or neutral".<br>2. Do not depress the accelerator pedal.<br>3. Turn the key to "START" position.<br>4. Release the key switch to the to "ON" position.<br>Does the engine crank? | — | Go to *Step 27* | Go to *Step 4* |
| 4 | 1. Install the Tech 2.<br>2. Select "Display DTCs" with the Tech 2.<br>Are any DTCs stored? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Review and record for Tech 2 Failure Records data and DTCs.<br>Were any DTCs information stored? | — | Go to *DTCs Chart* | — |
| 6 | 1. Gear position is "park or neutral".<br>2. Do not depress the accelerator pedal.<br>3. Turn the key to "START" position.<br>Is the engine cranking? | — | Go to *Step 27* | Go to *Step 7* |
| 7 | Check the anti–theft module circuit. Check the circuit between PCM and anti–theft module.<br>Is the problem found? | — | Go to *Step 8* | Go to *Step 9* |
| 8 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Probe the anti-theft module circuit to GND.<br>2. Turn the key to "START" position.<br>Is the engine cranking? | — | Go to *Step 10* | Go to *Step 11* |
| 10 | Check the anti-theft system. Refer to *section 8H anti-theft.* | — | Verify repair | — |
| 11 | Check the starter relay, starter fuse and engine fuse.<br>Is the problem found? | | Go to *Step 12* | Go to *Step 13* |
| 12 | Replace the starter relay, starter fuse and engine fuse.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check the starter circuit.<br>1. Ignition is "OFF".<br>2. Remove the starter relay.<br>3. Check the circuit between starter relay and starter motor.<br>Is the problem found? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 15 | Check the starter circuit.<br>1. Remove the main fuse (100A).<br>2. Check the circuit between main fuse and starter motor.<br>3. Check the circuit between GND and starter motor.<br>Is the problem found? | — | Go to *Step 16* | Go to *Step 17* |

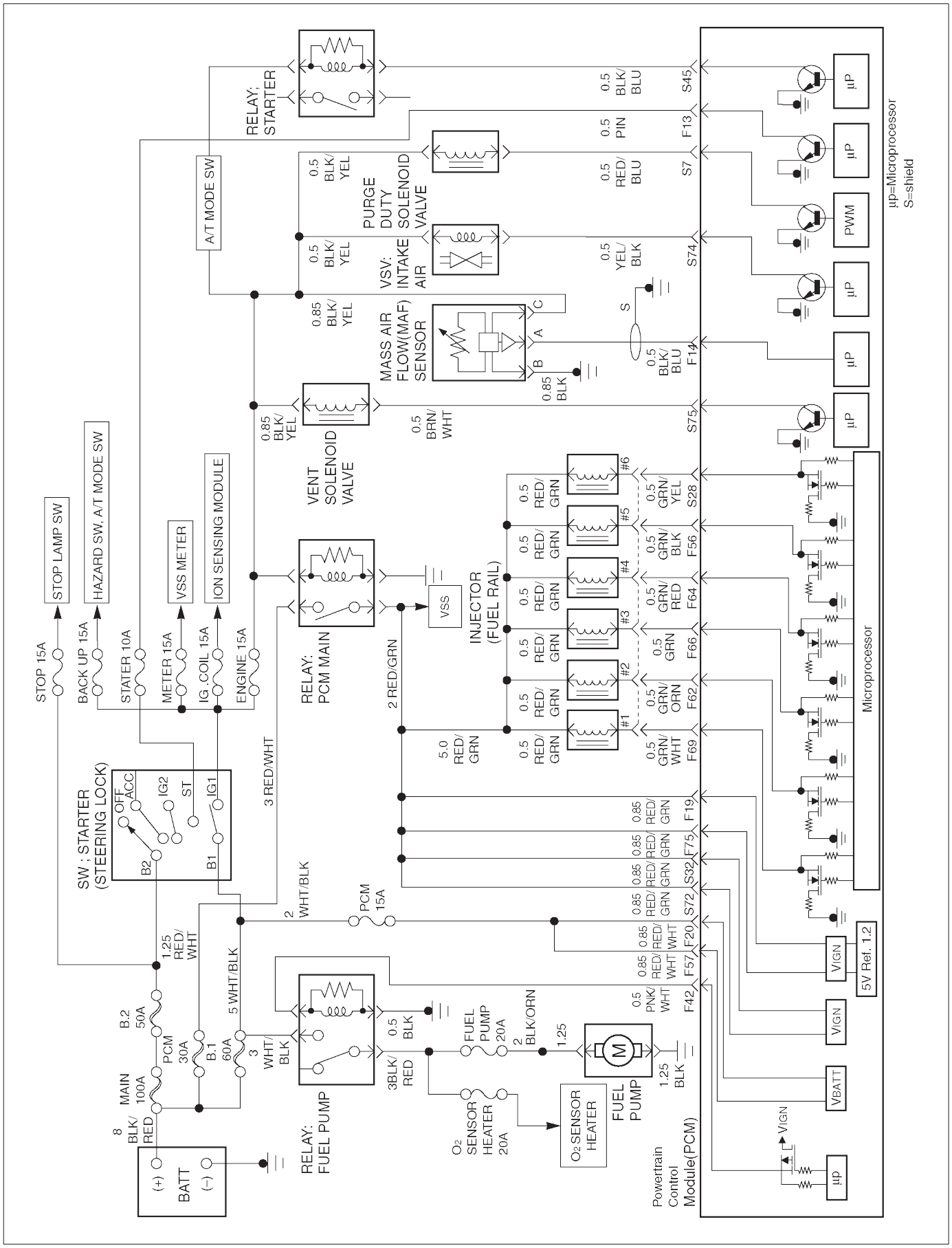
## Starter Control System Check (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 16 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 17 | Check the starter signal circuit.<br>1. Remove the starter fuse (10A).<br>2. Disconnect the PCM.<br>3. Check the circuit between Powertrain Control module (PCM) and starter fuse.<br>Is the problem found? | — | Go to *Step 18* | Go to *Step 19* |
| 18 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 19 | Check the "park or neutral" signal circuit.<br>1. Remove the starter relay.<br>2. Disconnect the PCM.<br>3. Check the circuit between PCM and starter relay.<br>Is the problem found? | — | Go to *Step 20* | Go to *Step 21* |
| 20 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 21 | Check the "park or neutral" signal circuit.<br>1. Remove the starter relay.<br>2. Disconnect the MODE switch.<br>3. Remove the engine (15A) fuse and back up (15A) fuse.<br>4. Check the circuit between MODE switch and starter relay.<br>5. Check the circuit between MODE switch and engine fuse.<br>6. Check the circuit between MODE switch and PCM.<br>7. Check the circuit between MODE switch and back up fuse.<br>Is the problem found? | — | Go to *Step 22* | Go to *Step 23* |
| 22 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 23 | Check the MODE switch. Refer to *4L30E Automatic transmission.*<br>Is the problem found? | | Go to *Step 24* | Go to *Step 25* |
| 24 | Replace the MODE switch.<br>Is the action complete? | — | Verify repair | — |
| 25 | Check the starter motor. Refer to *Section 6D Engine Electrical.*<br>Is the problem found? | | Go to *Step 26* | Go to *Step 28* |
| 26 | Replace the starter motor.<br>Is the action complete? | — | Verify repair | — |

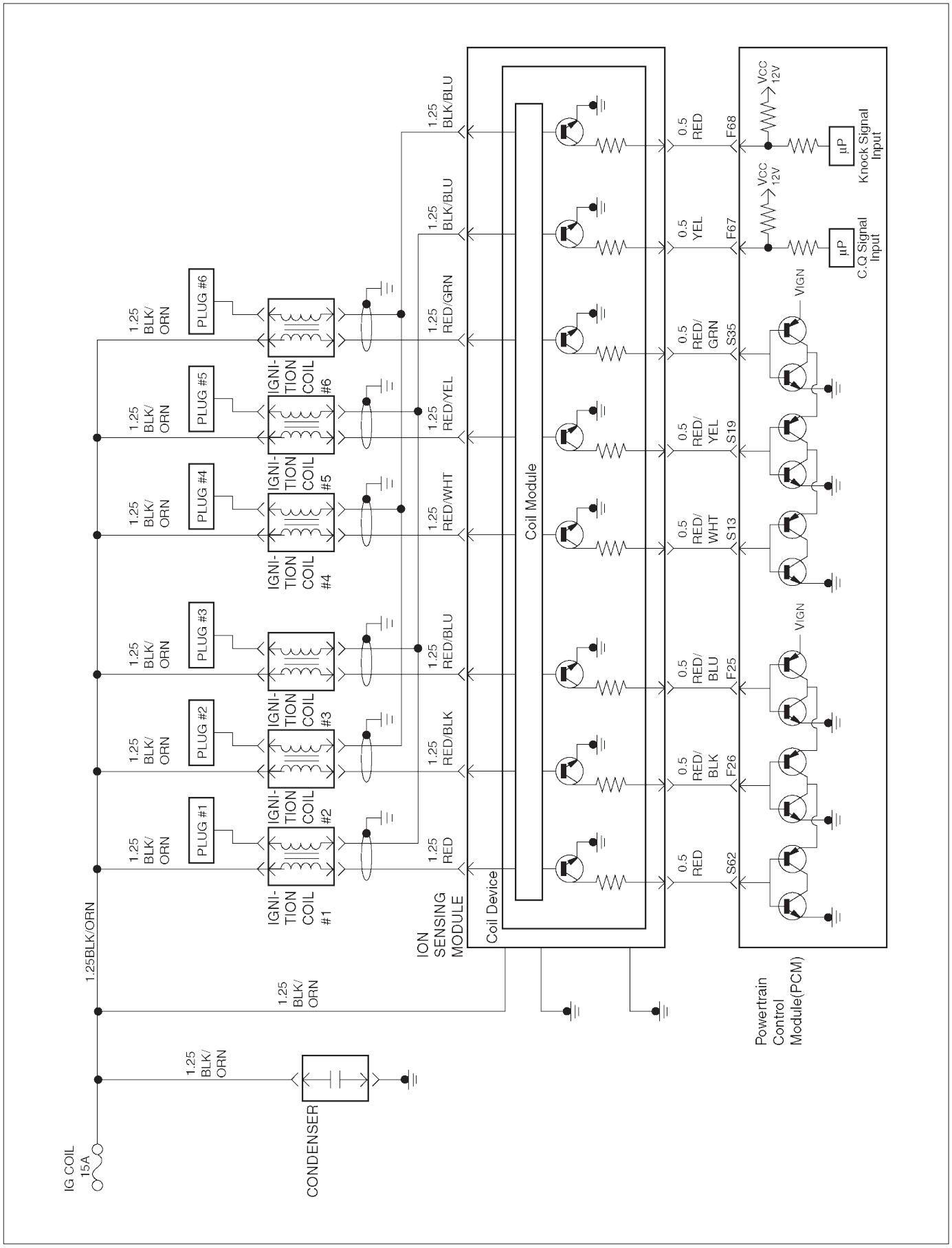
## Starter Control System Check (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 27 | Check the engine start times.<br>Is the engine start time less than specified value? | 10 sec. | System OK | Go to *the Engine Cranks But Will Not Run Chart* |
| 28 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.Refer to *ON-Vehicle Service in Power ControlModule and Sensors* for procedures.And also refer to latest Service Bulletin.Check to see if the latest software is released ornot.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Engine Cranks But Will Not Run




060R200083


IG COIL
15A
1.25BLK/ORN
1.25 BLK/ ORN
CONDENSER
1.25 BLK/ ORN
IGNI-TION COIL #1
IGNI-TION COIL #2
IGNI-TION COIL #3
IGNI-TION COIL #4
IGNI-TION COIL #5
IGNI-TION COIL #6
PLUG #1
PLUG #2
PLUG #3
PLUG #4
PLUG #5
PLUG #6
1.25 BLK/ ORN
1.25 RED
1.25 RED/BLK
1.25 RED/BLU
1.25 RED/WHT
1.25 RED/YEL
1.25 RED/GRN
1.25 BLK/BLU
ION SENSING MODULE
Coil Device
Coil Module
0.5 RED
0.5 RED/ BLK
0.5 RED/ BLU
0.5 RED/ WHT
0.5 RED/ YEL
0.5 RED/ GRN
0.5 YEL
0.5 RED
S62
F26
F25
S13
S19
S35
F67
F68
VIGN
VIGN
VCC 12V
VCC 12V
µP
µP
C.Q Signal Input
Knock Signal Input
Powertrain Control Module(PCM)

060R200075

## Circuit Description

The electronic Ignition system uses a coil -at-plug method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver outside the Ignition Current Sense System (ICSS), which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICSS opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all six injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left "OFF" during the next six 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting been received by the PCM. The ION sensor signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start - up, the PCM will begin sequential fuel delivery with a 1 -in-6 chance that fuel delivery is correct. The engine will run without a ION sensor signal, but will set a DTC code.

## Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed - through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or 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.
- Faulty engine coolant temperature sensor-Using a Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10 ° C of intake air temperature. If not, replace the ECT sensor.

## Test Description

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

5. An obvious cause of low fuel pressure would be an empty fuel tank.
6. The engine will easily start and run if a few injectors are disabled. It is not necessary to test all injectors at this time since this step is only a test to verify that all of the injectors have not been disabled by fuel contamination.
7. A blinking test light verifies that the PCM is monitoring the 58X crankshaft reference signal and is capable of activating the injectors. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 300 – 306 should be set.
19. By using a spark tester, each ignition coil's ability to produce 25,000 volts is verified.
25. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 301 – 306 should be set. All six injector driver circuits can be checked at one time without removing the intake manifold if a J 39021 – 95 test light is available. This is the alternative procedure:
    - With the ignition "OFF", disconnect the gray connector located at the rear of the air filter, attached to a bracket on the purge canister.
    - Connect test light J 39021 – 95 to the connector. Do any of the light constantly illuminate or fail to blink when the engine is cranked? If so, repair the short or open circuit, or replace the PCM if indicated.

This procedure only tests the driver circuit as far as the test connection, so step 31 is added to test the circuit all the way to the injector.

## Engine Cranks But Will Not Run

| 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 | Check the ignition coil fuse, the engine fuse, and the PCM fuse.<br>Was a fuse blown? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | Check for a short to ground and replace the fuse.<br>Is the action complete? | — | Verify repair | — |

## Engine Cranks But Will Not Run (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 4 | 1. Ignition "OFF", install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. (Use a shop cloth to absorb any fuel leakage while making the connection.)<br>2. Ignition "ON", observe the fuel pressure.<br>Is the fuel pressure within the specified values, and does it hold steady? | 285 - 375 kPa (43 – 55 psi) | Go to *Step 6* | Go to *Step 5* |
| 5 | Is any fuel pressure indicated? | — | Go to *Fuel System Electrical Test* | Go to *Fuel System Diagnosis* |
| 6 | Install the switch box J 39021–2 at the injector test connector and activate an injector.<br>Did the fuel pressure drop when the injector was activated? | — | Go to *Step 7* | Go to *Step 18* |
| 7 | Install an injector test light at the #2 cylinder injector harness connector.<br>Does the light blink when the engine is cranked? | — | Go to *Step 8* | Go to *Step 24* |
| 8 | 1. Ignition " OFF".<br>2. Disconnect the 11-pin connector at the ION sensing module.<br>3. With a test light to B + , probe each of the 6 exposed ION sensing module pins, one at a time, while the engine is cranked. (Use the gray narrow Metri - Pak © flexible female connector from the J - 35616 kit to make the pin accessible.)<br>Does the light flash at each pin when the engine is cranked? | — | Go to *Step 12* | Go to *Step 9* |
| 9 | 1. Remove the 4-pin connector at the ION sensing module.<br>2. Ignition " ON".<br>3. Use a test light at the harness connector to verify that the module is being supplied with B + and ground.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 11* |
| 10 | Repair the open ignition feed circuit or ground circuit to the ION sensing module.<br>Is the action complete? | — | Verify repair | — |
| 11 | Repair the ION sensing module.<br>Is the action complete? | — | Verify repair | — |
| 12 | 1. Reconnect the ION sensing module 11-pin connector.<br>2. Remove the electrical connector from each coil.<br>3. With a test light to B+, probe each of the coil connectors at the wire which runs to the ION sensing module.<br>Does the light flash at each coil connector when the engine is cranked? | — | Go to *Step 14* | Go to *Step 13* |
| 13 | Check for an open circuit between the coil and ION sensing module.<br>Is the action complete? | — | Verify repair | — |

## Engine Cranks But Will Not Run (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 14 | 1. Ignition "ON".<br>2. While the coil connectors are disconnected, touch each coil connector's ignition feed terminal with a grounded test light (the ignition feed wire is YEL tracer).<br>Did the test light illuminate? | — | Go to *Step 16* | Go to *Step 15* |
| 15 | Repair the open ignition feed circuit.<br>Is the action complete? | — | Verify repair | — |
| 16 | While the coil connectors are disconnected, touch each connector's secondary ground terminal with a test light to B +. (The ground wires are black.)<br>Did the test light illuminate at each coil connector? | — | Go to *Step 18* | Go to *Step 17* |
| 17 | Repair the open secondary ground circuit.<br>Is the action complete? | — | Verify repair | — |
| 18 | 1. Test the fuel for contamination.<br>2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test).<br>Was a problem found? | — | Verify repair | Go to *Step 19* |
| 19 | 1. Remove any ignition coil and install a spark tester at the spark plug end of the coil.<br>2. Observe the tester while the engine is cranking.<br>Was a crisp, blue spark observed? Only one or two sparks followed by no result is considered the same as "No Spark". | — | Go to *Step 21* | Go to *Step 20* |
| 20 | Replace the ignition coil, and return to Step 19 to test the remaining coils.<br>Is the action complete? | — | Verify repair | — |
| 21 | Repeat Step 19 for each coil. Remove only one coil at a time, and reinstall each coil on its spark plug after testing, but do not refasten coils with screws at this time.<br>After all coils have passed the spark test, does the engine start? | — | Refasten all coils with their screws | Go to *Step 22* |
| 22 | 1. Remove the spark plugs from all cylinders.<br>2. Visually inspect the spark plug electrodes.<br>3. Replace any spark plugs with loose or missing electrodes or cracked insulators.<br>Did your inspection reveal any spark plugs exhibiting excessive fouling? | — | Correct the fouling condition | Go to *Step 23* |

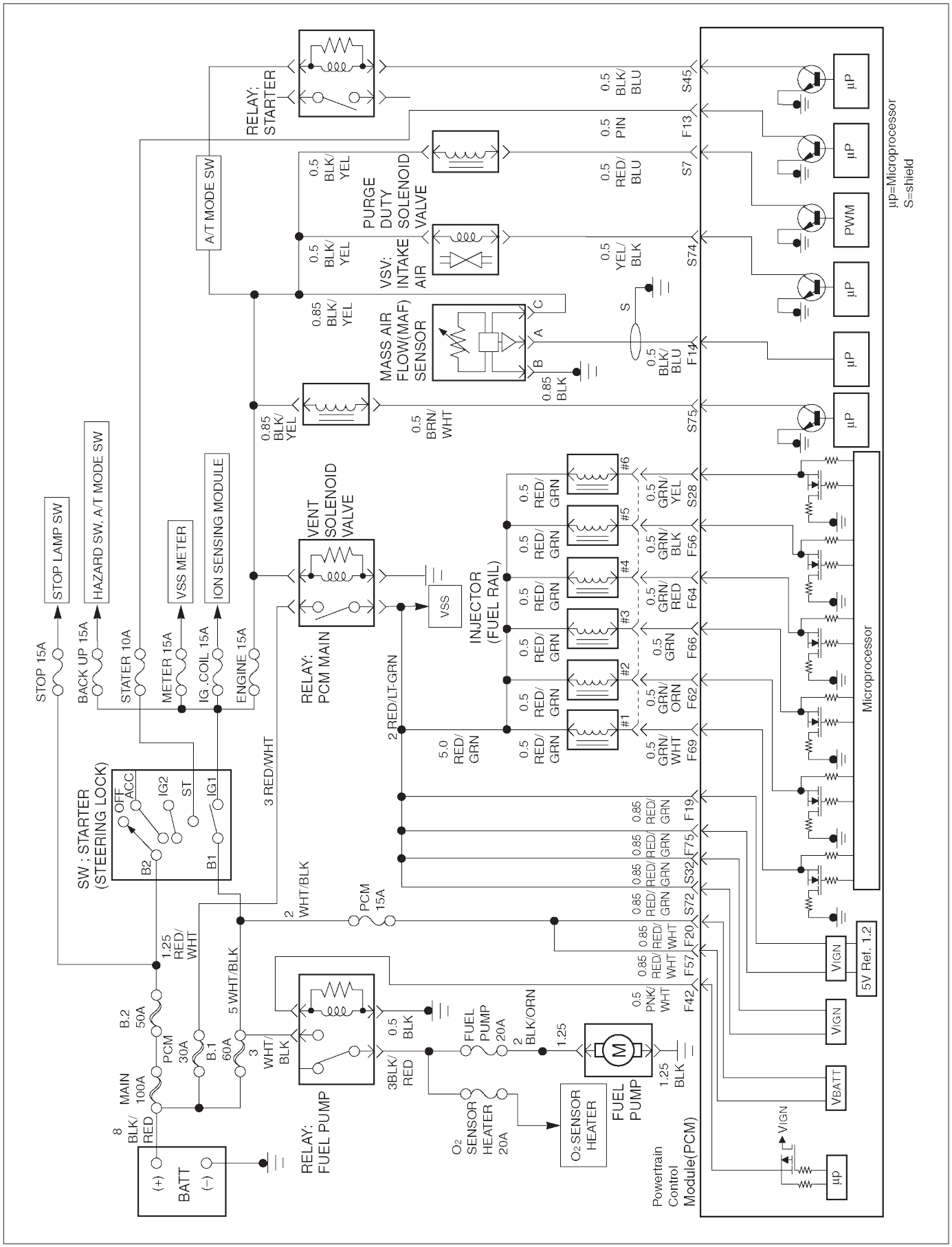
## Engine Cranks But Will Not Run (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 23 | Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions:<br>• Faulty or incorrect camshaft drive belts<br>• Leaking or sticky valves or rings<br>• Excessive valve deposits<br>• Weak valve springs<br>• Incorrect valve timing<br>• Leaking head gasket<br>Is the action complete? | — | Verify repair | Go to *Step 25* |
| 24 | Observe the "Engine Speed" data display on the Tech 2 while cranking the engine.<br>Is the engine RPM indicated? | — | Go to *Step 25* | Go to *Step 34* |
| 25 | 1. Disconnect the 7-pin gray connector at the rear of the air filter beneath the point where the air duct attaches to the MAF sensor.<br>2. Ignition "ON".<br>3. Using a test light connected to ground, probe the ignition terminal at the PCM (female) side of the 7-pin connector.<br>Is the test light "ON"? | — | Go to *Step 26* | Go to *Step 32* |
| 26 | 1. At the PCM (female) side of the connector, connect a test light between the ignition + terminal and one of the injector driver circuits at the same connector.<br>2. Ignition "ON".<br>3. Observe the test light, and repeat the test for each injector driver circuit.<br>Did the test light stay on when checking any of the 6 injector driver circuits? | — | Go to *Step 27* | Go to *Step 29* |
| 27 | 1. Ignition "OFF", disconnect the PCM.<br>2. Ignition "ON", observe the test light.<br>Is the test light "ON"? | — | Go to *Step 28* | Go to *Step 33* |
| 28 | Locate and repair the short to ground in the injector driver circuit.<br>Is the action complete? | — | Verify repair | — |
| 29 | 1. Using the same test location as in step 26, connect a test light between the ignition terminal and one of the driver circuits.<br>2. Crank the engine and observe the test light.<br>3. Repeat for each injector driver circuit.<br>Did the light blink during the test for each circuit? | — | Go to *Step 31* | Go to *Step 30* |
| 30 | Check for an open injector driver circuit.<br>Was a problem found? | — | Verify repair | Go to *Step 33* |

## Engine Cranks But Will Not Run (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 31 | 1. At the injector (male) side of the gray connector mentioned in step 25, connect an ohmmeter between the ignition pin and one of the driver circuit pins.<br>2. Check for continuity in the circuit.<br>3. Repeat for each injector circuit. The readings should be approximately equal to the specified value for injector resistance.<br>Was a problem found? | 12.5 Ω | Verify repair | Go to *Step 8* |
| 32 | Repair the ignition feed circuit.<br>Is the action complete? | — | Verify repair | — |
| 33 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 34 | 1. Raise the vehicle and disconnect the CKP sensor harness.<br>2. Ignition "ON".<br>3. With a test light to ground, probe the harness ignition feed terminal.<br>Did the light illuminate? | — | Go to *Step 36* | Go to *Step 35* |
| 35 | Check the ignition feed wire between the sensor and the PCM for a short to ground or open circuit.<br>Is the action complete? | — | Verify repair | — |
| 36 | 1. Ignition "ON".<br>2. At the CKP harness connector, connect a test light between the ignition and ground terminals.<br>Did the light illuminate? | — | Go to *Step 38* | Go to *Step 37* |
| 37 | Check the sensor ground circuit for an open or short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 38 | Check the signal circuit between the sensor and the PCM for a short to ground, short to voltage, or an open.<br>Was a problem found? | — | Verify repair | Go to *Step 39* |
| 39 | Replace the CKP position sensor.<br>Is the action complete? | — | Verify repair | Go to *Step 33* |

# Fuel System Electrical Test




060R200044

## Circuit Description

When the ignition switch is first turned “ON”, the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in-tank fuel pump. The fuel pump relay will remain “ON” as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned “ON” or the engine is stopped.
The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition “ON”, the fuel pump can be turned “ON” by using a command by the Tech 2.

## Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or 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.

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the “Fuel System Pressure Test” chart should be used for diagnosis.

**CAUTION: To reduce the risk of fire and personal injury:**

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

## Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

## Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover .
3. Reinstall the fuel pump relay.

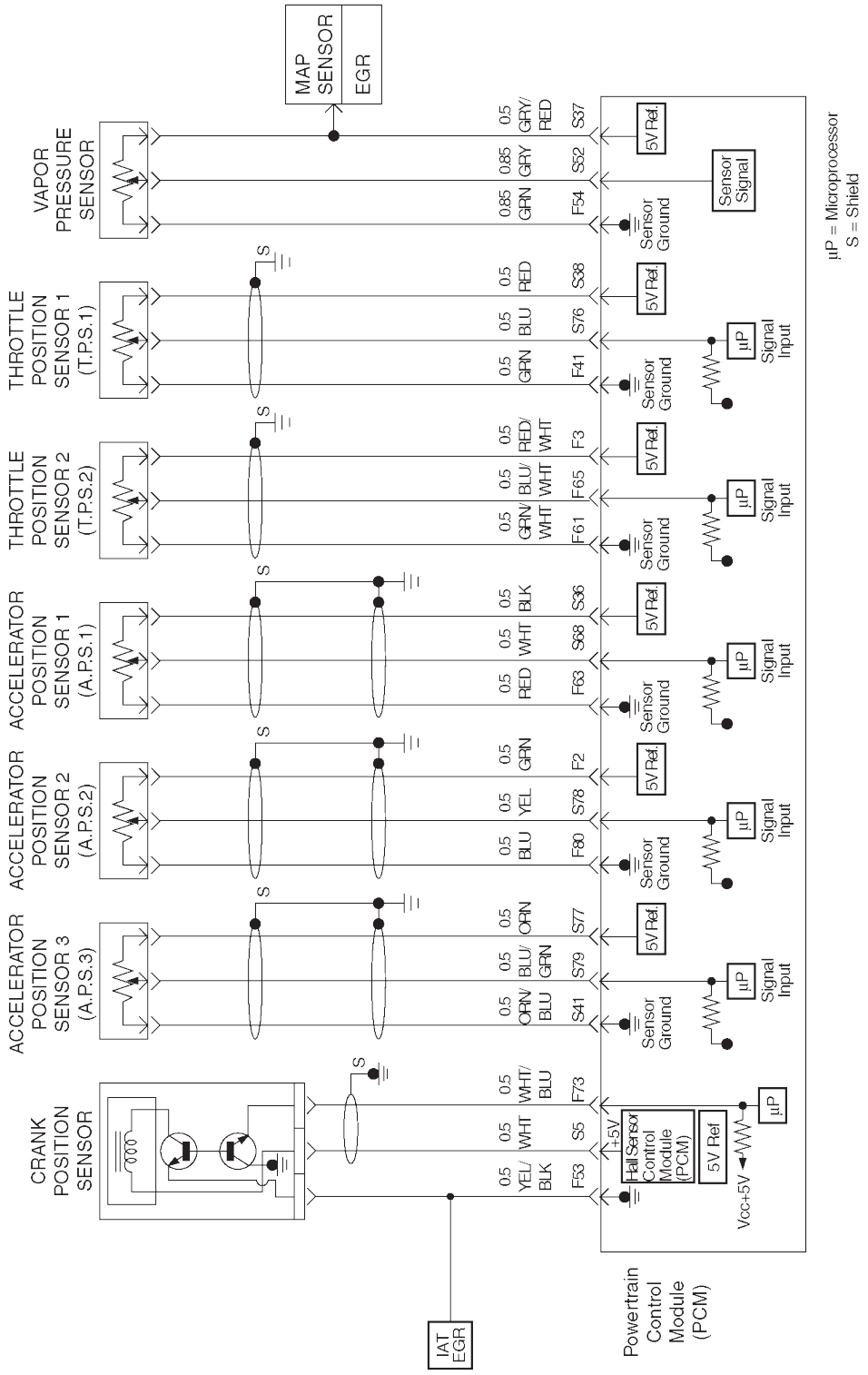
## Fuel System Electrical Test

| 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. Read the “Caution” above.<br>2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting.<br>3. Ignition ON, Engine is Off.<br>4. Use a Tech 2 to command the fuel pump “ON”. (Refer to the Miscellaneous Test.)<br>Is there an immediate pressure build-up which indicates the pump is running? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Verify that the pump is not running by removing the fuel filler cap and listening.<br>2. Command the pump “ON” with the Tech 2.<br>Did the pump turn “OFF” after 2 seconds? | — | Test completed | Go to *Step 12* |
| 4 | 1. Ignition “OFF”.<br>2. Remove the fuel pump relay.<br>3. Using a test light connected to ground, probe the battery feed to the relay.<br>Did the light illuminate? | — | Go to *Step 6* | Go to *Step 5* |
| 5 | Repair short or open battery feed to fuel pump relay.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Connect a test light between the two wires that connect to the fuel pump relay pull-in coil.<br>2. Ignition “ON”.<br>Did the test light illuminate for 2 seconds and then turn off? | — | Go to *Step 12* | Go to *Step 7* |
| 7 | 1. With a test light connected to battery (–), probe the fuel pump relay connector at the wire which runs from the relay pull-in coil to the PCM.<br>2. Ignition “ON”.<br>Did the test light illuminate for 2 seconds and then turn off? | — | Go to *Step 8* | Go to *Step 9* |
| 8 | Locate and repair open in the fuel pump relay ground circuit.<br>Is the action complete? | — | Verify repair | — |
| 9 | Check for short or open between the PCM and the fuel pump relay.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Check the fuel pump relay circuit for a poor terminal connection at the PCM.<br>2. If a problem is found, replace terminal as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |

## Fuel System Electrical Test (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 12 | 1. Reconnect the fuel pump relay.<br>2. Disconnect the fuel pump electrical connector at the fuel tank.<br>3. Using a test light connected to ground, probe the fuel pump feed wire (harness side).<br>4. Command the fuel pump "ON" with a Tech 2.<br>Did the light illuminate for 2 seconds? | — | Go to *Step 15* | Go to *Step 13* |
| 13 | 1. Honk the horn to verify that the horn relay is functioning.<br>2. Substitute the horn relay for the fuel pump relay.<br>3. Leave the test light connected as in step 12.<br>4. Command the fuel pump "ON" with the Tech 2.<br>Did the test light illuminate for 2 seconds when the fuel pump was commanded "ON"? | — | Go to *Step 17* | Go to *Step 14* |
| 14 | 1. Re-connect the horn relay in its proper location.<br>2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank.<br>Is the action complete? | — | Verify repair | — |
| 15 | 1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side).<br>2. Command the fuel pump "ON" with a Tech 2.<br>Did the test light illuminate for 2 seconds? | — | Go to *Step 18* | Go to *Step 16* |
| 16 | Repair the open circuit in the fuel pump ground wire.<br>Is the action complete? | — | Verify repair | — |
| 17 | 1. Re-connect the horn relay in its proper location.<br>2. Replace the fuel pump relay.<br>Is the action complete? | — | Verify repair | — |
| 18 | Replace the fuel pump.<br>Is the action complete? | — | Verify repair | — |

# Electric Throttle Control (ETC) System Check




060R200065

## Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in PWM (%) to adjust the throttle valve into a passage in the throttle body to allow air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The accelerator position (AP1) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal angle will vary about 13% at idle position to about 87% at wide open throttle(WOT).

  APS signal is used to determine which DC motor will adjust throttle position.

  After the APS signal has been processed by the PCM, it will command DC motor to allow movement of throttle position.

## 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 connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.
- Accelerator pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the accelerator pedal arm and on the accelerator pedal.

## Test Description

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

2. Visually/physically inspect for the following throttle valve conditions.
3. Visually/physically inspect for the following accelerator pedal conditions.
5. Check the following circuits for throttle valve and DC motor. Check the following TP sensor resistance and DC motor.
7. Check the following circuits for accelerator pedal. Check the following AP sensor resistance.
10. Following DTC: Software detect Error for ETC system.
11. Following DTC: Software detect Error for ETC system.

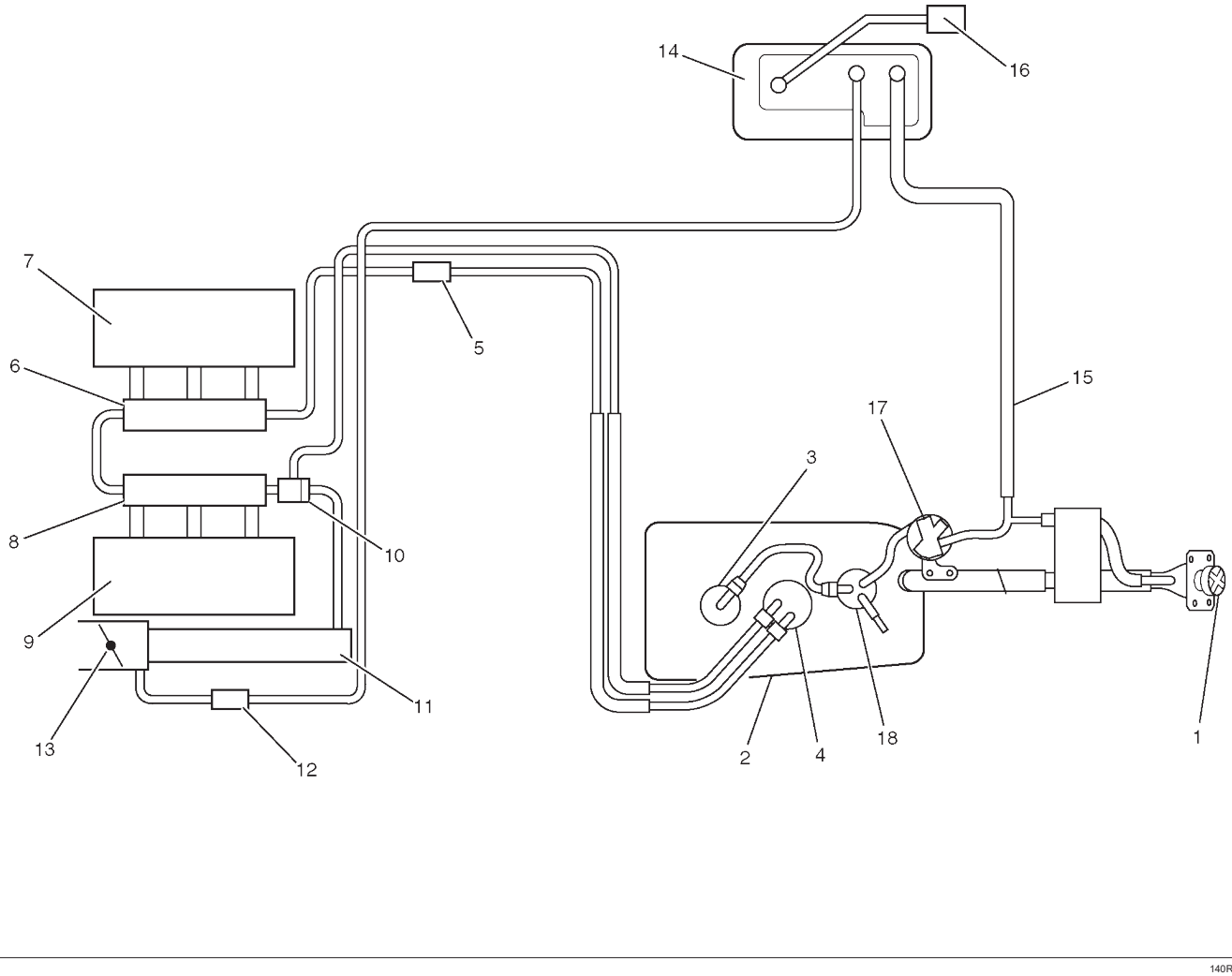
# Electric Throttle Control (ETC) System Check

| 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 | Visually/physically inspect for the following conditions:<br>● Throttle body tampering.<br>● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.<br>● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate.<br>● Throttle body with lever: When check for objects to send round the throttle spring lever that lever is smooth movement by less than 9 l·bm{1.0 N·m}, and spring lever has not excessive play.<br>● Throttle function: Check for the throttle function. When ignition switch "ON" that throttle lever is smooth operated by step on the accelerator pedal.<br>Did any of the above require a repair? | — | Refer to *appropriate section for on-vehicle service* | Go to *Step 3* |
| 3 | Visually/physically inspect for the following conditions:<br>● Accelerator pedal tampering.<br>● Accelerator pedal : Check for objects blocking the spring or pedal arm.<br>● Accelerator pedal : For check for objects to move the accelerator pedal that pedal is smooth movement, and accelerator pedal arm has not excessive play.<br>Did any of the above require a repair? | — | Refer to *appropriate section for on-vehicle service* | Go to *Step 4* |
| 4 | 1. Check for a poor connection at the throttle body harness connector.<br>2. Check for a poor connection at the accelerator position sensor harness connector.<br>3. If a problem is found, replace faulty terminals as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>● Throttle position sensor 1 circuit.<br>● Throttle position sensor 2 circuit.<br>● Throttle DC motor circuit.<br>● Throttle position sensor resistance.<br>● Throttle DC motor resistance.<br>If a problem is found, repair as necessary.<br>Was a problem found? | Vcc–GND<br>1–7kΩ<br>SIG–GND<br>change<br>resistance<br>0.3–100Ω | Verify repair | Go to *Step 6* |

# Electric Throttle Control (ETC) System Check (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Install the Tech 2<br>2. Ignition "ON" but not engine run.<br>3. Chech the valve for APS and TPS.<br>Was the problem found? | Idle AP1 = 11–13% AP2 = 87–88% AP3 = 87–88% TP1 = 1–6% TP2 = 1–6% WOT AP1 = 85–89% AP2 = 11–15% AP3 = 32–36% TP1 = 98–100% TP2 = 98–100% | Go to *Step 10* | Go to *Step 7* |
| 7 | Replace the throttle valve.<br>Is the action complete? | — | Go to *Step 8* | — |
| 8 | Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>● Accelerator position sensor 1 circuit.<br>● Accelerator position sensor 2 circuit.<br>● Accelerator position sensor 3 circuit.<br>● Accelerator position sensor resistance.<br>If a problem is found, repair as necessary.<br>Was a problem found? | Vcc–GND 4–6kΩ SIG–GND change resistance | Verify repair | Go to *Step 9* |
| 9 | Replace the accelerator position sensor.<br>Is the action complete? | — | Go to *Step 10* | – |
| 10 | Following below the DTCs stored:<br>P1125, P1290, P1295, P1299 | — | Go to *applicable DTC chart* | Go to *Step 11* |
| 11 | Following below the DTCs stored:<br>P1514, P1515, P1516, P1523, P1271, P1272, P1273 | — | Go to *applicable DTC chart* | Go to *Step 12* |
| 12 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Fuel System Diagnosis




140R200004

**Legend**

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Purge Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Vent Hose
(16) Vent Solenoid Valve
(17) Separator
(18) Shut off Valve (With Over Pressure Relief Valve)

## Circuit Description

When the ignition switch is turned "ON", the powertrain control module (PCM) will turn "ON" the in-tank fuel pump. The in-tank fuel pump will remain "ON" as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in-tank fuel pump "OFF" 2 seconds after the ignition switch is turned "ON" or 2 seconds after the engine stops running. The in-tank fuel pump is an electric pump within an integral reservoir. The in-tank fuel pump supplies fuel through an in-line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

## Test Description

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

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch "ON" and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 333-376 kPa (48-55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.

3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
   - The fuel pump check valve.
   - The fuel pump flex line.
   - The valve or valve seat within the fuel pressure regulator.
   - The fuel injector(s).

4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may case a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

**IMPORTANT:** Make sure the fuel system is not operating in the "Fuel Cut-Off Mode".

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine "OFF".

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
   - Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to *Fuel Rail Assembly* in *On-Vehicle Service.*
   - Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

**CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.**

- **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.

20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.

21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold ), hesitation, poor driveability, lack of power, surging , and misfiring.

22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump "ON" with the Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

**CAUTION: To reduce the risk of fire and personal injury:**

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

## Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

## Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover.
3. Reinstall the fuel pump relay.

# Fuel System 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. Turn the ignition “OFF”.<br>2. Turn the air conditioning system “OFF”.<br>3. Relieve fuel system pressure and install the fuel pressure gauge.<br>4. Turn the ignition “ON”.<br>NOTE: The fuel pump will run for approximately 2 seconds. Use the Tech 2 to command the fuel pump “ON”.<br>(Refer to the Miscellaneous Test.)<br>5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running.<br>Is the fuel pressure within the specified limits? | 290-376 kPa (42-55 psi) | Go to *Step 3* | Go to *Step 17* |
| 3 | NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant.<br>Does the fuel pressure indicated by the fuel pressure gauge remain constant? | — | Go to *Step 4* | Go to *Step 12* |
| 4 | 1. When the vehicle is at normal operation temperature, turn the ignition “ON” to build fuel pressure and observe the measurement on the gauge.<br>2. Start the engine and observe the fuel pressure gauge.<br>Did the reading drop by the amount specified after the engine was started? | 21-105 kPa (3-15 psi) | Go to *Step 5* | Go to *Step 9* |
| 5 | Is fuel pressure dropping off during acceleration, cruise, or hard cornering? | — | Go to *Step 6* | Check for improper fuel |
| 6 | Visually and physically inspect the following items for a restriction:<br>● The in-pipe fuel filter.<br>● The fuel feed line.<br>Was a restriction found? | — | Verify repair | Go to *Step 7* |
| 7 | Remove the fuel tank and visually and physically inspect the following items:<br>● The fuel pump strainer for a restriction.<br>● The fuel line for a leak.<br>● Verify that the correct fuel pump is in the vehicle.<br>Was a problem found in any of these areas? | — | Verify repair | Go to *Step 8* |

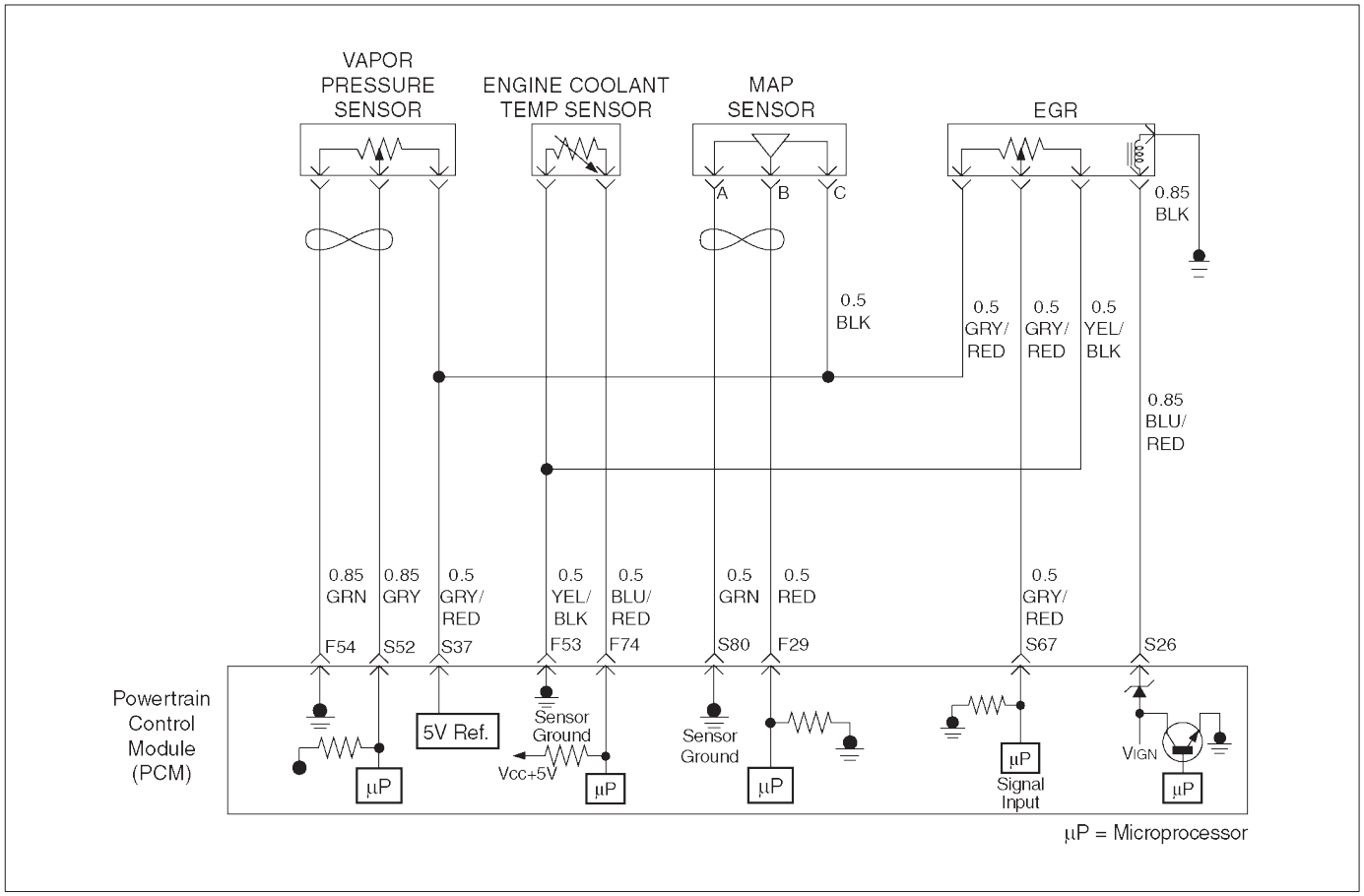
## Fuel System Diagnosis (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Replace the fuel pump.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Disconnect the vacuum hose from the fuel pressure regulator.<br>2. With the engine idling, apply 12-14 inches of vacuum to the fuel pressure regulator.<br>Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified? | 21-105 kPa (3-15 psi) | Go to *Step 10* | Go to *Step 11* |
| 10 | Locate and repair the loss of vacuum to the fuel pressure regulator.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the fuel pressure regulator.<br>Is the action complete? | — | Verify repair | — |
| 12 | 1. Run the fuel pump with the Tech 2.<br>2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers which will not damage the hose.<br>Does the fuel pressure indicated by the fuel pressure gauge remain constant? | — | Go to *Step 13* | Go to *Step 15* |
| 13 | Visually inspect the fuel supply line and repair any leaks.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | Remove the fuel tank and inspect for leaky hose or in-tank fuel line.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 15 | 1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers.<br>2. With suitable locking pliers, which will not damage the hose, clamp the fuel return line to prevent fuel from returning to the fuel tank.<br>3. Run the fuel pump with the Tech 2.<br>4. After pressure has built up, remove power to the pump.<br>Does the fuel pressure indicated by the fuel pressure gauge remain constant? | — | Go to *Step 11* | Go to *Step 16* |
| 16 | Locate and replace any leaking fuel injector(s).<br>Is the action complete? | — | Verify repair | — |
| 17 | Is the fuel pressure indicated by the fuel pressure gauge above the specified limit? | 376 kPa (55 psi) | Go to *Step 18* | Go to *Step 21* |

## Fuel System Diagnosis (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 18 | 1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief.*<br>2. Disconnect the fuel return line from the fuel rail.<br>3. Attach a length of flexible hose to the fuel rail return outlet passage.<br>4. Place the open end of the flexible hose into an approved gasoline container.<br>5. Run the fuel pump with the Tech 2.<br>6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running.<br>Is the fuel pressure within the specified limits? | 290-376 kPa (42-55 psi) | Go to *Step 19* | Go to *Step 20* |
| 19 | Locate and correct the restriction in the fuel return line.<br>Is the action complete? | — | Verify repair | — |
| 20 | Visually and physically inspect the fuel rail outlet passages for a restriction.<br>Was a restriction found? | — | Verify repair | Go to *Step 11* |
| 21 | Is the fuel pressure indicated by the fuel pressure gauge above the specified value? | 0 kPa (0 psi) | Go to *Step 22* | Go to *Step 23* |
| 22 | 1. Command the fuel pump "ON" with the Tech 2.<br>2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed.<br>**CAUTION: Do not let the fuel pressure exceed the second specified value.**<br>Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value? | 376 kPa (55 psi)<br>414 kPa (60 psi) | Go to *Step 11* | Go to *Step 7* |
| 23 | 1. Command the fuel pump "ON" with the Tech 2.<br>2. Remove the fuel filler cap and listen for the sound of the fuel pump running.<br>3. Turn the pump off.<br>Was the fuel pump running? | — | Go to *Step 7* | Go to *Fuel System Electrical Test Chart* |

# Exhaust Gas Recirculation (EGR) System Check




060R200050

## Circuit Description

A properly operation exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio. Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NOx) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

## Diagnostic Aids

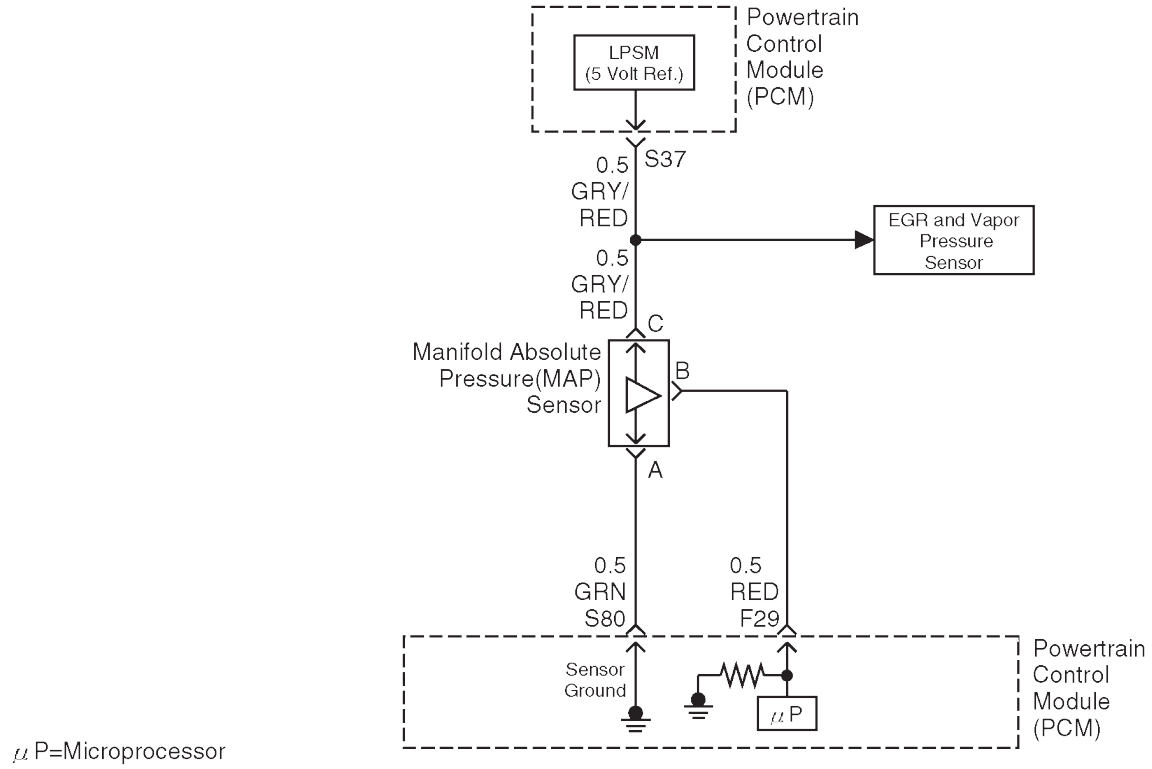
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NOx. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause a rough idle. Also, an EGR mounted incorrectly (rotated 180°) could cause rough idle. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to *Manifold Absolute Pressure Output Check.*

# Exhaust Gas Recirculation (EGR) System Check

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Check the EGR valve for looseness.<br>Is the EGR valve Loose? | — | Go to *Step 2* | Go to *Step 3* |
| 2 | Tighten the EGR valve.<br>Is the action complete? | — | Verify repair | — |
| 3 | 1. Place the transmission selector in Park or Neutral.<br>2. Start the engine and idle until warm.<br>3. Using a Tech 2, command EGR “50% ON”. (Refer to the Miscellaneous Test.)<br>Does the engine idle rough and lose RPMs? | — | EGR system working properly. No problem found. | Go to *Step 4* |
| 4 | 1. Engine “OFF”.<br>2. Ignition “ON”.<br>3. Using a test light to ground, check the EGR harness between the EGR valve and the ignition feed.<br>Does the test light illuminate? | — | Go to *Step 6* | Go to *Step 5* |
| 5 | Repair the EGR harness ignition feed.<br>Was the problem corrected? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Remove the EGR valve.<br>2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions.<br>Does the EGR valve have excessive deposits, obstructions or any restrictions? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | Clean or replace EGR system components as necessary.<br>Was the problem corrected? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Ground the EGR valve metal case to battery (–).<br>2. Using a Tech 2, command EGR “ON” and observe the EGR valve pintle for movement.<br>Does the EGR valve pintle move according to command? | — | Go to *Step 9* | Go to *DTC P1406 chart* |
| 9 | 1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds.<br>2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage.<br>Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions? | — | Go to *Step 10* | EGR system working properly. No problem found. |
| 10 | Clean or replace EGR system components as necessary.<br>Is the action complete? | — | Verify repair | — |

# Manifold Absolute Pressure (MAP) Output Check




060R200051

## Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5-volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1-2 volts at idle. Higher pressure (high voltage) output voltage will be about 4-4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

## Test Description

**IMPORTANT:** Be sure to used the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Applying 34 kPa (10 inch Hg) vacuum to the MAP sensor should cause the voltage to be 1.5-2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction, Be sure that no other vacuum devices are connected to the MAP hose.

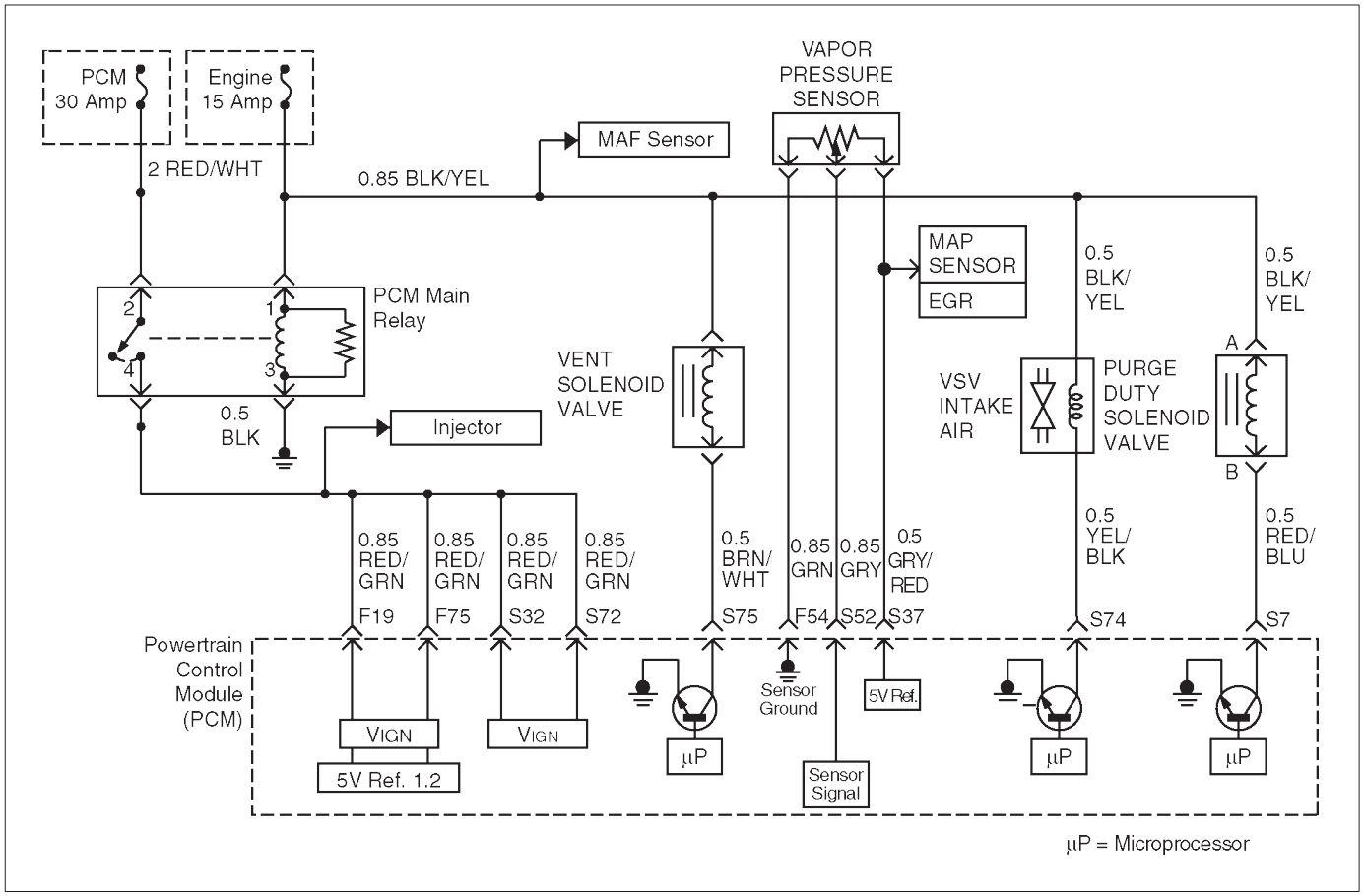
**IMPORTANT:** Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

# Manifold Absolute Pressure (MAP) Output Check

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | 1. Turn the ignition “OFF” and leave it “OFF” for 15 seconds.<br>2. Ignition “ON”. Don’t crank engine.<br>3. The Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage.<br>4. Compare this scan reading to scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1-4.<br>Is the voltage reading the same +/–0.40 volt? | — | Go to *Step 2* | Go to *Step 5* |
| 2 | 1. Disconnect the vacuum hose at the MAP sensor and plug the hose.<br>2. Connect a hand vacuum pump to the MAP sensor.<br>3. Start the engine.<br>4. Apply 34 kPa (10 in.Hg) of vacuum and note the voltage change.<br>Is the voltage change 1.5-2.1 volts less than Step 1? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | Check the sensor cover for leakage or restriction.<br>Does the hose supply vacuum to the MAP sensor only? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | Repair the hose blockage.<br>Is the action complete? | — | Verify repair | — |
| 5 | Check the sensor connection.<br>Is the sensor connection good? | — | Go to *Step 6* | Go to *Step 7* |
| 6 | Refer to *On-Vehicle Service, MAP Sensor.*<br>Is the action complete? | — | Verify repair | — |
| 7 | Repair the poor connection.<br>Is the action complete? | — | Verify repair | — |

# Evaporative (EVAP) Emissions Canister Purge Valve Check




060RY00398

## Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge “ON”). The EVAP purge solenoid control is turned “ON” and “OFF” several times a second. The duty cycle (pulse width or “ON” time) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the purge solenoid is enabled when the appropriate conditions have been met:

- The engine run time after start is more than 60 seconds.
- The engine coolant temperature is above 30°C (86°F).
- The fuel control system is operating in the closed-loop mode.

## Diagnostic Aids

- Make a visual check of vacuum hoses.
- Check the throttle body for cracks.
- Check the malfunction indicator lamp for a possible mechanical problem.

## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

1. Check to see if the solenoid is open or closed. The solenoid is normally de-energized in this step, so it should be closed.
2. This step checks to determine if the solenoid was open due to an electrical circuit problem or a defective solenoid.
3. This should normally energize the solenoid, opening the valve and allowing the vacuum to drop (purge “ON”).

# Evaporative (EVAP) Emissions Canister Purge Valve Check

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | 1. Ignition “OFF”.<br>2. Ignition “ON”, engine “OFF”.<br>3. At the throttle body, disconnect the hose that goes to the purge solenoid.<br>4. Using a hand vacuum pump with an attached vacuum gauge J 23738-A, apply vacuum (10 in. Hg or 34 kPa) to the solenoid.<br>Does the solenoid hold the vacuum? | — | Go to *Step 3* | Go to *Step 2* |
| 2 | 1. Disconnect the solenoid electrical connector.<br>2. As in Step 1, apply vacuum (10 in. Hg or 34 kPa) to the solenoid.<br>Does the solenoid hold the vacuum? | — | Go to *Step 4* | Go to *Step 7* |
| 3 | 1. At the throttle body, put a cap over the vacuum port where the hose was disconnected for testing. This is to prevent a vacuum leak when the engine is started.<br>2. Ignition “OFF”.<br>3. Install the Tech 2.<br>4. Apply vacuum to the purge solenoid with the hand vacuum pump.<br>5. Start the engine, run at 2500 RPM.<br>6. Using the Tech 2, select Powertrain, 3.5–V6 6VE1, F3: Misc. Tests, F2: EVAP Purge, F0: EVAP Purge. (Refer to the Misellaneous Test.)<br>7. Turn the purge solenoid “ON”.<br>Did the vacuum drop when the purge was turned on? | — | Go to *Step 8* | Go to *Step 9* |
| 4 | Check for a short to ground in the S7 Pin wire.<br>Is there a short? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the short to ground.<br>Is the action complete? | — | Verify repair | — |
| 6 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service*in *Powertrain Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 7 | Replace the faulty purge solenoid. Refer to *On-Vehicle Service, EVAP Canister Purge Solenoid.*<br>Is the action complete? | — | Verify repair | — |

# Evaporative (EVAP) Emissions Canister Purge Valve Check (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Turn the ignition "OFF".<br>2. At the throttle body, install a vacuum gauge where the hose from the purge solenoid was disconnected for testing.<br>3. Start the engine.<br>4. Stabilize the engine speed at about 2500 RPM.<br>5. Momentarily snap the throttle open and let it return to idle.<br>Is there approximately 10 in. Hg (34 kPa) of vacuum available at the EVAP emission canister purge solenoid? | — | No problem found in the EVAP emission canister purge valve check | Refer to *Diagnostic Aids* |
| 9 | 1. Disconnect the solenoid electrical connector.<br>2. Connect a test lamp between the harness terminals.<br>Does the test lamp light? | — | Go to *Step 7* | Go to *Step 10* |
| 10 | Probe terminal A and terminal B with a test lamp to ground.<br>Does the test lamp light on both terminals? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Repair the short to voltage in the S7 Pin wire.<br>Is the action complete? | — | Verify repair | — |
| 12 | Does one of the terminals light the test lamp? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Check for an open in the S7 Pin wire between the purge solenoid and the PCM.<br>Was there an open circuit? | — | Go to *Step 15* | Go to *Step 6* |
| 14 | Repair the open in the BLK/YEL wire.<br>Is the action complete? | — | Verify repair | — |
| 15 | Repair the open in the S7 Pin wire.<br>Is the action complete? | — | Verify repair | — |

# PCM Diagnostic Trouble Codes

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Tech 2, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

**PCM Diagnostic Trouble Codes**

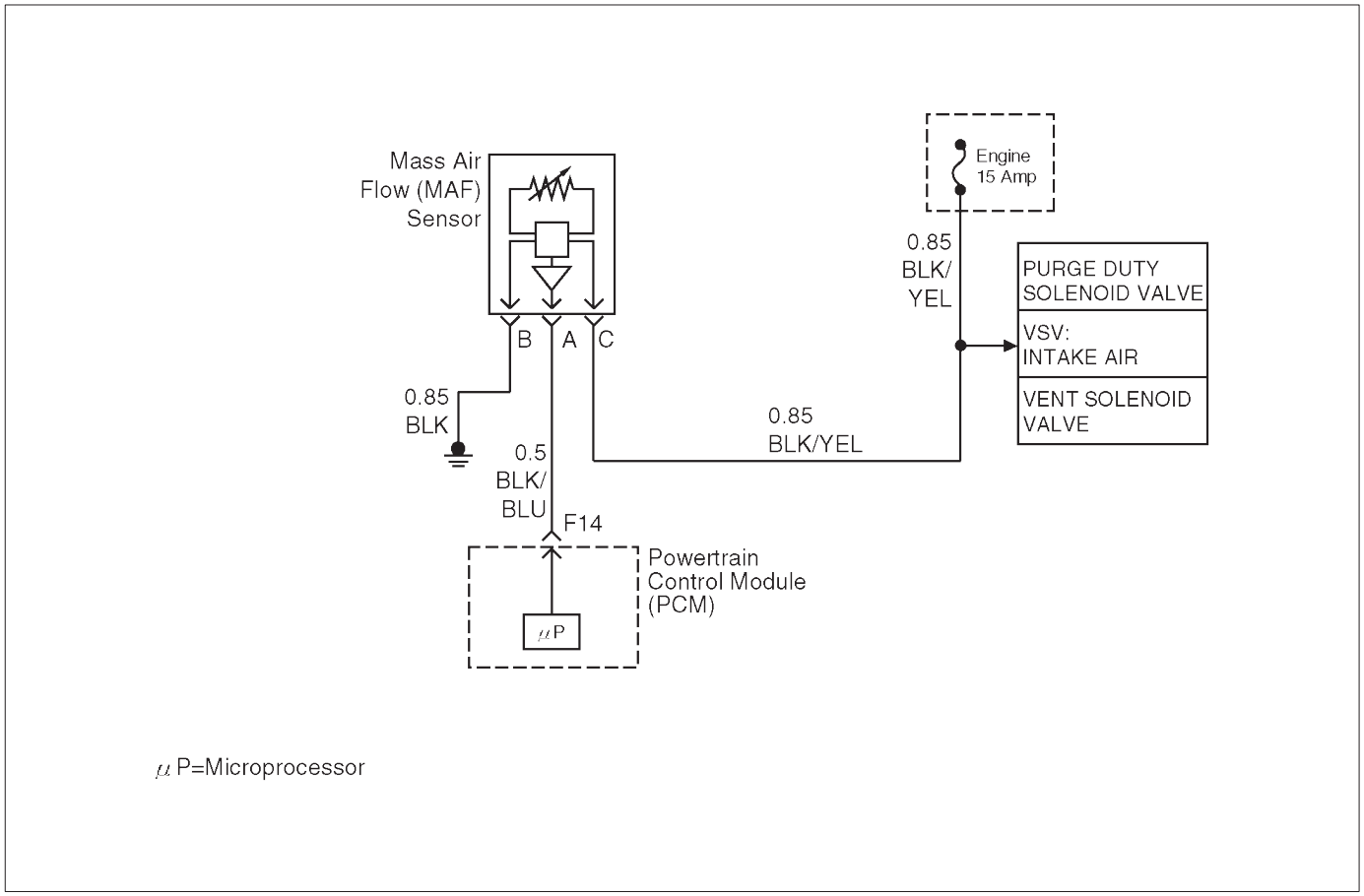
| DTC | Description | Type | Illuminate MIL (Check Engine Lamp) | Illuminate RPL (Reduced Power Lamp) |
|---|---|---|---|---|
| P0101 | MAF System Performance | B | Yes | No |
| P0102 | MAF Sensor Circuit Low Frequency | B | Yes | No |
| P0103 | MAF Sensor Circuit High Frequency | B | Yes | No |
| P0106 | MAP Rationality/Performance | B | Yes | No |
| P0107 | MAP Circuit Low Input Voltage | B | Yes | No |
| P0108 | MAP Circuit High Input Voltage | B | Yes | No |
| P0112 | IAT Circuit Low Input Voltage | B | Yes | No |
| P0113 | IAT Circuit High Input Voltage | B | Yes | No |
| P0117 | ECT Circuit Low Input Voltage | B | Yes | No |
| P0118 | ECT Circuit High Input Voltage | B | Yes | No |
| P0125 | ECT Insufficient for Closed Loop Fuel Control | B | Yes | No |
| P0128 | ECT Below Thermostat Regulating Temperature | B | Yes | No |
| P0131 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) | B | Yes | No |
| P0132 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) | B | Yes | No |
| P0133 | O2 Sensor Circuit Slow Response (Bank 1 Sensor 1) | B | Yes | No |
| P0134 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) | B | Yes | No |
| P0135 | O2 Sensor Heater Circuit (Bank 1 Sensor 1) | B | Yes | No |
| P0137 | O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2) | B | Yes | No |
| P0138 | O2 Sensor Circuit High Voltage (Bank 1 Sensor 2) | B | Yes | No |
| P0140 | O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2) | B | Yes | No |
| P0141 | O2 Sensor Heater Circuit (Bank 1 Sensor 2) | B | Yes | No |
| P0151 | O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1) | B | Yes | No |
| P0152 | O2 Sensor Circuit High Voltage (Bank 2 Sensor 1) | B | Yes | No |
| P0153 | O2 Sensor Circuit Slow Response (Bank 2 Sensor 1) | B | Yes | No |
| P0154 | O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1) | B | Yes | No |
| P0155 | O2 Sensor Heater Circuit (Bank 2 Sensor 1) | B | Yes | No |
| P0157 | O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2) | B | Yes | No |
| P0158 | O2 Sensor Circuit High Voltage (Bank 2 Sensor 2) | B | Yes | No |
| P0160 | O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2) | B | Yes | No |
| P0161 | O2 Sensor Heater Circuit (Bank 2 Sensor 2) | B | Yes | No |
| P0171 | O2 Sensor – System too Lean (Bank 1) | B | Yes | No |
| P0172 | O2 Sensor – System too Rich (Bank 1) | B | Yes | No |
| P0174 | O2 Sensor – System too Lean (Bank 2) | B | Yes | No |
| P0175 | O2 Sensor – System too Rich (Bank 2) | B | Yes | No |

| DTC | Description | Type | Illuminate MIL (Check Engine Lamp) | Illuminate RPL (Reduced Power Lamp) |
|---|---|---|---|---|
| P0201 | Injector 1 Control Circuit | A | Yes | No |
| P0202 | Injector 2 Control Circuit | A | Yes | No |
| P0203 | Injector 3 Control Circuit | A | Yes | No |
| P0204 | Injector 4 Control Circuit | A | Yes | No |
| P0205 | Injector 5 Control Circuit | A | Yes | No |
| P0206 | Injector 6 Control Circuit | A | Yes | No |
| P0300 | Engine Misfire Detected | B | Yes | No |
| P0301 | Engine Misfire Detected Cylinder #1 | B | Yes | No |
| P0302 | Engine Misfire Detected Cylinder #2 | B | Yes | No |
| P0303 | Engine Misfire Detected Cylinder #3 | B | Yes | No |
| P0304 | Engine Misfire Detected Cylinder #4 | B | Yes | No |
| P0305 | Engine Misfire Detected Cylinder #5 | B | Yes | No |
| P0306 | Engine Misfire Detected Cylinder #6 | B | Yes | No |
| P0325 | ION Sensing Module | B | Yes | No |
| P0336 | CKP Sensor Circuit Range/Performance (58X) | B | Yes | No |
| P0337 | CKP Sensor Circuit No signal (58X) | B | Yes | No |
| P0351 | Ignition 1 Control Circuit | A | Yes | No |
| P0352 | Ignition 2 Control Circuit | A | Yes | No |
| P0353 | Ignition 3 Control Circuit | A | Yes | No |
| P0354 | Ignition 4 Control Circuit | A | Yes | No |
| P0355 | Ignition 5 Control Circuit | A | Yes | No |
| P0356 | Ignition 6 Control Circuit | A | Yes | No |
| P0401 | EGR Flow Insufficient | B | Yes | No |
| P0402 | EGR Flow Excessive | B | Yes | No |
| P0404 | EGR Range/Performance (Open Valve) | B | Yes | No |
| P0405 | EGR Sensor Circuit Low Voltage | B | Yes | No |
| P0406 | EGR Sensor Circuit High Voltage | B | Yes | No |
| P0420 | Catalyst System Low Efficiency (Bank 1) | A | Yes | No |
| P0430 | Catalyst System Low Efficiency (Bank 2) | A | Yes | No |
| P0440 | EVAP Control System | B | Yes | No |
| P0442 | EVAP Control System Small Leak Detected | B | Yes | No |
| P0444 | EVAP Purge Control Circuit Open | D | No | No |
| P0445 | EVAP Purge Control Circuit Short | D | No | No |
| P0446 | EVAP Canister Vent Control Malfunction | B | Yes | No |
| P0447 | EVAP Vent Solenoid Circuit Open | D | No | No |
| P0448 | EVAP Vent Solenoid Circuit Short | D | No | No |
| P0452 | EVAP Control System Tank Pressure Sensor Low Input | B | Yes | No |
| P0453 | EVAP Control System Tank Pressure Sensor High Input | B | Yes | No |
| P0456 | EVAP Control System Very Small Leak Detected | B | Yes | No |
| P0461 | Fuel Level Sensor Circuit Range/Performance | D | No | No |

| DTC | Description | Type | Illuminate MIL (Check Engine Lamp) | Illuminate RPL (Reduced Power Lamp) |
|---|---|---|---|---|
| P0462 | Fuel Level Sensor Circuit Low Input Voltage | B | Yes | No |
| P0463 | Fuel Level Sensor Circuit High Input Voltage | B | Yes | No |
| P0464 | Fuel Level Sensor Noisy Signal | D | No | No |
| P0502 | No VSS Signal | B | Yes | No |
| P0506 | Idle Speed Control RPM too Low | B | Yes | No |
| P0507 | Idle Speed Control RPM too High | B | Yes | No |
| P0562 | System Voltage is Low | D | No | No |
| P0563 | System Voltage is High | B | Yes | No |
| P0565 | Cruise Main Switch Circuit Error | D | No | No |
| P0566 | Cruise Cancel Switch Circuit Error | D | No | No |
| P0567 | Cruise Resume Switch Circuit Error | D | No | No |
| P0568 | Cruise Set Switch Circuit Error | D | No | No |
| P0601 | PCM/ECM Memory Checksum | A | Yes | No |
| P0602 | PCM/ECM Programming error | D | No | No |
| P0604 | PCM/ECM RAM error | D | No | No |
| P0606 | PCM/ECM Internal Performance | D | No | No |
| P1106 | MAP Circuit Intermittent High Voltage) | D | No | No |
| P1107 | MAP Circuit Intermittent Low Input Voltage | D | No | No |
| P1111 | IAT Circuit Intermittent High Voltage | D | No | No |
| P1112 | IAT Circuit Intermittent Low Input Voltage | D | No | No |
| P1114 | ECT Circuit Intermittent Low Voltage | D | No | No |
| P1115 | ECT Circuit Intermittent High Voltage | D | No | No |
| P1120 | TPS1 Circuit | B | Yes | No |
| P1125 | ETC Limit Performance Mode | A | Yes | Yes |
| P1133 | O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 1 Sensor 1) | B | Yes | No |
| P1134 | O2 Sensor – Transition Switch Time ratio (Bank 1 Sensor 1) | B | Yes | No |
| P1153 | O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 2 Sensor 1) | B | Yes | No |
| P1154 | O2 Sensor – Transition Switch Time ratio (Bank 2 Sensor 1) | B | Yes | No |
| P1167 | Fuel supply System RICH During Decel Fuel Cut Off (Bank 1) | D | No | No |
| P1169 | Fuel supply System RICH During Decel Fuel Cut Off (Bank 2) | D | No | No |
| P1171 | Fuel supply System Lean During Power Enrichment | D | No | No |
| P1220 | TPS2 Circuit | B | Yes | No |
| P1221 | TPS1–TPS2 Correlation (Circuit Performance) | D | No | No |
| P1271 | APS1–APS2 Correlation (Circuit Performance) | D | No | No |
| P1272 | APS2–APS3 Correlation (Circuit Performance) | D | No | No |
| P1273 | APS1–APS3 Correlation (Circuit Performance) | D | No | No |
| P1275 | APS1 Circuit | B | Yes | No |
| P1280 | APS2 Circuit | B | Yes | No |
| P1285 | APS3 Circuit | B | Yes | No |

| DTC | Description | Type | Illuminate MIL (Check Engine Lamp) | Illuminate RPL (Reduced Power Lamp) |
|---|---|---|---|---|
| P1290 | ETC Forced Idle Mode | A | Yes | Yes |
| P1295 | ETC Power Management Mode | A | Yes | Yes |
| P1299 | ETC Forced Engine Shutdown in Mode | A | Yes | Yes |
| P1310 | ION Sensing Module Diagnostic | A | Yes | No |
| P1311 | ION Sensing Module SEC 1 Line Circuit Fault | A | Yes | No |
| P1312 | ION Sensing Module SEC 2 Line Circuit Fault | A | Yes | No |
| P1326 | ION Sensing Module Combustion Quality circuit | A | Yes | No |
| P1340 | ION Sensing Module – Cylinder Synchronization | B | Yes | No |
| P1404 | EGR Range/Performance (Closed Valve) | B | Yes | No |
| P1441 | EVAP Control System Continuous Open Purge Flow | B | Yes | No |
| P1514 | TPS–MAF Correlation | A | Yes | No |
| P1515 | Command–Acrual TPS Correlation | A | Yes | No |
| P1516 | Command–Acrual TPS Correlation Error | A | Yes | No |
| P1523 | Throttle Actuator Control Return Performance | D | No | No |
| P1625 | PCM/ECM System Reset | D | No | No |
| P1635 | Reference Voltage #1 Circuit | D | No | No |
| P1639 | Reference Voltage #2 Circuit | D | No | No |
| P1640 | ODM Output circuit Fault | D | No | No |
| P1650 | QDM Output Circuit Fault | D | No | No |

# Diagnostic Trouble Code (DTC) P0101 MAF System Performance




060R200052

## Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity or air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on throttle position and engine RPM.

## Conditions for setting the DTC

- The engine is running.
- No TP sensor and MAP sensor DTCs are set.
- No MAF frequency DTCs are set.
- System voltage is between 11.5 volts and 16 volts.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0101 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0101 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.
- The duct work at the MAF sensor for leaks.
- An engine vacuum leak.
- The PCV system for vacuum leaks.
- An incorrect PCV valve.
- The engine oil dip stick not fully seated.
- The engine oil fill cap loose or missing.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the Mass Air Flow (MAF) display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide–open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3–6 g/s at idle to 100 g/s or greater at the time of the 1–2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault.

If DTC P0101 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P001 Diagnostic Chart may isolate the cause of the fault.

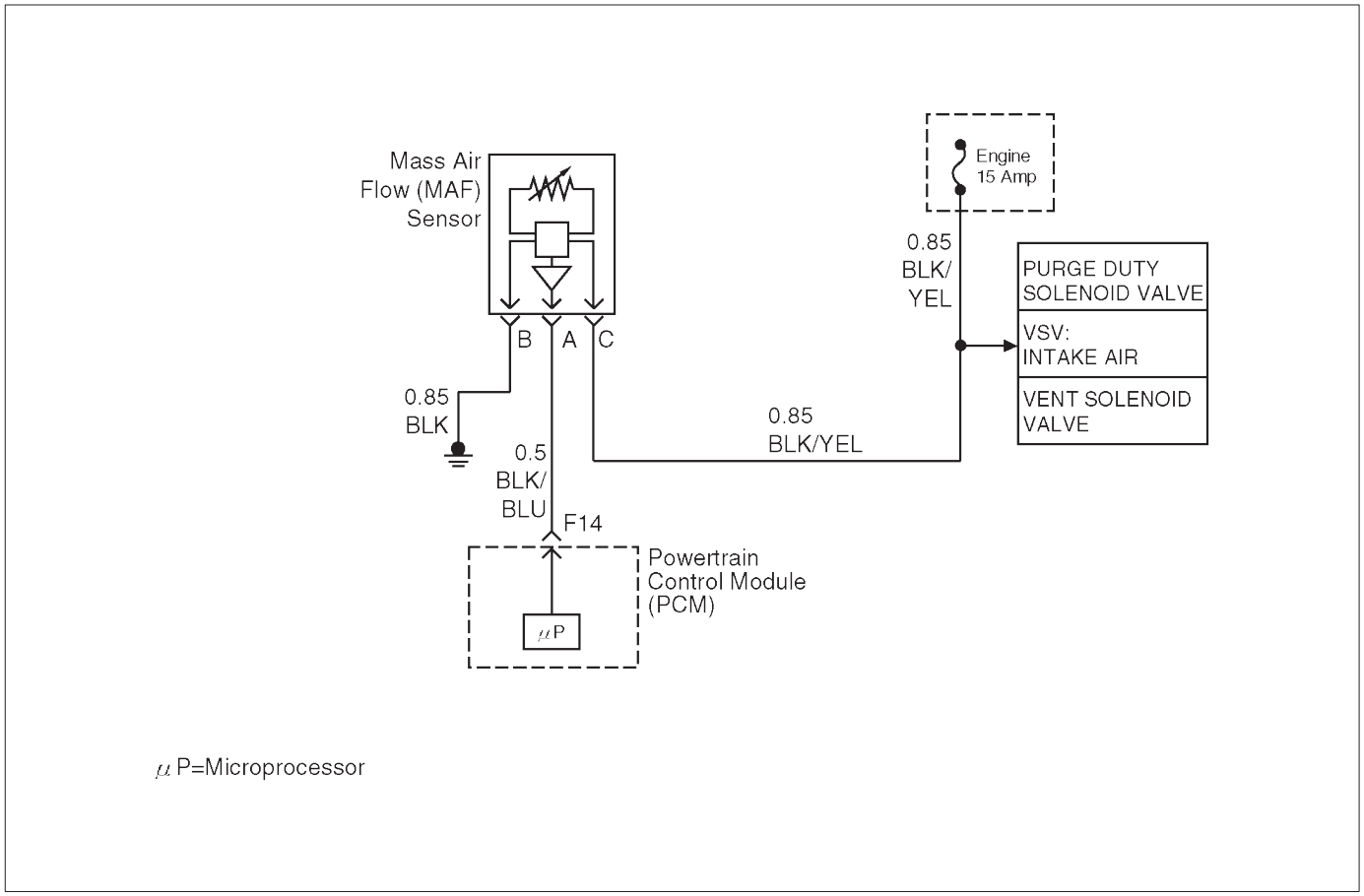
## DTC P0101 – MAF System Performance

| 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 “OFF”.<br>2. Disconnect the Mass Air Flow (MAF) Sensor harness connector from the MAF Sensor.<br>3. Place an unpowered test lamp between the 12 volt signal circuit and the ground circuit, both at the MAF Sensor connector.<br>4. Ignition “ON”, Engine“OFF”.<br>Did the test lamp illuminate? | — | Go to *Step 6* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, Engine “OFF”.<br>2. Using a Digital Voltmeter (DVM), check the 12 volt signal circuit for the correct voltage.<br>Did the DVM indicate a value within the following range? | 11.5 to 12.5 Volt | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Ignition “OFF”.<br>2. Check the 12 volt signal circuit for the following conditions:<br>• An open circuit<br>• A short to ground<br>Was the problem found? | — | Verify repair | — |
| 5 | Check the MAF ground circuit for the following conditions:<br>• An open circuit<br>• A short to voltage<br>Was a problem found? | — | Verify repair | — |
| 6 | 1. Ignition “OFF”.<br>2. Check the MAF Sensor signal circuit between the PCM and the MAF Sensor for the following conditions:<br>• An open circuit<br>• A short to ground<br>• A short to battery voltage<br>Was a problem found? | — | Verify repair | Go to *Step 7* |

# DTC P0101 – MAF System Performance (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | 1. Connect the MAF Sensor wiring harness connector to the MAF Sensor.<br>2. Connect the Tech 2 to the vehicle.<br>3. Place the Transmission in Park/Neutral, and fully apply the Parking Brake.<br>4. Start the engine.<br>5. Select the Mass Air Flow (MAF) parameter on the Tech 2.<br>With the engine idling, does the Tech 2 display the following value(s)? | 4 to 7 g/s | Go to *Step 8* | Go to *Step 9* |
| 8 | Observe the Tech 2 value while increasing the engine RPM to its upper limit.<br>Does the Tech 2 display the following value(s)? | 25 to 40 g/s | Go to *Step 10* | Go to *Step 9* |
| 9 | Replace the MAF Sensor.<br>Is the action complete? | — | Verify repair | — |
| 10 | Replace the PCM.<br>**IMPORTANT:** The PCM must be reprogrammed. Refer to PCM reprogramming.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0102 MAF Sensor Circuit Low Frequency




060R200052

## Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0102 will be set if the signal from the MAF sensor is below the possible range of a normally operating MAF sensor.

## Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is below 1.6g/s for a total of 50-percent of the last 1000 samples monitored. A sample is taken every cylinder event.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0102 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0102 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Misrouted harness – Inspect the MAF sensor harness to ensure that it is not routed too close to high voltage wires.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
- Plugged intake air duct or filter element – A wide-open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from

about 3-6 g/second at idle to 100 g/second or greater at the time of the 1-2 shift. If not, check for a restriction.

If DTC P0102 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

## Test Description

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

2. This step verifies that the problem is present at idle.
4. A voltage reading of less than 4 or over 5 volts at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.
5. This verifies that ignition feed voltage and a good ground are available at the MAF sensor.

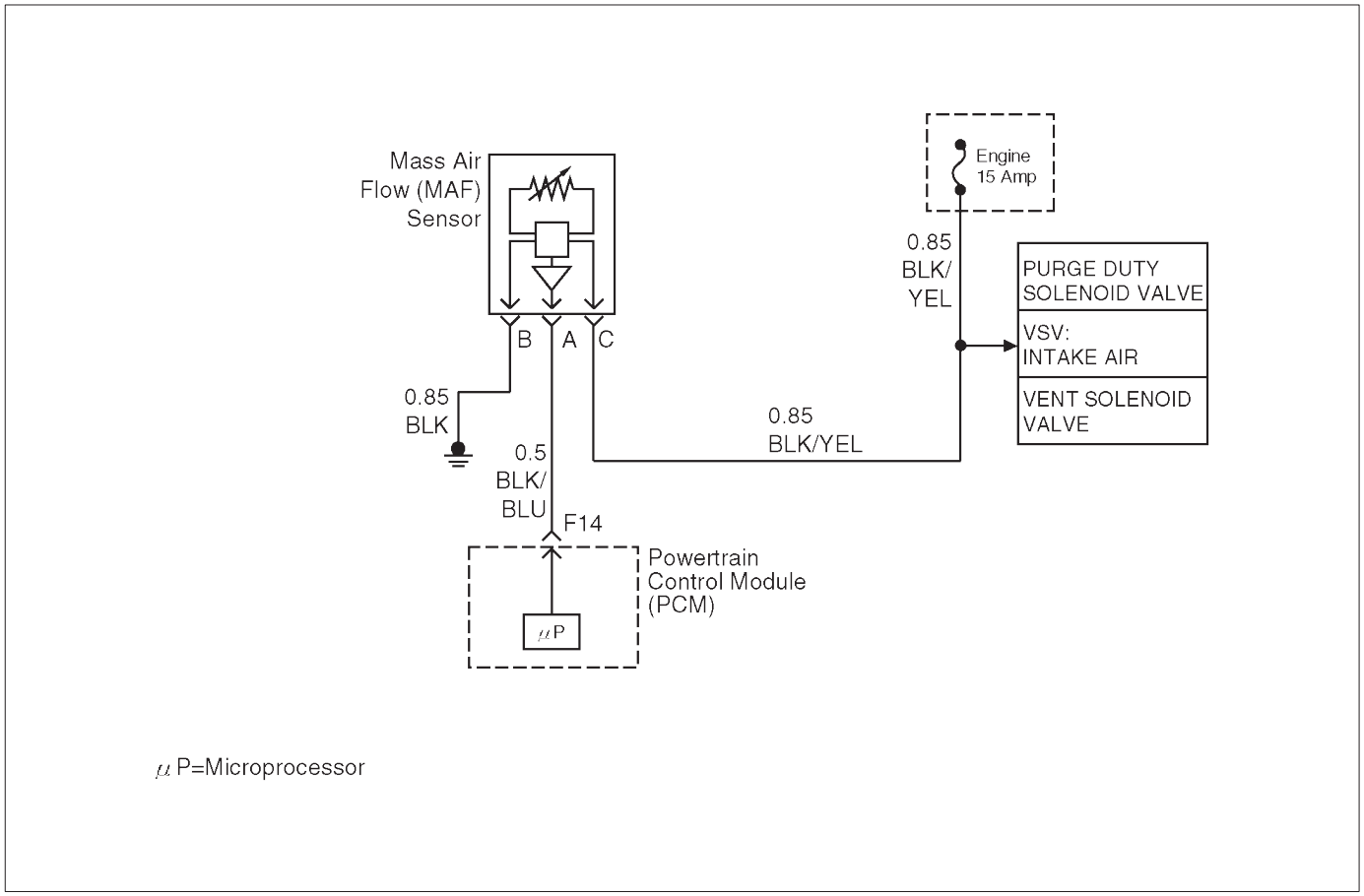
## DTC P0102 – MAF Sensor Circuit Low Frequency

| 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. Start the engine.<br>2. With the engine idling, monitor “MAF Frequency” display on the Tech 2.<br>Is the “MAF Frequency” below the specified value? | 1.6 g/s | Go to *Step 3* | Go to *Step 5* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0102.<br>Does the Tech 2 indicate DTC P0102 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition “OFF”.<br>2. Disconnect the MAF sensor connector.<br>3. Ignition “ON”, engine “OFF”.<br>4. Using a DVM, measure voltage between the MAF sensor signal circuit and battery ground.<br>Is the voltage near the specified value? | 11.5–12 V | Go to *Step 5* | Go to *Step 8* |
| 5 | Connect a test light between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector.<br>Is the test light “ON”? | — | Go to *Step 7* | Go to *Step 6* |
| 6 | Connect a test light between the MAF sensor ignition feed circuit and battery ground.<br>Is the test light “ON”? | — | Go to *Step 11* | Go to *Step 7* |
| 7 | 1. Check for a poor connection at the MAF sensor.<br>2. If a poor connection is found, replace the faulty terminal(s).<br>Was a poor connection found? | — | Verify repair | Go to *Step 12* |
| 8 | 1. Ignition “OFF”.<br>2. Disconnect the MAF sensor.<br>3. Disconnect the PCM connector for the MAF signal circuit.<br>4. Ignition “ON”, engine “OFF”.<br>5. With the DVM, measure the voltage between the MAF signal terminal at the PCM and battery ground.<br>Is the voltage under the specified value? | 0 V | Go to *Step 9* | Go to *Step 10* |

# DTC P0102 – MAF Sensor Circuit Low Frequency (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector.<br>3. Ignition "ON".<br>4. Check the MAF sensor signal circuit for a short to 5 volts.<br>Is the action complete? | — | Verify repair | — |
| 10 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector.<br>3. Ignition "ON".<br>4. Check the MAF sensor signal circuit between the PCM and the MAF sensor for an open, short to ground, or short to the MAF ground circuit.<br>Is the action complete? | — | Verify repair | Go to *Step 13* |
| 11 | Locate and repair the open in the ground circuit to the MAF sensor.<br>Is the action complete? | — | Verify repair | — |
| 12 | Locate and repair the open in the ignition feed circuit to the MAF sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | Go to *Step 14* |
| 14 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0103 MAF Sensor Circuit High Frequency




060R200052

## Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0103 will be set if the signal from the MAF sensor is above the possible range of a normally operating MAF sensor.

## Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is above 40g/s for a total of 50 percent of the last 200 samples monitored. A sample is taken every cylinder event.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM calculates an airflow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0103 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0103 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

If DTC P0103 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

## Test Description

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

2. This step verifies that the problem is present at idle.

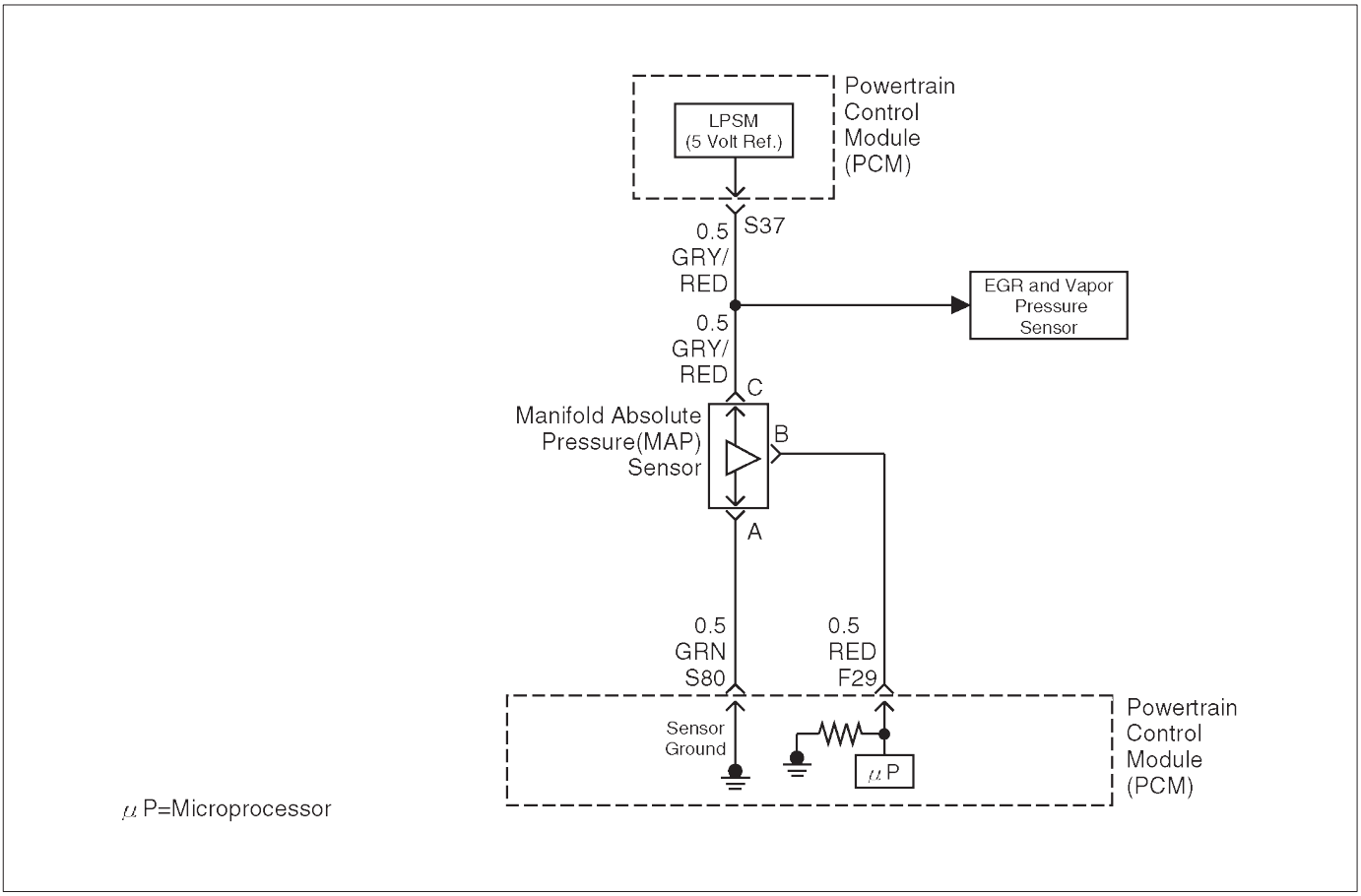
4. A frequency reading with the MAF sensor connector disconnected indicates an electromagnetic interference (EMI) related fault.

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

# DTC P0103 – MAF Sensor Circuit High Frequency

| 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”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0103.<br>Does the Tech 2 indicate DTC P0103 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Start the engine.<br>2. With the engine idling, monitor “MAF Frequency” display on the Tech 2.<br>Is “MAF Frequency” above the specified value? | 40g/s | Go to *Step 4* | Go to *Step 7* |
| 4 | 1. Ignition “OFF”.<br>2. Disconnect the MAF sensor connector.<br>3. Ignition “ON”, engine idling.<br>4. Using a Tech 2, monitor “MAF Frequency”.<br>Does the Tech 2 indicate a “MAF Frequency” at the specified value? | 0g/s | Go to *Step 5* | Go to *Step 6* |
| 5 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | Go to *Step 8* |
| 6 | 1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors).<br>2. If incorrect routing is found, correct the harness routing.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. With the engine idling, monitor “MAF Frequency” display on the Tech 2.<br>2. Quickly snap open throttle to wide open throttle while under a road load and record value.<br>Does the Tech 2 indicate “MAF Frequency” above the specified value? | 40g/s | Go to *Step 5* | Go to *Step 8* |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0106 MAP System Performance




060R200051

## Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts at wide-open throttle (low vacuum) at sea level.

The MAP sensor is used to determine manifold pressure changes while the linear exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401), engine vacuum level for some other diagnostics, and barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.

## Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine speed is steady, changing less then 100 RPM.
- Engine speed is between 1000 rpm and 4000 rpm.
- Throttle position is steady, throttle angle changes less than 1%.
- EGR flow rate is steady, changing less than 4%.
- No change in brake switch, A/C clutch, TCC or power steering pressure switch status.
- Above conditions are met for longer than 1 second.
- Actual MAP value varies more than 10 kPa.
- The MAP value must vary for a total of 10 seconds over a 20-second period of time that the samples were monitored.
- The failure must occur for 2 consecutive trips.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0106 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0106 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1107 Diagnostic Chart may isolate the cause of the fault.

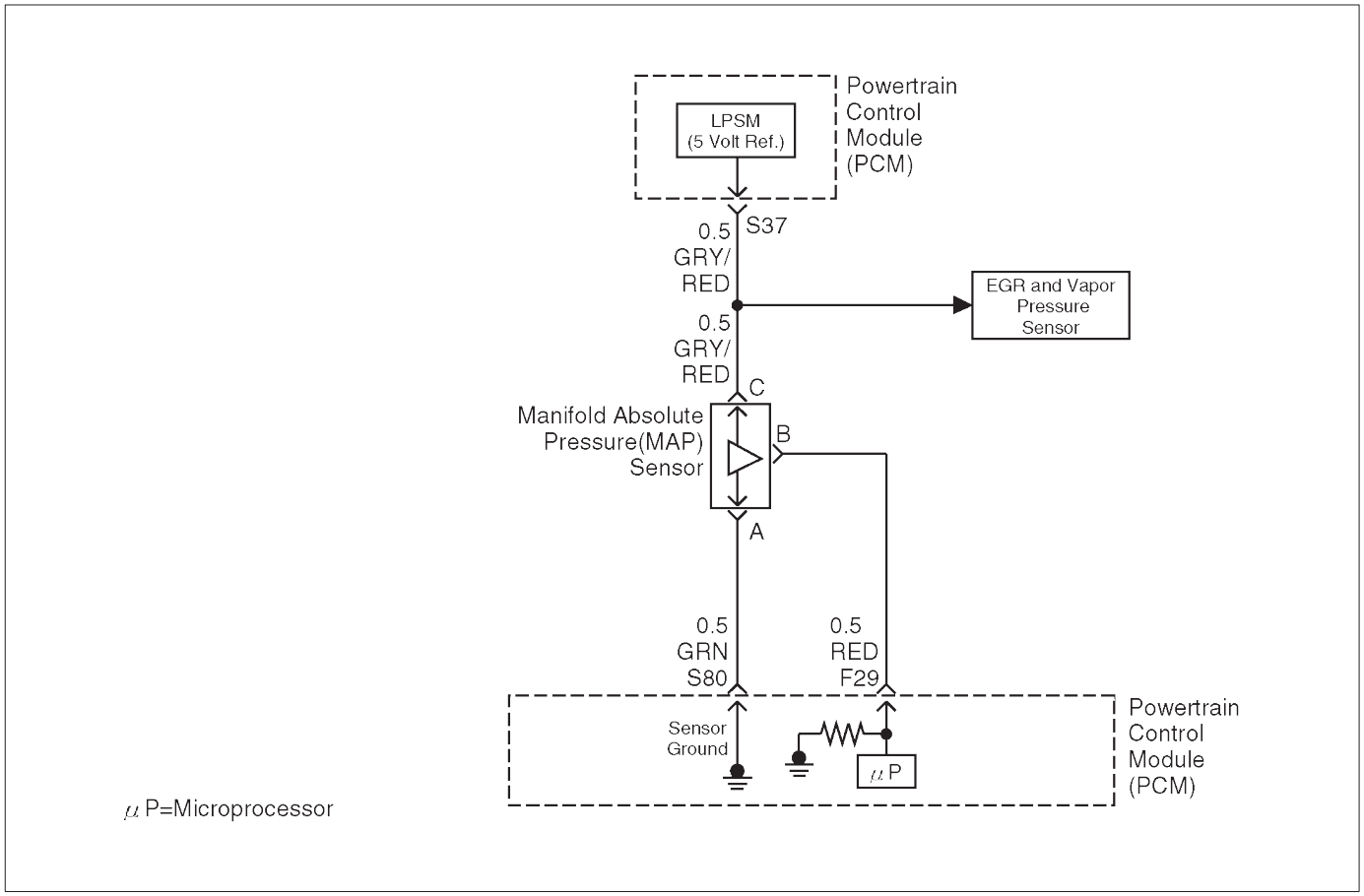
## DTC P0106 – MAP System Performance

| 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”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0106.<br>Does the Tech 2 indicate DTC P0106 failed? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Check for the following conditions:<br>• Vacuum hoses disconnected, damaged, or incorrectly routed<br>• Intake manifold vacuum leaks<br>• Vacuum leaks at throttle body<br>• Vacuum leaks at EGR valve flange and pipes<br>• Crankcase ventilation valve faulty, missing or incorrectly installed.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic Aids* |
| 4 | 1. Disconnect the MAP sensor electrical connector.<br>2. Observe the MAP value displayed on the Tech 2.<br>Is the MAP value near the specified value? | 11 kPa | Go to *Step 5* | Go to *Step 13* |
| 5 | 1. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector.<br>2. Observe the MAP value displayed on the Tech 2.<br>Is the MAP value near the specified value? | 105 kPa | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Jumper the 5 volt reference circuit and the MAP signal circuit together at the MAP sensor harness connector.<br>2. Observe the MAP value displayed on the Tech 2.<br>Is the MAP value near the specified value? | 104 kPa | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Ignition “OFF”.<br>2. Disconnect the PCM and check the sensor ground circuit for high resistance, an open between the PCM and the MAP sensor, or for a poor connection at the PCM.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |

# DTC P0106 – MAP System Performance (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Check the 5 volt reference circuit for high resistance, an open between the PCM and the MAP sensor, or a poor connection at the PCM.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM, and check the MAP sensor signal circuit for high resistance, an open, a short to ground, or a short to the sensor ground circuit.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Check the MAP sensor signal circuit for a poor connection at the PCM.<br>2. If a problem is found, repair as necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 14* |
| 11 | 1. Check for a poor connection at the MAP sensor.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | 1. Ignition "OFF", disconnected the PCM.<br>2. Ignition "ON", check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0107 MAP Sensor Circuit Low Voltage




060R200051

## Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, DTC P0107 will be set.

## Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure at or below 11 kPa for a total of approximately 10 seconds over a 16-second period.
- Ignition voltage more than 11 volts.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0107 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0107 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Check for intermittent codes.
- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit .
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0107 Diagnostic Chart may isolate the cause of the fault.

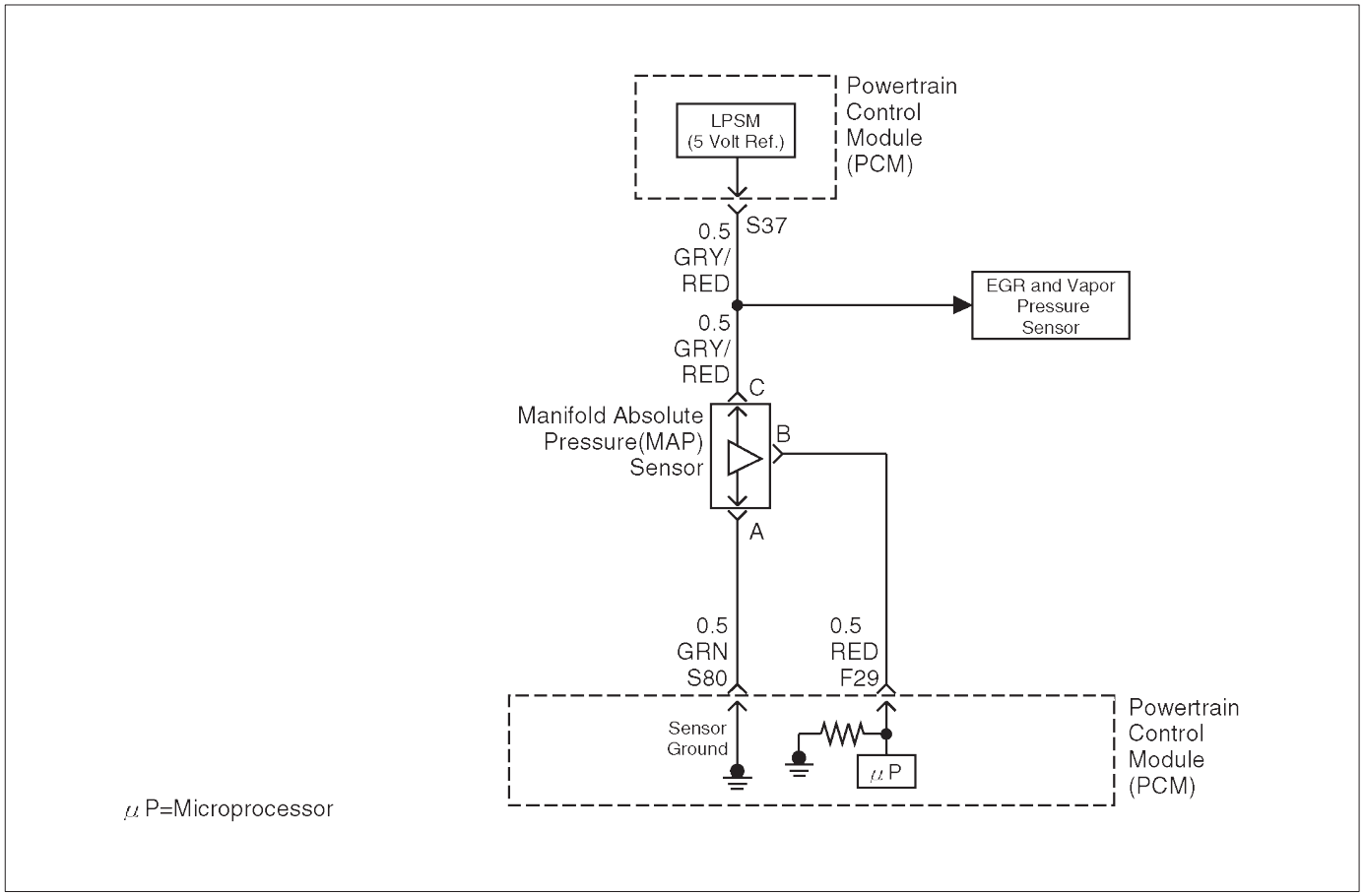
## DTC P0107 – MAP Sensor Circuit Low Voltage

| 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".<br>2. With the throttle closed, observe the MAP value displayed on the Tech 2.<br>Is the MAP value near the specified value? | 0 V 11 kPa at sea level | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", engine "OFF".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0107.<br>Does the Tech 2 indicate DTC P0107 failed? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition "OFF".<br>2. Disconnect the MAP sensor electrical connector.<br>3. Jumper the 5 volt reference circuit and the MAP signal together at the MAP sensor harness connector.<br>4. Ignition "ON".<br>5. Observe the MAP value displayed on the Tech 2.<br>Is the MAP value near the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.) | 5 V 104 kPa | Go to *Step 10* | Go to *Step 5* |
| 5 | 1. Disconnect the jumper.<br>2. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector.<br>3. Observe the MAP value displayed on the Tech 2.<br>Is the MAP value near the specified value. | 5 V 104 kPa | Go to *Step 6* | Go to *Step 8* |
| 6 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground.<br>3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary.<br>Was the 5 volt reference circuit open or shorted to ground? | — | Verify repair | Go to *Step 7* |
| 7 | Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 11* |

# DTC P0107 – MAP Sensor Circuit Low Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Ignition "OFF".<br>2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit.<br>3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary.<br>Was the MAP signal circuit open or shorted to ground? | — | Verify repair | Go to *Step 9* |
| 9 | Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 11* |
| 10 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0108 MAP Sensor Circuit High Voltage




060R200051

## Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, DTC P0108 will be set.

## Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running for more than 10 seconds.
- Throttle position is below 3% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 10 seconds over a 16-second period.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0108 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0108 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor (Vapor Pressure Sensor). If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1108 Diagnostic Chart may isolate the cause of the fault.

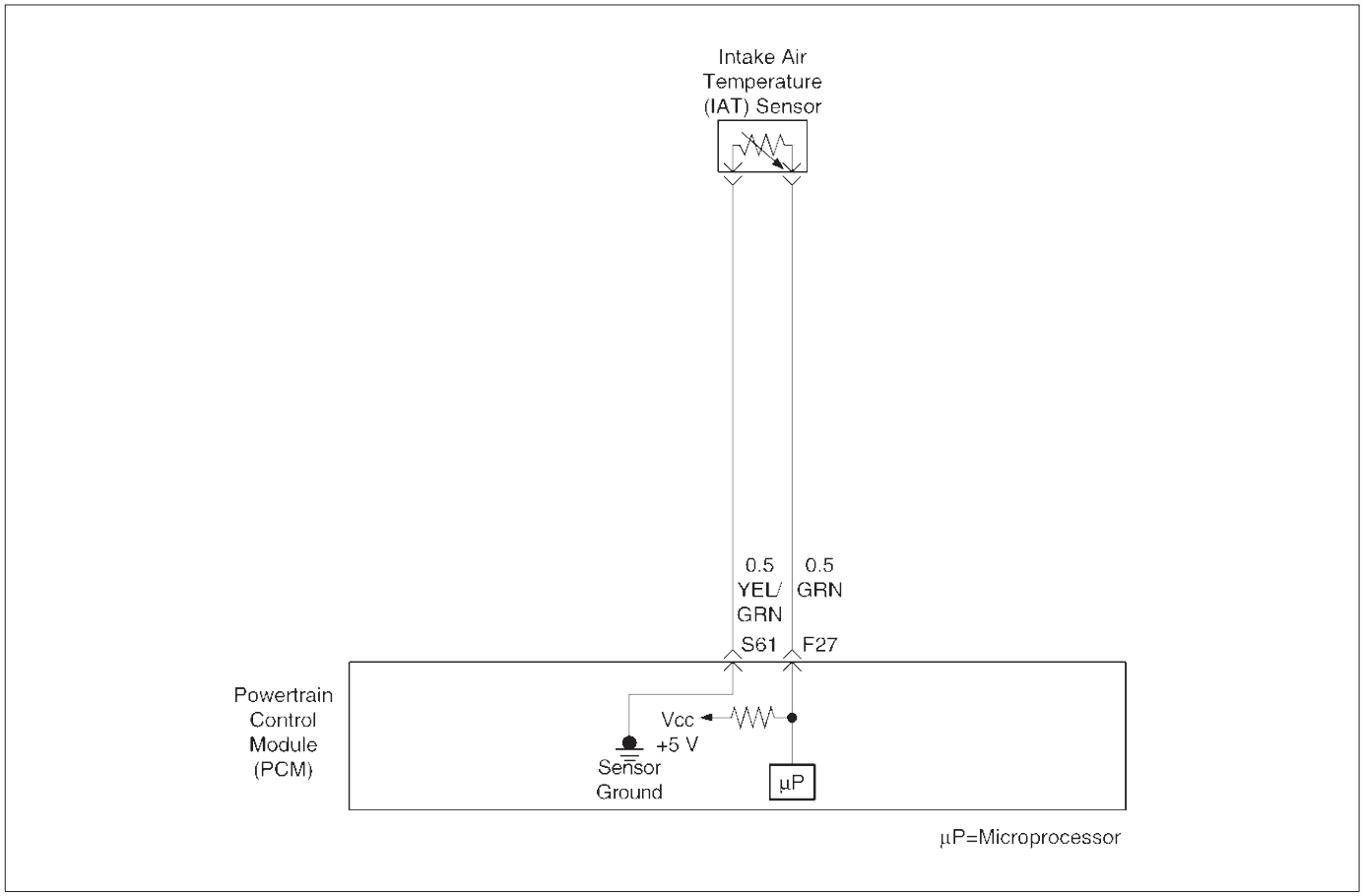
## DTC P0108 – MAP Sensor Circuit High Voltage

| 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. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to *Symptoms* section.<br>2. With the engine idling, note the MAP value on the Tech 2.<br>Is the MAP reading above the specified value? | 90 kPa | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0108.<br>Does the Tech 2 indicate DTC P0108 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition “OFF”.<br>2. Disconnect the MAP sensor electrical connector.<br>3. Ignition “ON”.<br>4. Note the MAP sensor voltage displayed on the Tech 2. (If no, start with diagnostic chart for other sensors in the circuit and see if 5V returns.)<br>Is the MAP sensor voltage at the specified value? | 11 kPa 0.0 V | Go to *Step 5* | Go to *Step 6* |
| 5 | Probe the sensor ground circuit with a test light to B+.<br>Is the test light “ON”? | — | Go to *Step 7* | Go to *Step 9* |
| 6 | 1. Check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit.<br>2. If the MAP sensor signal circuit is shorted, repair circuit as necessary.<br>Was the MAP sensor signal circuit shorted? | — | Verify repair | Go to *Step 11* |
| 7 | 1. Check for a poor sensor ground terminal connection at the MAP sensor electrical connector.<br>2. If a problem is found, replace the faulty terminal.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 8* |
| 8 | Check for a plugged or leaking vacuum supply to the MAP sensor.<br>Is the vacuum supply plugged or leaking? | — | Verify repair | Go to *Step 12* |
| 9 | 1. Check for a poor sensor ground terminal connection at the PCM.<br>2. If a problem is found, replace the faulty terminal.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 10* |

# DTC P0108 – MAP Sensor Circuit High Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Check the continuity of the MAP sensor ground circuit.<br>2. If the MAP sensor ground circuit measures over 5 ohms, repair open or poor connection.<br>Was a condition found and corrected? | — | Verify repair | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify Repair | — |
| 12 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0112 IAT Sensor Circuit Low Voltage




D06RY00147

## Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. DTC P0112 will set when the PCM detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

## Conditions for Setting the DTC

- The engine has been running for over 15 seconds.
- Vehicle speed is greater than 30 mph (48 km/h) .
- IAT signal voltage indicates and intake air temperature greater than 148°C (298°F) (about 5 volts) for a total of 12.5 seconds over a 25-second period of time.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-bout terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

## Test Description

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

2. Verifies that the fault is present.

3. If DTC P0112 can be repeated only by duplicating the Failure Records condition, refer to the *Temperature vs. Resistance Value* table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

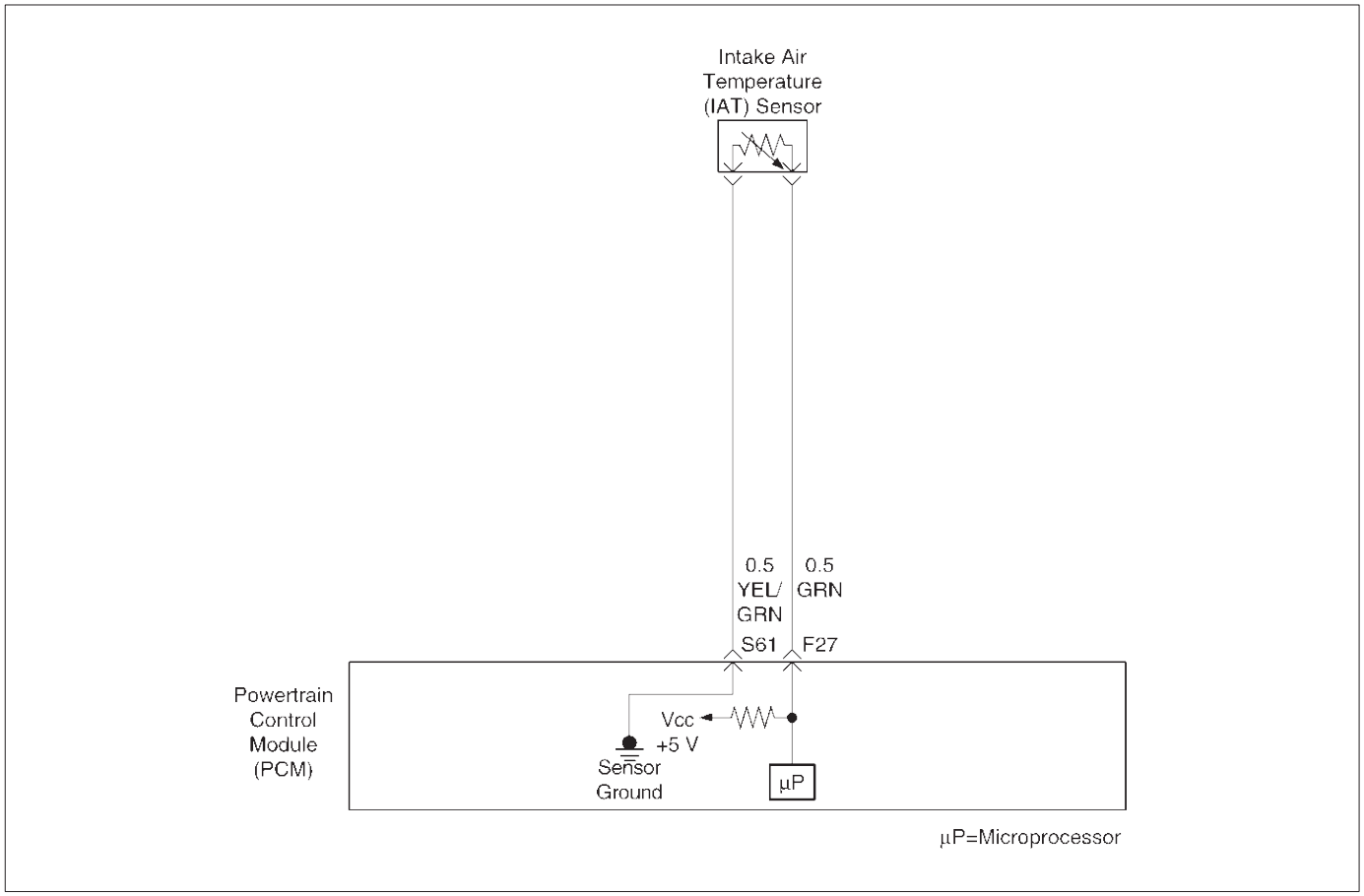
## Intake Air Temperature Sensor

| ˚C | ˚F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

# DTC P0112–IAT Sensor Circuit Low Voltage

| 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”.<br>2. Using a Tech 2, monitor the intake air temperature (IAT).<br>Is the intake air temperature greater than the specified value? | 148˚C (283˚F) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine “OFF”. Review and record Tech 2 Failure Records data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor the “DTC” info for DTC P0112.<br>Does the Tech 2 indicate DTC P0112 failed this ignition? | — | Refer to *Test Description* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition “OFF”.<br>2. Disconnect the IAT sensor electrical connector.<br>3. Ignition “ON”.<br>4. Observe the intake air temperature on the Tech 2.<br>Is the intake air temperature below the specified value? | –38˚C (–36˚F) | Go to *Step 6* | Go to *Step 5* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the PCM electrical connectors.<br>3. Check the IAT sensor signal circuit for a short to ground.<br>Is the IAT sensor signal circuit shorted to ground? | — | Verify repair | Go to *Step 7* |
| 6 | Replace the IAT sensor.<br>Is the action complete? | — | Verify repair | — |
| 7 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0113 IAT Sensor Circuit High Voltage




D06RY00147

## Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

## Conditions for Setting the DTC

- The engine has been running for over 30 seconds.
- Vehicle speed is less than 20 mph (32 km/h).
- ECT signal temperature is above 60˚C (140˚F).
- Mass air flow is less then 20 g/second.
- IAT signal voltage indicates an intake air temperature less than –39˚C (–38˚F) for total of 12.5 seconds over a 25-second period.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0113 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0113 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- The IAT sensor shares a ground with the EGR position sensor and the TP sensor. Check the ground if these DTC’s are set.
- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

## Test Description

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

2. Verifies that the fault is present.

3. If DTC P0113 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

## Intake Air Temperature Sensor

| ˚C | ˚F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

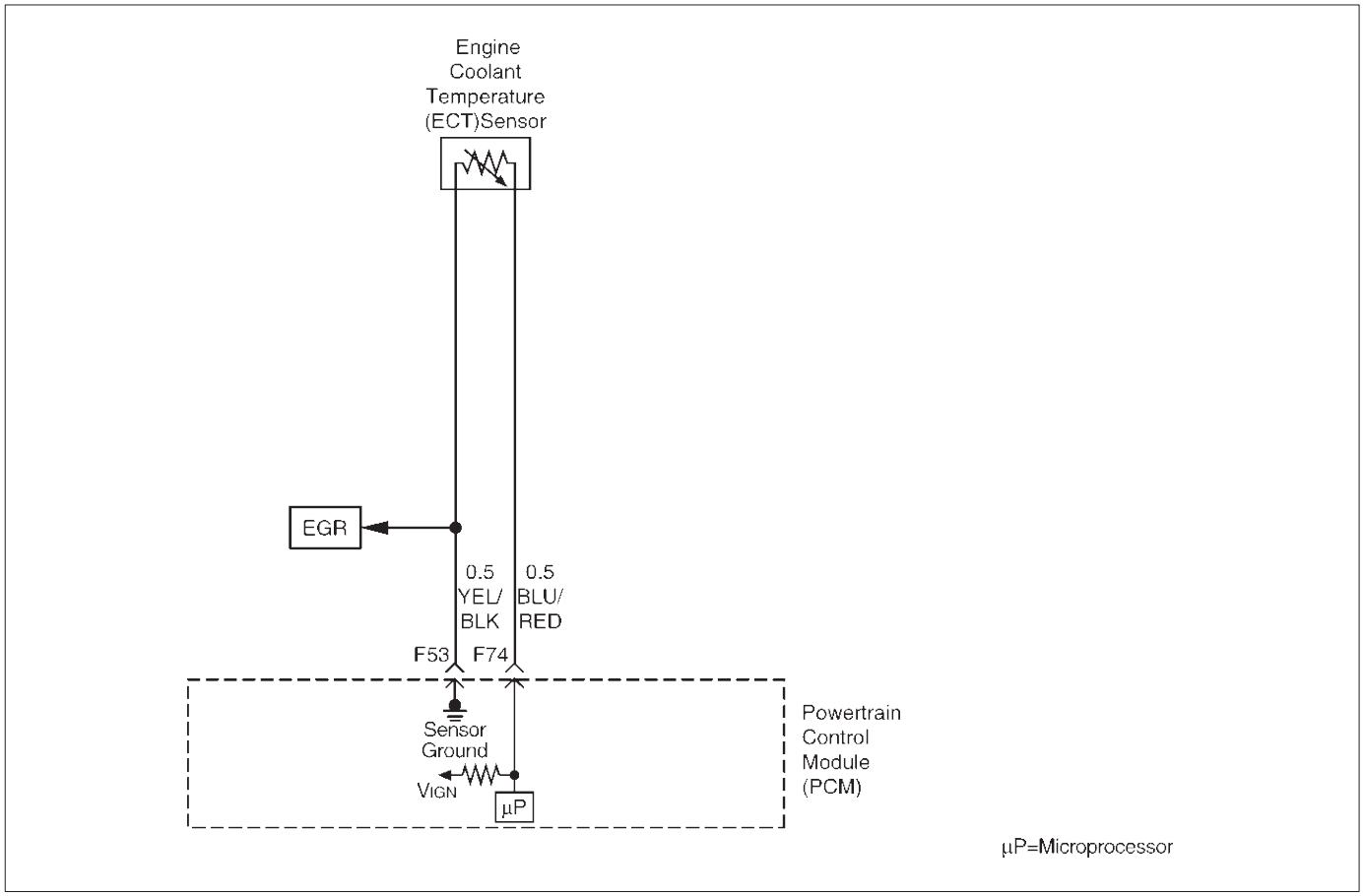
# DTC P0113 –IAT Sensor Circuit High Voltage

| 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 | Ignition "ON", engine "OFF". Observe the "Intake Air Temp" display on the Tech 2.<br>Is the "Intake Air Temp" below the specified value? | –38˚C (–36˚F) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", engine "OFF".<br>2. Review and record Tech 2 Failure Records data parameters.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0113.<br>Does the Tech 2 indicate DTC P0113 failed? | — | Refer to *Test Description* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition "OFF".<br>2. Disconnect the IAT sensor electrical connector.<br>3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector.<br>4. Ignition "ON".<br>5. Observe the "Intake Air Temp" display on the Tech 2.<br>Is the "Intake Air Temp" at the specified value? | 140˚C (284˚F) | Go to *Step 6* | Go to *Step 5* |
| 5 | 1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground.<br>2. Observe the "Intake Air Temp" display on the Tech 2.<br>Is the "Intake Air Temp" at the specified value? | 140˚C (284˚F) | Go to *Step 7* | Go to *Step 8* |

# DTC P0113 –IAT Sensor Circuit High Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Check for poor connections at the IAT sensor and replace terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 10* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the PCM, and check the IAT sensor ground circuit for an open.<br>3. If the IAT sensor ground circuit is open, repair it as necessary.<br>Was the IAT sensor ground circuit open? | — | Verify repair | Go to *Step 9* |
| 8 | 1. Ignition "OFF".<br>2. Disconnect the PCM, and check the IAT signal circuit for an open.<br>3. If the IAT sensor signal circuit is open, repair it as necessary.<br>Was the IAT signal circuit open? | — | Verify repair | Go to *Step 9* |
| 9 | Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary.<br>Did any of the terminals need to be replaced? | — | Verify repair | Go to *Step 11* |
| 10 | Replace the IAT sensor.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0117 ECT Sensor Circuit Low Voltage




D06RY00148

## Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

## Conditions for Setting the DTC

- Engine running time is longer than 120 seconds.
- The ECT sensor signal indicates an engine coolant temperature greater than 150˚C (302˚F) (about 0.10 V) for a total of 50 seconds over a 100–second period.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0117 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0117 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1114 Diagnostic Chart may isolate the cause of the fault.

## Test Description

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

2. Verifies that the fault is present.

3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

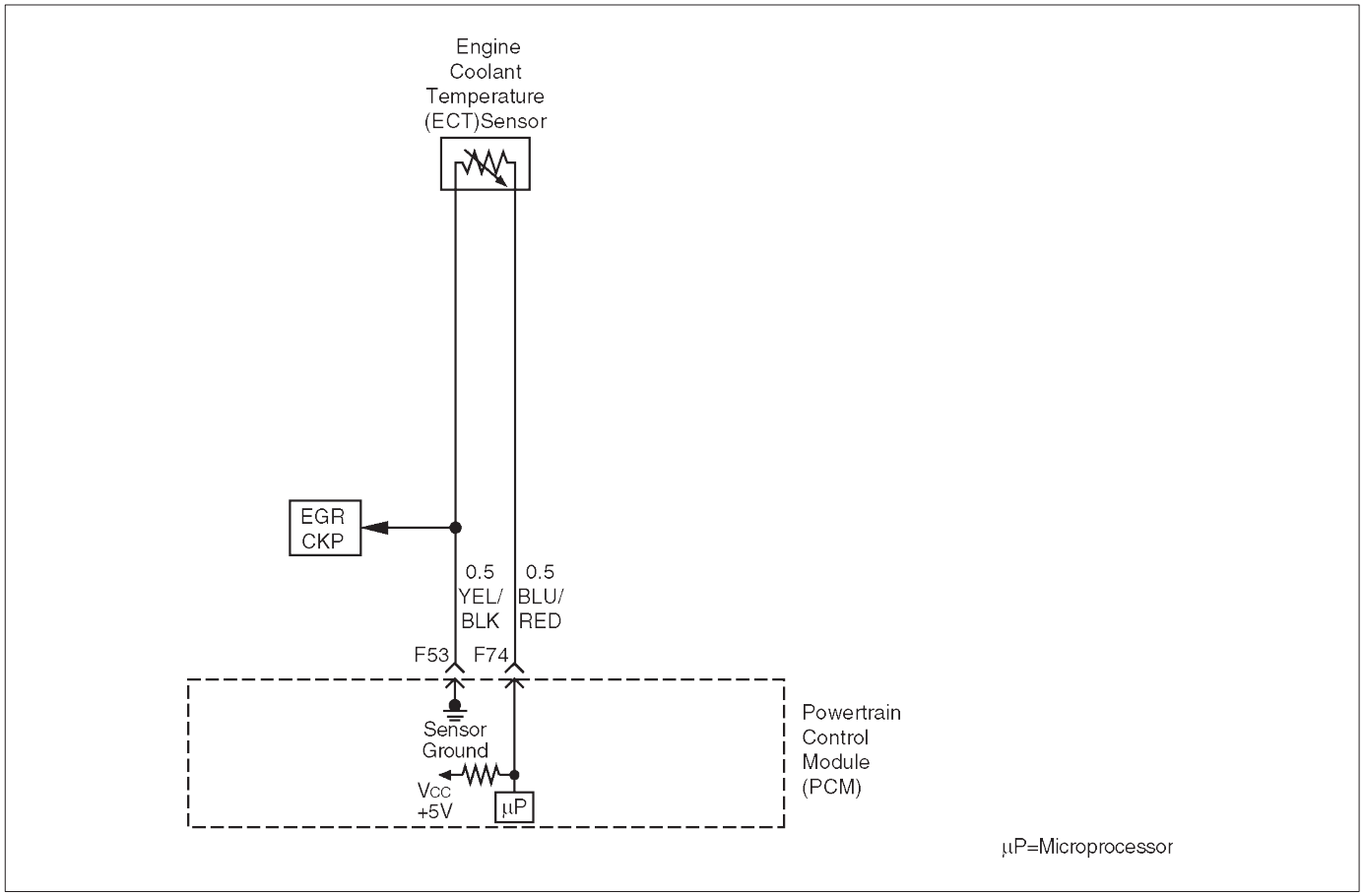
## Engine Coolant Temperature Sensor

| °C | °F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

# DTC P0117 – ECT Sensor Low Voltage

| 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”.<br>2. Observe the “Eng Cool Temp” display on the Tech 2.<br>Is the “Eng Cool Temp” below the specified value? | 139˚C (282˚F) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0117.<br>Does the Tech 2 indicate DTC P0117 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Disconnect the ECT sensor electrical connector.<br>2. Observe the “Eng Cool Temp” display on the Tech 2.<br>Is the “Eng Cool Temp” at the specified value? | –39˚C (–38˚F) | Go to *Step 6* | Go to *Step 5* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit.<br>3. If the ECT signal circuit is shorted. repair it as necessary.<br>Was the ECT signal circuit shorted to ground? | — | Verify repair | Go to *Step 7* |
| 6 | Replace the ECT sensor.<br>Is the action complete? | — | Verify repair | — |
| 7 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0118 ECT Sensor Circuit High Voltage




## Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

## Conditions for Setting the DTC

- Engine running time is longer than 90 seconds.
- The ECT sensor signal indicates an engine coolant temperature of –39°C (–38°F) or less (about 5 volts) for a total of 50 seconds over a 100-second period.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0118 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0118 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:
The ECT shares a ground with the Transmission Fluid Temperature sensor, the Fuel Tank Pressure sensor, and the MAP sensor.
Check the ground if these DTCs are also set.

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently,

performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

## Test Description

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

2. Verifies that the fault is present.

3. If DTC P0118 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

## Engine Coolant Temperature Sensor

| ˚C | ˚F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

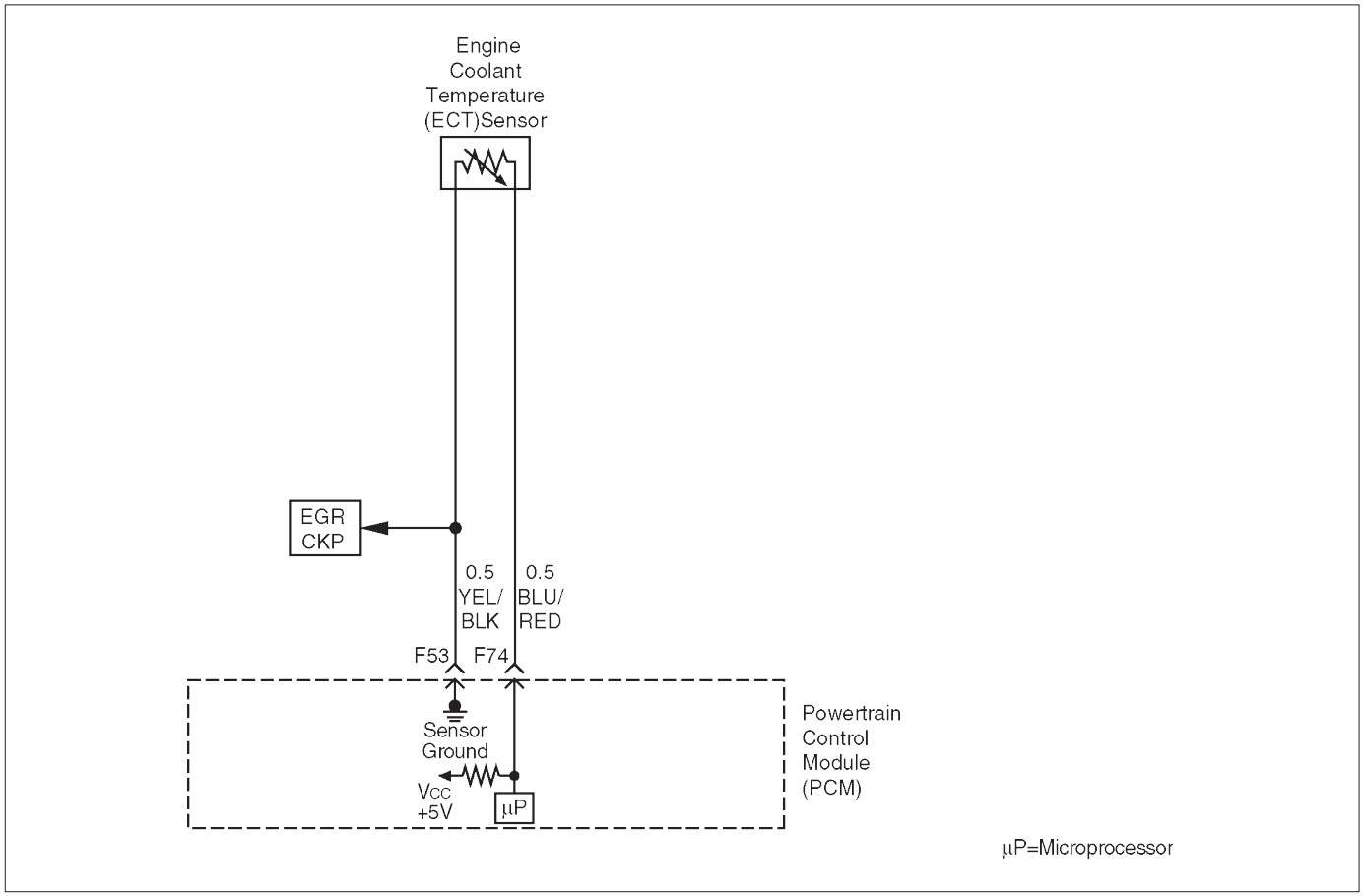
# DTC P0118 – ECT Sensor Circuit High Voltage

| 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".<br>2. Observe the "Eng Cool Temp" display on the Tech 2.<br>Is the "Eng Cool Temp" below the specified value? | –39˚C (–38˚F) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", engine "OFF".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor the "DTC" info for DTC P0118.<br>Does the Tech 2 indicate DTC P0118 failed? | — | Refer to *Test Description* | Refer to *Diagnostic Aids* |
| 4 | 1. Disconnect the ECT sensor electrical connector.<br>2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector.<br>3. Observe the "Eng Cool Temp" display on the Tech 2.<br>Is the "Eng Cool Temp" at the specified value? | 140˚C (284˚F) | Go to *Step 6* | Go to *Step 5* |
| 5 | 1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground.<br>2. Observe the "Eng Cool Temp" display on the Tech 2.<br>Is the "Eng Cool Temp" at the specified value? | 140˚C (284˚F) | Go to *Step 7* | Go to *Step 8* |
| 6 | Check for poor connections at the ECT sensor and replace terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 10* |

# DTC P0118 – ECT Sensor Circuit High Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | 1. Ignition "OFF".<br>2. Disconnect the PCM, and check the ECT sensor ground circuit for an open.<br>3. If the ECT sensor ground circuit is open, repair it as necessary.<br>Was the ECT sensor ground circuit open? | — | Verify repair | Go to *Step 9* |
| 8 | 1. Ignition "OFF".<br>2. Disconnect the PCM, and check the ECT signal circuit for an open.<br>3. If the ECT sensor signal circuit is open, repair it as necessary.<br>Was the ECT signal circuit open? | — | Verify repair | Go to *Step 9* |
| 9 | Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary.<br>Did any of the terminals need to be replaced? | — | Verify repair | Go to *Step 11* |
| 10 | Replace the ECT sensor.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0125 ECT Excessive Time to Closed Loop Fuel Control




## Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. When the vehicle is first started, the powertrain control module (PCM) controls fuel delivery in “open loop”, ignoring the heated oxygen sensor (HO2S) signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position, and mass air flow sensors. The PCM will begin using the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals for controlling fuel delivery under “closed loop” conditions when the following conditions have been met:

- The HO2S output signals are varying, indicating that the sensors are hot enough to operate properly.
- The engine coolant temperature sensor indicates coolant temperature above 50˚C (122˚F).
- Time since start-up is at least 16 seconds for a warm engine or 23 seconds for a cold engine.

## Conditions for Setting the DTC

- No active IAT, MAF or ECT DTC(s) are present.
- Engine is running.
- Vehicle speed is greater than 5 mph (8 km/h) .
- Intake air temperature is greater than –10˚C (14˚F) 0˚C (32˚F).
- Start–up engine coolant temperature is between –10˚C (–14˚F) and 28˚C (82˚F).
- For a warm engine (intake air temperature is greater than 10˚C/50˚F), engine coolant temperature sufficient to allow “closed loop” operation (50˚C/122˚F) is not achieved within 2 minutes of start-up. For a cold engine (intake air temperature between (–7˚C and 10˚C), engine coolant temperature sufficient to allow “closed loop” operation (50˚C/122˚F) is not achieved within 10 minutes of start-up.
- The above condition fails 20 consecutive times.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0125 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0125 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

DTC P0125 set indicates a faulty ECT sensor. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0125 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage wince the DTC was last set.

## Test Description

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

2. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor. If the temperatures are close, the fault is intermittent; refer to *Diagnostic Aids*.

## Engine Coolant Temperature

| ˚C | ˚F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

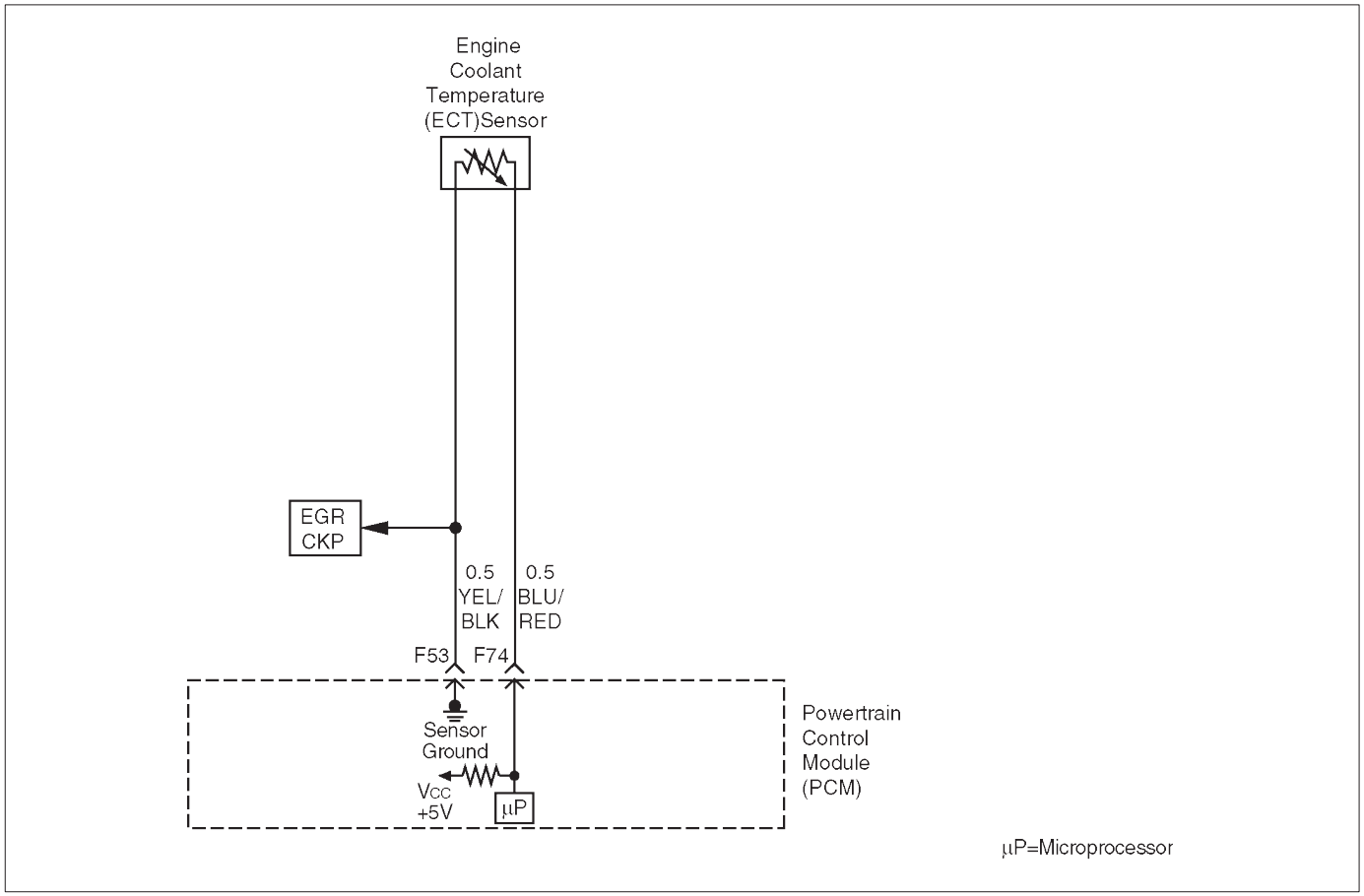
## DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control

| 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 | Are any ECT sensor DTCs set? | — | Go to applicable ECT sensor DTC chart | Go to *Step 3* |
| 3 | 1. Allow the engine to cool completely.<br>2. Check the cooling system coolant level (refer to *Cooling and Radiator*).<br>Is the coolant level OK? | — | Go to *Step 4* | Go to *Step 9* |
| 4 | 1. Start the engine.<br>2. With the engine idling, monitor “ENG COOL TEMP” display on the Tech 2.<br>Does “ENG COOL TEMP” increase to above the specified value within 2 minutes? | 21˚C (70˚F) | Refer to *Diagnostic Aids* | Go to *Step 5* |
| 5 | Check for proper operation of the thermostat (refer to *Cooling and Radiator*).<br>Is the thermostat operating correctly? | — | Go to *Step 6* | Go to *Step 9* |

# DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Compare engine coolant temperature displayed on the Tech 2 to the actual coolant temperature measured with a thermometer. (Observe normal precautions when opening the cooling system.)<br>Is the Tech 2 engine coolant temperature indication close to the measured temperature? | — | Go to *Step 9* | Go to *Step 7* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the PCM.<br>3. Using a DVM, measure the resistance of the ECT at the PCM connector.<br>4. Compare the DVM reading with the chart in "Test Description".<br>Is the chart value approximately equal to the thermometer reading? | — | Go to *Step 12* | Go to *Step 8* |
| 8 | Check for high resistance in wiring related to the ECT sensor. Also, check for poor connections at the ECT sensor and the PCM.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 11* |
| 9 | Refer to *Cooling and Radiator* for cooling system diagnosis and repair condition as necessary.<br>Is the action complete? | — | Verify repair | — |
| 10 | Replace the faulty terminal(s) or repair faulty wiring as necessary.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the ECT sensor.<br>Is the action complete? | — | Verify repair | — |
| 12 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code(DTC)
# P0128 Thermostat Insufficient Temperature for Stable Operation




## Circuit Description

- The engine coolant temperature (ECT) sensor thermistor mounted on a coolant crossover pipe at the front of the engine.

  This code determines if system has insufficient coolant temperatures for stable operation.

## Conditions for setting the DTC

- Engine running.
- No IAT, ECT and MAF DTCs set.
- No VSS DTC set.

Warm case(Ambient temperature is between 50˚F and 128˚F.):

- Time for coolant to reach stabilized closed loop value is less than 239 sec.

Cold case(Ambient temperature is between 20˚F and 50˚F.):

- Time for coolant to reach stabilized thermostat regulation temperature is more than 263 sec.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0128 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0128 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

  Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM–Inspect harness connectors 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.

If the harness appears to be OK, observe the ECT display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

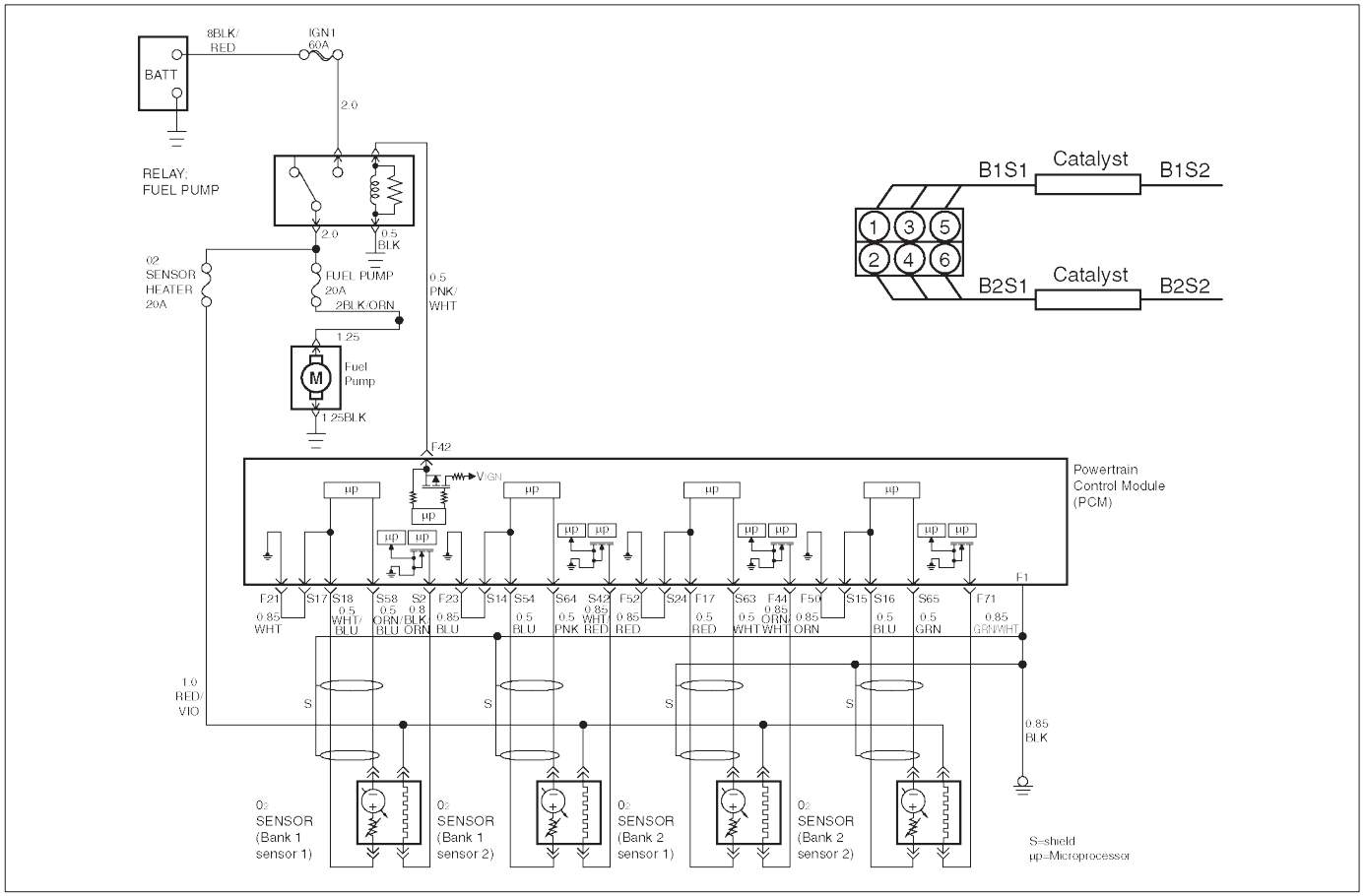
If DTC P0128 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0128 Diagnostic Chart may isolate the cause of the fault.

## Diagnostic Trouble Code (DTC)
## P0128 Thermostat Insufficient Temperature for stable operation

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board(OBD)System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Visually/physically check air duct and water pipe for splits, kinks, and proper connections and routing.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 3* |
| 3 | 1. Remove and check the Thermostat for stable operation. Refer to *6B section.*<br>2. Replace the thermostat if necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0128.<br>Does the Tech 2 indicate DTC P0128 failed this ignition? | — | Go to *Step 5* | Refer to *Diagnostic Aids* |
| 5 | 1. Ignition “ON”, engine “OFF”.<br>2. Oberve the “Eng Cool Temp” display on the Tech 2.<br>Is the “Eng Cool Temp” below the specified value? | 139˚C (282˚F) | Verify repair | Go to *Step 6* |
| 6 | 1. Ignition “OFF”.<br>2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit.<br>3. If the ECT signal circuit is shorted, repair it as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic*<br>Go to *Step 7* |
| 7 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0131 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- Vehicle is operating in "closed loop".
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0131 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0131 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, If fuel pressure is too low, a DTC P0131 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test".
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.

- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

### Test Description

Number(s) below refer to step numbers on the diagnostic chart.

3. DTC P0131 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

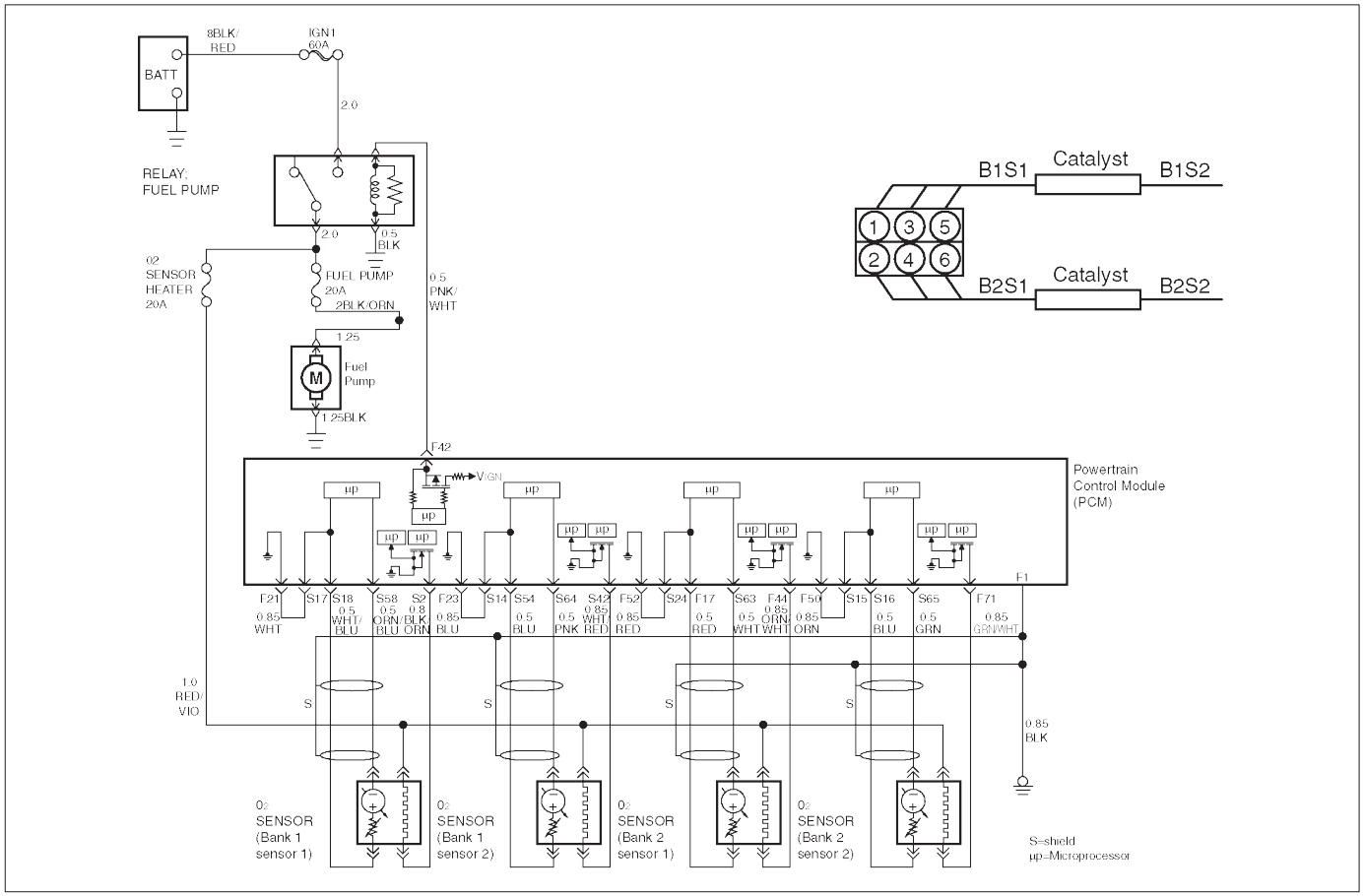
## DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1

| 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. Install the Tech 2.<br>2. Run the engine at normal operating temperature.<br>3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage.<br>Does the Bank 1 HO2S 1 voltage remain below the specified value? | 22 mV | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data and note parameters.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0131 until the DTC P0131 test runs.<br>Note test result.<br>Does Tech 2 indicate DTC P0131 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Turn the ignition “OFF”.<br>2. Disconnect the PCM.<br>3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit.<br>Are the Bank 1 HO2S 1 signal circuits shorted to ground? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the Bank 1 HO2S 1 signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Turn the ignition “OFF”, HO2S 1 and PCM disconnected.<br>2. Check for short circuit between the high and low signal circuits.<br>Was there continuity between the high and low circuits? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | Repair the short between the high and low circuits.<br>Is the action complete? | — | Verify repair | — |

# DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Ignition "OFF".<br>2. Reconnect the PCM, leave the sensor disconnected.<br>3. Ignition "ON".<br>Does the Tech 2 indicate Bank 1 HO2S 1 voltage between the specified values? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 9* |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0132 HO2S Circuit High Voltage Bank 1 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0132 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60°C (140°F)
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during "deceleration fuel cutoff mode" operation for 3 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0132 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0132 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0132 may be set. Refer to *Fuel System Diagnosis*.
- Perform "Injector Balance Test" – Refer to *Fuel System Diagnosis*.

- Check the EVAP canister for fuel saturation – If full of fuel, check canister control and hoses. Refer to *Evaporative (EVAP) Emission Control System*.
- MAF sensor –The system can go rich if MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see it the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine acceleration.
- Shorted Heated Oxygen Sensor (HO2S) –If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit or Faulty HO2S–A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle by monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal conditions.
- If none of the above conditions are present, replace the affected HO2S.

## Test Description

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

3. DTC P0132 failing during "deceleration fuel cutoff mode" operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

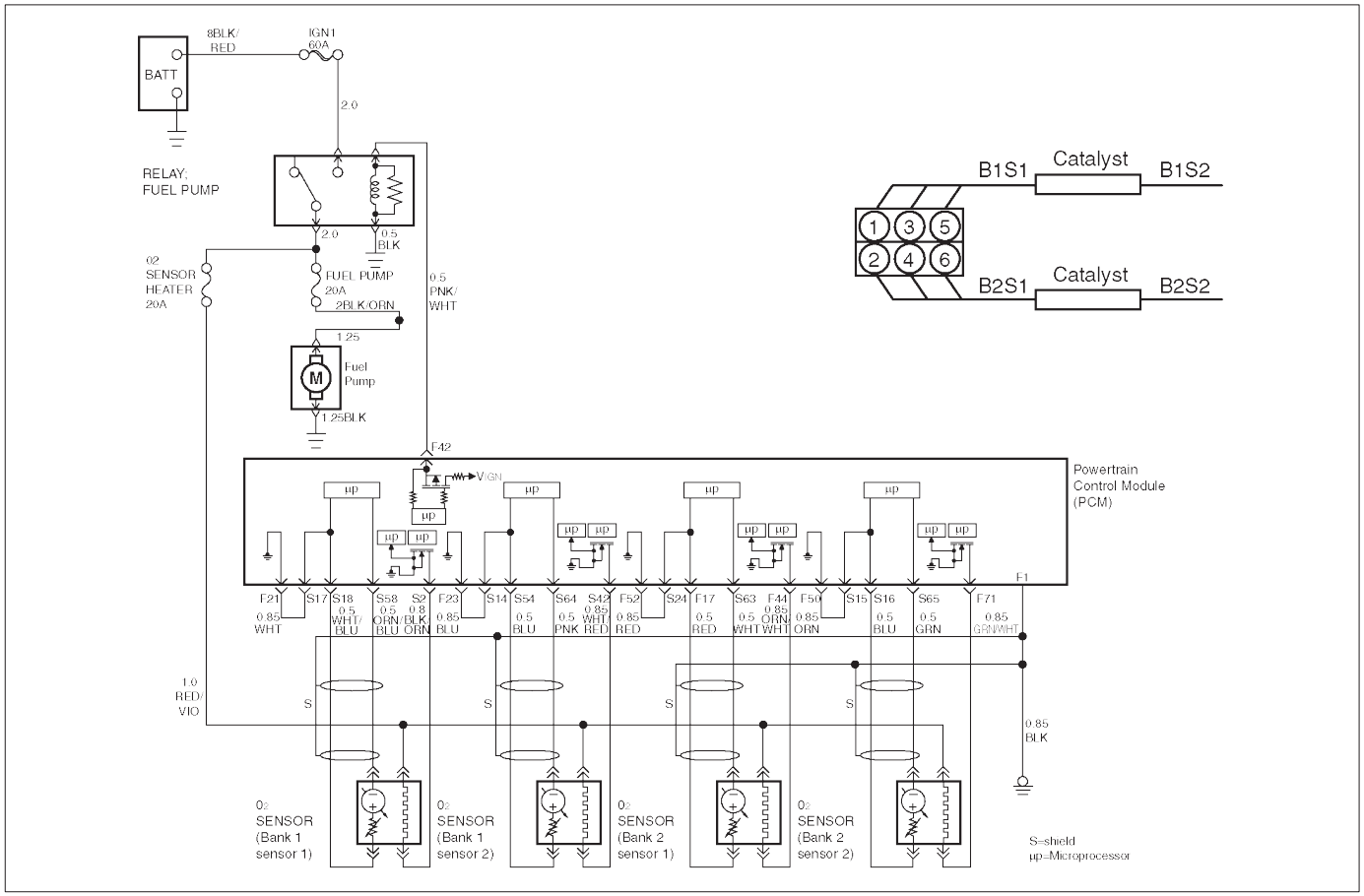
# DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage.<br>Does the Bank 1 HO2S 1 voltage remain above the specified value? | 952 mV (500 mV in deceleration fuel cutoff mode) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", review and record Tech 2 Failure Records data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0132 until the DTC P0132 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0132 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition "OFF".<br>2. Disconnect Bank 1 HO2S 1.<br>3. Ignition "ON".<br>4. At HO2S Bank 1 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals.<br>Are the voltages in the specified range? | 3-4 V | Go to *Step 5* | Go to *Step 6* |

# DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | Repair short to voltage in signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition "ON", engine"OFF".<br>2. At Bank 1 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage.<br>Is Bank 1 HO2S 1 voltage below the specified value? | 10 mV | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Disconnect the jumpers to ground from Bank 1 HO2S 1 PCM-side connector.<br>2. With the HO2S 1 connector disconnected, monitor Bank 1 HO2S 1 voltage.<br>Is Bank 1 HO2S 1 voltage between the specified values? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 8* |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0133 HO2S Slow Response Bank 1 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0133 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 60°C (140°F).
- Engine is operating in "closed loop".
- Engine has been running for at least 90 seconds.
- Engine speed is between 1500 RPM and 3000 RPM.
- Canister purge duty cycle is greater than 2%.
- Mass air flow is between 18 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after "closed loop" has been enabled, Bank1 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or rich-to-lean average transition response time was longer than 105 milliseconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0133 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0133 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. Verifies that the fault is currently present.

3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

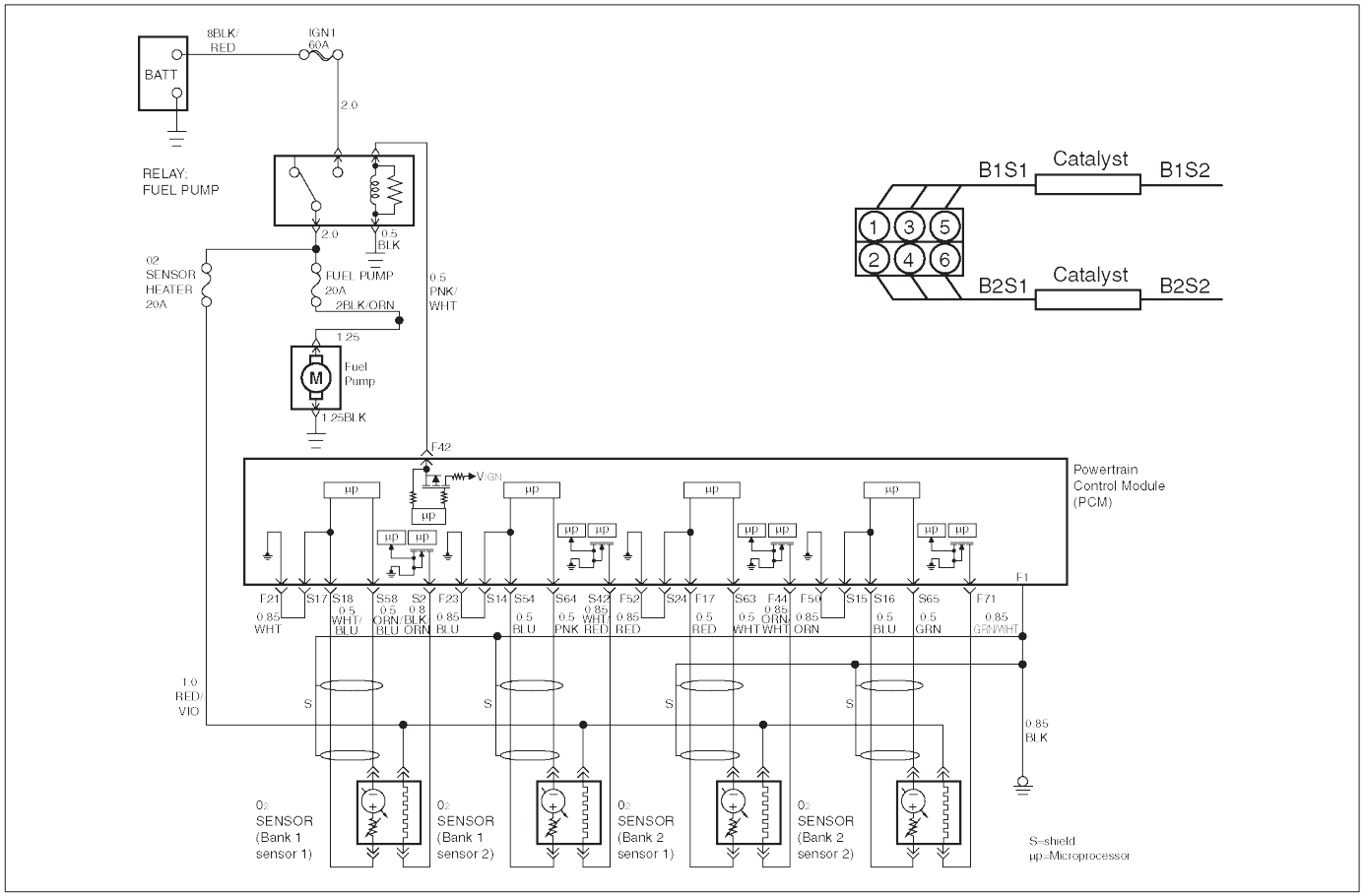
# DTC P0133 – HO2S Slow Response Bank 1 Sensor 1

| 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 | NOTE: If any DTCs are set (expect P0153, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart.<br>1. Install the Tech 2.<br>2. Idle the engine at normal operating temperature.<br>3. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” included in Diagnostic Support.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0133 until the DTC P0133 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0133 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 failed this ignition? | — | Go to *Step 17* | Go to *Step 4* |
| 4 | Check for leaks at the pipe joints.<br>Are the joints leaking? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Tighten the U–bolt nuts at the leaking joints.<br>Is the action complete? | — | Go to *Step 2* | — |
| 6 | Check for gaskets that are damaged or improperly installed.<br>Are there damaged or misaligned gaskets? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Replace damaged gaskets.<br>2. Align the connections.<br>3. Tighten the connections.<br>Is the action complete? | — | Go to *Step 2* | — |
| 8 | Check for loose exhaust flange connections.<br>Are the flange connections loose? | — | Go to *Step 2* | Go to *Step 10* |
| 9 | Tighten the stud nuts or bolts to specifications.<br>Is the action complete? | — | Go to *Step 2* | — |
| 10 | Check for burned or corroded exhaust pipes.<br>Are the exhaust pipes burned or corroded? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Replace the exhaust pipes, as required.<br>Is the action complete? | — | Go to *Step 2* | — |
| 12 | Check for leaks at the exhaust manifold.<br>Are there leaks at the exhaust manifold? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Tighten the bolts to specifications to replace the manifold if necessary.<br>Is the action complete? | — | Go to *Step 2* | — |

# DTC P0133 – HO2S Slow Response Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 14 | Visually/physically inspect the following items:<br>● Ensure that the Bank 1 HO2S 1 is securely installed.<br>● Check for corrosion on terminals.<br>● Check terminal tension (at Bank 1 HO2S 1 and at the PCM).<br>● Check for damaged wiring.<br>Was a problem found in any of the above areas? | — | Go to *Step 18* | Go to *Step 15* |
| 15 | 1. Disconnect Bank 1 HO2S 1.<br>2. Ignition "ON".<br>3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground.<br>Are both voltages in the specified range? | 3-4 V | Go to *Step 16* | Go to *Step 19* |
| 16 | 1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground.<br>2. Ignition "ON".<br>3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage.<br>Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed? | — | Go to *Step 21* | Go to *Step 22* |
| 17 | Replace the affected heated oxygen sensors.<br>NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected.<br>● Fuel contamination.<br>● Use of improper RTV sealant.<br>● Engine oil/coolant consumption.<br>Is the action complete? | — | Verify repair | — |
| 18 | Repair condition as necessary.<br>Is the action complete? | — | Verify repair | — |
| 19 | Check for faulty PCM connections or terminal damage.<br>Is the action complete? | — | Verify repair | Go to *Step 20* |
| 20 | Repair open, short or grounded signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 21 | Replace Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1




060R200054

## Circuit Description

- The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0134 will be set, indicating an open sensor signal or sensor low circuit.
- Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active.
- Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

## Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- The engine has been running for over 5 seconds.
- Engine coolant temperature (ETC) is above 60˚C (140˚F).
- Oxygen sensor heater has been determined to be functioning properly.
- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

## Action Take When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition "ON", engine "OFF", after a cool down period, the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the Ignition "ON", monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

## Test Description

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

3. If the DTC P0134 test passes while the Failure Records conditions are being duplicated, an intermittent conditions is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

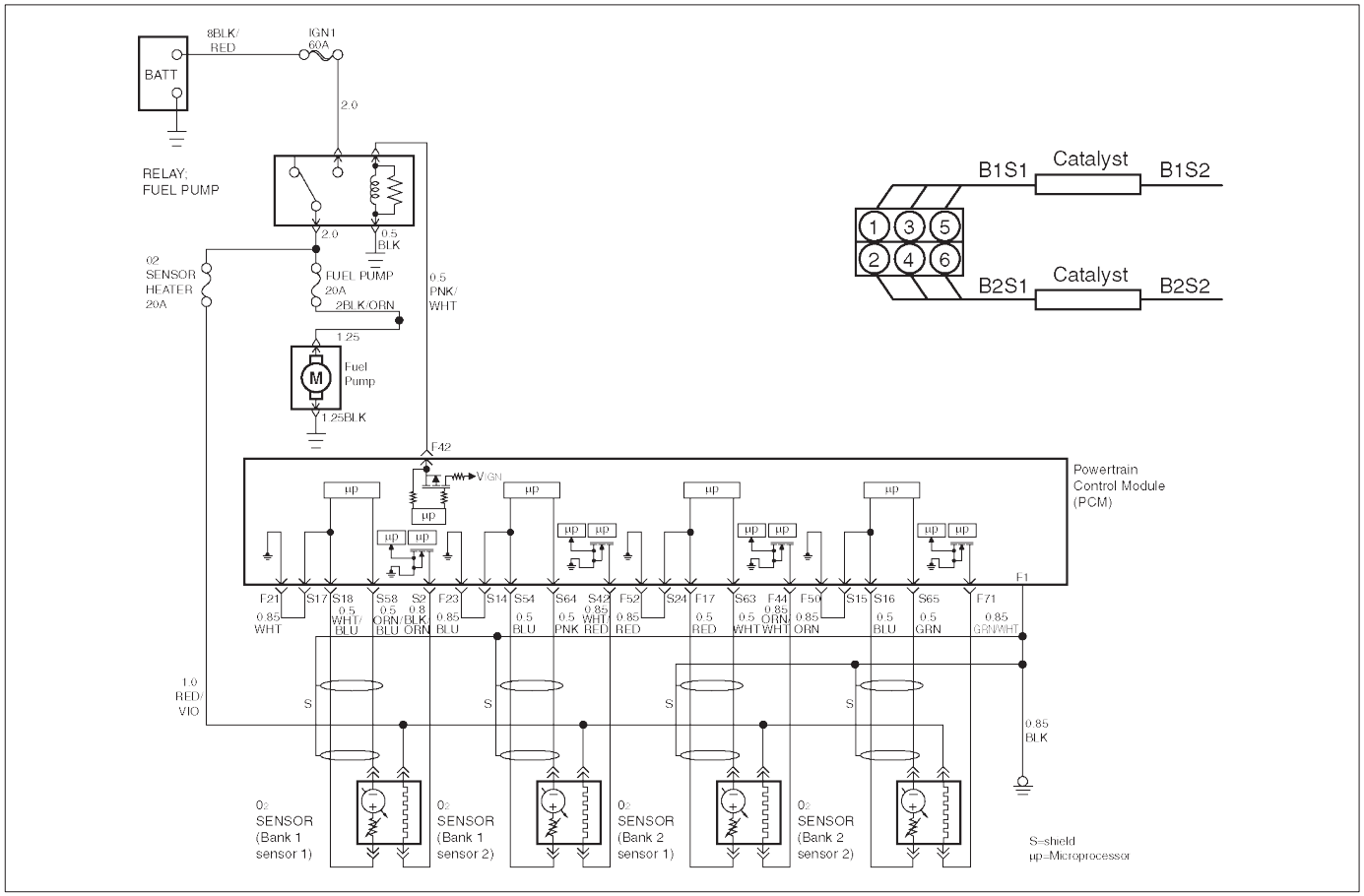
# DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the engine above 1200 RPM for two minutes.<br>Does the Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values? | 400-500 mV | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data and note parameters.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0134 until the DTC P0134 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0134 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Check for a damaged harness.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 6* |
| 6 | Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 7* |

# DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit.<br>3. If the Bank 1 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary.<br>Was a Bank 1 HO2S 1 high circuit problem found and corrected? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit.<br>3. If the Bank 1 HO2S 1 low circuit measures over 5 ohms, repair open or poor connection as necessary.<br>Was a Bank 1 HO2S 1 low circuit problem found and corrected? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Ignition "ON", engine "OFF".<br>2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage.<br>Is Bank 1 HO2S 1 voltage in the specified range? | 0-10 mV | Go to *Step 10* | Go to *Step 11* |
| 10 | Replace Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0135 HO2S Heater Circuit Bank 1 Sensor 1




060R200054

## Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 1 to become active, a DTC P0135 will set. The time it should take the HO2S to reach operating temperature is based on the accumulated amount of air that has passed through the MAF sensor and into the engine (more accumulated air flow = shorter time to HO2S activity).

## Conditions for Setting the DTC

- The engine has been running for over 120 seconds.
- Heater signal is below 0.1A.
- Bank 1 HO2S 1 voltage does not change more than 150 mV from the bias voltage (between 400 mV and 500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 150 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulate air flow since start-up.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0135 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0135 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks or an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

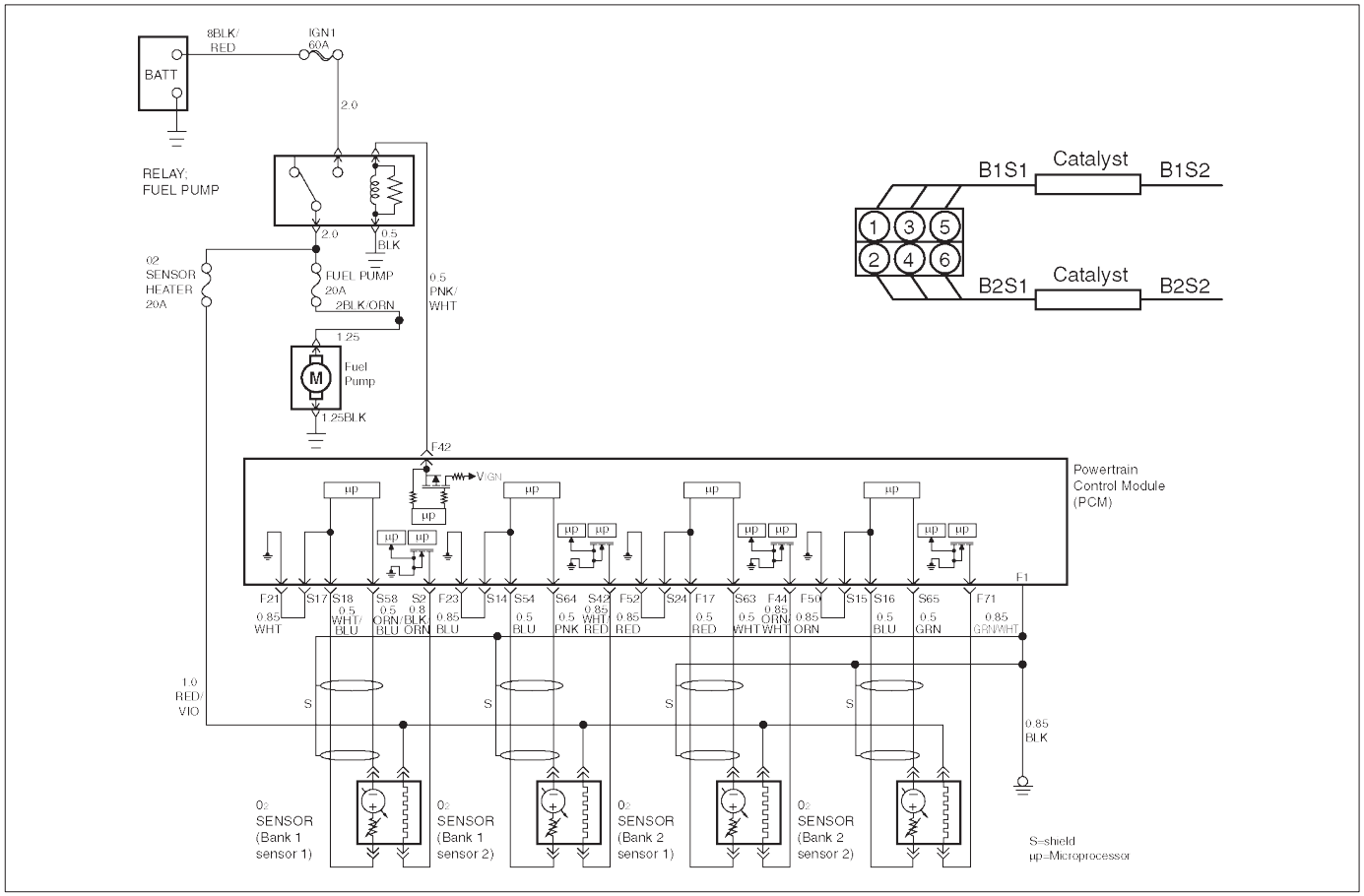
# DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1

| 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 | NOTE: If the engine has just been operating ,allow the engine to cool for at least 15 minutes before proceeding.<br>1. Remove the fuel pump relay.<br>2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses.<br>3. Ignition “OFF”.<br>4. Install a Tech 2.<br>5. Ignition “ON”, engine “OFF”.<br>6. Monitor the Bank 1 HO2S 1 voltage for several minutes.<br>Did the HO2S voltage go from bias voltage to above or below the specified values? | Above 650 mV or below 250 mV | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Inspect the fuse for the Bank 1 HO2S 1 ignition feed.<br>Is the fuse open? | — | Go to *Step 15* | Go to *Step 4* |
| 4 | 1. Ignition “OFF”.<br>2. Raise the vehicle.<br>3. Disconnect the Bank 1 HO2S 1 electrical connector.<br>4. Using a test light connected to a good ground (do not use Bank 1 HO2S 1 heater ground or Bank 1 HO2S 1 low), probe the ignition feed circuit at the Bank 1 HO2S 1 electrical connector (PCM harness side).<br>Does the test light illuminate? | — | Go to *Step 5* | Go to *Step 7* |
| 5 | Connect the test light between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground.<br>Does the test light illuminate? | — | Go to *Step 6* | Go to *Step 8* |

# DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Allow the HO2S to cool for at least 15 minutes.<br>2. Using a DVM, measure the resistance between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground at the Bank 1 HO2S 1 pigtail.<br>Is the HO2S heater resistance within the specified values? | 3-6 ohms | Go to *Step 9* | Go to *Step 10* |
| 7 | Repair the open Bank 1 HO2S 1 ignition feed circuit to Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 8 | Repair the open Bank 1 HO2S 1 heater ground circuit to Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Check for a poor connection at the Bank 1 HO2S 1 harness terminals.<br>2. If a poor connection is found, replace terminals.<br>Was a poor connection found? | — | Verify repair | Go to *Step 10* |
| 10 | Check for a poor Bank 1 HO2S 1 high or low circuit terminal connection at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit.<br>3. If the Bank 1 HO2S 1 high circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | Check for a poor Bank 1 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 13* |
| 13 | Check for a poor Bank 1 HO2S 1 high circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 14* |
| 14 | Replace the Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 15 | Locate and repair the short to ground in Bank 1 HO2S 1 ignition feed circuit and replace the fault fuse.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2




060R200054

## Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm impedance digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0137 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop”.
- Engine coolant temperature is above 60°C (140°F).
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains below 22 mV during normal “closed loop” operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains below 400 mV during power enrichment mode fuel control operation for up to 5 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0137 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0137 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0137 to set. The system will go lean if pressure is too low. The PCM can

compensate for some decrease. However, if fuel pressure is too low, a DTC P0137 may be set. Refer to *Fuel System Diagnosis*.

- Lean injector(s) – Perform "Injector Balance Test".
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0137 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

## Test Description

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

3. DTC P0137 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC0137 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

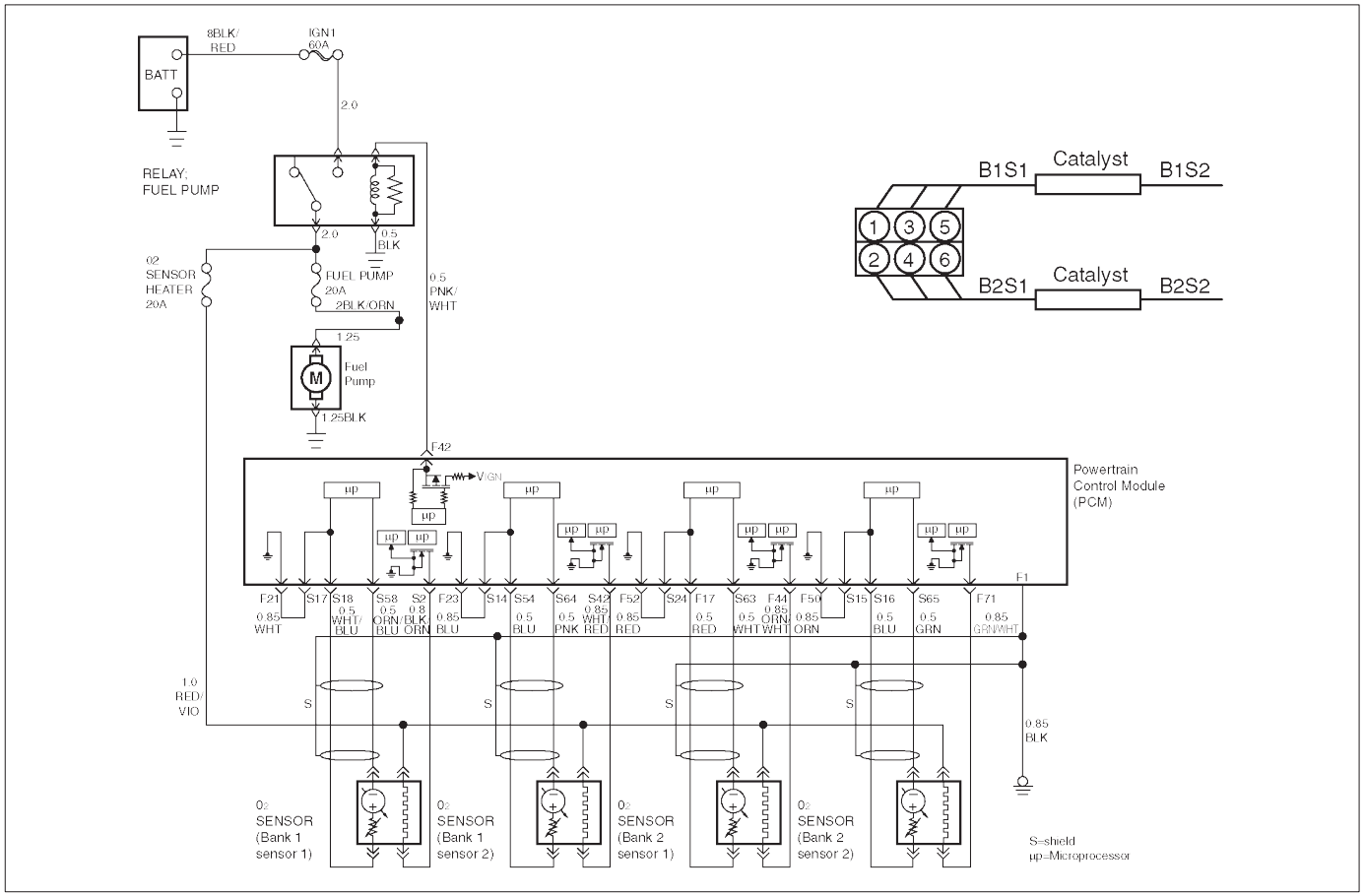
# DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage.<br>Does the Bank 1 HO2S voltage remain below the specified value? | 22 mV | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data and note parameters.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0137 until the DTC P0137 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0137 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Turn ignition "OFF".<br>2. Disconnect the PCM.<br>3. Check the Bank 1 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit.<br>Were Bank 1 HO2S 2 signal circuits shorted? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the Bank 1 HO2S 2 signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition "OFF".<br>2. Leave the PCM and HO2S 2 disconnected.<br>3. Check for continuity between the high and low signal circuits.<br>Was there continuity between the high and low circuits? | — | Go to *Step 7* | Go to *Step 8* |

# DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | Repair the short between the high and low circuits.<br>Is the action complete? | — | Verify repair | — |
| 8 | 1. Ignition "OFF".<br>2. Reconnect the PCM, leave HO2S 2 disconnected.<br>3. Ignition "ON".<br>Does the Tech 2 indicate Bank 1 HO2S 2 voltage near the specified value? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 9* |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0138 HO2S Circuit High Voltage Bank 1 Sensor 2




060R200054

## Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 voltage remains excessively high for an extended period of time, DTC P0138 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop”.
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60°C (140°F).
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains above 952 mV during normal “closed loop” operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cut–off mode operation for up to 3 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0138 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0138 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0138 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform “Injector Balance Test”.
- Leaking injector – Refer to *Fuel System Diagnosis*.

- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check the canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S – A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

## Test Description

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

3. DTC P0138 being set during deceleration fuel mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0138 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

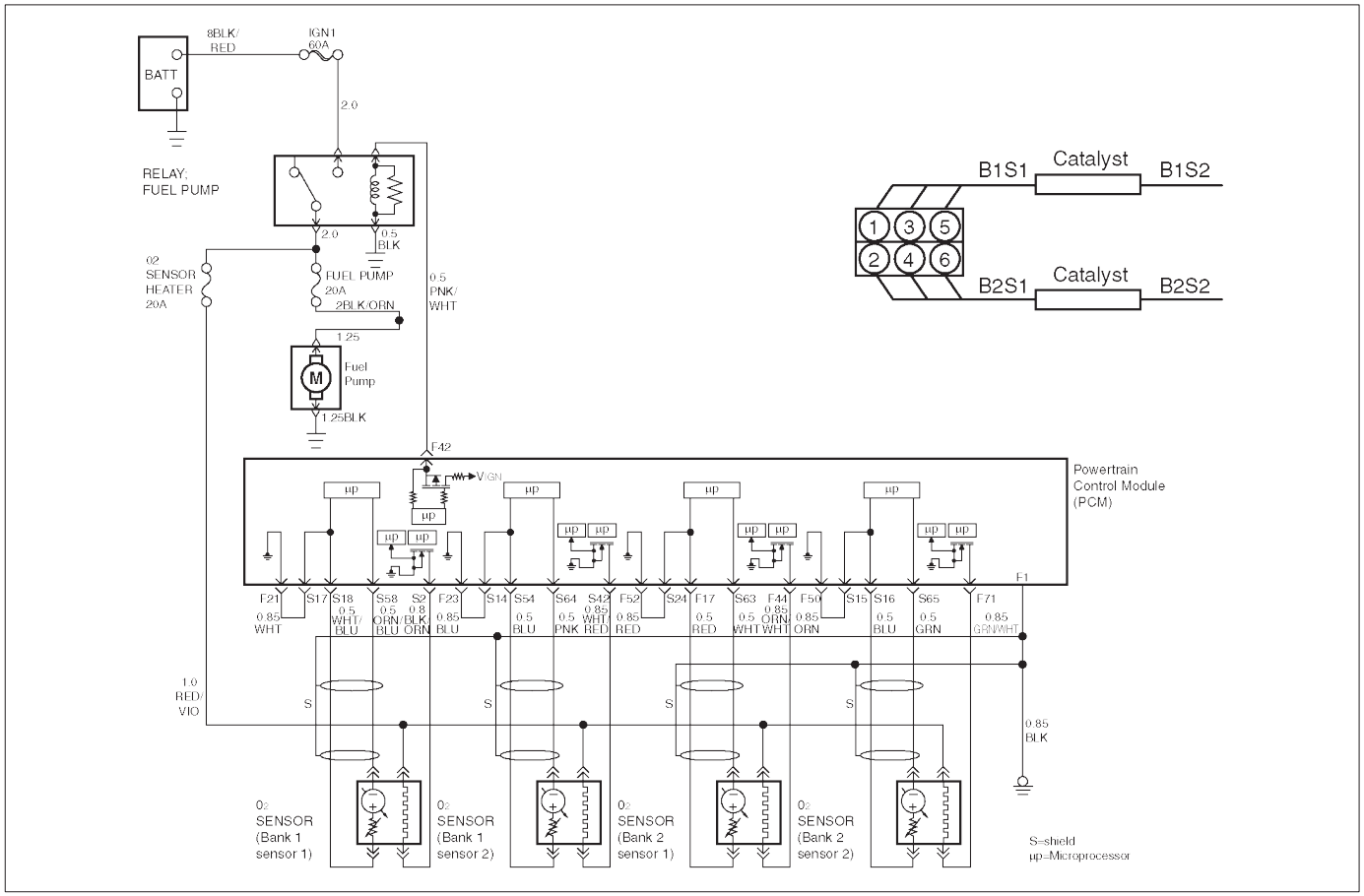
# DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage.<br>Does the Bank 1 HO2S voltage remain above the specified value? | 952 mV (500 mV in deceleration fuel cutoff mode) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", review and record Tech 2 Failure Records data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0138 until the DTC P0138 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0138 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition "OFF".<br>2. Disconnect Bank 1 HO2S 1.<br>3. Ignition "ON".<br>4. At the HO2S Bank 1 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals.<br>Are the voltages above the specified range? | 3-4 V | Go to *Step 5* | Go to *Step 6* |

# DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | Repair short to voltage in the signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition "ON", engine"OFF".<br>2. At Bank 1 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage.<br>Is Bank 1 HO2S 2 voltage below the specified value? | 10 mV | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Disconnect the jumpers to ground from Bank 1 HO2S 2 PCM–side connector.<br>2. With the HO2S 2 connector disconnected, monitor BANK 1 HO2S 2 voltage.<br>Is the Bank 1 HO2S 2 voltage between the specified values? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 8* |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code(DTC)
# P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2




060R200054

## Circuit Description

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 powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 2 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 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 catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0140 will be set. Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60˚C (140˚F).
- The engine has been running for over 5 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is operating in "closed loop"
- Bank 1 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Cleaning the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0140 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0140 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness– Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit–With the ignition“ON”, engine “OFF”, the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test–With the ignition “ON”, monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

## Test Description

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

3. If the DTC P0140 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

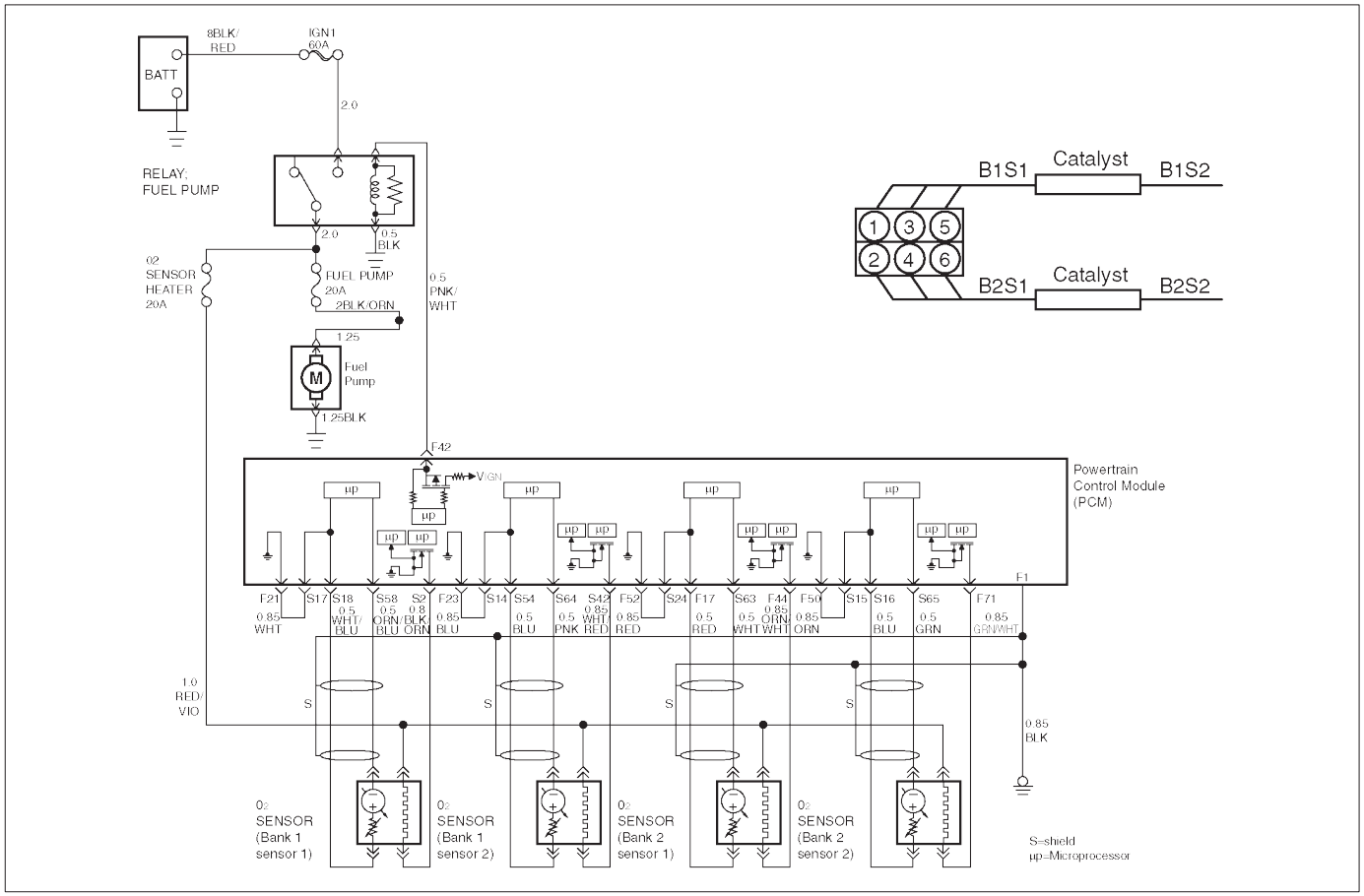
# DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the engine above 1200 RPM for two minutes.<br>Does the Tech 2 indicate Bank 1 HO2S 2 voltage varying outside the specified values? | 425-475 mV | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data and note parameters.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0140 until the DTC P0140 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0140 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Check for a damaged harness.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the Bank 1 HO2S 2 harness connector and replace terminal(s) if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 6* |
| 6 | Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Ignition “OFF”.<br>2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit.<br>3. If the Bank 1 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connection as necessary.<br>Was a Bank 1 HO2S 2 high circuit problem found and corrected? | — | Verify repair | Go to *Step 8* |

# DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit.<br>3. If the Bank 1 HO2S 2 low circuit measures over 5.0 ohms, repair open or poor connection as necessary.<br>Was a Bank 1 HO2S 2 low circuit problem found and corrected? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Ignition "ON", engine"OFF".<br>2. Disconnect Bank 1 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage.<br>Is Bank 1 HO2S 2 voltage in the specified range? | 0-10 mV | Go to *Step 10* | Go to *Step 11* |
| 10 | Replace Bank 1 HO2S 2.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0141 HO2S Heater Circuit Bank 1 Sensor 2




060R200054

## Circuit Description

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

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 2 to become active, a DTC P0141 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total airflow = shorter time to HO2S activity).

## Conditions for Setting the DTC

- No related DTCs.
- The engine has been running for over 120 seconds.
- Ignition voltage is between 11 volts and 18 volts.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV–500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0141 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0141 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

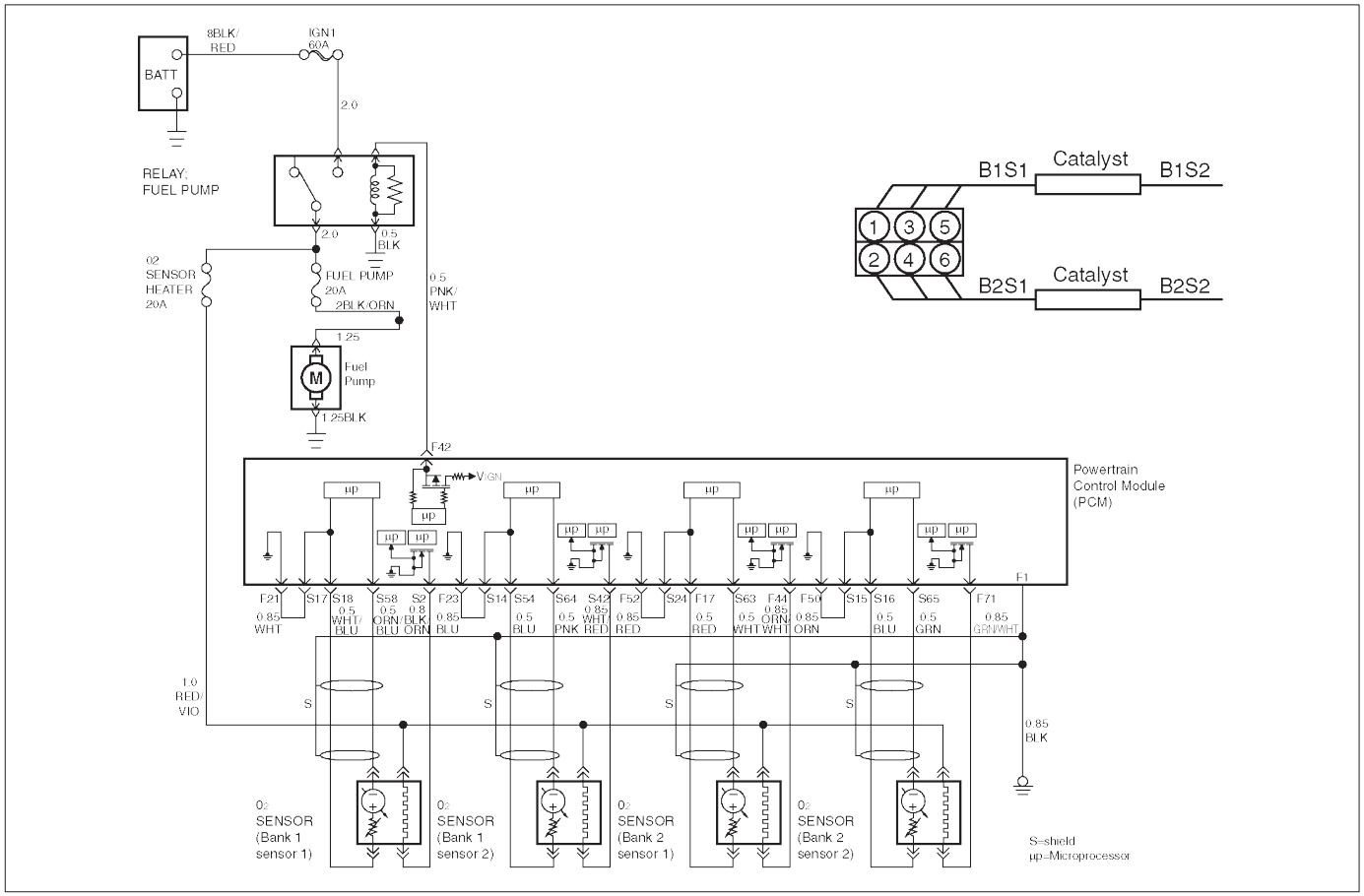
# DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2

| 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 | NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding.<br>1. Remove the fuel pump relay.<br>2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses.<br>3. Ignition “OFF”.<br>4. Install a Tech 2.<br>5. Ignition “ON”, engine “OFF”.<br>6. Monitor the Bank 1 HO2S 2 voltage for several minutes.<br>Did the HO2S voltage go from bias voltage to above or below the specified values? | Above 650 mV or below 250 mV | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Inspect the fuse for Bank 1 HO2S 2 ignition feed.<br>Is the fuse open? | — | Go to *Step 15* | Go to *Step 4* |
| 4 | 1. Ignition “OFF”.<br>2. Raise the vehicle.<br>3. Disconnect the Bank 1 HO2S 2 electrical connector.<br>4. Using a test light connected to a good ground (do not use Bank 1 HO2S 2 heater ground or Bank 1 HO2S 2 low), probe the ignition feed circuit at the Bank 1 HO2S 2 electrical connector (PCM harness side).<br>Does the test light illuminate? | — | Go to *Step 5* | Go to *Step 7* |
| 5 | Connect the test light between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground.<br>Does the test light illuminate? | — | Go to *Step 6* | Go to *Step 8* |

# DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Allow the HO2S to cool for at least 15 minutes.<br>2. Using a DVM, measure the resistance between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground at the Bank 1 HO2S 2 pigtail.<br>Is the HO2S resistance within the specified values? | 3-6 ohms | Go to *Step 9* | Go to *Step 10* |
| 7 | Repair the open Bank 1 HO2S 2 ignition feed circuit to Bank 1 HO2S 2.<br>Is the action complete? | — | Verify repair | — |
| 8 | Repair the open Bank 1 HO2S 2 heater ground circuit.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Check for a poor connection at the Bank 1 HO2S 2 harness terminals.<br>2. If a poor connection is found, replace the terminals.<br>Was a poor connection found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 2 signal circuit and the Bank 1 HO2S 2 low circuit.<br>3. If the Bank 1 HO2S 2 signal circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit.<br>3. If the Bank 1 HO2S 1 high circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | Check for a poor Bank 1 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 13* |
| 13 | Check for a poor Bank 1 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 14* |
| 14 | Replace Bank 1 HO2S 2.<br>Is the action complete? | — | Verify repair | — |
| 15 | Locate and repair the short to ground in Bank 1 HO2S 2 ignition feed circuit and replace the faulty fuse.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0151 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop".
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Bank 2 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0151 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0151 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0151 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test".
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.

- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor –The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

## Test Description

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

3. DTC P0151 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0151 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicate.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

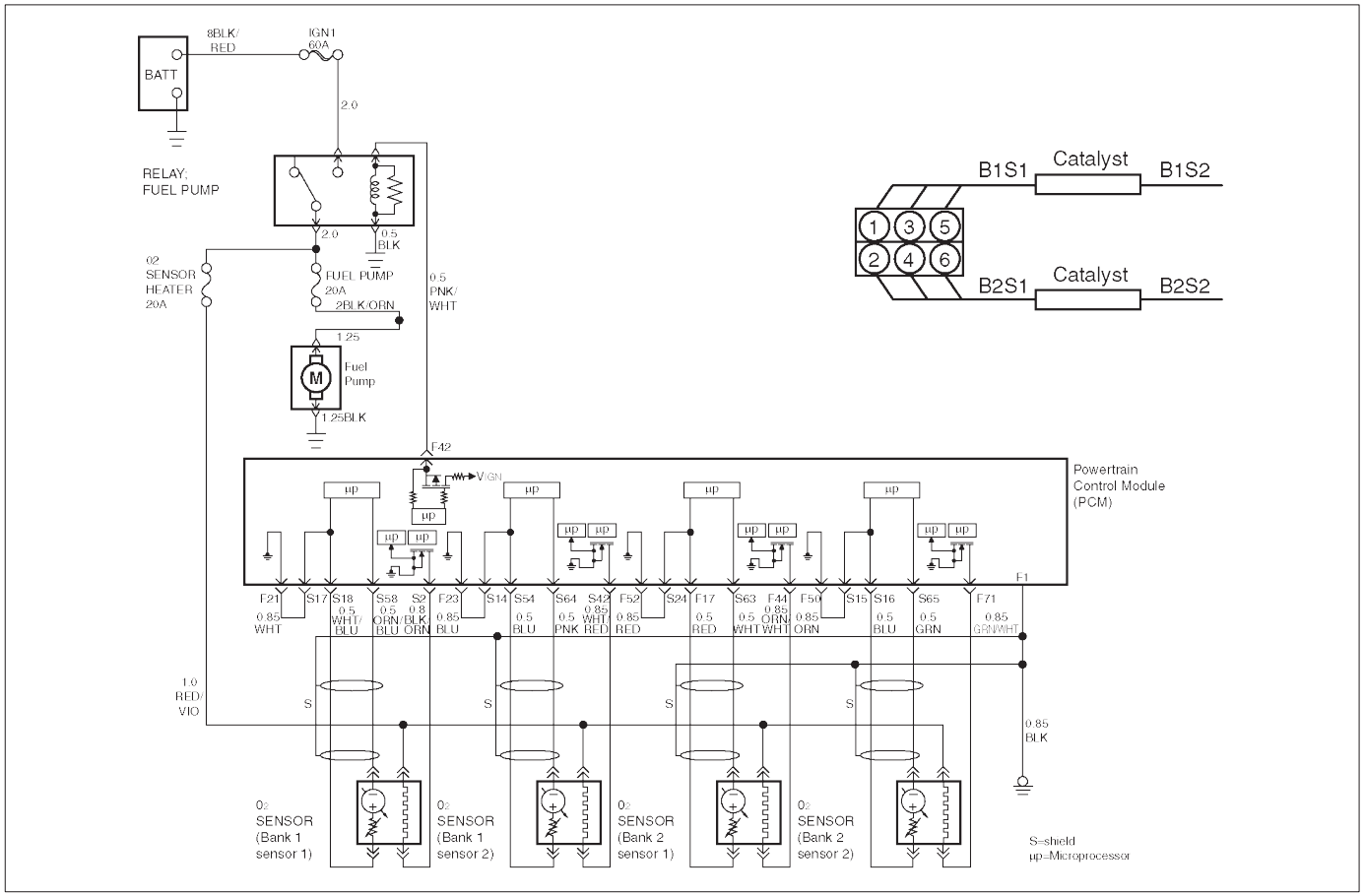
# DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage.<br>Does the Bank 2 HO2S 1 voltage remain below the specified value? | 22 mV | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data and note parameters.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0151 until the DTC P0151 test runs.<br>4. Note test result.<br>Does the Tech 2 indicate DTC P0151 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Turn ignition “OFF”.<br>2. Disconnect the PCM.<br>3. Check the Bank 2 HO2S 1 high and low signal circuits for a short to ground or a short to the heater ground circuit.<br>Were Bank 2 HO2S 1 signal circuits shorted? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the Bank 2 HO2S 1 signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition “OFF”.<br>2. Leave the PCM and HO2S 1 disconnected.<br>3. Check for continuity between the high and low signal circuits.<br>Was there continuity between the high and low circuits? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | Repair the short between the high and low circuits.<br>Is the action complete? | — | Verify repair | — |

# DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Ignition "OFF".<br>2. Reconnect the PCM, leave HO2S disconnected.<br>3. Ignition "ON".<br>Does the Tech 2 indicate Bank 2 HO2S 1 voltage near the specified value? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 9* |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0152 HO2S Circuit High Voltage Bank 2 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing the injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0152 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop".
- The engine coolant temperature is above 60°C (140°F).
- Bank 2 HO2S 1 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period.

OR

- Bank 2 HO2S 1 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

## Action Taken When the DTC Sets

- The PCM will "ON" the MIL after second trip with detected fault
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0152 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0152 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0152 may be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test".
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) system – Check the canister for fuel saturation. If the canister is full of fuel,

check EVAP control system components and hoses. Refer to *Evaporative Emission (EVAP) Control System*.

- MAF sensor – The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if rich condition is corrected. If so, replace MAF sensor.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S)– If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can cause a high HO2S voltage to be indicated. This condition is indicated by powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S– A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage switch between the rich and lean thresholds can also cause the condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

## Test Description

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

3. DTC P0152 failing during deceleration fuel cutoff mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0152 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

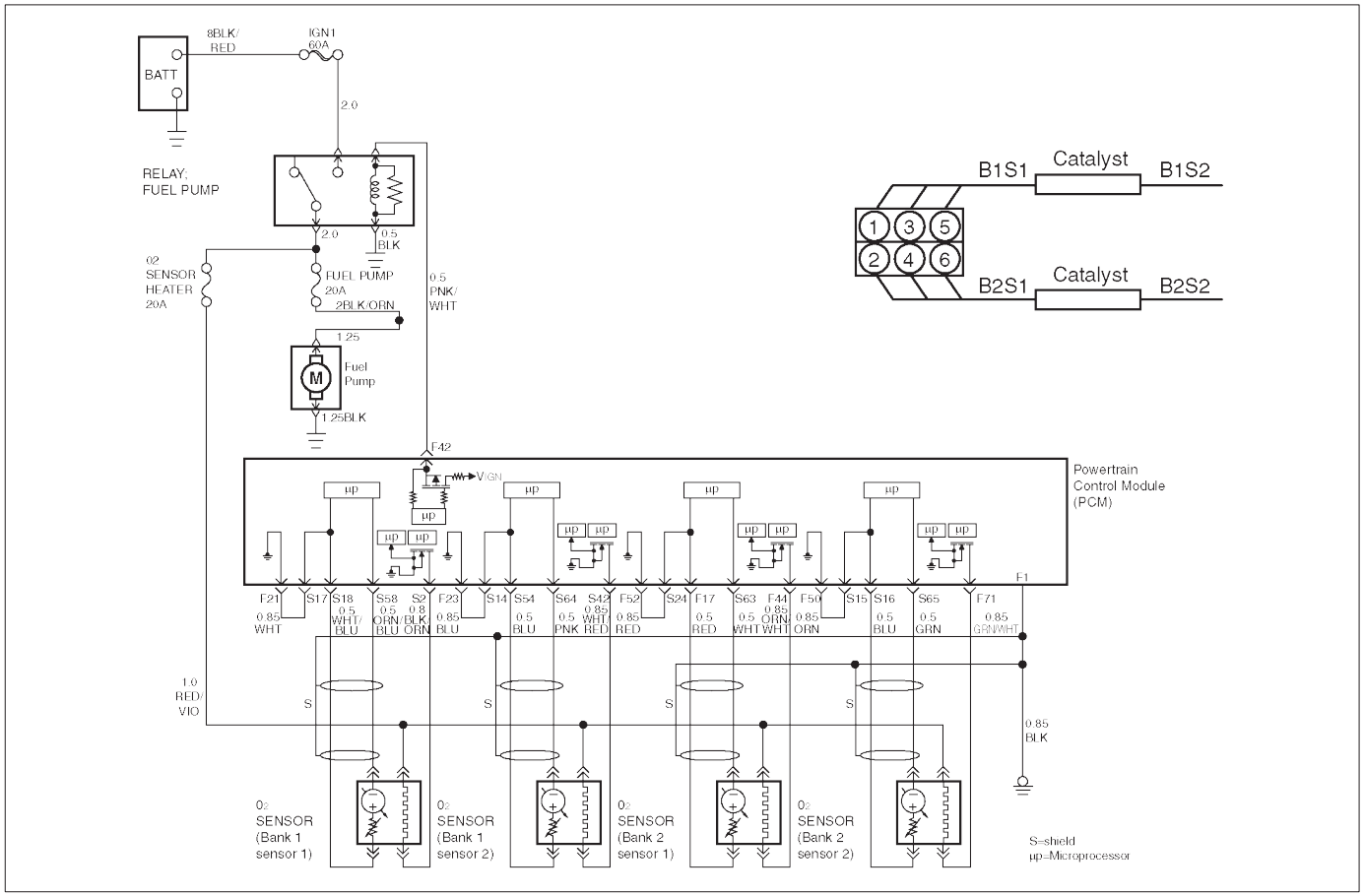
# DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1

| 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. Install the Tech 2.<br>2. Engine is at operating temperature.<br>3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage.<br>Does the Bank 2 HO2S 1 voltage remain above the specified value? | 952 mV (500 mV in deceleration fuel cut-off mode) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0152 until the DTC P0152 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0152 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Ignition "OFF".<br>2. Disconnect Bank 2 HO2S 1.<br>3. Ignition "ON".<br>4. At HO2S Bank 2 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals.<br>Are the voltages in the specified range? | 3-4 V | Go to *Step 5* | Go to *Step 6* |

# DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | Repair short to voltage in signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition "ON", engine"OFF".<br>2. At Bank 2 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage.<br>Is Bank 2 HO2S 1 voltage below the specified value? | 10 mV | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Disconnect the jumpers to ground from Bank 2 HO2S 1 PCM-side connector.<br>2. With the HO2S 1 connector disconnected, monitor Bank 2 HO2S 1 voltage.<br>Is the Bank 2 HO2S 1 voltage between the specified values? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 8* |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0153 HO2S Slow Response Bank 2 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0153 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 60°C (140°F).
- The engine is operating in "closed loop".
- Engine has been running for over 60 seconds.
- Canister purge duty cycle is above 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 18 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after "closed loop" has been enabled, Bank 2 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or the rich-to-lean average transition response time was longer than 105 milliseconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0153 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. Verifies that the fault is currently present.

3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

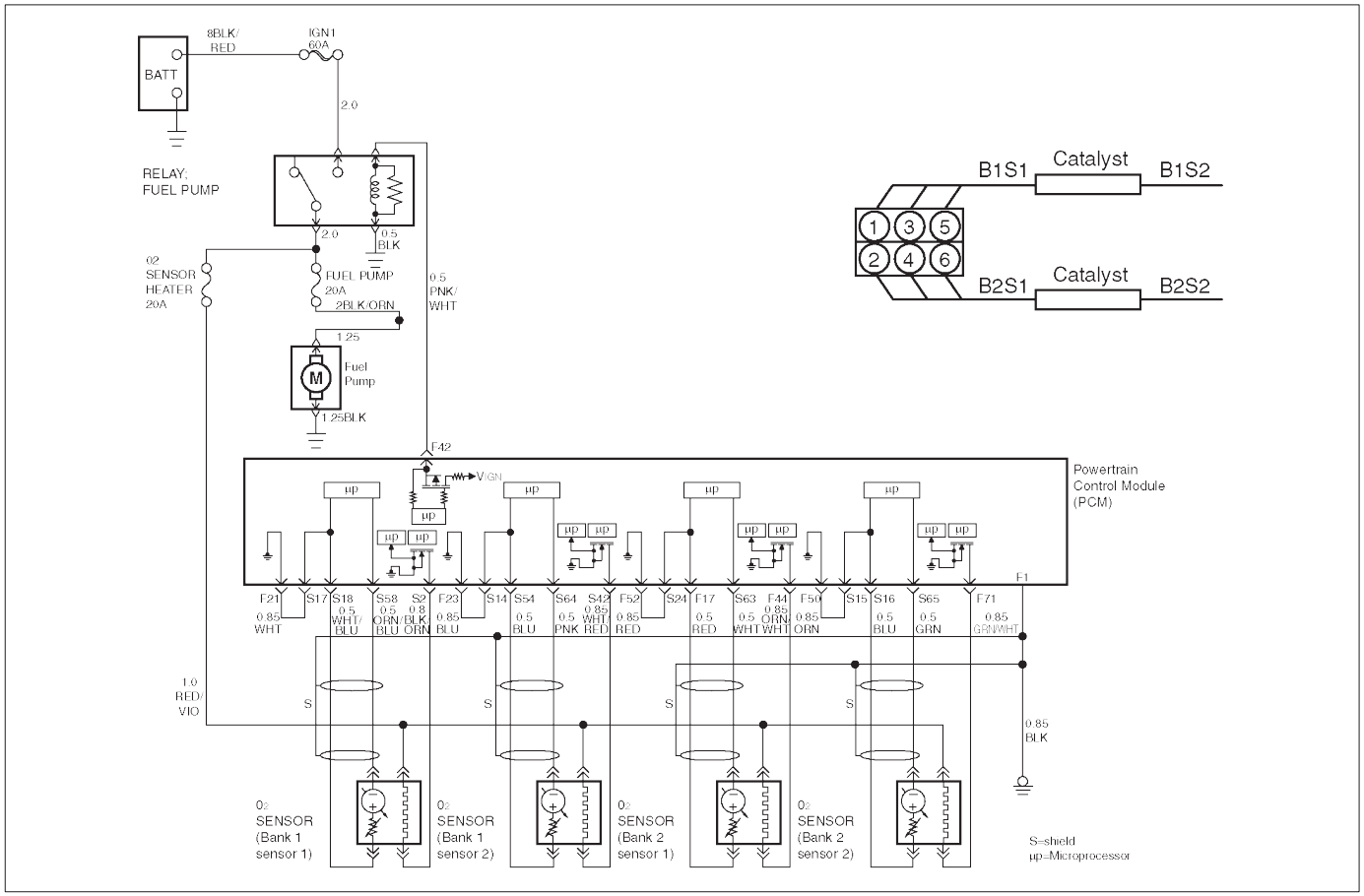
# DTC P0153 – HO2S Slow Response Bank 2 Sensor 1

| 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 | NOTE: If any DTCs are set, (except P0133, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart.<br>1. Install the Tech 2.<br>2. Idle the engine at operating temperature.<br>3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0153 until the DTC P0153 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0153 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 test failed this ignition? | — | Go to *Step 17* | Go to *Step 4* |
| 4 | Check for leaks at the pipe joints.<br>Are the joints leaking? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Tighten the U-bolt nuts at the leaking joint.<br>Is your action complete? | — | Go to *Step 2* | — |
| 6 | Check for gaskets that are damage or improperly installed.<br>Are there damaged or misaligned gaskets? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Replace the damaged gaskets.<br>2. Align the connections.<br>3. Tighten the connections.<br>Is your action complete? | — | Go to *Step 2* | — |
| 8 | Check for loose exhaust flange connections.<br>Are the flange connections loose? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | Tighten the stud nuts or bolts to specifications.<br>Is your action complete? | — | Go to *Step 2* | — |
| 10 | Check for burned or corroded exhaust pipes.<br>Are the exhaust pipes burned or corroded? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Replace the exhaust pipes, as required.<br>Is your action complete? | — | Go to *Step 2* | — |
| 12 | Check for leaks at the exhaust manifold.<br>Are there leaks at the exhaust manifold? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Tighten the bolts to specifications or replace the manifold if necessary.<br>Is your action complete? | — | Go to *Step 2* | — |

# DTC P0153 – HO2S Slow Response Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 14 | 1. Visually/physically inspect the following items:<br>• Ensure that the Bank 2 HO2S 1 is securely installed.<br>• Check for corrosion on terminals.<br>• Check terminal tension (at Bank 2 HO2S 1 and at the PCM).<br>• Check for damaged wiring.<br>Was a problem found in any of the above areas? | — | Go to *Step 18* | Go to *Step 15* |
| 15 | 1. Disconnect Bank 2 HO2S 1.<br>2. Ignition "ON".<br>3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground.<br>Are both voltages in the specified range? | 3-4 V | Go to *Step 16* | Go to *Step 19* |
| 16 | 1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground.<br>2. Ignition "ON".<br>3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage.<br>Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed? | — | Go to *Step 21* | Go to *Step 22* |
| 17 | Replace the affected heated oxygen sensors.<br>NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected.<br>• Fuel contamination.<br>• Use of improper RV sealant.<br>• Engine oil/coolant consumption.<br>Is the action complete? | — | Verify repair | — |
| 18 | Repair condition as necessary.<br>Is the action complete? | — | Verify repair | — |
| 19 | Check for faulty PCM connections or terminal damage.<br>Is the action complete? | — | Verify repair | Go to *Step 20* |
| 20 | Repair open, short or grounded signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 21 | Replace Bank 2 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0154 will be set, indicating an open sensor signal or sensor low circuit.

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60°C (140°F).
- The engine has been running for over 5 seconds.
- Oxygen sensor heater is functioning properly.
- Bank 2 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0154 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals,

improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire-connection, and damaged harness.

- Faulty HO2S heater or heater circuit – With the ignition "ON", engine "OFF", the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition "ON", monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

## Test Description

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

3. If the DTC P0154 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

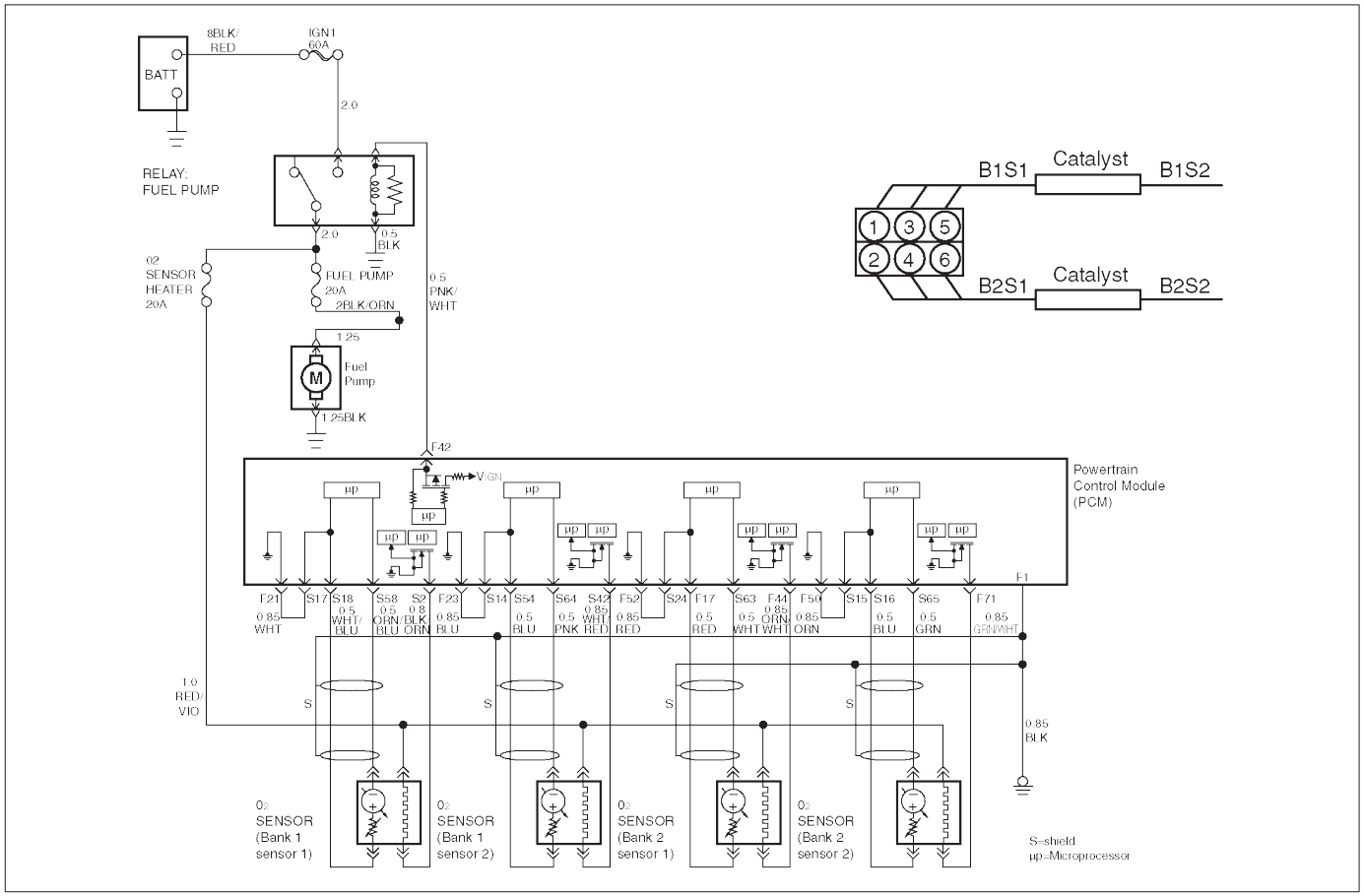
# DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the engine above 1200 RPM for two minutes.<br>Does the Tech 2 indicate Bank 2 HO2S 1 voltage varying outside the specified values? | 400-500 mV | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Ignition "ON", engine "OFF".<br>2. Review and record Tech 2 Failure Records data and note parameters.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0154 until the DTC P0154 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0154 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Check for a damaged harness.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 6* |
| 6 | Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 7* |

# DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 high circuit.<br>3. If the Bank 2 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary.<br>Was a Bank 2 HO2S 1 high circuit problem found and corrected? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 low circuit.<br>3. If the Bank 2 HO2S 1 low circuit measures over 5.0 ohms, repair open or poor connection as necessary.<br>Was a Bank 2 HO2S 1 low circuit problem found and corrected? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Ignition "ON", engine "OFF".<br>2. Disconnect Bank 2 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage.<br>Is the Bank 2 HO2S 1 voltage in the specified range? | 0-10 mV | Go to *Step 10* | Go to *Step 11* |
| 10 | Replace Bank 2 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0155
# HO2S Heater Circuit Open Bank 2 Sensor 1




060R200054

## Circuit Description

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

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 1 to become active, a DTC P0155 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the mass air flow (MAF) sensor and into the engine (more total air flow = shorter time to HO2S activity).

## Conditions for Setting the DTC

- No related DTCs.
- The engine has been running for over 120 seconds.
- Ignition voltage is between 11 volts and 18 volts.
- Heater signal is below 0.1A.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0155 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0155 can be cleared by using the Tech 2 “Clear info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks for an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

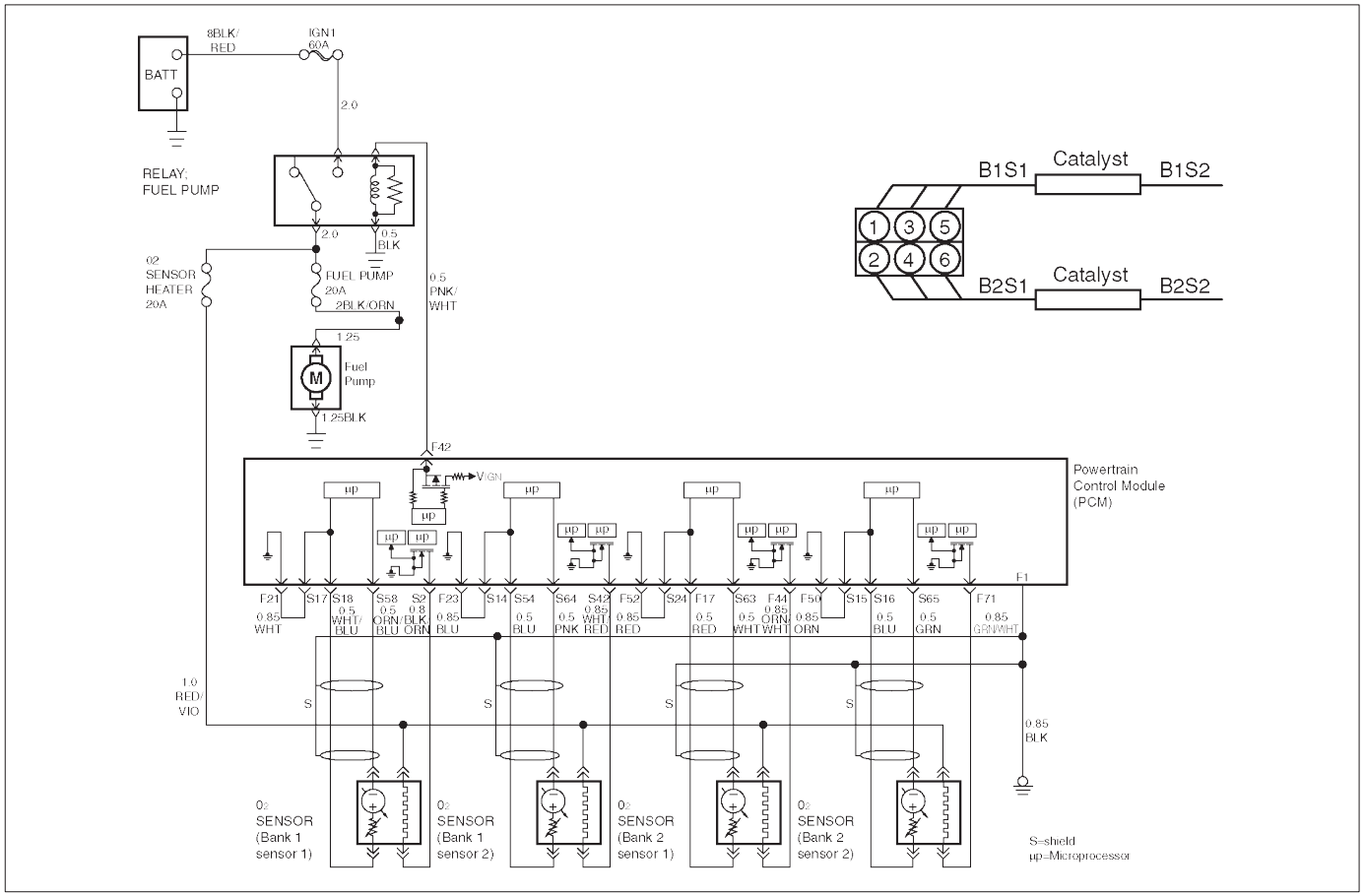
# DTC P0155 – HO2S Heater Circuit Open Bank 2 Sensor 1

| 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 | NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding.<br>1. Remove the fuel pump relay.<br>2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses.<br>3. Ignition “OFF”.<br>4. Install a Tech 2.<br>5. Ignition “ON”, engine “OFF”.<br>6. Monitor the Bank 1 HO2S 1 voltage for several minutes.<br>Did the HO2S voltage go from bias voltage to above or below the specified value? | Above 650 mV or below 250 mV | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Inspect the fuse for the Bank 2 HO2S 1 ignition feed.<br>Is the fuse open? | — | Go to *Step 15* | Go to *Step 4* |
| 4 | 1. Ignition “OFF”.<br>2. Raise the vehicle.<br>3. Disconnect the Bank 2 HO2S 1 electrical connector.<br>4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 1 heater ground or Bank 2 HO2S 1 low), probe the ignition feed circuit at the Bank 2 HO2S 1 electrical connector (PCM harness side).<br>Does the test light illuminate? | — | Go to *Step 5* | Go to *Step 7* |
| 5 | Connect the test light between Bank 2 HO2S 1 ignition feed and Bank 2 HO2S 1 heater ground.<br>Does the test light illuminate? | — | Go to *Step 6* | Go to *Step 8* |

# DTC P0155 – HO2S Heater Circuit Open Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Allow the HO2S to cool for at least 15 minutes.<br>2. Using a DVM, measure resistance between the Bank 2 HO2S 1 ignition feed and the Bank 2 HO2S 1 heater ground at the Bank 2 HO2S 1 pigtail.<br>Is the HO2S resistance within the specified values? | 3-6 ohms | Go to *Step 9* | Go to *Step 10* |
| 7 | Repair the open Bank 2 HO2S 1 ignition feed circuit to Bank 2 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 8 | Repair the open Bank 2 HO2S 1 heater ground circuit.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Check for a poor connection at the Bank 2 HO2S 1 harness terminals.<br>2. If a poor connection is found, replace terminals.<br>Was a poor connection found? | — | Verify repair | Go to *Step 10* |
| 10 | Check for a poor Bank 2 HO2S 1 signal or low circuit terminal connection at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 1 signal circuit and the Bank 2 HO2S 1 low circuit.<br>3. If the Bank 2 HO2S 1 signal circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | Check for a poor Bank 2 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 13* |
| 13 | Check for a poor Bank 2 HO2S 1 signal circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 14* |
| 14 | Replace Bank 2 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 15 | Locate and repair short to ground in Bank 2 HO2S 1 ignition feed circuit and replace the faulty fuse.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2




060R200054

## Circuit Description

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 powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 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 Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0157 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop".
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8
- Bank 2 HO2S 2 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 2 HO2S 2 signal voltage remains below 400 mV during "power enrichment" mode fuel control operation for up to 5 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0157 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0157 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0157 to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0157 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test".
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0157 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of above conditions are present, replace the affected HO2S 2.

## Test Description

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

3. DTC P0157 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0157 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

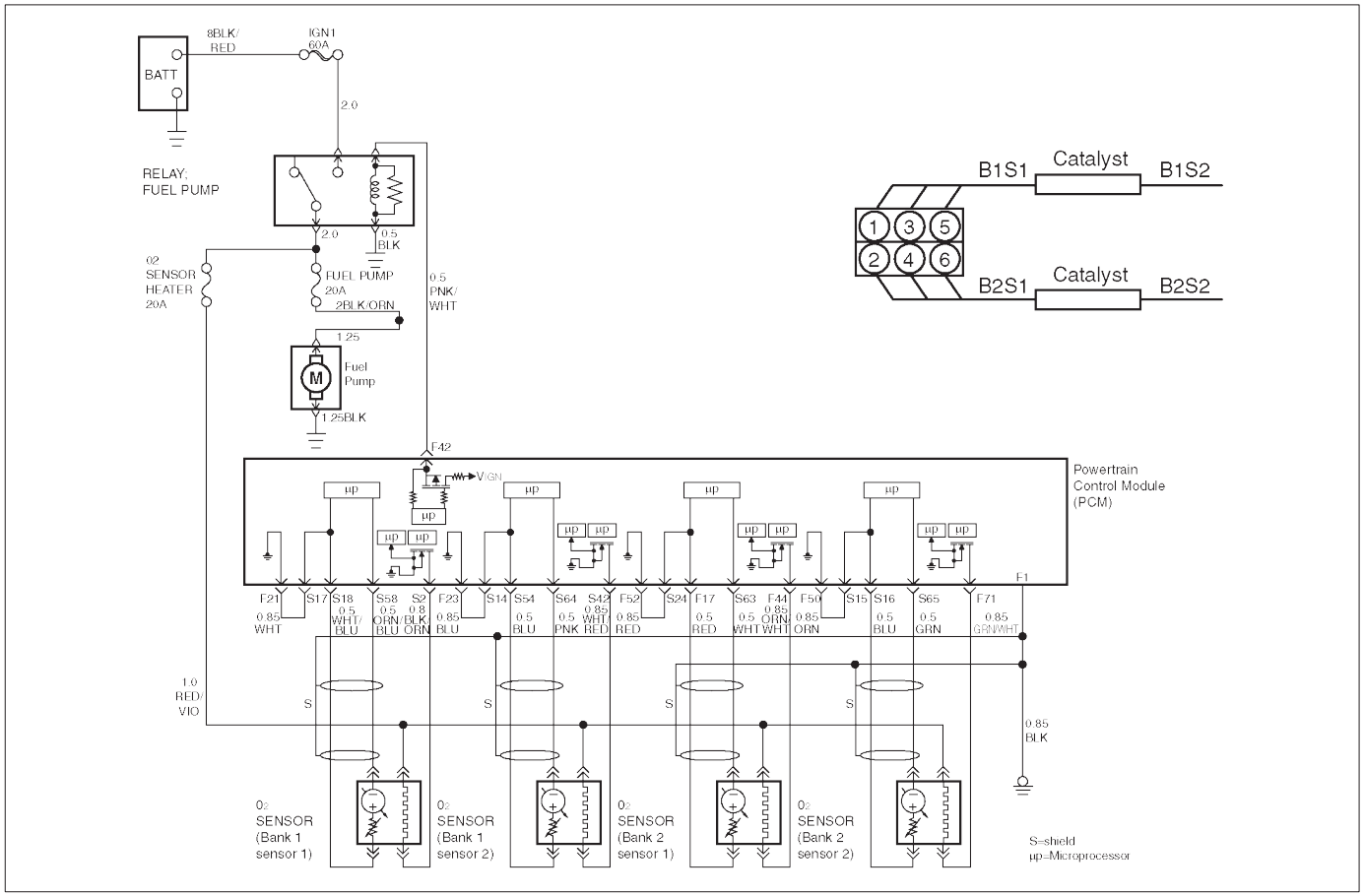
# DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage.<br>Does the Bank 2 HO2S 2 voltage remain below the specified value? | 22 mV | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON", engine "OFF".<br>2. Review and record Tech 2 Failure Records data and note parameters.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0157 until the DTC P0157 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0157 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Turn the ignition "OFF".<br>2. Disconnect the PCM.<br>3. Check the Bank 2 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit.<br>Were Bank 2 HO2S 2 signal circuits shorted? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the Bank 1 HO2S 2 signal circuit.<br>Is the action complete? | — | Verify repair | — |

# DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Ignition "OFF".<br>2. Leave the PCM and HO2S 2 disconnected.<br>3. Check for continuity between the high and low signal circuits.<br>Was there continuity between the high and low circuits? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | Repair the short between the high and low circuits.<br>Is the action complete? | — | Verify repair | — |
| 8 | 1. Ignition "OFF".<br>2. Reconnect the PCM, leave HO2S 2 disconnected.<br>3. Ignition "ON".<br>Does the Tech 2 indicate Bank 2 HO2S 2 voltage near the specified value? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 9* |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0158 HO2S Circuit High Voltage Bank 2 Sensor 2




060R200054

## Circuit Description

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 powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 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 Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively high for an extended period of time, DTC P0158 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop".
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60˚C (140˚F).
- Bank 2 HO2S 2 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period.

OR

- Bank 2 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0158 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0158 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0158 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test".
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if a rich condition is corrected. If so, replace the MAF sensor.
- Check for a leaking fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON", engine "OFF". If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S signal or low circuit, or faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel cutoff mode operation. An HO2S which is faulty and does not allow full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.
- If none of above conditions are present, replace the affected HO2S.

## Test Description

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

3. DTC P0158 being set during deceleration fuel cutoff mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0158 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

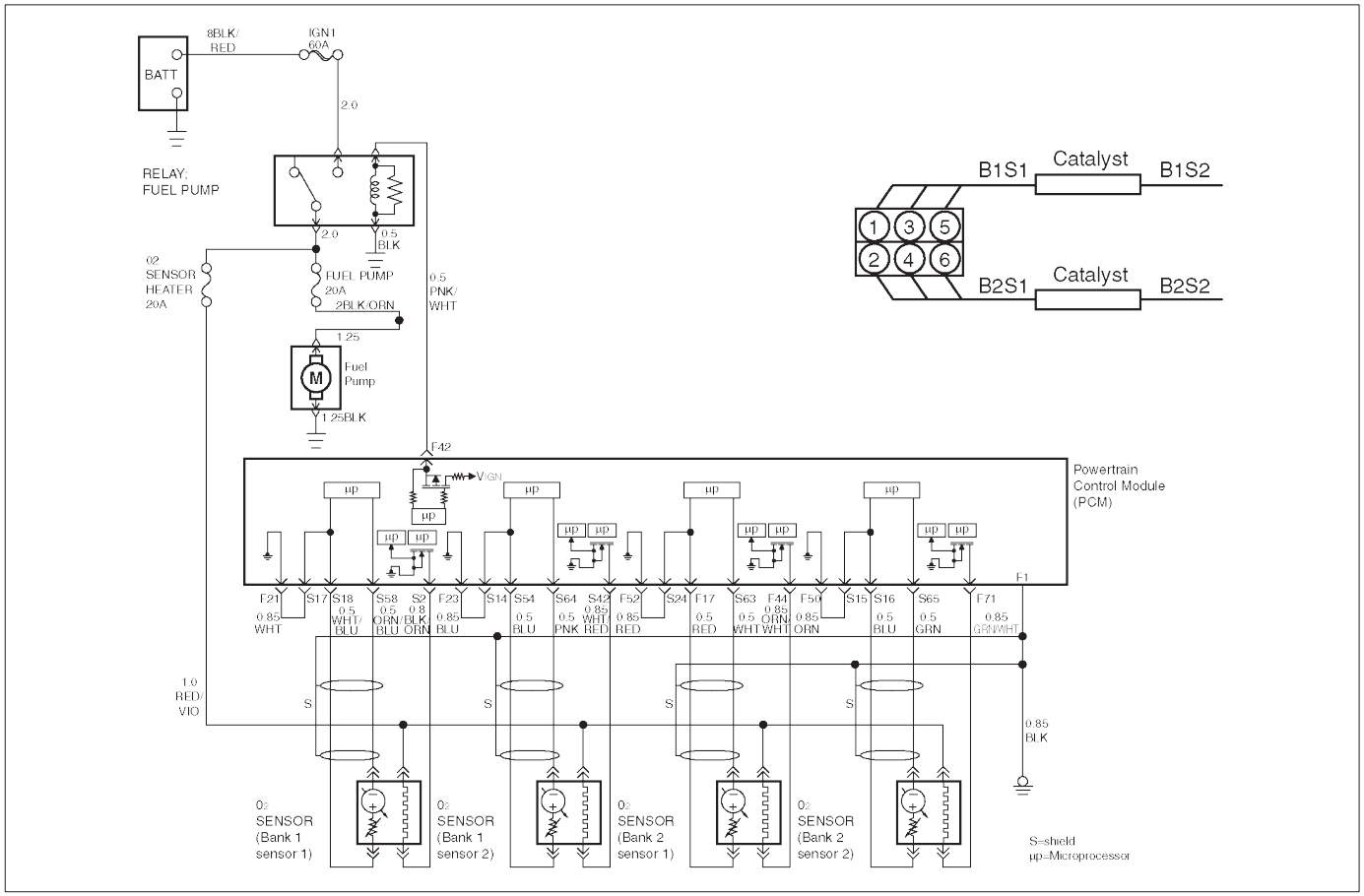
# DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support.<br>4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage.<br>Does the Bank 2 HO2S 2 voltage remain above the specified value? | 952 mV (500 mV in deceleration fuel cut-out mode) | Go to *Step 4* | Go to *Step 3* |
| 3 | 1. Ignition "ON".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor "DTC" info for DTC P0158 until the DTC P0158 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0158 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |

# DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 4 | 1. Ignition "OFF".<br>2. Disconnect Bank 2 HO2S 2.<br>3. Ignition "ON".<br>4. At the HO2S Bank 2 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals.<br>Are the voltages in the specified range? | 3-4 V | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair short to voltage in signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition "ON", engine "OFF".<br>2. At Bank 2 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage.<br>Is Bank 2 HO2S 2 voltage below the specified value? | 10 mV | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Disconnect the jumpers to ground from Bank 2 HO2S 2 PCM-side connector.<br>2. With the HO2S 2 connector disconnected, monitor Bank 2 HO2S 2 voltage.<br>Is Bank 2 HO2S 2 voltage between the specified values? | 425-475 mV | Refer to *Diagnostic Aids* | Go to *Step 8* |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2




060R200054

## Circuit Description

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 powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 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 Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0160 will be set.

Heated Oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

## Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- The engine has been running for over 5 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is in "closed loop" operation.
- Bank 2 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0160 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0160 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition “ON”, engine “OFF”, the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition “ON”, monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

## Test Description

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

3. If the DTC P0160 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

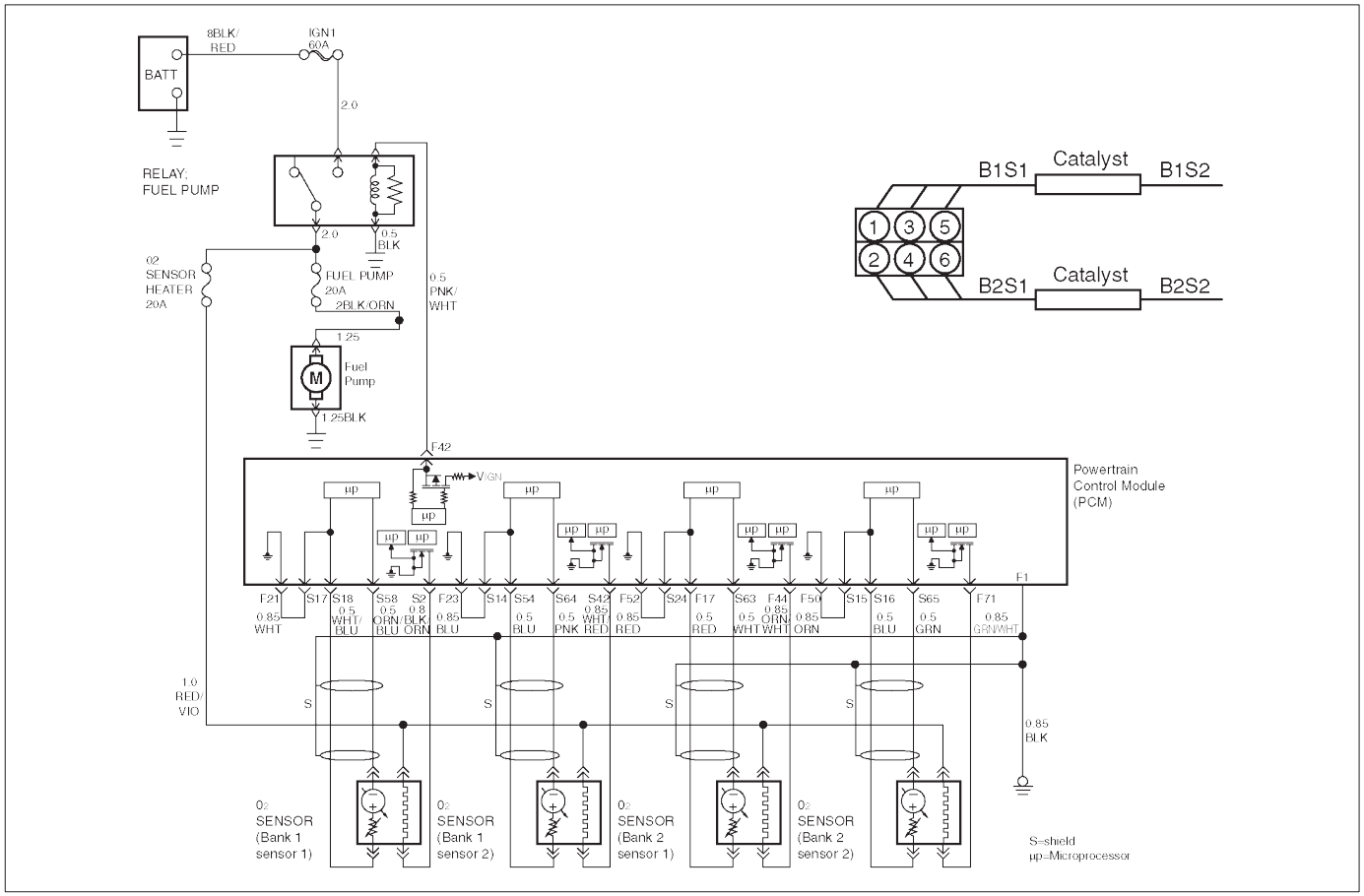
# DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2

| 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. Install the Tech 2.<br>2. Run the engine at operating temperature.<br>3. Operate the engine above 1200 RPM for two minutes.<br>Does the Tech 2 indicate Bank 2 HO2S 2 voltage varying outside the specified values? | 425-475 mV | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data and note parameters.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0160 until the DTC P0160 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0160 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Check for a damaged harness.<br>Was problem found? | — | Verify repair | Go to *Step 5* |
| 5 | Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the Bank 2 HO2S 2 harness connector and replace terminal(s) if necessary.<br>Did either terminal require replacement? | — | Verify repair | Go to *Step 6* |
| 6 | Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the PCM and replace terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 7* |

# DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 high circuit.<br>3. If the Bank 2 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connections as necessary.<br>Was a Bank 2 HO2S 2 high circuit problem found and corrected? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Ignition "OFF".<br>2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 low circuit.<br>3. If the Bank 2 HO2S 2 low circuit measures over 5 ohms, repair open or poor connections as necessary.<br>Was a Bank 2 HO2S 2 low circuit problem found and corrected? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Ignition "ON", engine "OFF".<br>2. Disconnect Bank 2 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground.<br>3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage.<br>Is Bank 2 HO2S 2 voltage in the specified range? | 0-10 mV | Go to *Step 10* | Go to *Step 11* |
| 10 | Replace Bank 2 HO2S 2.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0161 HO2S Heater Circuit Bank 2 Sensor 2




060R200054

## Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started, the PCM will monitor the HO2S voltage. When the Bank 2 HO2S 2 voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 2 to become active, a DTC P0161 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total air flow = shorter time to HO2S activity).

## Conditions for Setting the DTC

- No related DTCs.
- The engine has been running for over 120 seconds.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass air flow for the sample period is less than 23 g/second.
- Bank 2 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0161 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0161 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

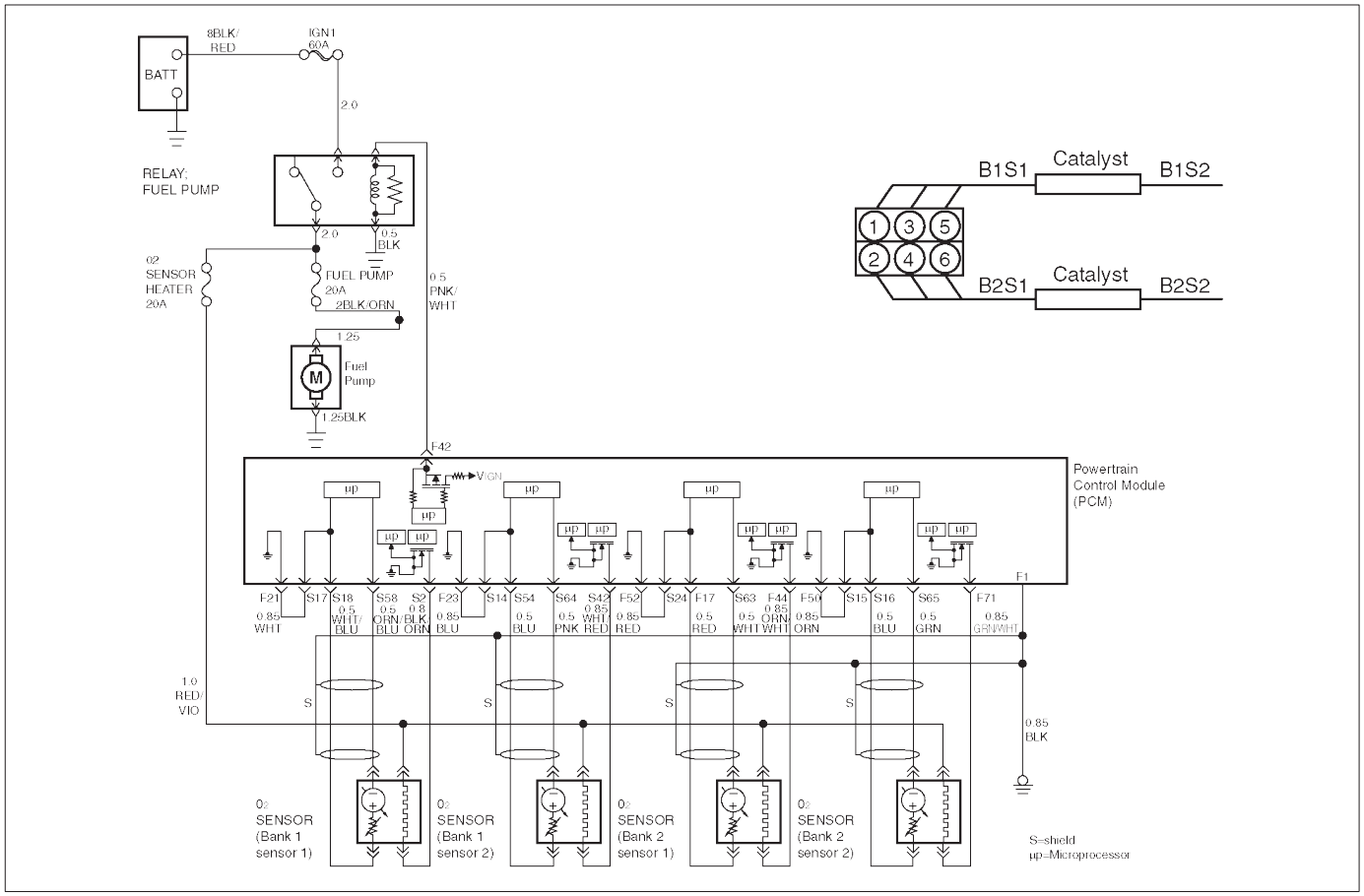
# DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2

| 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 | NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding.<br>1. Remove the fuel pump relay.<br>2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses.<br>3. Ignition “OFF”.<br>4. Install a Tech 2.<br>5. Ignition “ON”, engine “OFF”.<br>6. Monitor the Bank 2 HO2S 2 voltage for several minutes.<br>Did the HO2S voltage go from bias voltage to above or below the specified values? | Above 650 mV or Below 250 mV | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Inspect the fuse for the Bank 2 HO2S 2 ignition feed.<br>Is the fuse open? | — | Go to *Step 15* | Go to *Step 4* |
| 4 | 1. Ignition “OFF”.<br>2. Raise the vehicle.<br>3. Disconnect the Bank 2 HO2S 2 electrical connector.<br>4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 2 heater ground or Bank 2 HO2S 2 low), probe the ignition feed circuit at the Bank 2 HO2S 2 electrical connector (PCM harness side).<br>Does the test light illuminate? | — | Go to *Step 5* | Go to *Step 7* |
| 5 | Connect the test light between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground.<br>Does the test light illuminate? | — | Go to *Step 6* | Go to *Step 8* |

# DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Allow the HO2S to cool for at least 15 minutes.<br>2. Using a DVM, measure resistance between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground at the Bank 2 HO2S 2 pigtail.<br>Is the HO2S resistance within the specified values? | 3-6 ohms | Go to *Step 9* | Go to *Step 10* |
| 7 | Repair the open Bank 2 HO2S 2 ignition feed circuit to Bank 2 HO2S 2.<br>Is the action complete? | — | Verify repair | — |
| 8 | Repair the open Bank 2 HO2S 2 heater ground circuit.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Check for a poor connection at the Bank 2 HO2S 2 harness terminals.<br>2. If a poor connection is found, replace the terminals.<br>Was a poor connection found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit.<br>3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Ignition "OFF".<br>2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit.<br>3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | Check for a poor Bank 2 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 13* |
| 13 | Check for a poor Bank 2 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary.<br>Did the terminal require replacement? | — | Verify repair | Go to *Step 14* |
| 14 | Replace Bank 2 HO2S 2.<br>Is the action complete? | — | Verify repair | — |
| 15 | Locate and repair the short to ground in the Bank 2 HO2S 2 ignition feed circuit and replace the faulty fuse.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0171 Fuel Trim System Lean Bank 1




060R200054

## Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set DTC P0171.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12% (manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

## Conditions for Setting the DTC

- None of the following: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TP sensor DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.
- Canister purge duty cycle is greater than 0% if on.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0171 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

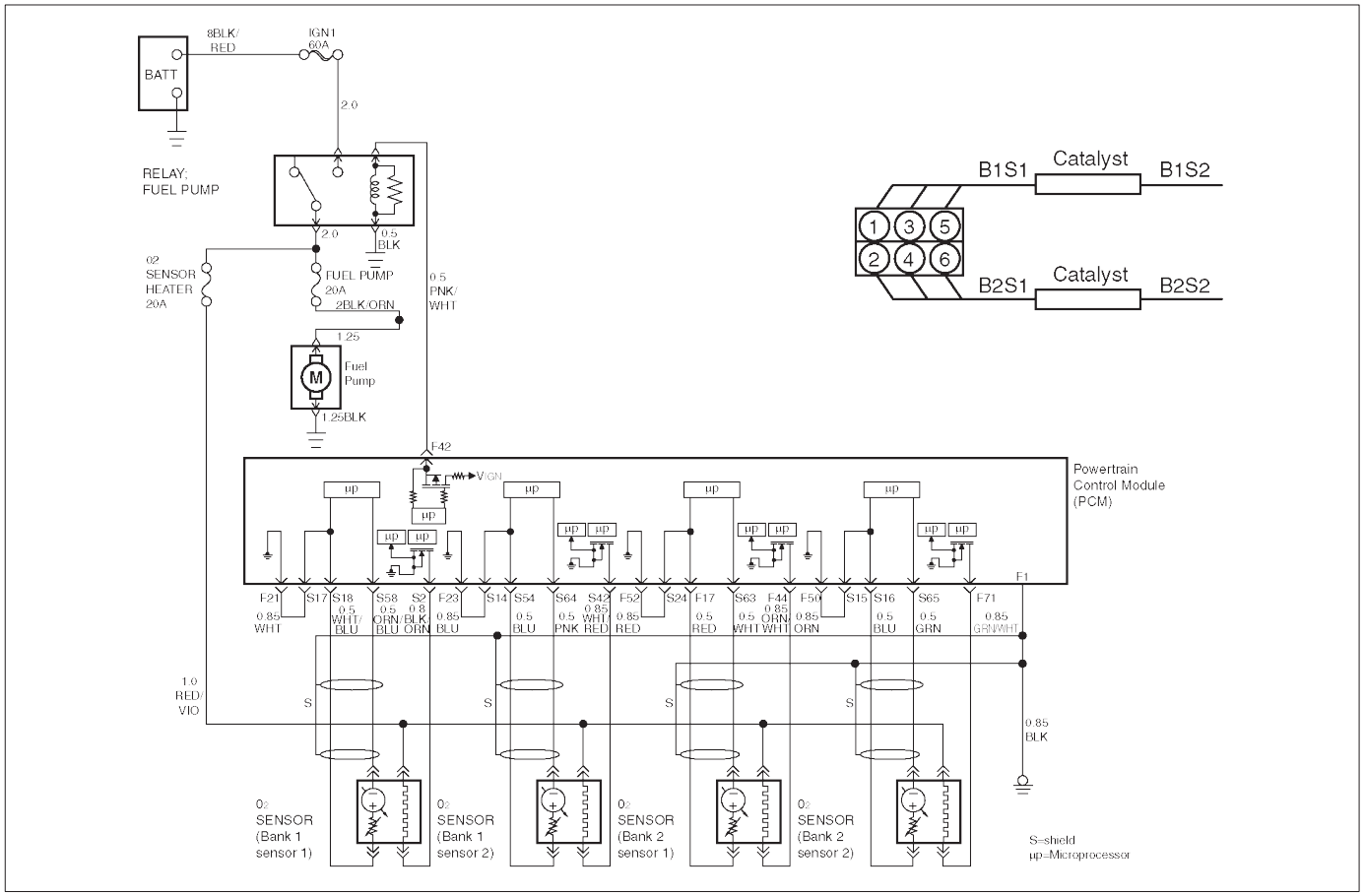
# DTC P0171 – Fuel Trim System Lean Bank 1

| 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 | Are any DTCs set other than P0171 and P0174? | — | Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart | Go to *Step 3* |
| 3 | 1. Start the engine and operate the vehicle in "closed loop".<br>2. Observe the "BANK 1 L.T. FUEL TRIM" display on the Tech 2.<br>Is the displayed value greater than the specified value? | L.T. Fuel Trim: +20% | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review and record the Tech 2 Failure Records data.<br>2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions.<br>3. Monitor the Tech 2 "DTC" info for DTC P0171 while operating the vehicle to duplicate the Failure Records conditions.<br>4. Continue operating the vehicle until the DTC P0171 test runs and note the test result.<br>Does the Tech 2 indicate DTC P0171 failed this ignition? | — | Go to *Step 5* | The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section. |
| 5 | Was DTC P0174 also set? | — | Go to *Step 6* | Go to *Step 15* |
| 6 | Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found.<br>Did your inspection reveal a problem requiring repair? | — | Verify repair | Go to *Step 7* |
| 7 | Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*).<br>Did your inspection reveal a problem requiring repair? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor.<br>2. Correct any problem that is found as necessary.<br>Did your inspection of the MAF sensor reveal a condition requiring repair? | — | Verify repair | Go to *Step 9* |
| 9 | Start the engine and note the idle quality.<br>Is a high or unsteady idle being experienced? | — | Go to *Step 10* | Go to *Step11* |
| 10 | 1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks.<br>2. Repair any vacuum leaks as necessary.<br>Did your inspection reveal a vacuum leak? | — | Verify repair | Go to *Step 11* |

# DTC P0171 – Fuel Trim System Lean Bank 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for the procedure) and correct the contaminated fuel condition if present (see *Engine Fuel*).<br>Was the fuel contaminated? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations.<br>2. If a faulty ground condition is present, correct it as necessary.<br>Did your inspection reveal a condition requiring repair? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Disconnect the MAF sensor electrical connector.<br>2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 S.T. FUEL TRIM" displayed on the Tech 2.<br>Does "BANK 1 S.T. FUEL TRIM" value decrease to near the specified value? | 0% | Go to *Step 19* | Go to *Step 14* |
| 14 | Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary.<br>Did Fuel System Pressure Test isolate a condition requiring repair? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks.<br>2. Repair any problem that is found.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 16* |
| 16 | Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 17* |
| 17 | Perform the "Injector Balance Test", and correct any problem found (refer to *Fuel Metering System*).<br>Did Injector Balance Test isolate a problem? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged.<br>2. If a problem is found, correct it as necessary.<br>Did your inspection reveal a problem? | — | Verify repair | Refer to *Diagnostic Aids* |
| 19 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0172 Fuel Trim System Rich Bank 1




060R200054

## Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 heated oxygen sensors (HO2S) 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set DTC P0172.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12 (manual transmission) and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

## Conditions for Setting the DTC

- None of the following was set: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TPS DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.
- Canister purge duty cycle is greater than 0%, if “ON”.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0172 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0172 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.

4. If the DTC P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

# DTC P0172 – Fuel Trim System Rich Bank 1

| 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 | Are any DTCs set other than P0172 and P0175? | — | Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart | Go to *Step 3* |
| 3 | 1. Start the engine and operate the vehicle in "closed loop".<br>2. Observe "B1 Long Term Fuel Trim" display on the Tech 2.<br>Is the displayed value more negative than the specified value? | L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.) | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review and record the Tech 2 Failure Records data.<br>2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions.<br>3. Monitor the Tech 2 "DTC" info for DTC P0172 while operating the vehicle to duplicate the Failure Records conditions.<br>4. Continue operating the vehicle until the DTC P0172 test runs and note test result.<br>Does the Tech 2 indicate DTC P0172 failed this ignition? | — | Go to *Step 5* | The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*. |
| 5 | Is DTC P0175 also set? | — | Go to *Step 6* | Go to *Step 15* |
| 6 | Visually and physically inspect the air filter element and replace it if necessary.<br>Did the air filter require replacement? | — | Verify repair | Go to *Step 7* |
| 7 | Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary.<br>Did your inspection reveal a condition requiring repair? | — | Verify repair | Go to *Step 8* |

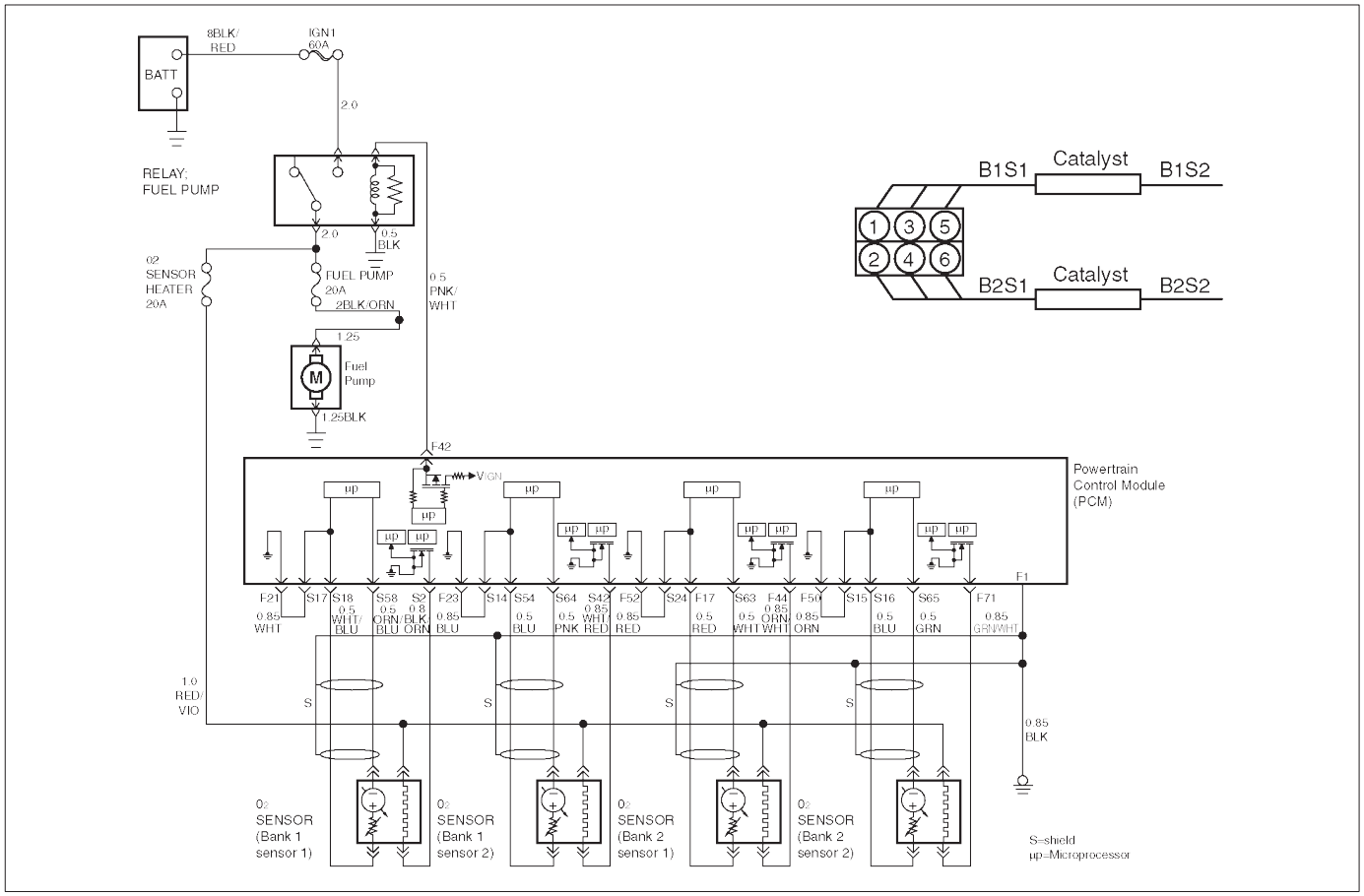
# DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found.<br>Did your inspection of the MAF sensor reveal a condition requiring repair or replacement? | — | Verify repair | Go to *Step 9* |
| 9 | Start the engine and note the idle quality.<br>Is a low or unsteady idle being experienced? | — | Go to *Step 10* | Go to *Step 11* |
| 10 | 1. Ignition "OFF".<br>2. Physically inspect the throttle body bore and throttle plate for coking and foreign objects.<br>3. If a problem was found, repair as necessary.<br>Did your inspection reveal a condition requiring repair? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel.<br>2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*).<br>Did the fuel pressure regulator require replacement? | — | Verify repair | Go to *Step 12* |
| 12 | Ignition "ON", engine "OFF", monitor the TP1 Angle display on the Tech 2 while slowly depressing the accelerator pedal.<br>Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle? | Minimum 8%<br>Maximum 92% | Go to *Step 13* | Go to *Step 21* |
| 13 | 1. Disconnect the MAF sensor electrical connector.<br>2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S. T. FUEL TRIM" display on the Tech 2.<br>Did both values change to near the specified value? | 0% | Go to *Step 22* | Go to *Step 14* |
| 14 | 1. Perform "Fuel System Pressure Test".<br>2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*).<br>Did the Fuel System Pressure Test isolate a problem requiring repair? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Ignition "ON", engine "OFF".<br>2. Connect a test light between the harness connector terminals of canister purge solenoid.<br>Is the test light on? | — | Go to *Step 16* | Go to *Step 19* |
| 16 | Check for short to ground in the wire (YEL/RED) between the canister purge solenoid and PCM terminal S-48.<br>Was there a short to ground? | — | Go to *Step 17* | Go to *Step 18* |
| 17 | Repair the short to ground.<br>Is the action complete? | — | Verify repair | — |

# DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 18 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 19 | 1. Perform the "Injector Balance Test".<br>2. If Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*).<br>Did the Injector Balance Test isolate a problem requiring repair? | — | Verify repair | Go to *Step 20* |
| 20 | 1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream.<br>2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors.<br>Did the sensor require replacement? | — | Verify repair | Refer to *Diagnostic Aids* |
| 21 | 1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing.<br>2. If the screws are OK, replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0174 Fuel Trim System Lean Bank 2




060R200054

## Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 2, the PCM will set DTC P0174.

The PCM’s maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

## Conditions for Setting the DTC

- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TP sensor, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 6°C (42.8°F) and 105°C (221°F).
- Intake air temperature is between –40°C (–40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.
- Canister purge duty cycle is greater than 0%, if “ON”.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0174 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0174 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0174 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

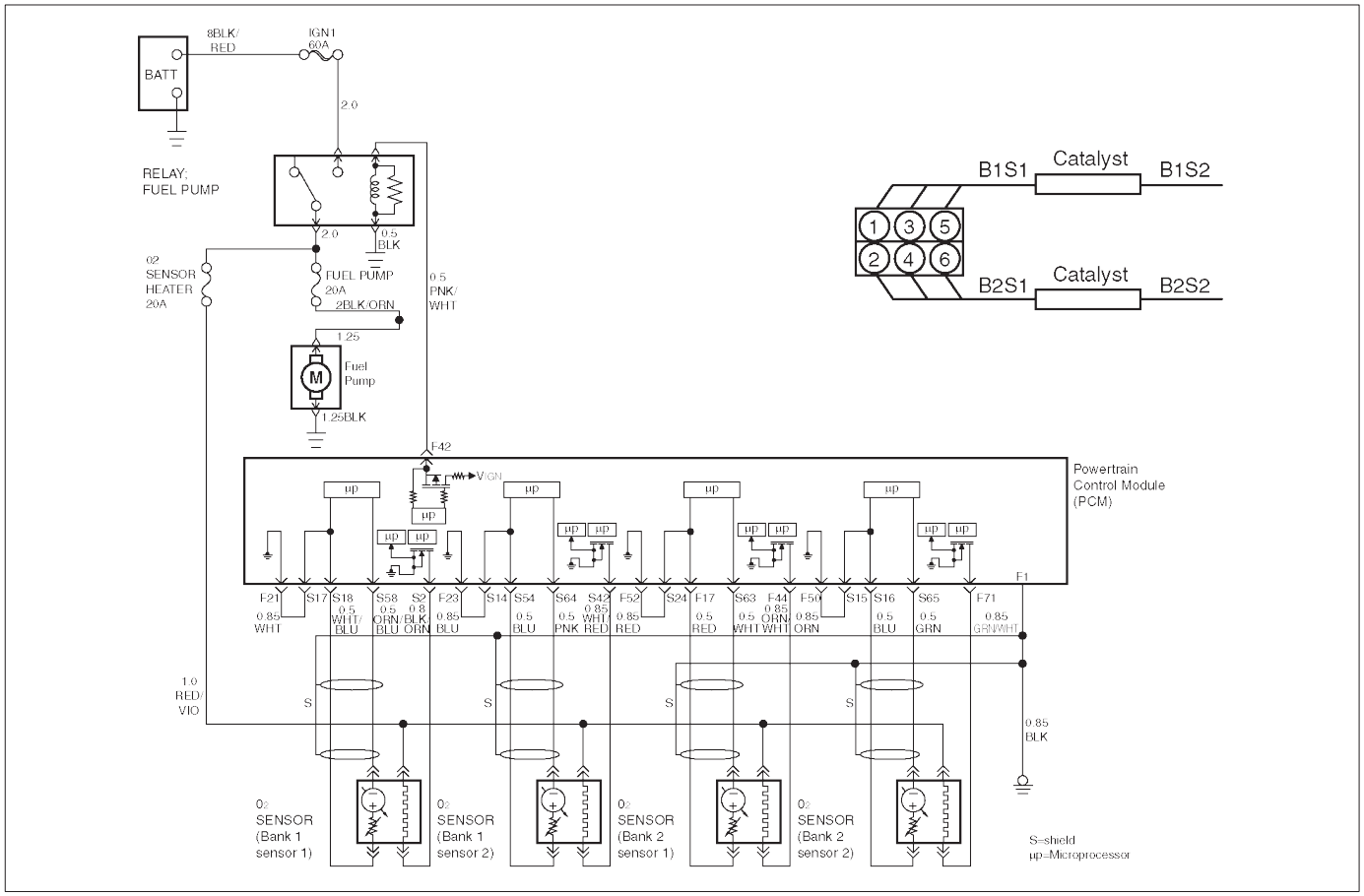
# DTC P0174 – Fuel Trim System Lean Bank 2

| 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 | Are any DTCs set other than P0174 and P0171? | — | Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart. | Go to *Step 3* |
| 3 | 1. Start the engine and operate the vehicle in "closed loop".<br>2. Observe the "BANK 2 L.T. FUEL TRIM" display on the Tech 2.<br>Is the displayed values greater than the specified values? | L.T. Fuel Trim: +20% | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review and record Tech 2 Failure Records data.<br>2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions.<br>3. Monitor the Tech 2 "DTC" info for DTC P0174 while operating the vehicle to duplicate the Failure Records conditions.<br>4. Continue operating the vehicle until the DTC P0174 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0174 failed this ignition? | — | Go to *Step 5* | The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section. |
| 5 | Was DTC P0171 also set? | — | Go to *Step 6* | Go to *Step 15* |
| 6 | Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found.<br>Did your inspection reveal a problem requiring repair? | — | Verify repair | Go to *Step 7* |
| 7 | Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*).<br>Did your inspection reveal a problem requiring repair? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor.<br>2. Correct any problem that is found as necessary.<br>Did your inspection of the MAF sensor reveal a condition requiring repair? | — | Verify repair | Go to *Step 9* |
| 9 | Start the engine and note the idle quality.<br>Is a high or unsteady idle being experienced? | — | Go to *Step 10* | Go to *Step 11* |

# DTC P0174 – Fuel Trim System Lean Bank 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks.<br>2. Repair any vacuum leaks as necessary.<br>Did your inspection reveal a vacuum leak? | — | Verify repair | Go to *Step 11* |
| 11 | Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for procedure) and correct the contaminated fuel condition is present (see *Engine Fuel*).<br>Was the fuel contaminated? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations.<br>2. If a faulty ground condition is present, correct it as necessary.<br>Did your inspection reveal a condition requiring repair? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Disconnect the MAF sensor electrical connector.<br>2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 S.T. FUEL TRIM" displayed on the Tech 2.<br>Does the "BANK 2 S.T. FUEL TRIM" value decrease to near the specified value? | 0% | Go to *Step 19* | Go to *Step 14* |
| 14 | Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary.<br>Did the Fuel System Pressure Test isolate a condition requiring repair? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks.<br>2. Repair any problem that is found.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 16* |
| 16 | Visually and physically inspect the Bank 2 exhaust manifold for leaks and loose or missing hardware and correct any problem found.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 17* |
| 17 | Perform the "Injector Balance Test" and correct any problem found (refer to *Fuel Metering System*).<br>Did the Injector Balance Test isolate a problem? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Visually and physically inspect the Bank 2 HO2S 1 to ensure that it is installed securely and that the Bank 2 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged.<br>2. If a problem is found, correct it as necessary.<br>Did your inspection reveal a problem? | — | Verify repair | Refer to *Diagnostic Aids* |
| 19 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0175 Fuel Trim System Rich Bank 2




060R200054

## Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop”, the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 2, the PCM will set DTC P0175.

The PCM’s maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

## Conditions for Setting the DTC

- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TPS, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 6˚C (42.8˚F) and 105˚C (221˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop”.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0175 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0175 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records Vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.

4. If the DTC P0175 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

# DTC P0175 – Fuel Trim System Rich Bank 2

| 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 | Are any DTCs set other than P0172 and P0175? | — | Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart. | Go to *Step 3* |
| 3 | 1. Start the engine and operate the vehicle in “closed loop”.<br>2. Observe the “BANK 2 L.T. FUEL TRIM” display on the Tech 2.<br>Is the displayed value more negative than the specified value? | L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.) | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review and record the Tech 2 Failure Records data.<br>2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions.<br>3. Monitor the Tech 2 “DTC” info for DTC P0175 while operating the vehicle to duplicate the Failure Records conditions.<br>4. Continue operating the vehicle until the DTC P0175 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0175 failed this ignition? | — | Go to *Step 5* | The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*. |
| 5 | Was DTC P0172 also set? | — | Go to *Step 6* | Go to *Step 15* |
| 6 | Visually and physically inspect the air filter element and replace it if necessary.<br>Did the air filter require replacement? | — | Verify repair | Go to *Step 7* |

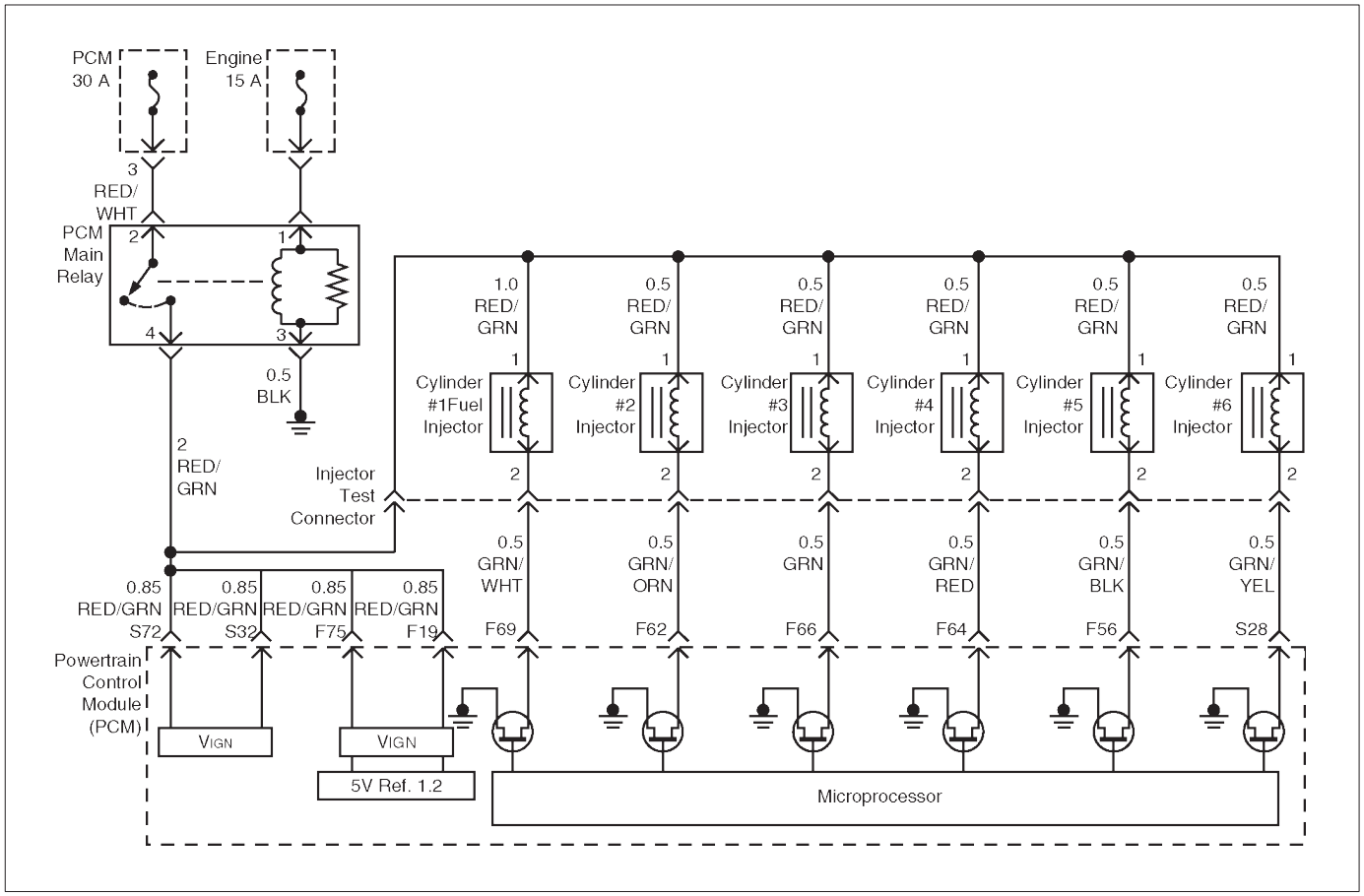
# DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary.<br>Did your inspection reveal a problem requiring repair? | — | Verify repair | Go to *Step 8* |
| 8 | Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found.<br>Did your inspection of the MAF sensor reveal a condition requiring repair or replacement? | — | Verify repair | Go to *Step 9* |
| 9 | Start the engine and note the idle quality.<br>Is a low or unsteady idle being experienced? | — | Go to *Step 10* | Go to *Step 11* |
| 10 | 1. Turn the ignition off and physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects.<br>2. If a problem was found, repair as necessary.<br>Did your inspection reveal a condition requiring repair? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel.<br>2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*).<br>Did the fuel pressure regulator require replacement? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Ignition "ON", engine "OFF".<br>2. Monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal.<br>Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle? | Minimum 8%<br>Maximum 92% | Go to *Step 13* | Go to *Step 21* |
| 13 | 1. Disconnect the MAF sensor electrical connector.<br>2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 L.T. FUEL TRIM" and "BANK 2 S.T. FUEL TRIM" display on the Tech 2.<br>Did both values change to near the specified value? | 0% | Go to *Step 22* | Go to *Step 14* |
| 14 | 1. Perform the "Fuel System Pressure Test".<br>2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*).<br>Did the Fuel System Pressure Test isolate a condition requiring repair? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Ignition "ON", engine "OFF".<br>2. Connect a test light between the harness connector terminals of canister purge solenoid.<br>Is the test light on? | — | Go to *Step 16* | Go to *Step 19* |
| 16 | Check for short to ground in the wire (YEL/RED) between the canister purge solenoid and PCM terminal S-48.<br>Was there a short to ground? | — | Go to *Step 17* | Go to *Step 18* |

# DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 17 | Repair the short to ground.<br>Is the action complete? | — | Verify repair | — |
| 18 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 19 | 1. Perform the "Injector Balance Test".<br>2. If the Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*).<br>Did the Injector Balance Test isolate a problem requiring repair? | — | Verify repair | Go to *Step 20* |
| 20 | 1. Remove and visually/physically inspect the Bank 2 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream.<br>2. If contamination is evident on the Bank 2 HO2S 1, replace the contaminated sensor.<br>Did the sensor require replacement? | — | Verify repair | Refer to *Diagnostic Aids* |
| 21 | 1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing.<br>2. If the screws are OK, replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0201 Injector 1 Control Circuit




060R200023

## Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

## Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0201 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0201 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

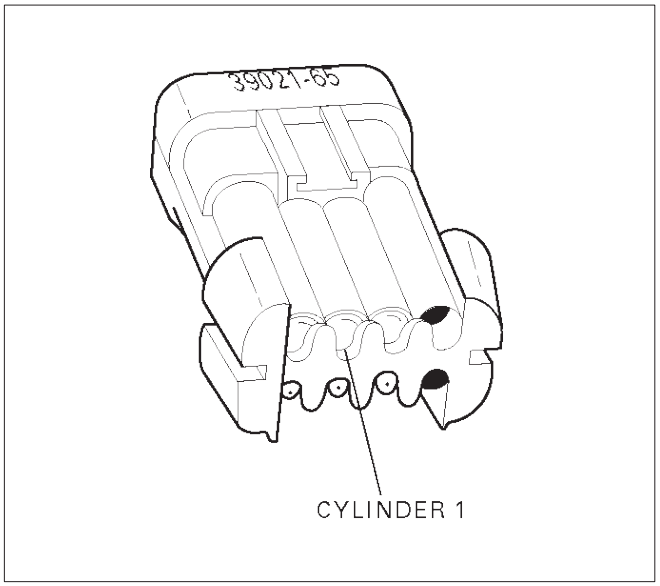
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 1 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.




R321054

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

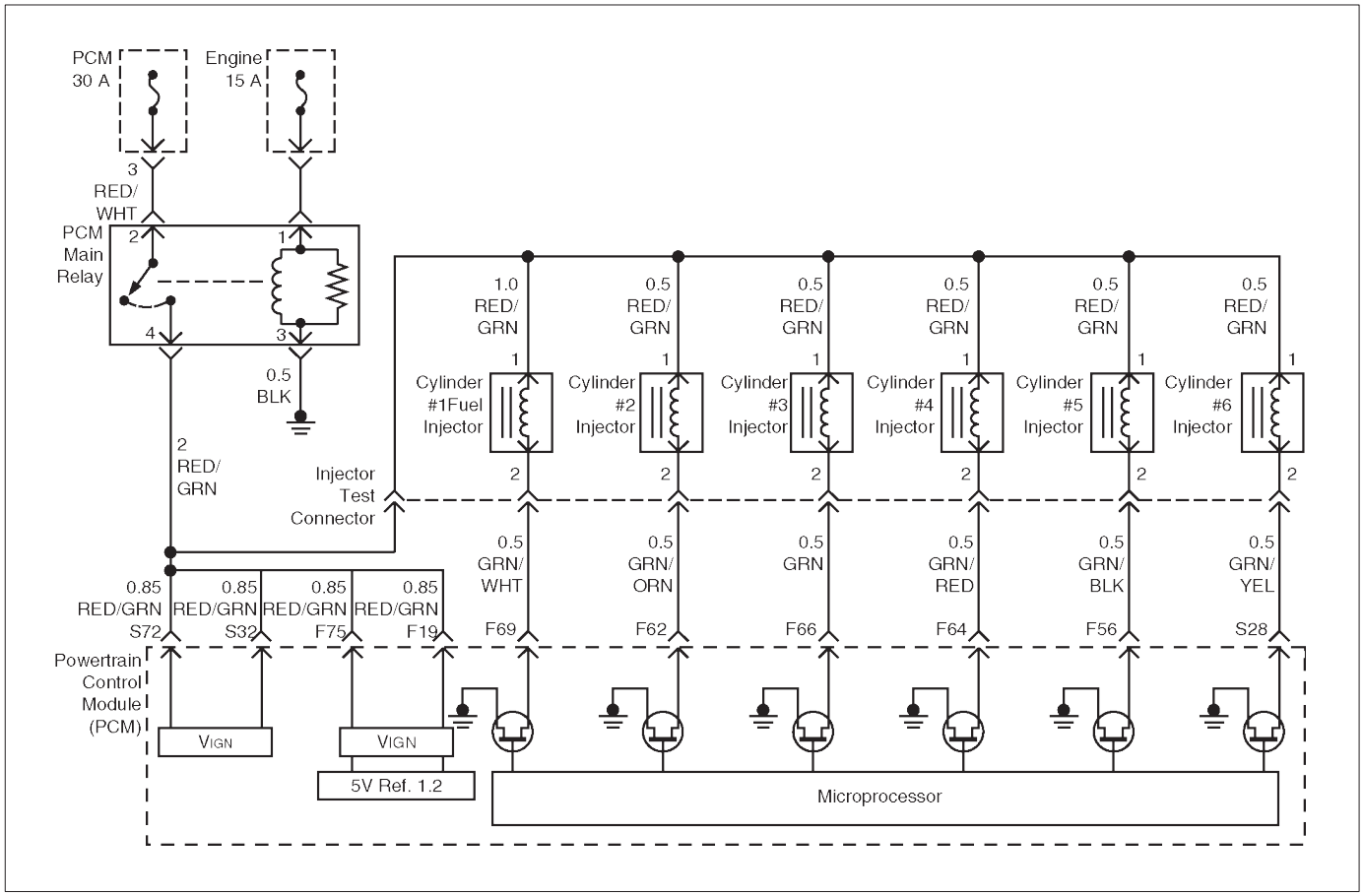
## DTC P0201 – Injector 1 Control Circuit

| 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 | Will the engine start? | — | Go to *Step 3* | Go to *Engine Cranks But Will Not Run* chart |
| 3 | 1. Install the Tech 2. Clear the DTC.<br>2. Idle the engine for one minute.<br>Does DTC P0201 reset? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters.<br>2. Operate the vehicle within the Freeze Frame conditions as noted.<br>Does P0201 reset? | — | Go to *Step 5* | Go to *Diagnostic Aids* |
| 5 | 1. Engine "OFF".<br>2. Disconnect the injector connector.<br>3. Install an injector test light J-39021-65 on the injector test connector.<br>4. Crank the engine and note the light.<br>Does the injector test light blink? | — | Go to *Fuel Injector Coil Test Procedure* | Go to *Step 6* |

# DTC P0201 – Injector 1 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Note whether the injector test light for cylinder 1 was "OFF" or "ON" steady in step 5.<br>Was the test light "ON" steady while cranking the engine? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Disconnect the PCM connector for the affected injectors.<br>2. With a test light connected to B+, probe the affected injector driver circuit.<br>Does the test light illuminate? | — | Go to *Step 8* | Go to *Step 15* |
| 8 | Repair short to ground in the injector driver circuit.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 9 | 1. Disconnect the injector test connector.<br>2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 1 (green with white tracer).<br>Does the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Repair the open injector harness wire or open injector.<br>Is the action complete? | — | Verify repair | — |
| 11 | At the PCM side of the injector test connector, check the green/white wire for a short to voltage.<br>Was there a short to voltage? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check for an open circuit between the injector test connector and the PCM.<br>Was there an open circuit? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the open circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0202 Injector 2 Control Circuit




060R200023

## Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

## Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0202 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0202 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

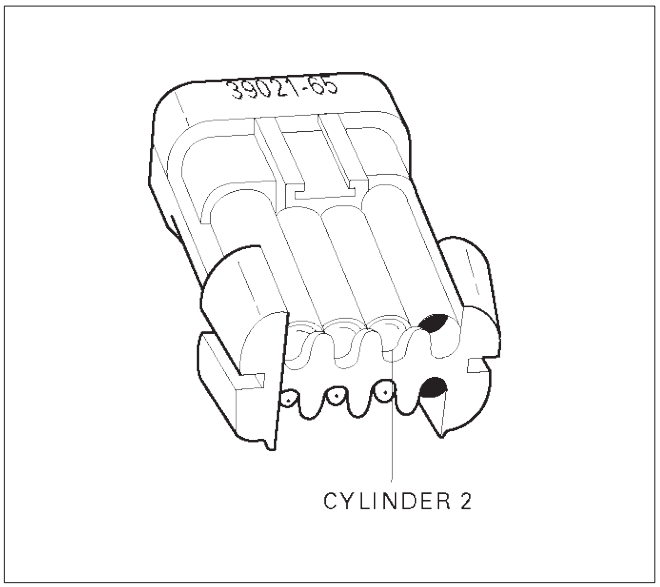
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 2 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.




R321055

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

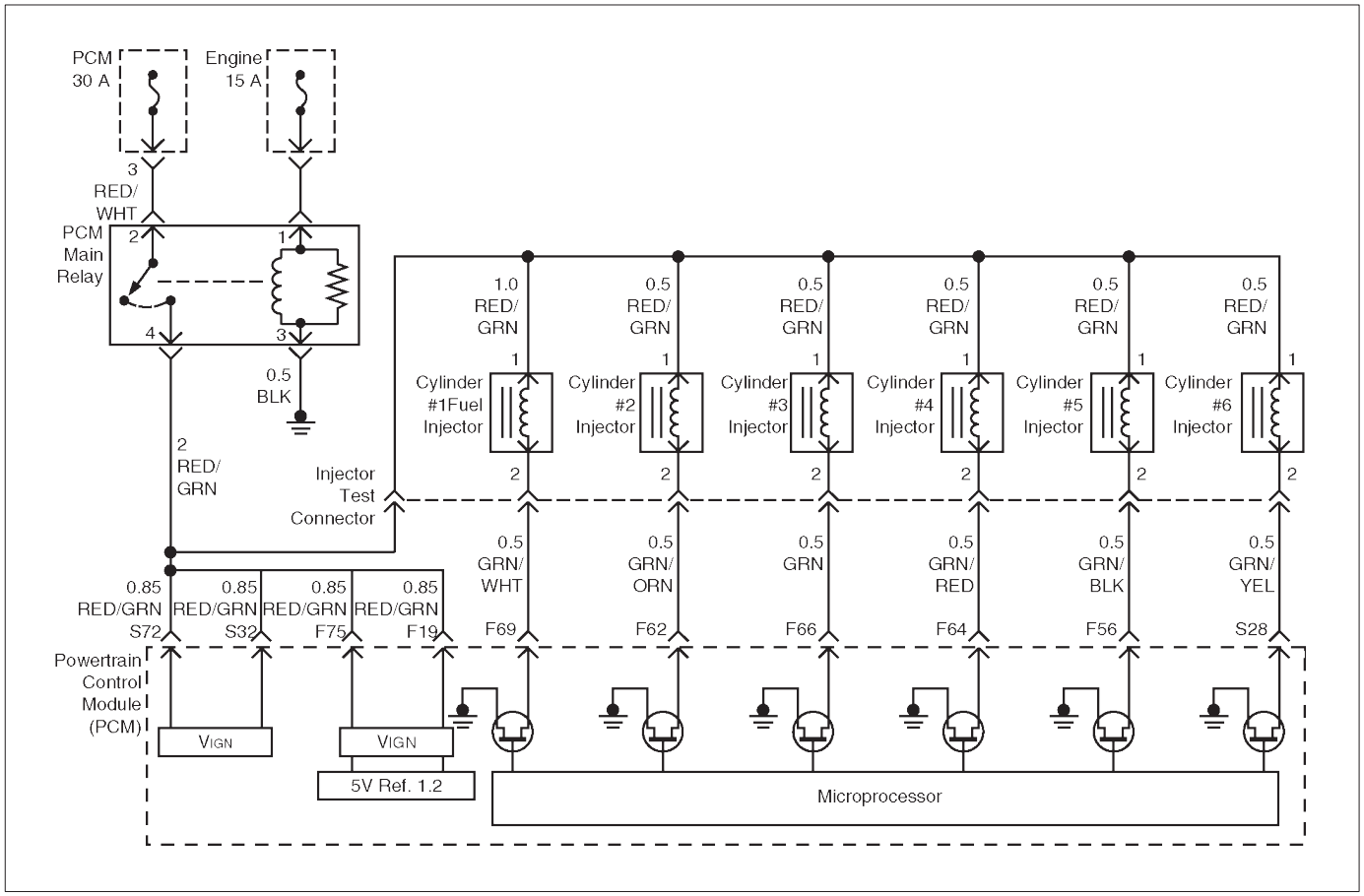
## DTC P0202 – Injector 2 Control Circuit

| 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 | Will the engine start? | — | Go to *Step 3* | Go to *Engine Cranks But Will Not Run* chart |
| 3 | 1. Install the Tech 2. Clear the DTC.<br>2. Idle the engine for one minute.<br>Does DTC P0202 reset? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters.<br>2. Operate the vehicle within the Freeze Frame conditions as noted.<br>Does P0202 reset? | — | Go to *Step 5* | Go to *Diagnostic Aids* |
| 5 | 1. Engine “OFF”.<br>2. Disconnect the injector test connector.<br>3. Install an injector test light J-39021-65 on injector connector.<br>4. Crank the engine and note the light.<br>Does the cylinder 2 test light blink? | — | Go to *Fuel Injector Coil Test Procedure* | Go to *Step 6* |

# DTC P0202 – Injector 2 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Note whether the injector test light for cylinder 2 was "OFF" or "ON" steady in step 5.<br>Was the test light "ON" steady while cranking the engine? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Disconnect the PCM connector for the affected injectors.<br>2. With a test light connected to B+, probe the affected injector driver circuit.<br>Does the test light illuminate? | — | Go to *Step 8* | Go to *Step 15* |
| 8 | Repair short to ground in the injector driver circuit.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 9 | 1. Disconnect the injector test connector.<br>2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 2 (green with orange tracer).<br>Does the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Repair the open injector harness wire or open injector.<br>Is the action complete? | — | Verify repair | — |
| 11 | At the PCM side of the injector test connector, check the green/orange wire for a short to voltage.<br>Was there a short to voltage? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check for an open circuit between the injector test connector and the PCM.<br>Was there an open circuit? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the open circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0203 Injector 3 Control Circuit




060R200023

## Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

## Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0203 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0203 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

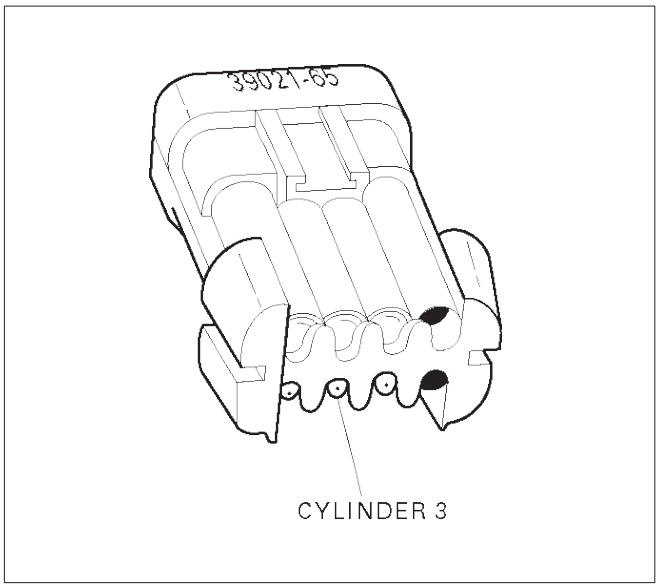
## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 3 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.




R321056

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

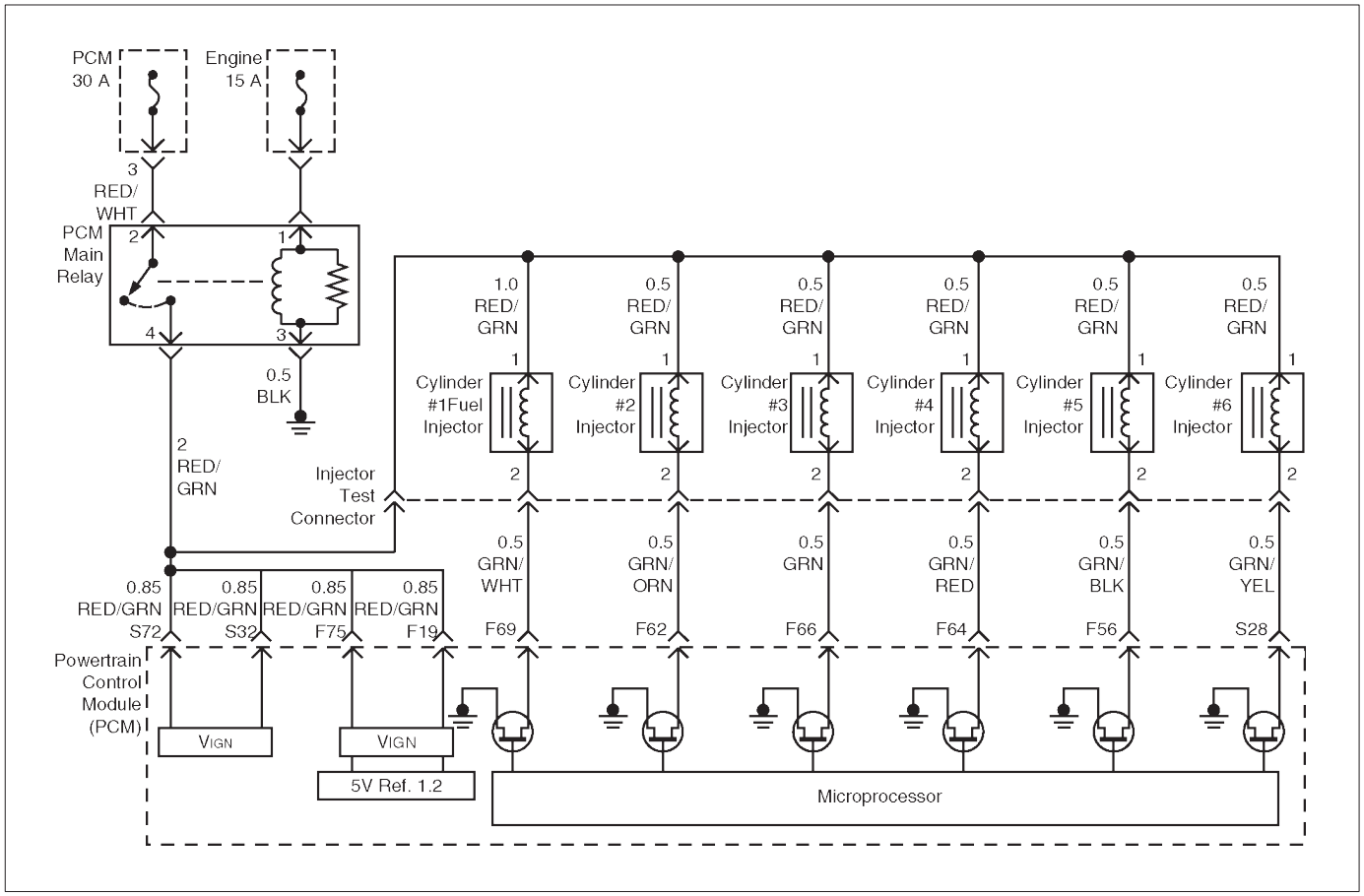
## DTC P0203 – Injector 3 Control Circuit

| 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 | Will the engine start? | — | Go to *Step 3* | Go to *Engine Cranks But Will Not Run* chart |
| 3 | 1. Install the Tech 2. Clear the DTC.<br>2. Idle the engine for one minute.<br>Does DTC P0203 reset? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters.<br>2. Operate the vehicle within the Freeze Frame conditions as noted.<br>Does P0203 reset? | — | Go to *Step 5* | Go to *Diagnostic Aids* |
| 5 | 1. Engine “OFF”.<br>2. Disconnect the injector test connector .<br>3. Install an injector test light J-39021-65 on injector connector.<br>4. Crank the engine and note the light.<br>Does the cylinder 3 test light blink? | — | Go to *Fuel Injector Coil Test Procedure* | Go to *Step 6* |

# DTC P0203 – Injector 3 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Note whether the injector test light for cylinder 3 was "OFF" or "ON" steady in step 5.<br>Was the test light "ON" steady while cranking the engine? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Disconnect the PCM connector for the affected injectors.<br>2. With a test light connected to B+, probe the affected injector driver circuit.<br>Does the test light illuminate? | — | Go to *Step 8* | Go to *Step 15* |
| 8 | Repair short to ground in the injector driver circuit.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 9 | 1. Disconnect the injector test connector.<br>2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 3 (green).<br>Does the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Repair the open injector harness wire or open injector.<br>Is the action complete? | — | Verify repair | — |
| 11 | At the PCM side of the injector test connector, check the green wire for a short to voltage.<br>Was there a short to voltage? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check for an open circuit between the injector test connector and the PCM.<br>Was there an open circuit? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the open circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0204 Injector 4 Control Circuit




060R200023

## Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

## Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0204 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0204 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

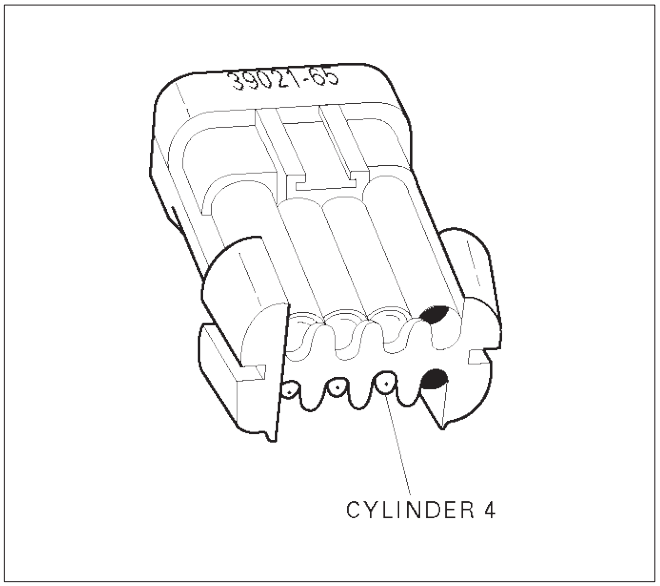
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 4 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.




R321057

7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

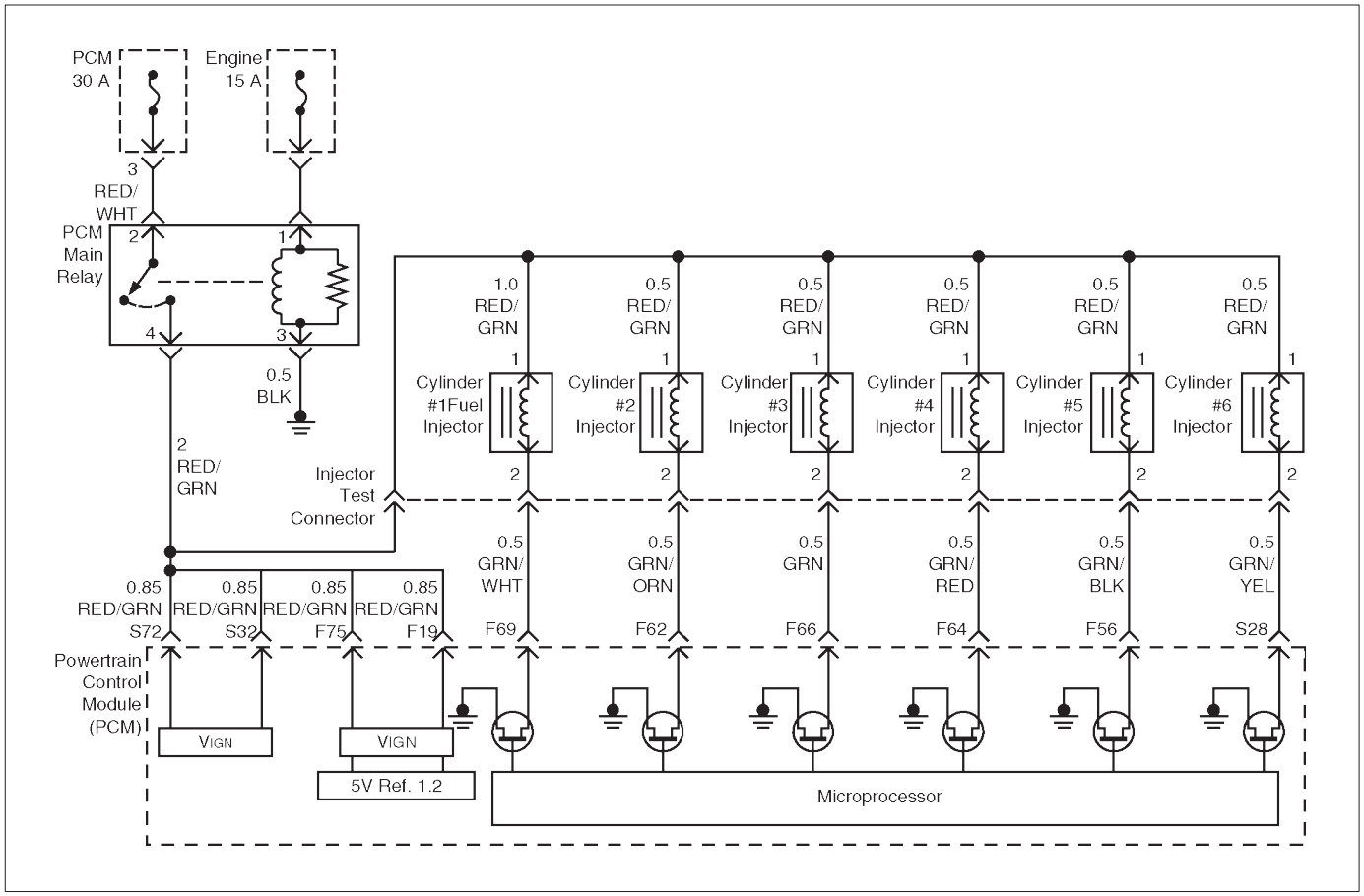
## DTC P0204 – Injector 4 Control Circuit

| 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 | Will the engine start? | — | Go to *Step 3* | Go to *Engine Cranks But Will Not Run* chart |
| 3 | 1. Install the Tech 2. Clear the DTC.<br>2. Idle the engine for one minute.<br>Does DTC P0204 reset? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters.<br>2. Operate the vehicle within the Freeze Frame conditions as noted.<br>Does P0204 reset? | — | Go to *Step 5* | Go to *Diagnostic Aids* |
| 5 | 1. Engine "OFF".<br>2. Disconnect the injector test connector.<br>3. Install an injector test light J-39021-65 on injector connector.<br>4. Crank the engine and note the light.<br>Does the cylinder 4 test light blink? | — | Go to *Fuel Injector Coil Test Procedure* | Go to Step 6 |

# DTC P0204 – Injector 4 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Note whether the injector test light for cylinder 4 was "OFF" or "ON" steady in step 5.<br>Was the test light "ON" steady while cranking the engine? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Disconnect the PCM connector for the affected injectors.<br>2. With a test light connected to B+, probe the affected injector driver circuit.<br>Does the test light illuminate? | — | Go to *Step 8* | Go to *Step 15* |
| 8 | Repair short to ground in the injector driver circuit.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 9 | 1. Disconnect the injector test connector.<br>2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 4 (green/red).<br>Does the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Repair the open injector harness wire or open injector.<br>Is the action complete? | — | Verify repair | — |
| 11 | At the PCM side of the injector test connector, check the green/red wire for a short to voltage.<br>Was there a short to voltage? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check for an open circuit between the injector test connector and the PCM.<br>Was there an open circuit? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the open circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0205 Injector 5 Control Circuit




060R200023

## Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

## Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0205 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0205 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0205 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

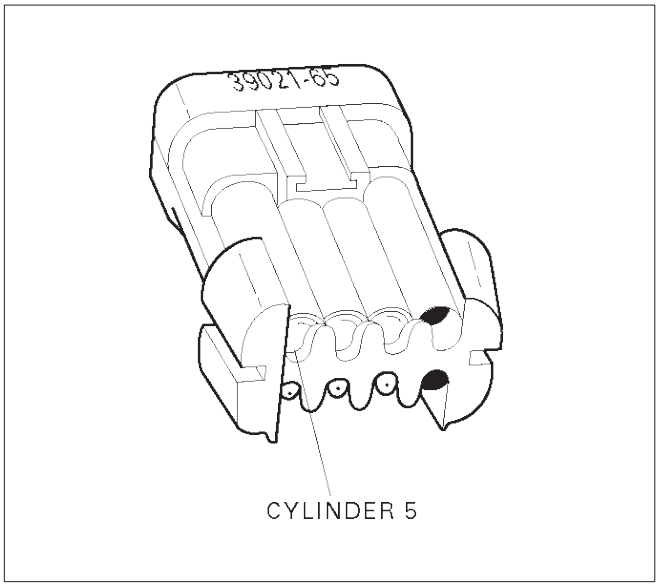
## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0205 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 5 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.




R321058

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

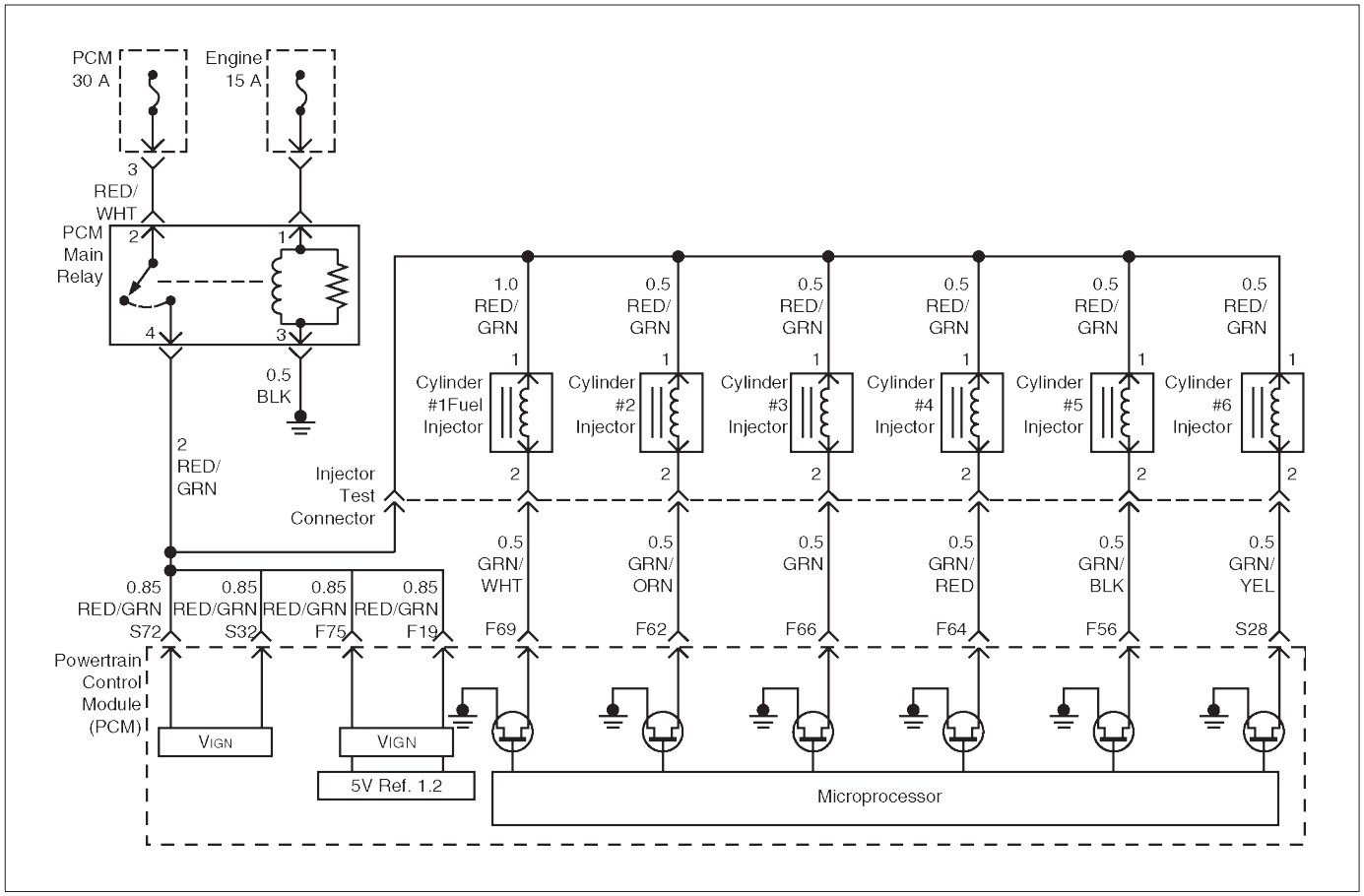
## DTC P0205 – Injector 5 Control Circuit

| 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 | Will the engine start? | — | Go to *Step 3* | Go to *Engine Cranks But Will Not Run* chart |
| 3 | 1. Install the Tech 2. Clear the DTC.<br>2. Idle the engine for one minute.<br>Does DTC P0205 reset? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters.<br>2. Operate the vehicle within the Freeze Frame conditions as noted.<br>Does P0205 reset? | — | Go to *Step 5* | Go to *Diagnostic Aids* |
| 5 | 1. Engine “OFF”.<br>2. Disconnect the injector test connector.<br>3. Install an injector test light J-39021-65 on injector connector.<br>4. Crank the engine and note the light.<br>Does the cylinder 5 test light blink? | — | Go to *Fuel Injector Coil Test Procedure* | Go to *Step 6* |

# DTC P0205 – Injector 5 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Note whether the injector test light for cylinder 5 was "OFF" or "ON" steady in step 5.<br>Was the test light "ON" steady while cranking the engine? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Disconnect the PCM connector for the affected injectors.<br>2. With a test light connected to B+, probe the affected injector driver circuit.<br>Does the test light illuminate? | — | Go to *Step 8* | Go to *Step 15* |
| 8 | Repair short to ground in the injector driver circuit.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 9 | 1. Disconnect the injector test connector.<br>2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 5 (green with black tracer).<br>Does the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Repair the open injector harness wire or open injector.<br>Is the action complete? | — | Verify repair | — |
| 11 | At the PCM side of the injector test connector, check the green/black wire for a short to voltage.<br>Was there a short to voltage? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check for an open circuit between the injector test connector and the PCM.<br>Was there an open circuit? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the open circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0206 Injector 6 Control Circuit




060R200023

## Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

## Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine speed is more than 700 rpm.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON”.
- The above conditions are met for 5 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0206 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0206 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0206 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

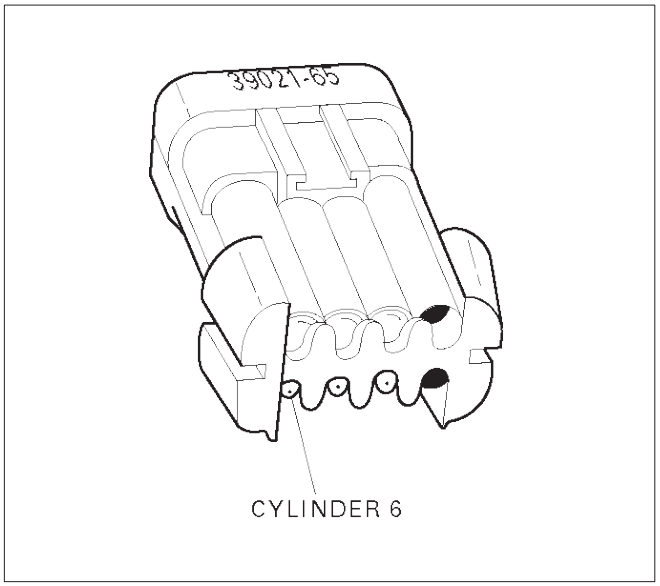
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

## Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0206 is the result of a hard failure or an intermittent condition.
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 6 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.




R321059

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

## DTC P0206 – Injector 6 Control Circuit

| 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 | Will the engine start? | — | Go to *Step 3* | Go to *Engine Cranks But Will Not Run* chart |
| 3 | 1. Install the Tech 2. Clear the DTC.<br>2. Idle the engine for one minute.<br>Does DTC P0206 reset? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters.<br>2. Operate the vehicle within the Freeze Frame conditions as noted.<br>Does P0206 reset? | — | Go to *Step 5* | Go to *Diagnostic Aids* |
| 5 | 1. Engine “OFF”.<br>2. Disconnect the injector test connector.<br>3. Install an injector test light J-39021-65 on injector connector.<br>4. Crank the engine and note the light.<br>Does the cylinder 6 test light blink? | — | Go to *Fuel Injector Coil Test Procedure* | Go to *Step 6* |

# DTC P0206 – Injector 6 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Note whether the injector test light for cylinder 6 was "OFF" or "ON" steady in step 5.<br>Was the test light "ON" steady while cranking the engine? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Disconnect the PCM connector for the affected injectors.<br>2. With a test light connected to B+, probe the affected injector driver circuit.<br>Does the test light illuminate? | — | Go to *Step 8* | Go to *Step 15* |
| 8 | Repair short to ground in the injector driver circuit.<br>Is the action complete? | — | Go to *OBD System Check* | — |
| 9 | 1. Disconnect the injector test connector.<br>2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 6 (green with yellow tracer).<br>Does the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 10* |
| 10 | Repair the open injector harness wire or open injector<br>Is the action complete? | — | Verify repair | — |
| 11 | At the PCM side of the injector test connector, check the green/yellow wire for a short to voltage.<br>Was there a short to voltage? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 13 | Check for an open circuit between the injector test connector and the PCM.<br>Was there an open circuit? | — | Go to *Step 14* | Go to *Step 15* |
| 14 | Repair the open circuit.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to the latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0300 Engine Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ION Sensing Module. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0300 will determine if a multiple cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, VSS, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine temperature sensor (ECT) indicates an engine temperature between –7°C (20°F) and 110°C (230°F).
- Throttle angle is steady and throttle changes less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will disable the TCC operation.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0300 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0300 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

The Tech 2 display “Misfire Cur. #1 through #6” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- MAF – A mass air flow (MAF) sensor output that causes the PCM to sense a lower than normal air flow will cause a lean condition.
- Air induction system – Air leaks into the induction system which bypass the MAF sensor will cause a lean condition. Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O-rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.
- Fuel quality – Using fuel with the wrong octane rating for the vehicle may cause driveability problems. 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 cold driveability of the engine. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall when changes by the refineries may not coincide with changes in the weather.
- Vehicle marshalling – 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 with a P0300 Misfire DTC.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

# DTC P0300 – Engine Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record the Tech 2 Freeze Frame data.<br>3. Operate the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data).<br>4. Monitor the Tech 2 "Misfire Cur. #" display for each cylinder.<br>Is "Misfire Cur. #" display increasing for any cylinder (indicating a misfire currently occurring)? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections.<br>2. If a problem is found, repair or replace the vacuum hoses as necessary.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 4* |
| 4 | 1. Visually and physically inspect the following areas for vacuum leaks:<br>• The intake manifold<br>• The injector O-rings<br>• The EGR adapter<br>• The EGR feed pipes<br>• ION Sensing Module<br>2. If a problem is found, repair the vacuum leak as necessary.<br>Did your inspection reveal a vacuum leak? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Visually and physically inspect the crankcase ventilation valve for improper installation or damaged grommet.<br>2. If a problem is found, repair as necessary (refer to *Crankcase Ventilation System*).<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects that may partially block the air flow sample through the MAF sensor.<br>2. If a problem is found, repair or replace the MAF sensor as necessary.<br>Did your inspection of the MAF sensor reveal a condition requiring repair or replacement? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Remove the EGR valve and visually/physically inspect the valve to ensure that the pintle is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely.<br>2. If a problem is found, clean the EGR valve pintle and seat or replace the EGR valve as necessary.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 8* |

## DTC P0300 – Engine Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | 1. Install a spark tester at the spark plug end of the ignition coil for a cylinder that indicated a misfire.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 14* | Go to *Step 9* |
| 9 | 1. Remove and visually/physically inspect the ignition coil(s) associated with the cylinders that were indicated as misfiring. Ensure that the coil(s) are free of cracks.<br>2. If a problem is found, replace the damaged ignition coil(s) as necessary.<br>Did any ignition coils require replacement? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Remove the spark plugs from the cylinders that were indicated as misfiring.<br>2. Visually inspect the spark plug electrodes.<br>Does your inspection reveal any spark plugs exhibiting excessive fouling? | — | Go to *Engine Mechanical Diagnosis* | Go to *Step 11* |
| 11 | 1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage.<br>2. If a problem is found, replace the faulty spark plug(s) as necessary.<br>Did your inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Disconnect the MAF sensor electrical connector.<br>2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S.T. FUEL TRIM" display on the Tech 2.<br>Do both values decrease below the specified values? | "BANK 1 L.T. FUEL TRIM" below +20%; "BANK 1 S.T. FUEL TRIM" below +50% | Go to *Step 13* | Replace the ignition coil of the affected cylinder |
| 13 | Replace the ignition coil control module.<br>Is the action complete? | — | Verify repair | — |
| 14 | 1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations.<br>2. If a problem is found, correct the faulty ground condition as necessary.<br>Did your inspection reveal a poor ground? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Perform the "Fuel System Pressure Test" procedure.<br>2. If a problem is found, repair as necessary (refer to *Engine Fuel or Fuel Metering System*).<br>Was a fuel system problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Check the fuel for excessive water, alcohol, or other contaminants (refer to *Diagnosis* in *Engine Fuel* for procedure).<br>2. If a problem is found, correct the contaminated fuel condition as necessary.<br>Was the fuel contaminated? | — | Verify repair | Go to *Step 17* |

# DTC P0300 – Engine Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 17 | 1. Perform the "Injector Coil/Balance Test".<br>2. If a problem is found, replace faulty injector(s) as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● Incorrect valve timing<br>● A leaking head gasket<br>● A loose or broken motor mount<br>2. If a problem is found, repair as necessary.<br>Was a basic engine mechanical problem found and repaired? | — | Verify repair | Go to *Step 19* |
| 19 | 1. Check for a transmission TCC problem. Refer to *4L30-E Automatic Transmission Diagnosis*.<br>2. If a problem is found, repair the transmission as necessary. Refer to *4L30-E Automatic Transmission Unit Repair*.<br>Was a transmission problem found and repaired? | — | Verify repair | Go to *Step 20* |
| 20 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0301 Cylinder Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0301 will determine if the No.1 cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0301 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0301 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

## DTC P0301 – Cylinder Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record Tech 2 Freeze Frame data.<br>3. Monitor “Misfire Cur. #1” on the Tech 2.<br>Is “Misfire Cur. #1” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | Monitor “Misfire Hist. #1” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2).<br>Is “Misfire Hist. #1” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Install a spark tester at the spark plug end of the cylinder #1 ignition coil.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 8* | Go to *Step 6* |

# DTC P0301 – Cylinder Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Remove and visually/physically inspect the ignition coil associated with cylinder #1. Ensure that the coil is free of cracks and carbon tracking.<br>2. If a problem is found, replace the damaged ignition coil as necessary.<br>Did the visual inspection reveal a problem? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Measure the ignition coil primary resistance.<br>2. If resistance is not within the specified value, replace the faulty ignition coil.<br>Did the ignition coil require replacement? | 2.6-2.7 KΩ | Verify repair | Go to *Step 12* |
| 8 | Remove the cylinder #1 spark plug and visually inspect the spark plug electrode.<br>Does the inspection reveal excessive fouling? | — | Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis* | Go to *Step 9* |
| 9 | 1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage.<br>2. If the spark plug is damaged, replace the spark plug.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Perform the "Injector Coil/Balance Test".<br>2. If any faulty injectors are found, replace them as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Inspect the injector O-rings for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● A leaking head gasket<br>Was a basic engine mechanical problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0302 Cylinder Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0302 will determine if the No.2 cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0302 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0302 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

## DTC P0302 – Cylinder Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record Tech 2 Freeze Frame data.<br>3. Monitor “Misfire Cur. #2” on the Tech 2.<br>Is “Misfire Cur. #2” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | Monitor “Misfire Hist. #2” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2).<br>Is “Misfire Hist. #2” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Install a spark tester at the spark plug end of the cylinder #2 ignition coil.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 8* | Go to *Step 6* |

# DTC P0302 – Cylinder Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Remove and visually/physically inspect the ignition coil associated with cylinder #2. Ensure that the coil is free of cracks and carbon tracking.<br>2. If a problem is found, replace the damaged ignition coil as necessary.<br>Did the visual inspection reveal a problem? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Measure the ignition coil primary resistance.<br>2. If resistance is not within the specified value, replace the faulty ignition coil.<br>Did the ignition coil require replacement? | 2.6-2.7 KΩ | Verify repair | Go to *Step 12* |
| 8 | Remove the cylinder #2 spark plug and visually inspect the spark plug electrode.<br>Does the inspection reveal excessive fouling? | — | Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis* | Go to *Step 9* |
| 9 | 1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage.<br>2. If the spark plug is damaged, replace the spark plug.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Perform the "Injector Coil/Balance Test".<br>2. If any faulty injectors are found, replace them as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Inspect the injector O-rings for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● A leaking head gasket<br>Was a basic engine mechanical problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0303 Cylinder Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0303 will determine if the No.3 cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0303 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0303 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector — Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

## DTC P0303 – Cylinder Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record Tech 2 Freeze Frame data.<br>3. Monitor “Misfire Cur. #3” on the Tech 2.<br>Is “Misfire Cur. #3” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | Monitor “Misfire Hist. #3” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2).<br>Is “Misfire Hist. #3” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Install a spark tester at the spark plug end of the cylinder #3 ignition coil.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 8* | Go to *Step 6* |

# DTC P0303 – Cylinder Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Remove and visually/physically inspect the ignition coil associated with cylinder #3. Ensure that the coil is free of cracks and carbon tracking.<br>2. If a problem is found, replace the damaged ignition coil as necessary.<br>Did the visual inspection reveal a problem? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Measure the ignition coil primary resistance.<br>2. If resistance is not within the specified value, replace the faulty ignition coil.<br>Did the ignition coil require replacement? | 2.6-2.7 KΩ | Verify repair | Go to *Step 12* |
| 8 | Remove the cylinder #3 spark plug and visually inspect the spark plug electrode.<br>Does the inspection reveal excessive fouling? | — | Go to *Contaminatio n Diagnosis* chart in *Engine Mechanical Diagnosis* | Go to *Step 9* |
| 9 | 1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage.<br>2. If the spark plug is damaged, replace the spark plug.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Perform the "Injector Coil/Balance Test".<br>2. If any faulty injectors are found, replace them as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Inspect the injector O-rings for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● A leaking head gasket<br>Was a basic engine mechanical problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0304 Cylinder Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0304 will determine if the No.4 cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0304 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0304 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

## DTC P0304 – Cylinder Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record Tech 2 Freeze Frame data.<br>3. Monitor “Misfire Cur. #4” on the Tech 2.<br>Is “Misfire Cur. #4” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | Monitor “Misfire Hist. #4” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2).<br>Is “Misfire Hist. #4” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Install a spark tester at the spark plug end of the cylinder #4 ignition wire.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 8* | Go to *Step 6* |

# DTC P0304 – Cylinder Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Remove and visually/physically inspect the ignition coil associated with cylinder #4. Ensure that the coil is free of cracks and carbon tracking.<br>2. If a problem is found, replace the damaged ignition coil as necessary.<br>Did the visual inspection reveal a problem? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Measure the ignition coil primary resistance.<br>2. If resistance is not within the specified value, replace the faulty ignition coil.<br>Did the ignition coil require replacement? | 2.6-2.7 KΩ | Verify repair | Go to *Step 12* |
| 8 | Remove the cylinder #4 spark plug and visually inspect the spark plug electrode.<br>Does the inspection reveal excessive fouling? | — | Go to *Contaminatio n Diagnosis* chart in *Engine Mechanical Diagnosis* | Go to *Step 9* |
| 9 | 1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage.<br>2. If the spark plug is damaged, replace the spark plug.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Perform the "Injector Coil/Balance Test".<br>2. If any faulty injectors are found, replace them as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Inspect the injector O-rings for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● A leaking head gasket<br>Was a basic engine mechanical problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0305 Cylinder Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0305 will determine if the No.5 cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor,vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0305 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0305 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

## DTC P0305 – Cylinder Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record Tech 2 Freeze Frame data.<br>3. Monitor “Misfire Cur. #5” on the Tech 2.<br>Is “Misfire Cur. #5” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | Monitor “Misfire Hist. #5” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2).<br>Is “Misfire Hist. #5” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Install a spark tester at the spark plug end of the cylinder #5 ignition wire.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 8* | Go to *Step 6* |

# DTC P0305 – Cylinder Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Remove and visually/physically inspect the ignition coil associated with cylinder #5. Ensure that the coil is free of cracks and carbon tracking.<br>2. If a problem is found, replace the damaged ignition coil as necessary.<br>Did the visual inspection reveal a problem? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Measure the ignition coil primary resistance.<br>2. If resistance is not within the specified value, replace the faulty ignition coil.<br>Did the ignition coil require replacement? | 2.6-2.7 KΩ | Verify repair | Go to *Step 12* |
| 8 | Remove the cylinder #5 spark plug and visually inspect the spark plug electrode.<br>Does the inspection reveal excessive fouling? | — | Go to *Contaminatio n Diagnosis* chart in *Engine Mechanical Diagnosis* | Go to *Step 9* |
| 9 | 1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage.<br>2. If the spark plug is damaged, replace the spark plug.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Perform the "Injector Coil/Balance Test".<br>2. If any faulty injectors are found, replace them as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Inspect the injector O-rings for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● A leaking head gasket<br>Was a basic engine mechanical problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0306 Cylinder Misfire Detected

## Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value. This DTC P0306 will determine if the No.6 cylinder misfire is occurring by monitoring the Combustion Quality.

## Conditions for Setting the DTC

- None of the following occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 110˚C (230˚F).
- The throttle angle is steady and throttle change less than 2% per 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0306 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0306 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

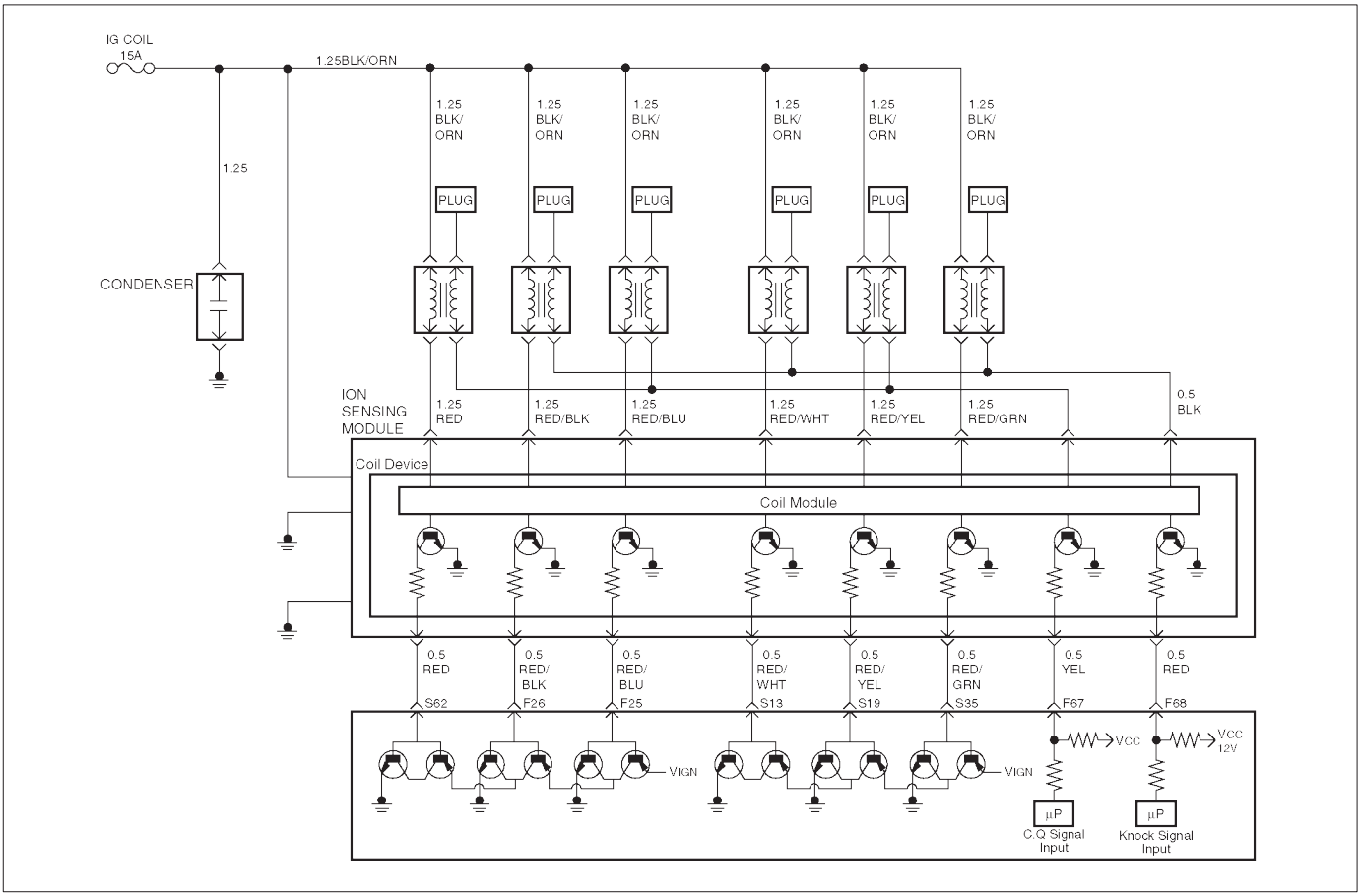
## DTC P0306 – Cylinder Misfire Detected

| 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. Start the engine. Run the engine at idle.<br>2. Review and record Tech 2 Freeze Frame data.<br>3. Monitor “Misfire Cur. #6” on the Tech 2.<br>Is “Misfire Cur. #6” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Go to *Step 3* |
| 3 | Monitor “Misfire Hist. #6” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2).<br>Is “Misfire Hist. #6” increasing (indicating a misfire currently occurring)? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Install a spark tester at the spark plug end of the cylinder #6 ignition wire.<br>2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed.<br>Is adequate spark present? | — | Go to *Step 8* | Go to *Step 6* |

# DTC P0306 – Cylinder Misfire Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Remove and visually/physically inspect the ignition coil associated with cylinder #6. Ensure that the coil is free of cracks and carbon tracking.<br>2. If a problem is found, replace the damaged ignition coil as necessary.<br>Did the visual inspection reveal a problem? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Measure the ignition coil primary resistance.<br>2. If resistance is not within the specified value, replace the faulty ignition coil.<br>Did the ignition coil require replacement? | 2.6-2.7 KΩ | Verify repair | Go to *Step 12* |
| 8 | Remove the cylinder #6 spark plug and visually inspect the spark plug electrode.<br>Does the inspection reveal excessive fouling? | — | Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis* | Go to *Step 9* |
| 9 | 1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage.<br>2. If the spark plug is damaged, replace the spark plug.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Perform the "Injector Coil/Balance Test".<br>2. If any faulty injectors are found, replace them as necessary.<br>Did any of the injectors require replacement? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Inspect the intake manifold and the injector O-rings for a vacuum leak.<br>2. If a problem is found, repair it as necessary.<br>Did the inspection reveal a problem? | — | Verify repair | Go to *Step 12* |
| 12 | Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions:<br>● A faulty or incorrect camshaft<br>● Leaking or sticky valves or rings<br>● Excessive valve deposits<br>● Weak valve springs<br>● A leaking head gasket<br>Was a basic engine mechanical problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0325
# ION Sensing Module/ION Sensing Knock Intensity Circuit Fault




060R200055

## Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The test is performed to evacuate the Knock Intensity (KI) signal pulse width if it is within a predetermined range. If the KI signal pulse width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the KI line circuit, ION module faults and analog input faults in the PCM.

## Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Crank DTCs set.
- No EST DTCs set.
- No Misfire DTCs set.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0325 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0325 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM- Inspect harness connectors 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.

If the harness appears to be OK, observe the Knock Present, Knock Sensor Noise Channel display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P0325 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0325 Diagnostic Chart may isolate the cause of the fault.

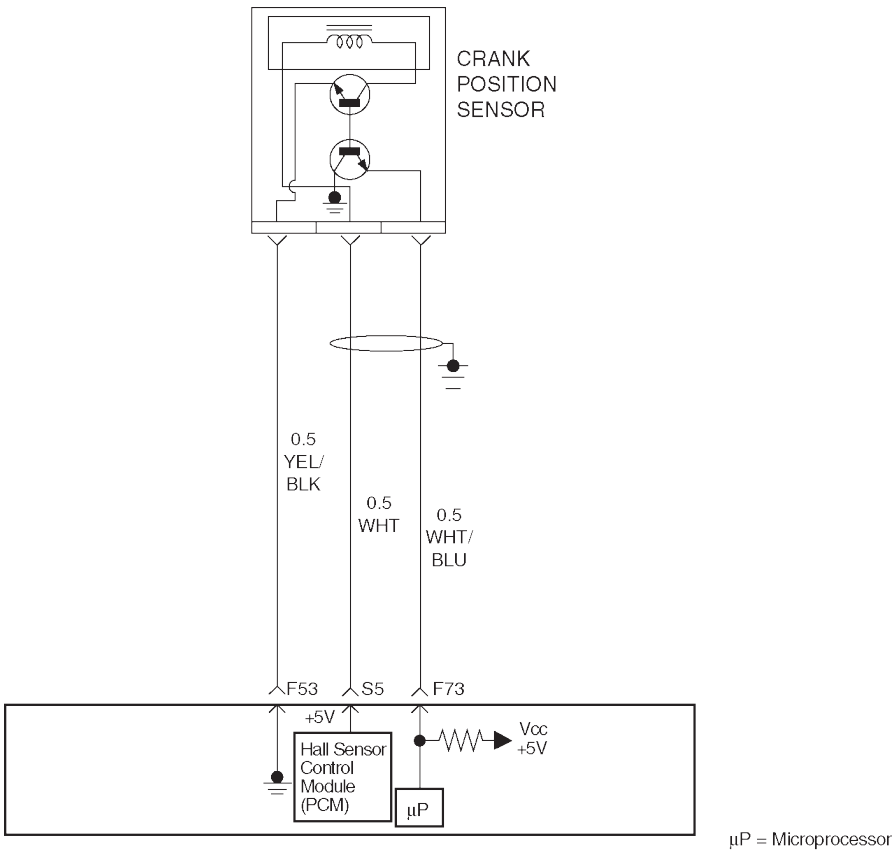
## DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P0325.<br>Does the Tech 2 indicate DTC P0325 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect the ION sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 4* | — |
| 4 | Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the KI line harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 6* | — |
| 6 | Check the ION sensing harness for open or short circuit between the ignition coil and ION sensing module circuit at the harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 9 | Check the following items;<br>1. ION sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 11* |
| 10 | Repair wiring harness.<br>Is the action complete? | — | Verify repair | Go to *Step 11* |

# DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Replace the ION Sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 12* |
| 12 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>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.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0336 58X Reference Signal Circuit




060R200066

## Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit. If the PCM receives an incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

## Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0336 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0336 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

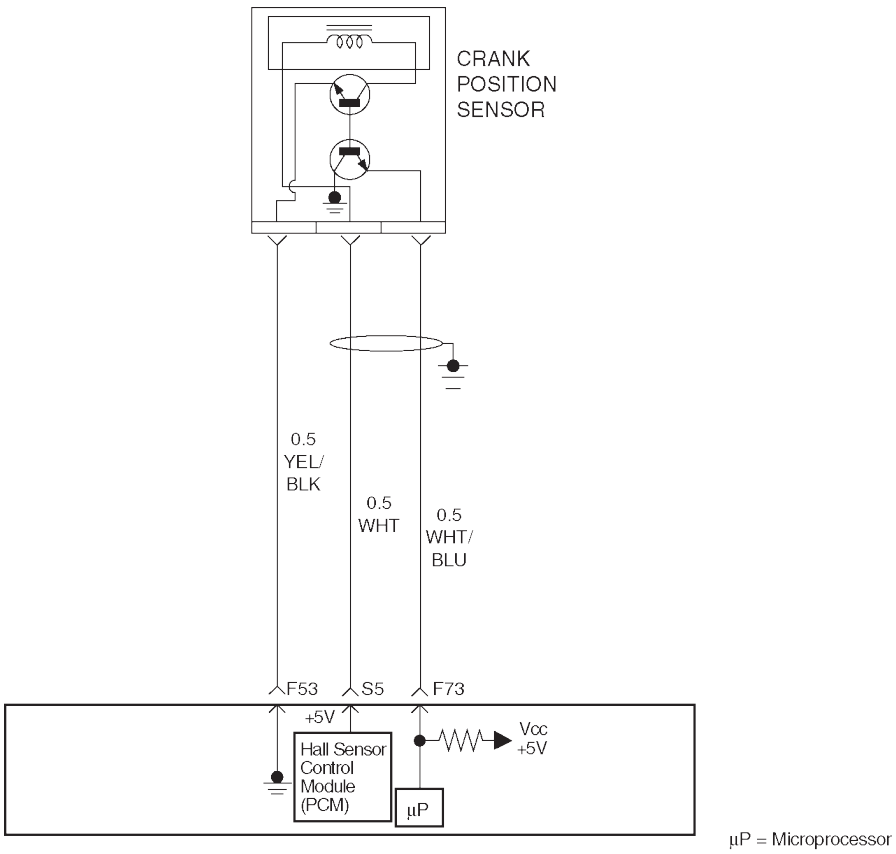
- Poor connection - Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

# DTC P0336 – 58X Reference Signal Circuit

| 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 | Attempt to start the engine.<br>Does the engine start? | — | Go to *Step 3* | Go to *"Engine Cranks But Will Not Run"* chart |
| 3 | 1. Review and record Failure Records information.<br>2. Clear DTC P0336.<br>3. Start the engine and idle for 1 minute.<br>4. Observe DTCs.<br>Is DTC P0336 set? | — | Go to *Step 4* | Refer to Diagnostic Aids |
| 4 | 1. Disconnect the PCM and CKP sensor.<br>2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Reconnect the PCM and CKP sensor.<br>2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector.<br>3. Observe the voltage while cranking the engine.<br>Is the voltage near the specified value? | 2.5 V | Go to *Step 8* | Go to *Step 6* |
| 6 | Check the connections at the CKP sensor and replace the terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 7* |
| 7 | Replace the CKP sensor. Use caution to avoid any hot oil that may drip out.<br>Is the action complete? | — | Verify repair | — |
| 8 | Check connections at the PCM and replace the terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 9* |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0337 CKP Sensor Circuit Low Frequency




060R200066

## Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit. If the PCM does not receive pulses on the 58X reference circuit, DTC P0337 will set.

## Conditions for Setting the DTC

- Engine cranking.
- Crankshaft position (CKP) sensor signal is not present between two cam pulses.
- CKP reference pulse is not detected within 8 CMP pulses.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0337 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0337 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## 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 connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

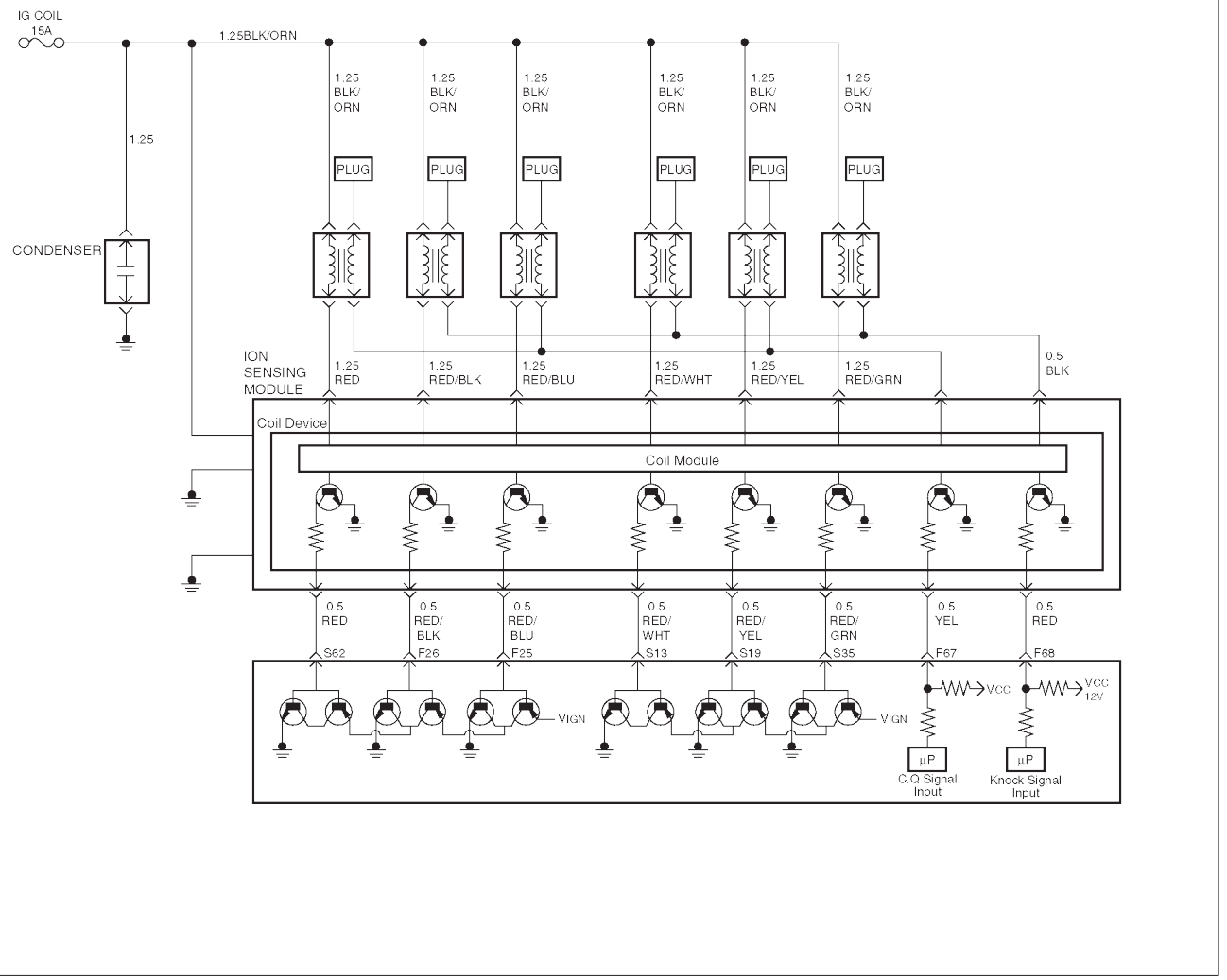
# DTC P0337 – CKP Sensor Circuit Low Frequency

| 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 | Attempt to start the engine.<br>Does the engine start? | — | Go to *Step 3* | Go to *Chart 3* |
| 3 | 1. Review and record Failure Records information.<br>2. Clear DTC P0337.<br>3. Start the engine and idle for 1 minute.<br>4. Observe DTCs.<br>Is DTC P0337 set? | — | Go to *Step 4* | Refer to *Diagnostic Aid* |
| 4 | 1. Disconnect the CKP sensor.<br>2. Ignition "ON".<br>3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (PCM side).<br>Are 4-6 volts and ground available at the sensor? | — | Go to *Step 7* | Go to *Step 5* |
| 5 | 1. Ignition "ON".<br>2. With a DVM, backprobe the PCM connector 5 V reference and ground connections.<br>Are 5 V reference and ground available at the PCM? | — | Go to *Step 6* | Go to *Step 11* |
| 6 | Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage.<br>Is the action complete? | — | Verify repair | — |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the PCM and CKP sensor.<br>3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector.<br>4. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Reconnect the PCM and CKP sensor.<br>2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector.<br>3. Observe the voltage while cranking the engine.<br>Is the voltage near the specified value? | 2.5 V | Go to *Step 11* | Go to *Step 9* |
| 9 | Check the connections at the CKP sensor and replace the terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 10* |

# DTC P0337 – CKP Sensor Circuit Low Frequency (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Replace the CKP sensor. Use caution and avoid hot oil that may drip out.<br>Is the action complete? | — | Verify repair | — |
| 11 | Check the connections at the PCM and replace the terminals if necessary.<br>Did any terminals require replacement? | — | Verify repair | Go to *Step 12* |
| 12 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0351 Ignition 1 Control Circuit




060R200055

## Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 1, it will set a DTC P0351.

## Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0351 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

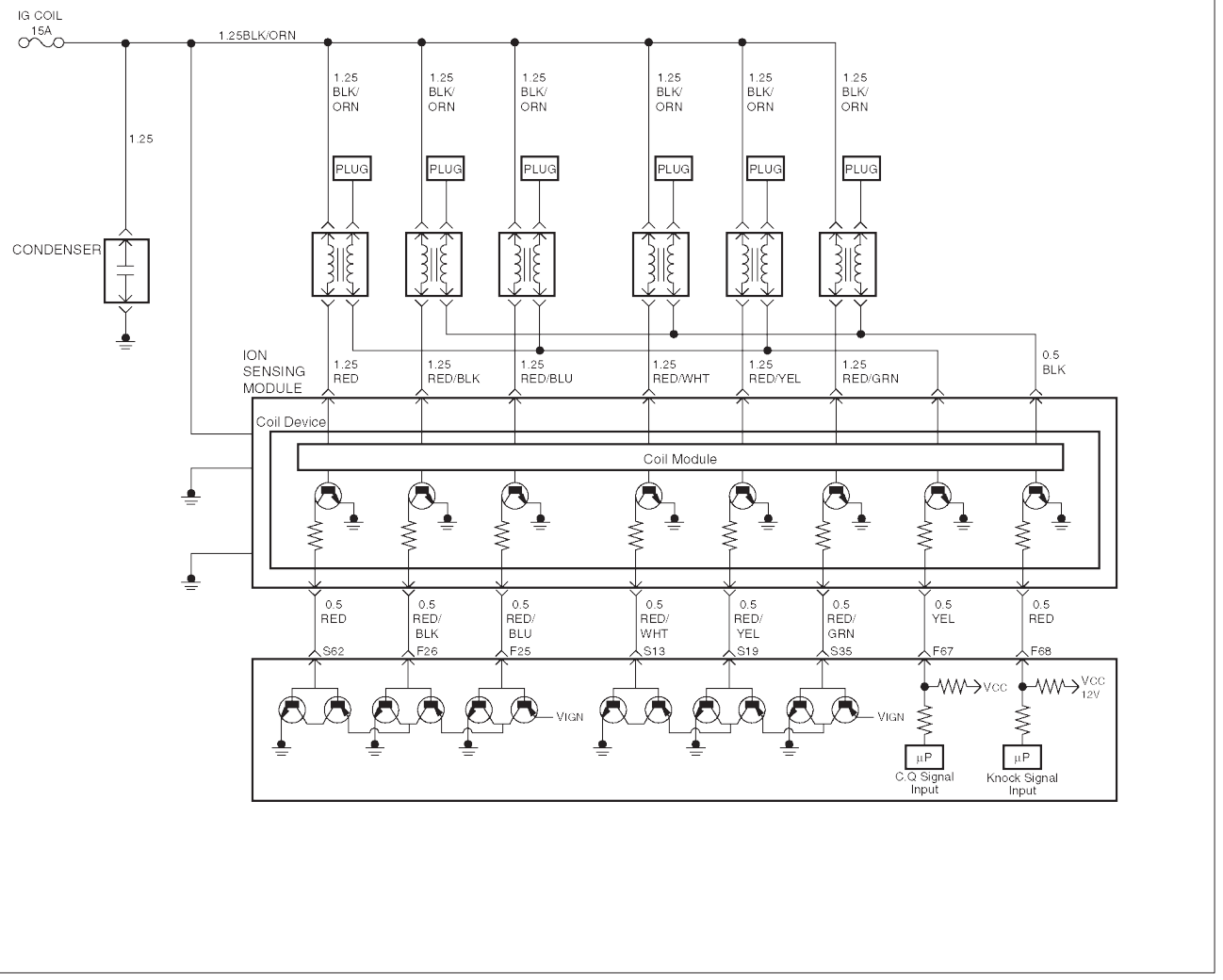
# DTC P0351 – Ignition 1 Control Circuit

| 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".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Record conditions as noted.<br>4. Use a Tech 2 to monitor the "DTC" information for DTC P0351 until the DTC P0351 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0351 failed this ignition cycle? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | Check for faulty connection at ignition coil.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | Check for faulty connection at PCM connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition "ON", engine "OFF".<br>2. Back probe the ignition control circuit 1 at the ION Sensing Module with a DVM.<br>Is the voltage near the specified value? | 25-55 mV | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Ignition "ON", engine running.<br>2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested.<br>Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher? | 100-180 mV | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the 3-pin and connector at the ignition coil.<br>3. Check ignition control circuit 1 voltage at the ignition coil connector while cranking the engine.<br>Does the voltage measure between the specified values? | 200-1200 mV | Go to *Step 8* | Go to *Step 11* |
| 8 | Replace the ignition coil.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM and the ignition coil.<br>3. Check ignition control circuit 1 for short to ground.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check ignition control circuit 1 for short to voltage.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |

# DTC P0351 – Ignition 1 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check for an open ignition control circuit 1.<br>Was the ignition control circuit open? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the open ignition control circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0352 Ignition 2 Control Circuit




060R200055

## Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 2, it will set a DTC P0352.

## Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58 X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0352 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0352 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

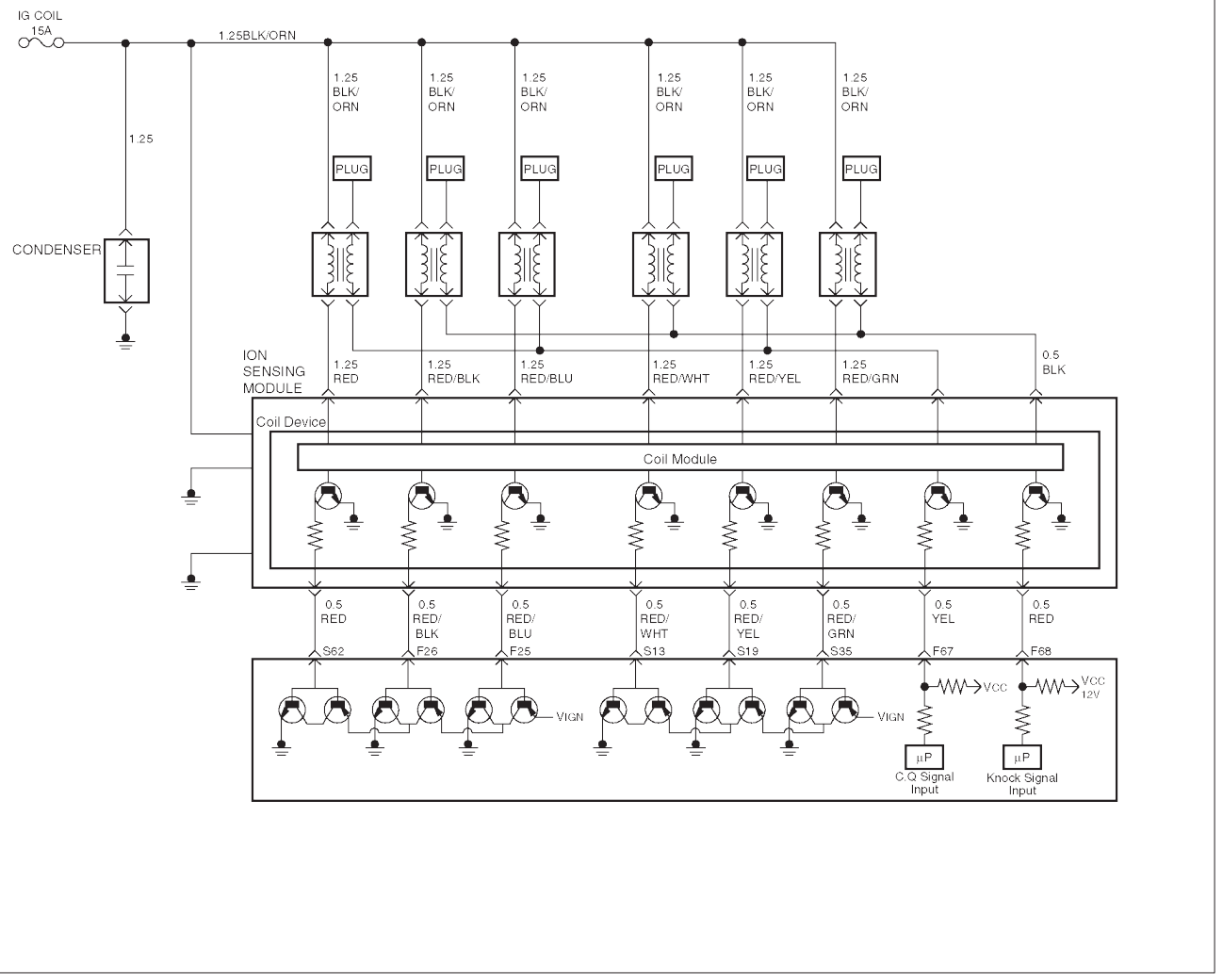
# DTC P0352 – Ignition 2 Control Circuit

| 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”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Record conditions as noted.<br>4. Use a Tech 2 to monitor the “DTC” information for DTC P0352 until the DTC P0352 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0352 failed this ignition cycle? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | Check for faulty connection at ignition coil.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | Check for faulty connection at PCM connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition “ON”, engine “OFF”.<br>2. Back probe the ignition control circuit 2 at the ION Sensing Module with a DVM .<br>Is the voltage near the specified value? | 25-55 mV | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Ignition “ON”, engine running.<br>2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested.<br>Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher? | 100-180 mV | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Ignition “OFF”.<br>2. Disconnect the 3-pin connector at the ignition coil.<br>3. Check ignition control circuit 2 voltage at the ignition coil connector while cranking the engine connector.<br>Does the voltage measure between the specified values? | 200-1200 mV | Go to *Step 8* | Go to *Step 11* |
| 8 | Replace the ignition coil.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Ignition “OFF”.<br>2. Disconnect the PCM and the ignition coil.<br>3. Check ignition control circuit 2 for short to ground.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check ignition control circuit 2 for short to voltage.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |

# DTC P0352 – Ignition 2 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check for an open ignition control circuit 2.<br>Was the ignition control circuit open? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the open ignition control circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0353 Ignition 3 Control Circuit




060R200055

## Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 3, it will set a DTC P0353.

## Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0353 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0353 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0353 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

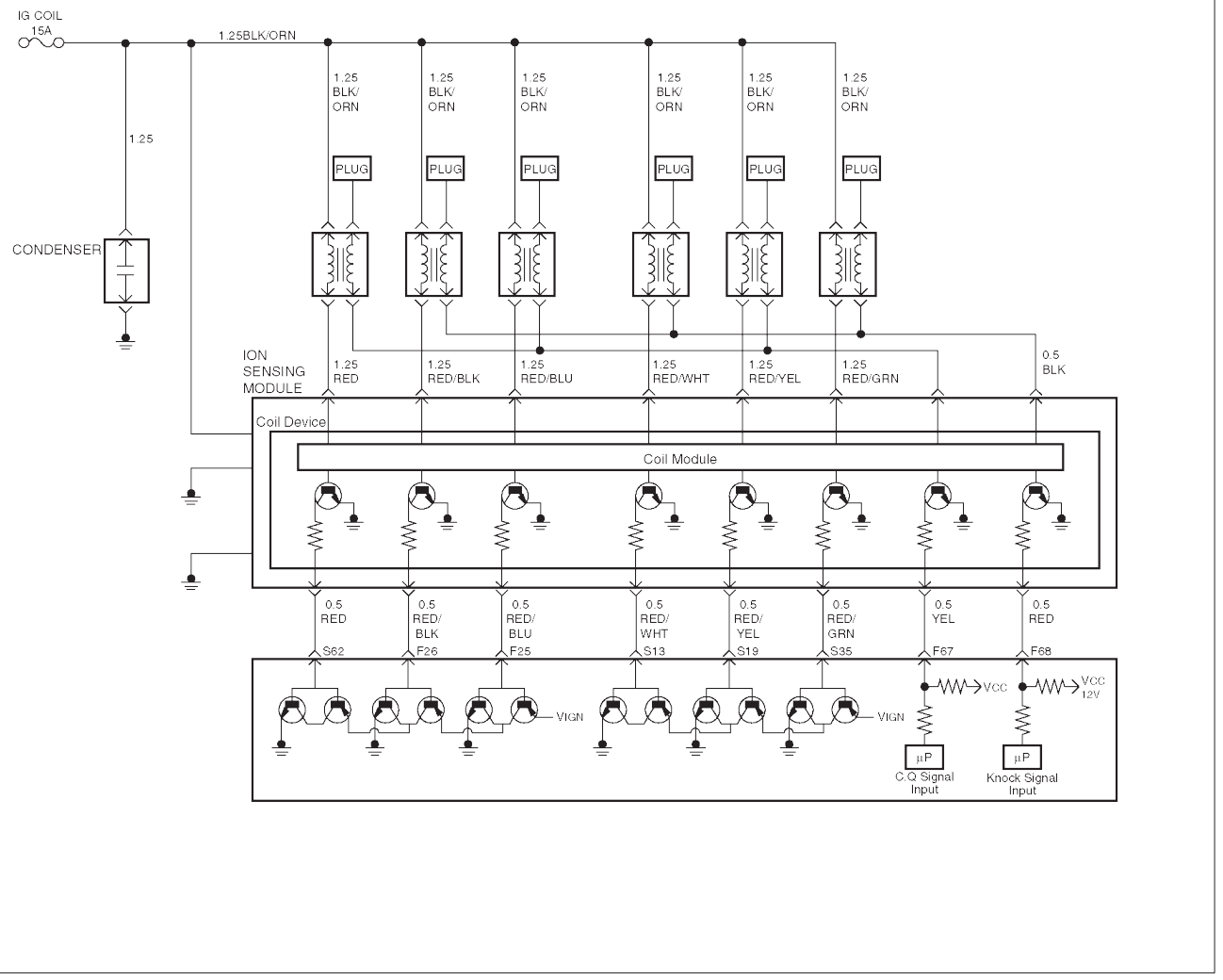
# DTC P0353 – Ignition 3 Control Circuit

| 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".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Record conditions as noted.<br>4. Use a Tech 2 to monitor the "DTC" information for DTC P0353 until the DTC P0353 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0353 failed this ignition cycle? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | Check for faulty connection at ignition coil.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | Check for faulty connection at PCM connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition "ON", engine "OFF".<br>2. Back probe the ignition control circuit 3 at the ION Sensing Module with a DVM positive lead with the negative lead to ground.<br>Is the voltage near the specified value? | 25-55 mV | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Ignition "ON", engine running.<br>2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested.<br>Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher? | 100-180 mV | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the 3-pin connector at the ignition coil.<br>3. Check ignition control circuit 3 voltage at the ignition coil connector while cranking the engine.<br>Does the voltage measure between the specified values? | 200-1200 mV | Go to *Step 8* | Go to *Step 11* |
| 8 | Replace the ignition coil.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM and the ignition coil.<br>3. Check ignition control circuit 3 for short to ground.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check ignition control circuit 3 for short to voltage.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |

# DTC P0353 – Ignition 3 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check for an open ignition control circuit 3.<br>Was the ignition control circuit open? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the open ignition control circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0354 Ignition 4 Control Circuit




060R200055

## Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 4, it will set a DTC P0354.

## Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0354 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0354 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0354 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

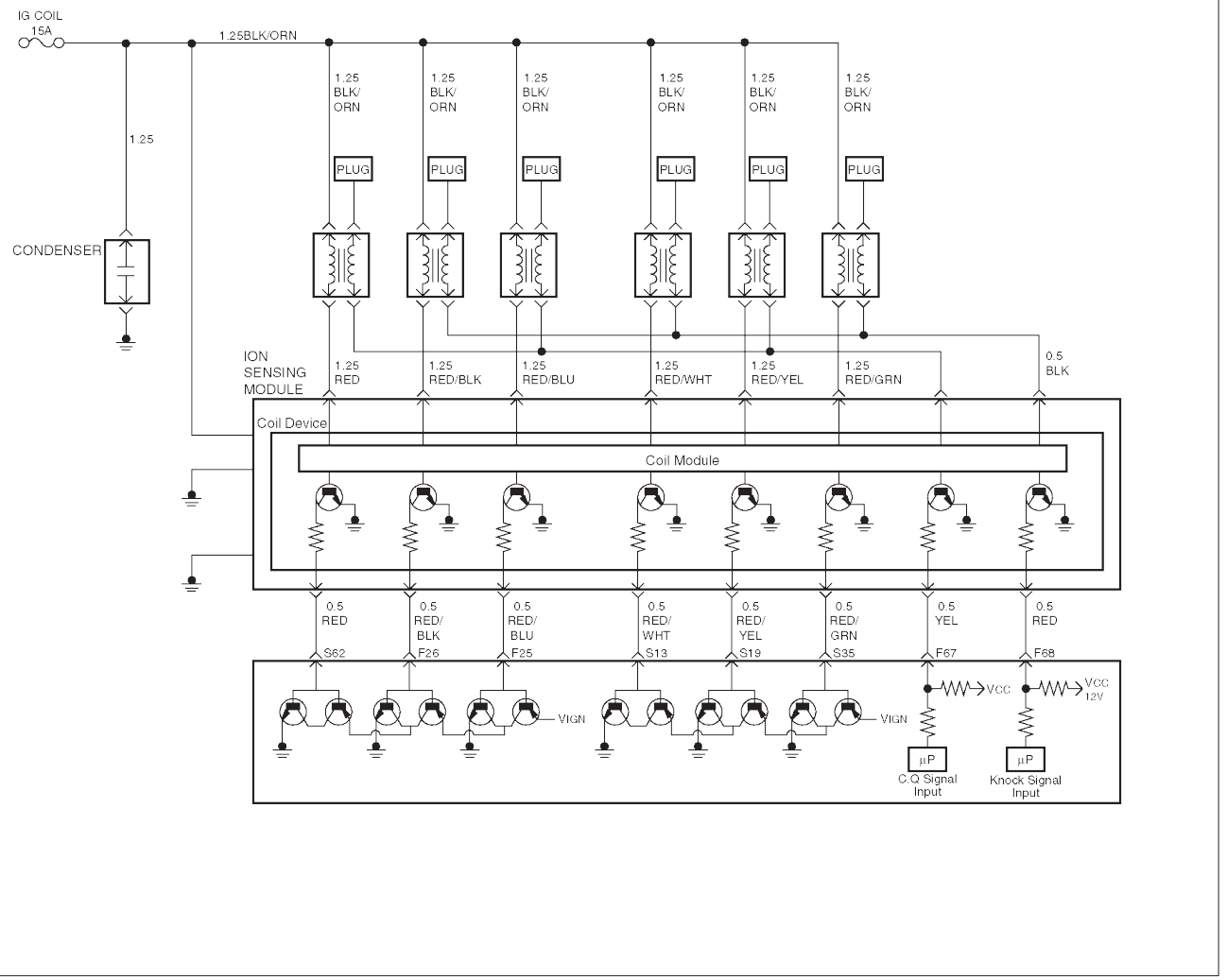
# DTC P0354 – Ignition 4 Control Circuit

| 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".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Record conditions as noted.<br>4. Use a Tech 2 to monitor the "DTC" information for DTC P0354 until the DTC P0354 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0354 failed this ignition cycle? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | Check for faulty connection at ignition coil.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | Check for faulty connection at PCM connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition "ON", engine "OFF".<br>2. Back probe the ignition control circuit 4 at the ION Sensing with a DVM positive lead with the negative lead to ground.<br>Is the voltage near the specified value? | 25-55 mV | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Ignition "ON", engine running.<br>2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested.<br>Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher? | 100-180 mV | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the 3-pin connector at the ignition coil.<br>3. Check ignition control circuit 4 voltage at the ignition coil connector while cranking the engine.<br>Does the voltage measure between the specified values? | 200-1200 mV | Go to *Step 8* | Go to *Step 11* |
| 8 | Replace the ignition coil.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM and the ignition coil.<br>3. Check ignition control circuit 4 for short to ground.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check ignition control circuit 4 for short to voltage.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |

# DTC P0354 – Ignition 4 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check for an open ignition control circuit 4.<br>Was the ignition control circuit open? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the open in ignition control circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0355 Ignition 5 Control Circuit




060R200055

## Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST in control circuit 5, it will set a DTC P0355.

## Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous spark events.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0355 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0355 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0355 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

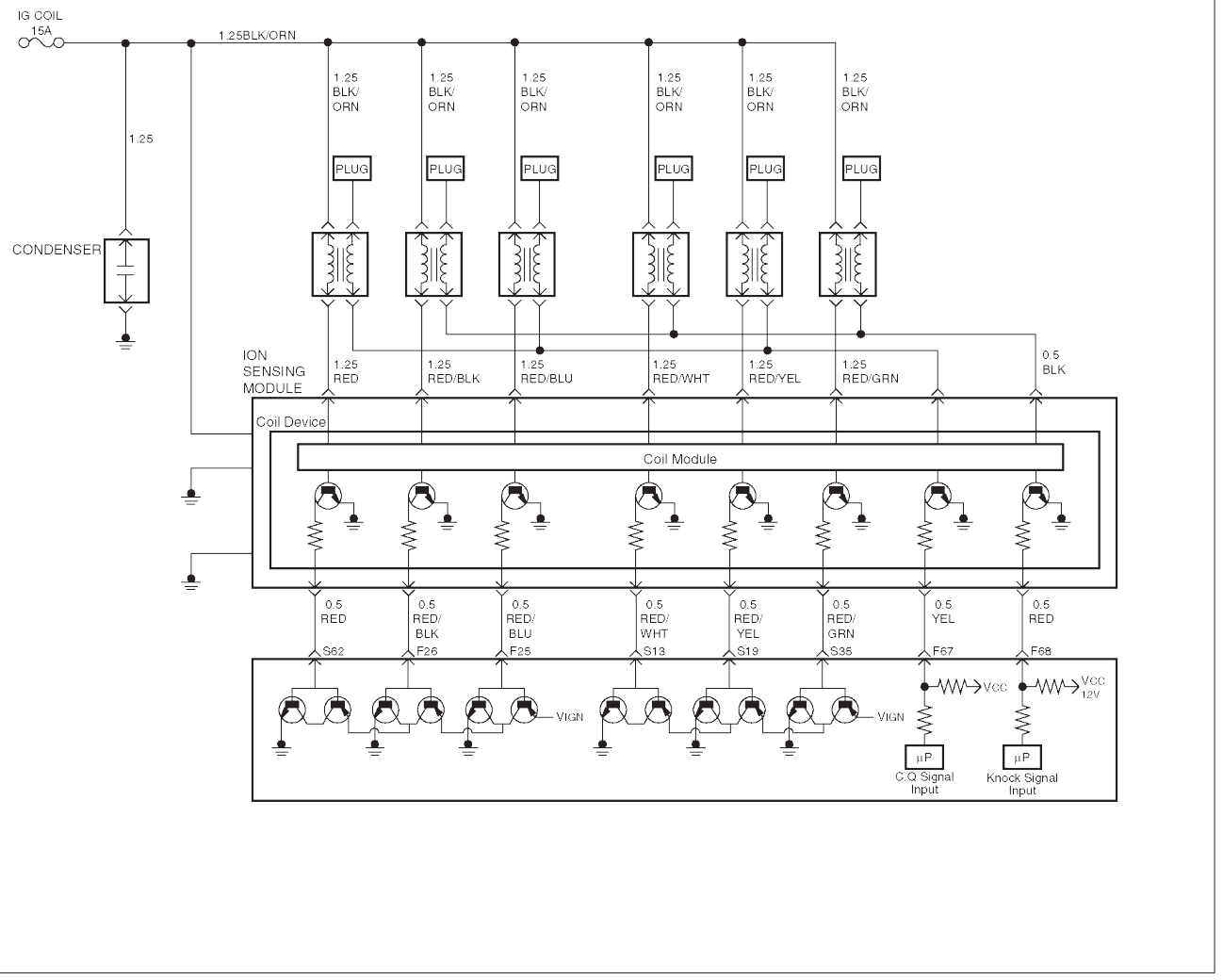
# DTC P0355 – Ignition 5 Control Circuit

| 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".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Record conditions as noted.<br>4. Use a Tech 2 to monitor the "DTC" information for DTC P0355 until the DTC P0355 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0355 failed this ignition cycle? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | Check for faulty connection at ignition coil.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | Check for faulty connection at PCM connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition "ON", engine "OFF".<br>2. Back probe the ignition control circuit 5 at the ION Sensing Module with a DVM positive lead with the negative lead to ground.<br>Is the voltage near the specified value? | 25-55 mV | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Ignition "ON", engine running.<br>2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested.<br>Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher? | 100-180 mV | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the 3-pin connector at the ignition coil.<br>3. Check ignition control circuit 5 voltage at the ignition coil connector while cranking the engine.<br>Does the voltage measure between the specified values? | 200-1200 mV | Go to *Step 8* | Go to *Step 11* |
| 8 | Replace the ignition coil.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM and the ignition coil.<br>3. Check ignition control circuit 5 for short to ground.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check ignition control circuit 5 for short to voltage.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |

# DTC P0355 – Ignition 5 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check for an open ignition control circuit 5.<br>Was the ignition control circuit open? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the open ignition control circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0356 Ignition 6 Control Circuit




060R200055

## Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 6, it will set a DTC P0356.

## Conditions for Setting the DTC

- The ignition is “ON”.
- The engine is running, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON”.
- The output voltage is not equal to 0 volts when output is “OFF”.
- Ten test failures occur within 10 samples of continuous circuit monitoring.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0356 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0356 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0356 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

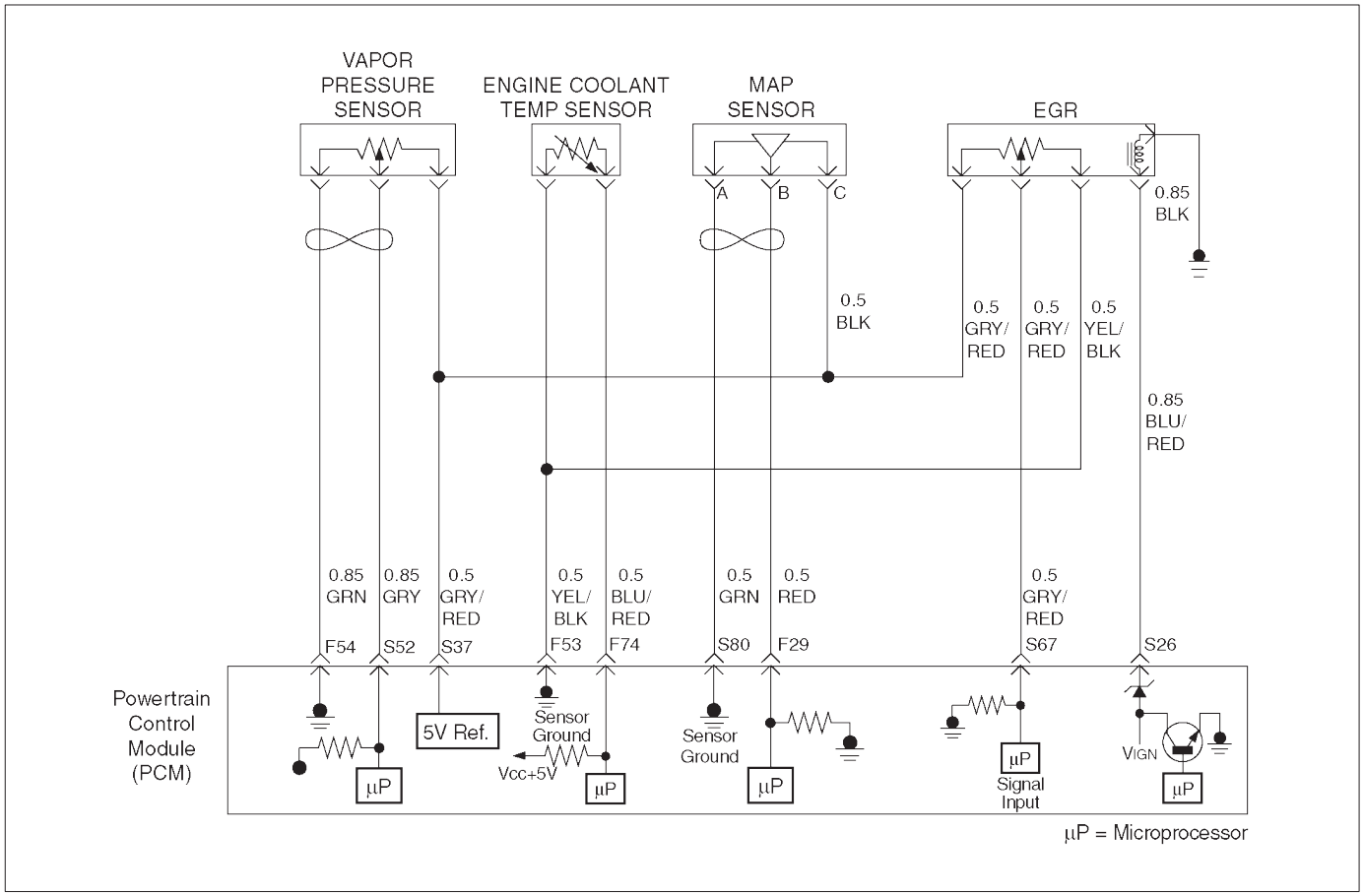
# DTC P0356 – Ignition 6 Control Circuit

| 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".<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Record conditions as noted.<br>4. Use a Tech 2 to monitor the "DTC" information for DTC P0356 until the DTC P0356 test runs.<br>5. Note the test result.<br>Does the Tech 2 indicate DTC P0356 failed this ignition cycle? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | Check for faulty connection at ignition coil.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | Check for faulty connection at PCM connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Ignition "ON", engine "OFF".<br>2. Back probe the ignition control circuit 6 at the ION Sensing Module with a DVM positive lead with the negative lead to ground.<br>Is the voltage near the specified value? | 25-55 mV | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Ignition "ON", engine running.<br>2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested.<br>Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher? | 100-180 mV | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Ignition "OFF".<br>2. Disconnect the 3-pin connector at the ignition coil.<br>3. Check ignition control circuit 6 voltage at the ignition coil connector while cranking the engine.<br>Does the voltage measure between the specified values? | 200-1200 mV | Go to *Step 8* | Go to *Step 11* |
| 8 | Replace the ignition coil.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the PCM and the ignition coil.<br>3. Check ignition control circuit 6 for short to ground.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | Check ignition control circuit 6 for short to voltage.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |

# DTC P0356 – Ignition 6 Control Circuit (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Check for an open ignition control circuit 6.<br>Was the ignition control circuit open? | — | Go to *Step 12* | Go to *Step 13* |
| 12 | Repair the open ignition control circuit.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0401 EGR Flow Insufficient




060R200050

## Circuit Description

The powertrain control module (PCM) tests the exhaust gas recirculation (EGR) system during deceleration by momentarily commanding the EGR valve to open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM monitors the change in MAP input signal. The PCM compares the MAP change to a RPM vs. BARO table. When the PCM interprets the change in MAP to be out of limits, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the severity of the detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows twelve test samples during the first ignition cycle following a Tech 2 “Clear Info” or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test.

## Conditions for Setting the DTC

- No TP sensor, vehicle speed sensor (VSS), MAP sensor, IAT sensor, IAC, EGR Pintle Position sensor, ECT sensor, misfire, or automatic transmission DTCs set.
- Engine coolant temperature is greater than 60°C (140°F).
- Ignition voltage between 11.5 and 16 volts.
- Vehicle speed is greater than 24 km/h (15 mph).
- A/C clutch status is unchanged.
- TCC status is unchanged.

## Start Test

- TP angle is less than 0.8%.
- EGR duty cycle is less than 1%.
- MAP is steady, changing less than 2 kPa.
- Engine speed is between 1100 RPM and 2000 RPM (M/T).
- MAP between 10 kPa and 40 kPa.
- Engine speed is between 900 RPM and 1500 rpm (A/T).

  The test will be aborted if the vehicle speed changes by more than 16 km/h (10 mph), engine speed changes by more than 100 RPM or the EGR is opened less than 95% of commanded position.
- The PCM will only run the EGR test during a closed throttle condition.
- The PCM will only run the EGR test at vehicle speeds above 24 km/h (15 mph).
- Several deceleration cycles will be necessary to run a sufficient number of EGR flow tests.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.

- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See *On-Vehicle Service*.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check”.

## Test Description

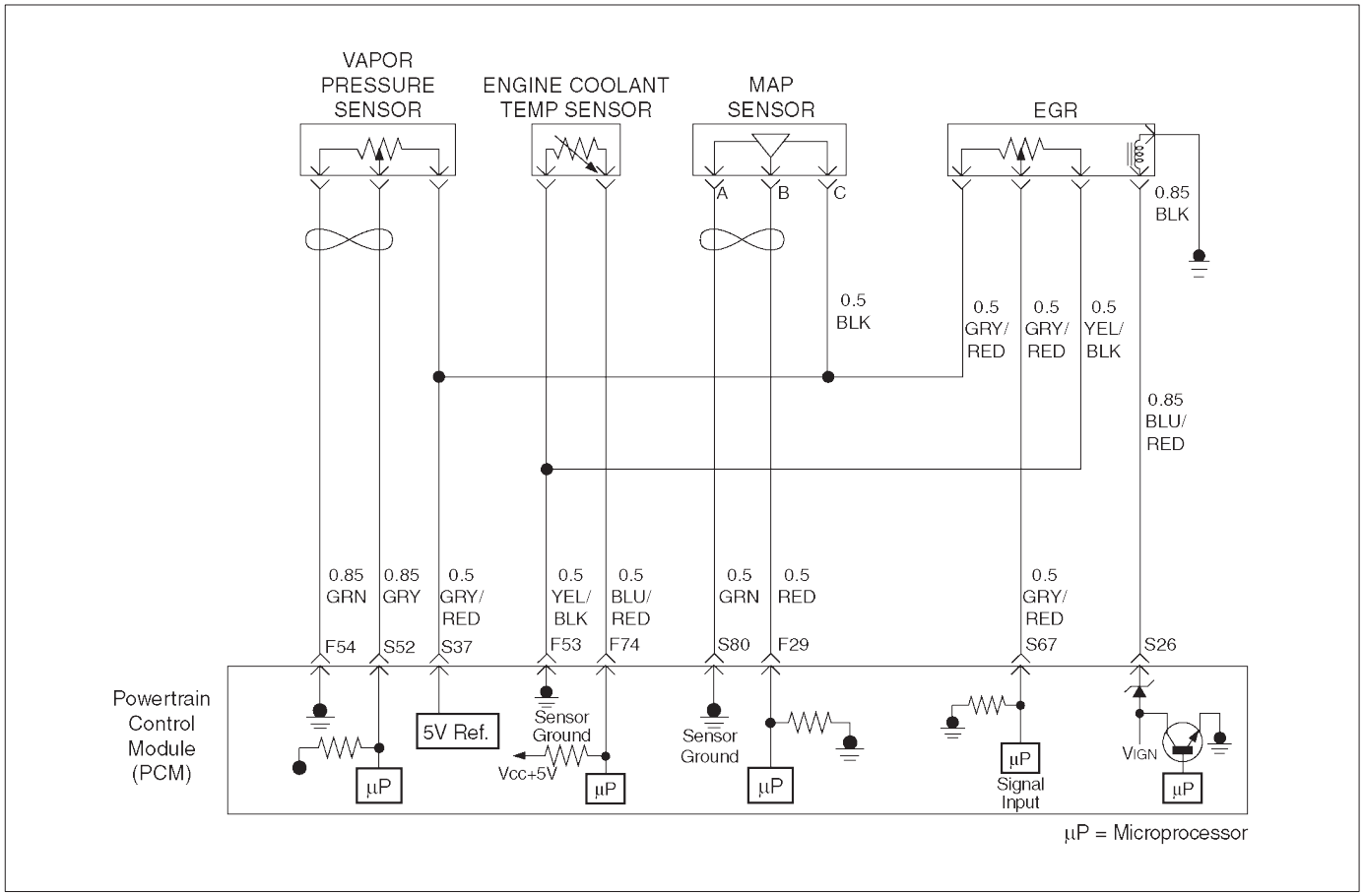
Number(s) below refer to the step number(s) on the Diagnostic Chart

3. A malfunctioning MAP sensor can set an EGR DTC. The MAP sensor could send a constant signal which is not low enough to set a low MAP DTC. The constant signal from the MAP sensor also may not be high enough to set a high MAP DTC. This step verifies that the MAP sensor is responding.

# DTC P0401 – EGR Flow Insufficient

| 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 | Is DTC P1404 also set? | — | Go to *DTC 1404* | Go to *Step 3* |
| 3 | 1. Start the engine.<br>2. Monitor the MAP signal with a Tech 2 while idling.<br>3. While idling, jab the accelerator pedal about halfway down and immediately let the engine return to idle.<br>Did the MAP value on the Tech 2 show an immediate large change? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 5 | 1. Inspect the exhaust system for modification of original installed parts or leaks.<br>2. If a problem was found, repair exhaust system as necessary.<br>Was a condition present that required repair? | — | Go to *Step 8* | Go to *Step 6* |
| 6 | 1. Remove the EGR valve.<br>2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction.<br>3. If a problem is found, clean or replace EGR system components as necessary.<br>Was a condition present that required repair? | — | Go to *Step 8* | Go to *Step 7* |
| 7 | 1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold.<br>2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage.<br>3. If a problem is found, correct the condition as necessary.<br>Was a condition present that required repair? | — | Go to *Step 8* | Refer to *Diagnostic Aids* |
| 8 | 1. Review and record the Tech 2 Failure Records data.<br>2. Clear DTC and monitor the Tech 2 System Info Screen while operating the vehicle as specified in “Diagnostic Aids”.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0401 until the DTC P0401 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P0401 failed this ignition? | — | — | Repair complete |

# Diagnostic Trouble Code (DTC) P0402 EGR Pintle Crank Error




060R200050

## Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is stuck open. If the PCM detects a pintle position signal indicates more than 21.5% and more than for 625 msec during cranking, the PCM will set DTC P0402.

## Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- At Engine revolution less than 600 RPM, EGR pintle position indicates more than 21.0% and more than for 625 msecs.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0402 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

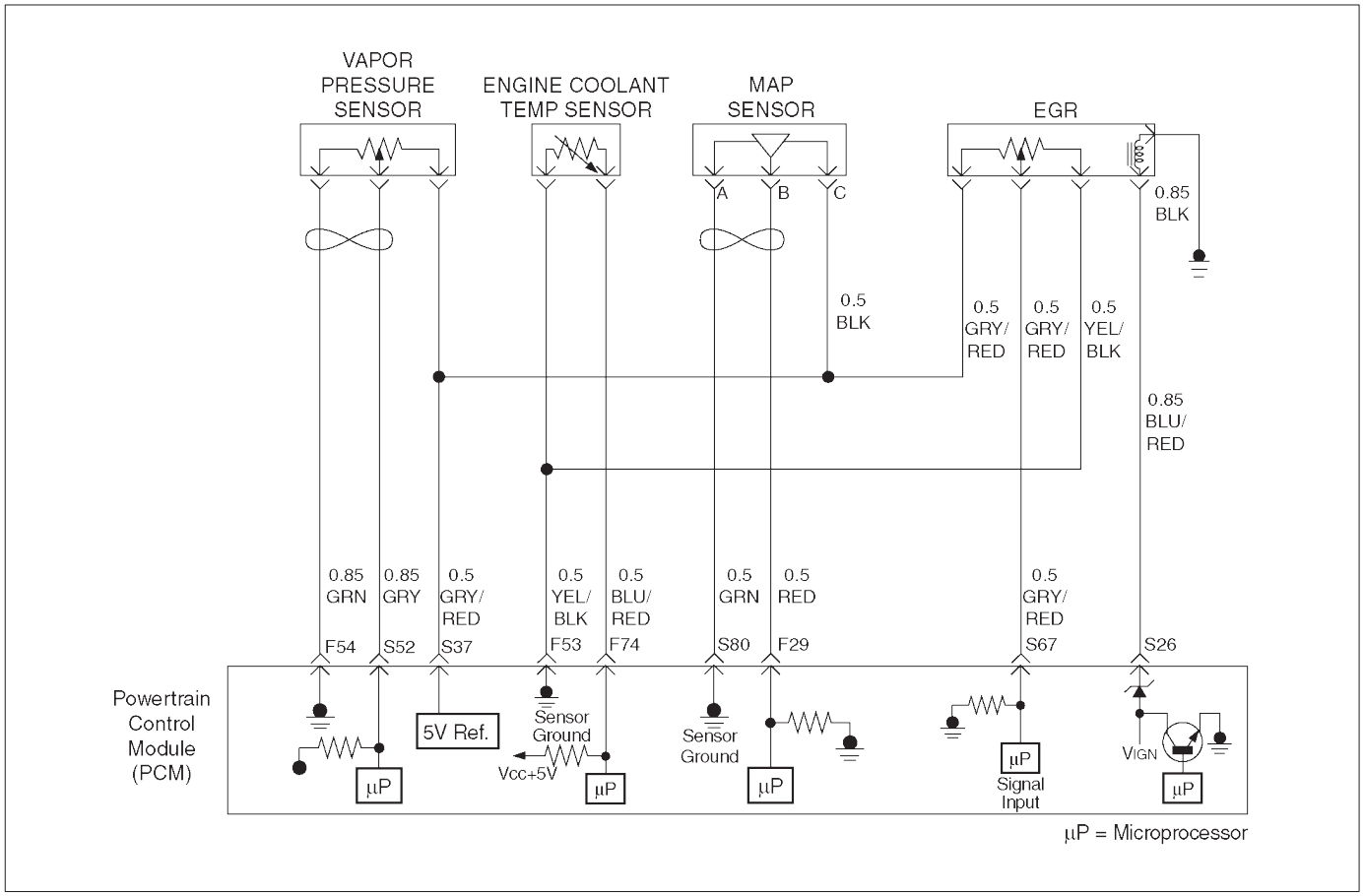
- Foreign material on EGR valve between pintle and seat may cause EGR stuck open. Inspect foreign material in EGR valve.
- Excessive carbon deposit may cause unsmooth operation of EGR valve shaft. Inspect for carbon deposit and clean up inside of carbon deposit.
- Poor connection or damaged harness–inspect the wiring harness for damage If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check”.

# DTC P0402 – EGR Pintle Crank Open Error

| 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”, review and record Tech 2 Failure Records data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0402 until the DTC P0402 test runs. Note the result.<br>Does the Tech 2 indicates DTC P0402 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Disconnect the EGR valve harness connector.<br>2. Inspect the EGR valve and connectors for damaged pin or terminals.<br>Were there any damaged pins or terminals? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | — |
| 5 | 1. Remove EGR valve from Engine.<br>2. Inspect EGR valve whether there is any foreign material between seat and pintle.<br>Was any foreign material in EGR valve? | — | Go to *Step 6* | Go to *Step 7* |
| 6 | 1. Remove EGR valve foreign material from EGR valve and clean up inside.<br>2. Visually inspect for damage of pintle and seat, which leakage may occur.<br>Was there any severe damage which affects function? | — | Go to *Step 7* | Verify repair<br>Go to *Step 8* |
| 7 | 1. Reconnect.<br>2. Ignition “OFF”.<br>3. Install the Tech 2.<br>4. Run the engine at idle.<br>5. On Tech-II, select special function for EGR.<br>6. Use the “UP” arrow to increase the EGR from 0% to 40%.<br>Did EGR work properly? | — | — | Go to *Step 8* |
| 8 | Replace the EGR valve.<br>Does DTC P0402 still fail “DTC” test on the Tech 2? | — | Go to *Step 9* | Verify repair |
| 9 | Replace the PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0404 EGR Open Stuck




060R200050

## Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is different from commanded position. If the PCM detects a pintle position signal indicates more than 15 points different between current and commanded and more than 15 seconds, the PCM will set DTC P0404.

## Conditions for Setting the DTC

- The engine is running.
- Ignition voltage is between 11 and 16 volts.
- Intake Air Temp is more than 3˚C (37.4˚F).
- Desire EGR position is less than 3%.
- The difference between desired EGR and current EGR is less than 3%.
- Difference EGR pintle position between current and commanded position becomes more than 15% and last more than 15 seconds, and this condition meets three times in a trip. Then it trigger, the PCM lights on.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

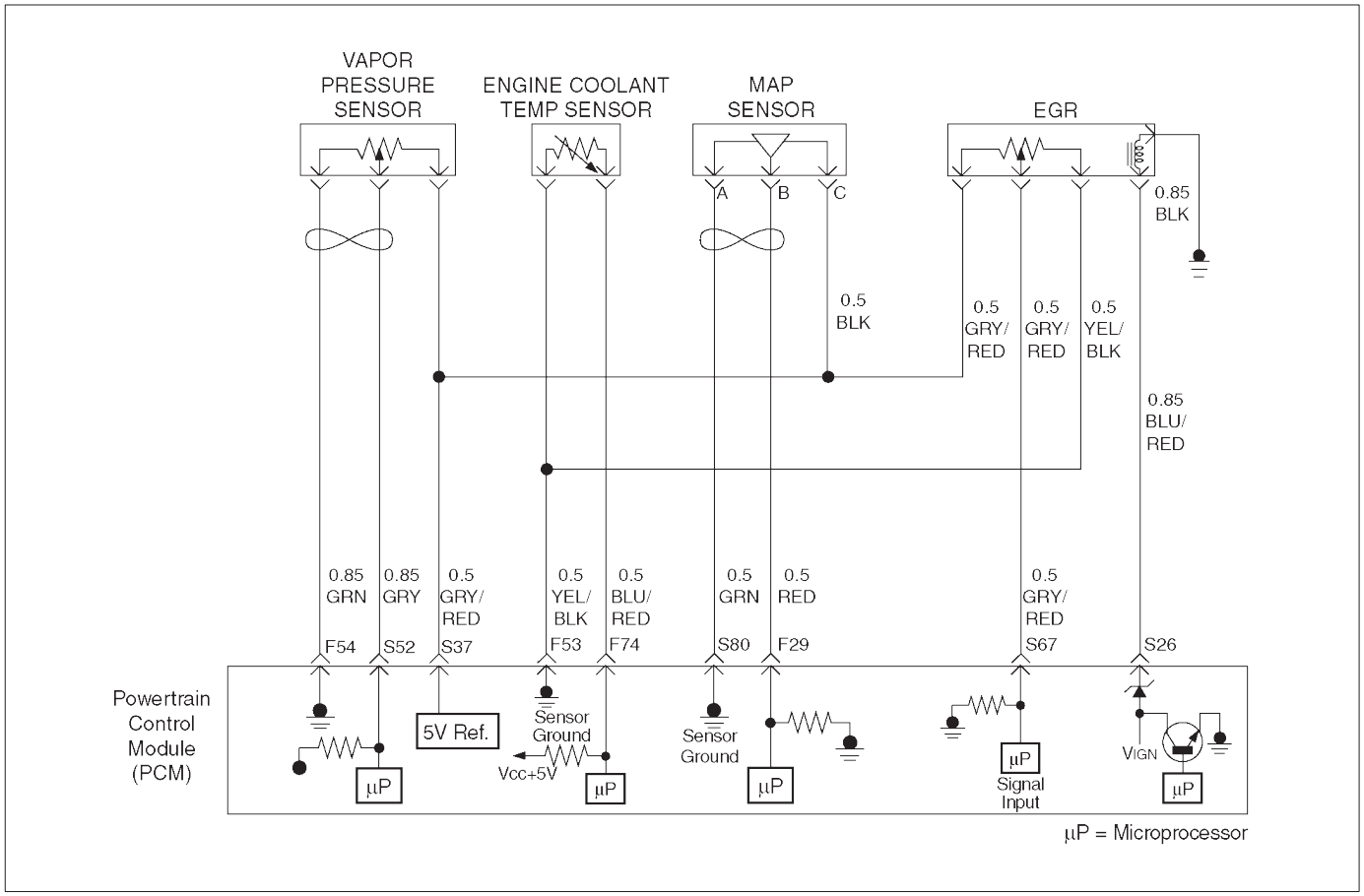
Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft may cause EGR stuck open or unsmooth operation. Those carbon deposit may occur by unusual port operation. Clean up carbon may make smooth function of EGR valve.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

# DTC P0404 – EGR Open Stuck

| 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", review and record Tech 2 Failure Records Data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0404 until the DTC P0404 test runs. Note the result.<br>Does the Tech 2 indicates DTC P0404 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Disconnect the EGR valve harness connector.<br>2. Inspect the EGR valve and connectors for damaged pin or terminals.<br>Were there any damaged pins or terminals? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the damaged pin or terminal. | — | Verify repair | Is the action complete? |
| 5 | 1. Remove EGR valve from Engine.<br>2. Inspect EGR valve whether there is any excessive carbon deposit on EGR shaft.<br>Was excessive carbon deposit on EGR valve shaft? | — | Go to *Step 6* | Go to *Step 7* |
| 6 | 1. Clean up EGR valve shaft and inside of EGR valve.<br>2. Visually inspect damage of pintle and seat if is bent, leakage may occur.<br>Was there any severe damage which affects function? | — | Go to *Step 8* | Verify repair<br>Go to *Step 7* |
| 7 | 1. Reconnect.<br>2. Ignition "OFF".<br>3. Install the Tech 2.<br>4. Run the engine at idle.<br>5. On the Tech 2, select EGR Control Test.<br>6. Use the "UP" arrow to increase the EGR from 0% to 40%.<br>Did EGR work properly? | — | — | Go to *Step 8* |
| 8 | Replace the EGR valve.<br>Does DTC P0404 still fail "DTC" test on the Tech 2? | — | Go to *Step 9* | Verify repair |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0405 EGR Low Voltage




060R200050

## Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates less than 0.1 V and last more than 10 seconds, then the PCM will set DTC P0405.

## Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air Temp is more than 3°C (37.4°F).
- EGR pintle position is less than 2% and last more than 10 sec. Action taken when the DTC sets.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0405 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

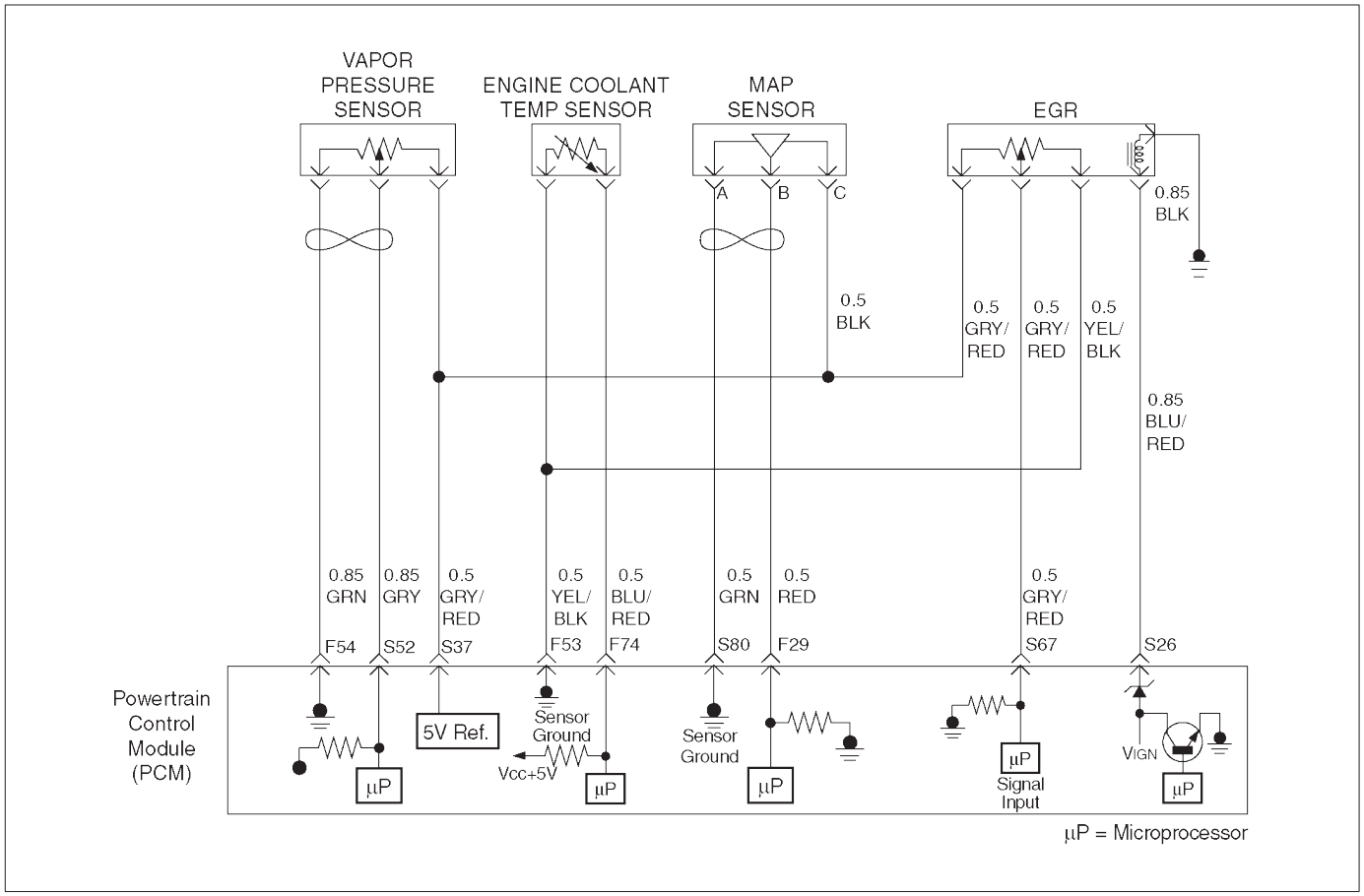
# DTC P0405 – EGR Low Voltage

| 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", review and record Tech 2 Failure Records Data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0405 until the DTC P0405 test runs. Note the result.<br>Does the Tech 2 indicates DTC P0405 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Disconnect the EGR valve harness connector.<br>2. Inspect the EGR valve and connectors for damaged pin or terminals.<br>Were there any damaged pins or terminals? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | — |
| 5 | 1. Disconnect the EGR harness connector.<br>2. Ignition "ON".<br>3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (BLU/RED) and ground.<br>Did the DVM indicate the specified value? | 4–6 V | Go to *Step 6* | Go to *Step 7* |
| 6 | 1. Disconnect the EGR harness connector.<br>2. Measure resistance between terminal 5 volt reference wire and ground.<br>Was resistance in range? | 5–5.5 KΩ | Go to *Step 10* | Go to *Step 17* |
| 7 | 1. Ignition "ON".<br>2. At the PCM connector, backprobe with a DVM at the 5 volt reference for the EGR valve.<br>Did the DVM indicate the specified value? | 4–6 V | Go to *Step 8* | Go to *Step 18* |
| 8 | Repair the open 5 volt reference circuit.<br>Is the action complete? | — | Verify repair | — |
| 9 | Repair the damaged sensor ground wire.<br>Is the action complete? | — | Verify repair | — |
| 10 | 1. Disconnect the EGR harness<br>2. Use an ohmmeter to measure between the pintle position pin and the sensor ground pin on the EGR valve.<br>NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve.<br>Was the ohmmeter reading approximately equal to the specified value? | 1 to 1.25 KΩ | Go to *Step 13* | Go to *Step 17* |
| 11 | 1. Ignition "ON".<br>2. Backprobe with a DVM to measure voltage at EGR valve pintle position pin and sensor ground pin.<br>Was voltage in range? | Less than 0.1 V | Go to *Step 17* | Go to *Step 12* |

# DTC P0405 – EGR Low Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | 1. Ignition "ON".<br>2. Backprobe with a DVM to measure voltage at PCM sensor ground pin and pintle position pin.<br>Was voltage in range? | Less than 0.1 V | Go to *Step 13* | Go to *Step 18* |
| 13 | 1. Ignition "OFF".<br>2. Disconnect the EGR harness.<br>3. Check short circuit between EGR pintle position circuit and EGR ground circuit.<br>Was any short circuit? | — | Go to *Step 14* | Go to *Step 18* |
| 14 | Locate and repair the short to ground in the pintle position circuit<br>Is the action complete? | — | Verify repair | — |
| 15 | 1. Ignition "OFF".<br>2. Disconnect the PCM.<br>3. Ignition "ON".<br>4. Measure the voltage between the EGR pintle position circuit and ground.<br>Is the measured voltage near the specified value? | Less than 0.1 V | Go to *Step 17* | Go to *Step 16* |
| 16 | Check for a short circuit between other wires and the pintle position circuit<br>Is there any short circuit? | — | Repair short circuit and then Verify repair | Go to *Step 17* |
| 17 | Replace the EGR valve.<br>Does DTC P1404 still fail "DTC test on the Tech 2? | — | Go to *Step 18* | Verify repair |
| 18 | Examine the PCM pin and terminal connection.<br>Was there a damaged terminal? | — | Go to *Step 4* | Go to *Step 19* |
| 19 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0406 EGR High Voltage




060R200050

## Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates more than 4.8 V and last more than 10 seconds, then the PCM will set DTC P0406.

## Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C (37.4°F).
- EGR pintle position is more than 99% and last more than 10 sec.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

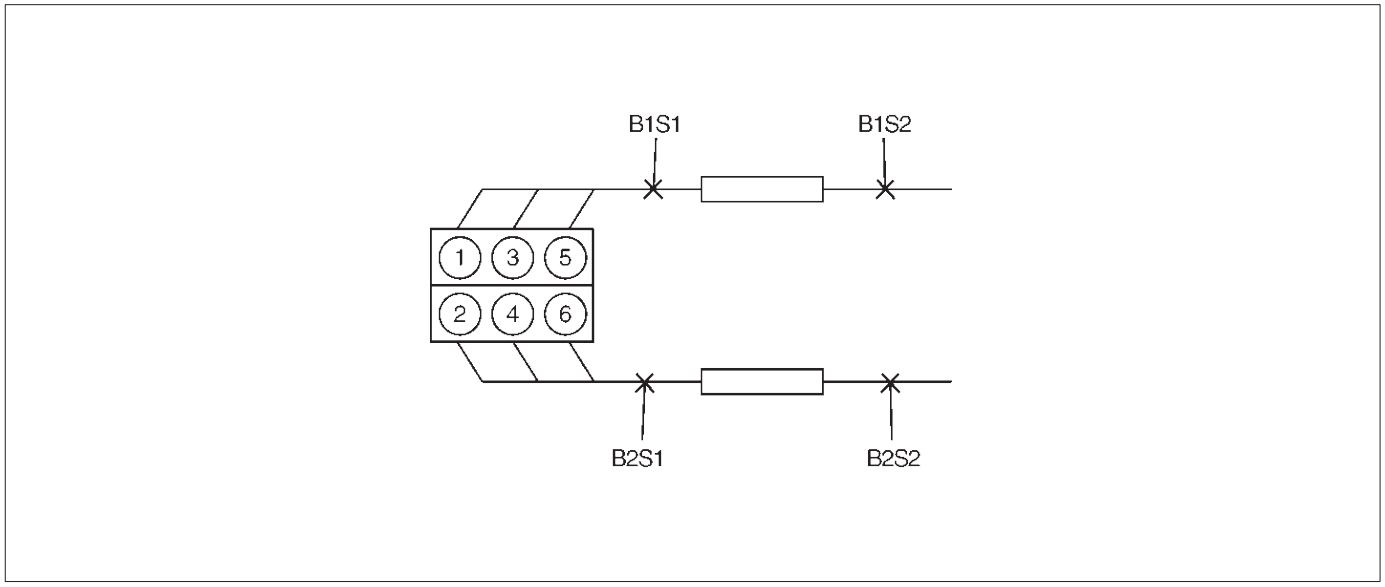
# DTC P0406 – EGR High Voltage

| 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", review and record Tech 2 Failure Records Data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0406 until the DTC P0406 test runs. Note the result.<br>Does the Tech 2 indicates DTC P0406 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Disconnect the EGR valve harness connector.<br>2. Inspect the EGR valve and connectors for damaged pin or terminals.<br>Were there any damaged pins or terminals? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | Is the action complete? |
| 5 | 1. Disconnect the EGR harness connector.<br>2. Ignition "ON".<br>3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (BLU/RED).<br>Did the DVM indicate the specified value? | 4–6 V | Go to *Step 8* | Go to *Step 6* |
| 6 | 1. Ignition "ON".<br>2. At the PCM connector, backprobe with a DVM at the 5 volt reference for the EGR valve.<br>Did the DVM indicate the specified value? | 4–6 V | Go to *Step 7* | Go to *Step 16* |
| 7 | Repair the open 5 volt reference circuit<br>Is the action complete? | — | Verify repair | — |
| 8 | 1. Ignition "OFF"<br>2. Disconnect the EGR harness.<br>3. Use a DVM to check for an resistance between 5 V reference and Sensor Ground at EGR sensor terminals.<br>NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve.<br>Was the measured resistance in range? | 5 to 5 KΩ | Go to *Step 9* | Go to *Step 15* |
| 9 | 1. Ignition "OFF".<br>2. Disconnect the EGR harness.<br>3. Use a DVM to check for an resistance between Sensor Ground and Signal Wire at EGR sensor terminal.<br>Is there an open circuit? | — | Go to *Step 15* | Go to *Step 10* |
| 10 | 1. Ignition "OFF".<br>2. Disconnect the EGR harness at PCM connector.<br>3. Use a DVM to check for shorted wire between S37 and F53.<br>Is there a shorted wire? | — | Go to *Step 14* | Go to *Step 11* |

# DTC P0406 – EGR High Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | 1. Ignition "ON".<br>2. Use a DVM to backprobe at terminal Connector of EGR valve for voltage.<br>Was measured voltage more than 4.8 V? | more than 4.8 V | Go to *Step 12* | Go to *Step 12* |
| 12 | 1. Ignition "ON".<br>2. Stay the EGR harness connected.<br>3. Check voltage by backprobing at PCM S37 terminal.<br>Was voltage more than 4.8 V? | 4.8 V | Go to *Step 16* | Go to *Step 13* |
| 13 | 1. Locate short circuit at EGR harness between BLU/RED to GRY/RED or GRY/RED to YEL, BLU/RED.<br>2. Replace EGR harness.<br>Is the action complete? | — | Verify repair | — |
| 14 | Replace EGR harness.<br>Is the action complete? | — | Verify repair | — |
| 15 | Replace the EGR valve.<br>Does DTC P1404 still fail "DTC test on the Tech 2? | — | Go to *Step 16* | Verify repair |
| 16 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0420 TWC System Low Efficiency Bank 1




T321075

## Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst 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 powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 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 Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the PCM detects a level of Bank 1 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0420 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop",
- Engine air load is below 99%.
- Engine coolant temperature is between 70˚C (158˚F) and 120˚C (248˚F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350˚C (662˚F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake Air Temperature is between –10˚C (14˚F) and 70˚C (158˚F).
- Throttle angle is less than 1.5%.
- Barometric Pressure is more than 72 kPa.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0420 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0420 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The "TWC Monitor Test Counter" displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice. A failed catalyst

will require three or more 50-sample tests to report a failure.

## Test Description

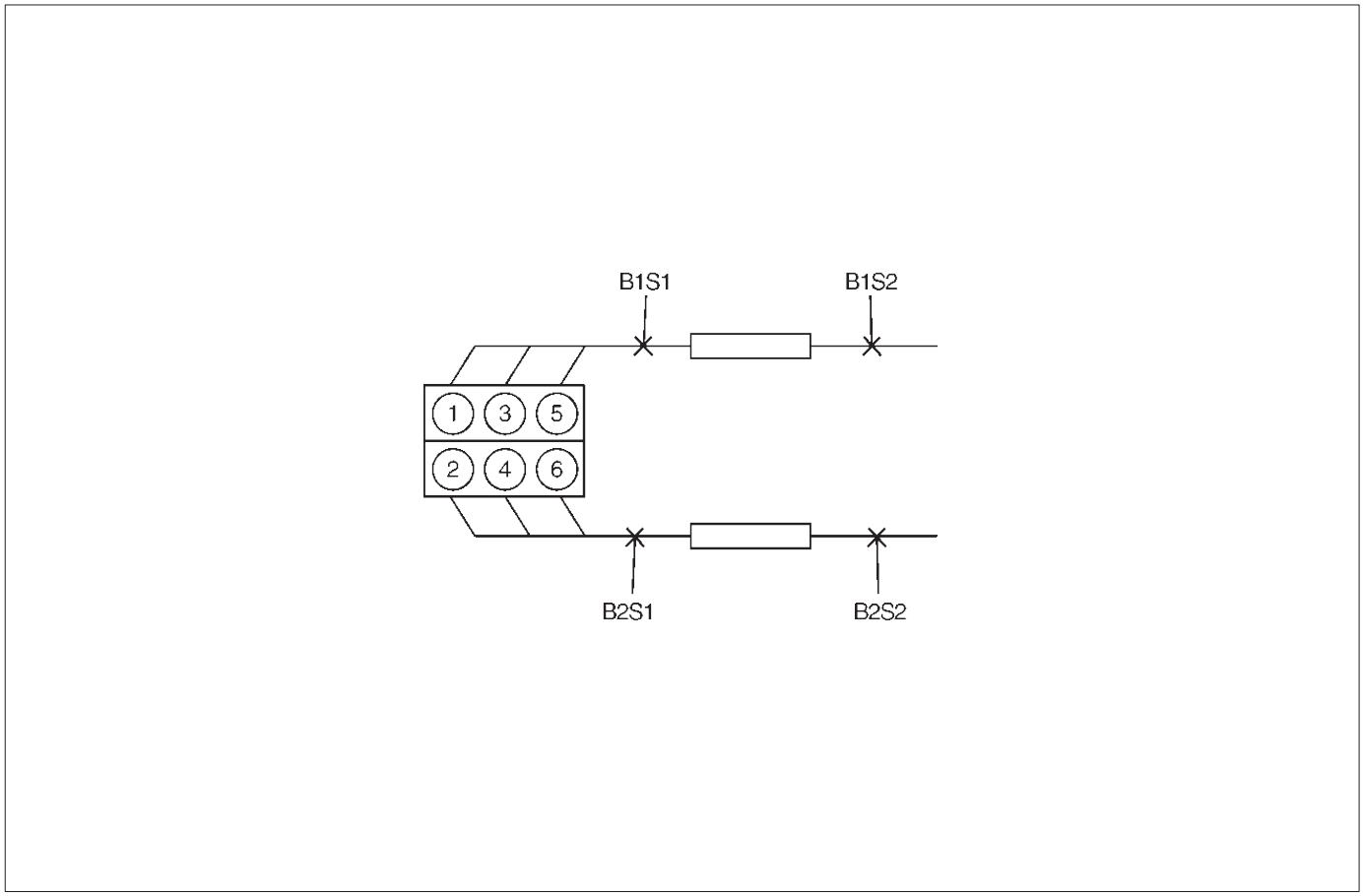
Number(s) below refer to the step number(s) on the Diagnostic Chart.

7. Difficulty completing the DTC P0420 “Status This Ign”, test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0420 “Status This Ign”, test, use the following procedure:
   - Allow the engine to warm up completely.
   - With the vehicle in “Park”, monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the DTC P0420 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     – Place the vehicle in “Park” or “Neutral”,
     – Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

# DTC P0420 – TWC System Low Efficiency Bank 1

| 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 | Are any other DTCs set (such as P0140)? | — | Diagnose other DTC(s) first | Go to *Step 3* |
| 3 | 1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following:<br>• dents<br>• severe discoloration caused by excessive temperatures<br>• holes<br>• internal rattle caused by damaged catalyst<br>2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part.<br>Did your inspection reveal a problem? | — | Go to *Step 6* | Go to *Step 4* |
| 4 | 1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware.<br>2. If a problem is found, repair as necessary.<br>Did your inspection reveal a problem? | — | Go to *Step 7* to verify repair | Go to *Step 5* |
| 5 | 1. Visually and physically inspect the Bank 1 HO2S 2.<br>2. Ensure that the Bank 1 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged.<br>3. If a problem is found, repair as necessary.<br>Did your inspection reveal a problem? | — | Go to *Step 7* to verify repair | Go to *Step 6* |
| 6 | Replace the three-way catalytic converter.<br>NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*).<br>Is the action complete? | — | Go to *Step 7* to verify repair | — |
| 7 | 1. Review and record the Tech 2 Failure Records data.<br>2. Clear DTC P0420.<br>3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value.<br>4. Run the engine to maintain the specified mass air flow range for at least 2 minutes.<br>5. Operate the vehicle to maintain DTC P0420 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions).<br>6. Using a Tech 2, monitor "DTC" info for DTC P0420 until the DTC P0420 test runs.<br>7. Note the test result.<br>Does the Tech 2 indicate DTC P0420 passed this ignition? | Engine coolant temp: greater than 60°C (140°F). Mass air flow: between 8 g/second and 50 g/second | Complete repair. If a driveability symptom still exists, refer to *Symptoms*. | Go to the *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0430 TWC System Low Efficiency Bank 2




T321075

## Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst 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 powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 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 Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the PCM detects a level of Bank 2 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0430 will be set.

## Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop".
- Engine air load is below 99%.
- Engine coolant temperature is between 70˚C (158˚F) and 120˚C (248˚F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Change in engine load is below 8%.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350˚C (662˚F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake air temperature is between –20˚C (4˚F) and 70˚C (158˚F).
- Throttle angle is less than 1.5%.
- Barometric Pressure is more than 72 kPa.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0430 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0430 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

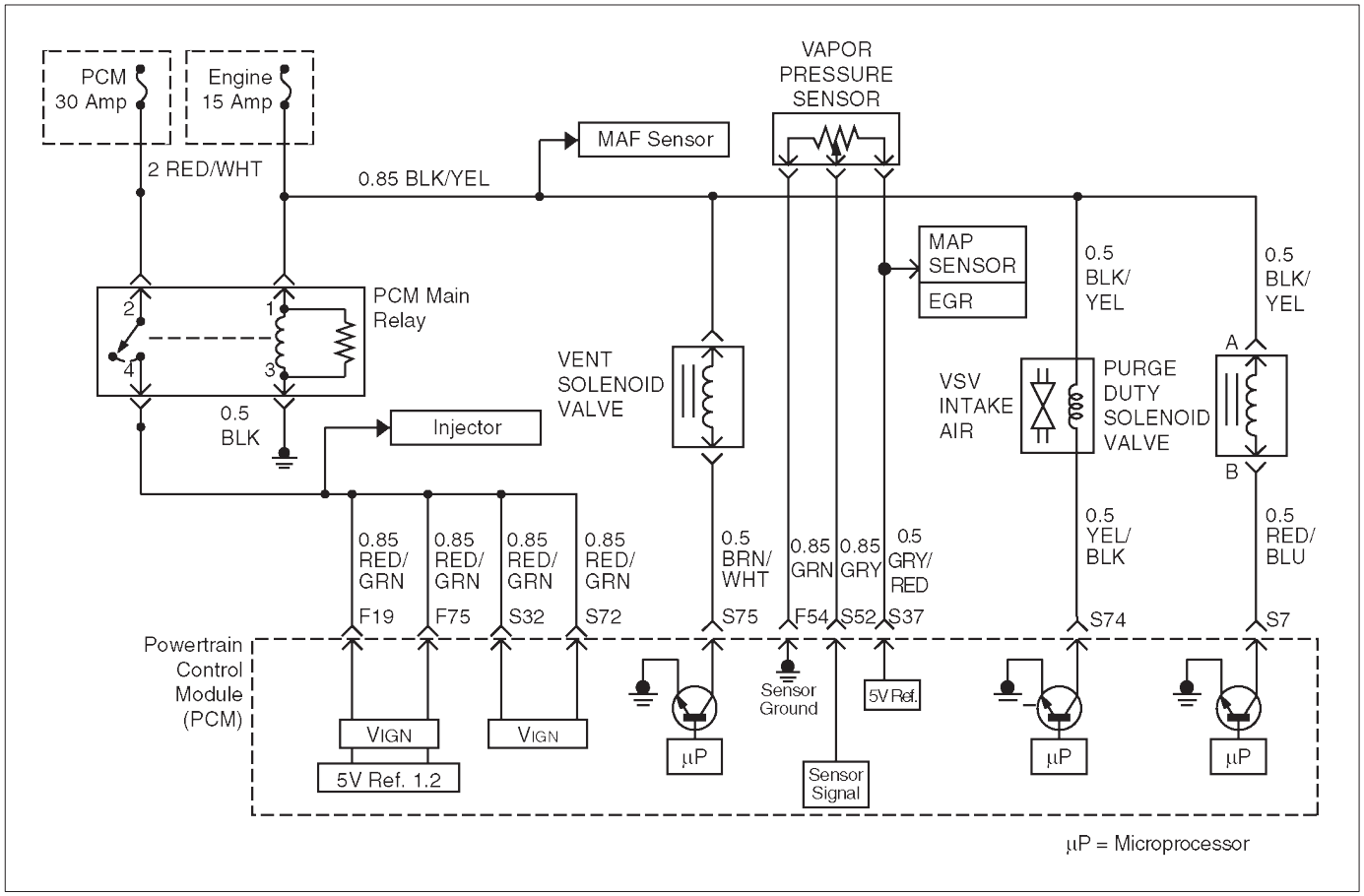
7. Difficulty completing the DTC P0430 “Status This Ign”, test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0430 “Status This Ign”, test, use the following procedure:
   - Allow the engine to warm up completely.
   - With the vehicle in “Park”, monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the DTC P0430 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     – Place the vehicle in “Park” or “Neutral”,
     – Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

The “TWC Monitor Test Counter” displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice.

# DTC P0430 – TWC System Low Efficiency Bank 2

| 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 | Are any other DTCs set (such as P0160)? | — | Diagnose other DTC(s) first | Go to *Step 3* |
| 3 | 1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following:<br>• dents<br>• severe discoloration caused by excessive temperatures<br>• holes<br>• internal rattle caused by damaged catalyst<br>2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part.<br>Did your inspection reveal a problem? | — | Go to *Step 6* | Go to *Step 4* |
| 4 | 1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware.<br>2. If a problem is found, repair as necessary.<br>Did your inspection reveal a problem? | — | Go to *Step 7* to verify repair | Go to *Step 5* |
| 5 | 1. Visually and physically inspect the Bank 2 HO2S 2.<br>2. Ensure that the Bank 2 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged.<br>3. If a problem is found, repair as necessary.<br>Did your inspection reveal a problem? | — | Go to *Step 7* to verify repair | Go to *Step 6* |
| 6 | Replace the three-way catalytic converter.<br>NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*).<br>Is the action complete? | — | Go to *Step 7* to verify repair | — |
| 7 | 1. Review and record the Tech 2 Failure Records data.<br>2. Clear DTC P0430.<br>3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value.<br>4. Run the engine to maintain the specified mass air flow range for at least 6 minutes.<br>5. Operate the vehicle to maintain DTC P0430 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions).<br>6. Using a Tech 2, monitor "DTC" info for DTC P0430 until the DTC P0430 test runs.<br>7. Note the test result.<br>Does the Tech 2 indicate DTC P0430 passed this ignition? | Engine coolant temp: greater than 70°C (158°F).<br>Mass air flow: between 2.5 g/second and 10 g/second | Complete repair. If a driveability symptom still exists, refer to *Symptoms*. | Go to the *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0440 EVAP System




060RY00398

## Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister purge duty solenoid valve
- Fuel tank (vapor) pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister vent valve (purge solenoid)

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON”, allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. If a sufficient vacuum level cannot be achieved, a large leak or a faulty EVAP canister purge solenoid is indicated. This can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister duty solenoid
- Open ignition feed circuit to the EVAP canister vent solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set DTC P0440.

## Conditions for Setting the DTC

- No TP sensor, IAT sensor, ECT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature is less than 32°C (90°F).
- Start-up engine coolant temperature is not more than 7°C (13°F) greater than start-up intake air temperature.
- Start-up intake air temperature is greater than 4°C (39°F) .
- Start-up intake air temperature is not more than 2°C (4°F) greater than start-up engine coolant temperature.
- Vehicle speed is less than 5 mph (8 km/h).
- Throttle position is greater than 3%.
- Minimal fuel slosh.
- BARO is greater than 70 kPa.
- The EVAP system is unable to achieve or maintain vacuum during the diagnostic test.

- Engine speed is less than 1200 RPM.
- Above conditions are present for 60 to 180 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" when the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0440 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0440 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- Poor connection at PCM – Inspect harness connectors 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 to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched, or plugged vacuum source, EVAP purge, or fuel tank vapor line–Verify that the lines are not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0440.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Determines whether or not the EVAP system can be sealed sufficiently to be pressurized. If not, the large leak must be located and corrected before continuing with diagnosis.
5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
8. Checks for a blocked EVAP canister purge solenoid. The PCM commands the EVAP canister purge solenoid "OFF" (open) and the vent solenoid "ON" (closed) with the Tech 2 "System Perf", EVAP output control function activated. Any pressure in the system should be released through the EVAP canister purge solenoid within a few seconds when "System Perf", is activated.
9. Ensures that sufficient source vacuum is present at the EVAP canister purge solenoid.

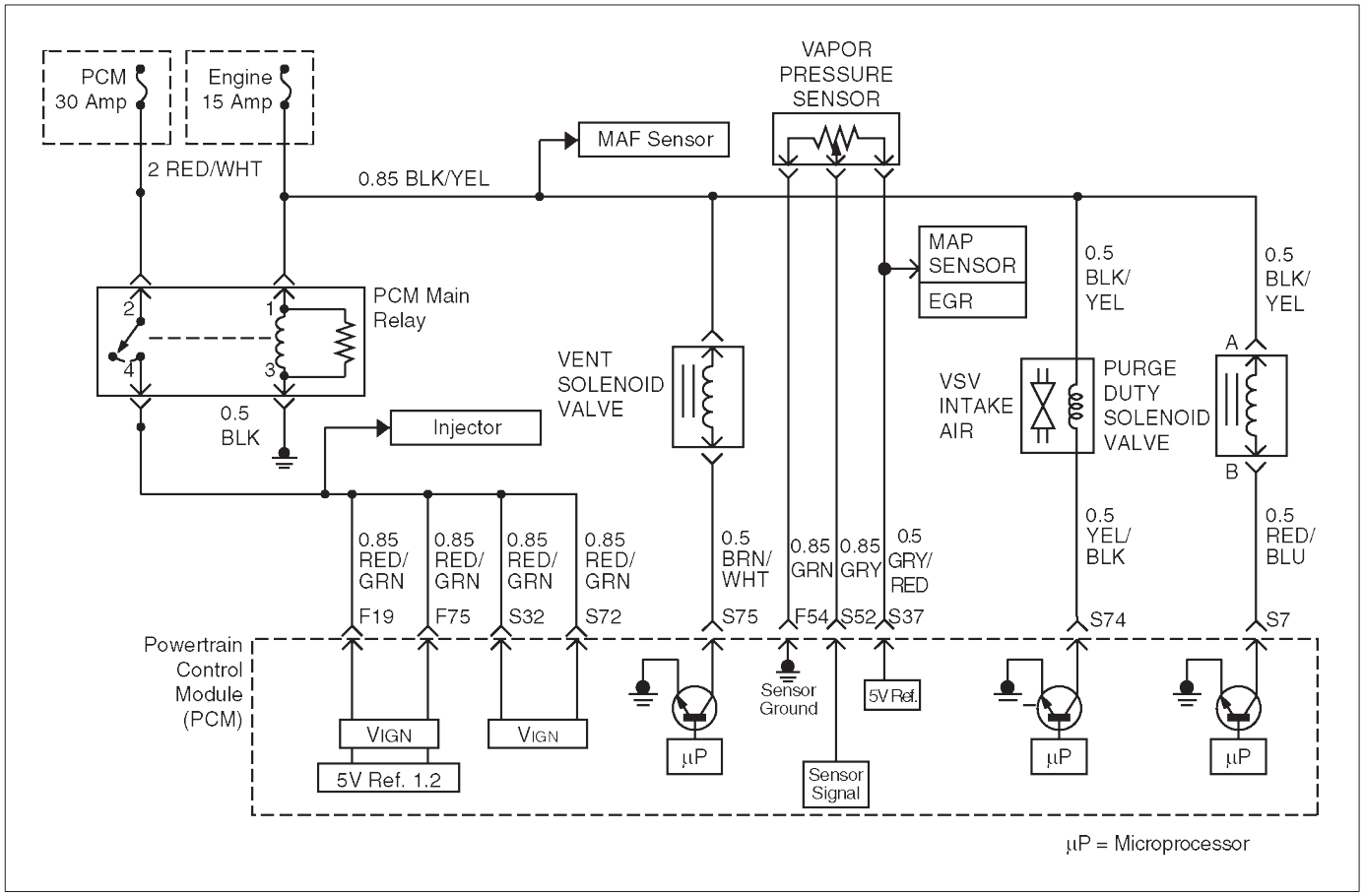
# DTC P0440 – EVAP System

| 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 | Is DTC P0452 or P0453 also set? | — | Go to *other DTC first* | Go to *Step 3* |
| 3 | 1. Ignition "OFF".<br>2. Remove the fuel cap.<br>3. Ignition "ON".<br>4. Observe "Fuel Tank Pressure" on the Tech 2.<br>Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value? | 1.51 V | Go to *Step 4* | Go to *DTC P0452* or *DTC P0453* |
| 4 | 1. Replace the fuel cap.<br>2. Engine is running.<br>3. Observe "Fuel Tank Vacuum" on the Tech 2.<br>Does Tech 2 indicate "Fuel Tank Vacuum" at the specified value? | 1.47–1.51 V | Go to *Step 7* | Go to *Step 6* |

# DTC P0440 – EVAP System (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | Ignition "OFF".<br>1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister.<br>2. Block the canister fitting for the fuel tank vapor line.<br>3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line.<br>4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed).<br>5. Attempt to apply vacuum to the EVAP canister.<br>Observe "Fuel tank pressure" on the Tech 2.<br>Does the Tech 2 indicate "Fuel tank pressure" at the specified value? | 1.47–1.51 V | Go to *Step 8* | Go to *Step 7* |
| 6 | 1. Visually/physically check for the following conditions:<br>● Restricted fuel tank vapor line.<br>● Restricted EVAP purge line.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *DTC P0452* or *DTC P0453* |
| 7 | 1. Visually/physically check for the following conditions:<br>● Vent hose disconnected or the damaged.<br>● EVAP canister damaged.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 8 | 1. Visually/physically check for the following conditions:<br>● Missing or faulty fuel cap.<br>● Disconnected or leaking fuel tank vapor line.<br>● Disconnected or damaged EVAP purge line.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 9 | Replace the EVAP canister purge solenoid.<br>Is the action complete? | — | Verify repair | — |
| 10 | Locate and repair cause of no source vacuum to the EVAP canister purge solenoid.<br>Is the action complete? | — | Verify repair | — |
| 11 | Replace the EVAP canister vent solenoid.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0442 EVAP System Small Leak Detected




060RY00398

## Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank (vapor) pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON”, allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned “OFF”, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

## Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- BARO is more than 70 kPa.
- Engine speed is less than 1200 RPM.
- Fuel level is between 15% and 85%.
- Vehicle speed is less than 5 mph (8 km/h).
- The DTC P0440 diagnostic test has passed.
- A vacuum decay condition, indicating a small leak, is detected during the diagnostic test.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0442 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0442 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.
- Poor connection at PCM – Inspect harness connectors 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 to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0442.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

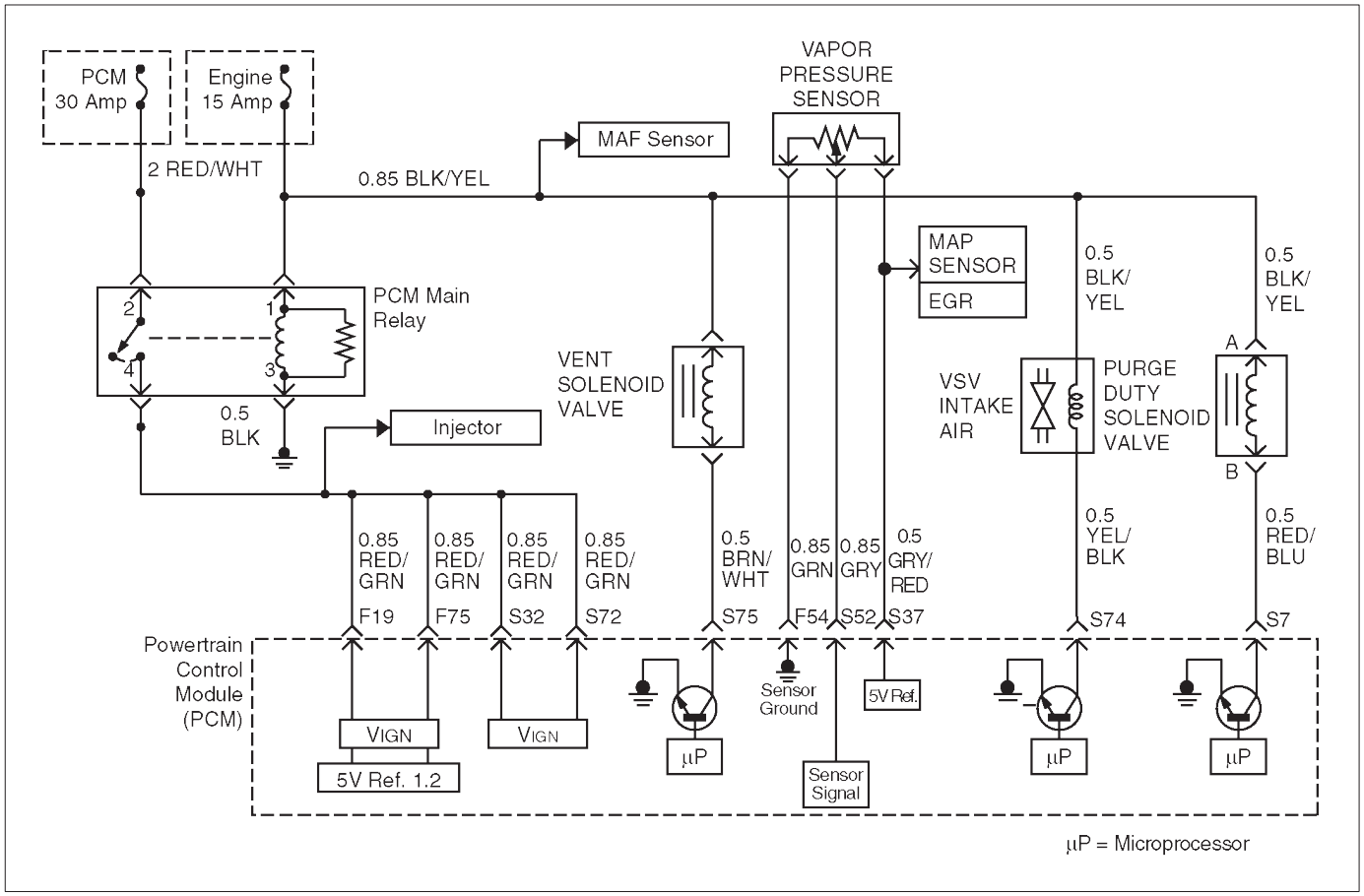
# DTC P0442 – EVAP System Leak Detected

| 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 “OFF”.<br>2. Remove the fuel cap.<br>3. Ignition “ON”.<br>4. Observe “Fuel Tank Pressure” on the Tech 2.<br>Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value? | 1.51V | Go to *Step 3* | Go to *Fuel Tank Pressure System* |
| 3 | **IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on EVAP pressure/purge cart J 41413 (refer to tool operating instructions).<br>1. Replace the fuel cap.<br>2. Capture Failure Records data for DTC P0442 and clear DTCs.<br>3. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port.<br>4. Using the Tech 2, command the EVAP canister vent solenoid “ON” (closed).<br>5. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value.<br>6. Observe “Fuel Tank Pressure” on the Tech 2.<br>Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value? | 1.47V | Go to *Step 4* | Go to *Fuel Tank Pressure System* |
| 4 | 1. Ignition “ON”, engine idling.<br>2. Using the Tech 2, command the EVAP canister vent solenoid “ON” (closed).<br>3. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to 15 in. $H_2O$.<br>4. Switch the rotary switch on the cart to “HOLD” and observe the EVAP pressure gauge.<br>Does the pressure decrease to less than the specified value within 2 minutes? | 1.47 – 1.51V | Go to *Step 5* | Refer to *Diagnostic Aids* |

# DTC P0442 – EVAP System Leak Detected (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | 1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister.<br>2. Block the canister fitting for the fuel tank vapor line.<br>3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line.<br>4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed).<br>5. Attempt to apply vacuum to the EVAP canister.<br>Can the vacuum be maintained at the specific value? | 1.46V | Go to *Step 8* | Go to *Step 6* |
| 6 | 1. Visually/physically check for the following conditions:<br>● Vent hose disconnected or damaged.<br>● EVAP canister damaged.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 7* |
| 7 | Replace the EVAP canister vent solenoid.<br>Is the action complete? | — | Go to *Step 10* | — |
| 8 | 1. Visually/physically check for the following conditions:<br>● Missing or faulty fuel cap.<br>● Disconnected or leaking fuel tank vapor line.<br>● Disconnected or damaged EVAP purge line.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 9* |
| 9 | 1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed).<br>2. With the cart connected to the EVAP service port, continuously attempt to pressurize the EVAP system by leaving the cart control knob in the pressurize position.<br>3. Using ultrasonic leak detector J 41416, locate and repair leak in EVAP system. (It may be necessary to partially lower the fuel tank to examine the connections on top of the tank.)<br>Is the action complete? | — | Go to *Step 10* | — |
| 10 | 1. Ignition "ON", engine not running.<br>2. Using the Tech 2, command the EVAP canister vent solenoid "ON" (closed).<br>3. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. $H_2O$.<br>4. Switch the rotary switch on the cart to "HOLD" and observe the EVAP pressure gauge.<br>Does the pressure decrease to less than the specified value within 2 minutes? | 2.14V | Go to *Step 2* | Verify repair |

# Diagnostic Trouble Code (DTC) P0444 EVAP Purge Control Circuit Open




060RY00398

## Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM).The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid is “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0444 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0444 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the EVAP purge solenoid display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

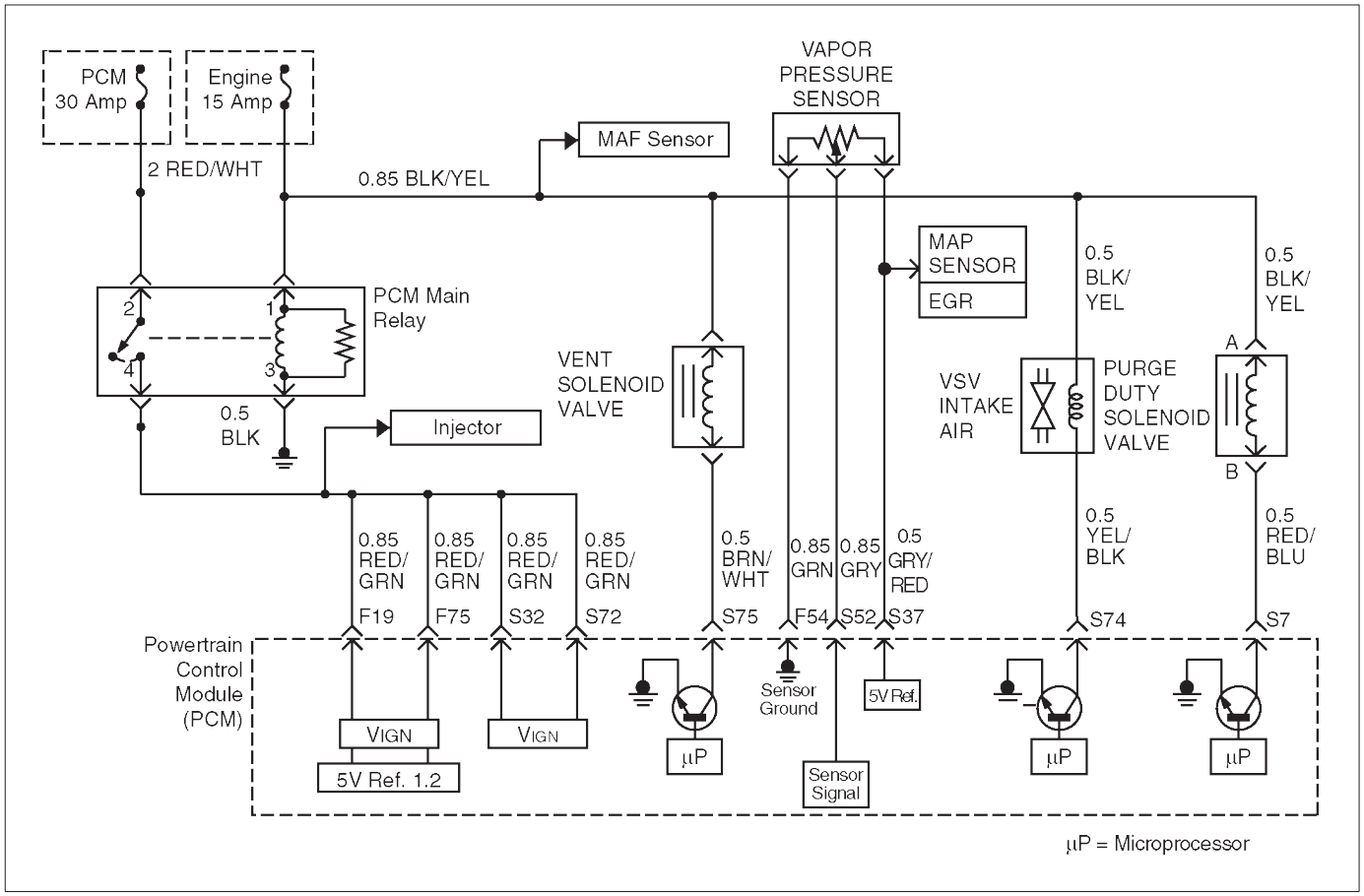
  A change in the display will indicate the location of the fault. If DTC P0444 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0444 Diagnostic Chart may isolate the cause of the fault.

# DTC P0444 EVAP Purge Control Circuit Open

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Install the Tech 2.<br>2. Ignition is “ON”,<br>3. Engine is “ON” and operate the accelerator pedal for 3 or 4 times.<br>4. Observe the EVAP purge solenoid reading on the Tech 2.<br>Is the EVAP purge solenoid reading near the specified value? | More than 1% | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Check the power supply circuit.<br>1. Ignition is “OFF”.<br>2. Disconnect the canister purge solenoid valve.<br>3. Ignition is “ON”.<br>4. Using a DVM, measure at the EVAP purge solenoid connector between ground and voltage supply.<br>Was the measurement near the specified value? | Battery voltage | Go to *Step 4* | Go to *Step 5* |
| 4 | Check the signal circuit for the EVAP purge solenoid.<br>1. Ignition is “OFF”.<br>2. Disconnect the canister purge solenoid valve.<br>3. Disconnect the PCM.<br>4. Check the circuit between EVAP purge solenoid connector and PCM connector.<br>Is the problem found? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 6 | Check the canister purge solenoid valve. Using a DVM, measure resistance for purge solenoid valve connector terminal.<br>Is the purge solenoid valve resistance within the specified values? | 25–30 Ω (at 68˚F{20˚C}) | Go to *Step 8* | Go to *Step 7* |
| 7 | Replace the canister purge solenoid valve.<br>Is the action complete? | — | Verify repair | — |
| 8 | Replace the<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures*.<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0445 EVAP Purge Control Circuit Short




060RY00398

## Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM). The PCM monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid is “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0445 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0445 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the EVAP purge solenoid display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

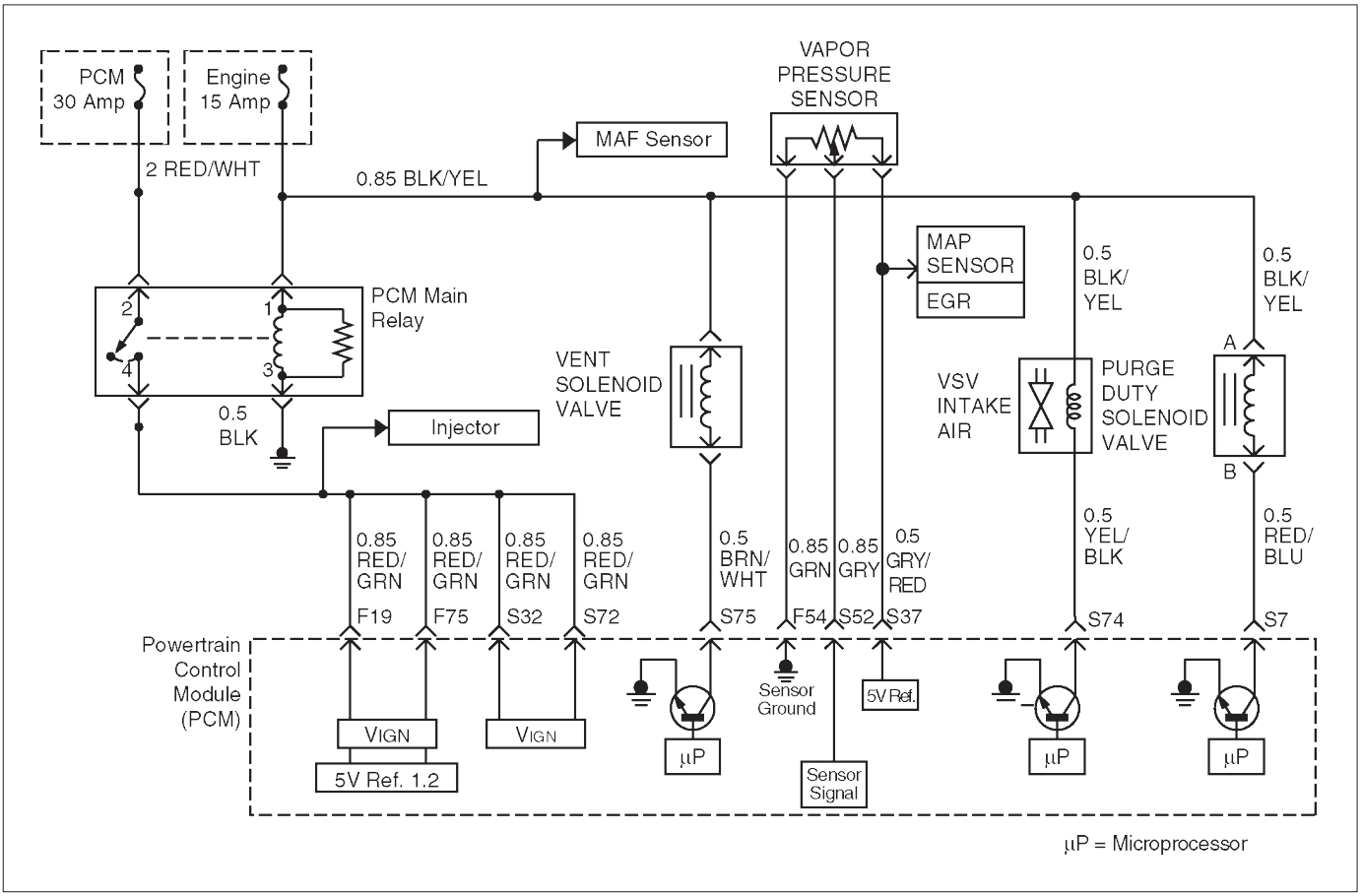
  A change in the display will indicate the location of the fault. If DTC P0445 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0445 Diagnostic Chart may isolate the cause of the fault.

# DTC P0445 EVAP Purge Control Circuit Short

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Install the Tech 2.<br>2. Ignition is “ON”,<br>3. Observe the EVAP purge solenoid reading on the Tech 2.<br>Is the EVAP purge solenoid reading near the specified value? | 0% | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Check the signal circuit for canister purge solenoid valve.<br>1. Ignition is “OFF”.<br>2. Disconnect the canister purge solenoid valve.<br>3. Disconnect the PCM.<br>4. Check the circuit between EVAP purge solenoid connector and PCM connector.<br>Is the problem found? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the circuit as necessary. Is the action complete? | — | Verify repair | — |
| 5 | Check the canister purge solenoid valve.<br>Using a DVM, measure resistance for purge solenoid valve connector terminal.<br>Is the purge solenoid valve resistance within the specified values? | 25–30 (at 68˚F{20˚C}) | Go to *Step 7* | Go to *Step 6* |
| 6 | Replace the canister purge solenoid valve.<br>Is the action complete? | — | Verify repair | — |
| 7 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0446 EVAP Canister Vent Control Malfunction




060RY00398

## Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank (vapor) pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

An incorrect fuel tank pressure sensor signal is detected by monitoring fuel tank pressure when the key is first turned “ON” during a cold start. If the fuel tank pressure signal is out of range, DTC P0446 will set. A restricted or blocked EVAP vent path is detected by monitoring fuel tank pressure during normal operation (EVAP canister vent solenoid open, EVAP canister purge solenoid normal). With the EVAP canister vent solenoid open, vacuum level in the system should be very low unless the vent path is blocked. A blockage can be caused by the following condition:

- Faulty EVAP canister vent solenoid (stuck closed).
- Plugged, kinked or pinched vent hose.
- Shorted EVAP canister vent solenoid driver circuit.
- Plugged evaporative canister.

If any of these conditions are present, DTC P0446 will set.

## Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature and start-up intake air temperature are more than 4˚C (39˚F) but less than 34˚C(93˚F).
- Start-up engine coolant temperature is not more than 7˚C (13˚F) greater than start-up intake air temperature.
- Fuel tank level is between 15% and 85%.
- BARO is greater than 70 kPa.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0446 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0446 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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 to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched, or plugged vent hose–Verify that the vent hose between the EVAP canister and EVAP canister vent solenoid is not restricted.

  Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. If a vent solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0446.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
6. Checks for a blocked EVAP canister.

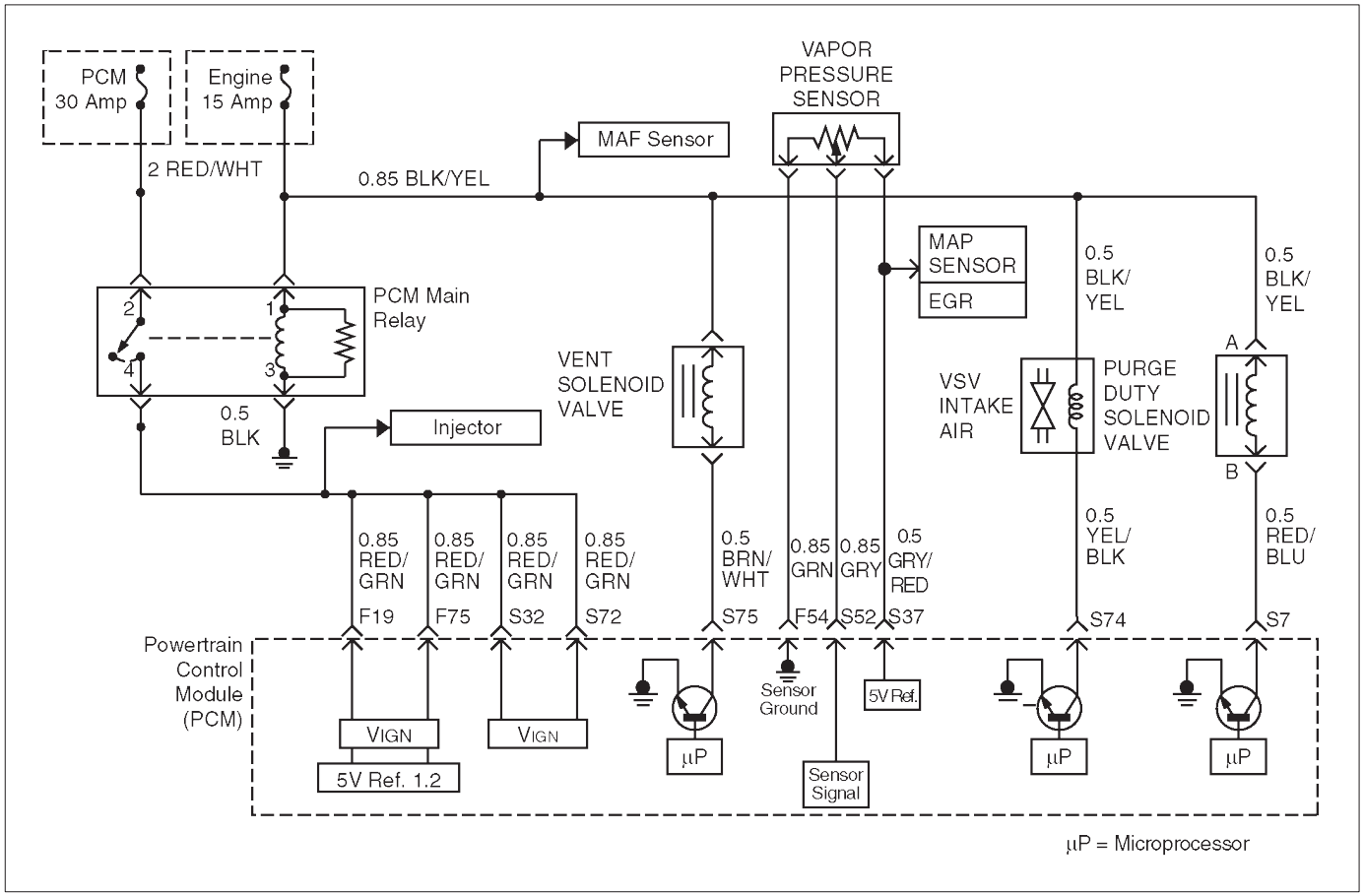
# DTC P0446– EVAP Canister Vent Control Malfunction

| 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."<br>2. Capture Failure Records data for DTC P0446 and clear DTCs.<br>3. Ignition "OFF."<br>4. Remove the fuel cap.<br>5. Ignition "ON."<br>6. Observe "Fuel Tank Pressure" on the Tech 2.<br>Does Tech 2 indicate "Fuel Tank Pressure" at the specified value? | 1.51V | Go to *Step 3* | Go to *Fuel Tank Pressure System* |
| 3 | **IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on the EVAP pressure/purge cart J 41413 (refer to tool operating instructions).<br>7. Replace the fuel cap.<br>8. Using the Tech 2, command the EVAP vent solenoid "ON" (closed).<br>9. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port.<br>10. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value.<br>11. Observe "Fuel Tank Pressure" on the Tech 2.<br>Does Tech 2 indicate "Fuel Tank Pressure" at the specified value? | 1.52 – 1.69V | Go to *Step 4* | Go to *Fuel Tank Pressure System* |
| 4 | 1. Maintain the EVAP pressure at 5 in. at $H_2O$.<br>2. Using Tech 2, command the EVAP vent solenoid "OFF" (open) while observing the EVAP pressure gauge on the cart J 41413.<br>Does the EVAP pressure return to the specified value within 5 seconds? | 0 in. $H_2O$ | Refer to *Diagnostic Aids* | Go to *Step 5* |

# DTC P0446– EVAP Canister Vent Control Malfunction (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | 1. Disconnect the large vent hose (marked "AIR") from the EVAP canister.<br>2. Switch the rotary switch on the cart J 41413 to "PURGE."<br>3. Ignition "ON," engine idling at normal operating temperature.<br>4. Observe vacuum gauge for 5 seconds while holding the engine speed at 2500 RPM.<br>Does the vacuum remain less than the specified value? | 30 in. $H_2O$ | Go to *Step 6* | Go to *Step 8* |
| 6 | 1. Inspect the vent hose between the EVAP canister and the EVAP canister vent solenoid for kinks, pinched areas, or any other form of blockage.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 7* |
| 7 | Replace the EVAP canister vent solenoid.<br>Is the action complete? | — | Go to *Step 9* | — |
| 8 | Replace the EVAP canister.<br>Is the action complete? | — | Go to *Step 9* | — |
| 9 | 1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed).<br>2. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. $H_2O$.<br>3. Switch the rotary switch on cart J 41413 to "HOLD."<br>4. Using the Tech 2, command the EVAP canister vent solenoid "OFF" (open) while observing the EVAP pressure gauge on cart J 41413.<br>Does the EVAP pressure return to the specified value within 5 seconds? | 0 in. $H^2O$ | Verify repair | Go to *Step 2* |

# Diagnostic Trouble Code (DTC)
# P0447 EVAP Vent Solenoid Circuit Open




060RY00398

## Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM).The PCM monitors vacuum level via the fuel tank pressure sensor input.
At an appropriate time, the EVAP canister vent solenoid is “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0447 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0447 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the EVAP vent valve display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

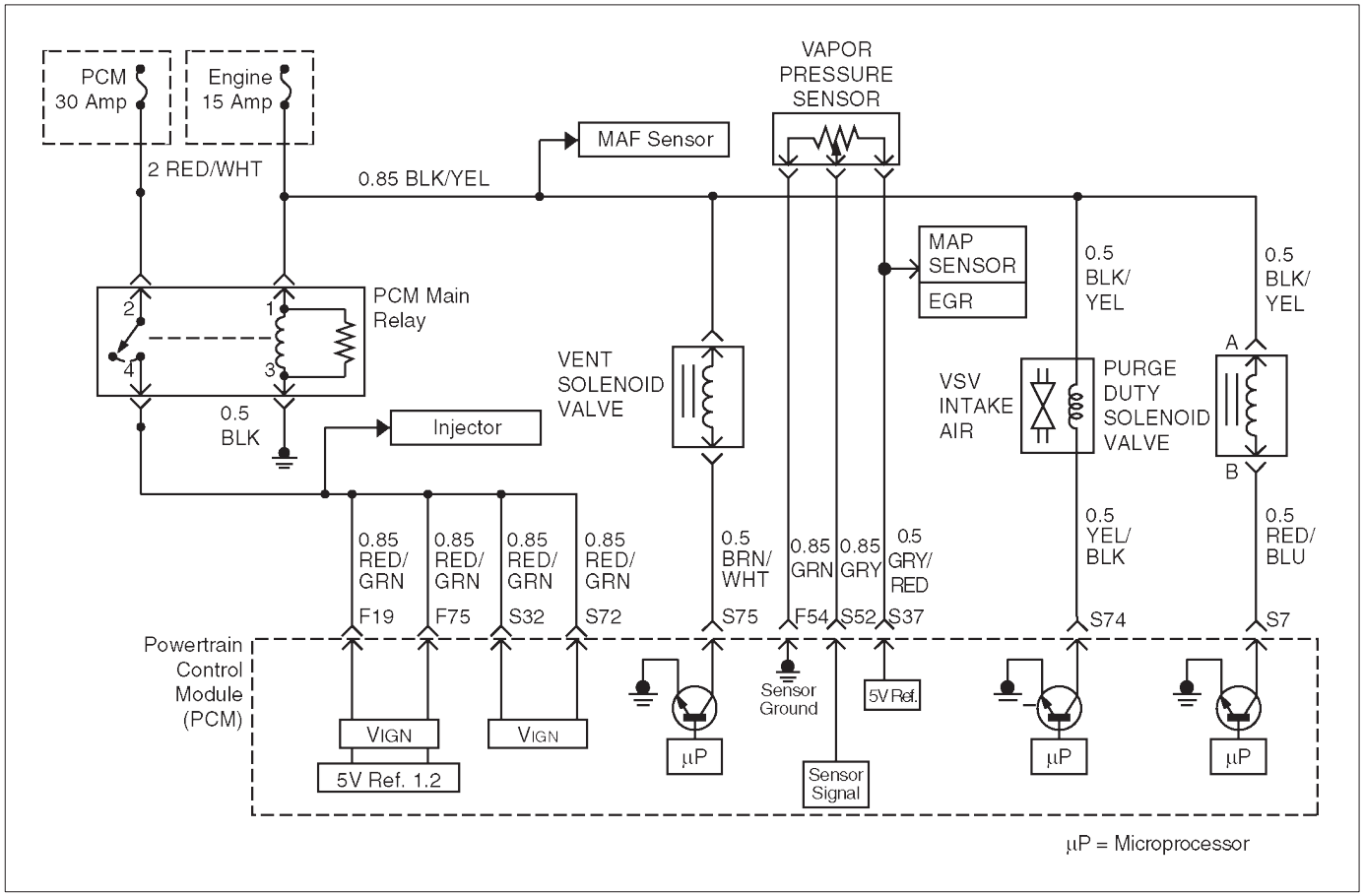
  A change in the display will indicate the location of the fault. If DTC P0447 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0447 Diagnostic Chart may isolate the cause of the fault.

# DTC P0447 EVAP Vent Solenoid Circuit Open

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Install the Tech 2.<br>2. Ignition is “ON”,<br>3. Engine is “ON”and operate the acceleration pedal for 3 or 4 times.<br>4. Observe the EVAP vent solenoid reading on the Tech 2.<br>Is the EVAP vent solenoid reading to “ON”? | — | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Check the power supply circuit.<br>1. Ignition is “OFF”.<br>2. Disconnect the canister vent solenoid valve.<br>3. Ignition is “ON”.<br>4. Using a DVM, measure at the EVAP vent solenoid connector between ground and voltage supply.<br>Was the measurement near the specified value? | Battery voltage | Go to *Step 4* | Go to *Step 5* |
| 4 | Check the signal circuit for vent solenoid valve.<br>1. Ignition is “OFF”.<br>2. Disconnect the canister vent solenoid valve.<br>3. Disconnect the PCM.<br>4. Check the circuit between EVAP vent solenoid connector and PCM connector.<br>Is the problem found? | — | Go to *Step 5* | — |
| 5 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 6 | Check the canister vent solenoid valve.<br>Using a DVM, measure resistance for vent solenoid valve connector terminal.<br>Is the vent solenoid valve resistance within the specified values? | — | 21.8-28.5Ω (at 68˚F{20˚C}) | — |
| 7 | Replace the canister vent solenoid valve.<br>Is the action complete? | — | Verify repair | — |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0448 EVAP Vent solenoid Circuit Short




060RY00398

## Circuit Description

The canister purge solenoid valve is controlled by the Power Train Control Module (PCM). The PCM monitors vacuum level via the fuel tank pressure sensor input.
At an appropriate time, the EVAP canister vent solenoid is "ON," allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system.

## Conditions for setting the DTC

- The Ignition is "ON".
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0448 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0448 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the EVAP vent valve display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

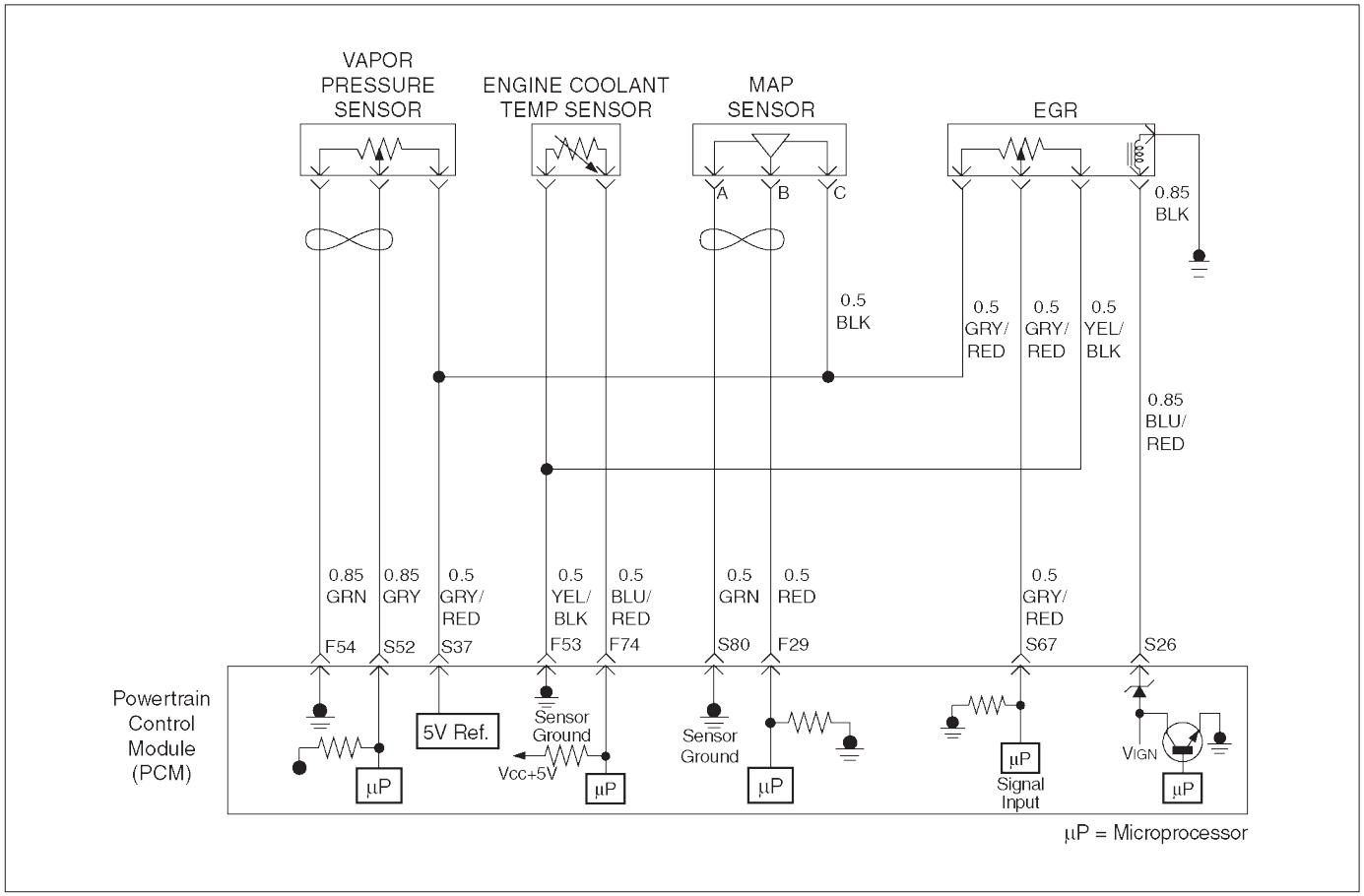
  A change in the display will indicate the location of the fault. If DTC P0448 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0448 Diagnostic Chart may isolate the cause of the fault.

# DTC P0448 EVAP Vent Solenoid Circuit Short

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Install the Tech 2.<br>2. Ignition is “ON”,<br>3. Observe the EVAP vent solenoid reading on the Tech 2.<br>Is the EVAP vent solenoid reading near the specified value? | 0% | Refer to *Diagnostic Aids* | Go to *Step 3* |
| 3 | Check the signal circuit for canister vent solenoid valve.<br>1. Ignition is “OFF”.<br>2. Disconnect the canister vent solenoid valve.<br>3. Disconnect the PCM.<br>4. Check the circuit between EVAP vent solenoid connector and PCM connector.<br>Is the problem found? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 5 | Check the canister vent solenoid valve. Using a DVM, measure resistance for purge solenoid valve connector terminal.<br>Is the vent solenoid valve resistance within the specified values? | 21.8-28.5Ω (at 68˚F{20˚C}) | Go to *Step 7* | Go to *Step 6* |
| 6 | Replace the canister vent solenoid valve.<br>Is the action complete? | — | Verify repair | — |
| 7 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin.*<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0452 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) Low Voltage




060R200050

## Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evap system. When the tank pressure output indicates low voltage, PCM will set DTC P0452.

## Conditions for Setting the DTC

- Tank sensor output is less than 0.2 volts for 12.5 sec.
- 100 test failures within a 200 tests.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Open circuit of 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452, and P0107 at the same time.
- Open circuit or short circuit to ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452 and P0107 at the same time.
- Tank fuel pressure sensor malfunction may cause P0452.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

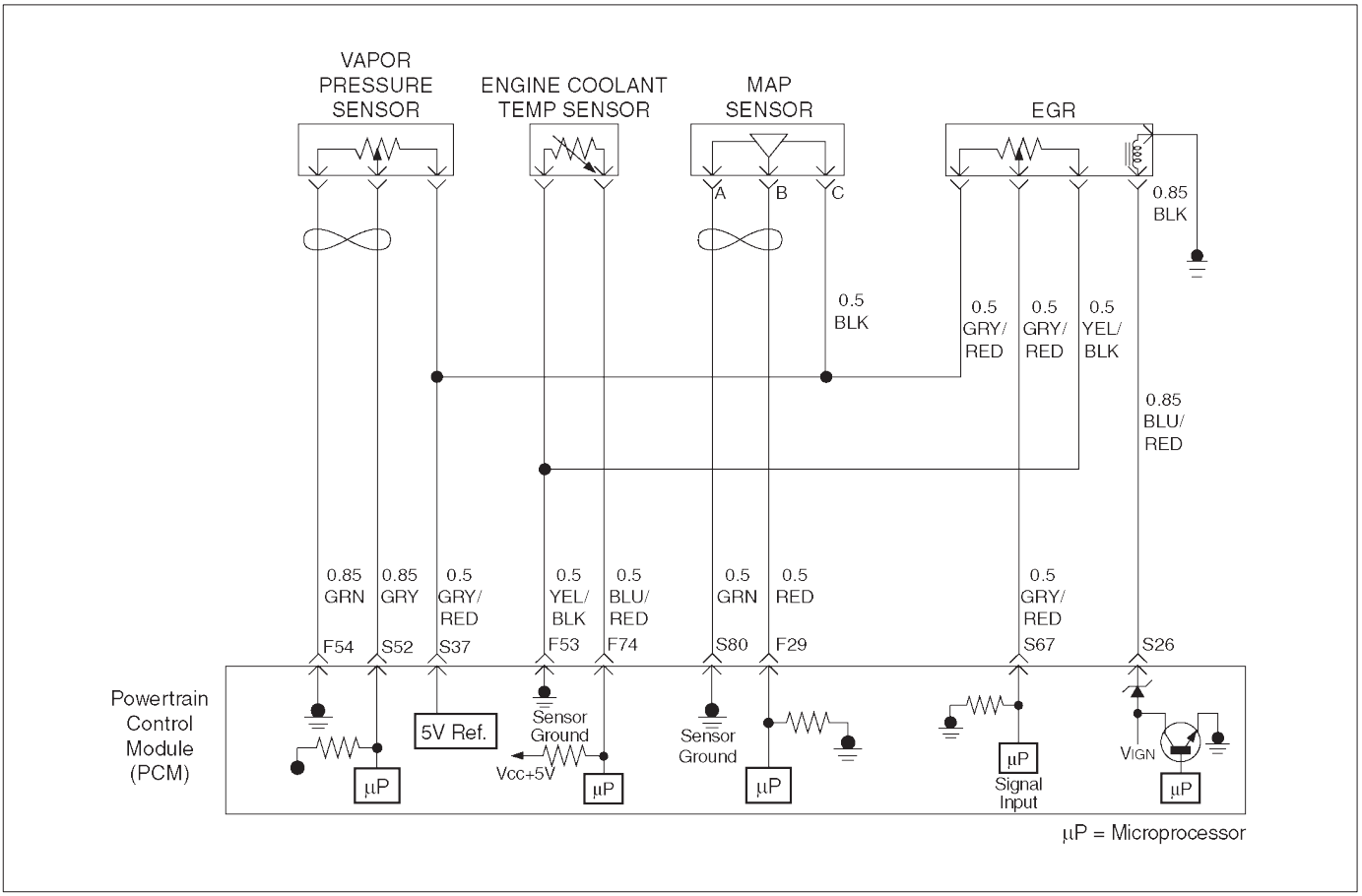
# DTC P0452 – Tank Pressure Sensor Low Voltage

| 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", review and record Tech 2 Failure Records Data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC" info for DTC P0452 until the DTC P0452 test runs. Note the result.<br>Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition? | — | P0452/P0107 turn on<br>Go to *Step 3*<br>P0452 turns on<br>Go to *Step 6* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition "OFF".<br>2. Disconnect connector at the PCM.<br>3. Ignition "ON".<br>4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals.<br>Was the voltage in range? | 4–6 V | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Ignition "OFF".<br>2. Connect the PCM connector to the PCM.<br>3. Backprobe with a DVM at fuel tank pressure sensor between 5 V reference terminal and sensor ground terminal.<br>Was the voltage within range? | 4–6 V | For P0452 go to *Step 5* and for P0107, go to diagnosis section. | Go to *Step 5* |
| 5 | 1. Locate open wiring of 5 volt reference circuit from the PCM to fuel tank pressure sensor.<br>2. Repair wiring harness.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition "ON"<br>2. At the PCM connector, backprobe with a DVM at the sensor output for the voltage.<br>Was voltage within the range? | Less than 0.2 V | Go to *Step 7* | Go to *Step 10* |
| 7 | At the sensor output terminal, backprobe with a DVM at the sensor output<br>Was voltage within range? | Less than 0.2 V | Go to *Step 9* | Go to *Step 8* |
| 8 | 1. Locate open circuit or short circuit to ground line.<br>2. Repair the harness.<br>Is the action complete? | — | Verify repair | — |

# DTC P0452 – Tank Pressure Sensor Low Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | 1. Locate open circuit or short circuit to ground line.<br>2. Repair the harness.<br>Is the action complete? | — | Verify repair | — |
| 10 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0453 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) High Voltage




060R200050

## Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evap system. When the tank pressure output indicates high voltage , PCM will set DTC P0453.

## Conditions for Setting the DTC

- Tank sensor output is more than 4.9 volts for 12.5 sec.
- 100 test failures within a 200 tests.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0453 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- Info function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Open circuit of sensor ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453, and P0108 at the same time.
- Open circuit or short circuit to 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453 and P0108 at the same time.
- Tank fuel pressure sensor malfunction may cause P0453.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

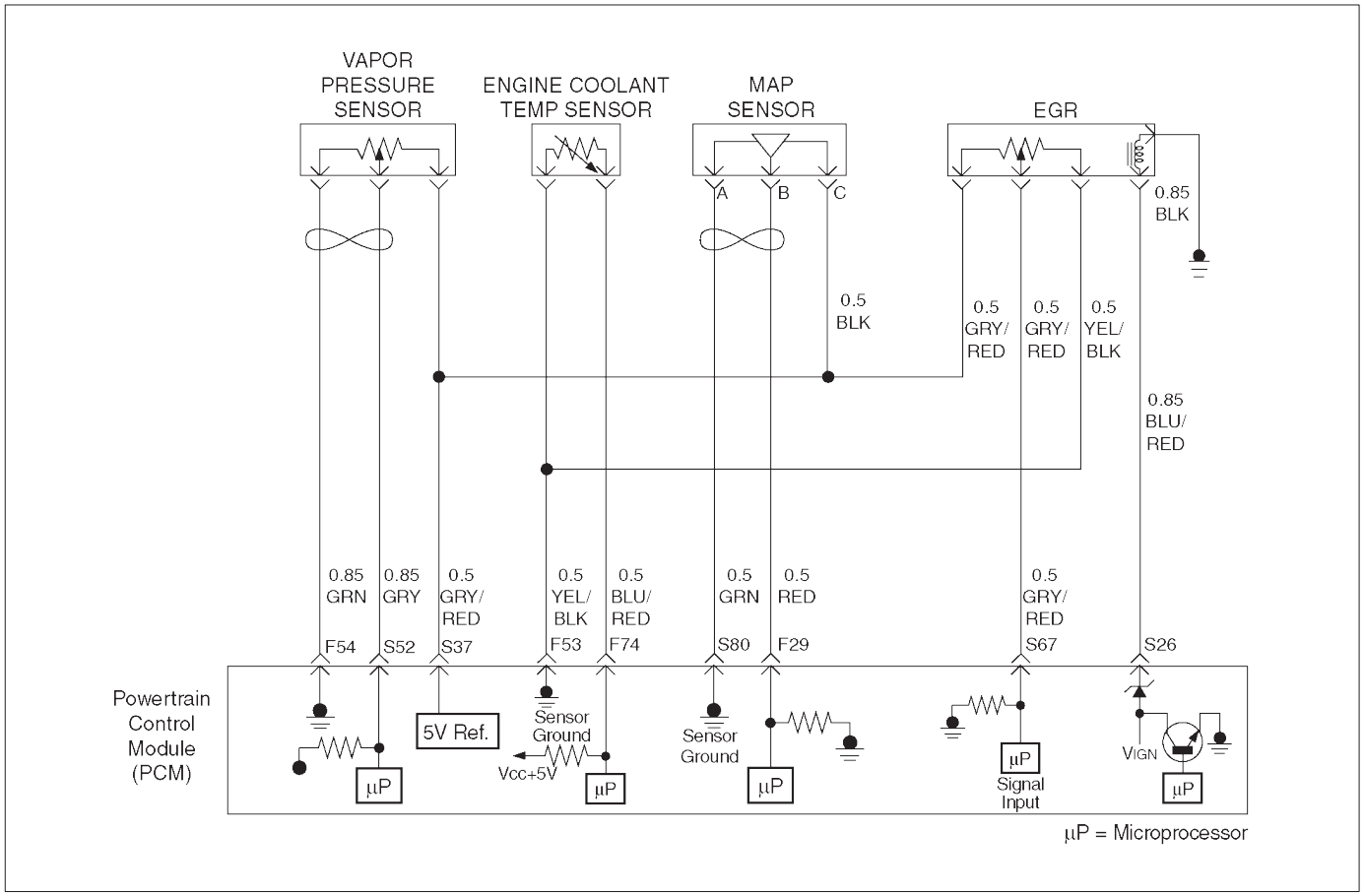
# DTC P0453 – Fuel Tank Pressure Sensor High Voltage

| 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”, review and record Tech 2 Failure Records Data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor “DTC” info for DTC P0453 until the DTC P0453 test runs. Note the result.<br>Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition? | — | P0453/P0108 turn on<br>Go to *Step 3*<br>P0452 turns on<br>Go to *Step 6* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect connector at the PCM.<br>3. Ignition “ON”.<br>4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals.<br>Was the voltage in range of voltage? | 4–6 V | Go to *Step 4* | Go to *Step 10* |
| 4 | 1. Ignition “OFF”.<br>2. Connect the PCM connector to the PCM.<br>3. Disconnect sensor harness at fuel pressure sensor. Measure voltage with a DVM at the end of the tank pressure wiring between 5 V reference terminal and sensor ground terminal.<br>Was the voltage within range? | 4–6 V | For P0453 go to *Step 6* and for P0108, go to diagnosis section. | Go to *Step 5* |
| 5 | 1. Locate open wiring of ground line from the PCM to fuel tank pressure sensor.<br>2. Repair wiring harness.<br>Is the action complete? | — | Verify repair | — |
| 6 | 1. Ignition “ON”.<br>2. At the PCM connector, backprobe with a DVM at the sensor output for the voltage.<br>Was voltage within range? | More than 4.9 V | Go to *Step 7* | Go to *Step 10* |
| 7 | At the sensor output terminal, backprobe with a DVM at the sensor output.<br>Was the voltage within range? | More than 4.9 V | Go to *Step 9* | Go to *Step 8* |
| 8 | 1. Locate open circuit or short circuit to ground line.<br>2. Repair the harness.<br>Is the action complete? | — | Verify repair | — |

## DTC P0453 – Fuel Tank Pressure Sensor High Voltage (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | Replace the tank pressure sensor.<br>Is the action complete? | — | Verify repair | — |
| 10 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0456 EVAP Very Small Leak




060R200050

## Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank (vapor) pressure sensor
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module(PCM)monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON”, allowing engine vacuum to draw a very small look on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned “OFF”, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant.

A very small leak in the system will cause DTC P0456 to be set.

## Conditions for setting the DTC

- No MAP DTC’s set.
- No TPS DTC’s set.
- No IAT DTC’s set.
- No ECT DTC’s set.
- No tank pressure sensor DTC’s set.
- Baro is more than 70KPa.
- Fuel level is between 40% and 80%.
- Throttle angle is less than 3%.
- Engine speed is less than 1200 RPM.
- Vehicle speed is less than 5 mph (8 km/h).
- A vacuum decay condition, indicating a very small leak, is detected during the diagnostic test.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

  Warm up cycles have occurred without a fault.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0456 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0456 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line. to wire connection.
- Poor connection at PCM–Inspect harness connectors 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 to the EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

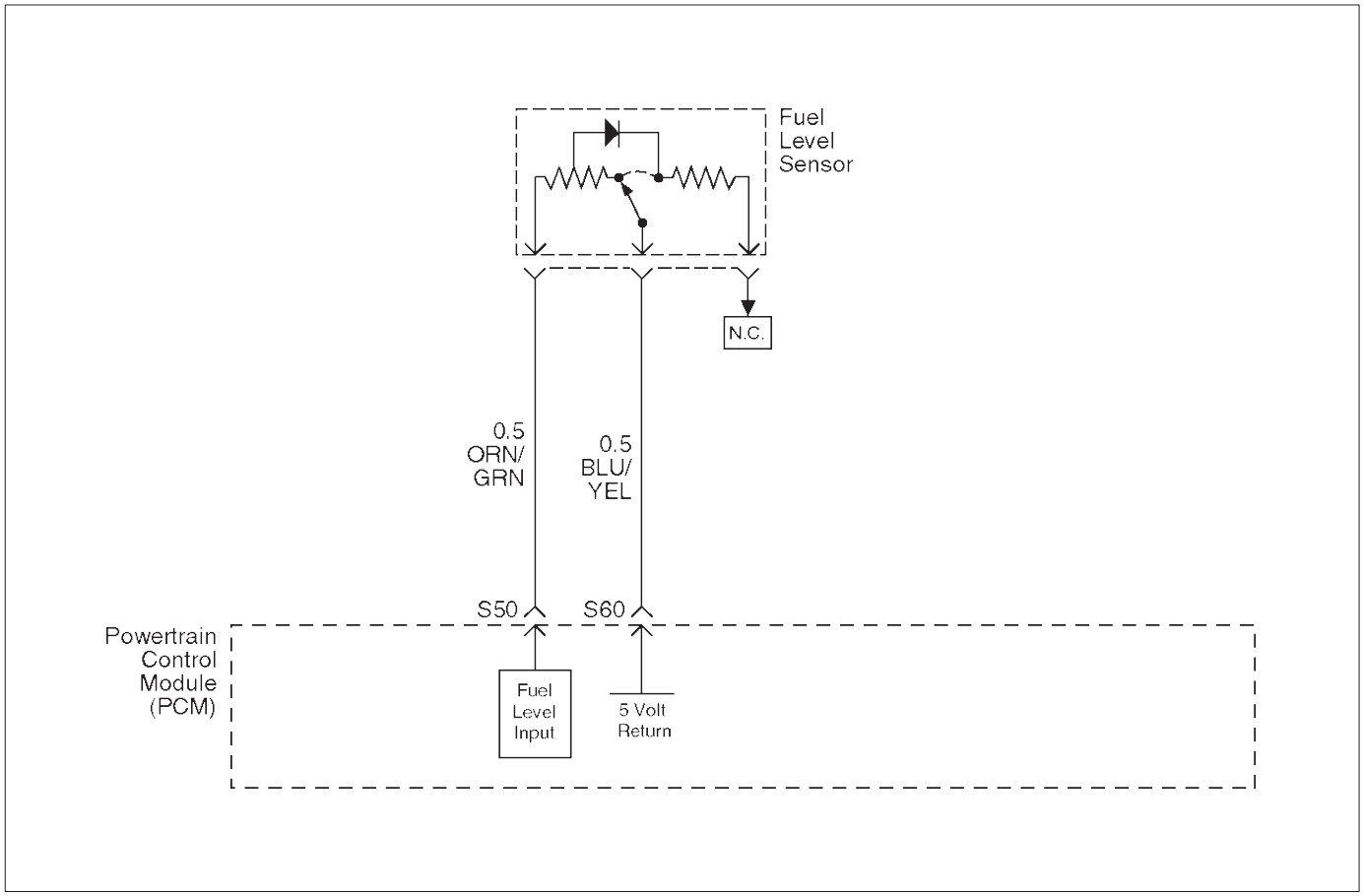
  Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs.

  This may assist in diagnosing the condition.

# Diagnostic Trouble Code(DTC)P0456 EVAP Very Small Leak

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board(OBD)System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “OFF”.<br>2. Remove the fuel cap.<br>3. Ignition “ON”.<br>4. Observe “Fuel Tank Pressure” on the Tech 2.<br>Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value? | 1.51V | Go to *Step 3* | Go to *Fuel Tank Pressure System* |
| 3 | 1. Visually/physically check for the following conditions:<br>● Vent hose disconnected or damaged.<br>● EVAP canister damaged.<br>● Fuel cap damaged<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 4* |
| 4 | 1. Ignition “ON”, engine “OFF”.<br>2. Install the fuel cap.<br>3. Review and record Tech 2 Failure Records data.<br>4. Operate the vehicle within Failure Records conditions as noted.<br>5. Using theTech 2,monitor the “DTC” info for DTC P0456.<br>Does the Tech 2 indicate DTC P0456? | — | Go to *Step 5* | Refer to *Diagnostic Aids* |
| 5 | 1. Ignition “ON”, engine idling.<br>2. Observe “Fuel Tank Pressure” on the Tech 2.<br>Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value? | — | Refer to *Diagnostic Aids* | Go to *Step 6* |
| 6 | 1. Ignition “ON”, engine idling.<br>2. Using theTech 2, command the EVAP canister vent solenoid “ON” (closed)<br>3. Observe “EVAP canister vent solenoid operation” second value?<br>4. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Visually/physically check for the following conditions:<br>● Disconnected or leaking fuel tank vapor line.<br>● Disconnected or damaged EVAP purge line.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P0461 Fuel Level Sensor Performance




060RY00163

## Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0461 is set.

## Conditions for Setting the DTC

- Sensor output change is more than 2% within 200km.
  Or Sensor movement position change is less than 15% within 200km.
- IAT is more than 0˚C.
- MAP changing in 3 sec is less than 10kPa.
- Engine speed changing in 3 sec is less than 50rpm.

When there are 12 test failures within 80 test samples, it is stored.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the DTC

- DTC P0461 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

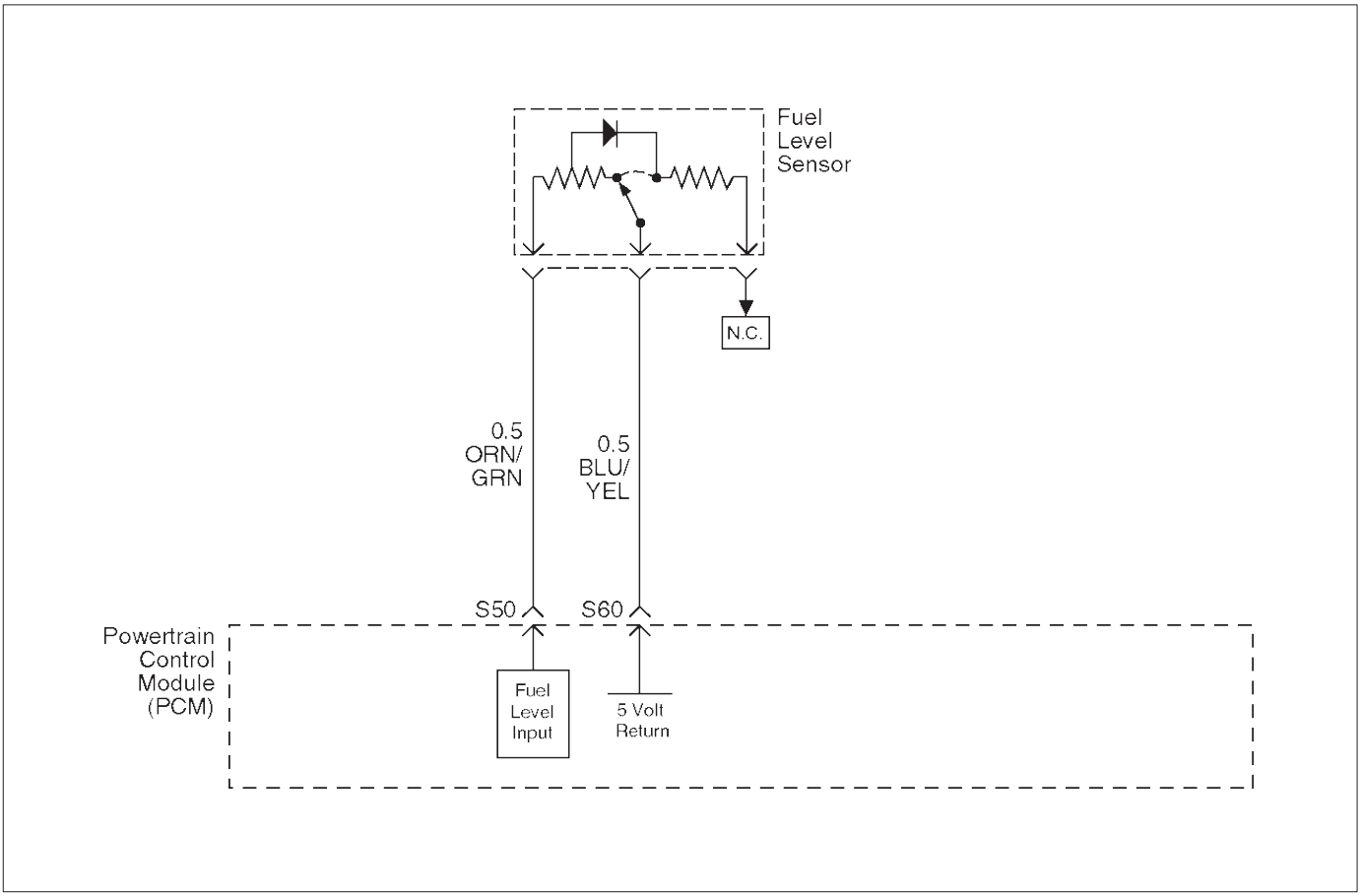
## Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

# DTC P0461– Fuel Level Sensor Performance

| 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 “Off”, Engine “Off”.<br>2. Install Tech 2.<br>3. Ignition “On”, Engine “Off”.<br>4. Check DTC P0462, P0463.<br>Was the DTC stored? | — | Go to *applicable DTC table* | Go to *Step 3* |
| 3 | Check DTC P0464.<br>Was the DTC stored? | — | Go to *DTC P464 table* | Go to *Step 4* |
| 4 | 1. Ignition “Off”, Engine “Off”.<br>2. Replace the fuel level sensor.<br>Was the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0462 Fuel Level Sensor Circuit–Low Voltage




060RY00163

## Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is more than 85% or less than 15% full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0462 is set.

## Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is less than a specified value.
- There are 100 test failures within a 200-test sample.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4˚C (40˚F) from the start-up ECT, and ECT exceeds 71˚C (160˚F) during that same ignition cycle).
- DTC P0462 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

## Test Description

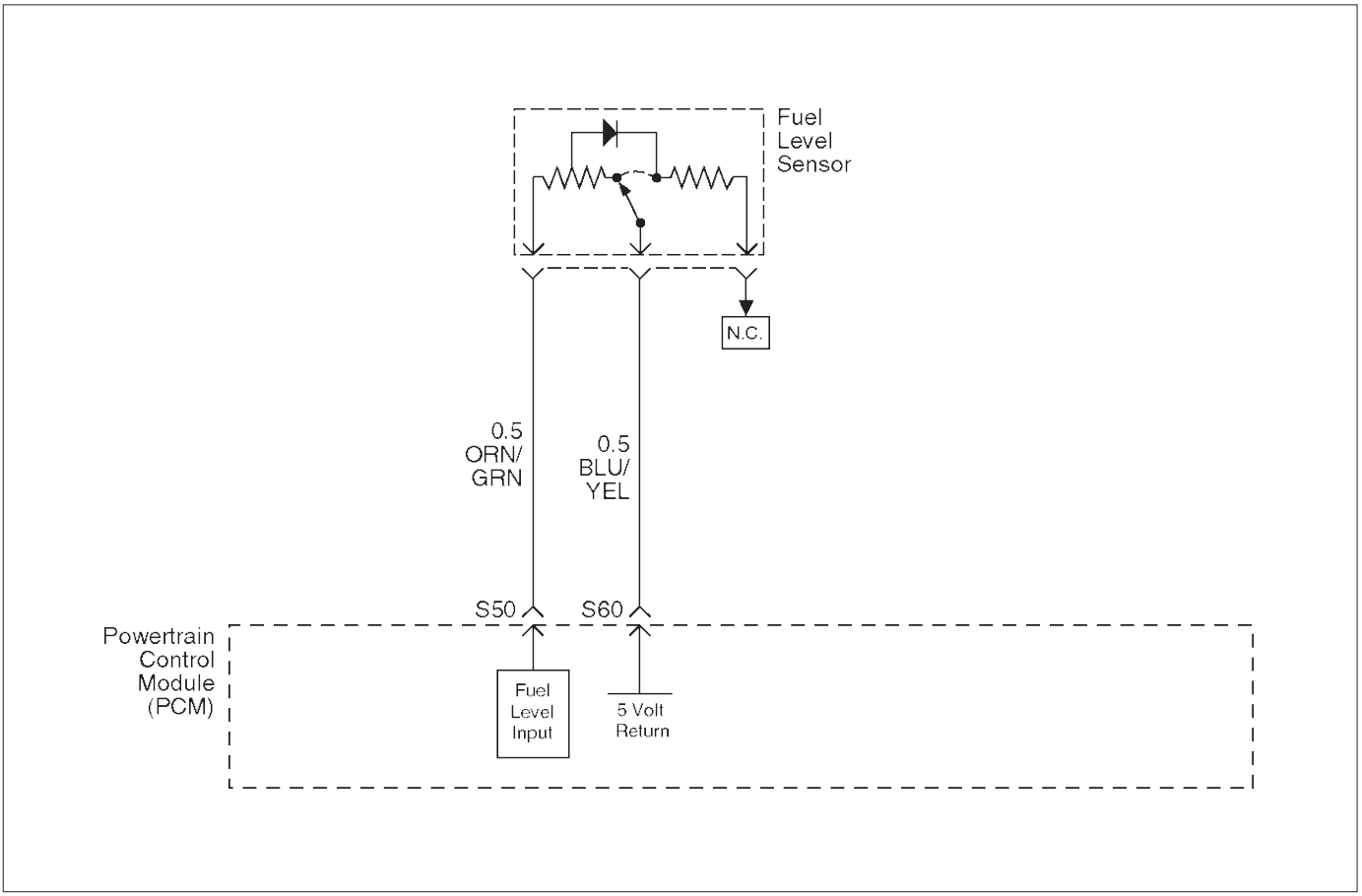
Number(s) below refer to the step number(s) on the Diagnostic Chart.

8. The following chart can be used to check the sending unit:

# DTC P0462– Fuel Level Sensor Circuit –Low Voltage

| 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. Disconnected the fuel level sensor harness from its connector at the fuel tank.<br>2. Ignition "ON", engine "OFF".<br>3. Using a DVM, measure the voltage between the sensor harness positive and ground wires.<br>Is the voltage approximately equal to the specified value? | 5 V | Go to *Step 6* | Go to *Step 3* |
| 3 | 1. Ignition "ON", engine "OFF".<br>2. With a DVM, backprobe the PCM connector at the terminal which supplies 5 volts to the fuel level sensor.<br>Is the voltage approximately equal to the specified value? | 5 V | Go to *Step 4* | Go to *Step 9* |
| 4 | 1. Ignition "ON", engine "OFF".<br>2. Fuel level sensor disconnected from wiring harness.<br>3. With a DVM, probe the 5-volt supply wire at the sensor harness.<br>Is the voltage approximately equal to the value measured in Step 4? | — | Go to *Step 5* | Go to *Step 9* |
| 5 | Check for open or high resistance connection in the ground wire between the PCM and the fuel level sensor.<br>Is the action complete? | — | Verify repair | — |
| 6 | Remove the fuel level sensor and check the following:<br>● Does the arm move freely?<br>● Are the wires open or intermittently open when wiggled?<br>● Do the resistance values match the specification chart?<br>Was a problem found? | — | Go to *Step 7* | Go to *Step 9* |
| 7 | Replace the fuel level sensor.<br>Is the action complete? | — | Verify repair | — |
| 8 | Replace the PCM.<br>**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.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 9 | Short to ground between the PCM connector and the fuel level sensor.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0463 Fuel Level Sensor Circuit–High Voltage




060RY00163

## Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is more than 85% or less than 15%, full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. High fuel level causes low resistance in the sending unit. This is recognized by the PCM because the circuit operates at a corresponding high voltage. When the circuit is continuously shorted to a voltage source greater than a specified value, or when the 5 volt signal is shorted to ground, DTC P0463 is set.

## Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is greater than a specified value.
- There are 100 test failures within a 200-test sample.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4˚C (40˚F) from the start-up ECT, and ECT exceeds 71˚C (160˚F) during that same ignition cycle) or the scan tool clearing function has been used.
- DTC P0463 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

## Test Description

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

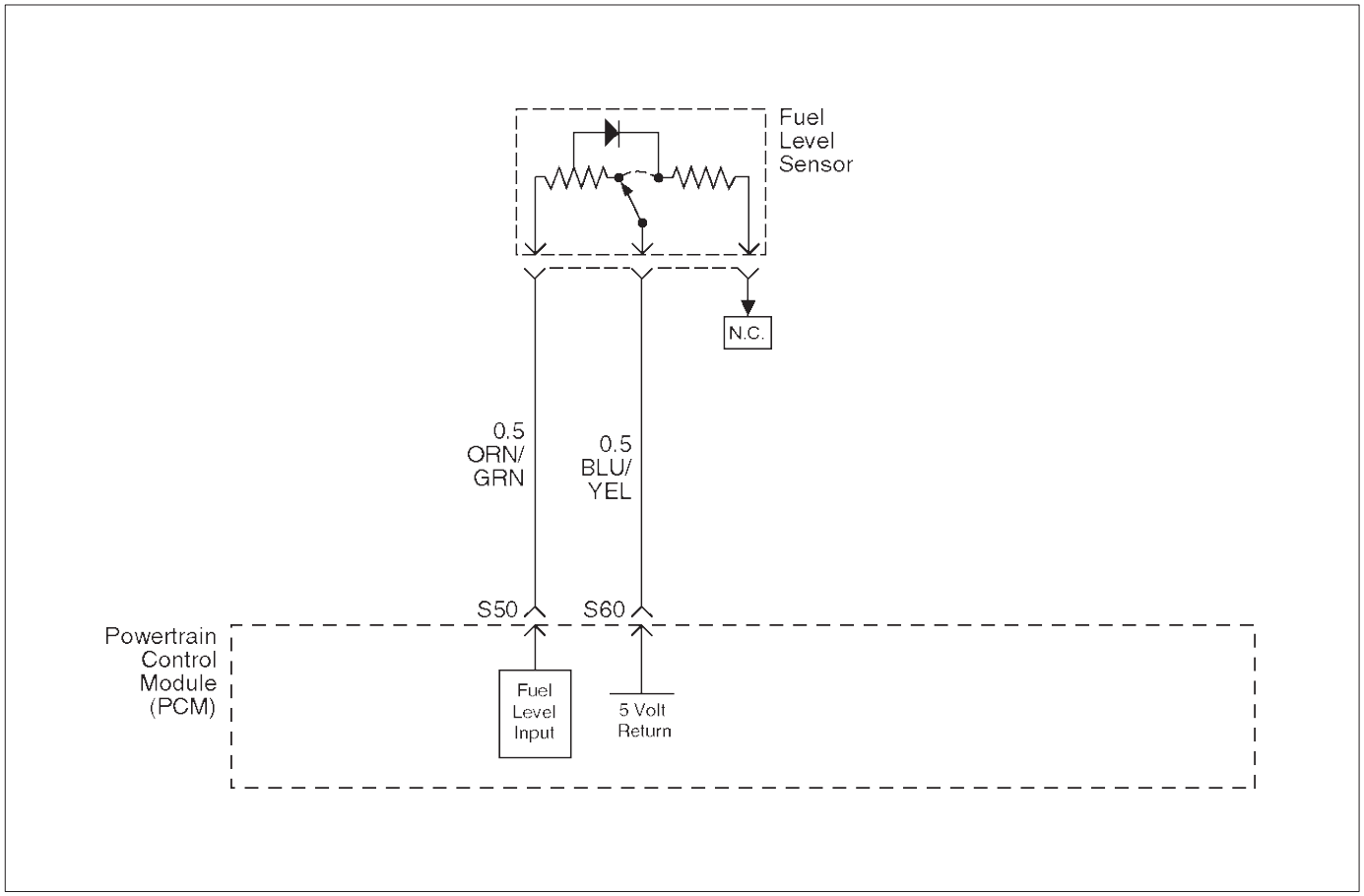
2. The ETC and MAP sensors share a ground at PCM terminal D9.

9. Equates the resistance values at various float positions to the following fuel gauge readings:

# DTC P0463– Fuel Level Sensor Circuit –High Voltage

| 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. Disconnected the fuel level sensor harness from its connector at the fuel tank.<br>2. Ignition “ON”, engine “OFF”.<br>3. Using a DVM, measure the voltage between the sensor harness positive and ground wires.<br>Is the voltage approximately equal to the specified value? | 5 V | Go to *Step 8* | Go to *Step 3* |
| 3 | With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor ground wire with the harness still disconnected.<br>Does the DVM indicate a short to a voltage source? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair short to voltage between the sensor and the PCM.<br>Is the repair complete? | — | Verify repair | — |
| 5 | With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor positive wire with the harness still disconnected.<br>Does the DVM indicate a voltage greater than the specified value? | 5 V | Go to *Step 4* | Go to *Step 6* |
| 6 | Open circuit between the PCM connector and the fuel level sensor? | — | Verify repair | Go to *Step 7* |
| 7 | Replace the PCM.<br>**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.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |
| 8 | Remove the fuel level sensor and check the following:<br>• Does the arm move freely?<br>• Are the wire leads shorted together?<br>• Do the resistance values match the specification chart?<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 7* |
| 9 | Replace the fuel level sensor.<br>Is the repair complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0462 Fuel Level Sensor Noisy Signal




060RY00163

## Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0464 is set.

## Conditions for Setting the DTC

- Sensor output changing is more than 15%.
- Fuel volume level is more than 0.01%.
- IAT is more than 0°C.
- Vehicle speed is more than 1km/h.
- Throttle position is more than 2%.

When there are 12 test failures within 80 test samples, it is stored.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the DTC

- DTC P0464 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

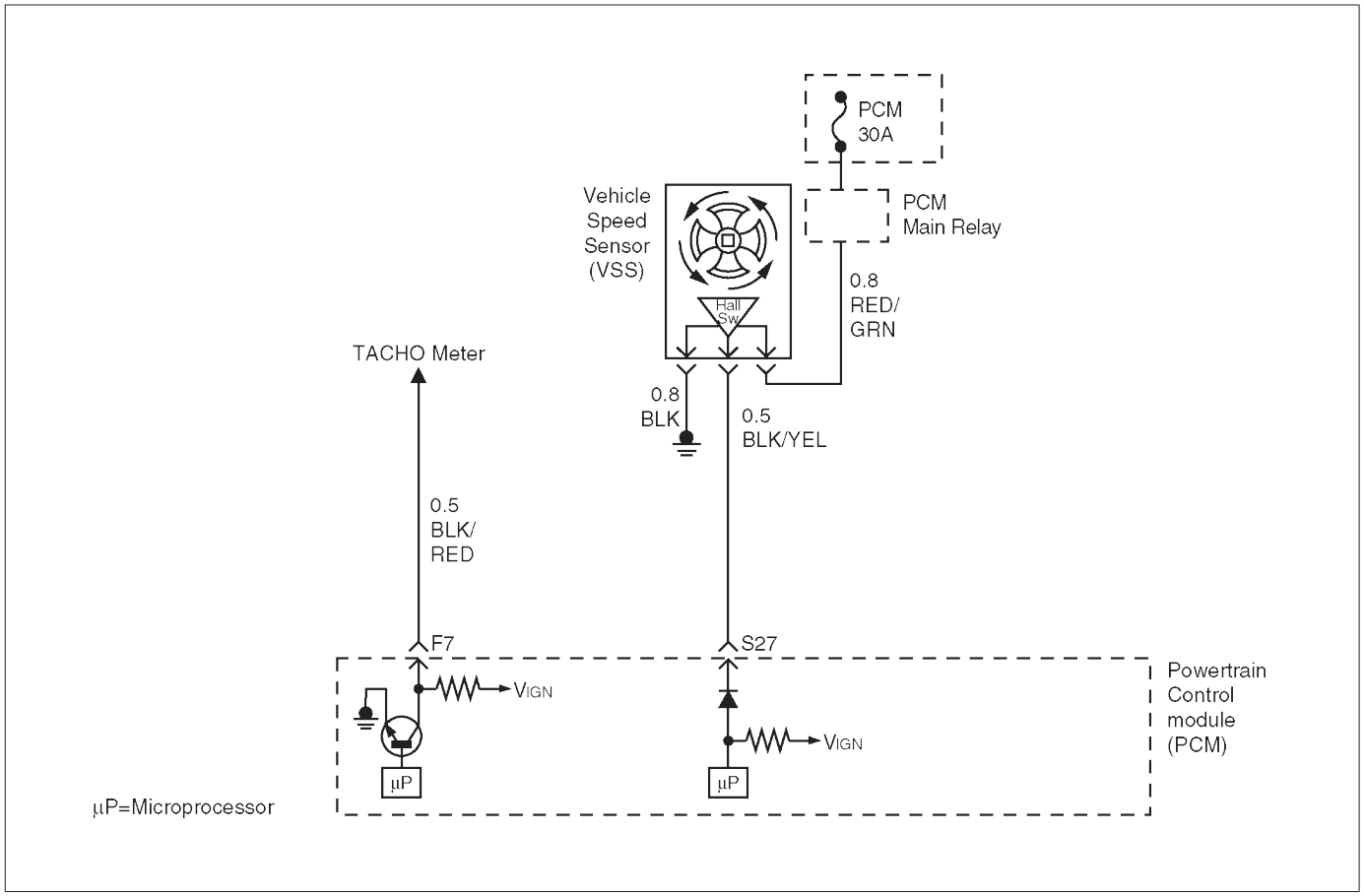
## Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

# DTC P0464 – Fuel Level Sensor Noisy Signal

| 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 “Off”, Engine “Off”.<br>2. Perform “Visual/Physical Check” for following points.<br>● Lose harness connector<br>● Clacked harness connector<br>● Poor wire condition<br>● Fuel tank condition<br>● Poor sensor condition<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 3* |
| 3 | 1. Disassemble fuel tank on the vehicle.<br>2. Check the below items.<br>● Fuel sender<br>Was a problem found? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Replace the Fuel sender.<br>Was the action complete? | — | Verify repair | Go to *Step 5* |
| 5 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Was the action completed? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0502 VSS Circuit Low Input




060R200056

## Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit the interacts with the magnetic field treated by the rotating magnet. A 12-volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 9-volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit.

## Conditions for Setting the DTC

- Engine is running.
- Engine speed is between 1800 RPM and 2500 RPM.
- Throttle angle is between 10% and 40%.
- Engine load is greater than 50 kPa.
- PCM detects no VSS signal for 12.5 seconds over a period of 15 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0502 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0502 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Test Description

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

10. To avoid backprobing the VSS and possibly damaging a seal or terminal, the VSS output can be tested at the point where the transmission harness connects to the engine harness. Power and ground are applied by jumpers to the VSS through the connectors which are located to the rear of the air cleaner assembly. The VSS signal is monitored with a DVM as the rear driveshaft turns. The wheels can be turned to rotate the driveshaft, or in 2-wheels-drive vehicles the driveshaft can be turned directly.

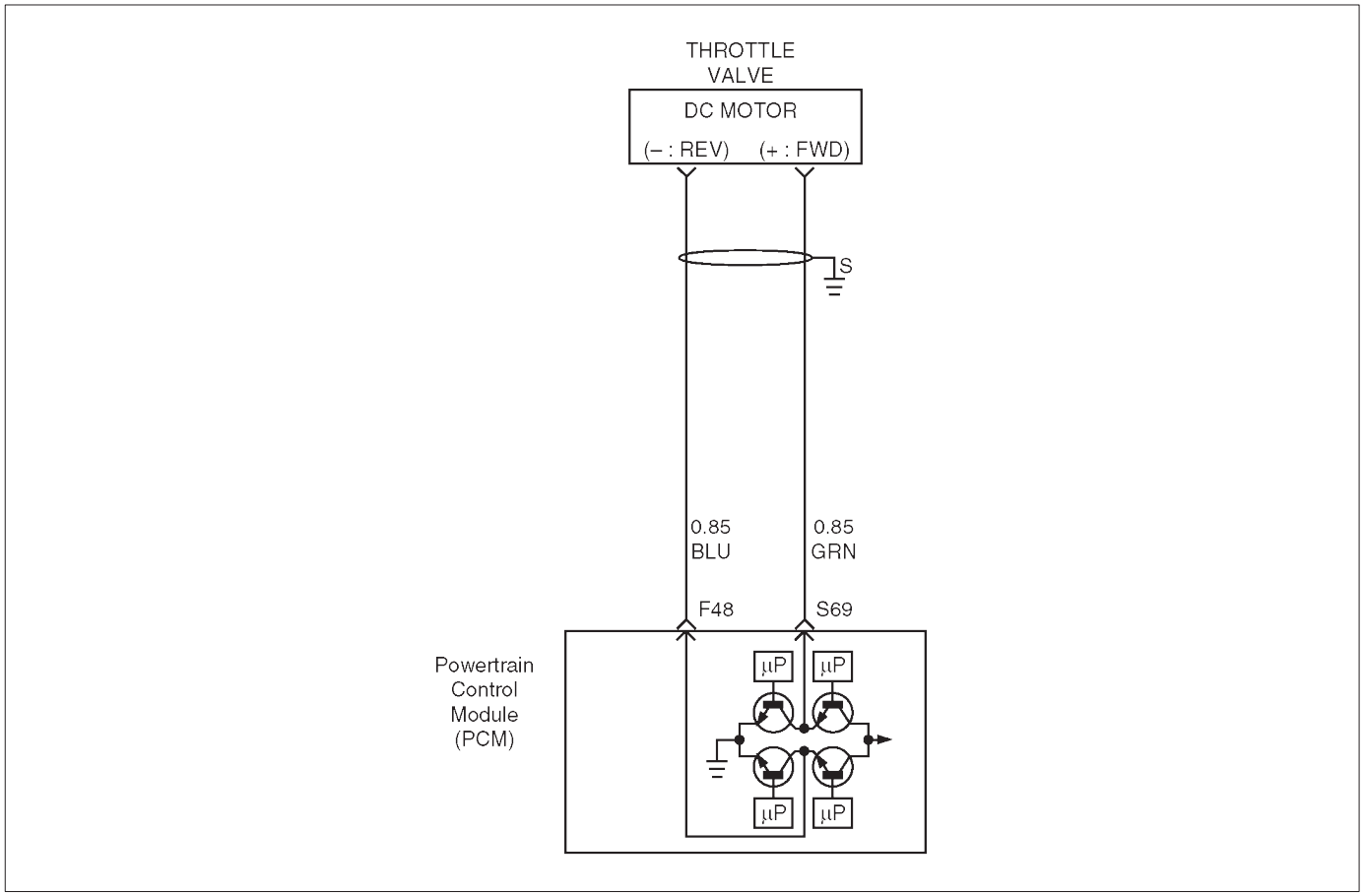
# DTC P0502 – VSS Circuit Low Input

| 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 | Does the speedometer work? | — | Go to *Step 10* | Go to *Step 3* |
| 3 | 1. Disconnect the VSS connector.<br>2. Ignition “ON”.<br>3. Using a test light to battery +, probe the connector ground wire.<br>Did the light illuminate? | — | Go to *Step 5* | Go to *Step 4* |
| 4 | Repair the sensor ground.<br>Is the action complete? | — | Verify repair | — |
| 5 | 1. Ignition “ON”, sensor disconnected.<br>2. Using a DVM, measure at the VSS connector between ground and voltage supply.<br>Was the measurement near the specified value? | Battery voltage | Go to *Step 7* | Go to *Step 6* |
| 6 | Repair the open or short to ground which may have blown the meter fuse.<br>Is the action complete? | — | Verify repair | — |
| 7 | 1. Ignition “ON”, VSS disconnected.<br>2. Using a DVM, measure at the VSS connector between ground and the wire from the speedometer.<br>Was the measurement near the specified value? | 7.5-8 V | Go to *Step 9* | Go to *Step 8* |
| 8 | Check for an open or short circuit between the speedometer and the VSS.<br>Was an open or short circuit located? | — | Verify repair | Go to *Step 9* |
| 9 | Replace the speedometer.<br>Is the action complete? | — | Verify repair | — |

# DTC P0502 – VSS Circuit Low Input (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Ignition "OFF".<br>2. Disconnect the MAF sensor. The connector attaches the VSS wires from the transmission harness to the left-side engine harness.<br>3. Disconnect the black 16-way connector.<br>4. Select a terminal adapter from kit J 35616 that can be used with a jumper to supply B+ to the blue wire with a yellow tracer (transmission side of the connector).<br>5. Use another terminal adapter to attach a voltmeter to the light-green wire with a white tracer (next to the wire in the previous step.)<br>6. Disconnect the blue connector next to the black 16-way connector, and locate the black/red tracer wire at one corner of the blue connector. The black/red wire is the VSS ground. Use a terminal adapter to attach a jumper to ground to the black/red VSS ground wire at the transmission side of the blue connector.<br>7. Raise the rear wheels off the ground with transmission in neutral.<br>Does the DVM toggle back and forth between 0.6 V and 10 V as the wheels (and driveshaft) are rotated? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Replace the VSS.<br>Is the action complete? | — | Verify repair | — |
| 12 | Check for an open or short between the PCM and the speedometer.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0506 Idle Air Control System Low RPM




060R200057

## Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0506 will set, indicating a problem with the idle control system.

## Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, MAP, IAT, low voltage, fuel system, canister purge, injector control, or ignition control DTCs are set.
- MAP is less than 60 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50°C (122°F).
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle more than 10%.
- All conditions are met for 10 seconds.
- Barometric pressure is more than 74.5 kPa.
- Engine speed is more than 100-200 RPM lower than desired idle based upon coolant temperature.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- DTC P0506 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors 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.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the ETC passage or throttle bore, excessive deposits in the

ETC passage and on the ETC position, and excessive deposits in the throttle bore and on the throttle plate.

- Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

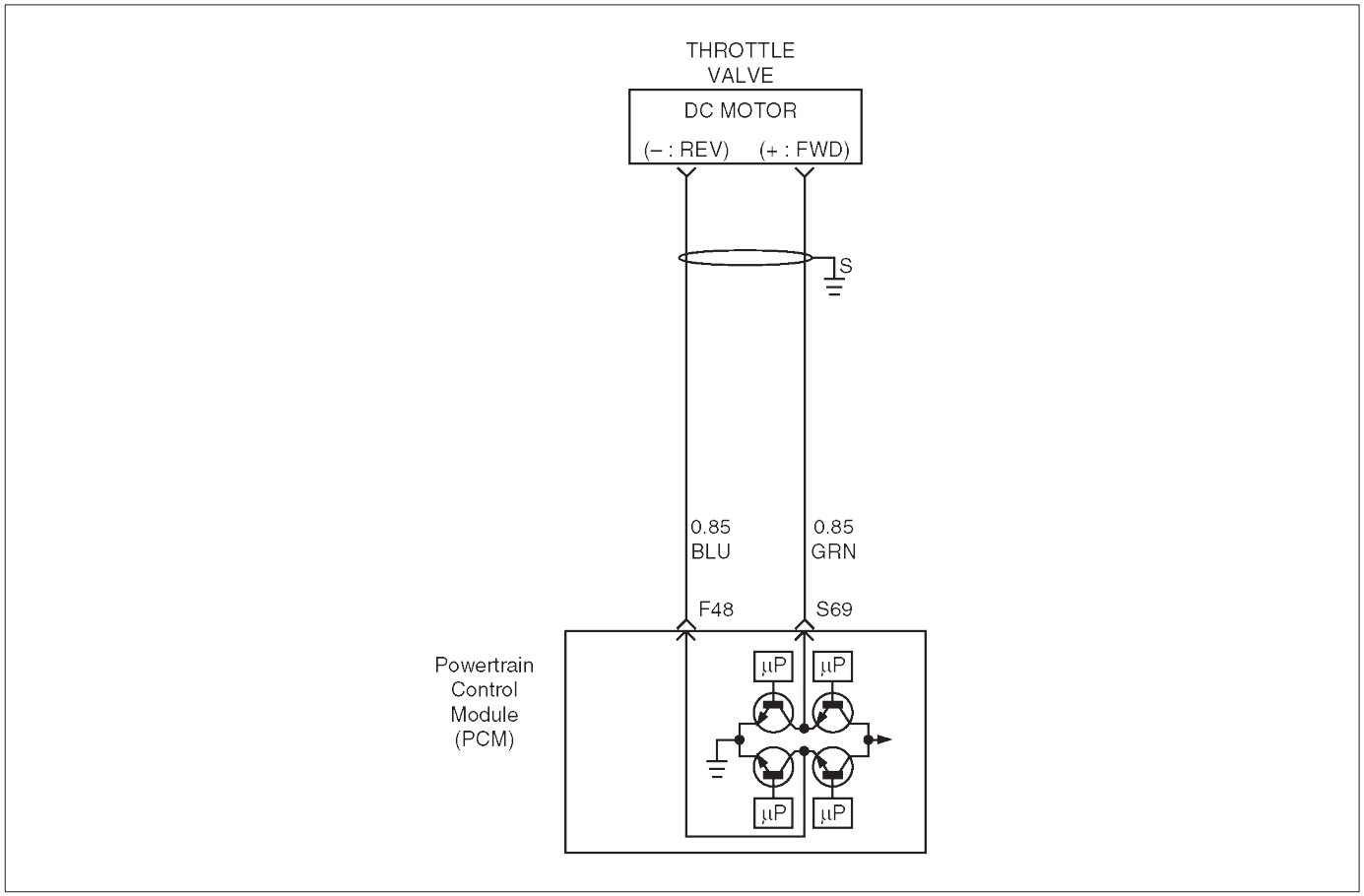
## DTC P0506 – Idle Air Control System Low RPM

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the "On-Board (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Visually/physically inspect for the following conditions:<br>● Throttle body tampering.<br>● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.<br>● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate.<br>● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play<br>Do any of the above require a repair? | — | Refer to *appropriate section for on–vehicle service* | Go to *Step 3* |
| 3 | Visually/physically inspect for the following conditions:<br>● Acceleration pedal tampering.<br>● Acceleration pedal : Check for objects blocking the spring or pedal arm.<br>● Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play.<br>Do any of the above require a repair? | — | Refer to *appropriatesection for on-vehicle service* | Go to *Step 4* |
| 4 | 1. Check for a poor connection at the throttle body harness connector.<br>2. Check for a poor connection at the acceleration position sensor harness connector.<br>3. If a problem is found, replace faulty terminals as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 5 | Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>● Throttle position sensor 1 circuit.<br>● Throttle position sensor 2 circuit.<br>● Throttle DC motor circuit.<br>● Throttle position sensor resistance.<br>● Throttle DC motor resistance.<br>● If a problem is found, repair as necessary.<br>Was a problem found? | Vcc-GND 1–7kΩ SIG-DND change resistance0.3 – 100Ω | Verify repair | Go to *Step 6* |

# DTC P0506 – Idle Air Control System Low RPM (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | Replace the throttle valve.<br>Is the action complete? | —— | Go to *Step 3* | —— |
| 7 | 1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>Accelerator position sensor 1 circuit.<br>Accelerator position sensor 2 circuit.<br>Sensor resistance.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | Vcc-GND<br>4–6kΩ<br>SIG-DND<br>change<br>resistance | Verify repair | Go to *Step 8* |
| 8 | Replace the acceleration position sensor.<br>Is the action complete? | —— | Go to *Step 9* | —— |
| 9 | Following below the DTCs stored: P1125, P1290, P1295, P1299 | —— | Go to *applicable DTC table* | Go to *Step 10* |
| 10 | Following below the DTCs stored:P1514, P1515, P1516, P1523, P1271, P1272, P1273 | —— | Go to *applicable DTC table* | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | —— | Verify repair | —— |

# Diagnostic Trouble Code (DTC)
# P0507 Idle Air Control System High RPM




060R200057

## Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
If the PCM detects a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0507 will set, indicating a problem with the idle control system.

## Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, MAP, IAT, low voltage, fuel system, canister purge, injector control or ignition control DTCs are set.
- Barometric pressure is above 75 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50°C (122°F).
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle is more than 10%.
- All conditions are met for 10 seconds.
- Engine speed is more than 100-200 RPM higher than desired idle based upon coolant temperature.
- Barometric pressure is more than 74.5 kPa.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0507 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0507 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors 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.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at EGR valve and EGR pipe to intake manifold, leak at the throttle body, a faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.
- Throttle body – Check for sticking throttle plate. Also inspect the air passage for deposits or objects which will not allow the ETC position to fully extend or properly seat.

If DTC P0507 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

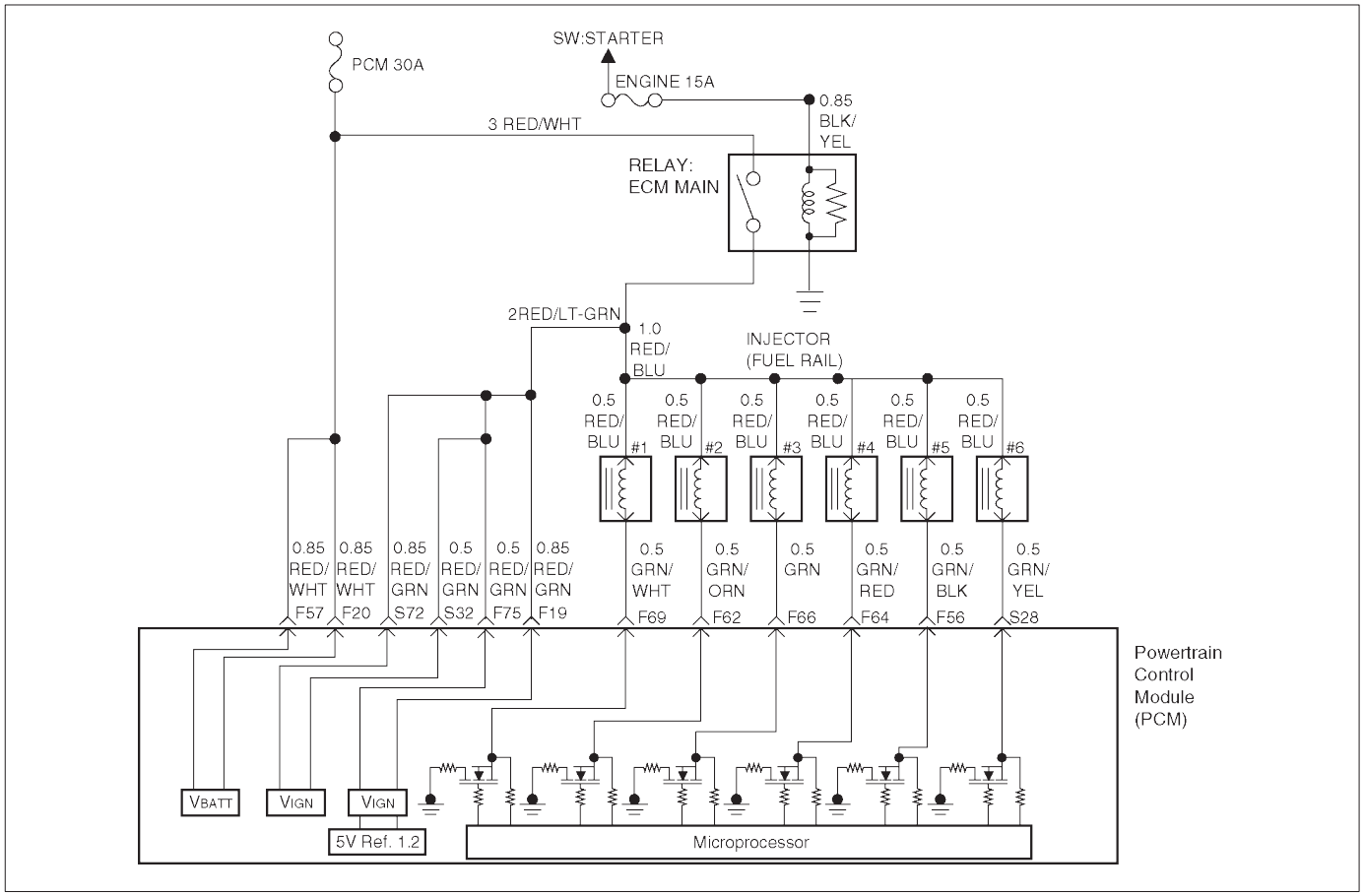
## DTC P0507 – Idle Air Control System High RPM

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the "On-Board (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Visually/physically inspect for the following conditions:<br>• Throttle body tampering.<br>• Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.<br>• Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate.<br>• Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play<br>Do any of the above require a repair? | — | Refer to *appropriate section for on-vehicle service* | Go to *Step 4* |
| 3 | Visually/physically inspect for the following conditions:<br>• Accelerator pedal tampering.<br>• Accelerator pedal : Check for objects blocking the spring or pedal arm.<br>• Accelerator pedal : Check for objects move the accelerator pedal that pedal is smooth movement, and accelerator pedal arm has not excessive play.<br>Do any of the above require a repair? | — | Refer to *appropriate section for on-vehicle service* | Go to *Step 4* |
| 4 | 1. Check for a poor connection at the throttle body harness connector.<br>2. Check for a poor connection at the accelerator position sensor harness connector.<br>3. If a problem is found, replace faulty terminals as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |

# DTC P0507 – Idle Air Control System High RPM (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 5 | Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>● Throttle position sensor 1 circuit.<br>● Throttle position sensor 2 circuit.<br>● Throttle DC motor circuit.<br>● Throttle position sensor resistance.<br>● Throttle DC motor resistance.<br>● If a problem is found, repair as necessary.<br>Was a problem found? | Vcc-GND 1–7kΩ SIG-GND change resistance 0.3 – 100Ω | Verify repair | Go to *Step 6* |
| 6 | Replace the throttle valve.<br>Is the action complete? | — | Go to *Step 3* | — |
| 7 | 1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>● Accelerator position sensor 1 circuit.<br>● Accelerator position sensor 2 circuit.<br>● Sensor 3 circuit.<br>● Sensor resistance.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | Vcc-GND 4–6kΩ SIG-GND change resistance | Verify repair | Go to *Step 8* |
| 8 | Replace the accelerator position sensor.<br>Is the action complete? | — | Go to *Step 9* | — |
| 9 | Stored DTCs: P1125, P1290, P1295, P1299 | — | Go to *applicable DTC table* | Go to *Step 10* |
| 10 | Stored DTCs: P1514, P1515, P1516, P1523, P1271, P1272, P1273 | — | Go to *applicable DTC table* | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0562 System Voltage Low




060R200058

## Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage DTC will set whenever the voltage is below a calibrated value.

## Conditions for Setting the DTC

- Ignition “ON”.
- System voltage is below 11.5 volts for 40 seconds.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P0562 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0562 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

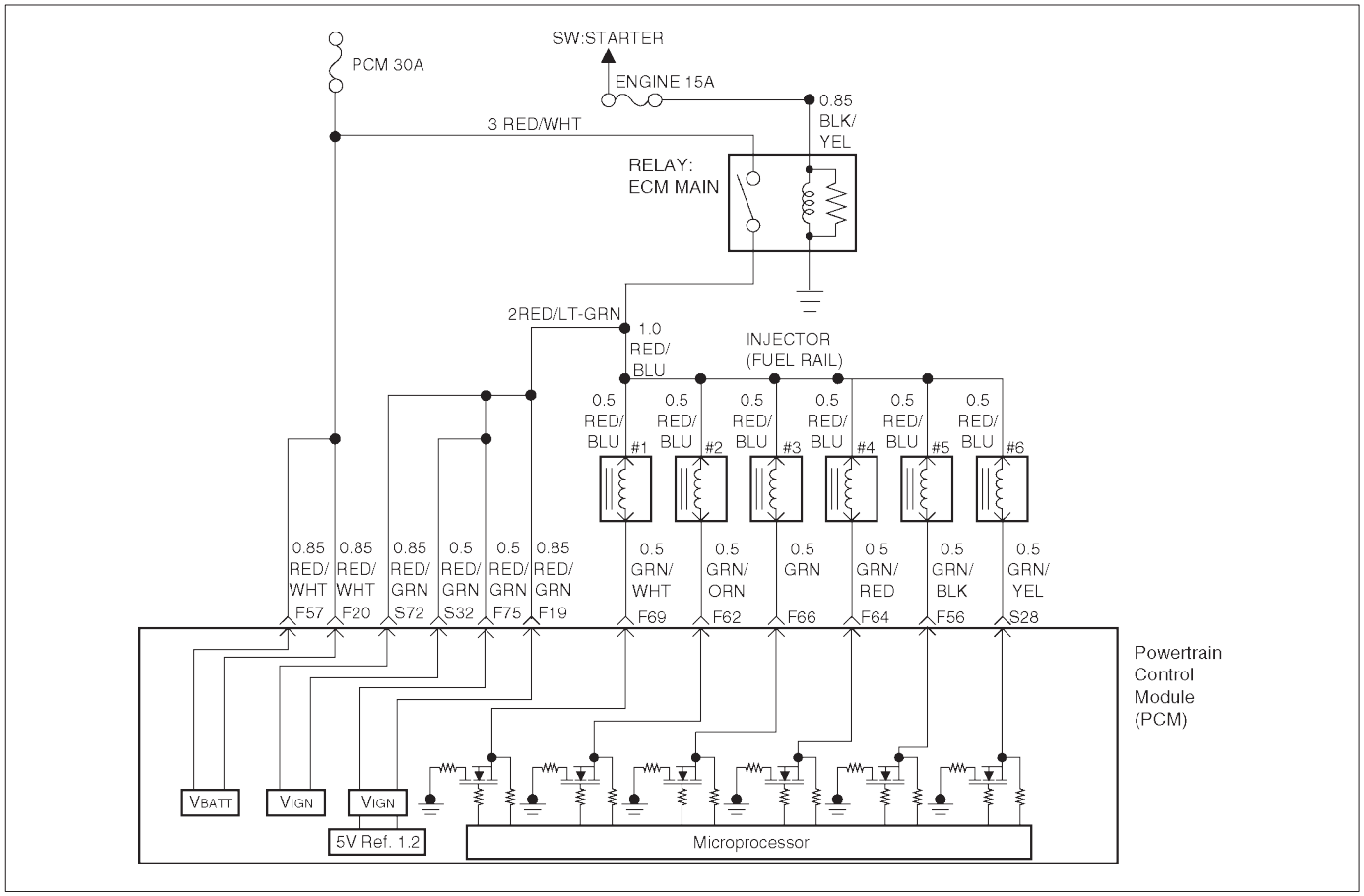
## Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

# DTC P0562 – System Voltage Low

| 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 | Using a DVM, measure the battery voltage at the battery.<br>Is the battery voltage greater than the specified value? | 11.5 V | Go to *Step 3* | Charge battery, then go to *Step 3* |
| 3 | 1. Install a Tech 2.<br>2. Select "Ignition Volts" on the Tech 2.<br>3. Start the engine and raise the engine speed to the specified value.<br>4. Load the electrical system by turning on the headlights, high blower, etc.<br>Is the ignition voltage approximately equal to the specified value? | 2000 RPM<br>12.8-14.1 V | Go to *Step 4* | Go to *Starting/Charging* |
| 4 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector at the PCM.<br>3. Using a DVM, measure the battery voltage at the PCM connector F-20 and F-57.<br>Is it approximately equal to battery voltage? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Check for faulty connections at the PCM harness terminals.<br>2. Repair as necessary.<br>Was a repair necessary? | — | Verify repair | Go to *Step 7* |
| 6 | Check for an open battery feed circuit to the PCM.<br>Is the action complete? | — | Verify repair | Go to *Step 7* |
| 7 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0563 System Voltage High




060R200058

## Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage DTC will set whenever the voltage is above a calibrated value.

## Conditions for Setting the DTC

- Ignition “ON”.
- System voltage is above 16 volts for 40 seconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- A history DTC P0563 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0563 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

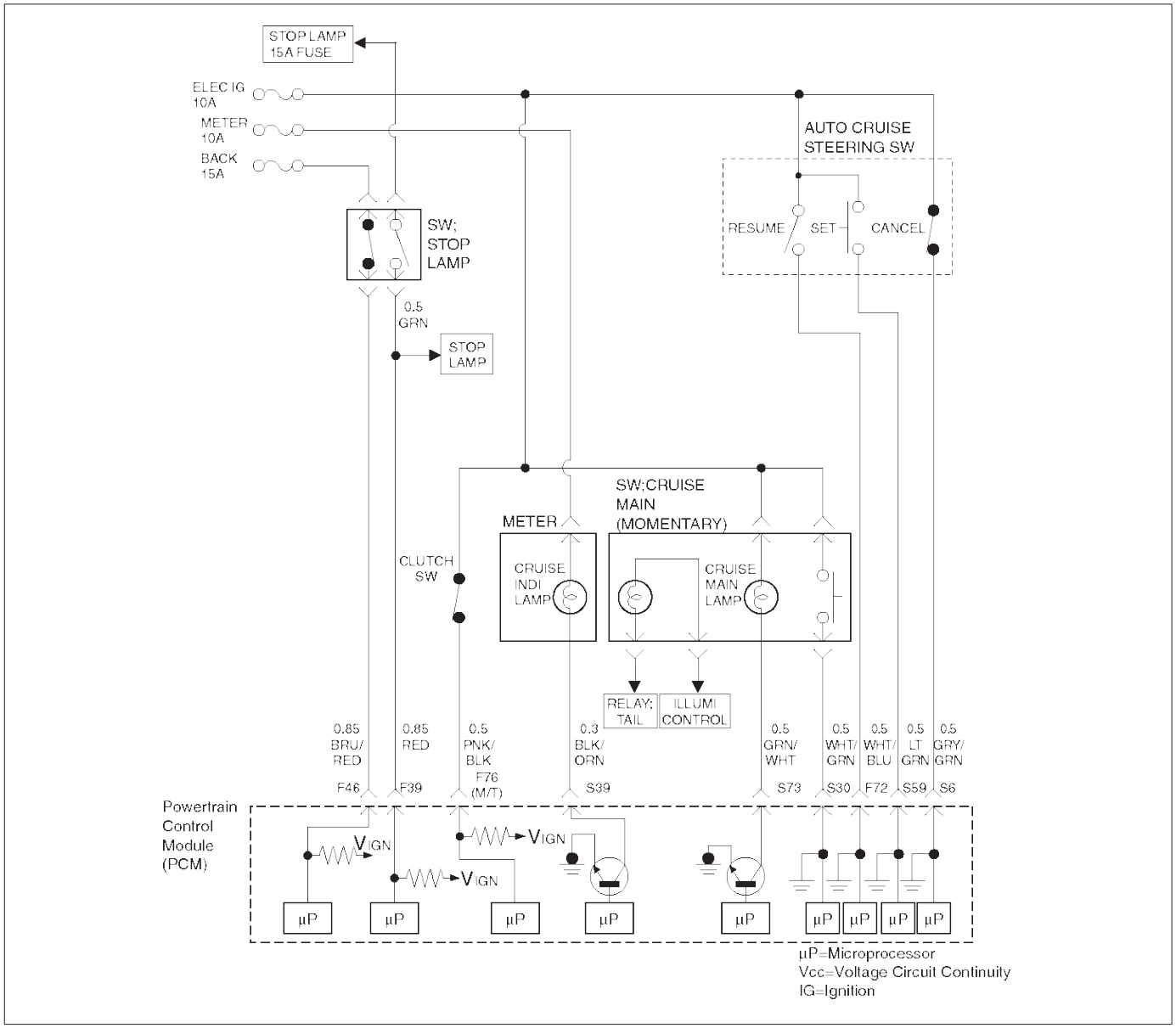
## Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

# DTC P0563 – System Voltage High

| 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 | Using a DVM, measure the battery voltage at the battery.<br>Is the battery voltage less than the specified value? | 11.5 V | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Charge the battery and clean the battery terminals.<br>2. Clean the battery ground cable connection if corrosion is indicated.<br>Is the battery voltage less than the specified value? | 11.5 V | Replace battery | Go to *Step 4* |
| 4 | 1. Turn "OFF" all the accessories.<br>2. Install a Tech 2.<br>3. Select the ignition voltage parameter on the Tech 2.<br>4. Start the engine and raise the engine RPM to the specified value.<br>Is the voltage more than 2.5 volts greater than the measurement taken in step 2 or 3? | 2000 RPM | Go to *Starting/ Charging* | Go to *Step 5* |
| 5 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0565 Cruise Main Switch Circuit Error




060R100094

## Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to power train control module(PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remains on for 15 seconds or more.
- Noises are generated by poor switch contact 60 times within 1 second.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0565 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0565 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the cruise main switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

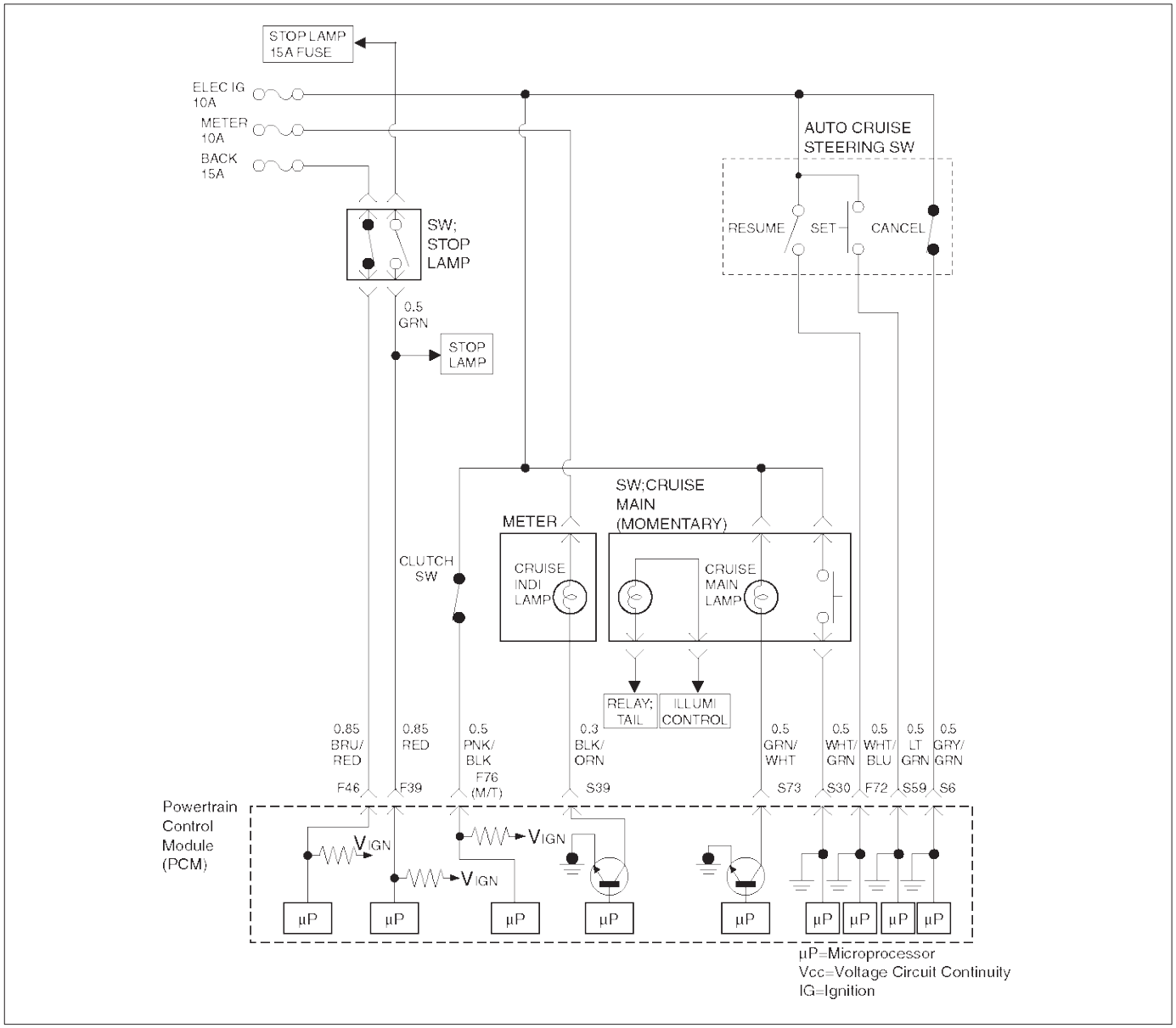
If DTC P0565 cannot be duplicated, the information included n the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0565 Diagnostic Chart may isolate the cause of the fault.

## DTC P0565 Cruise Main Switch Circuit Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON,” engine “ON.”<br>2. Observe the cruise main lamp in the switch.<br>Is the cruise main lamp “ON?” | — | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Push the auto cruise main switch.<br>2. Observe the cruise main lamp in the switch.<br>Is the cruise main lamp “OFF?” | — | Go to *Diagnostic Aids* | Go to *Step 4* |
| 4 | Check the signal circuit for auto cruise main switch.<br>1. Ignition is “OFF”.<br>2. Disconnect the powertrain control module(PCM).<br>3. Disconnect the cruise main switch.<br>Check for an open cruise main switch signal circuit between the PCM and the cruise main switch.<br>Is a problem found? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the auto cruise main switch signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | Check the auto cruise main switch and lamp circuit.<br>Is a problem found? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | Repair or replace the auto cruise main switch and lamp circuit.<br>Is the action complete? | — | Verify repair | — |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0566 Cruise Cancel Switch Circuit Error




060R100094

## Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to powertrain control module(PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.
When the cancel switch is “ON”, cruise system is “OFF”.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remains on for 40 seconds or more.
- Noises are generated by poor switch contact 100 times within 1.6 seconds.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0566 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

- DTC P0566 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the cruise cancel switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

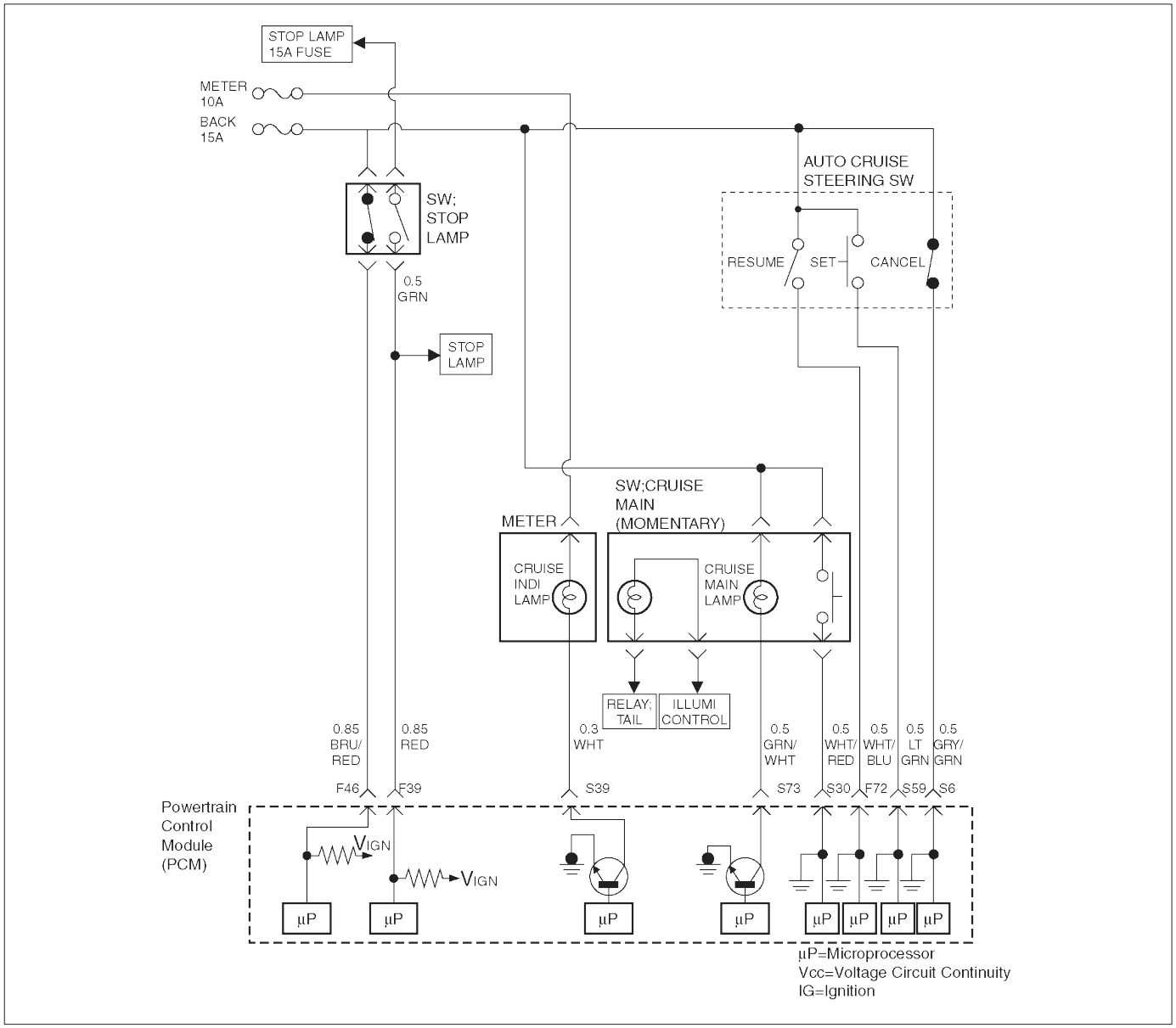
  A change in the display will indicate the location of the fault. If DTC P0566 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP0566 Diagnostic Chart may isolate the cause of the fault.

## DTC P0566 Cruise Cancel Switch Circuit Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Check the signal circuit for auto cruise cancel switch.<br>1. Ignition is “OFF”.<br>2. Disconnect the powertrain control module(PCM).<br>3. Disconnect the cruise cancel switch.<br>Check for cruise cancel switch signal circuit between the PCM and the cruise cancel switch.<br>Is a problem found? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | Repair the main cruise cancel switch signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 4 | Check the auto cruise main switch.<br>Is a problem found? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair or replace the main cruise main switch.<br>Is the action complete? | — | Verify repair | — |
| 6 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0567 Cruise Resume Switch Circuit Error




060R200086

## Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to powertrain control module(PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.
When the resume switch is “ON”, vehicle speed is reset to the previous set speed.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remain on for 50 seconds or more.
- Noises are generated by poor switch contact 100 times within 1.6 seconds.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0567 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P0567 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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.

If the harness appears to be OK, observe the Cruise resume switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

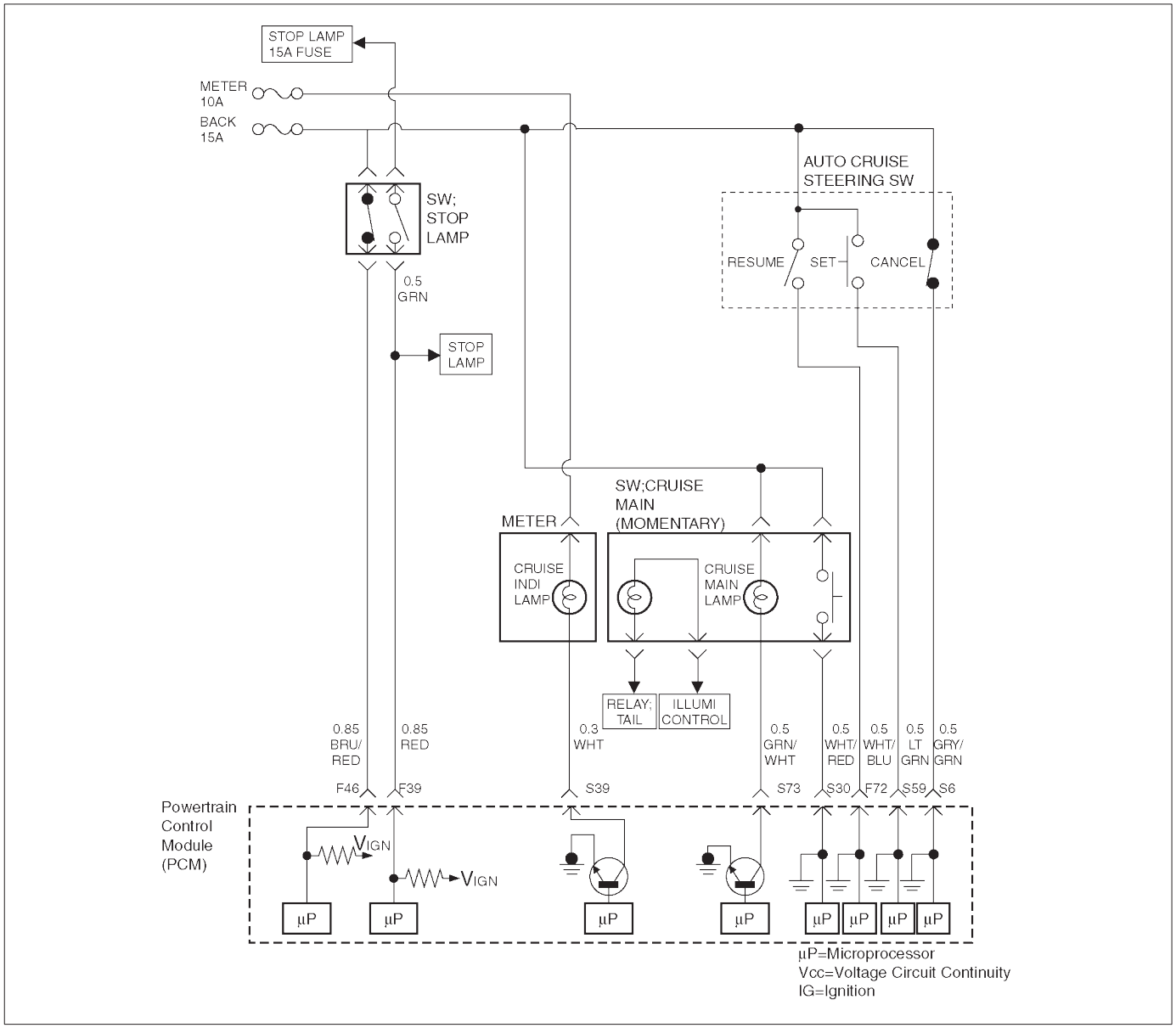
If DTC P0567 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTCP0567 Diagnostic Chart may isolate the cause of the fault.

## DTC P0567 Cruise Resume Switch Circuit Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Check the signal circuit for auto cruise resume switch.<br>1. Ignition is “OFF”.<br>2. Disconnect the powertrain control module (PCM).<br>3. Disconnect the cruise resume switch. Check for cruise resume switch signal circuit between the PCM and the cruise resume switch.<br>Is a problem found? | | Go to *Step 3* | Go to *Step 4* |
| 3 | Repair the main cruise resume switch signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 4 | Check the auto cruise resume switch.<br>Is a problem found? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair or replace the main cruise resume switch.<br>Is the action complete? | — | Verify repair | — |
| 6 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P0568 Cruise Set Switch Circuit Error




060R200086

## Circuit Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch is turned on with the vehicle in the running mode, the battery voltage is applied to powertrain control module (PCM). When a signal from the control switch is input to PCM while the vehicle is in this state, the cruise control system is activated. Also, while the PCM is operating, the “CRUISE MAIN” indicator light in the meter assembly lights up.
When the set switch is “ON”, vehicle speed is set.

## Conditions for setting the DTC

- The Ignition is “ON”.
- Engine is running.
- System voltage is between 11.5 volts and 16 volts.
- The switch contact remain on for 120 seconds or more.
- Noises are generated by poor switch contact 100 times within 1.6 seconds.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0568 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.

- DTC P0568 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the cruise set switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

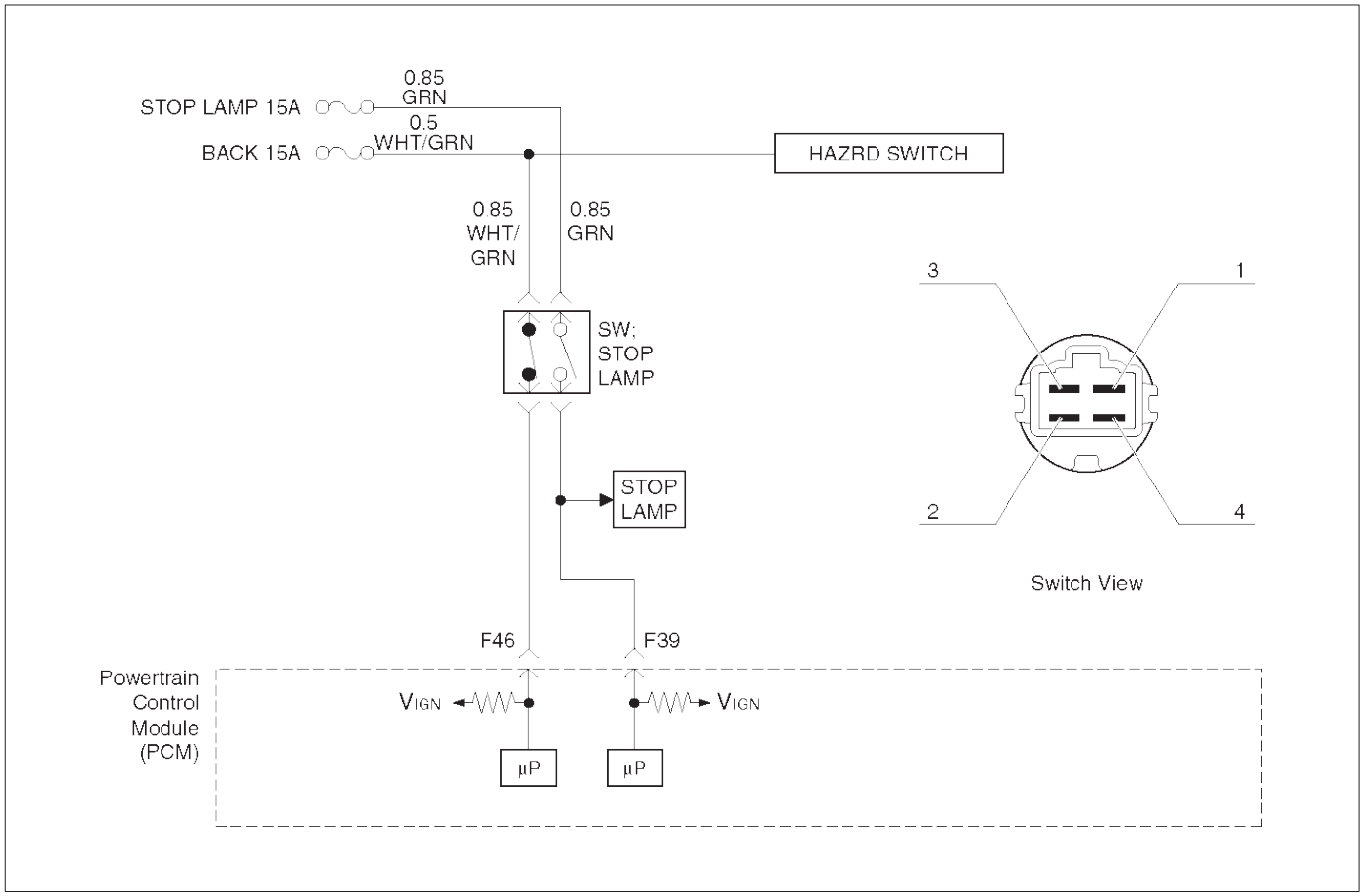
  If DTC P0568 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP0568 Diagnostic Chart may isolate the cause of the fault.

## DTC P0568 Cruise Set Switch Circuit Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON,” engine “ON.”<br>2. Observe the cruise indicator lamp in the meter.<br>Is the cruise indicator lamp “ON?” | — | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Push the auto cruise set switch.<br>2. Observe the cruise indicator lamp in the meter.<br>Is the cruise indicator lamp “OFF ?” | — | Go to *Diagnostic Aids* | Go to *Step 5* |
| 4 | Check the signal circuit for auto cruise set switch.<br>1. Ignition is “OFF”.<br>2. Disconnect the powertrain control module (PCM).<br>3. Disconnect the cruise set switch.<br>Check for cruise set switch signal circuit between the PCM and the cruise set switch.<br>Is a problem found? | | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the main cruise set switch signal circuit.<br>Is the action complete? | — | Verify repair | — |
| 6 | Check the auto cruise set switch.<br>Is a problem found? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | Repair or replace the main cruise set switch.<br>Is the action complete? | — | Verify repair | — |
| 8 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0571 No Brake Switch Signal




060R100093

## Circuit Description

The brake switch has 3 functions.

- Brake pedal operation check
- Brake light operation (On and off)
- Cruise control (Cancel)

The PCM receives vehicle speed and switch position signals from the brake switch. The PCM sets brake operating conditions in response to these signals.

If the brake switch is on, the brake system is in normal operation (cruise control cancelled).

## Conditions for Setting the DTC

- Two brake switch signals not acknowledged after signal changed.
- VSS not defective.
- Engine is running.
- Vehicle speed above 20km/h.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the DTC

- DTC P0571 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

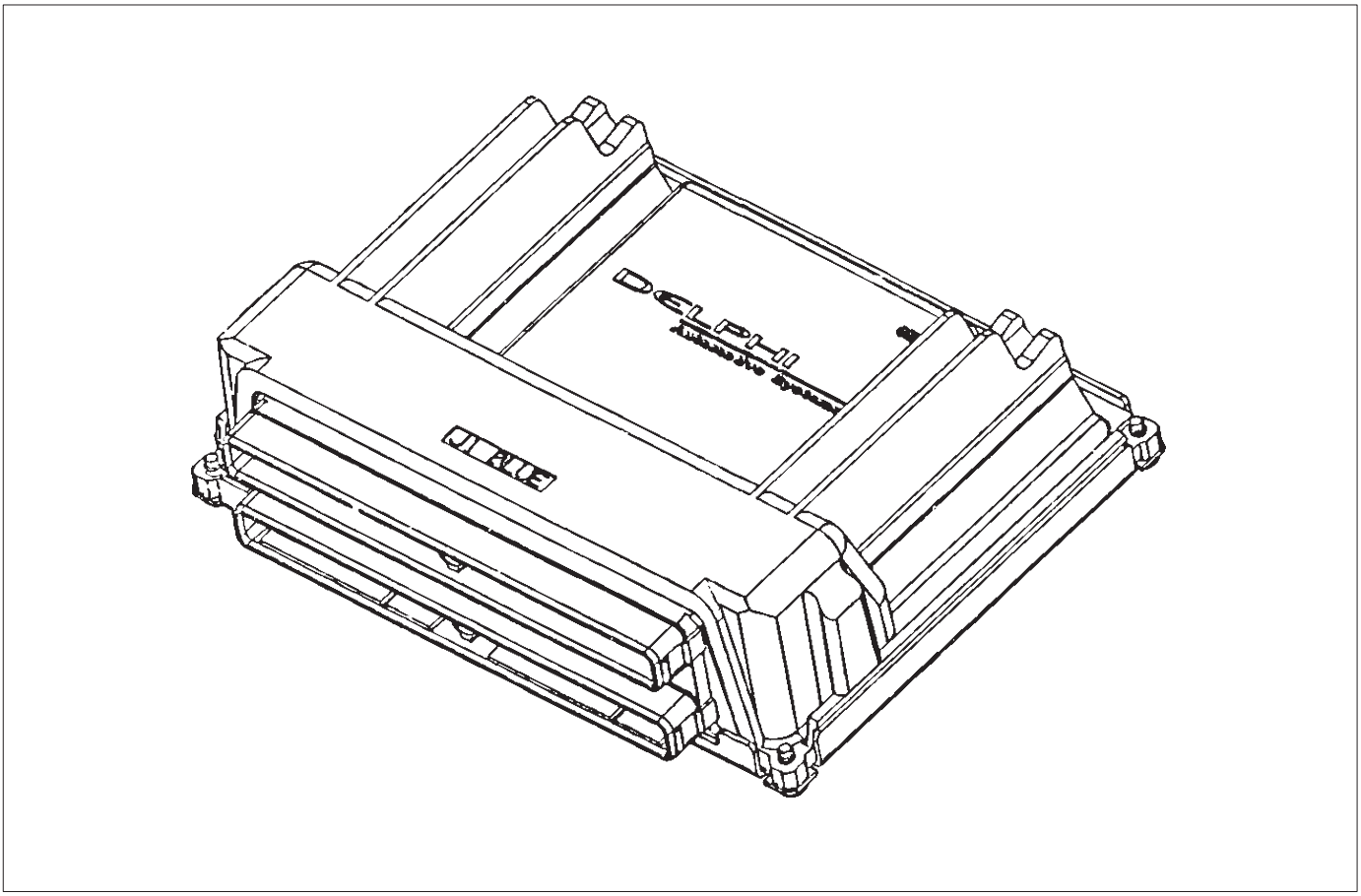
## Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

# DTC P01571 No Brake Switch Signal

| 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 “Off”. Engine “Off”.<br>2. Check following fuses.<br>● BACK 15A<br>● STOP LAMP 15A<br>Was a problem found? | — | Verify repair | Go to *Step 3* |
| 3 | 1. Make adjustment to the brake switch. The brake switch is installed to the brake pedal assembly. (Refer to *“Brake switch” in “10A CRUISE CONTROL SYSTEM”*.)<br>Was the problem found? | — | Verify repair | Go to *Step 4* |
| 4 | 1. Push the shaft at brake switch.<br>2. Check shaft operation for smooth movements.<br>Was the problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Disconnect the connector at brake switch.<br>2. Check following terminal pin at ohmmeter. (Leave the shaft position at brake switch. Don’t push it.)<br>● Between pin 1 and pin 2<br>● Between pin 3 and pin 4<br>Was it specified value? | Between pin1 and pin2 is 0Ω, Between pin3 and pin4 is ∞Ω | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Disconnect the connector at brake switch.<br>2. Check following terminal pin at ohmmeter. (Push the shaft position at brake switch and hold it)<br>● Between pin 1 and pin 2<br>● Between pin 3 and pin 4<br>Was it specified value? | Between pin1 and pin2 is ∞Ω, Between pin3 and pin4 is 0Ω | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Probe related circuits for open or short to ground.<br>2. If a problem was found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Replace the ECM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Was the action completed? | — | Verify repair | — |
| 9 | 1. Replace the brake switch.<br>Was the action completed? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0601 PCM Memory




060RY014

## Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read-only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation.
Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using a Tech 2. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for the EEPROM programming procedure.

## Conditions for Setting the DTC

- The PCM detects an internal program fault (check sum error).

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0601 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0601 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

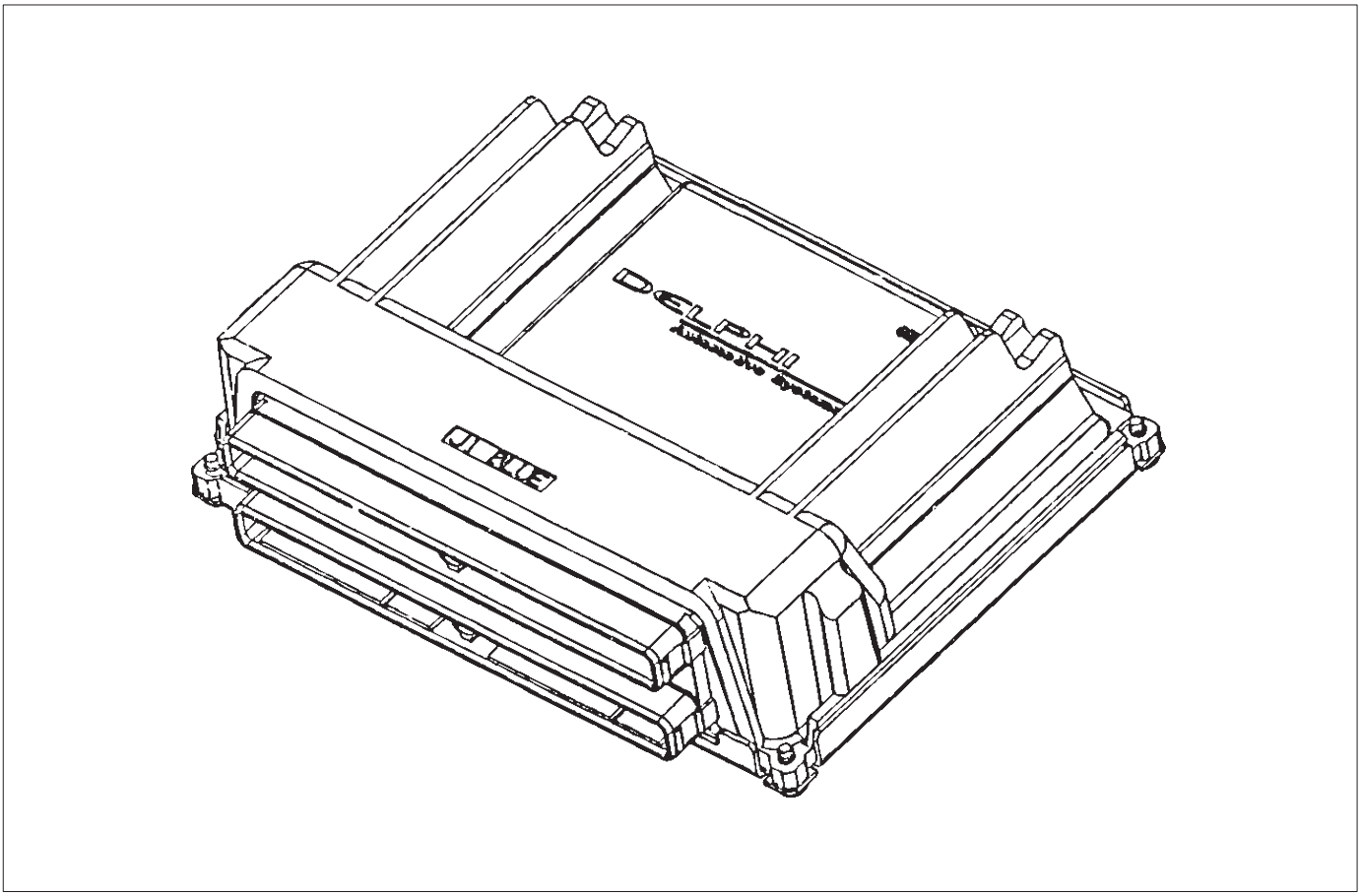
## Diagnostic Aids

- DTC P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM replacement. Remember to program the replacement PCM with the correct software and calibration for the vehicle.

# DTC P0601 – PCM Memory

| 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 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0602 PCM Programming Error




060RY014

## Circuit Description

The powertrain control module (PCM) uses Main CPU and Watchdog CPU software/calibration.

## Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU and Watchdog CPU software/calibration.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

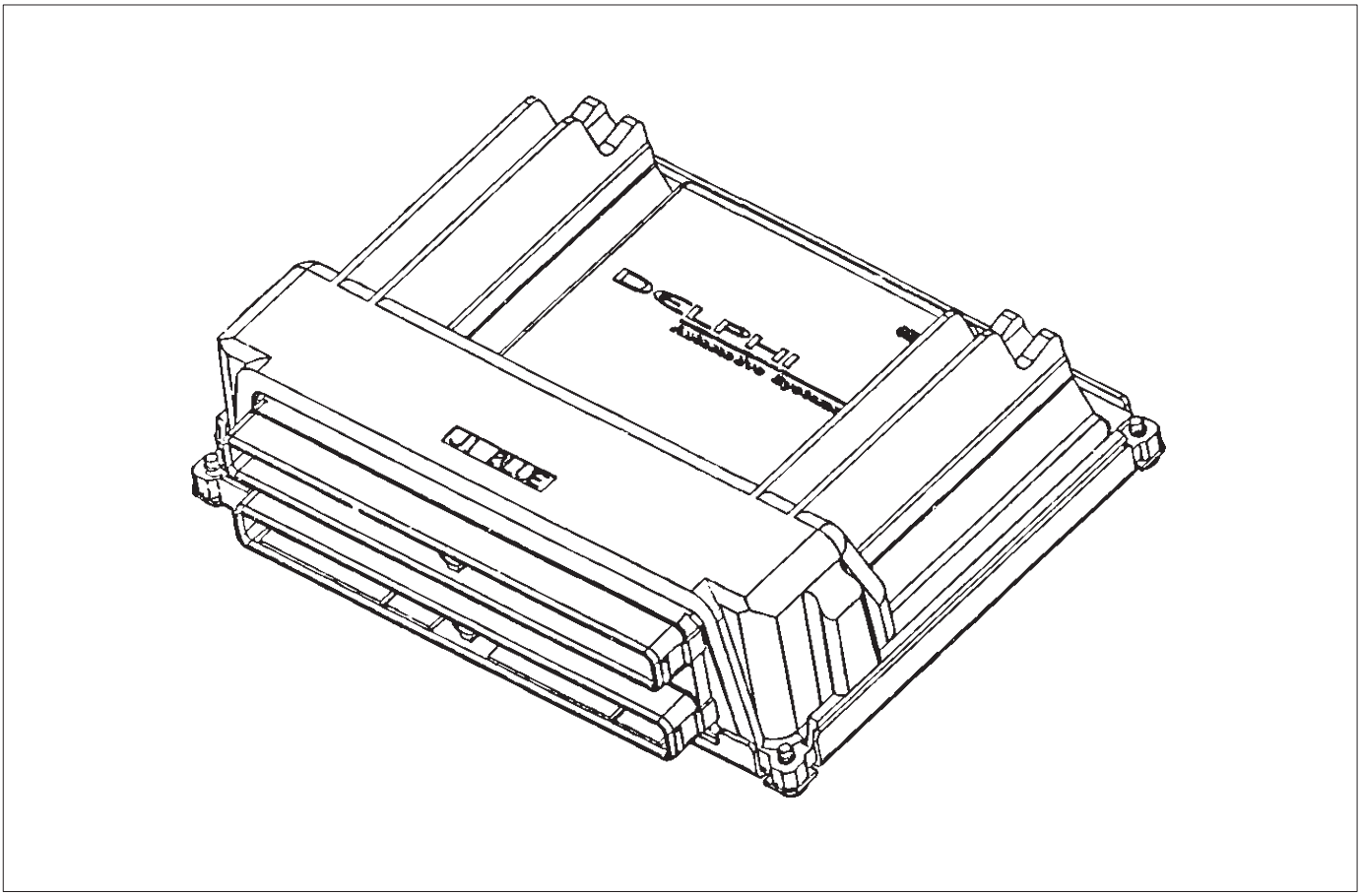
## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0602 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0602 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

# DTC P0602 – PCM Programming Error

| 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 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0604 PCM RAM Error




060RY014

## Circuit Description

The powertrain control module (PCM) uses Main CPU RAM and Watchdog CPU RAM.

## Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU RAM and Watchdog CPU RAM.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

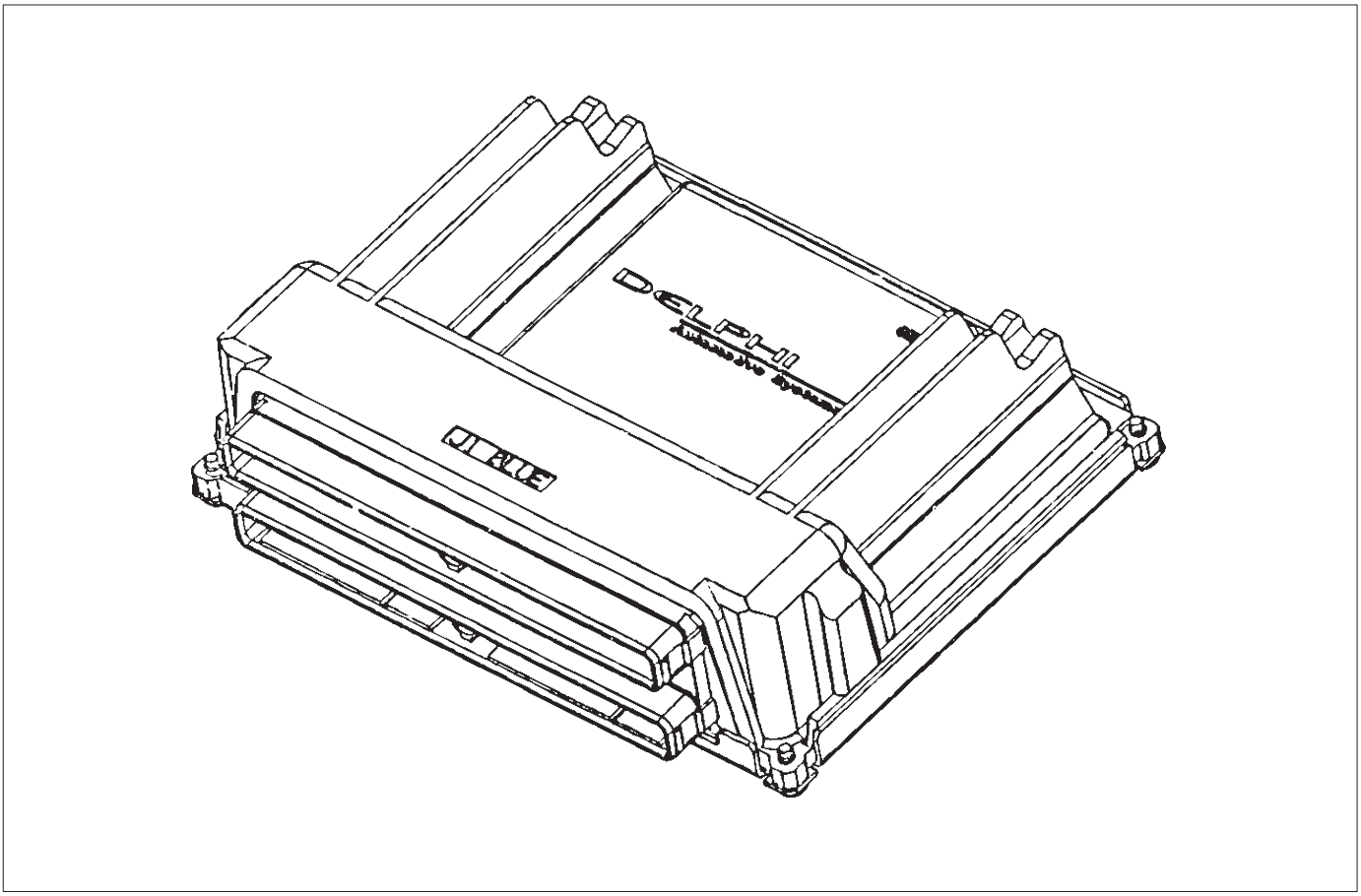
## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0604 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0604 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

# DTC P0604 – PCM RAM Error

| 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 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P0606 PCM Internal Performance




060RY014

## Circuit Description

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON”. These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs.

## Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU A/D converters and Watchdog CPU A/D converters.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

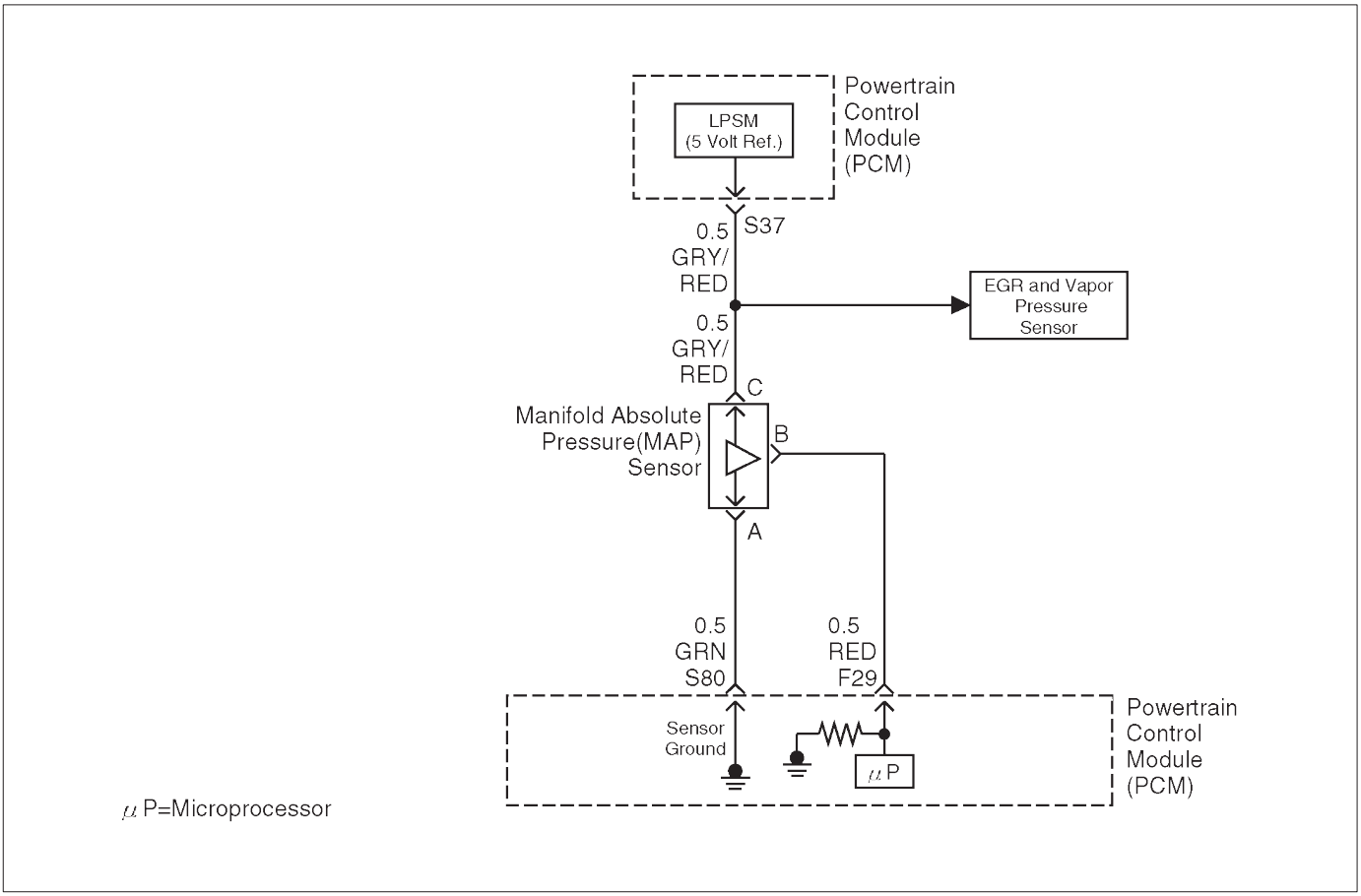
## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0606 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0606 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

# DTC P0606 – PCM Internal Performance

| 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 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>ANd also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1106 MAP Sensor Circuit Intermittent High Voltage




## Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON”, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the liner EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently above the calculated value, DTC P1106 will set.

## Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running for at least 10 seconds.
- Throttle angle is below 3% if engine speed is below 1000 RPM.
- Throttle angle is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 5 seconds over a 16-second period of time.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1106 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect PCM harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

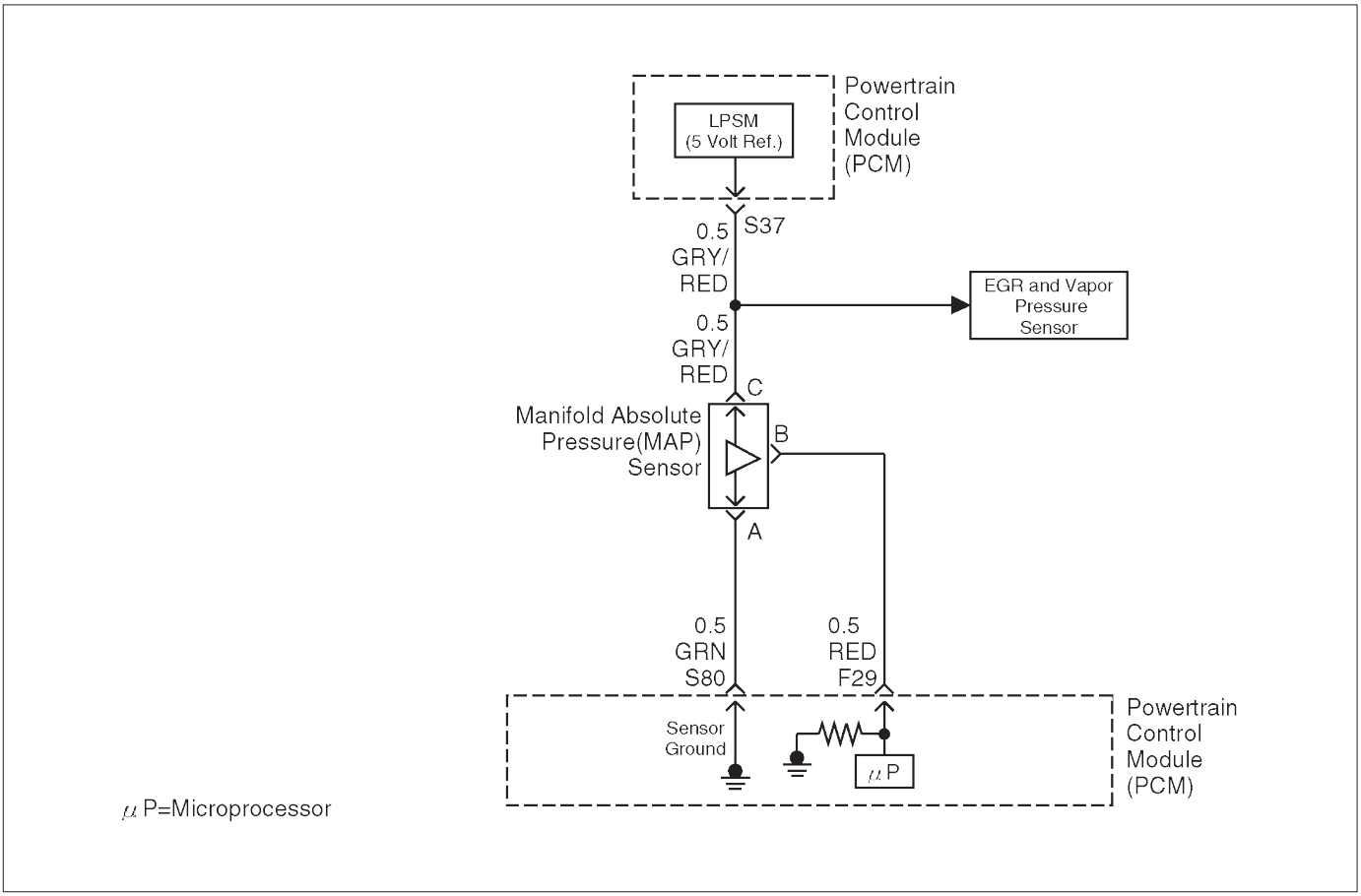
the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

- The MAP sensor shares a 5 Volt Reference with the Fuel Tank Pressure sensor. Check the 5 Volt reference if this DTC is also set.
- The MAP sensor shares a ground with the Fuel Tank Pressure sensor and the ECT Sensor. Check the ground if these other DTCs are also set.

## DTC P1106 – MAP Sensor Circuit Intermittent High Voltage

| 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 | Is DTC P0108 also set? | — | Go to *DTC P0108* chart first | Go to *Step 3* |
| 3 | Are DTC P1111, P1115, and/or P1120 also set? | — | Go to *Step 6* | Go to *Step 4* |
| 4 | Check for a poor sensor ground circuit terminal connection at the MAP sensor.<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 5* |
| 5 | Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent short to voltage.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 8* |
| 6 | Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components:<br>• MAP sensor<br>• EGR valve<br>• TP sensor<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 7* |
| 7 | Check for a poor sensor ground circuit terminal connection at the PCM.<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 8* |
| 8 | Check for an intermittent open or a faulty splice in the sensor ground circuit.<br>Was a problem found? | — | Go to *Step 10* | Refer to *Diagnostic Aids* |
| 9 | Replace the faulty harness connector terminal for the sensor ground circuit.<br>Is the action complete? | — | Verify repair | — |
| 10 | Locate and repair the intermittent open/short circuit in the wiring harness as necessary.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1107 MAP Circuit Intermittent Low Voltage




## Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON”, engine not running or at wide-open throttle (low vacuum).
The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently below the calculated value, DTC P1107 will be set.

## Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running.
- Ignition voltage is more than 11 volts.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 3% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure below 11 kPa for a total of approximately 5 seconds over a 16-second period of time.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1107 will Clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1107 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- The MAP Sensor shares a 5 Volt reference with the EGR Valve. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The MAP Sensor share a ground with the EGR Valve and the IAT Sensor.

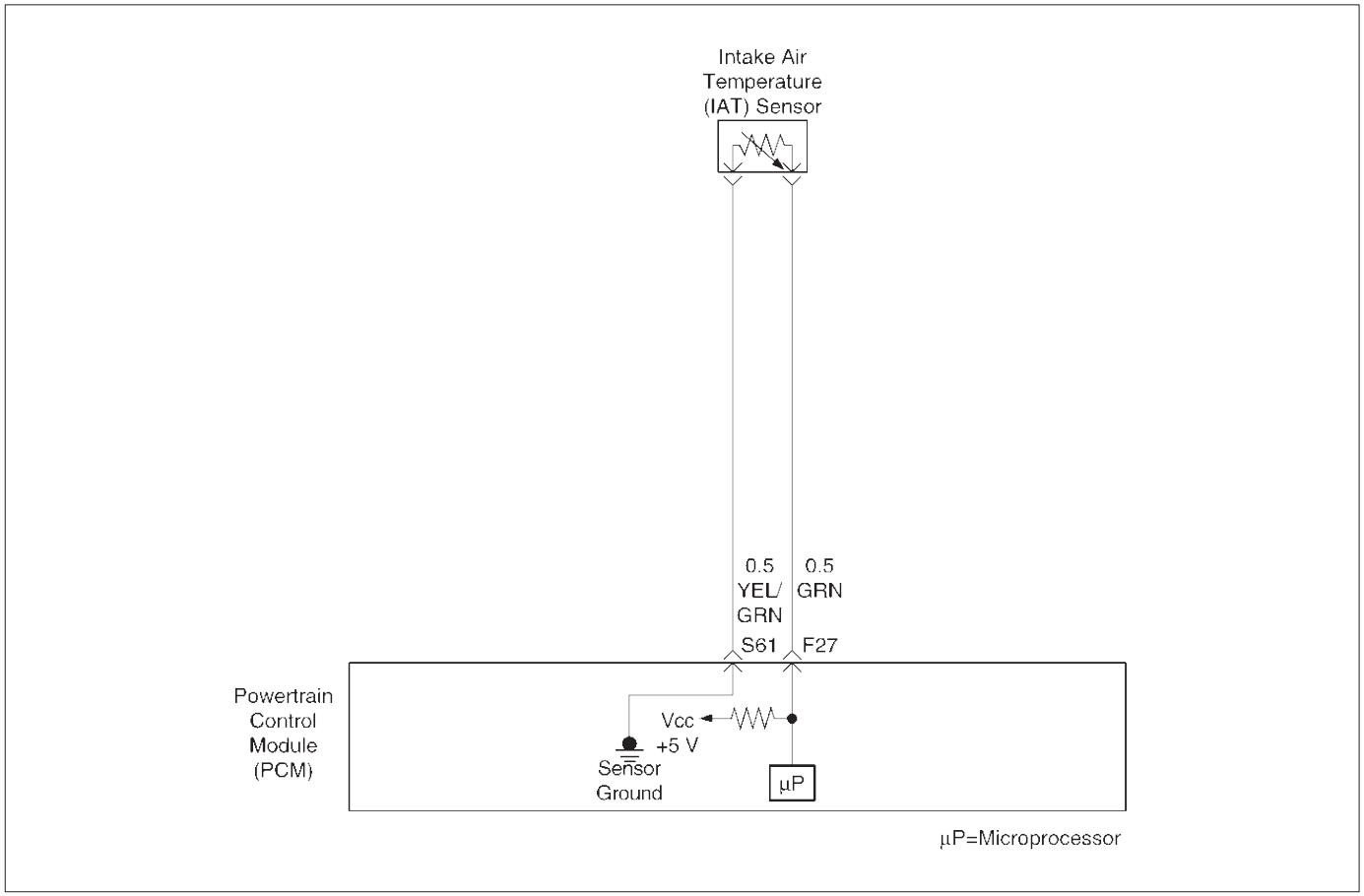
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## DTC P1107 – MAP Sensor Circuit Intermittent Low Voltage

| 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 | Is DTC P0107 also set? | — | Go to *DTC P0107* chart first | Go to *Step 3* |
| 3 | Check for a poor 5 volt reference circuit or MAP signal circuit terminal connection at the MAP sensor.<br>Was a problem found? | — | Go to *Step 8* | Go to *Step 4* |
| 4 | Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent open or short to ground.<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 7* |
| 5 | Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components:<br>• MAP sensor<br>• EGR valve<br>• TP sensor<br>Was a problem found? | — | Go to *Step 9* | Go to *Step 6* |
| 6 | Check for a poor 5 volt reference terminal connection at the PCM.<br>Was a problem found? | — | Go to *Step 8* | Go to *Step 7* |
| 7 | Check for an intermittent open or a faulty splice in the 5 volt reference circuit.<br>Was a problem found? (If no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.) | — | Go to *Step 9* | Refer to *Diagnostic Aids* |
| 8 | Replace the faulty harness connector terminal(s) for the 5 volt reference circuit and/or the MAP signal circuit as necessary.<br>Is the action complete? | — | Verify repair | — |
| 9 | Repair intermittent open/short circuit in the wiring harness as necessary.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1111 IAT Sensor Circuit Intermittent High Voltage




## Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P1111 will set when the PCM intermittently detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

## Conditions for Setting the DTC

- The engine has been running for over 30 seconds.
- Vehicle speed is less than 32 km/h (20 mph).
- Engine coolant temperature is above 60˚C (140˚F).
- Mass air flow is less than 20g/second.
- IAT signal voltage indicates and intake air temperature intermittently less than –39˚C (–38˚F) (about 5 volts) for approximately 2.5 seconds over a 25-second period of time.

## Action Taken When the DTC Sets

- The PCM will substitute a default value for intake air temperature.
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- DTC P1111 does not illuminate the MIL.

## Conditions for Clearing the MIL/DTC

- A history DTC P1111 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1111 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM –Inspect harness connectors 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. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

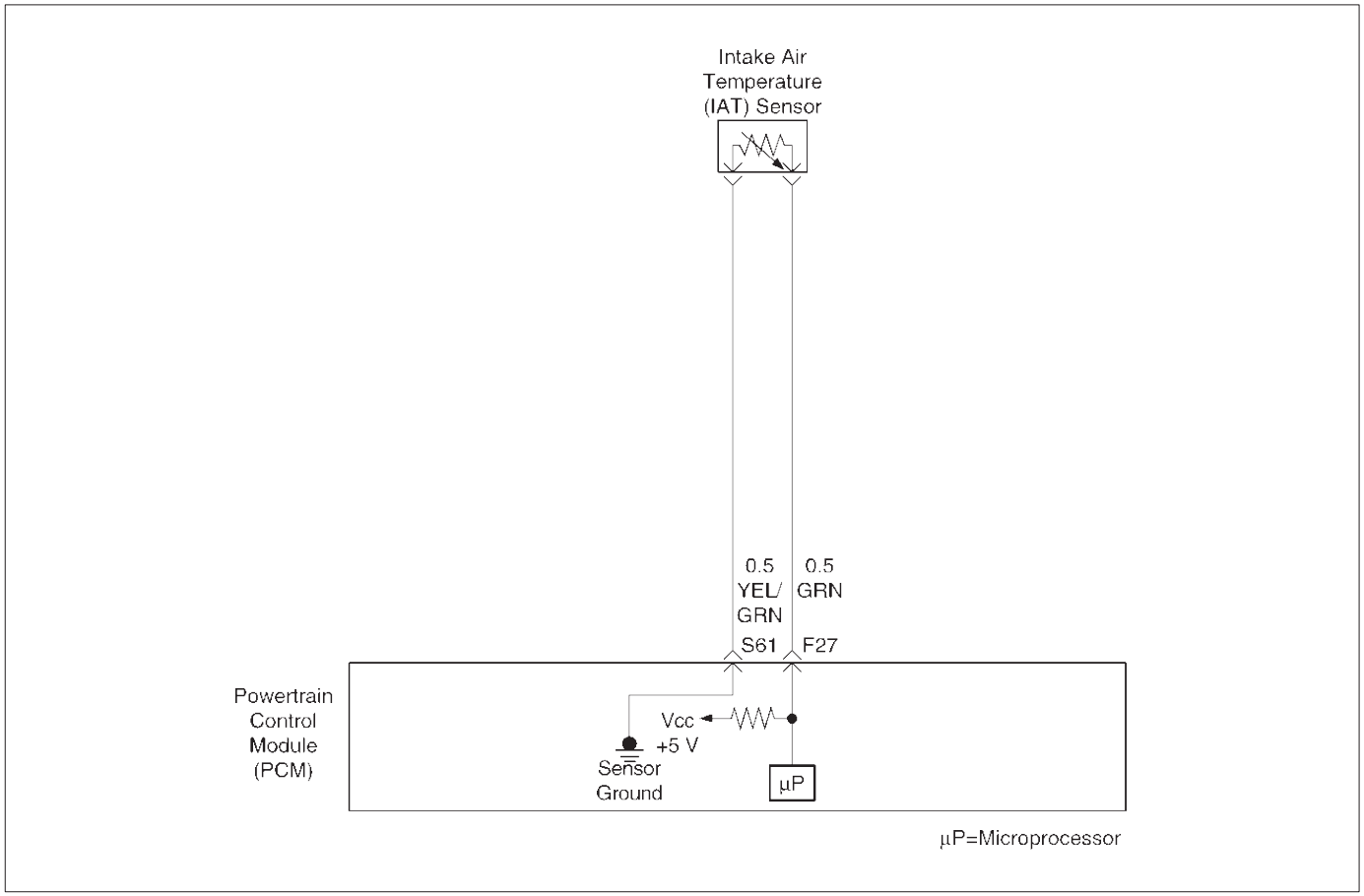
## Intake Air Temperature Sensor

| ˚C | ˚F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

# DTC P1111 –IAT Sensor Circuit Intermittent High Voltage

| 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 | Is DTC P0113 also set? | — | Go to *DTC P0113* chart first | Go to *Step 3* |
| 3 | Is DTC P1115, also set? | — | Go to *Step 6* | Go to *Step 4* |
| 4 | 1. Check for a poor sensor ground circuit terminal connection at the IAT sensor.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Check for a poor IAT signal circuit terminal connection at the IAT sensor.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent open.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to voltage.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Check for a poor sensor ground circuit terminal connection at the PCM.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Check for an intermittent open or a faulty splice in the sensor ground circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC)
# P1112 IAT Sensor Circuit Intermittent Low Voltage




## Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance becomes lower, causing the PCM to monitor a lower voltage. DTC P1112 will set when the PCM intermittently detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

## Conditions for Setting the DTC

- The engine has been running for over 15 seconds.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage is greater than 148°C (298°F) (about 0.10 volt) for a total of 2.5 seconds over a 25-second period of time.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The PCM will substitute a default value for intake air temperature.

## Conditions for Clearing the MIL/DTC

- A history DTC P1112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

2. Verifies that the fault is present.

3. If DTC P1112 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value Chart". The chart may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor.

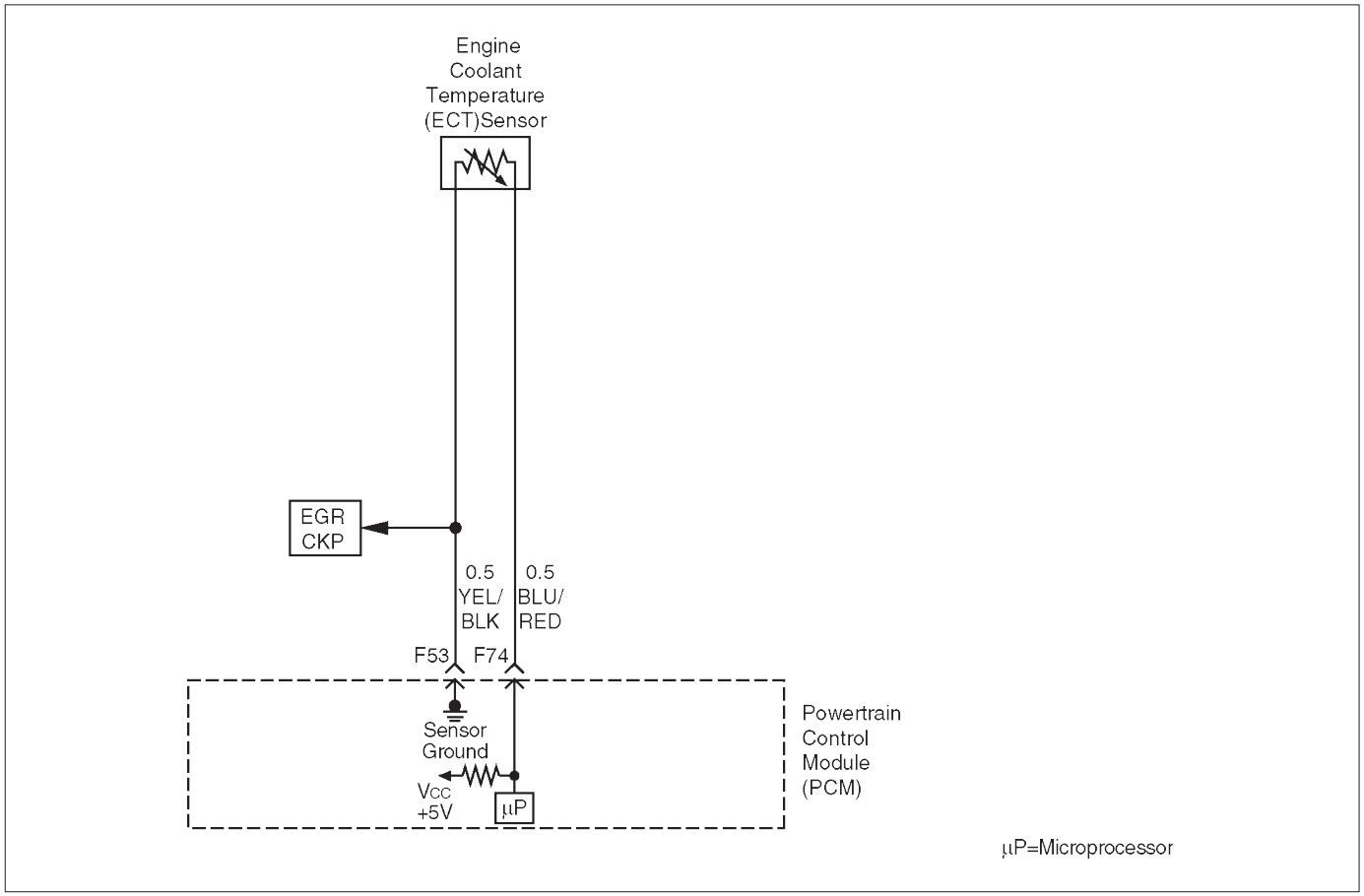
## Intake Air Temperature Sensor

| °C | °F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

# DTC P1112 – IAT Sensor Circuit Intermittent Low Voltage

| 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 | Is DTC P0112 also set? | — | Go to *DTC P0112* first | Go to *Step 3* |
| 3 | 1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to ground.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC)
# P1114 ECT Sensor Circuit Intermittent Low Voltage




060R200053

## Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, DTC P1114 will set.

## Conditions for Setting the DTC

- Engine run time longer than 120 seconds.
- The ECT sensor signal is intermittently greater than 150˚C (302˚F) (about 0.10 volt) for a total of 10 seconds over a 100-second period.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1114 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1114 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

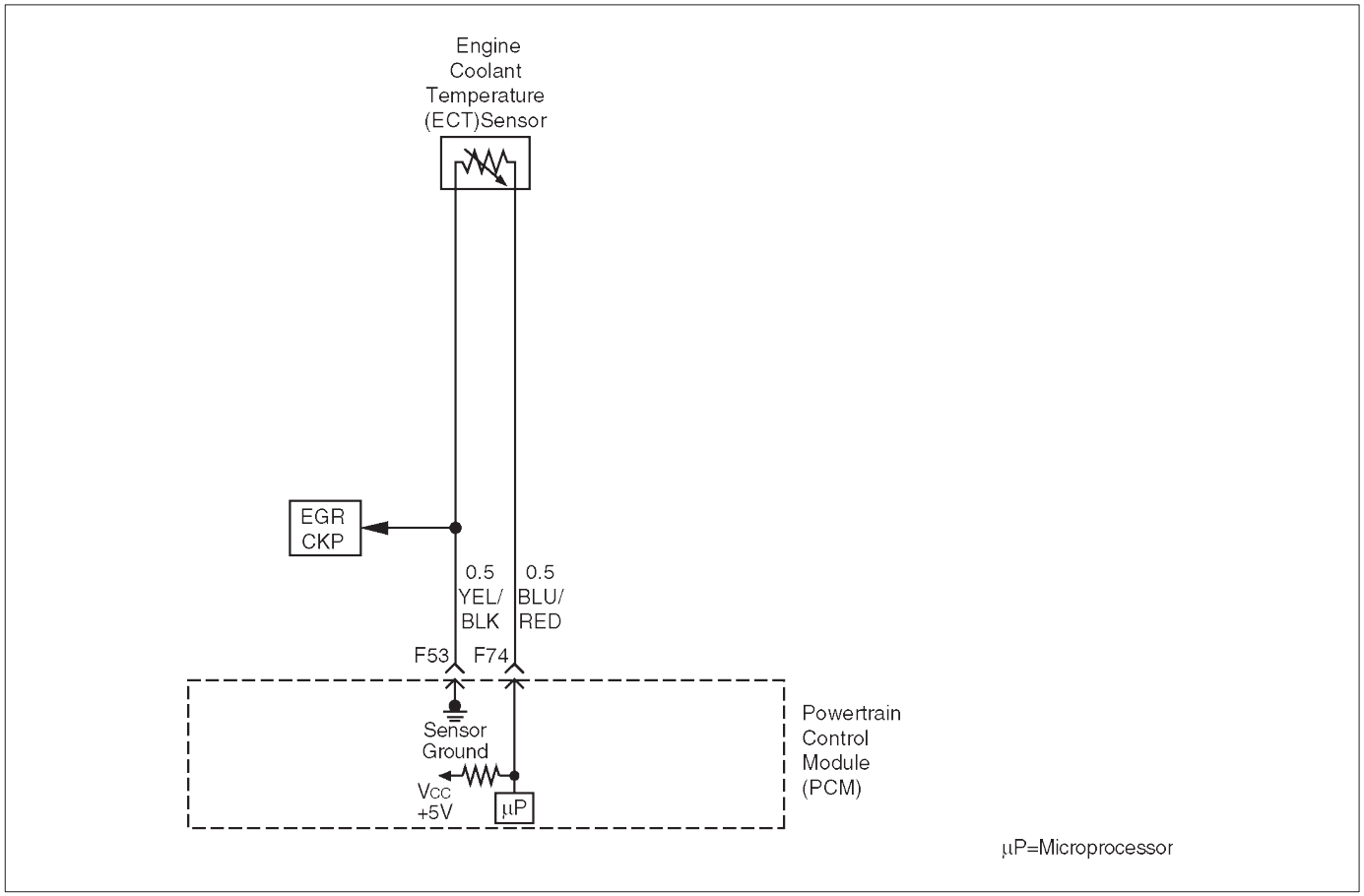
### Engine Coolant Temperature Sensor

| °C | °F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

## DTC P1114 – ECT Circuit Intermittent Low Voltage

| 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 | Is DTC P0117 also set? | — | Go to *DTC P0117* first | Go to *Step 3* |
| 3 | 1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to ground.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC)
# P1115 ECT Sensor Circuit Intermittent High Voltage




## Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, DTC P1115 will set.

## Conditions for Setting the DTC

- Engine running time longer than 90 seconds.
- The ECT sensor signal is intermittently greater than –39˚C (–38˚F) (about 5 volts) for a total of 10 seconds over a 100-second period.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1115 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1115 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

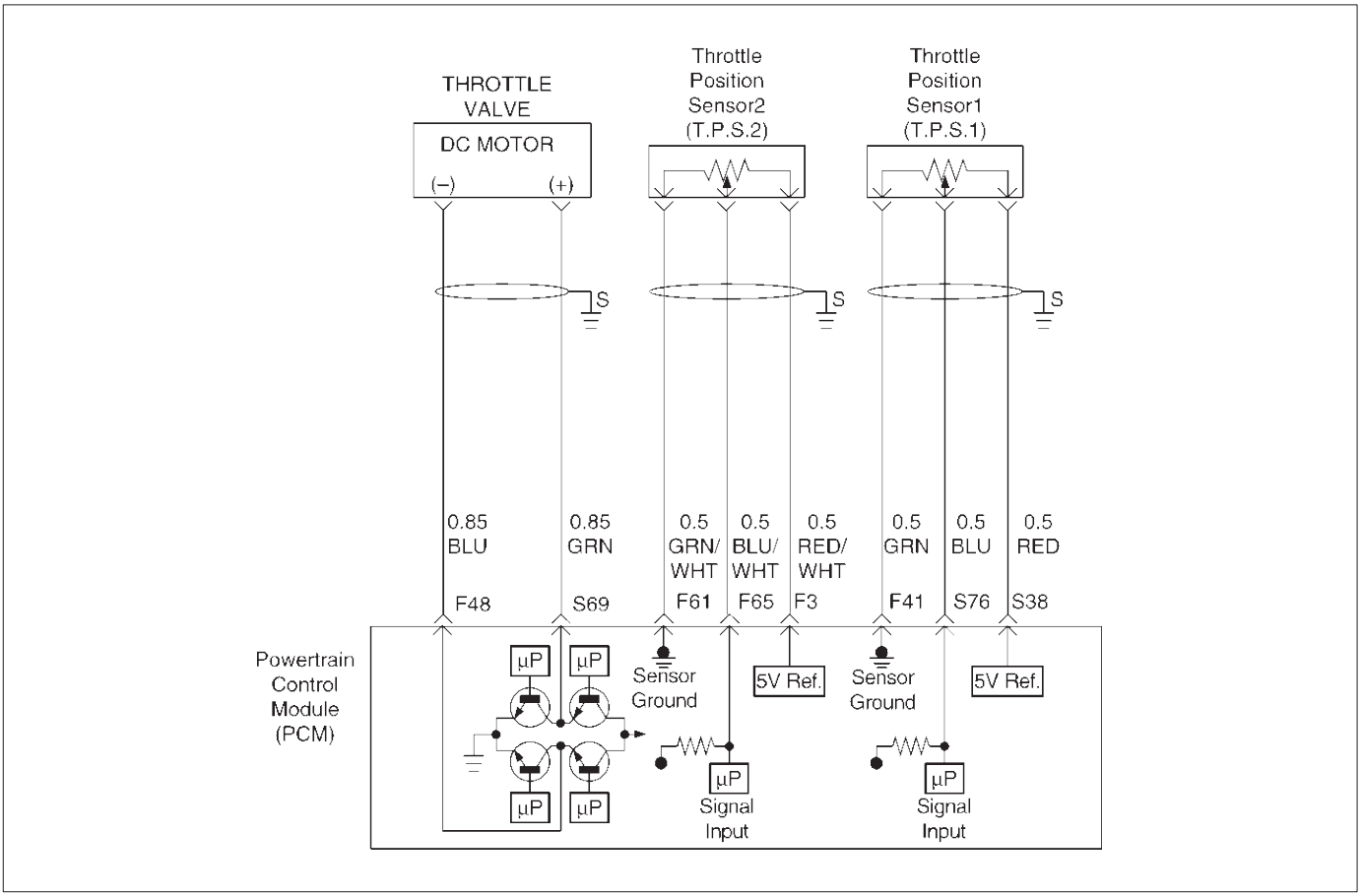
## Engine Coolant Temperature Sensor

| ˚C | ˚F | OHMS |
|---|---|---|
| **Temperature vs. Resistance Values (approximate)** | | |
| 100 | 212 | 177 |
| 80 | 176 | 332 |
| 60 | 140 | 667 |
| 45 | 113 | 1188 |
| 35 | 95 | 1802 |
| 25 | 77 | 2796 |
| 15 | 59 | 4450 |
| 5 | 41 | 7280 |
| –5 | 23 | 12300 |
| –15 | 5 | 21450 |
| –30 | –22 | 52700 |
| –40 | –40 | 100700 |

# DTC P1115 – ECT Sensor Circuit Intermittent High Voltage

| 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 | Is DTC P0118 also set? | — | Go to *DTC P0118* chart first | Go to *Step 3* |
| 3 | Is DTC P1111 also set? | — | Go to *Step 8* | Go to *Step 4* |
| 4 | 1. Check for a poor sensor ground circuit terminal connection at the ECT sensor.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Check for a poor ECT signal circuit terminal connection at the ECT sensor.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent open.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to voltage.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Check for a poor sensor ground circuit terminal connection at the PCM.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Check for an intermittent open or a faulty splice in the sensor ground circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Refer to *Diagnostic Aids* |

# Diagnostic Trouble Code(DTC)
# P1120-TPS 1 Throttle Position Sensor (TPS1) Output Abnormal




D06RY00111

## Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

  The TPS1 voltage will vary about 8% (0.4V) to about 92% (4.6V) at Wide Open Throttle (WOT) in the specified voltage (about 5V).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The TPS1 output is more than 93.6 milliseconds, less than 2.5% or more than 97.5% in the specified voltage (5V).

## Action Taken When the DTC Sets

- The PCM will turn “ON” the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1120 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1120 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the TPS 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

  If DTC P1120 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1120 Diagnostic Chart may isolate the cause of the fault.

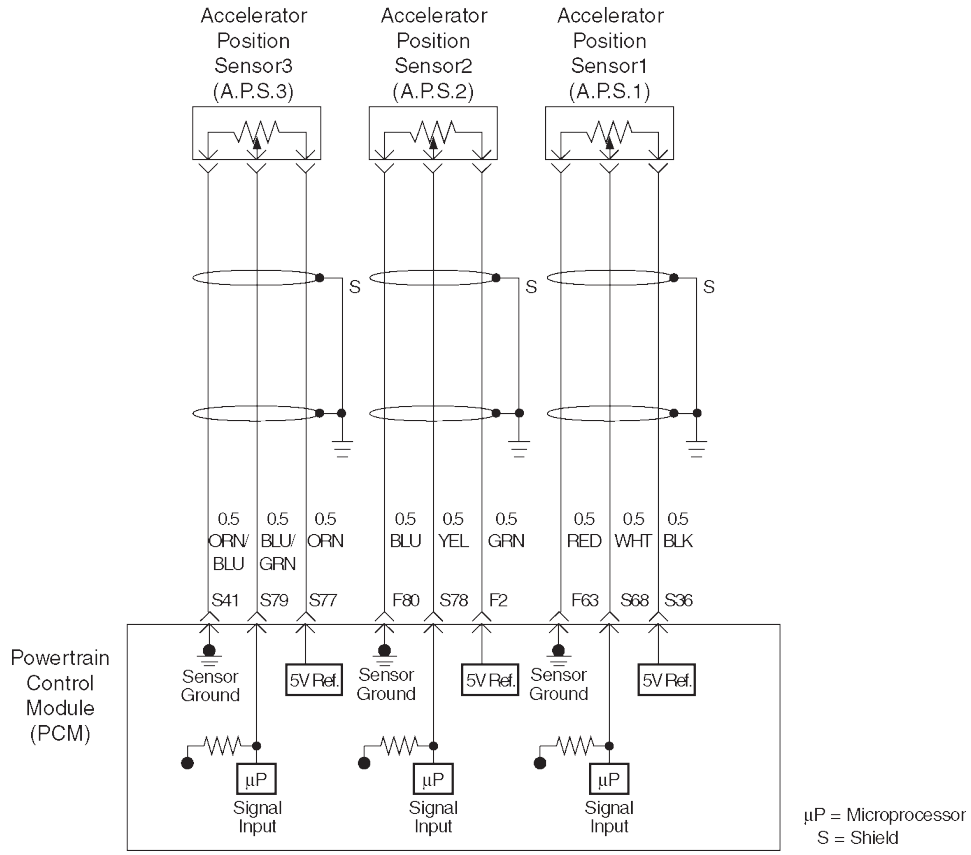
## Diagnostic Trouble Code(DTC)P1120-TPS 1 Output Abnormal

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board(OBD)System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine not running.<br>2. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? | 65kPa | Go to *Step 3* | Go to *Step 6* |
| 3 | 1. Disconnect the MAP sensor.<br>2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector.<br>3. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.) | — | Go to *Step 5* | Go to *Step 4* |
| 4 | 1. Check the MAP signal circuit between the PCM and MAP ground circuit.<br>2. If the MAP signal circuit is open or shorted, repair it as necessary.<br>Was the MAP signal circuit open or shorted? | — | Verify repair | Go to *Step 12* |
| 5 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 6 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Throttle Closed TPS1 8–10 % TPS2 8–10 % Wide Open Throttle TPS1 90–92 % TPS2 90–92 % | Refer to *Diagnostic Aids* | Go to *Step 7* |
| 7 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 8* | Go to *Step 9* |
| 8 | 1. Connect a test light between the 5Volt reference circuit and the TP sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 11* | Go to *Step 10* |
| 9 | Check the following items;<br>1. TP1 signal circuit for a short to voltage.<br>2. TP1 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |

# Diagnostic Trouble Code(DTC)P1120-TPS 1 Output Abnormal (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Check the following items;<br>1. TP signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 11 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 12 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1125 ETC (Electric Throttle Control) Limit Performance Mode




060R200064

## Circuit Description

- The accelerator position (AP1) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal angle will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects if the system is in Limit Performance Mode (Fail safe Mode) and Multiple DTCs performance Mode.

## Conditions for setting the DTC

- The Ignition is " ON".
- Limit Performance Mode is active. (Fail safe Mode)

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1125 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1125 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.

- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the AP sensor 1, AP sensor 2, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P1125 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1125 Diagnostic Chart may isolate the cause of the fault.

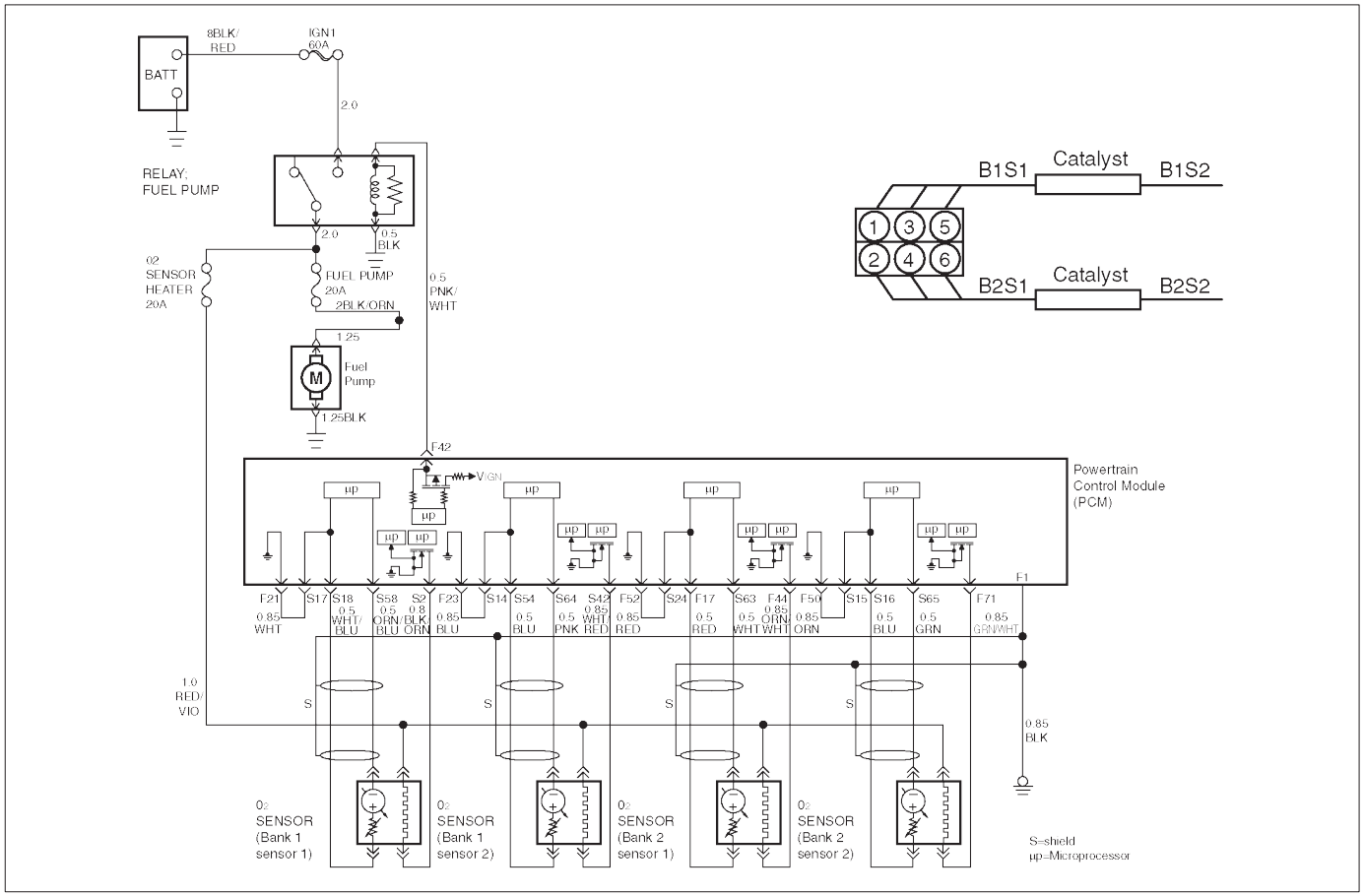
## DTC P1125 – ETC Limit Performance Model

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idle position AP sensor 1 =13 % AP sensor 2, 3 =85 ~ 89 % open throttle AP sensor 1 =85 ~ 89 % AP sensor 2 =11 ~ 15 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 Voltage supply circuit and the AP1, AP2 AND AP3 sensor signal circuit at the AP sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 7* | Go to *Step 8* |
| 6 | Check the following items;<br>1. AP1, AP2 or AP3 signal circuit for a short to voltage.<br>2. AP1, AP2 or AP3 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP1, AP2 or AP3 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |

# DTC P1125 – ETC Limit Performance Model (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 7 | Check the following items;<br>1. AP1, AP2 or AP3 signal circuit or 5 voltage supply circuit for a poor connection.<br>2. AP1, AP2 or AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP1, AP2 or AP3 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1133 HO2S Insufficient Switching Bank 1 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich threshold. If the PCM determines that the HO2S did not switch enough times, DTC P1133 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

## Conditions for Setting the DTC

- Engine coolant temperature (ECT) is above 60°C (140°F).
- Engine is operating in “closed loop”.
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 9 g/second and 42 g/second.
- Above conditions are present for 3 seconds.
- 90 seconds after “closed loop” and stoichiometric operation have been achieved, the PCM monitors the oxygen sensor as it switches above and below 450 mV. If fewer than 23 rich-to-lean and lean-to-rich switches are detected, DTC P1133 will be set.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1133 can be cleared by using Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1133 continues to set, replace the Bank 1 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

# DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1

| 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 | **IMPORTANT:** If any DTCs are set (except P1153 or P1154) refer to those DTCs before proceeding with this diagnostic chart.<br>1. Engine idling at operating temperature.<br>2. Operating the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support.<br>3. Using a Tech 2, monitor “DTC” info for DTC P1133 until the DTC P1133 test runs.<br>4. Note the test result.<br>Does the Tech 2 indicate DTC P1133 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | Did the Tech 2 also indicate that the P1153 or P1154 tests failed? | — | Go to *Step 20* | Go to *Step 4* |
| 4 | Check for leaks at the exhaust pipe joints.<br>Are the joints leaking? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Tighten the bolt/nuts at the leaking joints.<br>Is your action complete? | — | Go to *Step 2* | — |
| 6 | Check for gaskets that are damaged or improperly installed.<br>Are there damaged or misaligned gaskets? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Replace the damaged gaskets.<br>2. Align the connections.<br>3. Tighten the connections.<br>Is your action complete? | — | Go to *Step 2* | — |
| 8 | Check for loose exhaust flange connections.<br>Are the flange connections loose? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | Tighten the stud nuts or bolts to specifications.<br>Is your action complete? | — | Go to *Step 2* | — |
| 10 | Check for burned or corroded exhaust pipes.<br>Are the exhaust pipes burned or corroded? | — | Go to *Step 11* | Go to *Step 12* |

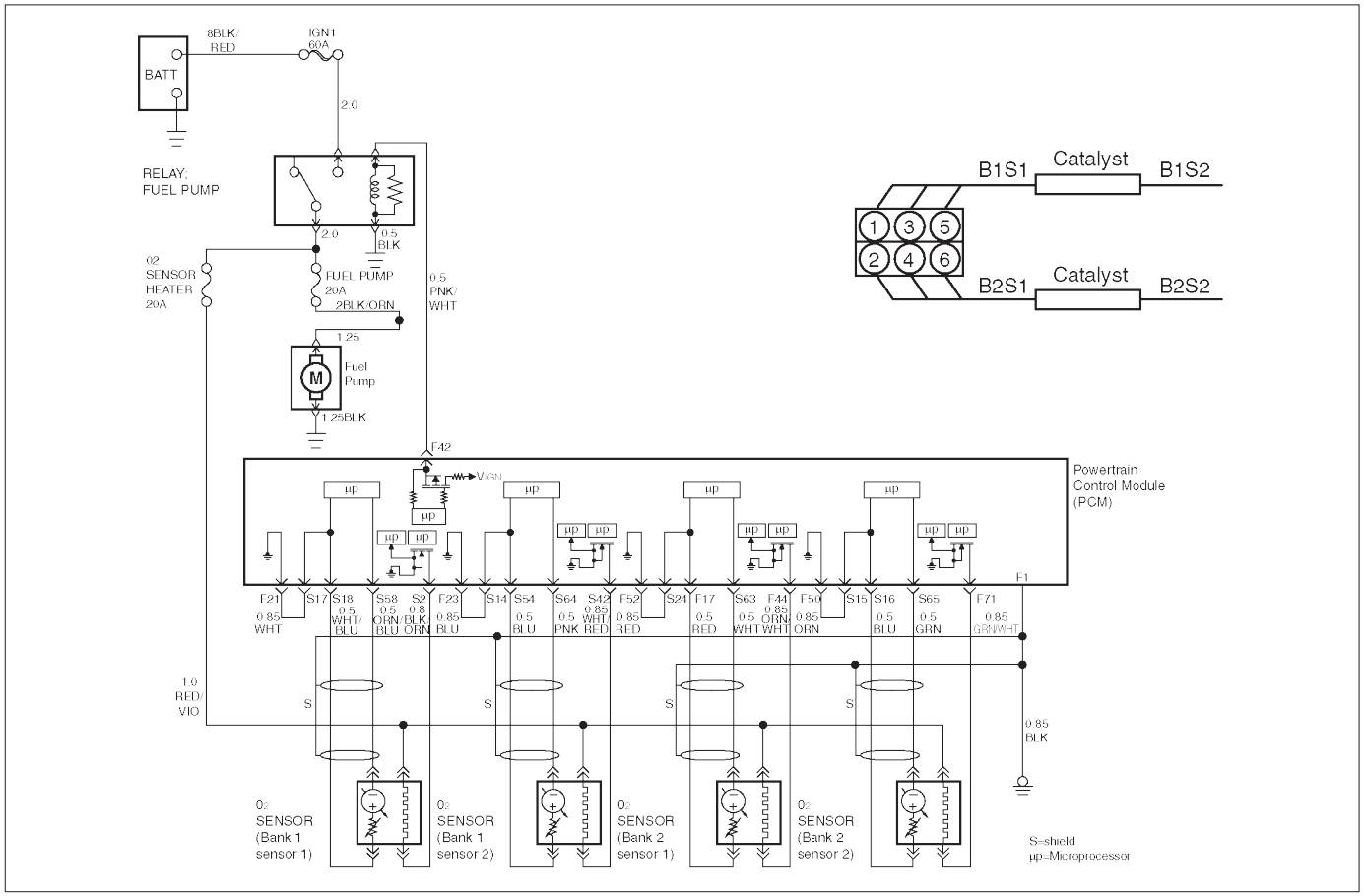
# DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Replace the exhaust pipes, as required.<br>Is your action complete? | — | Go to *Step 2* | — |
| 12 | Check for leaks at the exhaust manifold.<br>Are there leaks at the exhaust manifold? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Tighten the bolts to specifications or replace the manifold if necessary.<br>Is your action complete? | — | Go to *Step 2* | — |
| 14 | Visually/physically inspect the following items:<br>• Ensure that the Bank 1 HO2S 1 is securely installed.<br>• Check for corrosion on the terminals.<br>• Check the terminals at Bank 1 HO2S 1 and at the PCM.<br>• Check for damaged wiring.<br>Was a problem found in any of the above areas? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Disconnect Bank 1 HO2S 1.<br>2. Ignition "ON".<br>3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground.<br>Are both voltages in the specified range? | 3-4 mV | Go to *Step 18* | Go to *Step 16* |
| 16 | 1. Ignition "OFF".<br>2. Check for damage to PCM pins or terminals.<br>Was a problem found. | — | Verify repair | Go to *Step 17* |
| 17 | Check for a short to voltage or ground or an open in the signal circuit.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector.<br>3. With the HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |
| 19 | With the PCM connected and Bank 1 HO2S 1 disconnected from the harness, check Bank 1 HO2S 1 with a Tech 2.<br>Is the voltage in the specified range? | 425-475 mV | Go to *Step 21* | Go to *Step 22* |
| 20 | Replace the affected heated oxygen sensors.<br>NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected.<br>• Fuel contamination<br>• Use of improper RTV sealant.<br>• Engine oil/coolant consumption.<br>Is the action complete? | — | Verify repair | — |

# DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 21 | Replace Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1134 HO2S Transition Time Ratio Bank 1 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been established. During the monitoring period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 60°C (140°F).
- Engine is operating in “closed loop”,
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 18 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 1 HO2S 1 transition ratio between lean-to-rich and rich-to-lean is less than 0.44 or greater than 3.8.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1134 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1134 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

# DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1

| 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 | **IMPORTANT:** If any DTCs are set (except P1153 and/or P1154), refer to those DTCs before proceeding with this diagnostic chart.<br>1. Idle the engine at operating temperature.<br>2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support.<br>3. Using a Tech 2, monitor “DTC” info for DTC P1134 until the DTC P1134 test runs.<br>4. Note the test result.<br>Does Tech 2 indicate DTC 1134 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | Did the Tech 2 also indicate P1153, and/or P1154 test failed? | — | Go to *Step 17* | Go to *Step 4* |
| 4 | Check for leaks at the exhaust pipe joints.<br>Are the joints leaking? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Tighten the U-bolt nuts at the leaking joints.<br>Is your action complete? | — | Go to *Step 2* | — |
| 6 | Check for gaskets that are damaged or improperly installed.<br>Are there damaged or misaligned gaskets? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Replace the damaged gaskets.<br>2. Align the connections.<br>3. Tighten the connections.<br>Is your action complete? | — | Go to *Step 2* | — |
| 8 | Check for loose exhaust flange connections.<br>Are the flange connections loose? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | Tighten the stud nuts or bolts to specifications.<br>Is your action complete? | — | Go to *Step 2* | — |
| 10 | Check for burned or corroded exhaust pipes.<br>Are the exhaust pipes burned or corroded? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Replace the exhaust pipes, as required.<br>Is your action complete? | — | Go to *Step 2* | — |

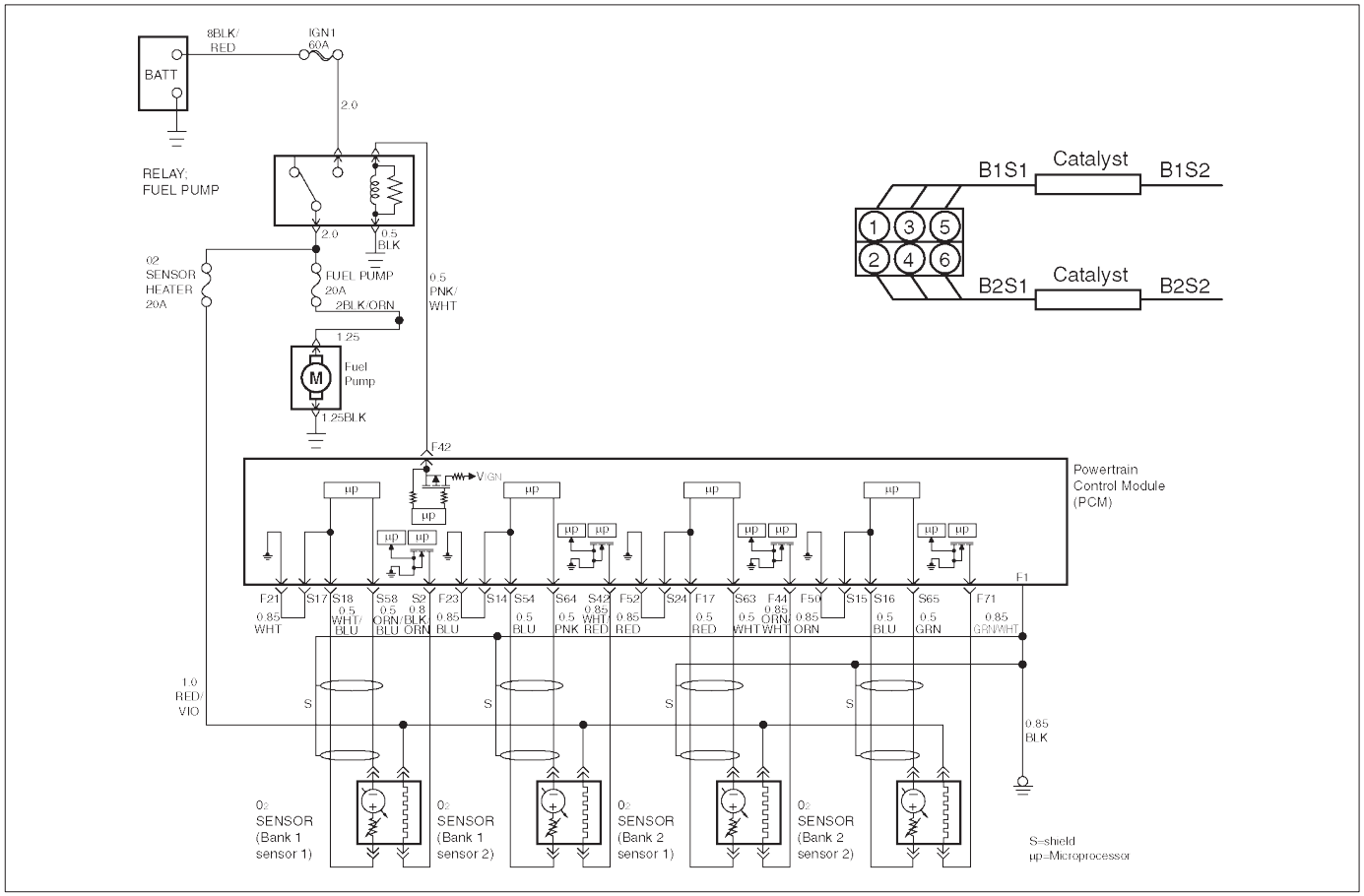
# DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | Check for leaks at the exhaust manifold.<br>Are there leaks at the exhaust manifold? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Tighten the bolts to specifications or replace the manifold if necessary.<br>Is your action complete? | — | Go to *Step 2* | — |
| 14 | Visually/physically inspect the following items:<br>● Ensure that the Bank 1 HO2S 1 is securely installed.<br>● Check for corrosion on terminals.<br>● Check the terminal tension (at Bank 1 HO2S 1 and at the PCM).<br>● Check for damaged wiring.<br>Was a problem found in any of the above areas? | — | Go to *Step 18* | Go to *Step 15* |
| 15 | 1. Disconnect Bank 1 HO2S 1.<br>2. Ignition "ON".<br>3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground.<br>4. Also measure the voltage between the low signal circuit and ground.<br>Are both voltages in the specified range? | 3-4V | Go to *Step 16* | Go to *Step 19* |
| 16 | 1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground.<br>2. Ignition "ON".<br>3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage.<br>Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed? | — | Go to *Step 21* | Go to *Step 22* |
| 17 | Replace affected heated oxygen sensors.<br>NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected.<br>● Fuel contamination.<br>● Use of improper RTV sealant.<br>● Engine oil/coolant consumption.<br>Is the action complete? | — | Verify repair | — |
| 18 | Repair condition as necessary.<br>Is the action complete? | — | Verify repair | — |
| 19 | Check for faulty PCM connections or terminal damage.<br>Is the action complete? | — | Verify repair | Go to *Step 20* |
| 20 | Repair open, short or grounded signal circuit.<br>Is the action complete? | — | Verify repair | Go to *Step 7* |

# DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 21 | Replace Bank 1 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1153 HO2S Insufficient Switching Bank 2 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich thresholds. If the PCM determines that the HO2S did not switch enough times, DTC P1153 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

## Conditions for Setting the DTC

- The engine is operating in “closed loop”,
- Engine coolant temperature (ECT) is above 60°C (140°F).
- The engine has been running for over 60 seconds.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 8 g/second and 42 g/second.
- Above conditions are present for a 3 seconds.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, the PCM monitors the oxygen sensor switching above and below 450 mV. If fewer than 27 rich-to-lean and lean-to-rich switches for Bank 2 HO2S 1 are detected, DTC P1153 will set.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1153 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1153 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1153 continues to set, replace the Bank 2 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

## DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1

| 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 | **IMPORTANT:** If any DTCs are set, (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart.<br>1. Idle the engine at operating temperature.<br>2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support.<br>3. Using a Tech 2, monitor “DTC” info for DTC P1153 until the DTC P1153 test runs.<br>Note the test result.<br>Does Tech 2 indicate DTC failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | Did the Tech 2 also indicate P1133 and/or P1134 test failed? | — | Go to *Step 20* | Go to *Step 4* |
| 4 | Check for leaks at the exhaust pipe joints.<br>Are the joints leaking? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Tighten the U-bolt nuts at the leaking joints.<br>Is your action complete? | — | Go to *Step 2* | — |
| 6 | Check for gaskets that are damaged or improperly installed.<br>Are there damaged or misaligned gaskets? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Replace the damaged gaskets.<br>2. Align the connections.<br>3. Tighten the connections.<br>Is your action complete? | — | Go to *Step 2* | — |
| 8 | Check for loose exhaust flange connections.<br>Are the flange connections loose? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | Tighten the stud nuts or bolts to specifications.<br>Is your action complete? | — | Go to *Step 2* | — |
| 10 | Check for burned or corroded exhaust pipes.<br>Are the exhaust pipes burned or corroded? | — | Go to *Step 11* | Go to *Step 12* |

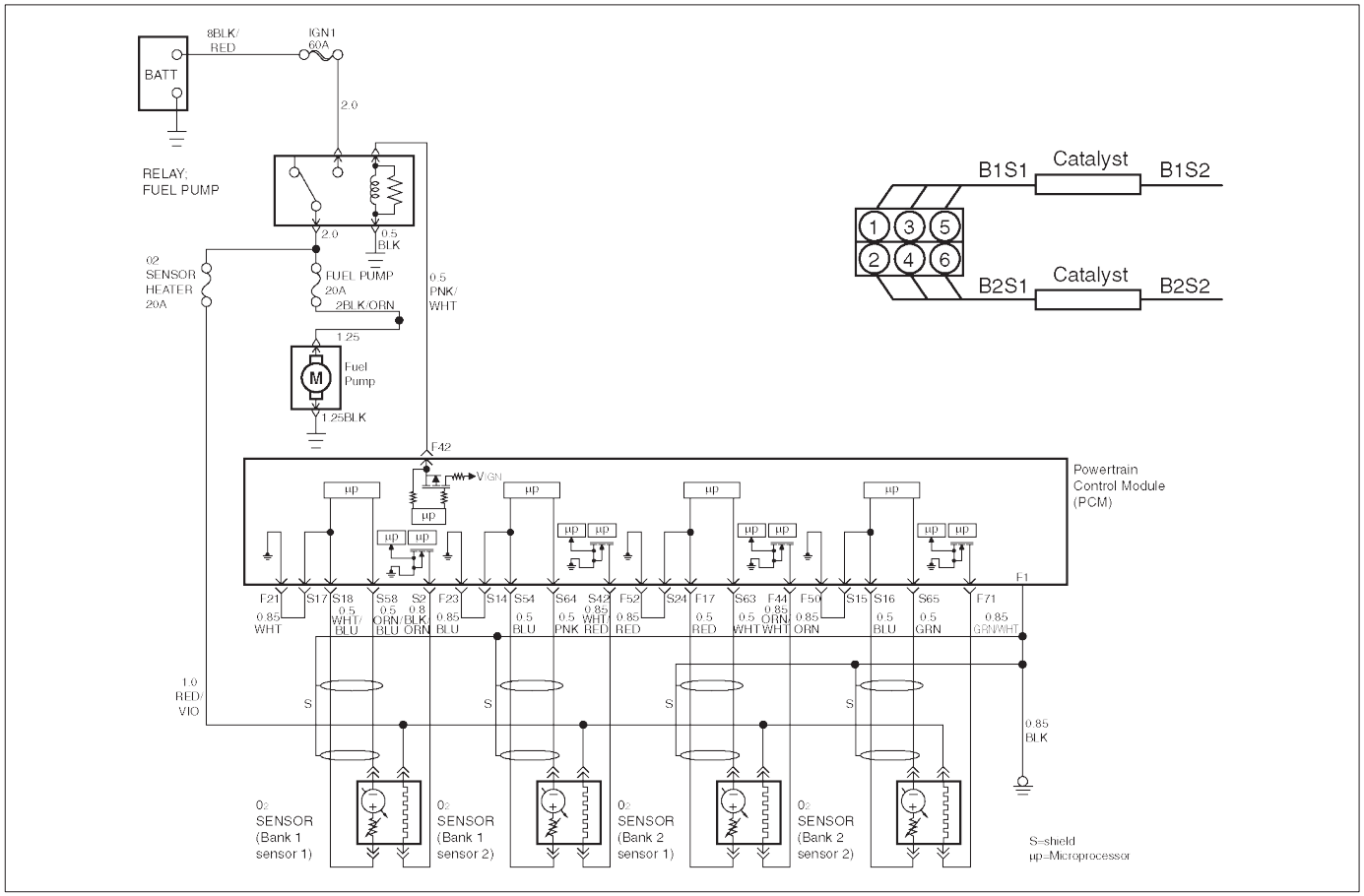
# DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | Replace the exhaust pipes, as required.<br>Is your action complete? | — | Go to *Step 2* | — |
| 12 | Check for leaks at the exhaust manifold.<br>Are there leaks at the exhaust manifold? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Tighten the bolts to specifications or replace the manifold if necessary.<br>Is your action complete? | — | Go to *Step 2* | — |
| 14 | Visually/physically inspect the following items:<br>• Ensure that the Bank 2 HO2S 1 is securely installed.<br>• Check for corrosion on terminals.<br>• Check the terminal tension at Bank 2 HO2S 1 and at the PCM.<br>• Check for damaged wiring.<br>Was a problem found in any of the above areas? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Disconnect Bank 2 HO2S 1.<br>2. Ignition "ON".<br>3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground.<br>Are both voltages in the specified range? | 3-4V | Go to *Step 18* | Go to *Step 16* |
| 16 | 1. Ignition "ON".<br>2. Check for damage to PCM pins or terminals.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | Check for short to voltage or ground or an open in the signal circuit.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector.<br>3. With HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |
| 19 | With the PCM connected and Bank 2 HO2S 1 disconnected from the harness, check Bank 2 HO2S 1 with a Tech 2.<br>Is the voltage in the specified range? | 425-475 mV | Go to *Step 21* | Go to *Step 22* |
| 20 | Replace affected heated oxygen sensors.<br>NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected.<br>• Fuel contamination.<br>• Use of improper RTV sealant.<br>• Engine oil/coolant consumption.<br>Is the action complete? | — | Verify repair | — |

# DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 21 | Replace Bank 2 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1154 HO2S Circuit Transition Time Ratio Bank 2 Sensor 1




060R200054

## Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During the monitor period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1154 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

## Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 60°C (140°F).
- The engine is operating in “closed loop”,
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 18 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 2 HO2S 1 transition ratio between lean to rich and rich to lean is less than 0.44 or greater than 3.8.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1154 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

A multifunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1154 to set. Check HO2S heater circuitry for intermittent faults or poor connections.

If connections and wiring are OK and DTC P1154 continues to set, replace the Bank 2 HO2S 1.
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

## DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1

| 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 | **IMPORTANT:** If any other DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart.<br>1. Idle the engine at operating temperature.<br>2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support.<br>3. Using a Tech 2, monitor “DTC” info for DTC P1154 until the DTC P1154 test runs.<br>Note the test result.<br>Does Tech 2 indicate DTC failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | Did the Tech 2 also indicate P1133, and/or P1134 test failed? | — | Go to *Step 17* | Go to *Step 4* |
| 4 | Check for leaks at the exhaust pipe joints.<br>Are the joints leaking? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Tighten the U-bolt nuts at the leaking joints.<br>Is your action complete? | — | Go to *Step 2* | — |
| 6 | Check for gaskets that are damaged or improperly installed.<br>Are there damaged or misaligned gaskets? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Replace the damaged gaskets.<br>2. Align the connections.<br>3. Tighten the connections.<br>Is your action complete? | — | Go to *Step 2* | — |
| 8 | Check for loose exhaust flange connections.<br>Are the flange connections loose? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | Tighten the stud nuts or bolts to specifications.<br>Is your action complete? | — | Go to *Step 2* | — |
| 10 | Check for burned or corroded exhaust pipes.<br>Are the exhaust pipes burned or corroded? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Replace the exhaust pipes, as required.<br>Is your action complete? | — | Go to *Step 2* | — |

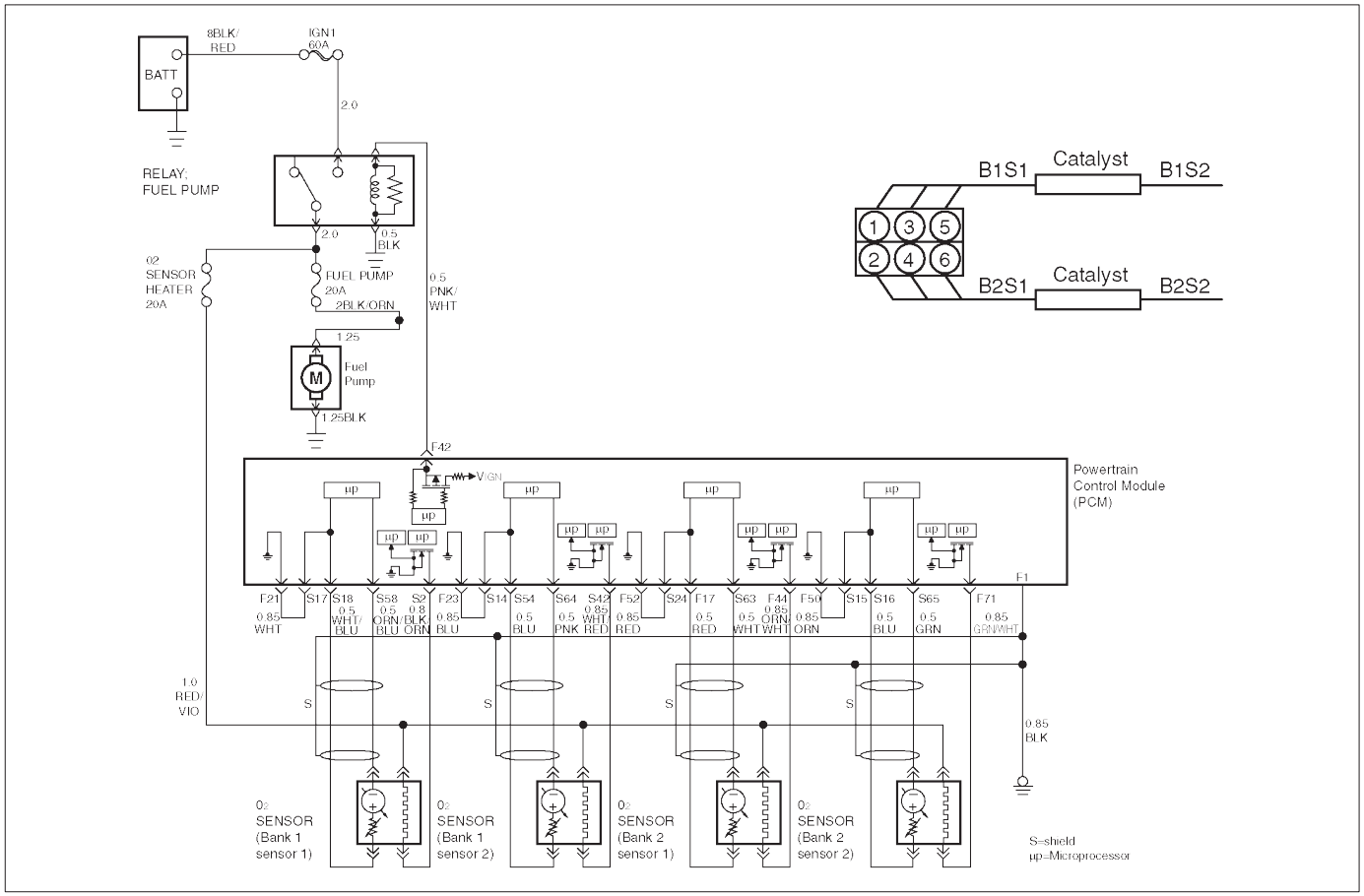
# DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | Check for leaks at the exhaust manifold.<br>Are there leaks at the exhaust manifold? | — | Go to *Step 13* | Go to *Step 14* |
| 13 | Tighten the bolts to specifications or replace the manifold if necessary.<br>Is your action complete? | — | Go to *Step 2* | — |
| 14 | Visually/physically inspect the following items:<br>● Ensure that the Bank 2 HO2S 1 is securely installed.<br>● Check for corrosion on terminals.<br>● Check terminal tension (at Bank 2 HO2S 1 and at the PCM).<br>● Check for damaged wiring.<br>Was a problem found in any of the above areas? | — | Go to *Step 18* | Go to *Step 15* |
| 15 | 1. Disconnect Bank 2 HO2S 1.<br>2. Ignition "ON".<br>3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground.<br>Also measure the voltage between the low signal circuit and ground.<br>Are both voltages in the specified range? | 3-4 V | Go to *Step 16* | Go to *Step 19* |
| 16 | 1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground.<br>2. Ignition "ON".<br>3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage.<br>Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed? | — | Go to *Step 21* | Go to *Step 22* |
| 17 | Replace affected heated oxygen sensors.<br>NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected.<br>● Fuel contamination.<br>● Use of improper RTV sealant.<br>● Engine oil/coolant consumption.<br>Is the action complete? | — | Verify repair | — |
| 18 | Repair condition as necessary.<br>Is the action complete? | — | Verify repair | — |
| 19 | Check for faulty PCM connections or terminal damage.<br>Is the action complete? | — | Verify repair | Go to *Step 20* |
| 20 | Repair open, short or grounded signal circuit.<br>Is the action complete? | — | Verify repair | — |

# DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 21 | Replace Bank 2 HO2S 1.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1167 Fuel System Rich During Decel Fuel Cut Off (Bank 1)




060R200054

## Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean response is indicated and adds the amount of time it look to complete all rich to lean transitions and lean to rich transitions.
This code detects if Bank1 O2 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

## Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 °C (140 °F).
- Engine is operating in “closed loop” power enrichment mode for 3 seconds.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1167 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1167 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

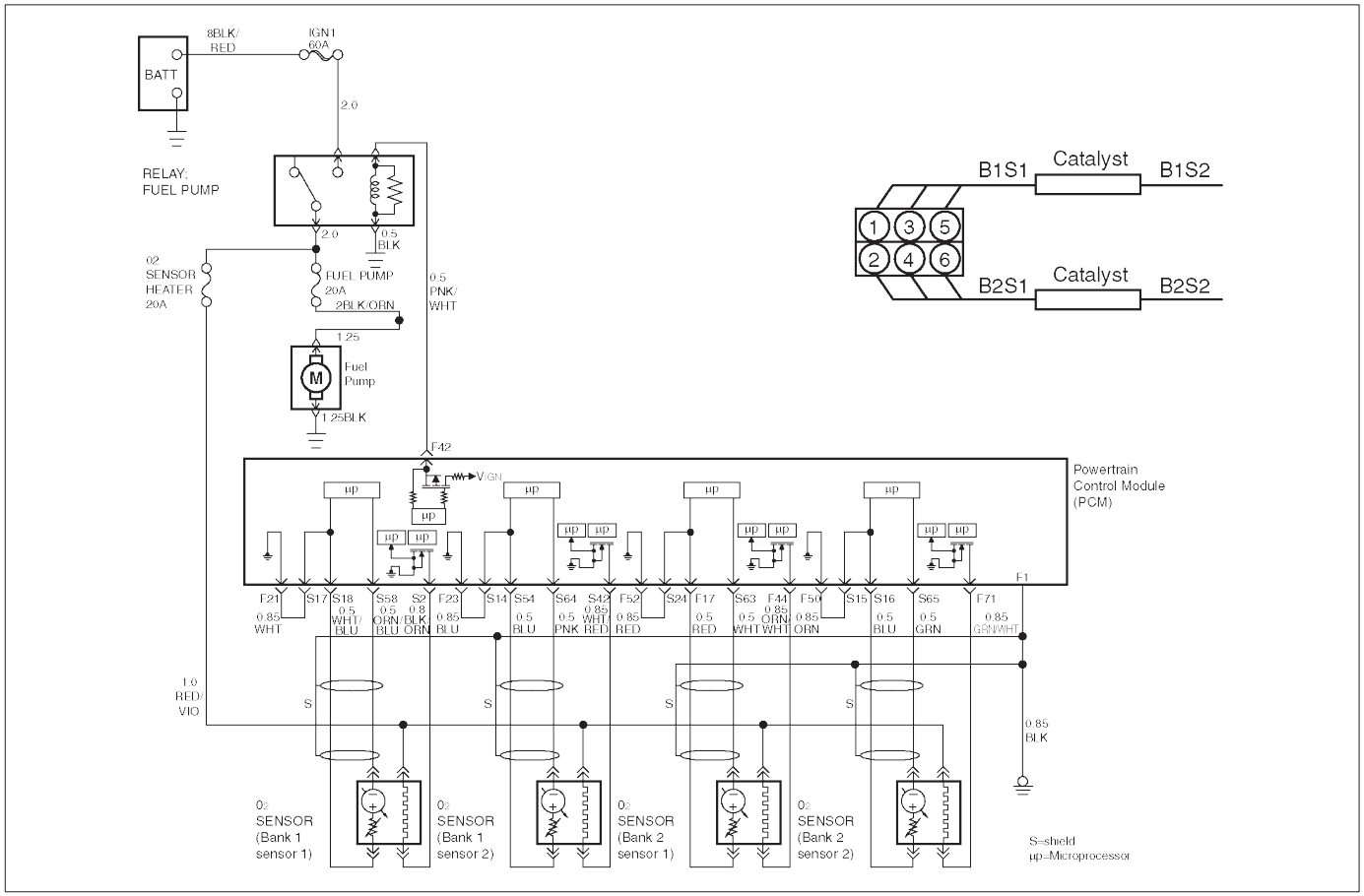
## Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.

# Diagnostic Trouble Code (DTC)
# P1167 Fuel System Rich During Decel Fuel Cut Off (Bank1)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Are any component related DTCs set? | | Go to *component DTC charts* | Go to *Step 3* |
| 3 | 1. Place the transmission in Park.<br>2. Using a Tech 2, HO2S 1 voltage while running warm engine 75 ˚C – 95 ˚C (167 ˚F – 203 ˚F) at 1200 RPM.<br>3. HO2S 1 voltages should vary within the specified range. (100 – 900mV)<br>4. Quickly open the wide open the throttle for a few seconds.<br>Did the voltage suddenly rise toward the low end of the specified range? | 100 – 600 mV | Go to *OBD System Check* | Go to *Step 4* |
| 4 | 1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure.<br>2. Install the fuel pressure gauge.<br>3. Start the engine and idle at normal operating temperature.<br>4. Disconnect the vacuum line going to the fuel pressure regulator.<br>With the engine running, is the fuel pressure within the specified range? | 280 – 325Kpa (41 – 46psi) | Go to *OBD System Check* | Go to *Step 5* |
| 5 | 1. Ignition “OFF”.<br>2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay’s battery terminal to the terminal leading to the fuel pump fuse.<br>3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value).<br>Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value?<br>Is the fuel pressure gauge reading near the specified value? | 325KPa (46psi)<br>414KPa (60psi) | Refer to *Diagnostic Aids* | Go to *Step 6* |
| 6 | Check the following items;<br>● Faulty fuel pump<br>● Incorrect fuel pump<br>● Incorrect fuel being used<br>● Cold fuel<br>If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1169 Fuel System Rich During Decel Fuel Cut Off (Bank 2)




060R200054

## Circuit Description

The powertrain control module(PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean response is indicated and adds the amount of time it look to complete all rich to lean transitions and lean to rich transitions.

This code detects if Bank2 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

## Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 °C (140 °F).
- Engine is operating in “closed loop” power enrichment mode for 3 seconds.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp(MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1169 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1169 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

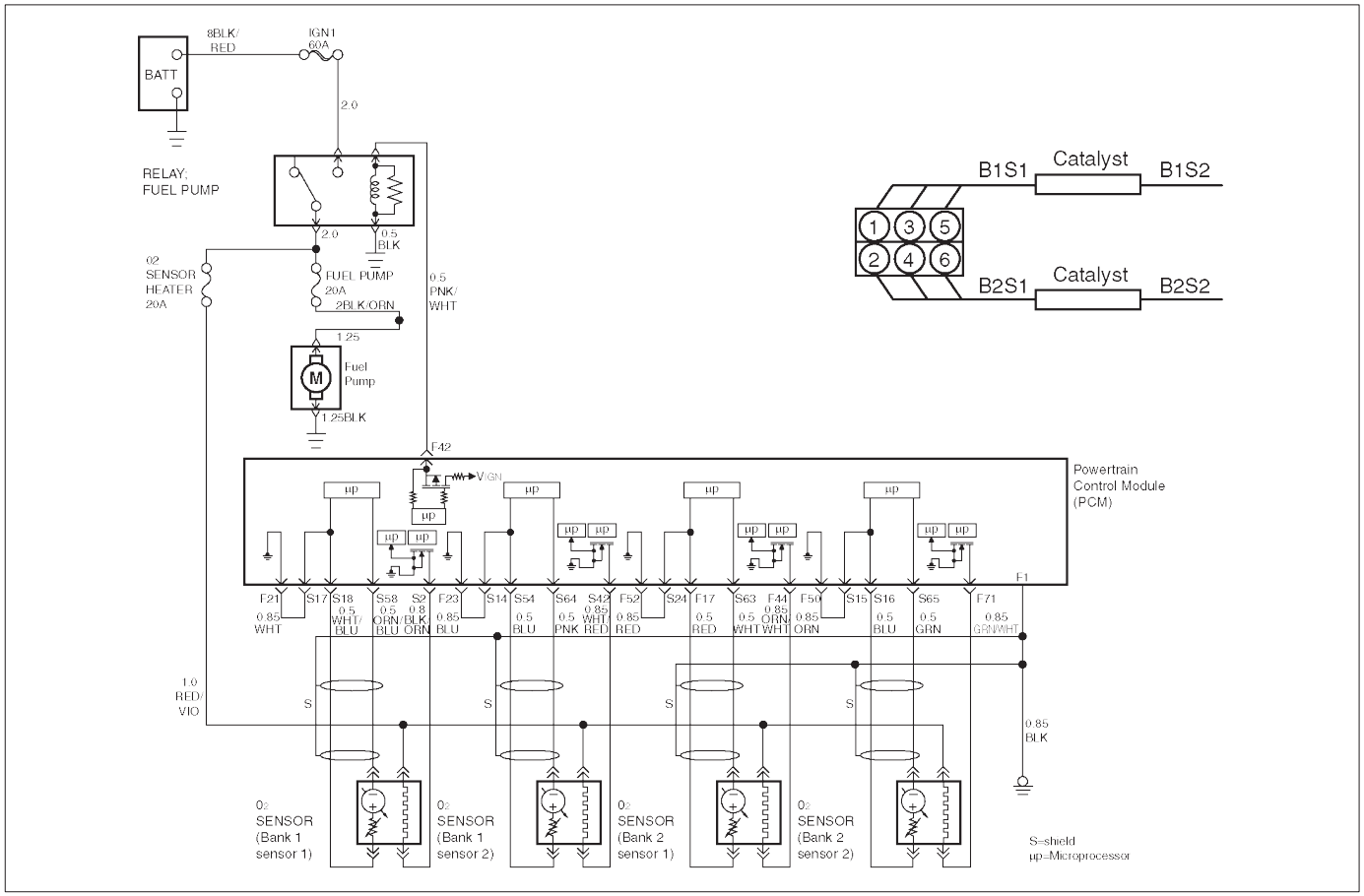
## Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.
- Check the pressure regulator.

# Diagnostic Trouble Code (DTC)
# P1169 Fuel System Rich During Decel Fuel Cut Off (Bank2)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Are any component related DTCs set? | | Go to *component DTC charts* | Go to *Step 3* |
| 3 | 1. Place the transmission in Park.<br>2. Using a Tech 2, HO2S 2 voltage while running warm engine75 C – 95 C (167 F – 203 F) at 1200 RPM.<br>3. HO2S 1 voltages should vary within the specified range. (100 – 900mV)<br>4. Quickly open the wide open the throttle for a few seconds.<br>Did the voltage suddenly rise toward the low end of the specified range? | 100 – 600 mV | Go to *OBD System Check* | Go to *Step 4* |
| 4 | 1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure.<br>2. Install the fuel pressure gauge.<br>3. Start the engine and idle at normal operating temperature.<br>4. Disconnect the vacuum line going to the fuel pressure regulator.<br>With the engine running, is the fuel pressure within the specified range? | 280 – 325Kpa (41 – 46psi) | Go to *OBD System Check* | Go to *Step 5* |
| 5 | 1. Ignition “OFF”.<br>2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay’s battery terminal to the terminal leading to the fuel pump fuse.<br>3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value).<br>Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value?<br>Is the fuel pressure gauge reading near the specified value? | 325KPa (46psi)<br>414KPa (60psi) | Refer to *Diagnostic Aids* | Go to *Step 6* |
| 6 | Check the following items;<br>● Faulty fuel pump<br>● Incorrect fuel pump<br>● Incorrect fuel being used<br>● Cold fuel.<br>If a problem is found, repair one as necessary.<br>Was a problem found? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1171 Fuel System Lean During Acceleration




060R200054

## Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during “closed loop” operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a “rich” condition (high oxygen sensor voltage). If this “rich” exhaust is not detected at this time, a DTC P1171 will set. A plugged fuel filter, restricted fuel line, restricted in-tank filter or defective fuel pump can prevent adequate amounts of fuel from being supplied during power enrichment mode.

## Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop power enrichment” mode for 3 seconds.
- Engine coolant temperature is above 60 °C (140 °F).
- While in “power enrichment” mode the oxygen sensor voltage remains below 400 mV for 3 seconds.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1171 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

- A restricted fuel filter or fuel line, restricted in-tank filter, or a defective fuel pump may supply adequate amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.
- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

## Test Description

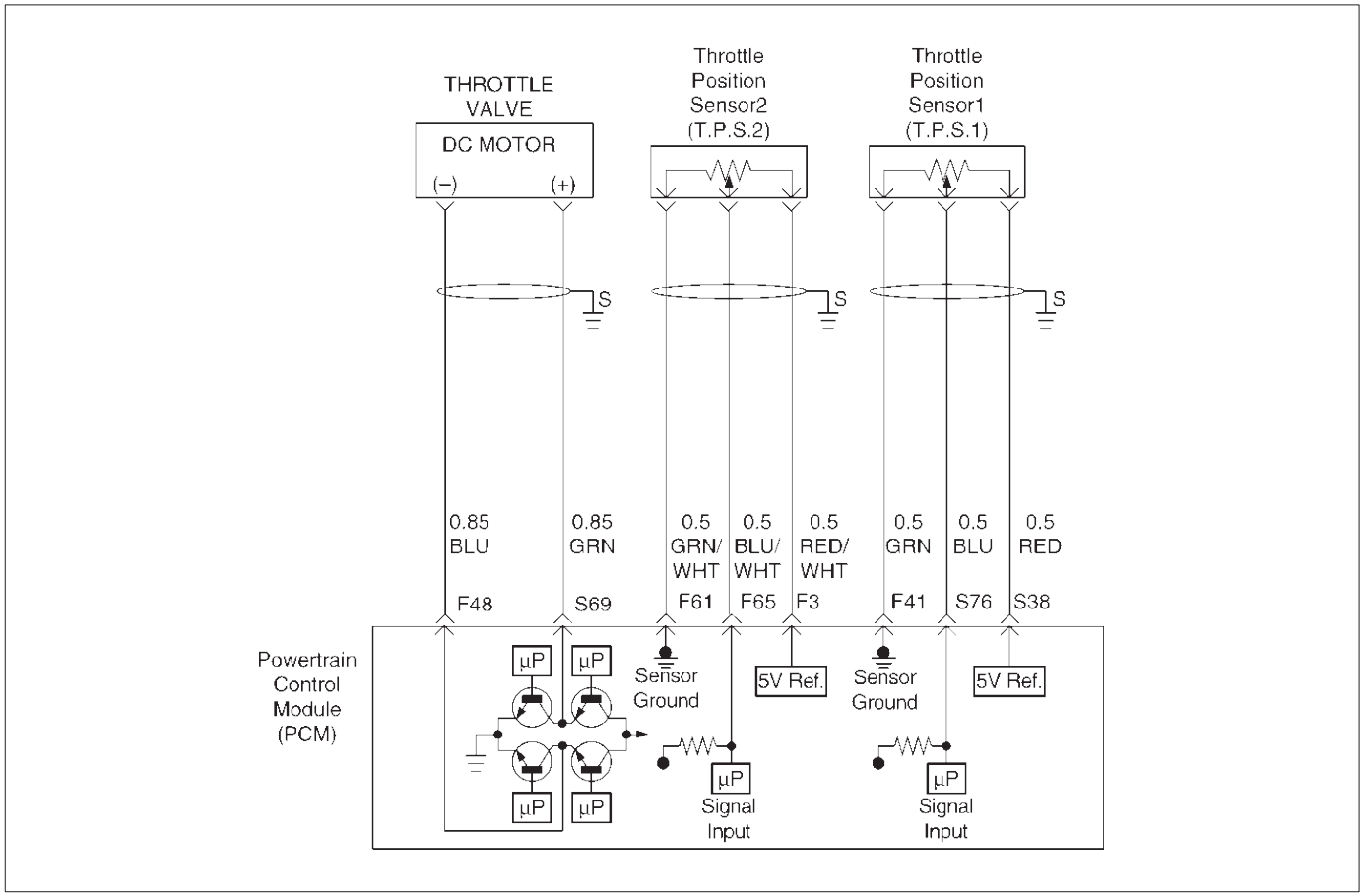
Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. It is possible to measure a satisfactory fuel pressure at idle even though the pressure may drop at high flow requirements. It may be necessary to watch fuel pressure at high engine load.
5. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing gauge. Ignition “ON”, pump pressure should be 280-320 kPa.
7. Add Caution, Use correct pliers so damage to fuel lines will not occur.

# DTC P1171 – Fuel System Lean During Acceleration

| 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 | Are any component-related DTCs set? | — | Go to component DTC charts | Go to *Step 3* |
| 3 | 1. Check the vehicle's fuel tank for an adequate amount of fuel.<br>2. Add fuel to the vehicle's fuel tank if the tank is almost empty.<br>Was fuel added to the vehicle's fuel tank? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | 1. Place the transmission in park.<br>2. Using a Tech 2, observe HO2S 1 voltage while running warm engine 75˚C-95˚C (167˚F-203˚F) at 1200 RPM.<br>3. HO2S 1 voltage should vary within the specified range.<br>4. Quickly open the throttle too halfway for a few seconds.<br>Did the voltage suddenly rise toward the high end of the specified range? | 100-900 mV | Go to *Fuel System Electrical Test* | Go to *Step 5* |
| 5 | 1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure.<br>2. Install the fuel pressure gauge.<br>3. Start the engine and idle at normal operating temperature.<br>4. Disconnect the vacuum line going to the fuel pressure regulator.<br>With the engine running, is the fuel pressure within the specified range? | 280-325 kPa (41-46 psi) | Go to *OBD System Check* | Go to *Step 6* |
| 6 | Check for restricted fuel lines or restricted in-line filter.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Ignition "OFF".<br>2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse.<br>3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value).<br>Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second specified value? | 325 kPa (46 psi)<br>414 kPa (60 psi) | Go to *Diagnostic Aids* | Go to *Step 8* |
| 8 | Check for:<br>● Faulty fuel pump<br>● Restricted fuel pump strainer (sock)<br>● Incorrect fuel pump<br>● Incorrect fuel being used<br>● Hot fuel<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1220 Throttle Position Senser2 (TPS2) Circuit Fault




D06RY00111

## Circuit Description

- The throttle position (TP2) sensor circuit provides a voltage signal relative to throttle blade angle.

  The TPS2 voltage will vary from about 8% (0.4V) to about 92% (4.6V) at Wide Open Throttle (WOT) in the specified voltage (about 5V).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The TPS2 output is more than 93.6 milliseconds, less than 2.5% or more than 97.5% in the specified voltage (5V).

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1120 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1120 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure, the ECT sensor, and the Transmission Fluid
- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the TP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1120 cannot be duplicated, the

information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC

P1120 Diagnostic Chart may isolate the cause of the fault.

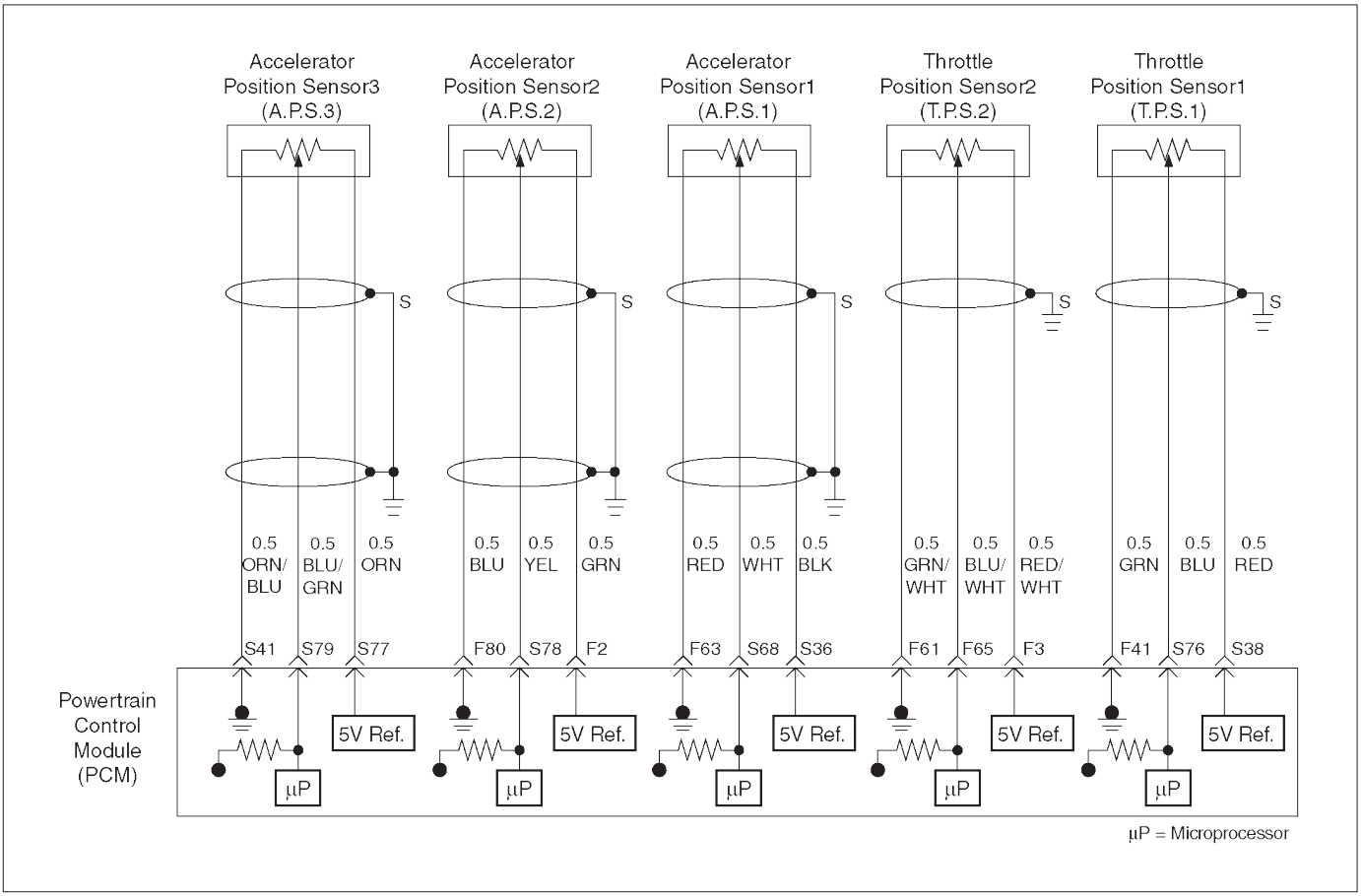
## DTC P1220-TPS 2 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Ignition “ON”, engine not running.<br>2. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? | 65 kPa | Go to *Step 4* | Go to *Step 7* |
| 4 | 1. Disconnect the MAP sensor.<br>2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector.<br>3. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.) | — | Go to *Step 6* | Go to *Step 5* |
| 5 | 1. Check the MAP signal circuit between the PCM and MAP ground circuit.<br>2. If the MAP signal circuit is open or shorted, repair as necessary.<br>Was the MAP signal circuit open or shorted? | — | Verify repair | Go to *Step 13* |
| 6 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 7 | Observe the TP angle reading on the Tech-2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed TPS1 8–10 % TPS2 8–10 % WTO TPS1 90–92 % TPS2 90–92 % | Refer to *Diagnostic Aids* | Go to *Step 8* |
| 8 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Connect a test light between the 5Volt reference circuit and the TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 12* | Go to *Step 11* |

# DTC P1220-TPS 2 Circuit Fault (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Check the following items;<br>1. TP2 signal circuit for a short to voltage.<br>2. TP2 sensor ground circuit for high resistance between the PCM and the TP2 sensor.<br>3. TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 11 | Check the following items;<br>1. TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 12 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnosis Trouble Code(DTC)
# P1221 TPS1 – TPS2 Correlation(Circuit Performance)




060R200069

## Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to DC motor coil in duty (%) to adjustment the valve into a passage in the throttle body to air flow.

  This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal angle (AP1) will vary from about 13% at idle position to about 87% at open throttle(WOT).

  APS signal is used to determine which DC will adjust throttle position.

  After the APS signal has been processed by the PCM, it will command the DC motor to move the throttle position.
- Accelerator pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the accelerator pedal arm and on the accelerator pedal.

## Conditions for Setting the DTC

- The ignition is “ON”.
- A difference of between TPS1 and TPS2 correlation of over 6.5% within 125 milliseconds.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Condition for Clearing the MIL/DTC

- A history DTC 1221 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC 1221 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Test Description

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

2. Visually/physically inspect for the following throttle valve conditions.

3. Visually/physically inspect for the following accelerator pedal conditions.

5. Check the following circuits for throttle valve and DC moter. Check the following TP sensor resistance and DC motor.

7.Check the following circuits for accelerator pedal problems. Check the following AP sensor resistance.

9.Following DTC: Software detect Error for ETC system.

10.Following DTC: Software detect Error for ETC system.

## 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 connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.

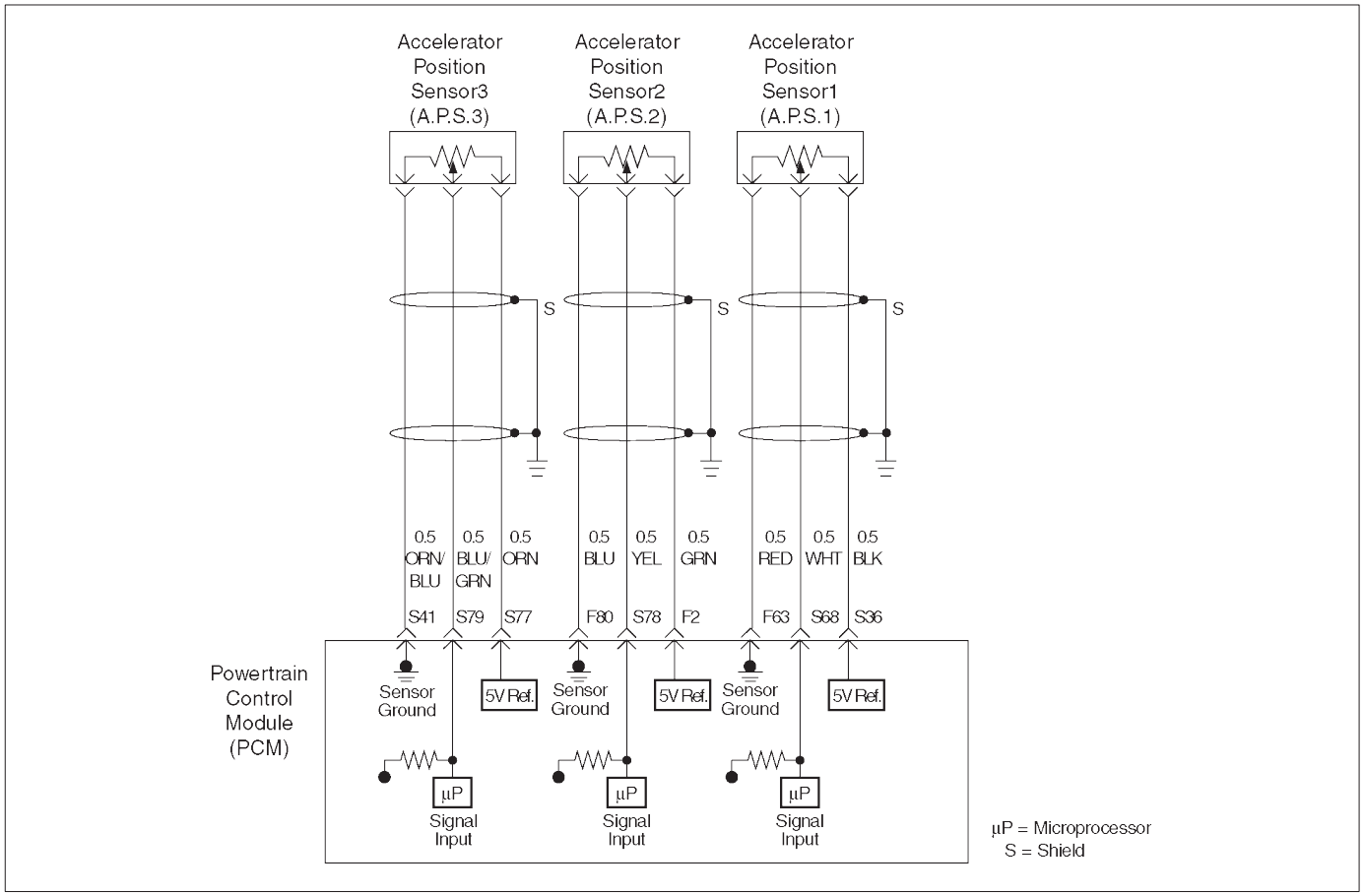
# Diagnosis Trouble Code(DTC) P1221 TPS1 – TPS2 Correlation(Circuit Performance)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Visually/physically inspect for the following conditions:<br>● Throttle body tampering.<br>● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.<br>● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate.<br>● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play<br>Do any of the above require a repair? | — | Refer to *appropriate section for on–vehicle service* | Go to *Step 4* |
| 4 | Visually/physically inspect for the following conditions:<br>● Accelerator pedal tampering.<br>● Accelerator pedal : Check for objects blocking the spring or pedal arm.<br>● Accelerator pedal : Check for objects move the accelerator pedal that pedal is smooth movement, and accelerator pedal arm has not excessive play.<br>Do any of the above require a repair? | — | Refer to *appropriate section for on–vehicle service* | Go to *Step 5* |
| 5 | 1. Check for a poor connection at the throttle body harness connector.<br>2. Check for a poor connection at the accelerator position sensor harness connector.<br>3. If a problem is found, replace faulty terminals as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |

# Diagnosis Trouble Code(DTC)
# P1221 TPS1 – TPS2 Correlation(Circuit Performance) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>Throttle position sensor 1 circuit.<br>Throttle position sensor 2 circuit.<br>Throttle DC motor circuit.<br>Throttle position sensor resistance.<br>Throttle DC motor resistance.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | Vcc-GND 1–7kΩ<br>SIG-GND change resistance 0.3 – 100Ω | Verify repair | Go to *Step 7* |
| 7 | 1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM:<br>● Accelerator position sensor 1 circuit.<br>● Accelerator position sensor 2 circuit.<br>● Sensor 3 circuit.<br>● Sensor resistance.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | Vcc-GND 1–7kΩ<br>SIG-GND change resistance 0.3 – 100Ω | Verify repair | Go to *Step 8* |
| 8 | Replace the accelerator position sensor.<br>Is the action complete? | — | Go to *Step 9* | — |
| 9 | Stored DTCs;<br>P1125, P1290, P1295, P1299 | — | Go to *applicable DTC table* | Go to *Step 10* |
| 10 | Stored DTCs;<br>P1514, P1515, P1516, P1523, P1271, P1272, P1273 | — | Go to *applicable DTC table* | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1271 APS 1– 2 Correlation Error




060R200064

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal sensor (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle(WOT) to specified voltage (about 5V).

  This code detects a correlation error between APS1 and APS2.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The accelerator pedal angle difference is more than 4.5 % between ASP1 and APS2 for more than 265 milliseconds.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1271 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1271 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the AP sensor 1, AP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1271 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP1271 Diagnostic Chart may isolate the cause of the fault.

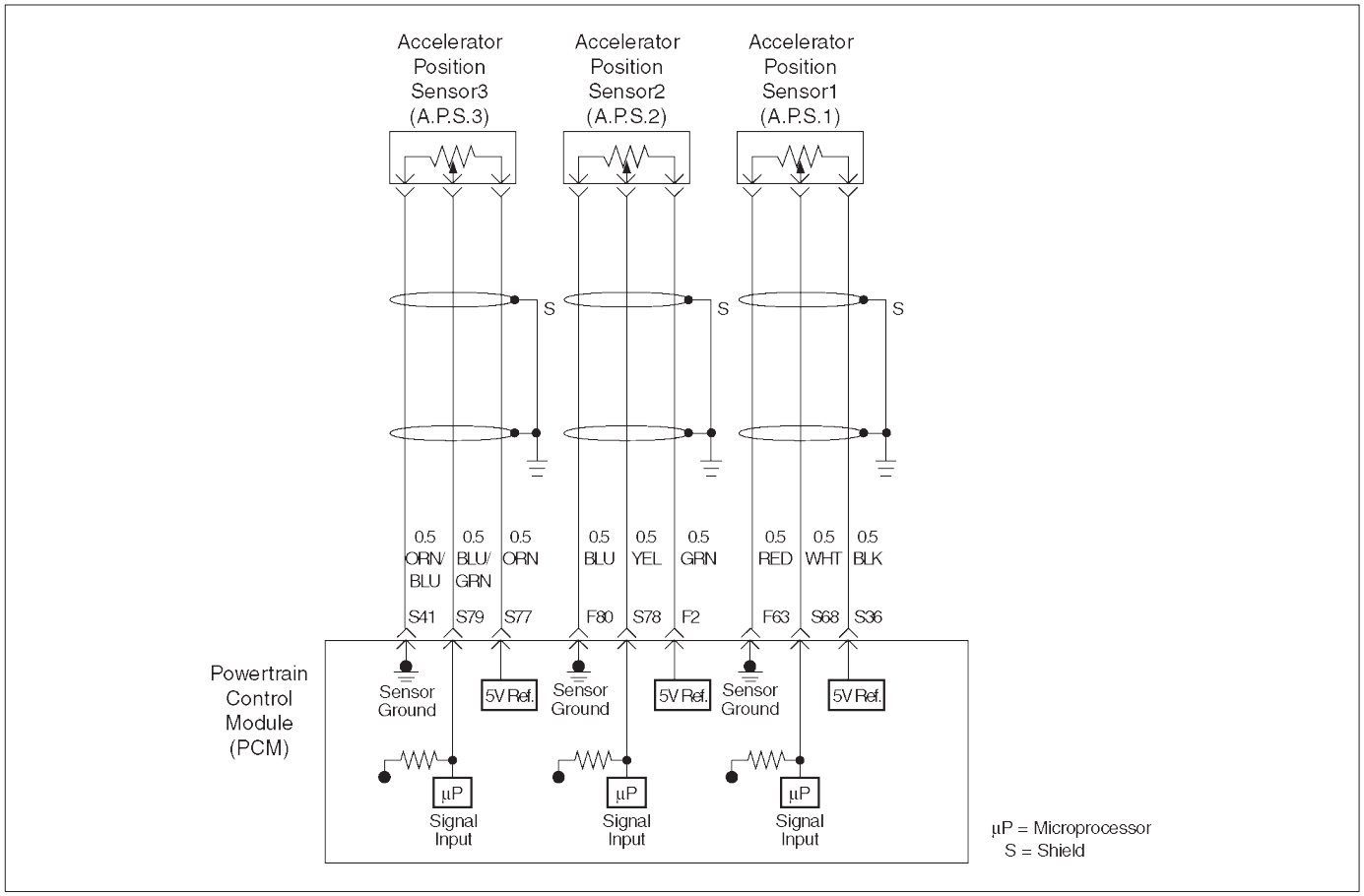
# DTC P1271 – APS 1– 2 Correlation Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idle position AP sensor 1 =13 % AP sensor 2 =85 ~ 89 % Wide open throttle AP sensor 1 =85 ~ 89 % AP sensor 2 =11 ~ 15 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 V supply circuit and the AP sensor signal circuit at the AP1, AP2 sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP1and AP2 signal circuit for a short to voltage.<br>2. AP1and AP2 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP1and AP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP1and AP2 signal circuit or 5 V supply circuit for a poor connection.<br>2. AP1and AP2 signal circuit or 5 V supply circuit for high resistance between the PCM and the AP1 and AP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |

# DTC P1271 – APS 1– 2 Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>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.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1272 APS 2 – 3 Correlation Error




060R200064

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal sensor (AP2) will vary from about 87 % at idle position to about 13 % at wide open throttle (WOT) to specified voltage (about 5V).

  This code detects a correlation error betweenAPS2 and APS3.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle difference is more than 4.5 % between ASP2 and APS3 for more than 265 millisecond.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1272 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1272 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the AP sensor 2, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1272 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC

P1272 Diagnostic Chart may isolate the cause of the fault.

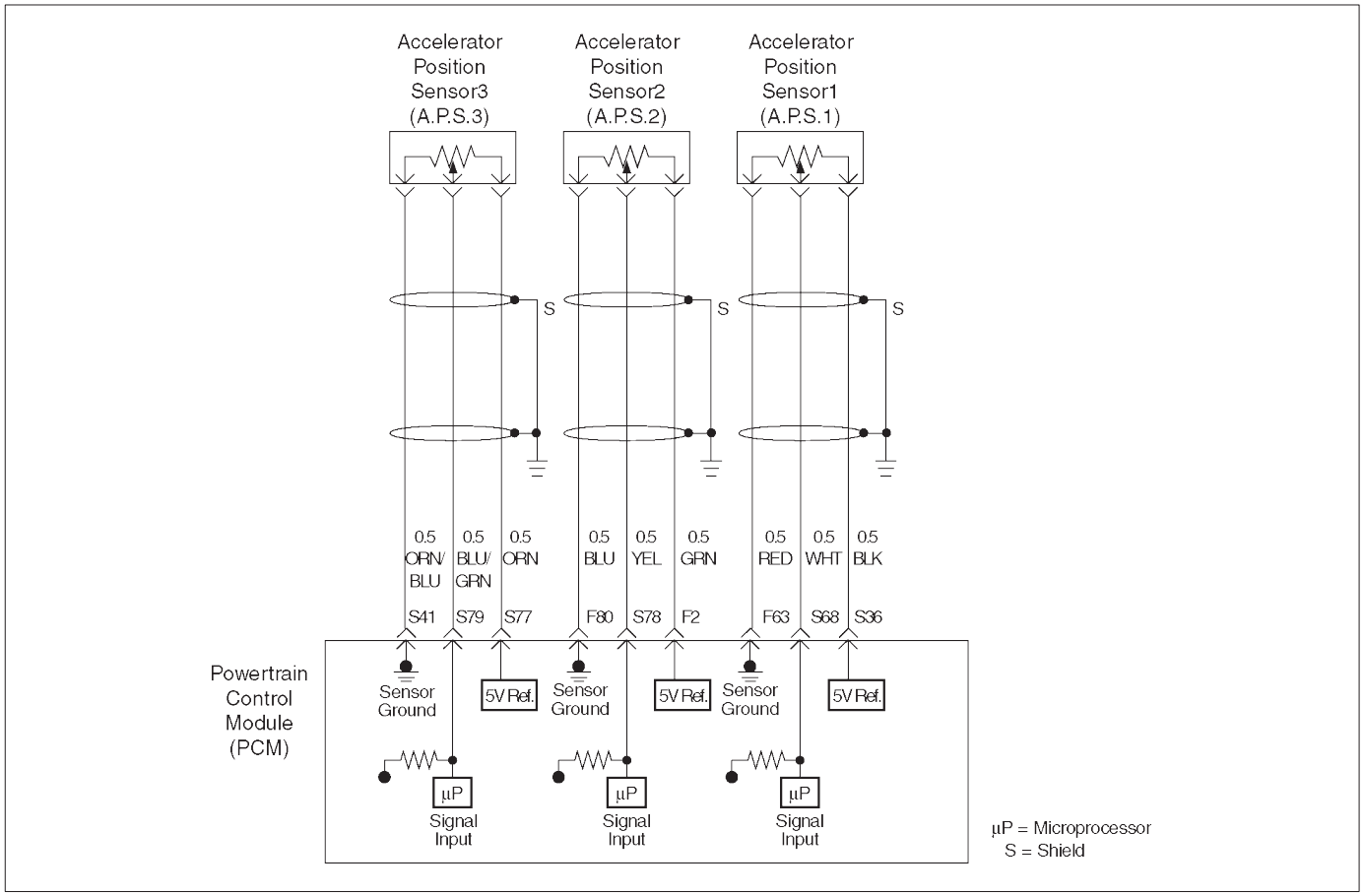
# DTC P1272 – APS 2 – 3 Correlation Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idleposition AP sensor 2 =86 ~ 88 % AP sensor 3 =86 ~ 88 % Wide open throttle AP sensor 2 =12 ~ 14 % AP sensor 3 =32 ~ 36 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 Voltage supply circuit and the AP sensor signal circuit at the AP2 and AP3 sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP2 and AP3 signal circuit for a short to voltage.<br>2. AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP2 and AP3 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP2 and AP3 signal circuit or 5 voltage supply circuit for a poor connection.<br>2. AP2 and AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP2 and AP3 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |

# DTC P1272 – APS 2 – 3 Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1273 APS 1 – 3 Correlation Error




060R200064

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal sensor (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle (WOT) to specified voltage (about 5V).

  This code detects a correlation error between APS1 and APS3.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The accelerator pedal angle difference is more than 4.5 % between ASP1 and APS3 for more than 265 milliseconds.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1273 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1273 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the AP sensor 1, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1273 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently,performing the DTC

P1273 Diagnostic Chart may isolate the cause of the fault.

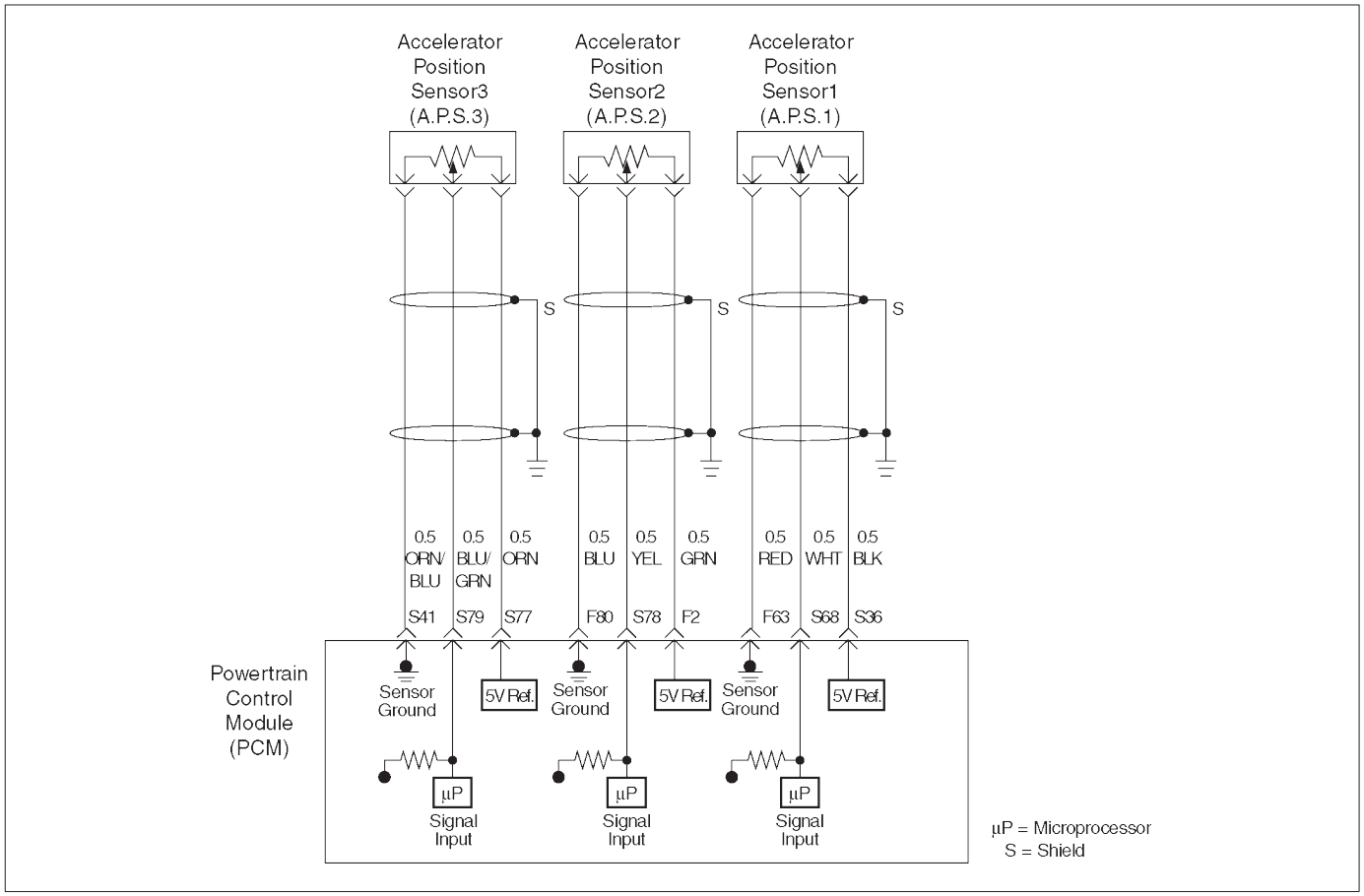
# DTC P1273 – APS 1 – 3 Correlation Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idleposition AP sensor 1 =13 % AP sensor 3 =85 ~ 89 % Wide open throttle AP sensor 1 =85 ~ 89 % AP sensor 3 =32 ~ 36 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 Voltage supply circuit and the AP sensor signal circuit at the AP1 and AP3 sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP1 and AP3 signal circuit for a short to voltage.<br>2. AP1 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP1 and AP3 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP1 and AP3 signal circuit or 5 voltage supply circuit for a poor connection.<br>2. AP1 and AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP1 and AP3 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |

# DTC P1273 – APS 1 – 3 Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1275 APS 1 Output Fault




060R200064

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal sensor (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle (WOT) to specified voltage (about 5V).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The accelerator pedal sensor 1 is less than 2.5 % or more than 97 % in the specified voltage (5V) for more than 62.4 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1275 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1275 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the APP sensor 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1275 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

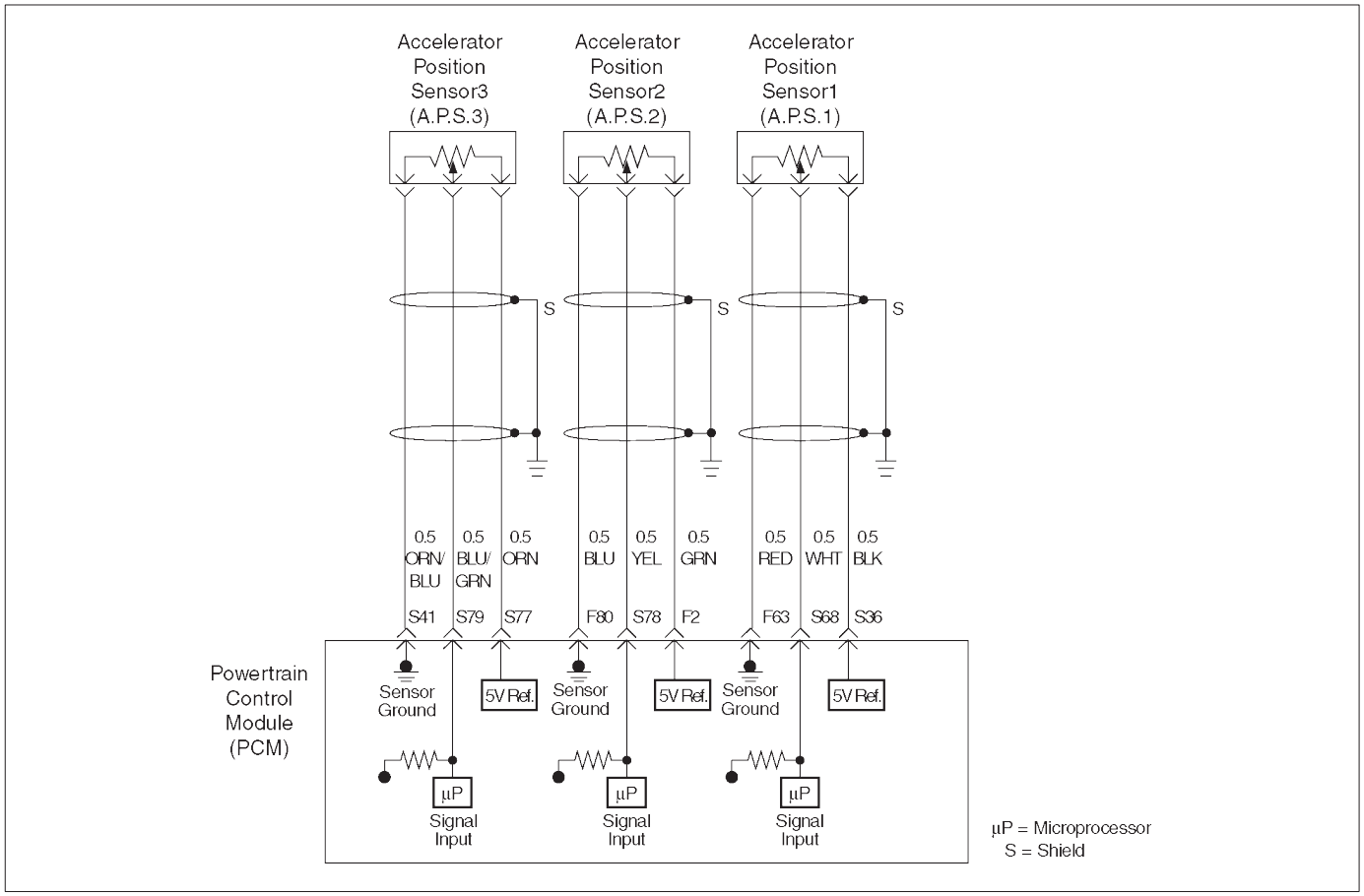
  If it is determined that the DTC occurs intermittently, performing the DTC

P1275 Diagnostic Chart may isolate the cause of the fault.

# DTC P1275 – APS 1 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the "On-Board (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idle position =12 ~ 14 %<br>Wide open throttle =86 ~ 88 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 Volt supply circuit and the AP1 sensor signal circuit at the AP sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP1 signal circuit for a short to voltage.<br>2. AP1 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP1 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP1 signal circuit or 5 volt supply circuit for a poor connection.<br>2. AP1 signal circuit or 5 volt supply circuit for high resistance between the PCM and the AP1 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1280 APS 2 Output Fault




060R200064

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal sensor (AP2) will vary from about 87 % at idle position to about 13 % at wide open throttle(WOT) to specified voltage (about 5V).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The accelerator pedal sensor 2 is less than 2.5 % or more than 97 % in the specified voltage (5V) for more than 62.4 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1280 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1280 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the APP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1280 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

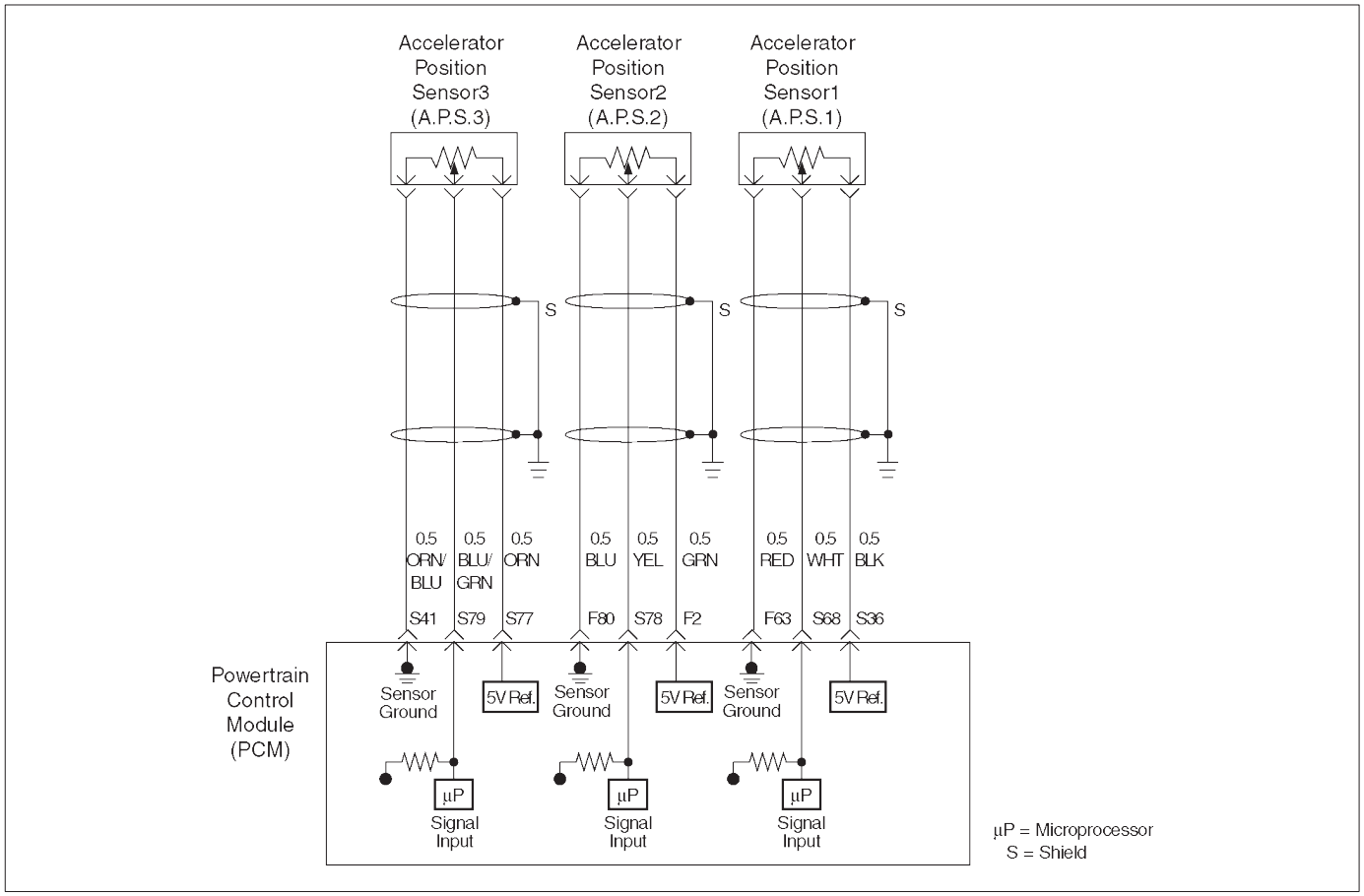
  If it is determined that the DTC occurs intermittently, performing the DTC

  P1280 Diagnostic Chart may isolate the cause of the fault.

# DTC P1280 - APS 2 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idle position =86 ~ 88 %Wide open throttle =12 ~ 14 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 voltage supply circuit and the AP2 sensor signal circuit at the AP sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP2 signal circuit for a short to volt.<br>2. AP2 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP2 signal circuit or 5 volt supply circuit for a poor connection.<br>2. AP2 signal circuit or 5 volt supply circuit for high resistance between the PCM and the AP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1285 APS 3 Output Fault




060R200064

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal sensor (AP3) will vary from about 87 % at idle position to about 34 % at wide open throttle(WOT) to specified voltage (about 5V).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

## Conditions for setting the DTC

- The Ignition is “ON”.
- The accelerator pedal sensor 3 is less than 2.5 % or more than 97 % in the specified voltage (5V) for more than 62.4 milliseconds.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1285 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1285 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1285 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

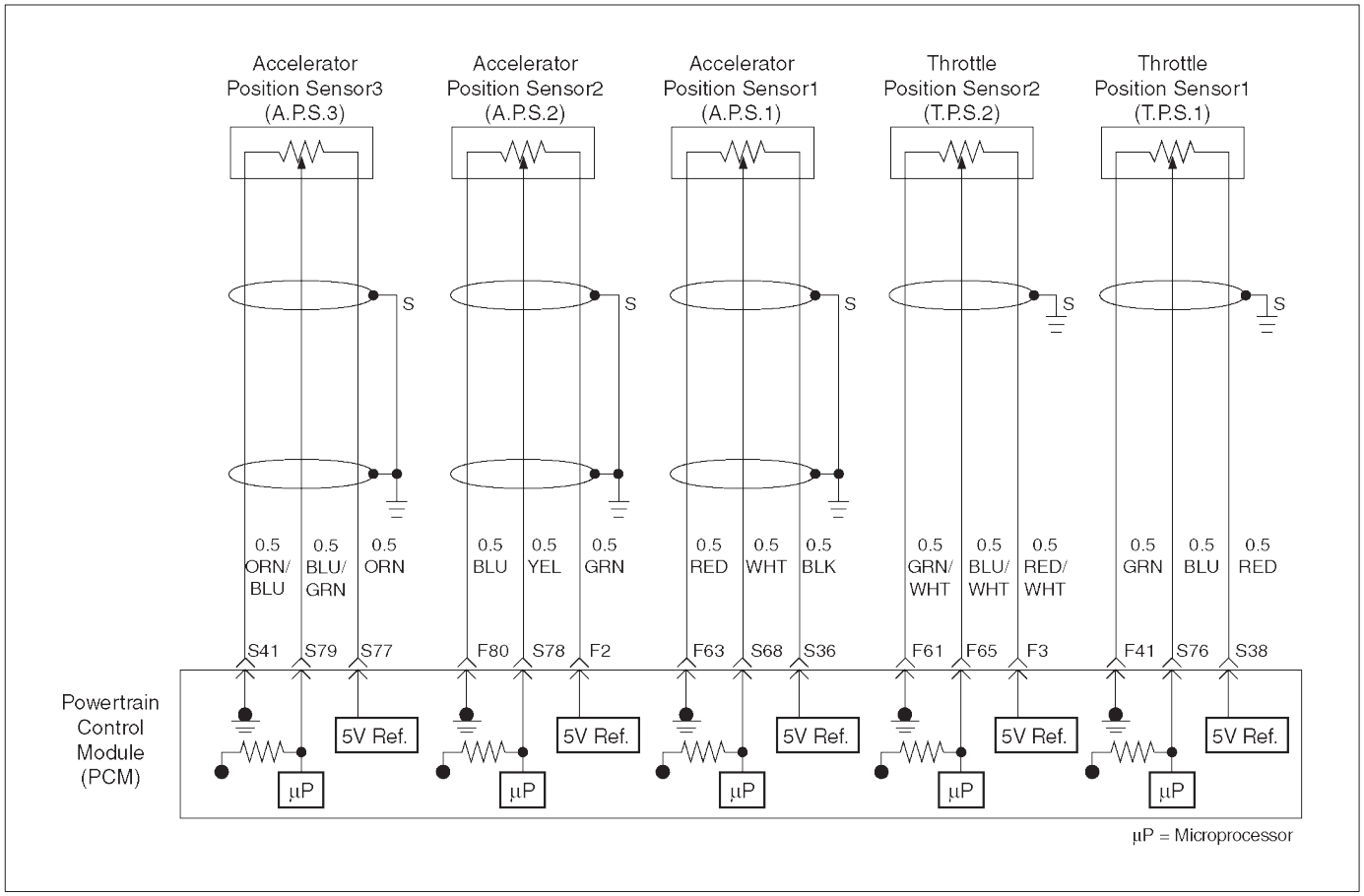
  If it is determined that the DTC occurs intermittently, performing the DTC

  P1285 Diagnostic Chart may isolate the cause of the fault.

# DTC P1285 – APS 3 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the "On-Board (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idle position =86 ~ 88 %Wide open throttle =32 ~ 36 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 volt supply circuit and the AP3 sensor signal circuit at the AP sensor harness connector.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP3 signal circuit for a short to voltage.<br>2. AP3 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP3 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP3 signal circuit or 5 volt supply circuit for a poor connection.<br>2. AP3 signal circuit or 5 voltage supply circuit for high resistance between the PCM and the AP3 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1290 ETC Forced Idle Mode




060R200069

## Circuit Description

- The accelerator position (AP) sensor circuit provides a voltage signal relative to accelerator pedal angle.

  The accelerator pedal angle (AP1) will vary from about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects that if the system is in Forced Idle Mode. (Fail safe Mode)

## Conditions for setting the DTC

- The Ignition is “ON”.
- Forced Idle Mode is active. (Fail safe Mode)

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1290 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1290 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the AP sensor 1, AP sensor 2, AP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1290 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC

  P1290 Diagnostic Chart may isolate the cause of the fault.

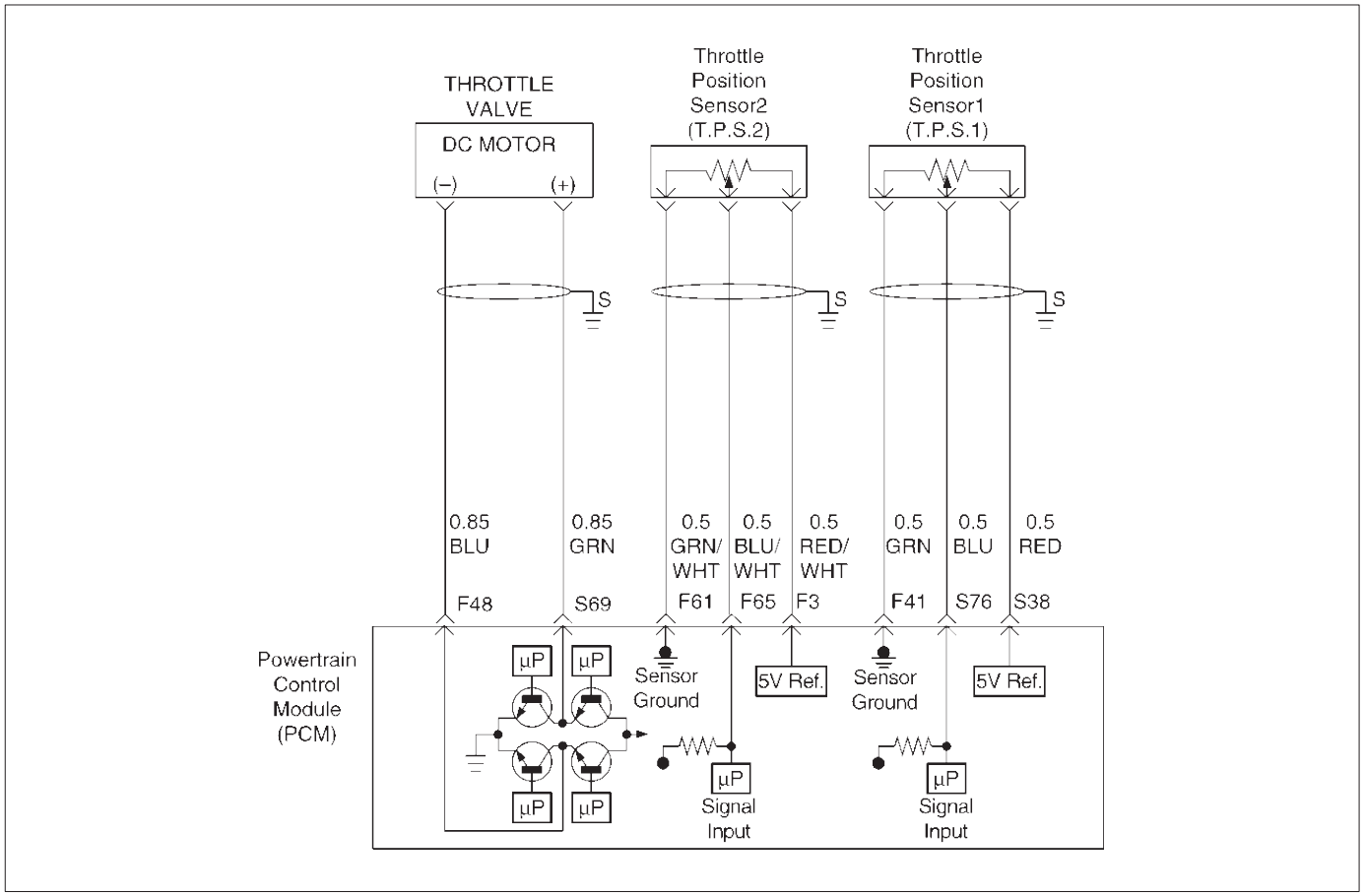
# DTC P1290 - ETC Forced Idle Mode

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On - Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the AP angle reading on the Tech2 while slowly opening the throttle.<br>Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Idle position AP sensor 1 =12 ~ 14 % AP sensor 2, 3 =86 ~ 88 % Wide open throttle AP sensor 1 =86 ~ 88 % AP sensor 2 =12 ~ 14 % AP sensor 3 =32 ~ 36 % | Refer to *Diagnostic Aids* | Go to *Step 4* |
| 4 | 1. Disconnect the AP sensor.<br>2. Observe the AP sensor reading on the Tech 2.<br>Is the AP sensor reading near the specified value? | 0V | Go to *Step 5* | Go to *Step 6* |
| 5 | 1. Connect a test light between the 5 voltage supply circuit and the AP1, AP2 and AP3 sensor signal circuit at the AP sensor harness connector.<br>2. Observe the AP sensor reading on the Tech2.<br>Is the AP sensor reading near the specified value? | 5V | Go to *Step 8* | Go to *Step 7* |
| 6 | Check the following items;<br>1. AP1,AP2 and AP3 signal circuit for a short to voltage.<br>2. AP1, AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor.<br>3. AP1, AP2 and AP3 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 7 | Check the following items;<br>1. AP1, AP2 and AP3 signal circuit or 5 volt supply circuit for a poor connection.<br>2. AP1, AP2 and AP3 signal circuit or 5 volt supply circuit for high resistance between the PCM and the AP1, AP2 and AP3 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |

# DTC P1290 - ETC Forced Idle Mode (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 8 | Replace the AP sensor.<br>Is the action complete? | — | Verify repair | — |
| 9 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1295 ETC Power Management Mode




D06RY00111

## Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantity of air entering the engine indicates an accelerator or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC detects that if the system is in Power Management Mode.(Fail safe Mode)

## Conditions for setting the DTC

- The ignition is “ON”.
- Power Management Mode is active. (Fail safe Mode)

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on throttle blade position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1295 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1295 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1295 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determining that the DTC occurs intermittently, performing the DTC

  P1295 Diagnostic Chart may isolate the cause of the fault.

## DTC P1295 - ETC Power Management Mode

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1295.<br>Does the Tech 2 indicate DTC P1295 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 % | Go to *Step 9* | Go to *Step 5* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the DC motor.<br>Is the DC motor reading near the specified value? | 0.3 ~ 100 Ω | Go to *Step 6* | Go to *Step 8* |
| 6 | Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the throttle valve assembly.<br>Was a problem found? | | Verify repair | Go to *Step 8* |
| 8 | Replace the DC motor. (Replace the Throttle valve assembly)<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 10* | Go to *Step 11* |

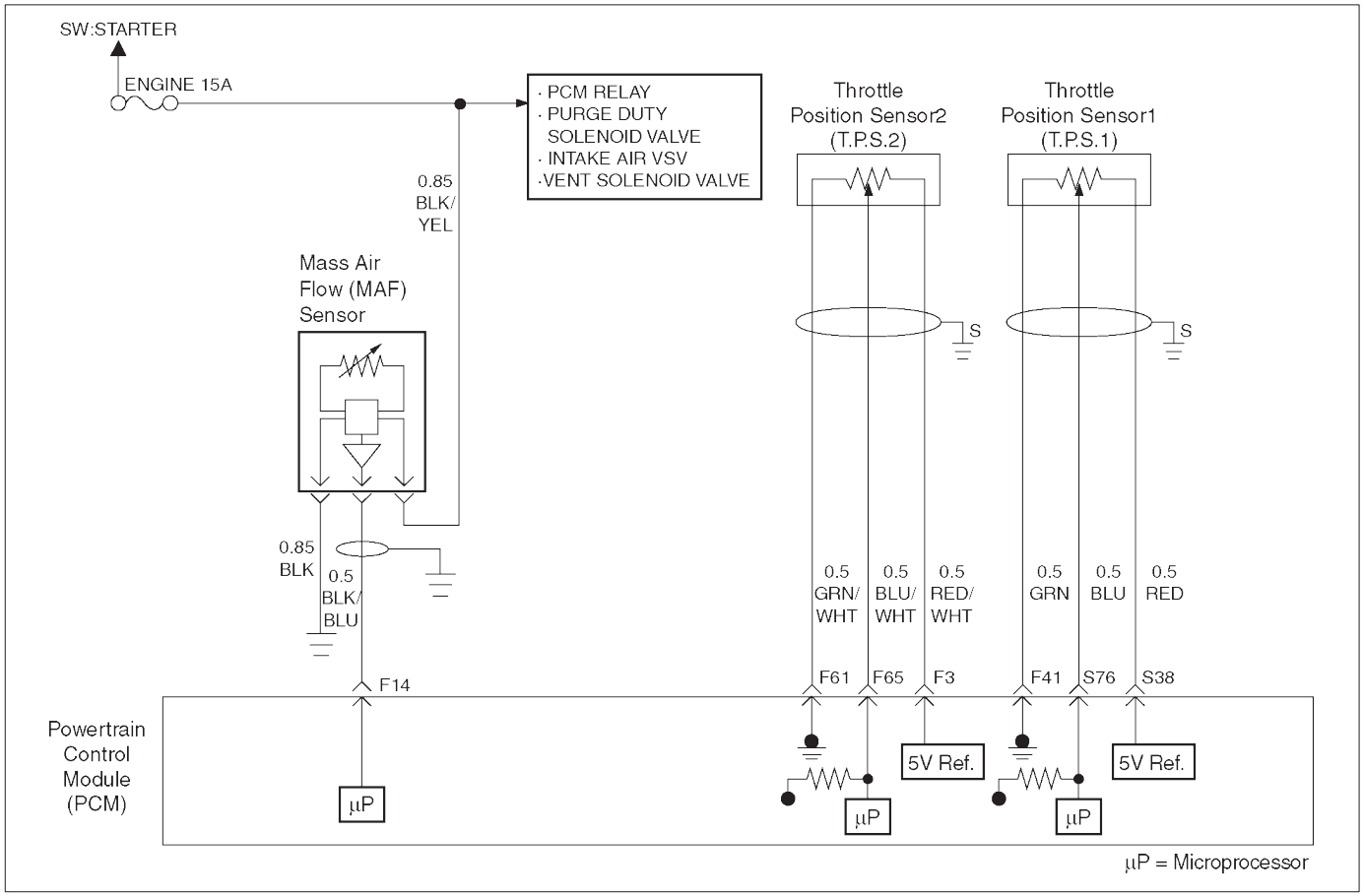
# DTC P1295 - ETC Power Management Mode (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Connect a test light between the 5Volt reference "A" circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 13* | Go to *Step 12* |
| 11 | Check the following items;<br>1. TP1 and TP2 signal circuit for a short to voltage.<br>2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1and TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 12 | Check the following items;<br>1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 13 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 14 | 1. Start the engine.<br>2. With the engine idling, monitor "MAF Frequency" display on the Tech 2.<br>Is the "MAF Frequency" below the specified value? | 6 ~ 10 g/s | Go to *Step 15* | Go to *Step 18* |
| 15 | 1. Ignition "OFF".<br>2. Disconnect the MAF sensor connector.<br>3. Ignition "ON", engine idling.<br>4. Using a Tech 2, monitor "MAF Frequency".<br>Does the Tech 2 indicate a "MAF Frequency" at the specified value? | 0g/s | Go to *Step 16* | Go to *Step 17* |
| 16 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | — |
| 17 | 1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors).<br>2. If incorrect routing is found, correct the harness routing.<br>Was a problem found? | — | Verify repair | Go to *Step 23* |
| 18 | 1. With the engine idling, monitor "MAF Frequency" display on the Tech 2.<br>2. Quickly snap open throttle to wide open throttle while under a road load and record value.<br>Does the Tech 2 indicate a "MAF Frequency" at the specified value? | 6 ~ 10 g/s | Go to *Step 16* | Go to *Step 19* |

# DTC P1295 - ETC Power Management Mode (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 19 | 1. Ignition "ON", engine not running.<br>2. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? | 65kPa | Go to *Step 20* | Go to *Step 23* |
| 20 | 1. Disconnect the MAP sensor.<br>2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector.<br>3. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.) | 5V | Go to *Step 22* | Go to *Step 21* |
| 21 | 1. Check the MAP signal circuit between the PCM and MAP ground circuit.<br>2. If the MAP signal circuit is open or shorted, repair it as necessary.<br>Was the MAP signal circuit open or shorted? | — | Verify repair | Go to *Step 23* |
| 22 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 23 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures*.<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1299 ETC Forced Engine Shutdown Mode




060R200061

## Circuit Description

- The throttle position sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary from about 8% at closed throttle to about 92% at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an accelerator or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC detects if the system is in ETC Forced Engine Shutdown Mode.(Fail safe Mode)

## Conditions for setting the DTC

- The ignition is “ON”.
- ETC Forced Engine Shutdown Mode is active. (Fail safe Mode)

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1299 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1299 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1299 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determining that the DTC occurs intermittently, performing the DTC P1299 Diagnostic Chart may isolate the cause of the fault.

## DTC P1299 - ETC Forced Engine Shutdown Mode

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 % | Go to *Step 8* | Go to *Step 4* |
| 4 | 1. Ignition “OFF”.<br>2. Disconnect the DC motor.<br>Is the DC motor reading near the specified value? | 0.3 ~ 100Ω | Go to *Step 5* | Go to *Step 7* |
| 5 | Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | Check the throttle valve assembly.<br>Was a problem found? | | Verify repair | Go to *Step 7* |
| 7 | Replace the DC motor. (Replace the Throttle valve assembly)<br>Is the action complete? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Connect a test light between the 5 Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 12* | Go to *Step 11* |

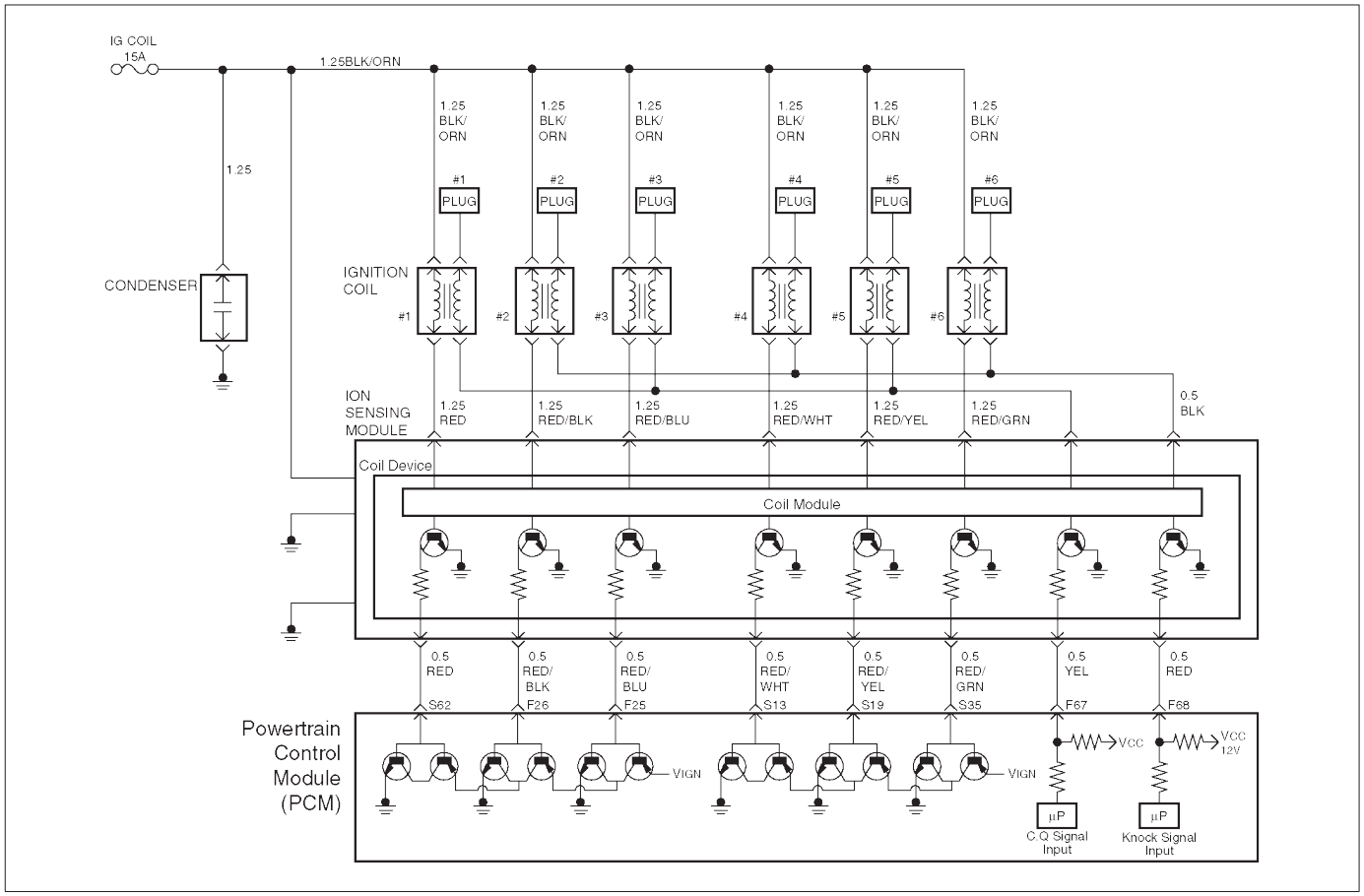
# DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Check the following items;<br>1. TP1 and TP2 signal circuit for a short to voltage.<br>2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1and TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 11 | Check the following items;<br>1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 12 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | 1. Start the engine.<br>2. With the engine idling, monitor "MAF Frequency" display on the Tech 2.<br>Is the "MAF Frequency" below the specified value? | 6 ~ 10 g/s | Go to *Step 16* | Go to *Step 17* |
| 14 | 1. Ignition "OFF".<br>2. Disconnect the MAF sensor connector.<br>3. Ignition "ON", engine idling.<br>4. Using a Tech 2, monitor "MAF Frequency".<br>Does the Tech 2 indicate a "MAF Frequency" at the specified value? | 0g/s | Go to *Step 15* | Go to *Step 16* |
| 15 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | Go to *Step 18* |
| 16 | 1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors).<br>2. If incorrect routing is found, correct the harness routing.<br>Was a problem found? | — | Verify repair | Go to *Step 22* |
| 17 | 1. With the engine idling, monitor "MAF Frequency" display on the Tech 2.<br>2. Quickly snap open throttle to wide open throttle while under a road load and record value.<br>Does the Tech 2 indicate a "MAF Frequency" at the specified value? | 6 ~ 10 g/s | Go to *Step 15* | Go to *Step 18* |
| 18 | 1. Ignition "ON", engine not running.<br>2. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? | 65kPa | Go to *Step 19* | Go to *Step 22* |

# DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 19 | 1. Disconnect the MAP sensor.<br>2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector.<br>3. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value?(If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.) | — | Go to *Step 20* | Go to *Step 21* |
| 20 | 1. Check the MAP signal circuit between the PCM and MAP ground circuit.<br>2. If the MAP signal circuit is open or shorted ,repair it as necessary.<br>Was the MAP signal circuit open or shorted? | — | Verify repair | Go to *Step 22* |
| 21 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 22 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1310 ION Sensing Module Diagnosis




060R200068

## Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The Deceleration Fuel Cut Off (DFCO) test is performed to evaluate the Combustion Quality (CQ) signal pulse width
- If it is below a predetermined value, the value it is expected to be during DFCO conditions. If the CQ signal pulse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.
- The Power Enrichment (PE) test is performed to evaluate the Combustion Quality (CQ) signal pulse width
- If it is below a predetermined value, the value is expected to be during PE conditions.

  If the CQ signal pulse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.
- The Combustion Quality (CQ) test is performed to check if inappropriate (CQ) signal status were detected. If missing CQ pulses or multiple CQ pulses or CQ pulse width calculation errors were detected, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.

## Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 19%.
- Engine speed is between 650rpm and 6500rpm.
- No Crank DTCs set.
- No System voltage DTCs set.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1310 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1310 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1310 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1310 Diagnostic Chart may isolate the cause of the fault.

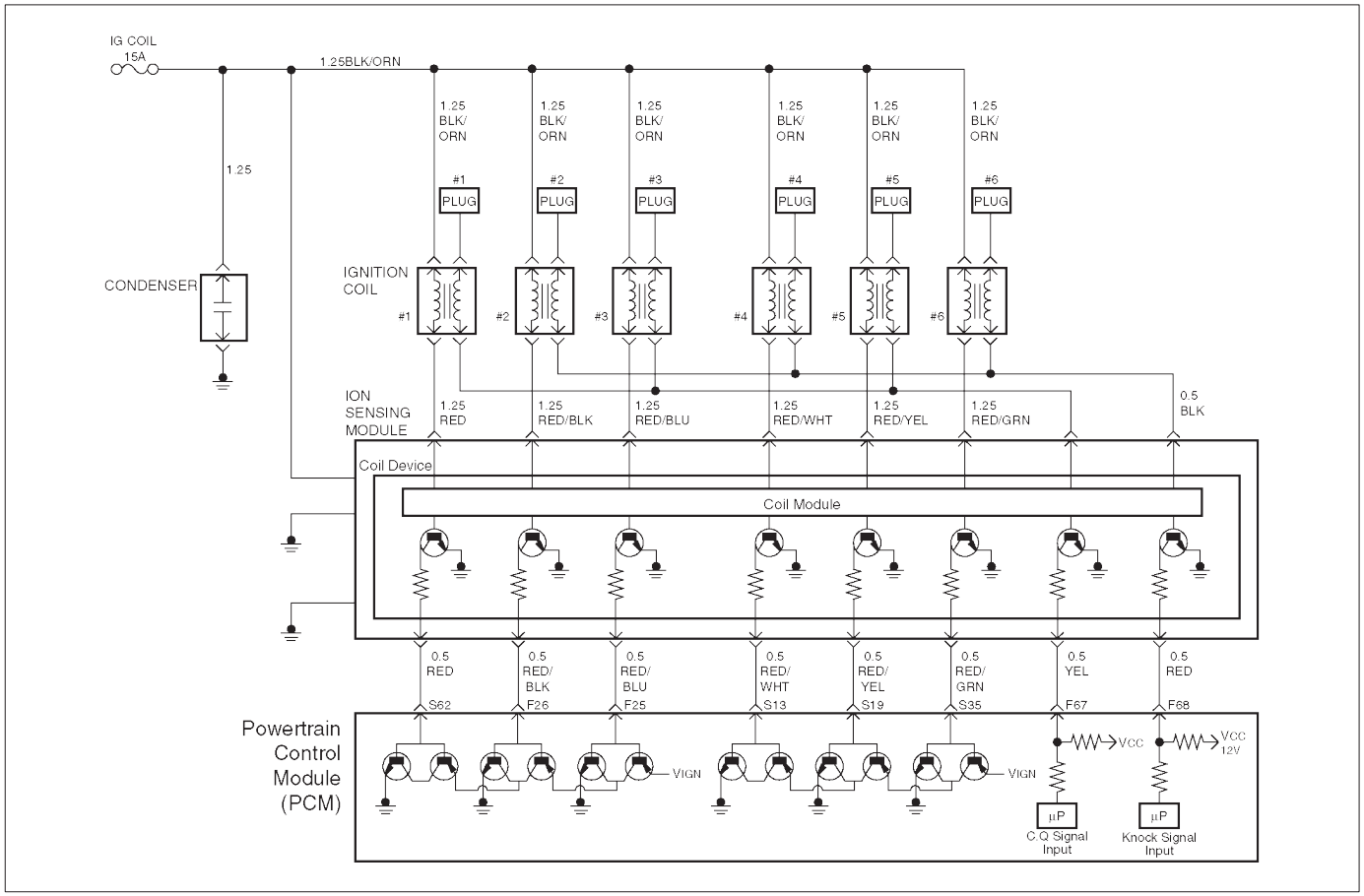
## DTC P1310 - ION Sensing Module Diagnostic

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1310.<br>Does the Tech 2 indicate DTC P1310 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect the ION Sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 4* | Go to *Step 3* |
| 4 | Check the ION Sensing harness between the PCM and ION Sensing module circuit harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 5 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 6* | Go to *Step 5* |
| 6 | Check the ION Sensing harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 9 | Check the following items;<br>1. ION Sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

# DTC P1310 - ION Sensing Module Diagnostic (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Replace the ION Sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1311 ION Sensing Module SEC Line 1 Circuit Fault




060R200068

## Circuit Description

- The Power Control Module (PCM) will compare the secondary current reading to predetermined maximum and minimum thresholds.

  If the secondary current signal pulse width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

  This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

## Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 19%.
- Engine speed is between 650rpm and 6500rpm.
- ION Sensing Module circuit is open or shorted signals on the SEC 1 line.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1311 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1311 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.
- A change in the display will indicate the location of the fault. If DTC P1311 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.
- If it is determined that the DTC occurs intermittently, performing the DTC P1311 Diagnostic Chart may isolate the cause of the fault.

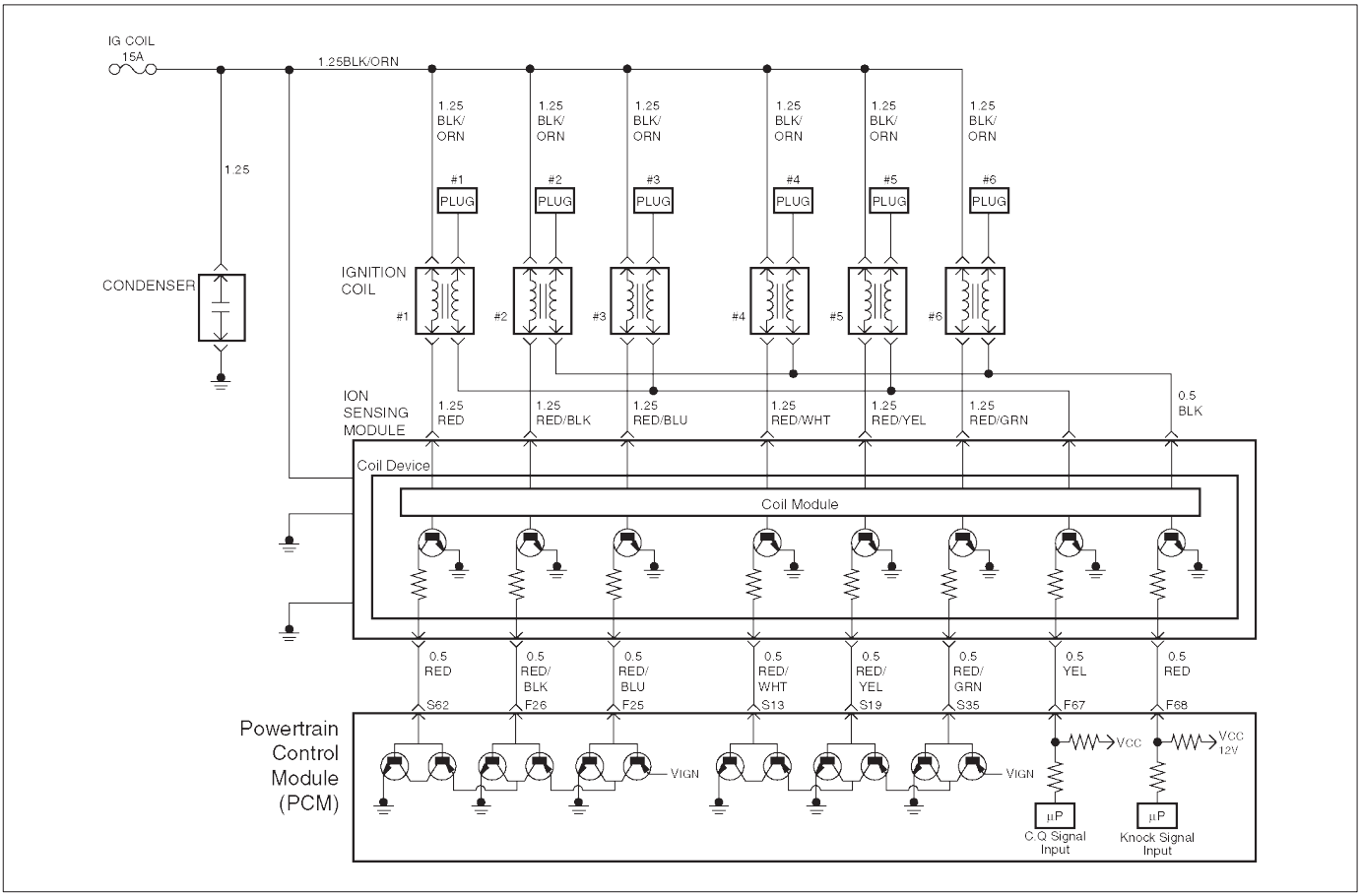
## DTC P1311 - ION Sensing Module SEC Line 1 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1311.<br>Does the Tech 2 indicate DTC P1311 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect the ION Sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 4* | Go to *Step 3* |
| 4 | Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the ION Sensing module harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 6* | Go to *Step 5* |
| 6 | Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 1 harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 9 | Check the following items;<br>1. ION Sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

# DTC P1311 - ION Sensing Module SEC Line 1 Circuit Fault (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Replace the ION Sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1312 ION Sensing Module SEC Line 2 Circuit Fault




060R200068

## Circuit Description

- The Power Control Module (PCM) will compare the secondary current reading to predetermined maximum and minimum thresholds.

  If the secondary current signal pulse width is out of the predetermined range, the fail counter will be incremented. If the fail counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

  This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

## Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 19%.
- Engine speed is between 650rpm and 6500rpm.
- ION Sensing Module circuit is open or shorted signals on the SEC 2 line.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1312 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1312 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1312 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1312 Diagnostic Chart may isolate the cause of the fault.

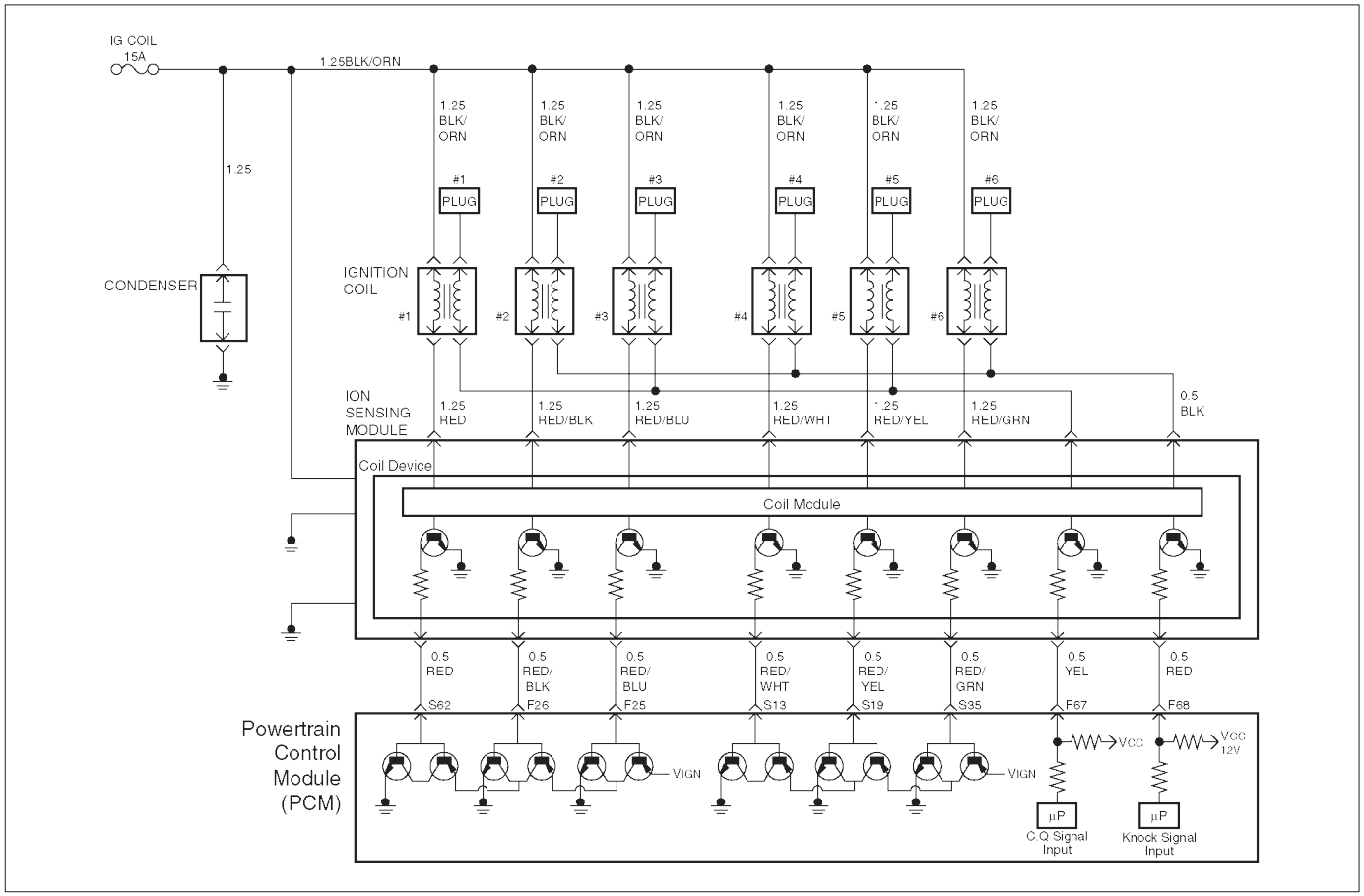
## DTC P1312 - ION Sensing Module SEC Line 2 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1312.<br>Does the Tech 2 indicate DTC P1312 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect the ION Sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 4* | Go to *Step 3* |
| 4 | Check the ION Sensing module harness between the PCM and ICSS module circuit at the ION Sensing Module harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 6* | Go to *Step 5* |
| 6 | Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 2 harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 9 | Check the following items;<br>1. ION Sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

# DTC P1312 - ION Sensing Module SEC Line 2 Circuit Fault (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Replace the ION Sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1326 ION Sensing Module Combustion Quality Input Circuit Fault




060R200068

## Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The test is performed to evacuate the Combustion Quality (CQ) signal pulse width if it is within a predetermined range. If the CQ signal pulse width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the CQ line circuit, ION Sensing module faults and analog input faults in the PCM.

## Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Crank DTCs set.
- No cylinder ID DTCs set.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1326 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1326 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1326 cannot be duplicated, the information included in the Failure Records data can

be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1326 Diagnostic Chart may isolate the cause of the fault.

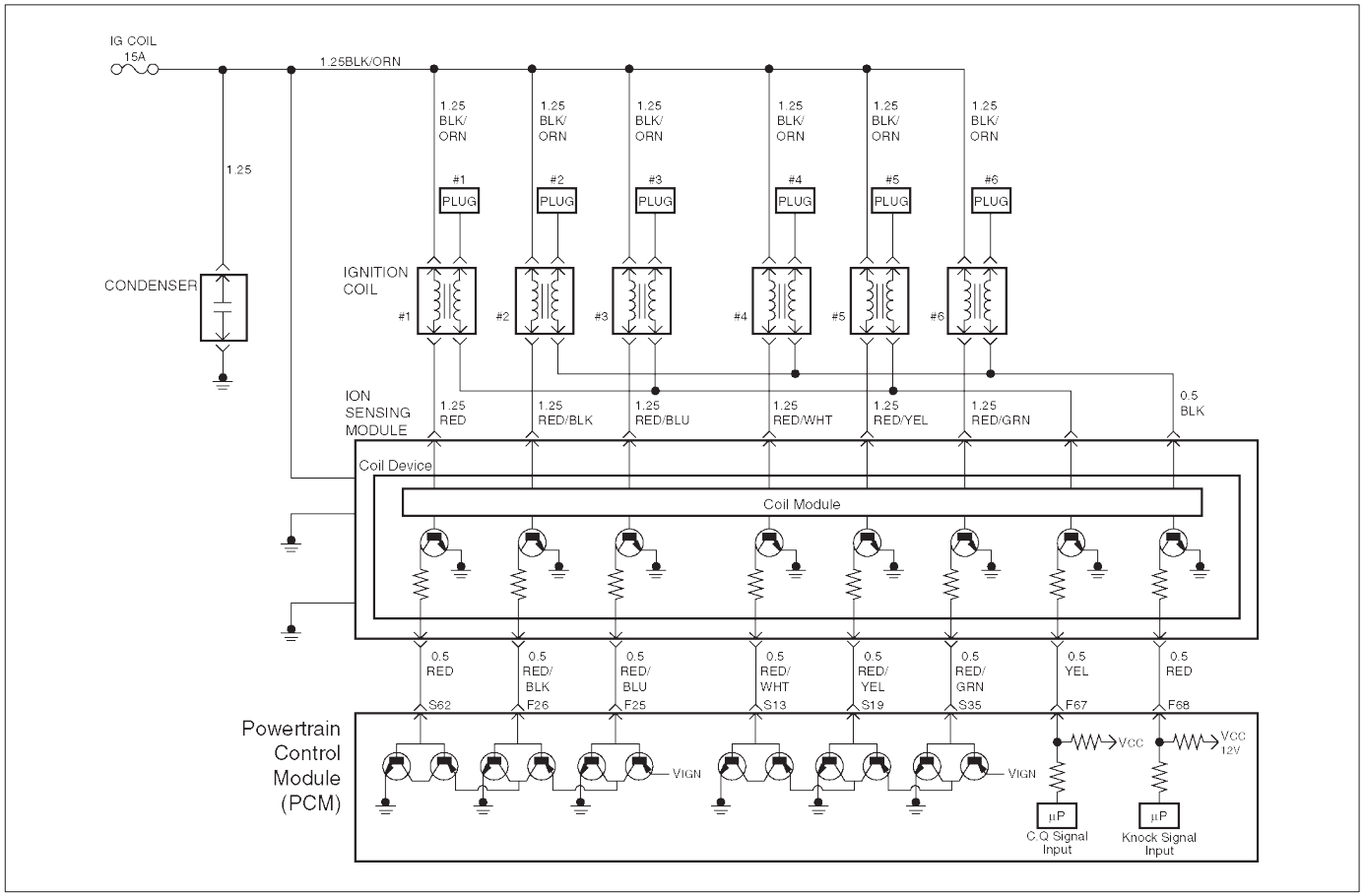
## DTC P1326 - ION Sensing Module Combustion

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1326.<br>Does the Tech 2 indicate DTC P1326 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect the ION Sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 4* | Go to *Step 3* |
| 4 | Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the QC line harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 6* | Go to *Step 5* |
| 6 | Check the ION Sensing module harness between the ignition coil and ICSS module circuit at the ION Sensing Module harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 9 | Check the following items;<br>1. ION Sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

# DTC P1326 - ION Sensing Module Combustion (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Replace the ION Sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin .Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1340 ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)




060R200068

## Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- This test will return a fault if the cylinder synchronization routine has not been completed after a predetermined number of events after crank. This test will detect fault that will prevent the PCM from synchronization, such as Knock Signal (KI) - Combustion Quality (CQ) lines being swapped, shorted spark plugs, ION Sensing module faults, an PCM hardware faults.

## Conditions for setting the DTC

- Ignition voltage is between 11volts and 16 volts.
- Engine speed is between 650rpm and 6250rpm.
- No ECT DTCs set.
- No injector DTCs set.
- No Fuel Trim DTCs set.
- No Misfire DTCs set.
- No system voltage DTCs set.

## Action Taken When the DTC Sets

- The PCM will ON the MIL after second trip with detected the fault.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1340 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1340 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1340 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1340 Diagnostic Chart may isolate the cause of the fault.

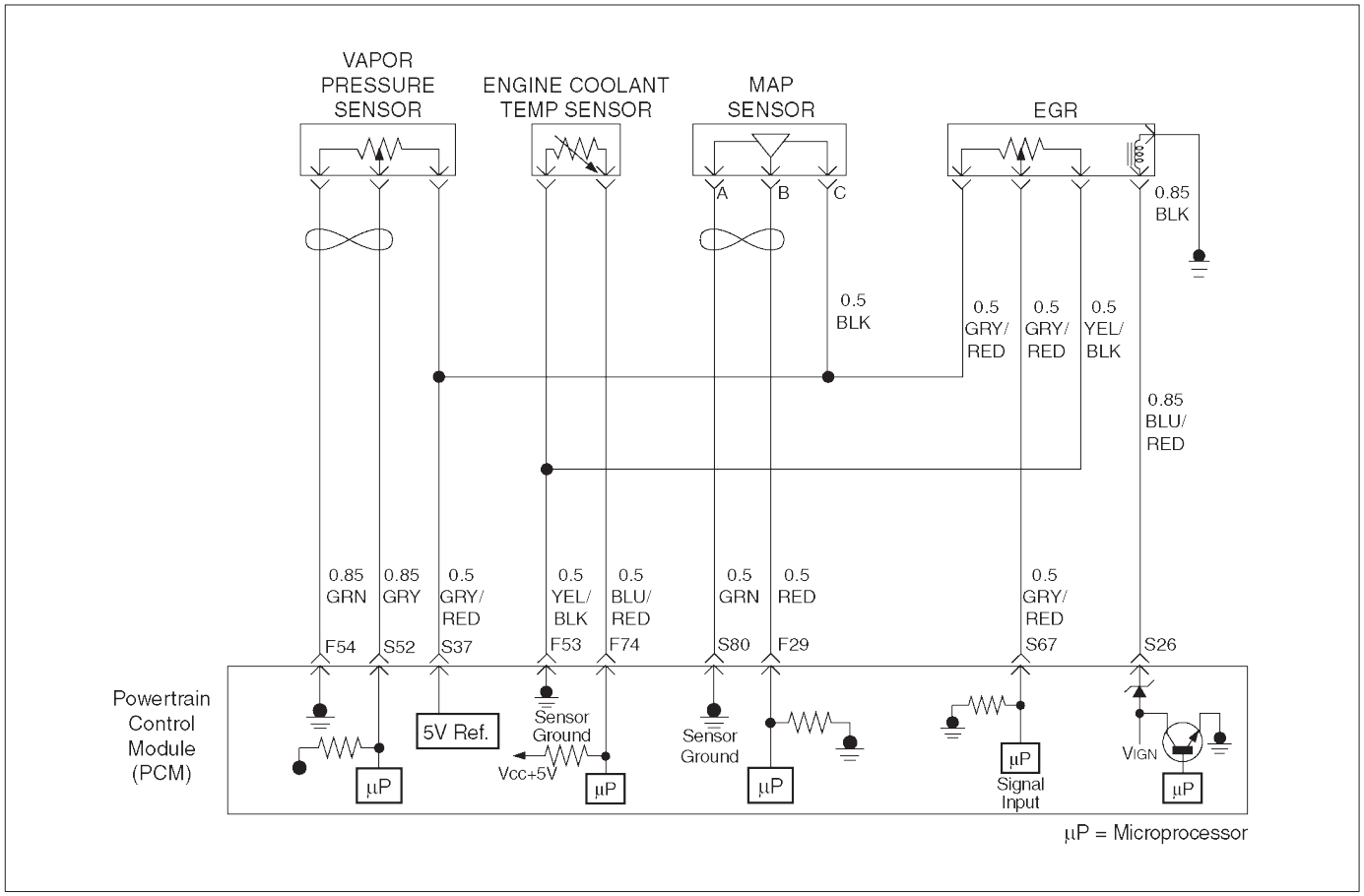
## DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “ DTC” info for DTC P1340.<br>Does the Tech 2 indicate DTC P1340 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Ignition “OFF”.<br>2. Disconnect the ION Sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 4* | Go to *Step 3* |
| 4 | Check the ION Sensing module harness between the PCM and ICSS module circuit at the QC line harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 6* | Go to *Step 5* |
| 6 | Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 9 | Check the following items;<br>1. ION Sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

# DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Replace the ION Sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 11* |
| 11 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1404 EGR Stuck Closed




060R200050

## Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if current pintle zero position is different from the learned zero position. If the PCM detects a pintle position signal indicates more than 30 % different between current zero position and the learned zero position for more than 5 seconds, and this condition exists 3 times during trip, then the PCM will set DTC P1404.

## Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C.
- Desired EGR position is more than 3 %.
- Difference of EGR pintle position between current and the learned zero is more than 30 % for more than 5 seconds, and exists three times to the above condition during a trip the PCM will set DTC 1404. Then it trigger the PCM light on.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after consecutive 2nd trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft and/or foreign material may cause the EGR valve not to fully seat. The carbon deposit may occur by unusual port operation. Remove foreign material and/or excessive carbon deposit on EGR valve shaft and to allow the EGR valve to be fully seated.
- Poor connection or damaged harness – Inspect the wiring harness for damage.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

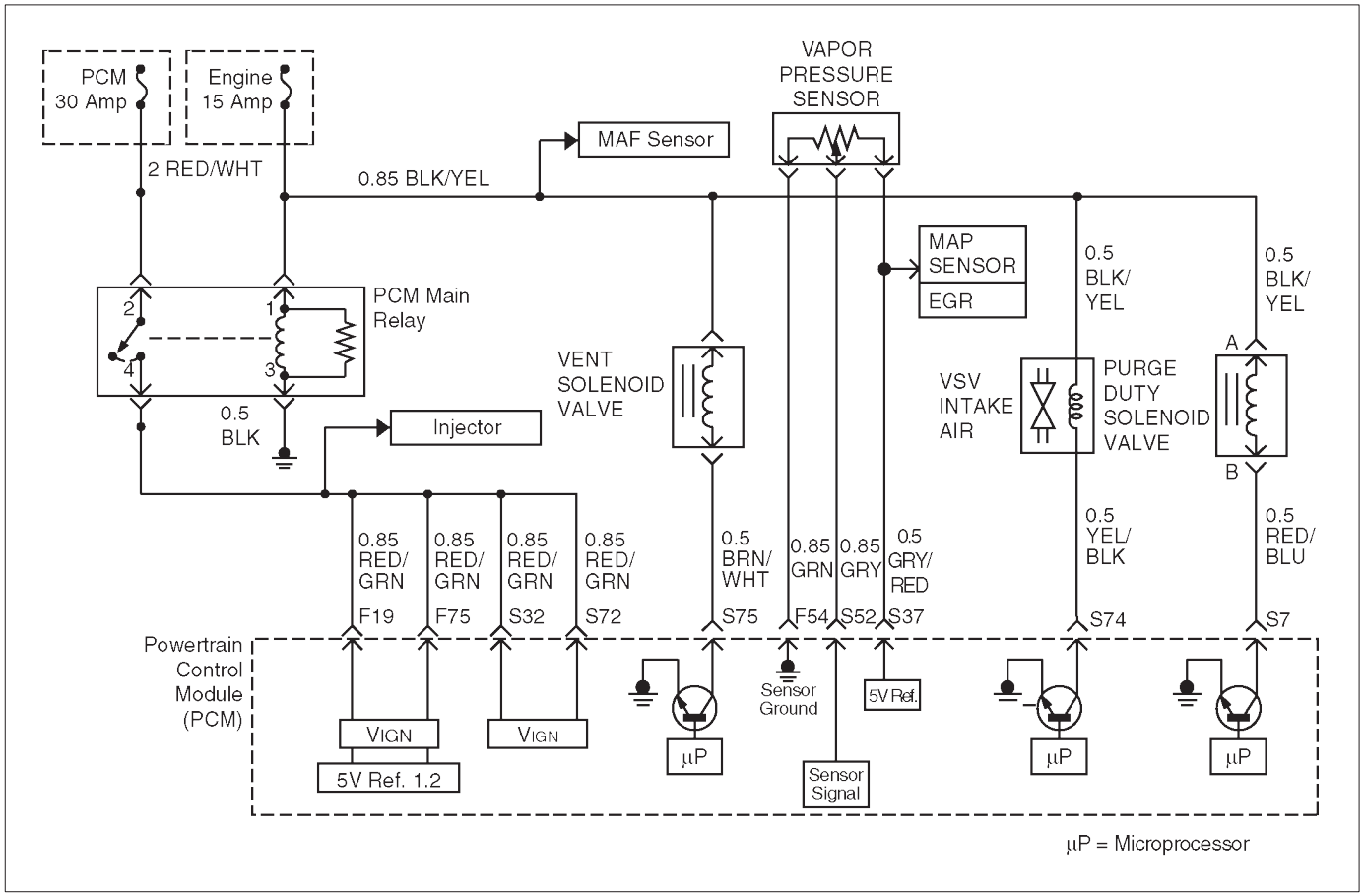
# DTC P1404 – EGR Stuck Closed

| 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", review and record Tech 2 Failure Records Data.<br>2. Operate the vehicle within Failure Records conditions as noted.<br>3. Using a Tech 2, monitor "DTC inf." for DTC P1404 until the DTC P1404 test runs. Note the result.<br>Does the Tech 2 indicates DTC P1404 failed this ignition? | — | Go to *Step 3* | Refer to *Diagnostic Aids* |
| 3 | 1. Disconnect the EGR valve harness connector.<br>2. Inspect the EGR valve and connectors for damaged pin or terminals.<br>Were there any damaged pins or terminals? | — | Go to *Step 4* | Go to *Step 5* |
| 4 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | — |
| 5 | 1. Remove EGR valve from Engine.<br>2. Inspect EGR valve for any excessive carbon deposit on EGR shaft.<br>3. Inspect for any foreign material inside of EGR valve.<br>Was excessive carbon deposit on EGR valve shaft and/or foreign material in EGR valve ? | — | Go to *Step 6* | Go to *Step 7* |
| 6 | 1. Clean up EGR valve shaft and inside of EGR valve.<br>2. Remove foreign material from EGR valve.<br>3. Visually inspect damage of pintle and seat to see if it is bent. If damaged, leakage may occur.<br>Was there any severe damage which affects function? | — | Go to *Step 9* | Verify repair<br>Go to *Step 7* |
| 7 | 1. Install the EGR valve.<br>2. Ignition "OFF".<br>3. Install the Tech 2.<br>4. Run the engine at idle.<br>5. On the Tech 2, select EGR Control Test.<br>6. Use the "UP" arrow to increase the EGR from 0% to 40%.<br>Did EGR work properly? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Reset the learned zero EGR valve position.<br>2. Repeat step 7.<br>Did EGR work properly? | — | Verify repair | Go to *Step 9* |

# DTC P1404 – EGR Stuck Closed (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | Replace the EGR valve.<br>Does DTC P1404 still fail "DTC" test on the Tech 2? | — | Go to *Step 10* | Verify repair |
| 10 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1441 EVAP System Flow During Non-Purge




060RY00398

## Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge “ON”). The EVAP purge solenoid control is pulse-width modulated (PWM) or turned “ON” and “OFF” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

## Conditions for Setting the DTC

- No active ECT sensor, IAT sensor, MAP sensor, or TP sensor DTCs set.
- BARO reading is above 85 kPa.
- Engine coolant temperature is below 70˚C (158˚F).
- Start-up intake air temperature (IAT) and start-up engine coolant temperature (ECT) are both above 5˚C (41˚F).
- The difference between start-up ECT and start-up IAT is less than 25˚C (45˚F).
- TP sensor indicates a throttle position above 12%.
- Battery voltage is between 11.5 volts and 16 volts.
- Engine speed is between 800 and 6,000 RPM.
- Canister purge duty cycle is below 3%.
- Fuel level is between 15% and 85%.
- All conditions are present for at least 3 seconds.

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1441 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P1441 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wring harness for damage. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

3. Determines if the PCM is able to control the EVAP purge solenoid valve.
4. Determines if the DTC will set under the conditions present when the DTC was originally stored. If not, the fault is intermittent.
5. Checks for a grounded EVAP purge solenoid driver circuit, a faulty EVAP vacuum switch, or a leaking EVAP purge solenoid valve.

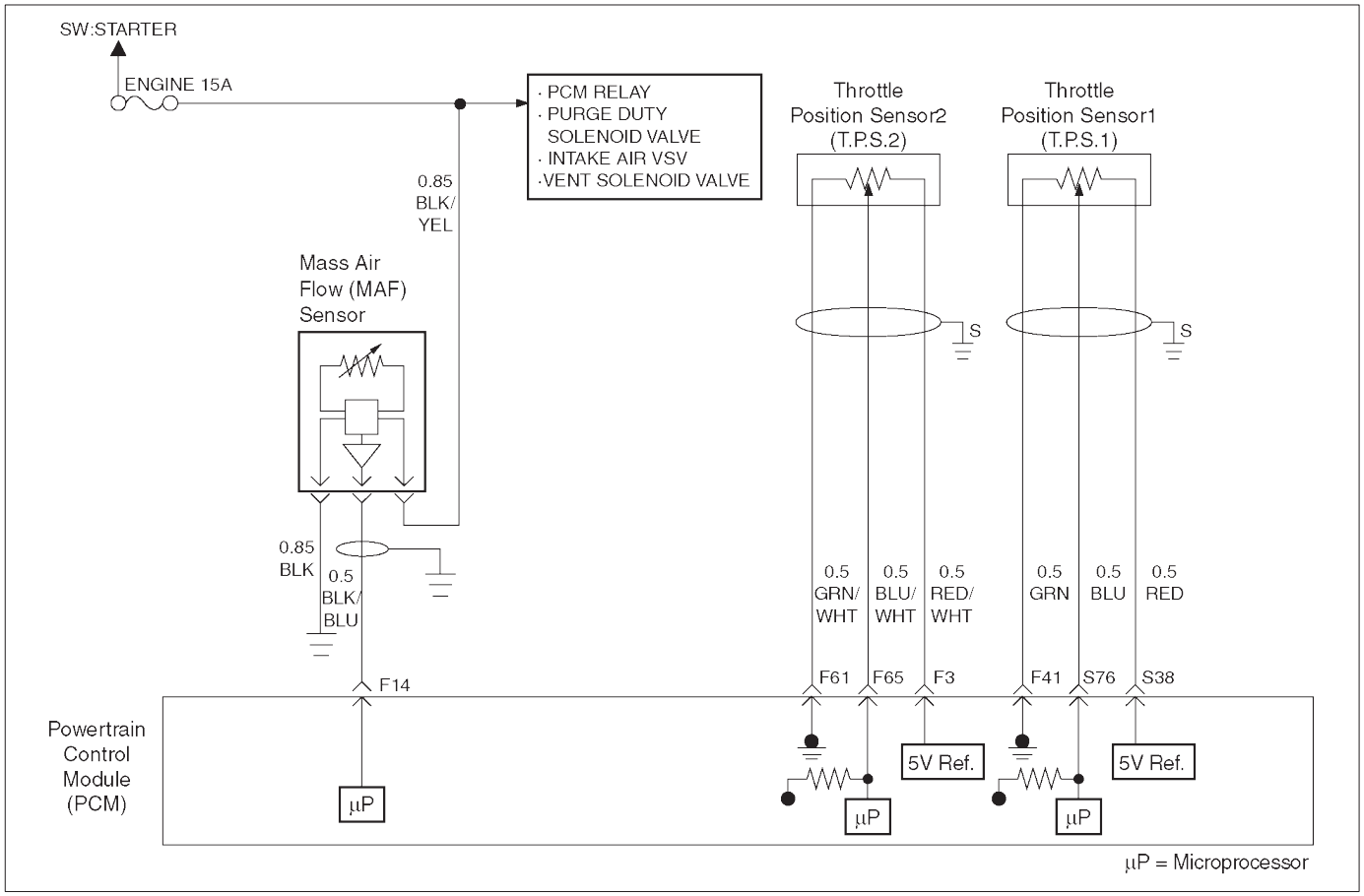
# DTC P1441 – EVAP System Flow During Non-Purge

| 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 “OFF”.<br>2. Remove the fuel filler cap.<br>3. Ignition “ON”.<br>4. Observe “Fuel Tank Pressure” on the Tech 2.<br>Is “Fuel Tank Pressure” at the specified value? | 1.51V | Go to *Step 3* | Go to *DTC P0452 or P0453* |
| 3 | 1. Re-install the fuel filler cap.<br>2. Using the Tech 2, command the EVAP Vent Solenoid Valve “ON” (Closed).<br>3. Disconnect the canister side rubber hose end that hose is connected between the Purge Solenoid Valve and Canister.<br>**IMPORTANT:** Before continuing with the diagnosis, zero the EVAP pressure/purge cart J41413 (refer to the tool operating instructions).<br>And them monitor the fuel tank inner pressure using the Tech 2.<br>Does the fuel tank pressure remain the specified value? | 1.52 - 1.60V | Go to *Step 4* | Go to *Step 6* |
| 4 | 1. Disconnect the EVAP pressure/purge cart J41413, and then plug the hose end.<br>2. Disconnect the rubber hose end of engine vacuum source side, (the hose connected between Purge Solenoid Valve and engine).<br>3. Connect the vacuum hand pump to this rubber hose end.<br>4. Then apply the -15 in H2O vacuum by the vacuum pump.<br>5. Monitor the fuel tank inner pressure using the Tech 2.<br>Does the fuel tank inner pressure hold the specified value? | 1.47 - 1.51V | Go to *Step 6* | Go to *Step 5* |
| 5 | Replace the Purge Solenoid Valve. | — | Verify Repair | — |

# DTC P1441 – EVAP System Flow During Non-Purge (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 6 | 1. Check leaks, kinks or pinched hoses at the EVAP system rubber hose line, and also check if the rubber hoses are correctly connected or not.<br>2. Check for a leak from Vent Solenoid Valve and EVAP system rubber hoses, and also check for clogged Filter of air separator which is located near the vent solenoid valve.<br>Was a problem found? Using the Vacuum Hose Routing Diagram, repair or re-connect the rubber hoses correctly. | — | Verify Repair | Go to *Step 7* |
| 7 | 1. Start engine.<br>2. Remove the Fuel Filler cap.<br>3. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%).<br>4. Replace the Fuel Filler Cap.<br>5. Run the engine at 2500RPM constant while monitoring "Fuel Tank Vacuum" on the Tech 2.<br>Does the fuel tank vacuum remain at the specified value while the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%)? | 30 - 40 % | Verify Repair | Go to *Diagnostic Aids* |

# Diagnostic Trouble Code (DTC) P1514 TPS - MAF Correlation Error




060R200061

## Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantity of air entering the engine indicates an accelerator or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.

## Conditions for setting the DTC

- The engine is running.
- No MAF sensor DTCs are set.
- Throttle actuation mode is not off.
- MAF reading-ETC estimated air flow is less than 40g/s for 250 failures within test 1000 test samples (15.6 m sec).

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault conditions is no longer present.
- A history DTC P1514 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1514 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM - Inspect harness connectors 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. If the harness appears to be OK, observe the Mass Air Flow, TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide - open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3 – 6 g/s at idle to 100 g/s or greater at the time of the 1 – 2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault. If DTC P1514 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1514 Diagnostic Chart may isolate the cause of the fault.

## DTC P1514 - TPS-MAF Correlation Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1514.<br>Does the Tech 2 indicate DTC P1514 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | 1. Start the engine.<br>2. With the engine idling, monitor “MAF Frequency” display on the Tech 2.<br>Is the “MAF Frequency” below the specified value? | 6 ~ 10 g/s | Go to *Step 5* | Go to *Step 8* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the MAF sensor connector.<br>3. Ignition “ON”, engine idling.<br>4. Using a Tech 2, monitor “MAF Frequency”.<br>Does the Tech 2 indicate a “MAF Frequency” at the specified value? | 0g/s | Go to *Step 6* | Go to *Step 7* |
| 6 | Replace the MAF sensor.<br>Is the action complete? | — | Verify repair | Go to *Step 9* |
| 7 | 1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors).<br>2. If incorrect routing is found, correct the harness routing.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |
| 8 | 1. With the engine idling, monitor “MAF Frequency” display on the Tech 2.<br>2. Quickly snap open throttle to wide open throttle while under a road load and record value.<br>Does the Tech 2 indicate a “MAF Frequency” at the specified value? | 6 ~ 10 g/s | Go to *Step 6* | Go to *Step 9* |
| 9 | 1. Ignition“ON”, engine not running.<br>2. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? | 65kPa | Go to *Step 10* | Go to *Step 13* |

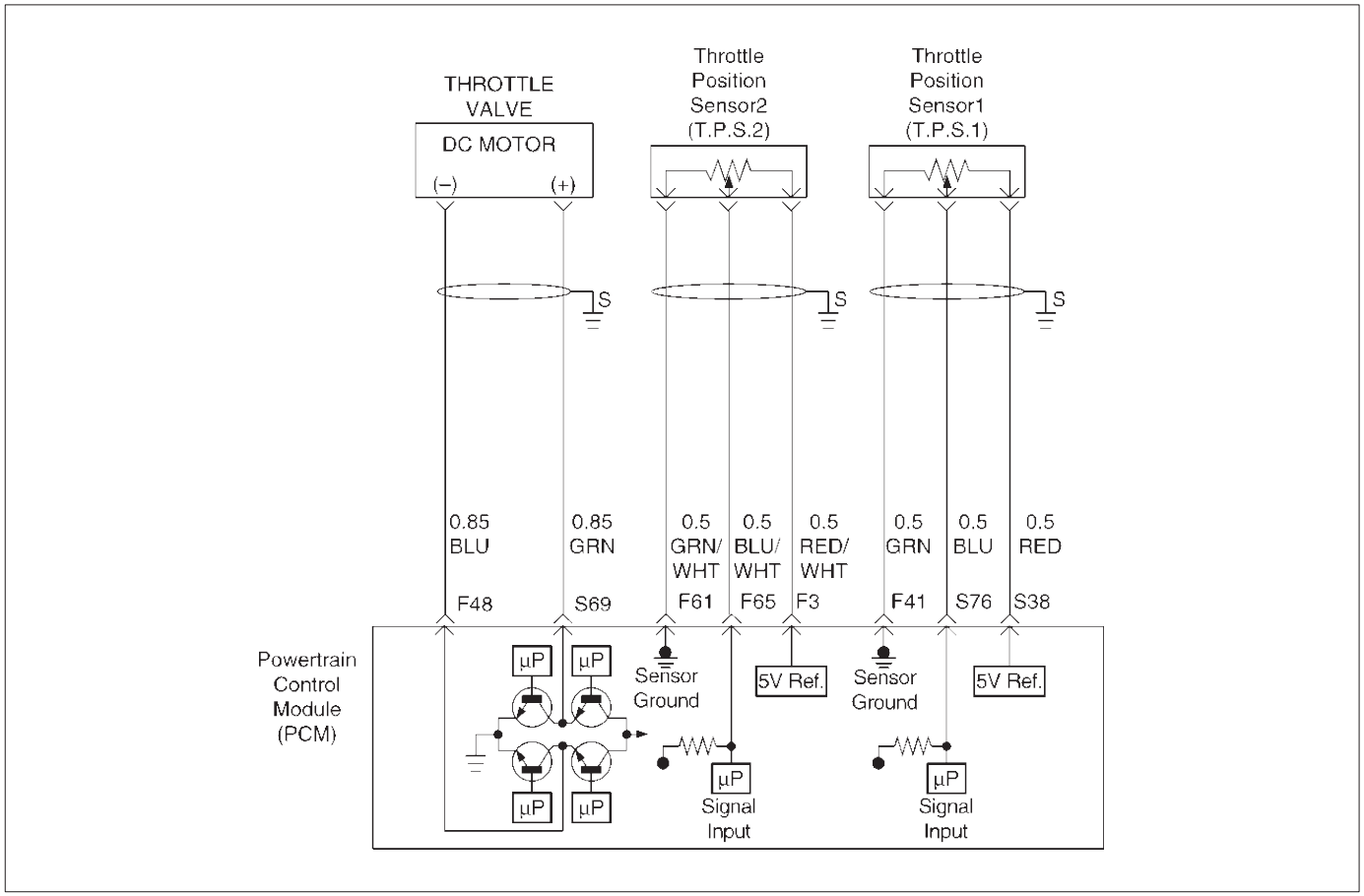
# DTC P1514 - TPS-MAF Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Disconnect the MAP sensor.<br>2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector.<br>3. Observe the MAP reading on the Tech 2.<br>Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5Vreturns.) | — | Go to *Step 11* | Go to *Step 12* |
| 11 | 1. Check the MAP signal circuit between the PCM and MAP ground circuit.<br>2. If the MAP signal circuit is open or shorted, repair it as necessary.<br>Was the MAP signal circuit open or shorted? | — | Verify repair | Go to *Step 13* |
| 12 | Replace the MAP sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 % | Refer to *Diagnostic Aids* | Go to *Step 14* |
| 14 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 15* | Go to *Step 16* |
| 15 | 1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 18* | Go to *Step 17* |
| 16 | Check the following items;<br>1. TP1 and TP2 signal circuit for a short to voltage.<br>2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1 and TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |

# DTC P1514 - TPS-MAF Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 17 | Check the following items;<br>1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 19 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1515 Command - Actual TPS Correlation Error




D06RY00111

## Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).
  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects the difference between actual throttle position and command throttle position.

## Conditions for setting the DTC

- The ignition is “ON”.
- Throttle actuation mode is normal.
- Command Throttle position - Actual Throttle position is more than + 5 % for 100 counts within 1000 test samples (15.6 m sec) else Actual Throttle position is less than + 40 % and Command Throttle position - Actual Throttle position is more than - 5 % or Command Throttle position - Actual Throttle position is more than - 20 % for 150 failures within test 1000 test samples (15.6 m sec).

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on throttle blade position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1515 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1515 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, proper mating, locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while

moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1515 cannot be duplicated, the information included in the Failure Records data can be useful in determing vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1515 Diagnostic Chart may isolate the cause of the fault.

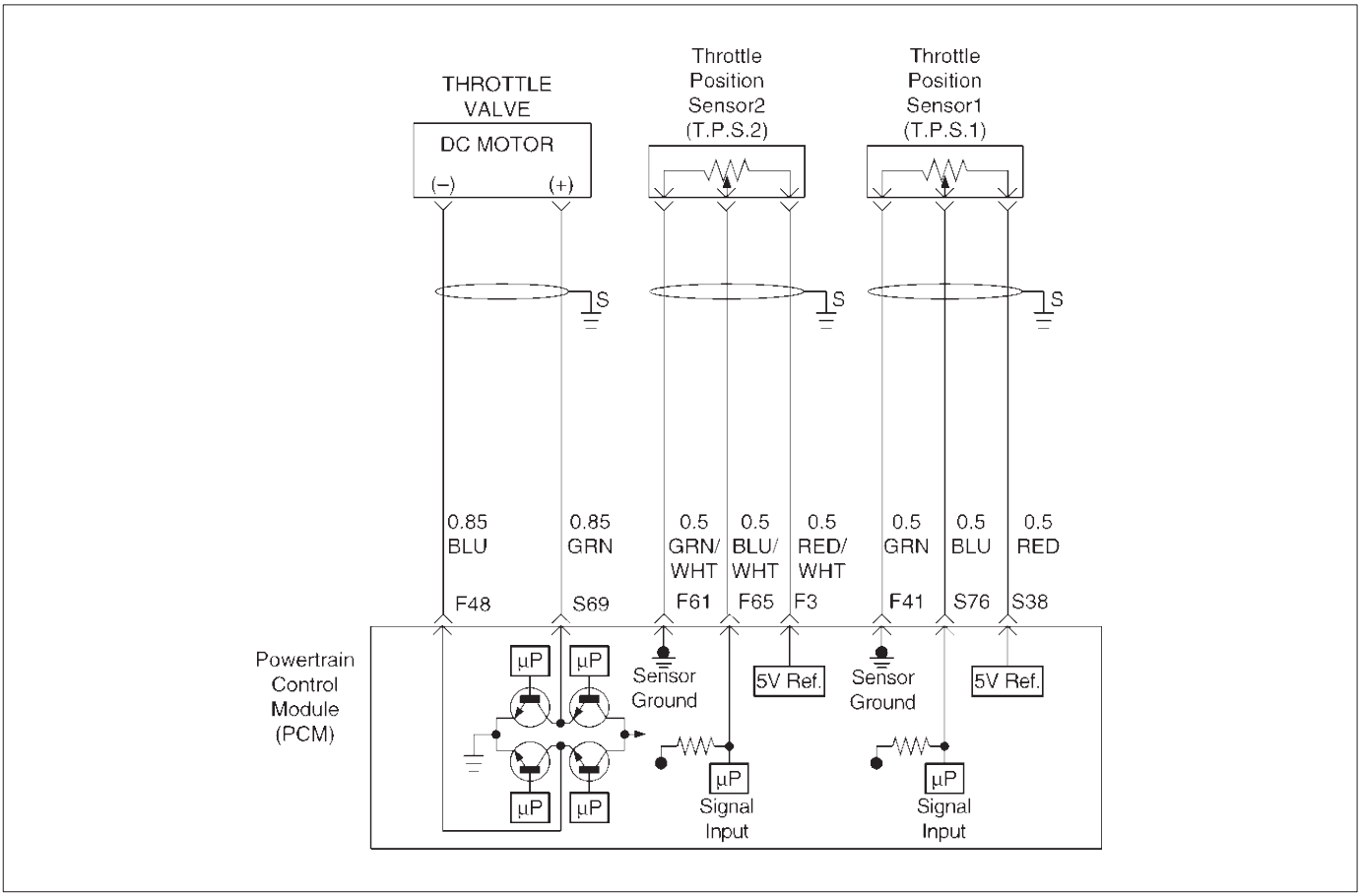
## DTC P1515 - Command - Actual TPS Correlation Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “ DTC” info for DTC P1515.<br>Does the Tech 2 indicate DTC P1515 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 % | Go to *Step 5* | Go to *Step 8* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the DC motor.<br>Is the DC motor reading near the specified value? | 0.3 ~ 100 Ω | Go to *Step 6* | Go to *Step 7* |
| 6 | Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 7 | Replace the DC motor.<br>Is the action complete? | — | Verify repair | Go to *Step 6* |
| 8 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 12* | Go to *Step 11* |

# DTC P1515 - Command - Actual TPS Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Check the following items;<br>1. TP1 and TP2 signal circuit for a short to voltage.<br>2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1and TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 11 | Check the following items;<br>1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 12 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1516 Command - Actual TPS Correlation Error




D06RY00111

## Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle). The throttle blade angle will vary from about 8% at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects the difference between actual throttle position and command throttle position in steady state.

## Conditions for setting the DTC

- The ignition is “ON”.
- Throttle Actuation mode is normal.
- Command Throttle position-Actual Throttle position is less than 8 % when desired TPS is steady within 0.5 % for 30 seconds within test samples (30 second)

## Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1516 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1516 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1516 cannot be duplicated, the

information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1516 Diagnostic Chart may isolate the cause of the fault.

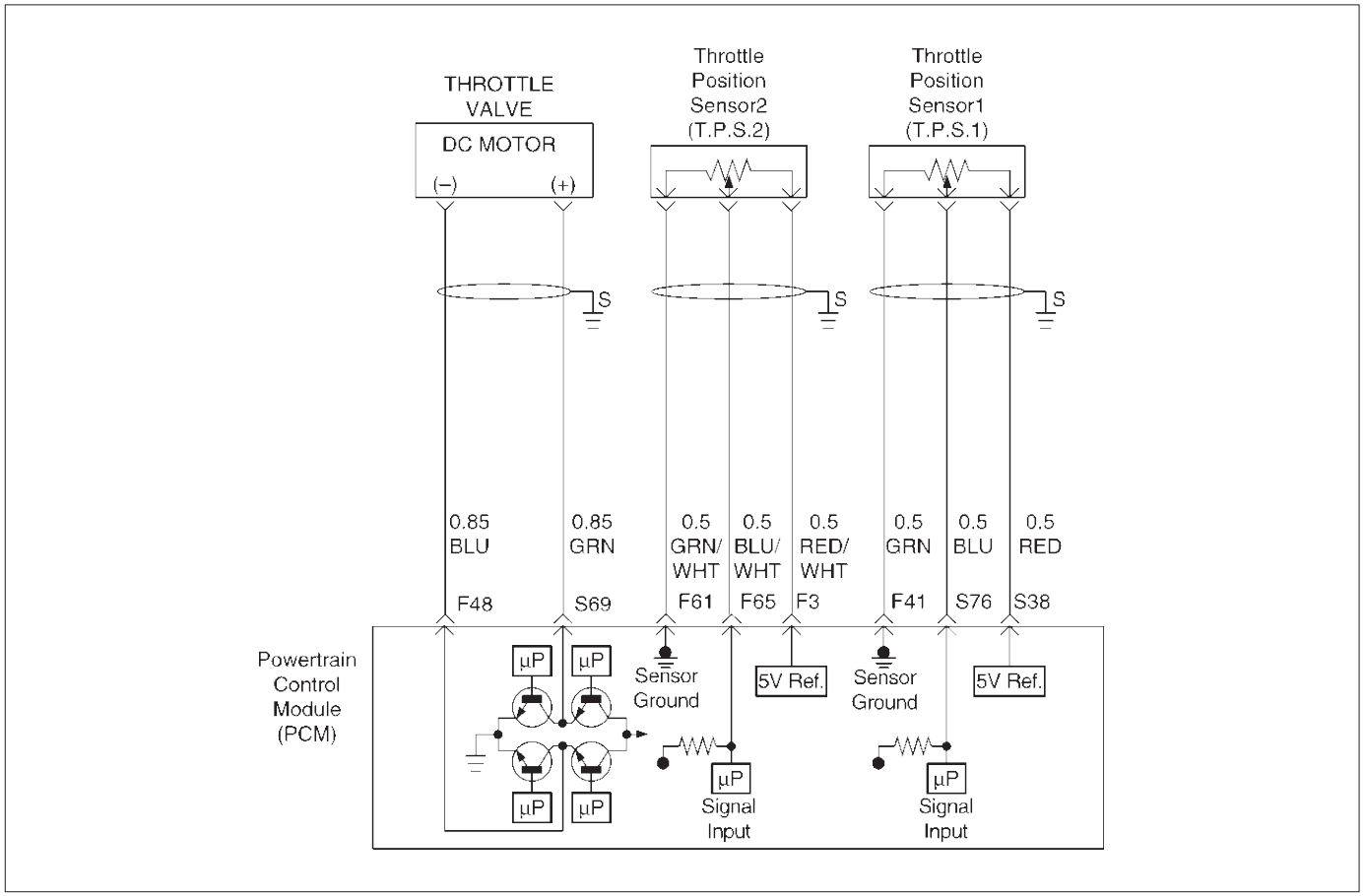
## DTC P1516 - Command - Actual TPS Correlation Error

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Ignition “ON”, engine “OFF”.<br>2. Review and record Tech 2 Failure Records data.<br>3. Operate the vehicle within Failure Records conditions as noted.<br>4. Using a Tech 2, monitor “DTC” info for DTC P1516.<br>Does the Tech 2 indicate DTC P1516 failed this ignition? | — | Go to *Step 4* | Refer to *Diagnostic Aids* |
| 4 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 % | Go to *Step 5* | Go to *Step 8* |
| 5 | 1. Ignition “OFF”.<br>2. Disconnect the DC motor.<br>Is the DC motor reading near the specified value? | 0.3 ~ 100 Ω | Go to *Step 6* | Go to *Step 7* |
| 6 | Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 7 | Replace the DC motor.<br>Is the action complete? | — | Verify repair | Go to *Step 6* |
| 8 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Connect a test light between the 5 Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 12* | Go to *Step 11* |

# DTC P1516 - Command - Actual TPS Correlation Error (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Check the following items;<br>1. TP1 and TP2 signal circuit for a short to voltage.<br>2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1and TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 11 | Check the following items;<br>1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1 and TP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 12 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 13 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed.<br>Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin.<br>Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1523 Actuator Control Return Performance




D06RY00111

## Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).
  The throttle blade angle will vary from about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects if the throttle return to the default position at key on is steady.

## Conditions for setting the DTC

- The ignition is “ON”.
- Normalized TPS is less than 7 % or Normalized TPS is more than 25 %.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1523 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1523 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Misrouted harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors 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. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
  A change in the display will indicate the location of the fault. If DTC P1523 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1523 Diagnostic Chart may isolate the cause of the fault.

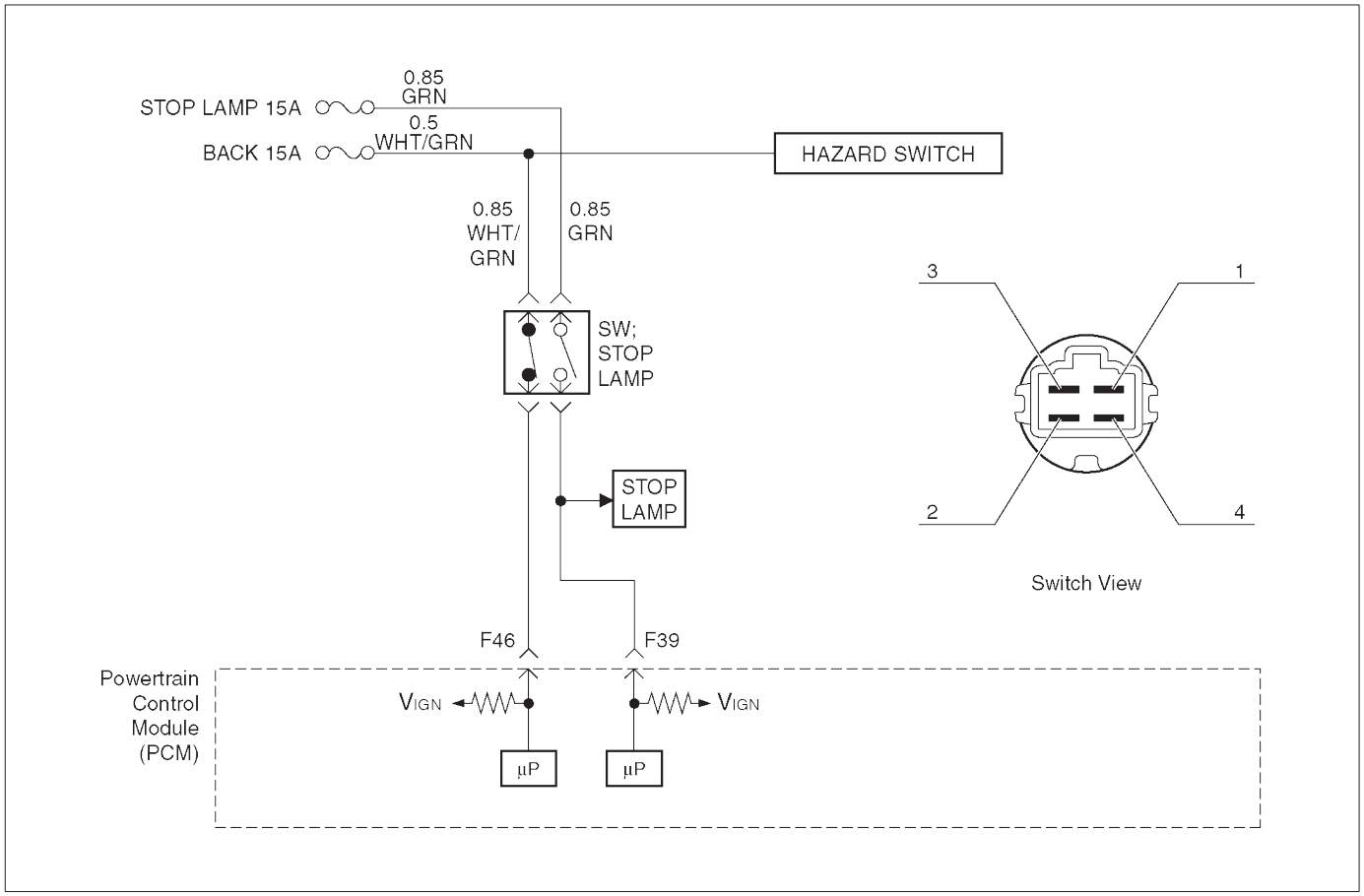
## DTC P1523 - Actuator Control Return Performance

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | Observe the TP angle reading on the Tech 2 while slowly opening the throttle.<br>Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value? | Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 % | Go to *Step 4* | Go to *Step 7* |
| 4 | 1. Ignition “OFF”.<br>2. Disconnect the DC motor.<br>Is the DC motor reading near the specified value? | 0.3 ~ 100 Ω | Go to *Step 5* | Go to *Step 6* |
| 5 | Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 6 | Replace the DC motor.<br>Is the action complete? | — | Verify repair | Go to *Step 5* |
| 7 | 1. Disconnect the TP sensor.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 0V | Go to *Step 8* | Go to *Step 9* |
| 8 | 1. Connect a test light between the 5 Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector.<br>2. Observe the TP sensor reading on the Tech 2.<br>Is the TP sensor reading near the specified value? | 5V | Go to *Step 11* | Go to *Step 10* |
| 9 | Check the following items;<br>1. TP1 and TP2 signal circuit for a short to voltage.<br>2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor.<br>3. TP1and TP2 sensor ground circuit for a poor connection.<br>4. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |

# DTC P1523 - Actuator Control Return Performance (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | Check the following items;<br>1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection.<br>2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 11 | Replace the TP sensor.<br>Is the action complete? | — | Verify repair | — |
| 12 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1571 Brake Switch No Operation




060R200067

## Circuit Description

The brake switch has 3 functions.

- Brake pedal operation check
- Brake light operation (On and off)
- Cruise control (Cancel)

The PCM receives vehicle speed and switch position signals from the brake switch. The PCM sets brake operating conditions in response to these signals.

If the brake switch is on, the brake system is in normal operation (cruise control cancelled).

## Conditions for Setting the DTC

- Two break switch signals do not acknowledge after signal changed.
- Switch does not change during accelerating vehicle or decelerating.
- VSS is not fault.
- Engine is running.

## Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON”.
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the DTC

- DTC P1571 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

# DTC P1571 Brake Switch No Operation

| 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 "Off". Engine "Off".<br>2. Check following fuses.<br>● BACK 15A<br>● STOP LAMP 15A<br>Was a problem found? | — | Verify repair | Go to *Step 3* |
| 3 | 1. Make adjustment to the brake switch. (Refer to *"Brake switch" in "10A CRUISE CONTROL SYSTEM"*.)<br>Was the problem found? | — | Verify repair | Go to *Step 4* |
| 4 | 1. Push the shaft on brake switch.<br>2. Check shaft operation for smooth movement.<br>Was the problem found? | — | Verify repair | — |
| 5 | 1. Disconnect the connector at brake switch.<br>2. Check following terminal pin by ohmmeter. (Leave the shaft position at brake switch. Don't push it.)<br>● Between pin 1 and pin 2<br>● Between pin 3 and pin 4<br>Was it specified value? | Between pin1 and pin2 is 0Ω, Between pin3 and pin4 is ∞Ω | Go to *Step 6* | Go to *Step 9* |
| 6 | 1. Disconnect the connector at brake switch.<br>2. Check following terminal pin at ohmmeter. (Don't press the button of the brake switch.)<br>● •Between pin 1 and pin 2<br>● •Between pin 3 and pin 4<br>Was it specified value? | Between pin1 and pin2 is ∞Ω, Between pin3 and pin4 is 0Ω | Go to *Step 7* | Go to *Step 9* |
| 7 | 1. Probe related circuits for open or short to ground.<br>2. If a problem was found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Was the action completed? | — | Verify repair | — |
| 9 | 1. Replace the brake switch.<br>Was the action completed? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset

## Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only record code DTC P1625.

## Conditions for Setting the DTC

- Clock or COP (Computer Operating Properly) reset.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1625 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1625 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

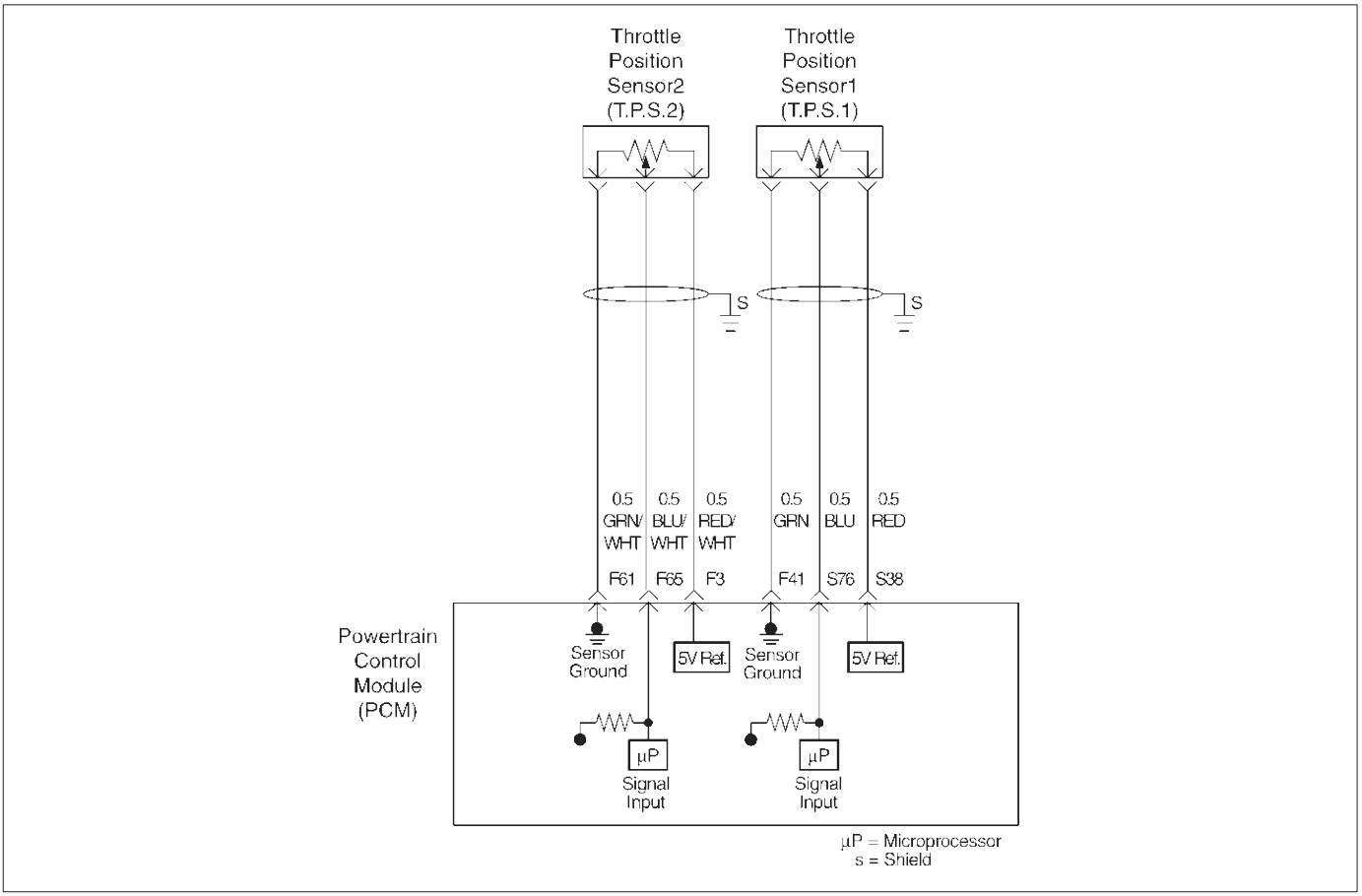
Check for the following conditions:

- P1625 stored alone does not need diagnosis. Clear DTC code.

# DTC P1625 – PCM Unexpected Reset

| 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 is “ON”.<br>2. Install the Tech 2.<br>3. Start the engine and let it Idle.<br>4. On the Tech 2, select “DTC info”.<br>Does the Tech 2 indicate DTC P1625 failed? | — | Go to *Step 3* | Go to *Diagnostic Aids* |
| 3 | 1. Ignition is “ON”.<br>2. Clear DTC P1625 by using the Tech 2 “Clear Info”.<br>3. Start the engine and let it Idle.<br>4. On the Tech 2, select “DTC info”.<br>Does the Tech 2 indicate DTC P1625 failed? | — | Go to *Step 4* | Go to *Diagnostic Aids* |
| 4 | 1. Check for aftermarket electronics, such as transceiver, stereos, and anti theft devices. They may radiate EMI into the control system if they are improperly installed. (This may cause a false sensor reading and turn on the MIL.)<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1635 Reference Voltage # 1 Circuit Fault




D06RY00093

## Circuit Description

The TP sensor # 1 shares a 5 Volt reference with the PCM.
If the PCM detects the 5 Volt reference for the TP sensor # 1 is failure, DTCP1635 will be set.

## Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the TP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the TP sensor # 1 is more than 5 volts.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL) .
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

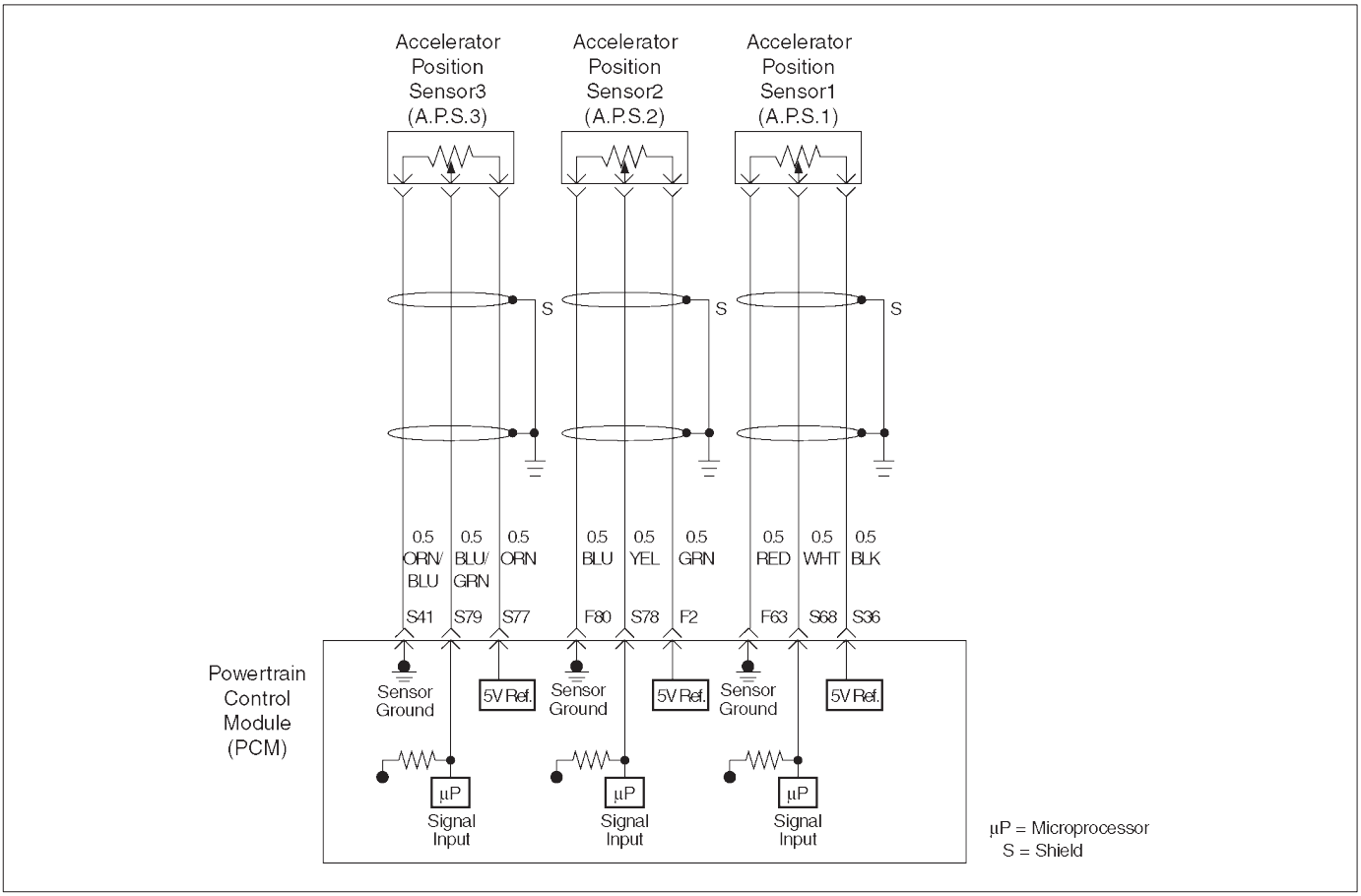
## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1635will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1635 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech2 “ Clear Info” function or by disconnecting the PCM battery feed.

# Diagnostic Trouble Code (DTC) P1635 Reference Voltage # 1 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board(OBD)System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine not running.<br>2. Using a DVM at the PCM side of the connector, check the voltage at terminal S38 (RED) pin.<br>Is the voltage in specified range? | 4.95 – 5.0V | Go to *ETC System Check* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine not running.<br>2. Using a DVM at the PCM side of the connector, check the voltage at terminal F20 (RED/WHT) pin.<br>Is the voltage in specified range? | 11.6 – 12.7V | Go to *Step 4* | Go to *Step 5* |
| 4 | 1. Ignition “ON”, engine not running.<br>2. Using a DVM at the PCM side of the connector, check the voltage at terminal F57 (RED/WHT) pin.<br>Is the voltage in specified range? | 11.6 – 12.7V | Go to *Step 6* | Go to *Step 5* |
| 5 | Observe the battery voltage and circuit. If a problems found, repair it as necessary.<br>Was the problem found? | — | Verify repair | Go to *Step 6* |
| 6 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1639 Reference Voltage # 2 Circuit Fault




060R200064

## Circuit Description

The AP sensor # 1shares a 5 Volt reference with the PCM. If the PCM detects the 5 Volt reference for the AP sensor # 1 is failure, DTC P1635 will be set.

## Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the AP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the AP sensor # 1 is more than 5 volts.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1639 will clear after 40 consecutive trip cycles during which the warm up cycles have occurred without a fault.
- DTC P1639 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

# Diagnostic Trouble Code (DTC)
# P1639 Reference Voltage # 2 Circuit Fault

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | Was the “On-Board (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Ignition “ON”, engine not running.<br>2. Using a DVM at the PCM side of the connector, check the voltage at terminal S36 (BLK) pin.<br>Is the voltage in specified range? | 4.95 – 5.0V | Go to *ETC System Check* | Go to *Step 3* |
| 3 | 1. Ignition “ON”, engine not running.<br>2. Using a DVM at the PCM side of the connector, check the voltage at terminal F20(RED/WHT) pin.<br>Is the voltage in specified range? | 11.6 – 12.7V | Go to *Step 4* | Go to *Step 5* |
| 4 | 1. Ignition “ON”, engine not running.<br>2. Using a DVM at the PCM side of the connector, check the voltage at terminal F57 (RED/WHT) pin.<br>Is the voltage in specified range? | 11.6 – 12.7V | Go to *Step 6* | Go to *Step 5* |
| 5 | Observe the battery voltage and circuit.<br>If a problem is found, repair it as necessary.<br>Was the problem found? | — | Verify repair | Go to *Step 6* |
| 6 | Replace the PCM.<br>**IMPORTANT:**<br>The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.*<br>And also refer to latest Service Bulletin. Check to see if the latest software is released or not.<br>And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC)
# P1640 Driver-1-Output Circuit Fault (ODM)

## Circuit Description

Output driver modules (ODMs) are used by the powertrain control module (PCM) to turn “ON” many of the current-driven devices that are needed to control various engine and transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding “ON”.

Unlike the Quad Driver Modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P1640 set indicates an improper voltage level has been detected on an ODM output.

Since A/C is an option, No A/C will cause the air conditioning clutch relay output to always fail. If a fault is seen on the air conditioning clutch relay output, it will not be logged as a fault until the A/C request input interrupts a high voltage, indicating that A/C has been installed.

## Conditions for Setting the DTC

- Ignition “ON”.
- Engine running.
- Ignition voltage is above 13.2 volts for 4 seconds.
- Output voltage does not equal ignition voltage when output is “OFF” or output voltage is not less than 1 volt when output is “ON”.
- Above conditions occur for at least 1 second.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- A history DTC P1640 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P1640 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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, If the harness appears to be OK, disconnect the PCM, turn the ignition “ON” and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses related to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: Instrument cluster harness, canister purge solenoid, A/C clutch relay. An open ignition feed circuit at any of these components will cause DTC P1640 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## Test Description

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

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate “short circuit” even when the problem is an open circuit. The cause of an open circuit may be in the component itself-lamp, purge, solenoid, or A/C compressor relay.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

# DTC P1640 – Driver-1-Output Circuit Fault (ODM)

| 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 | Check the fuse for the driver circuit that was shown as faulty.<br>Was the fuse blown? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Check for a short to ground between the fuse and the affected component.<br>2. Replace the fuse after making any necessary repairs.<br>Is the action complete? | — | Verify repair | — |
| 4 | Disconnect the PCM connector for the affected driver circuit.<br>Is there any damage to the PCM pin or connector? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | — |
| 6 | Were either of the lamp circuits for "Check Engine" or "Check Trans" indicated as faulty by the Tech 2? | — | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Leave the PCM connector for the lamp driver circuit disconnected.<br>2. Ignition "ON".<br>3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit.<br>Was the voltage equal to the specified value? | B+ | Go to *Step 15* | Go to *Step 8* |
| 8 | 1. Ignition "ON".<br>2. Check for battery voltage at the fuse for the affected lamp circuit.<br>Was battery voltage available at the fuse? | — | Go to *Step 10* | Go to *Step 9* |
| 9 | Repair the open circuit between the ignition switch and the fuse.<br>Is the action complete? | — | Verify repair | — |
| 10 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector for the affected driver terminal.<br>3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver.<br>Did the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Repair the short to ground between the affected component and its PCM driver terminal.<br>Is the action complete? | — | Verify repair | — |
| 12 | Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit.<br>Is the action complete? | — | Verify repair | — |

# DTC P1640 – Driver-1-Output Circuit Fault (ODM) (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 13 | 1. Connect the PCM.<br>2. Start the engine and let it idle.<br>3. Backprobe the affected terminal at the PCM with a DVM.<br>Was the voltage equal to the specified value? | +B | Go to *Step 15* | Go to *Step 14* |
| 14 | 1. Run the engine at idle.<br>2. Check for battery voltage at the fuse for the affected circuit.<br>Was battery voltage available at the fuse? | — | Go to *Step 10* | Go to *Step 9* |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Diagnostic Trouble Code (DTC) P1650 Quad Driver Module "A" Fault

## Circuit Description

The Quad Driver Module (QDMs) are used by the powertrain control module (PCM) to turn "ON" current–driven devices that are needed to control two engine functions. The PCM monitors open or short circuit of either of Canister Control Purge (CCP) Vent solenoid or Variable Intake Manifold (VIM).

## Conditions for Setting the DTC

- Ignition "ON".
- Engine running.
- Ignition voltage.
- Output voltage does not equal voltage and is not less than 1 volt when out put is "ON".
- Above conditions occur for at least 0.5 second.

## Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

## Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1650 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1650 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

## Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors 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, If the harness appears to be OK, disconnect the PCM, turn the ignition "ON" and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: canister purge solenoid, fuel level sensor. An open ignition feed circuit at any of these components will cause DTC P1650 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

## The following PCM pins are controlled by Quad driver modules (QDMs):

- S74 – VIM
- S48 – Canister control purge

## Test Description

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

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

# DTC P1650 – Quad Driver Module (QDM) Fault

| 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 | Check the fuse for the driver circuit that was shown as faulty.<br>Was the fuse blown? | — | Go to *Step 3* | Go to *Step 4* |
| 3 | 1. Check for a short to ground between the fuse and the affected component.<br>2. Replace the fuse after making any necessary repairs.<br>Is the action complete? | — | Verify repair | — |
| 4 | Disconnect the PCM connector for the affected driver circuit.<br>Is there any damage to the PCM pin or connector? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Repair the damaged pin or terminal.<br>Is the action complete? | — | Verify repair | — |
| 6 | Were either of the lamp circuits for "Check Engine" or "Check Trans". indicated as faulty by the Tech 2? | — | Go to *Step 7* | Go to *Step 13* |
| 7 | 1. Leave the PCM connector for the lamp driver circuit disconnected.<br>2. Ignition "ON".<br>3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit.<br>Was the voltage equal to the specified value? | B+ | Go to *Step 15* | Go to *Step 8* |
| 8 | 1. Ignition "ON".<br>2. Check for battery voltage at the fuse for the affected lamp circuit.<br>Was battery voltage available at the fuse? | — | Go to *Step 10* | Go to *Step 9* |
| 9 | Repair the open circuit between the ignition switch and the fuse.<br>Is the action complete? | — | Verify repair | — |
| 10 | 1. Ignition "OFF".<br>2. Disconnect the PCM connector for the affected driver terminal.<br>3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver.<br>Did the ohmmeter indicate continuity? | — | Go to *Step 11* | Go to *Step 12* |
| 11 | Repair the short to ground between the affected component and its PCM driver terminal.<br>Is the action complete? | — | Verify repair | — |
| 12 | Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit.<br>Is the action complete? | — | Verify repair | — |

# DTC P1650 – Quad Driver Module (QDM) Fault (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 13 | 1. Connect the PCM.<br>2. Start the engine and let it idle.<br>3. Backprobe the affected terminal at the PCM with a DVM.<br>Was the voltage equal to the specified value? | +B | Go to *Step 15* | Go to *Step 14* |
| 14 | 1. Run the engine at idle.<br>2. Check for battery voltage at the fuse for the affected circuit.<br>Was battery voltage available at the fuse? | — | Go to *Step 10* | Go to *Step 9* |
| 15 | Replace the PCM.<br>**IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures.<br>And also refer to latest Service Bulletin.<br>Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.<br>Is the action complete? | — | Verify repair | — |

# Symptom Diagnosis

## Preliminary Checks

Before using this section, perform the "On-Board Diagnostic (OBD) System Check" and verify all of the following items:

- The powertrain control module (PCM), and malfunction indicator lamp (MIL) (Check Engine lamp) and Reduced Power Lamp (RPL) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to *Typical Scan Data Values*.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

## Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time.

This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Ignition components for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

## Intermittents

**IMPORTANT:** An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a Tech 2 to help detect intermittent conditions. The scan tool has several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Tech 2's "Freeze Frame" buffer or "Failure Records" buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Check Engine lamp) comes on. DTC P0107 should be stored and kept in memory when the ignition is turned "OFF". If not, the PCM is faulty. When this test is completed, make sure that you clear the DTC P0107 from memory.

An intermittent MIL (Check Engine lamp) with no stored DTC may be caused by the following:

- Ignition coil shorted to ground and arcing.
- MIL (Check Engine lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Check all wires from the PCM to the ignition coils for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in *Electrical Diagnosis*).

If problem has not been found, refer to *PCM Connector Symptom* tables.

- Check the "Calibration ID" of the PCM, and compare it with the latest Isuzu service bulletins and/or Isuzu EEPROM reprogramming equipment to determine if an update to the PCM's reprogrammable memory has been released. To check the "Calibration ID", connect the Tech 2, then look for "Powertrain", then select "Calibration ID". This identifies the contents of the reprogrammable software and calibration contained in the PCM. If the "Calibration ID" is not the most current available, it is advisable to reprogram the PCM's EEPROM memory, which may either help identify a hard-to-find problem or may fix the problem.
- Calibration ID (example)

| | |
|---|---|
| Part number | 9377709 |
| Broadcast Code | CYYD |
| Identifier | 801 |

# Hard Start Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stall.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 4* |
| 4 | Was a visual/physical check performed? | — | Go to *Step 5* | Go to *Visual/ Physical Check* |
| 5 | Check engine coolant temperature (ECT) sensor for shift in value. After 8 hours with the hood up and the engine not running, connect the Tech 2. With the ignition "ON" and the engine not running, compare engine coolant temperature to intake air temperature.<br>Are ECT and IAT within the specified value of each other? | ± 5°C (± 9°F) | Go to *Step 10* | Go to *Step 6* |
| 6 | 1. Using a Tech 2, display the engine coolant temperature and note the value.<br>2. Check the resistance of the engine coolant temperature sensor.<br>3. Refer to *Engine Coolant Temperature Sensor Temperature vs. Resistance* chart on *DTC P0118 Diagnostic Support* for resistance specifications.<br>Is the resistance value near the resistance for the temperature noted? | — | Go to *Step 8* | Go to *Step 7* |
| 7 | Replace the ECT sensor.<br>Is the action complete? | — | Verify repair | — |
| 8 | Locate and repair high resistance or poor connection in the ECT signal circuit or the ECT sensor ground.<br>Is the action complete? | — | Verify repair | — |
| 9 | 1. Check for a faulty, plugged, or incorrectly installed PCV valve.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Check for water- or alcohol-contaminated fuel.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Perform the procedure in *Fuel System Pressure Test*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |

## Hard Start Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | 1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | 1. Check for a loose ignition coil ground and ION Sensing module circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Remove the ignition coils and check the ignition coils for cracks or carbon tracking.<br>2. If a problem is found, replace affected coil(s) as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Check for the following engine mechanical problems (refer to *Engine Mechanical*):<br>• Low compression<br>• Leaking cylinder head gaskets<br>• Worn or incorrect camshaft<br>• Camshaft drive belt slipped or stripped<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>• Visual/physical inspection<br>• Tech 2 data<br>• Freeze Frame data/Failure Records buffer<br>• All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

## Surges and/or Chuggles Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 4* |
| 4 | Was a visual/physical check performed? | — | Go to *Step 5* | Go to *Visual/ Physical Check* |
| 5 | Be sure that the driver understands transmission torque converter clutch and A/C compressor operation as explained in the owner's manual.<br>Inform the customer how the TCC and the A/C clutch operate.<br>Is the customer experiencing a normal condition? | — | System OK | Go to *Step 6* |
| 6 | 1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicone or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating.<br>Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication).<br>The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Check the fuel pressure. Refer to *Fuel System Pressure Test*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | Monitor the long term fuel trim on the Tech 2.<br>Is the long term fuel trim significantly in the negative range (rich condition)? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 11* | Verify repair |

## Surges and/or Chuggles Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 11* | Verify repair |
| 11 | 1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Check for a loose ignition coil ground and ION Sensing module circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Check the ignition coils for cracks or carbon tracking.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 14 | 1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Check the injector connections.<br>2. If any of the injector connectors are connected to an incorrect cylinder, correct as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Check PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | 1. Check MAF sensor connections.<br>2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |

## Surges and/or Chuggles Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 19 | 1. Check the exhaust system for possible restriction:<br>• Inspect the exhaust system for damaged or collapsed pipes.<br>• Inspect the muffler for heat distress or possible internal failure.<br>• Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 20* |
| 20 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>• Visual/physical inspection<br>• Tech 2 data<br>• Freeze Frame data/Failure Records buffer<br>• All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

# Lack of Power, Sluggish, or Spongy Symptoms

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part-way.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 4* |
| 4 | Was a visual/physical check performed? | — | Go to *Step 5* | Go to *Visual/ Physical Check* |
| 5 | 1. Remove and check the air filter element for dirt or restrictions. Refer to *Air Intake System* in *ON-Vehicle Service*.<br>2. Replace the air filter element if necessary.<br>Was a repair required? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Check for low fuel pressure. Refer to *Fuel System Pressure Test*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Check for water- or alcohol-contaminated fuel.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Install the Tech 2.<br>2. Run the engine at idle.<br>3. On the Tech 2, select F3: Miscellaneous Test, F6: Variable Intake Manifold.<br>4. Repeat Switch ON or OFF of VIM solenoid valve by using the Tech 2.<br>5. Check to see if the actuator works normally.<br>6. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

## Lack of Power, Sluggish, or Spongy Symptoms (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Check the ignition coils for cracks or carbon tracking.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Check the PCM grounds for cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Check the exhaust system for possible restriction:<br>● Inspect the exhaust system for damaged or collapsed pipes.<br>● Inspect the muffler for heat distress or possible internal failure.<br>● Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | 1. Check the torque converter clutch (TCC) for proper operation. Refer to *4L30-E Transmission Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Check for an engine mechanical problem. Check for low compression, incorrect or worn camshaft, loose timing belt, etc. Refer to *Engine Mechanical*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records buffer<br>● All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

## Detonation/Sparks Knock Symptoms

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 3* |
| 3 | Was a visual/physical check performed? | — | Go to *Step 4* | Go to *Visual/ Physical Check* |
| 4 | If Tech 2 readings are normal (refer to *Typical Scan Values*) and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87 and re-evaluate the vehicle performance.<br>Is detonation present? | — | Go to *Step 5* | Verify repair |
| 5 | 1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive.<br>2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*).<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Check TCC operation. Refer to *4L30-E Transmission Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Check for obvious overheating problems:<br>• Low engine coolant.<br>• Restricted air flow to radiator, or restricted water flow through radiator.<br>• Correct coolant solution should be a 50/50 mix of approved antifreeze/coolant and water. Refer to *Engine Cooling*.<br>• EGR operation. Refer to *DTC P0401*.<br>• ION sensing module fault.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Ignition "OFF".<br>2. Disconnect the ION sensing module.<br>3. Disconnect the PCM.<br>Is the action complete? | — | Go to *Step 9* | — |
| 9 | Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the KI line harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

## Detonation/Sparks Knock Symptoms (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Disconnect the ignition coil.<br>Is the action complete? | — | Go to *Step 11* | — |
| 11 | Check the ION sensing harness between the ignition coil and ION sensing module circuit at the DC motor harness connector.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | Check the following items;<br>1. Ignition coil and ignition coil circuit.<br>2. Ignition coil ground circuit for a poor connection.<br>3. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | Replace the Ignition coil.<br>Is the action complete? | — | Verify repair | Go to *Step 14* |
| 14 | Check the following items;<br>1. ION sensing module ground circuit for a poor connection.<br>2. If a problem is found, repair wiring harness as necessary.<br>Was a problem found? | — | Go to *Step 10* | Go to *Step 16* |
| 15 | Replace the ION sensing module.<br>Is the action complete? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Check fuel pressure. Refer to Chart Fuel System Pressure Test.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | 1. Check items that can cause an engine to run lean (long term fuel trim significantly in the positive range). For a lean condition, refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Spark plugs for proper heat range. Refer to *General Information*.<br>2. If incorrect spark plugs are installed, replace spark plugs as necessary.<br>Did any spark plugs require replacement? | — | Verify repair | Go to *Step 19* |
| 19 | 1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can.<br>2. Re-evaluate vehicle performance.<br>Is detonation still present? | — | Go to *Step 20* | Verify repair |

## Detonation/Sparks Knock Symptoms (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 20 | 1. Check for an engine mechanical problem. Perform a cylinder compression check. Refer to *Engine Mechanical*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 21* |
| 21 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records buffer<br>● All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

# Rough, Unstable, or Incorrect Idle, Stalling Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.<br>Was the “On-Board Diagnostic (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the “Electric Throttle Control (ETC) System Check” performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Go to *Step 14* | Go to *Step 4* |
| 4 | Was a visual/physical check performed? | — | Go to *Step 5* | Go to *Visual/ Physical Check* |
| 5 | 1. Check the PCM grounds for cleanliness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | Observe the long term fuel trim on the Tech 2.<br>Is the long term fuel trim significantly in the negative range (rich condition)? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 8 | Is the long term fuel trim significantly in the positive range (lean condition)? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Check for incorrect idle speed. Ensure that the following conditions are present:<br>• The engine is fully warm.<br>• The accessories are “OFF”.<br>2. Using a Tech 2, monitor the Engine Speed.<br>Is the Engine Speed within the specified values? | Desired Idle Speed | Go to *Step 12* | Go to *Step 11* |

## Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | 1. Visually/physically inspect for the following conditions:<br>• Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.<br>• Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or a disconnected brake booster hose.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 12 | Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | 1. Check for fuel in the pressure regulator vacuum hose.<br>2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | 1. Check for a loose ignition coil ground and ION Sensing Module circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Check ignition coils for cracks or carbon tracking.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |

## Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 19 | Using a Tech 2, monitor the throttle position 1 and 2 angle with the engine idling.<br>Is the TP angle at the specified value and steady? | 8 ~ 10% | Go to *Step 20* | Refer to *DTC* for further diagnosis |
| 20 | 1. Check the positive crankcase ventilation (PCV) valve for proper operation. Refer to *Crankcase Ventilation System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 21* |
| 21 | 1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive.<br>2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*).<br>Was a problem found? | — | Verify repair | Go to *Step 22* |
| 22 | 1. Check for the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures:<br>• Low compression<br>• Sticking or leaking valves<br>• Worn camshaft lobe(s)<br>• Camshaft drive belt slipped or stripped<br>• Incorrect valve timing<br>• Worn rocker arms<br>• Broken valve springs<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 23* |
| 23 | 1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 24* |
| 24 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>• Visual/physical inspection<br>• Tech 2 data<br>• Freeze Frame data/Failure Records buffer<br>• All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

# Poor Fuel Economy Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. (Non-standard tires will cause odometer readings to be incorrect, and that may cause fuel economy to appear poor when it is actually normal.)<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 3* |
| 3 | Was a visual/physical check performed? | — | Go to *Step 4* | Go to *Visual/ Physical Check* |
| 4 | Check owner's driving habits.<br>● Is the A/C "ON" full time (defroster mode "ON")?<br>● Are tires at the correct pressure?<br>● Are excessively heavy loads being carried?<br>● Is acceleration too much, too often?<br>Was a problem found? | — | Go to *Step 5* | Go to *Step 6* |
| 5 | Review the items in Step 4 with the customer and advise as necessary.<br>Is the action complete? | — | System OK | — |
| 6 | 1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Remove and check the air filter element for dirt or for restrictions. Refer to *Air Intake System*.<br>2. Replace the air filter element if necessary.<br>Was a repair required? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Spark Plug Replacement*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 9 | 1. Check for low engine coolant level. Refer to *Engine Cooling*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |

# Poor Fuel Economy Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Check for an incorrect or faulty engine thermostat. Refer to *Engine Cooling*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Check for low engine compression. Refer to *Engine Mechanical*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Check the TCC operation. Refer to *4L30-E Transmission Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Check the exhaust system for possible restriction:<br>● Inspect the exhaust system for damaged or collapsed pipes.<br>● Inspect the muffler for heat distress or possible internal failure.<br>● Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | Check for proper calibration of the speedometer.<br>Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2? | — | Go to *Step 16* | Go to *Step 15* |
| 15 | Diagnose and repair an inaccurate speedometer condition as necessary. Refer to *Vehicle Speed Sensor* in *Electrical Diagnosis*.<br>Was a problem found? | — | Verify repair | — |
| 16 | 1. Check the air intake system and the crankcase for air leaks. Refer to *Air Intake System* and *Crankcase Ventilation System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | 1. Review all diagnostic procedures within this table.<br>2. When all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records buffer<br>● All connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | Perform the procedure in *Fuel System Pressure Test*.<br>Was the fuel pressure normal? | — | Contact Technical Assistance | Verify repair |

# Excessive Exhaust Emissions or Odors Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. (Excessive odors do not necessarily indicate excessive emissions.)<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Go to *Step 13* | Go to *Step 3* |
| 3 | Was a thorough visual/physical check performed? | — | Go to *Step 4* | Go to *Visual/ Physical Check* |
| 4 | 1. Check for vacuum leaks. Check vacuum lines, intake manifold, throttle body, etc.<br>2. If a problem is found, repair as necessary.<br>Were any vacuum leaks located? | — | Go to *Step 13* | Go to *Step 5* |
| 5 | 1. Check the fuel cap for proper installation.<br>2. Secure the fuel cap if necessary.<br>Was the fuel cap installed properly? | — | Go to *Step 6* | Go to *Step 13* |
| 6 | 1. Check the fuel pressure. Perform the procedure in *Fuel System Pressure Test*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 7* |
| 7 | 1. Check for a faulty, plugged, or incorrectly installed crankcase ventilation valve; also check the crankcase ventilation system for plugging.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 8* |
| 8 | 1. Check the injector connections.<br>2. If any of the injectors are connected to an incorrect cylinder, correct as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 9* |
| 9 | 1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 10* |
| 10 | 1. Refer to *Engine Cooling* for cooling system diagnosis.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 11* |
| 11 | 1. Check EVAP canister for fuel loading. Refer to *Evaporative Emission Control System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 12* |

## Excessive Exhaust Emissions or Odors Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 12 | 1. Remove excessive carbon buildup with a top engine cleaner. Refer to the instructions on the top engine cleaner can.<br>2. Perform the exhaust emission test.<br>Does the vehicle pass the test? | — | System OK | Go to *Step 14* |
| 13 | Perform the exhaust emission test.<br>Does the vehicle pass the test? | — | System OK | Go to *Step 14* |
| 14 | Does the exhaust emission test indicate excessive CO and HC levels or is long term fuel trim significantly in the negative range (rich condition)? | — | Go to *Step 15* | Go to *Step 16* |
| 15 | 1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. Make any necessary repairs.<br>2. Perform the exhaust emission test.<br>Does the vehicle pass the test? | — | System OK | Go to *Step 17* |
| 16 | 1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. Make any necessary repairs.<br>2. Perform the exhaust emission test.<br>Does the vehicle pass the test? | — | System OK | Go to *Step 17* |
| 17 | 1. Check the EGR system (refer to *DTC P0401*).<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 18* |
| 18 | 1. Check for an engine mechanical problem.<br>Perform a cylinder compression check (refer to *Engine Mechanical*).<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Go to *Step 13* | Go to *Step 19* |
| 19 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>• Visual/physical inspection<br>• Tech 2 data<br>• Freeze Frame data/Failure Records butter<br>• All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

# Dieseling, Run-On Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Engine continues to run after key is turned “OFF,” but runs very rough. If engine runs smooth, check ignition switch and adjustment.<br>Was the “On-Board Diagnostic (OBD) System Check” performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 3* |
| 3 | Was a visual/physical check performed? | — | Go to *Step 4* | Go to *Visual/ Physical Check* |
| 4 | 1. Check for a short between B+ and any of the ignition feed circuits.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records butter<br>● All electrical connections within a suspected circuit and/or system<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

# Backfire Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 3* |
| 3 | Was a visual/physical check performed? | — | Go to *Step 4* | Go to *Visual/ Physical Check* |
| 4 | 1. Check for proper ignition voltage coil output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 5* |
| 5 | 1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. Refer to *DTC P0172* to determine the cause of a rich condition or *Engine Mechanical* for an oil fouling condition.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Visually/physically inspect the ignition coils for cracks.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | 1. Check for an intermittent ignition system malfunction:<br>• Intermittent CKP 58X signal.<br>• Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 8* |
| 8 | 1. Check the fuel pressure. Refer to *Fuel System Pressure Test*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |

## Backfire Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 9 | 1. Check for the following engine mechanical conditions.<br>Refer to *Engine Mechanical* for diagnosis procedures:<br>● Low compression<br>● Sticking or leaking valves<br>● Worn camshaft lobe(s)<br>● Camshaft drive belt slipped or stripped<br>● Incorrect valve timing<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Check the intake and exhaust manifold(s) for casting flash. Refer to *Engine Mechanical*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records butter<br>● All electrical connections within a suspected circuit and/or system.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

## Cuts Out, Misses Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Go to *Step 14* | Go to *Step 3* |
| 3 | Was a visual/physical check performed? | — | Go to *Step 4* | Go to *Visual/ Physical Check* |
| 4 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 5* | Go to *ETC System Check* |
| 5 | 1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | Observe the long term fuel trim on the Tech 2.<br>Is the long term fuel trim significantly in the negative range (rich condition)? | — | Go to *Step 7* | Go to *Step 8* |
| 7 | 1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 8 | Is the long term fuel trim significantly in the positive range (lean condition)? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 10* |
| 10 | 1. Check for incorrect idle speed. Ensure that the following conditions are present:<br>• The engine is fully warm.<br>• The accessories are "off".<br>2. Using a Tech 2, monitor the Engine Speed.<br>Is the Engine Speed within the specified values? | Desired Idle Speed | Go to *Step 12* | Go to *Step 11* |

## Cuts Out, Misses Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 11 | 1. Visually/physically inspect for the following conditions:<br>• Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.<br>• Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected .<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 9* |
| 12 | Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | 1. Check for fuel in the pressure regulator vacuum hose.<br>2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*.<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |
| 17 | 1. Check for a loose ignition coil ground and ION Sensing module circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Check ignition coils for cracks or carbon tracking.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 19* |
| 19 | Using a Tech 2, monitor the TP 1, 2 angle with the engine idling.<br>Is the TP angle at the specified value and steady? | 8 ~ 10% | Go to *Step 20* | Refer to *DTC P0123* for further diagnosis |

## Cuts Out, Misses Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 20 | 1. Check the PCV valve for proper operation. Refer to *Crankcase Ventilation System*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 21* |
| 21 | 1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive.<br>2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*).<br>Was a problem found? | — | Verify repair | Go to *Step 22* |
| 22 | 1. Check the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures:<br>● Low compression<br>● Sticking or leaking valves<br>● Worn camshaft lobe(s)<br>● Camshaft drive belt slipped or stripped<br>● Incorrect valve timing<br>● Worn rocker arms<br>● Broken valve springs<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 23* |
| 23 | 1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 24* |
| 24 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records butter<br>● All electrical connections within a suspected circuit and/or system<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

# Hesitation, Sag, Stumble Symptom

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 1 | **DEFINITION:**<br>Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.<br>Was the "On-Board Diagnostic (OBD) System Check" performed? | — | Go to *Step 2* | Go to *OBD System Check* |
| 2 | Was the "Electric Throttle Control (ETC) System Check" performed? | — | Go to *Step 3* | Go to *ETC System Check* |
| 3 | 1. Perform a bulletin search.<br>2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin.<br>Was a bulletin found that addresses the symptom? | — | Verify repair | Go to *Step 4* |
| 4 | Was a visual/physical check performed? | — | Go to *Step 5* | Go to *Visual/ Physical Check* |
| 5 | 1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating.<br>Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication).<br>The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 6* |
| 6 | 1. Check the fuel pressure. Refer to *Fuel System Pressure Test.*<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 7* |
| 7 | Observe the TP 1, 2 angle display on the Tech 2 while slowly increasing accelerator pedal depression.<br>Does the TP angle display steadily increase from 8 ~ 10% at closed throttle to 90 ~ 92% at WOT? | — | Go to *Step 8* | Go to *Step 9* |
| 8 | Monitor the long term fuel trim on the Tech 2.<br>Is the long term fuel trim significantly in the negative range (rich condition)? | — | Go to *Step 9* | Go to *Step 10* |
| 9 | 1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |

## Hesitation, Sag, Stumble Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 10 | 1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 11* |
| 11 | 1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 12* |
| 12 | 1. Check for a loose ignition coil ground and ION Sensing module circuit.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 13* |
| 13 | 1. Check the ignition coils for cracks or carbon tracking.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 14* |
| 14 | 1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*.<br>NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 15* |
| 15 | 1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in Electrical Diagnosis.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 16* |
| 16 | 1. Check the MAF sensor connections.<br>2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures.<br>Was a problem found? | — | Verify repair | Go to *Step 17* |

## Hesitation, Sag, Stumble Symptom (Cont'd)

| Step | Action | Value(s) | Yes | No |
|---|---|---|---|---|
| 17 | 1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label.<br>2. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Go to *Step 18* |
| 18 | 1. Review all diagnostic procedures within this table.<br>2. If all procedures have been completed and no malfunctions have been found, review/inspect the following:<br>● Visual/physical inspection<br>● Tech 2 data<br>● Freeze Frame data/Failure Records butter<br>● All electrical connections within a suspected circuit and/or system<br>3. If a problem is found, repair as necessary.<br>Was a problem found? | — | Verify repair | Contact Technical Assistance |

## Bank 1 Restricted Exhaust System Check

| 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. Remove the Bank 1 HO2S 2.<br>2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 1 HO2S 2.<br>3. Run the engine at normal operating temperature.<br>4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build.<br>5. Observe the exhaust system backpressure reading on the gauge.<br>Does the reading exceed the amount in the value column? | 8.62 kPa (1.25 psi) | Go to *Step 3* | Go to *Step 4* |
| 3 | Repair the restriction in the exhaust system after the catalytic converter.<br>Possible faults include:<br>• Collapsed pipe<br>• Heat distress<br>• Internal muffler failure<br>Is the action complete? | — | Verify repair | — |
| 4 | 1. Install the Bank 1 HO2S 2.<br>2. Install the Exhaust Backpressure Tester in place of Bank 1 HO2S 1.<br>3. Run the engine at normal operating temperature.<br>4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build.<br>5. Observe the exhaust system backpressure reading on the gauge.<br>Does the reading exceed the amount in the value column? | 8.62 kPa (1.25 psi) | Go to *Step 5* | No trouble found. If a driveability symptom exists, refer to symptom charts |
| 5 | Repair the restriction in the catalytic converter.<br>Is the action complete? | — | Verify repair | — |

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

## Bank 2 Restricted Exhaust System Check

| 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. Remove the Bank 2 HO2S 2.<br>2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 2 HO2S 2.<br>3. Run the engine at normal operating temperature.<br>4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build.<br>5. Observe the exhaust system backpressure reading on the gauge.<br>Does the reading exceed the amount in the value column? | 8.62 kPa (1.25 psi) | Go to *Step 3* | Go to *Step 4* |
| 3 | Repair the restriction in the exhaust system after the catalytic converter.<br>Possible faults include:<br>• Collapsed pipe<br>• Heat distress<br>• Internal muffler failure<br>Is the action complete? | — | Verify repair | — |
| 4 | 1. Install the Bank 2 HO2S 2.<br>2. Install the Exhaust Back pressure Tester in place of Bank 1 HO2S 1.<br>3. Run the engine at normal operating temperature.<br>4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build.<br>5. Observe the exhaust system backpressure reading on the gauge.<br>Does the reading exceed the amount in the value column? | 8.62 kPa (1.25 psi) | Go to *Step 5* | No trouble found. If a driveability symptom exists, refer to symptom charts |
| 5 | Repair the restriction in the catalytic converter.<br>Is the action complete? | — | Verify repair | — |

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

# Default Matrix Table

## Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then refer to the default matrix table for further diagnostic information.

**Default Matrix Table**

| Strategy Based Diagnostic Charts | Initial Diagnosis | Default Section(s) |
|---|---|---|
| On-Board Diagnostic (OBD) System Check | Vehicle does not enter diagnostics. | Chassis Electrical |
| On-Board Diagnostic (OBD) System Check | Vehicle enters diagnostics and communicates with the Tech 2. MIL is “ON” in diagnostics. Engine does not start and run. | Ignition System Check |
| On-Board Diagnostic (OBD) System Check | Engine starts and runs, no PCM codes set. Customer complains of vibration. | — |
| On-Board Diagnostic (OBD) System Check | Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation. | Automatic Transmission |
| PCM Power and Ground Check | On-Board Diagnostic (OBD) System Check. | Chassis Electrical |
| PCM Power and Ground Check | On-Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect. | Chassis Electrical |
| On-Board Diagnostic (OBD) System Check | Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation. | Automatic Transmission |

| Symptoms | Initial Diagnosis | Default Section(s) |
|---|---|---|
| Intermittents | 1. On-board Diagnostic (OBD) system check.<br>2. Careful visual/physical inspections. | Chassis Electrical |
| Hard Starts | 1. OBD system check.<br>2. ETC system check.<br>3. Sensors (ECT, MAP, MAF, TP) ; MAP output chart.<br>4. Fuel system electrical test, fuel system diagnosis.<br>5. Ignition system. | Engine Mechanical, Ignition System Check, Exhaust System Diagnosis |

| Symptoms | Initial Diagnosis | Default Section(s) |
|---|---|---|
| Surges and/or Chuggles | 1. OBD system check.<br>2. ETC system check.<br>3. Heated oxygen sensors.<br>4. Fuel system diagnosis.<br>5. Ignition system. | Calibration ID/Service Bulletins, Ignition System Check, Generator Output, Exhaust System Diagnosis, 4L30-E System Test |
| Lack of Power, Sluggish or Spongy | 1. OBD system check.<br>2. ETC system check.<br>3. Fuel system diagnosis.<br>4. Ignition system.<br>5. EGR operation.<br>6. EGR system check. | Refer to *Exhaust System* in *Engine Exhaust*, TCC Operation, Calibration ID/Service Bulletins |
| Detonation/Spark Knock | 1. OBD system check.<br>2. Transmission range switch.<br>3. EGR operation.<br>4. EGR system check.<br>5. TCC operation.<br>6. Fuel system diagnosis.<br>7. Ignition system.<br>8. ION sensing module check. | TCC operation, Cooling System, Ignition System Check, Calibration ID/Service Bulletins |
| Rough, Unstable, or Incorrect Idle, Stalling | 1. OBD system check.<br>2. ETC system check.<br>3. Fuel injector and fuel injector balance test.<br>4. EVAP emission canister purge valve check.<br>5. Ignition system.<br>6. EGR operation. | MAP Output Check, Throttle Linkage, EGR System Check, A/C Clutch Control Circuit Diagnosis, Crankcase Ventilation System, Calibration ID/Service Bulletins, Generator Output Voltage (refer to *Chassis Electrical*), Exhaust Diagnosis |
| Poor Fuel Economy | 1. OBD system check.<br>2. Careful visual/physical inspection.<br>3. Ignition system.<br>4. Cooling system. | TCC Operation, Exhaust System (refer to *Engine Exhaust*) |
| Hesitation, Sag, Stumble | 1. OBD system check.<br>2. ETC system check.<br>3. TP.<br>4. MAP output check.<br>5. Fuel system diagnosis.<br>6. Fuel injector and fuel injector balance test.<br>7. EVAP emission canister purge valve.<br>8. Ignition system. | EGR Operation, EGR System Check, Generator Output Voltage (refer to *Chassis Electrical*), Calibration ID/Service Bulletins, Ignition System Check |
| Cuts Out, Misses | 1. OBD system check.<br>2. Cylinder balance test.<br>3. ETC system check. | Ignition System Check |
| Engine Cranks But Will Not Run | 1. OBD system check. | Fuel System Electrical Diagnosis, Fuel System Diagnosis, Fuel Injector and Fuel Injector Balance Test. |

| Symptoms | Initial Diagnosis | Default Section(s) |
|---|---|---|
| Excessive Exhaust Emissions or Odors | 1. OBD system check.<br>2. Emission test.<br>3. Cooling system.<br>4. Fuel system diagnosis.<br>5. Fuel injector and fuel injector balance test.<br>6. EVAP emission canister purge valve.<br>7. Crankcase ventilation system.<br>8. Ignition system.<br>9. MAP output check. | EGR System Check, Exhaust Diagnosis, Calibration ID/Service Bulletins |
| Dieseling, Run-On | 1. OBD system check.<br>2. Careful visual/physical inspection.<br>3. Fuel system diagnosis. | — |
| Backfire | 1. OBD system check.<br>2. Ignition system.<br>3. Fuel system diagnosis.<br>4. Fuel injector and fuel injector balance test.<br>5. EGR operation, EGR system check. | Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check |
| Misfire | 1. OBD system check.<br>2. Ignition system.<br>3. Fuel system diagnosis.<br>4. Fuel injector and fuel injector balance test. | Vibrations, Transmission, Driveshaft and Axle |
| Catalyst Monitor | 1. OBD system check.<br>2. Careful visual/physical inspection.<br>3. Heated oxygen sensors. | Exhaust System |
| Fuel Trim | 1. OBD system check.<br>2. Careful visual/physical inspection.<br>3. Fuel system diagnosis.<br>4. Heated oxygen sensors, MAF sensors. | Exhaust System Intake Air System |
| Evaporative Emissions | 1. OBD system check.<br>2. Careful visual/physical inspection.<br>3. Fuel system diagnosis. | — |
| Heated Oxygen Sensors | 1. OBD system check.<br>2. Careful visual/physical inspection. | Exhaust System |

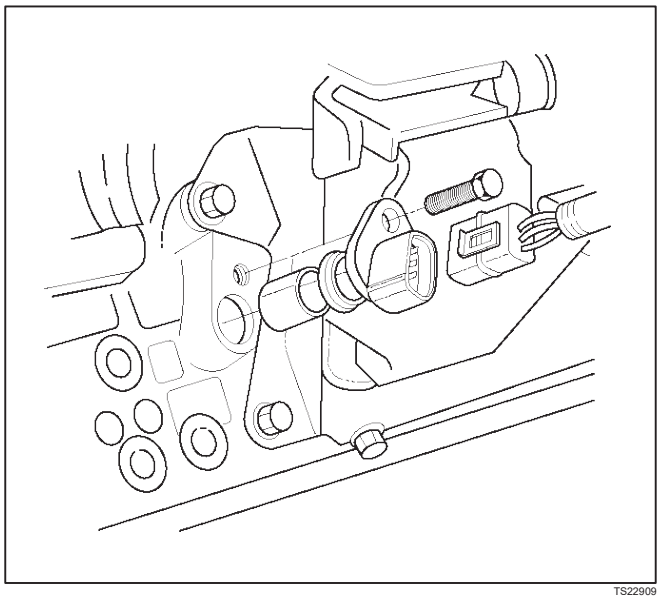
# On Vehicle

## Service Crankshaft Position (CKP) Sensor

### Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the CKP sensor.
3. Remove one bolt and the CKP sensor from the right side of the engine block, just behind the mount.

NOTE: Use caution to avoid any hot oil that might drip out.



TS22909

### Inspection Procedure

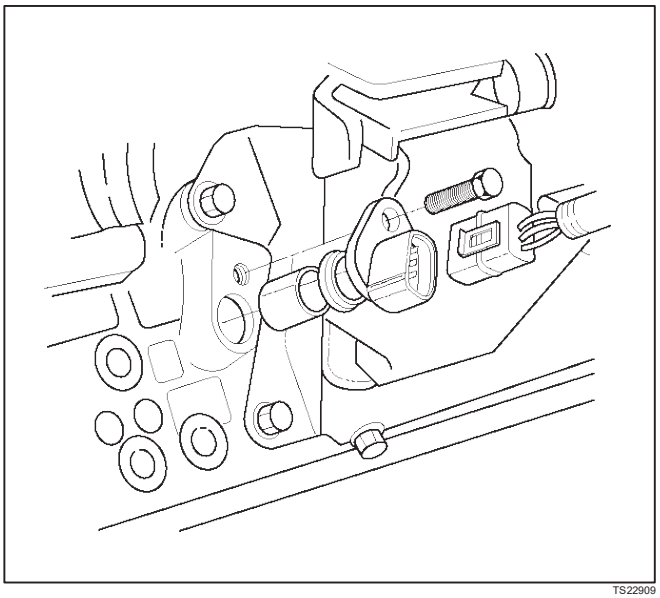
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

### Installation Procedure

1. Install the CKP sensor in the engine block.
2. Install the CKP sensor mounting bolt.

**Tighten**

- **Tighten the mounting bolt to 9 N·m (78 lb in.).**



TS22909

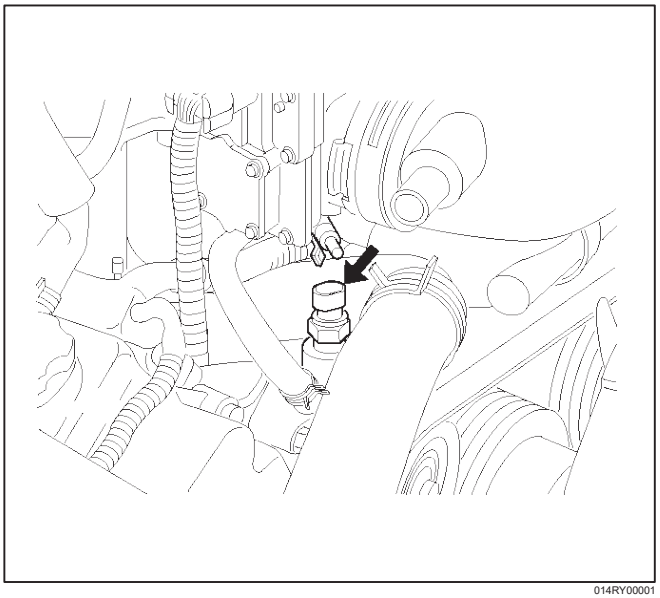
3. Connect the electrical connector to the CKP sensor.
4. Connect the negative battery cable.

## Engine Coolant Temperature (ECT) Sensor

### Removal Procedure

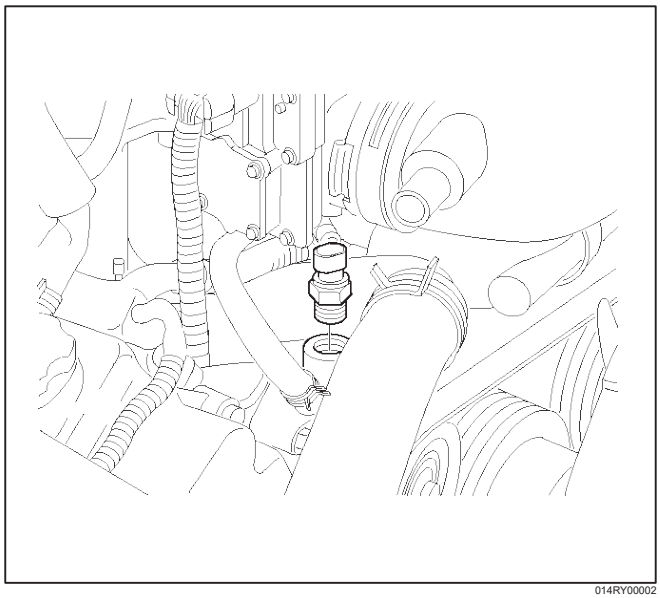
NOTE: Care must be taken when handling the engine coolant temperature (ECT) sensor. Damage to the ECT sensor will affect proper operation of the fuel injection system.

1. Disconnect the negative battery cable.
2. Drain the radiator coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
3. Disconnect the electrical connector.



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4. Remove the ECT sensor from the coolant crossover.



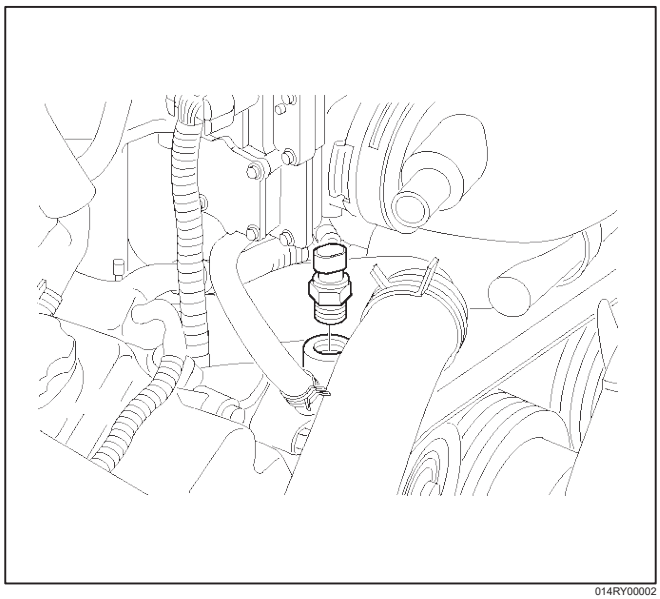
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## Installation Procedure

1. Apply sealer or the equivalent to the threads of the ECT sensor.
2. Install the ECT sensor in the coolant crossover.

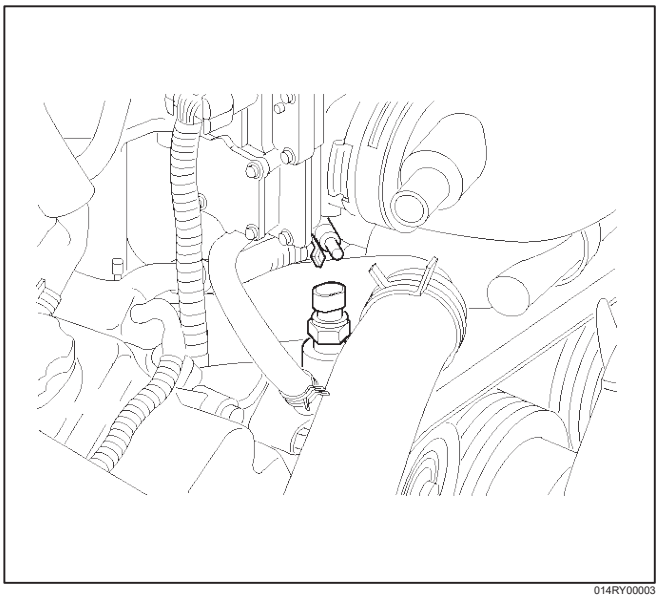
**Tighten**

- **Tighten the ECT sensor to 30 N·m (22 lb ft.).**



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3. Connect the electrical connector.



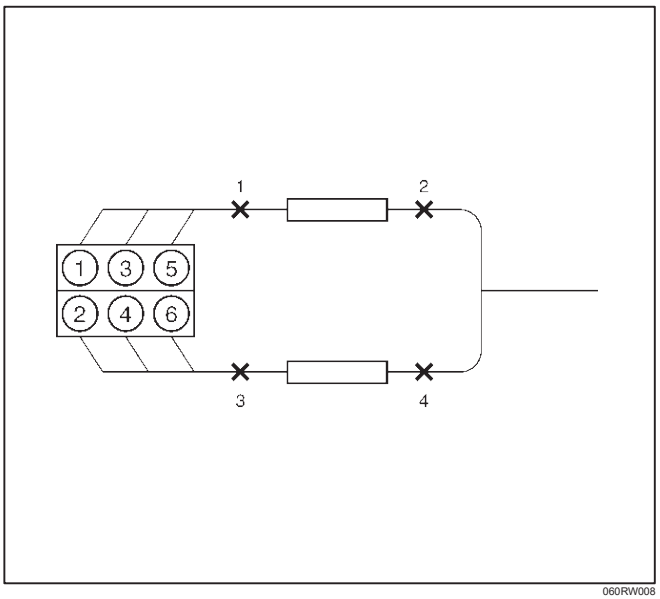
014RY00003

4. Fill the radiator with coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
5. Connect the negative battery cable.

# Heated Oxygen Sensor (HO2S)

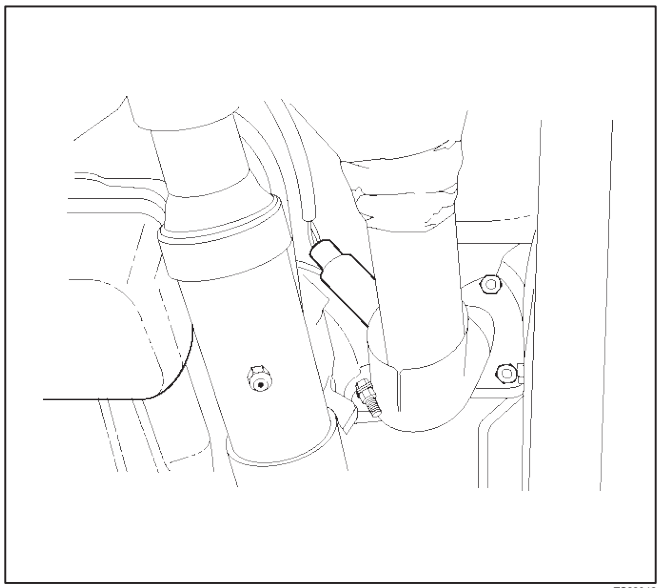
## Removal Procedure

1. Disconnect the negative battery cable.
2. Locate the four oxygen sensors.

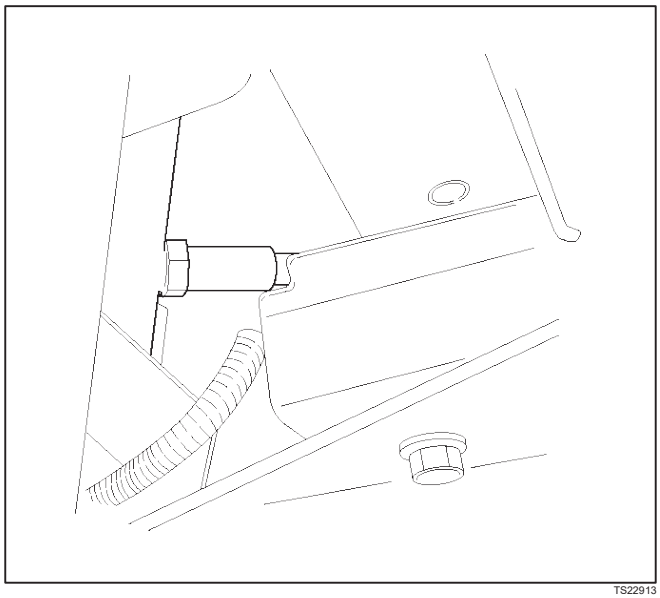



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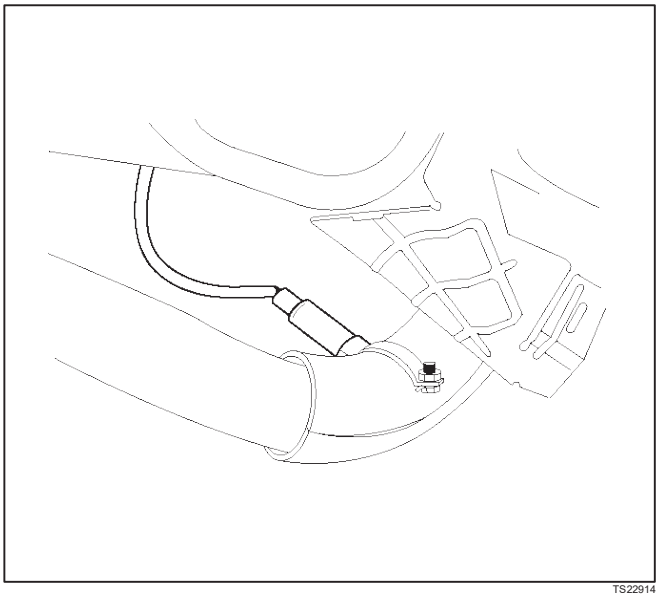
- Bank 1 sensor 1 is mounted on the exhaust pipe ahead of the right-hand catalytic converter.


TS22912

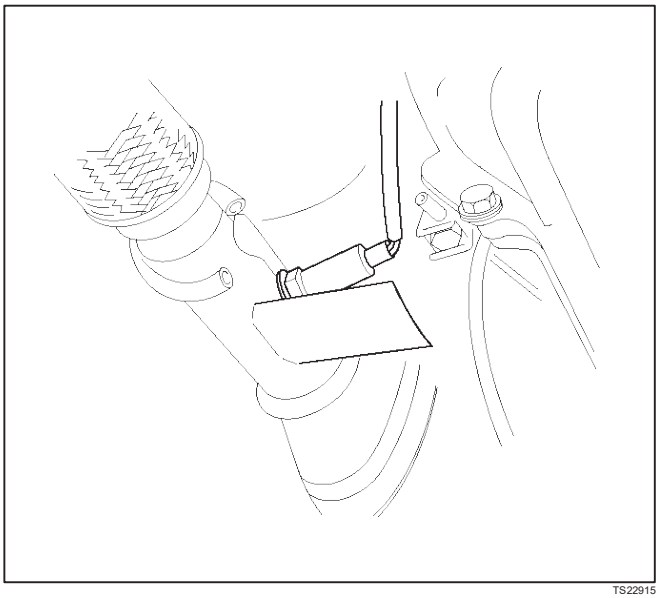
- Bank 1 sensor 2 is mounted behind the right-hand catalytic converter.


TS22913

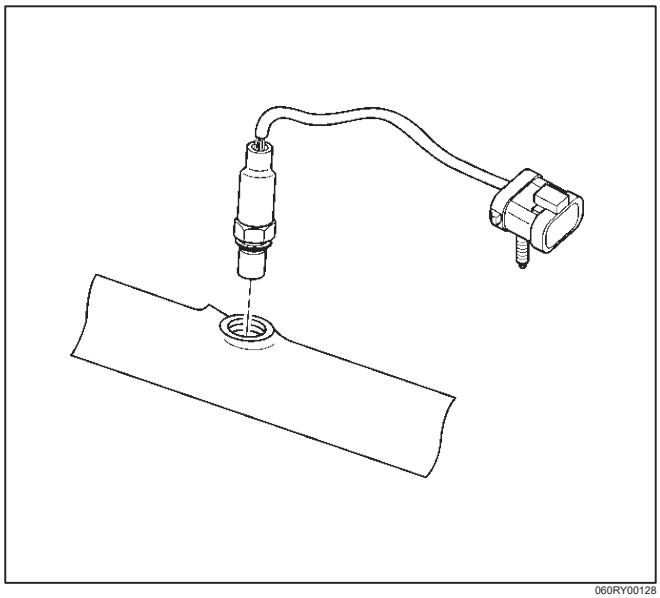
- Bank 2 sensor 1 is mounted on the exhaust pipe ahead of the left-hand catalytic converter.


TS22914

- Bank 2 sensor 2 is mounted behind the left-hand catalytic converter.


TS22915

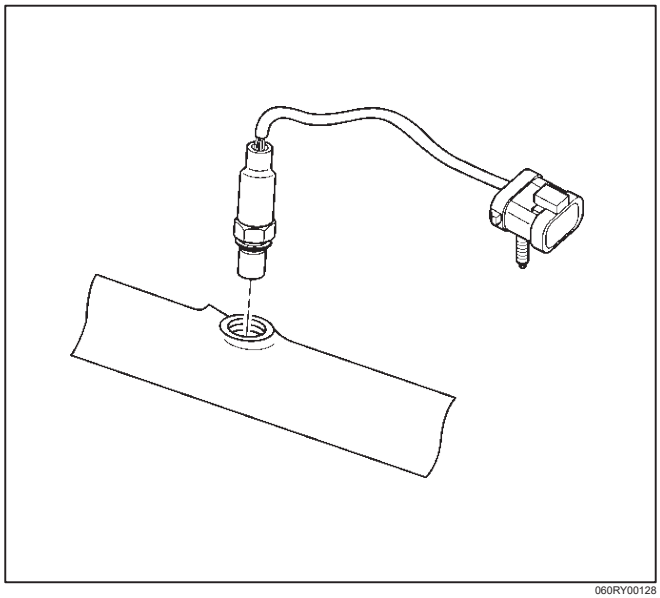
3. Disconnect the pigtail from the wiring harness.


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**IMPORTANT:** The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.

NOTE: Do not use a torch to remove an HO2S unless the sensor is being replaced. Using a torch could damage the sensor.

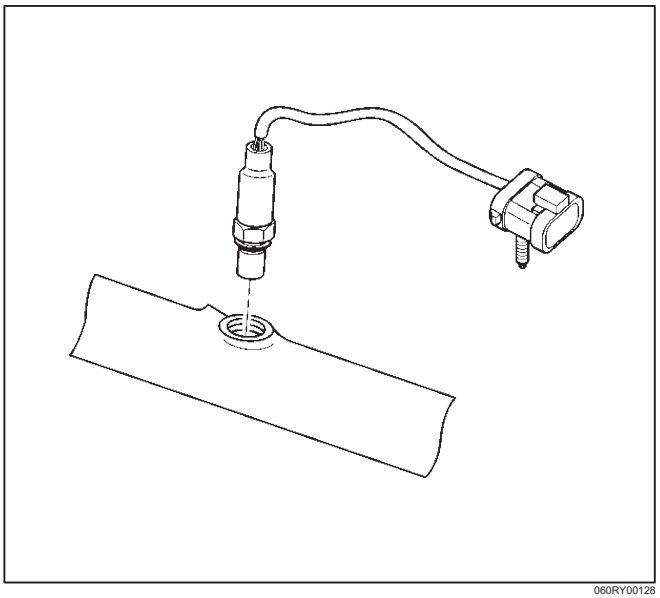
4. Remove the sensor from the exhaust pipe.
   - Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48°C (120°F).


060RY00128

## Inspection Procedure

All four sensors are identical. Inspect each in the same way.

1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion, and bare wires or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, or other contaminations.


060RY00128

## Installation Procedure

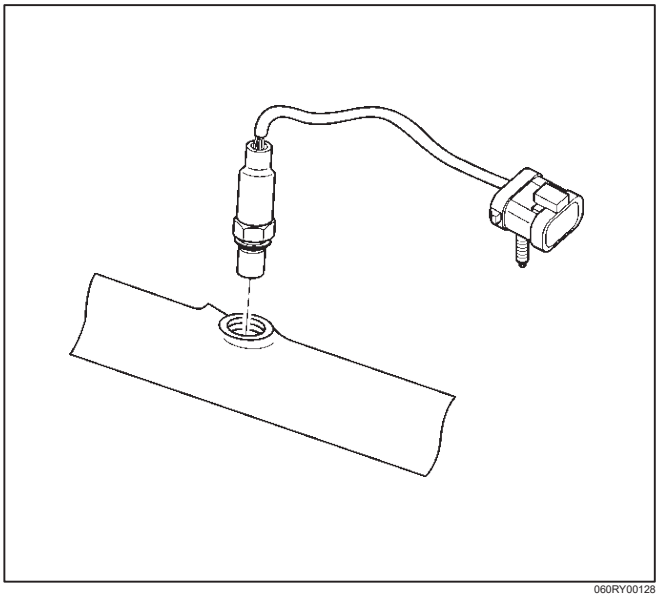
**IMPORTANT:**

- There is a special anti-seize compound on the HO2S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with engine heat, but the glass beads will remain, making the sensor easier to remove.
- New or service sensors will already have the compound applied to the threads. If a sensor is removed and is to be reinstalled for any reason, the threads must have anti-seize compound applied.

1. Apply anti-seize compound or the equivalent to the threads of the oxygen sensor, if necessary.
2. Install the oxygen sensor on the exhaust pipe in its original position.

**Tighten**

- **Tighten the oxygen sensor to 55 N·m (40 lb ft.).**

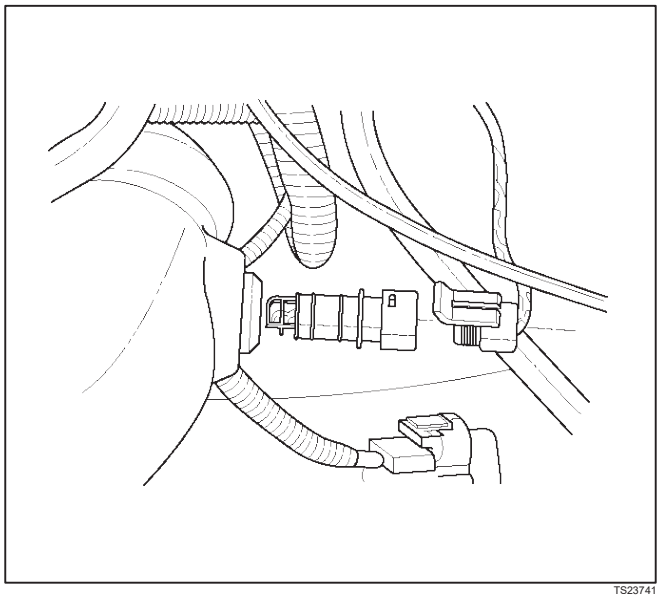

060RY00128

3. Connect the pigtail to the wiring harness.
4. Connect the negative battery cable.

# Intake Air Temperature (IAT) Sensor

## Removal Procedure

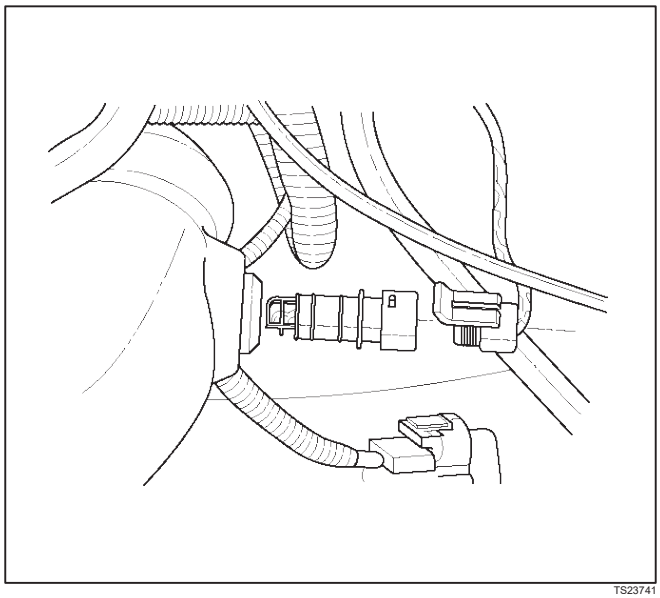
1. Disconnect the negative battery cable.
2. Remove the engine cover
3. The IAT sensor is located in the intake air duct, behind the throttle body.
4. Disconnect the electrical connector from the IAT sensor.


TS23741

5. Remove the IAT sensor from the intake air duct by using a rocking motion while pulling the sensor.

## Installation Procedure

1. Install the IAT sensor into the grommet in the intake air duct.
2. Correct the IAT electrical connector.

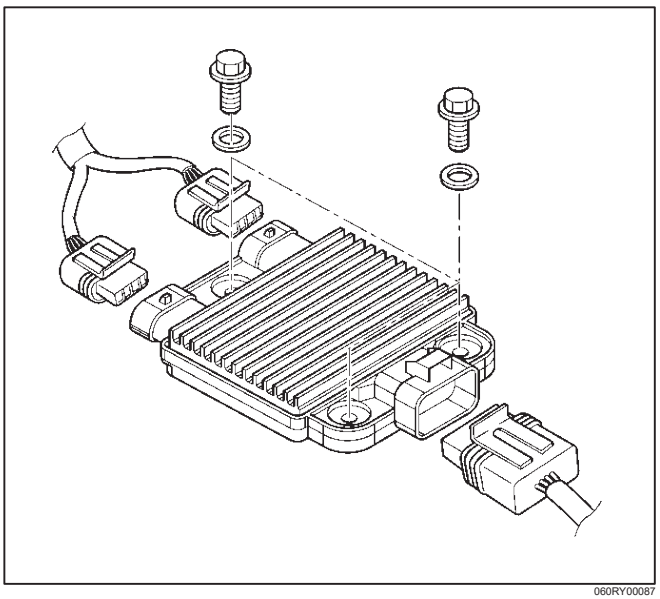

TS23741

3. Install the engine cover.
4. Connect the negative battery cable.

# ION Sensing Module

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ION sensing module connector.
3. Remove the bolts and the ION sensing module from the common chamber.


060RY00087

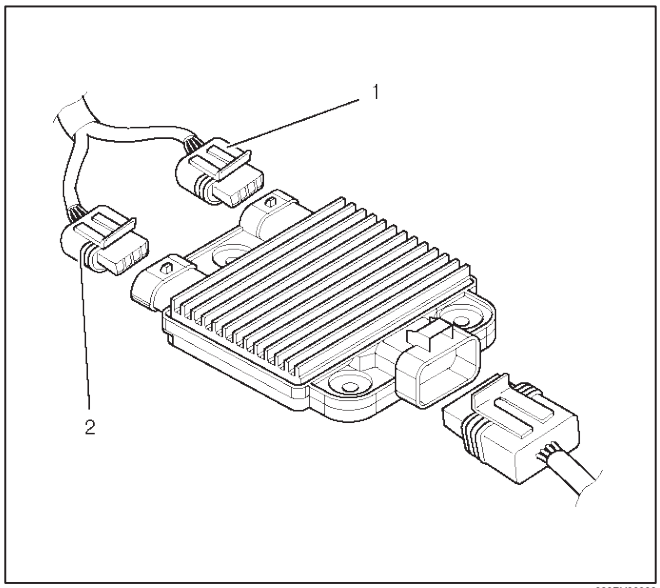
## Installation Procedure

1. Install the ION sensing module on the common chamber with the bolts.

**Tighten**

- **Tighten the ION sensing module to 4 N·m (35 lb in.).**

2. Connect the ION sensing module connectors as shown in the illustration.



060RY00003

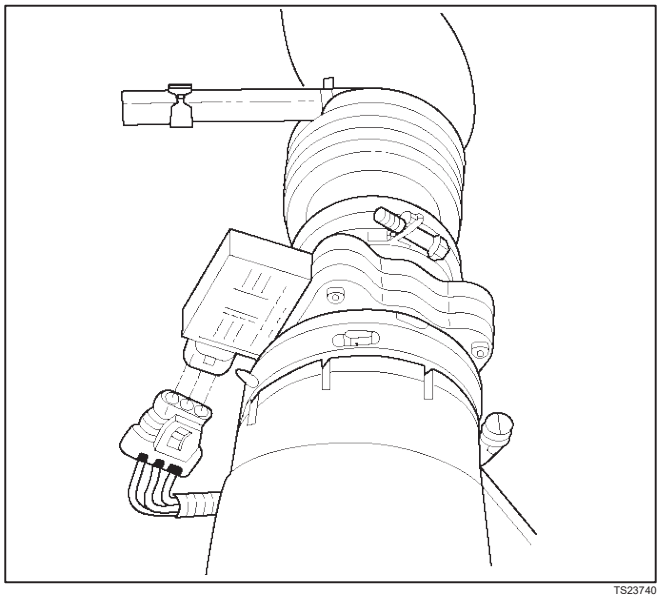
**Legend**
(1) Green Color Connector
(2) Blue Color Connector

3. Connect the negative battery cable.

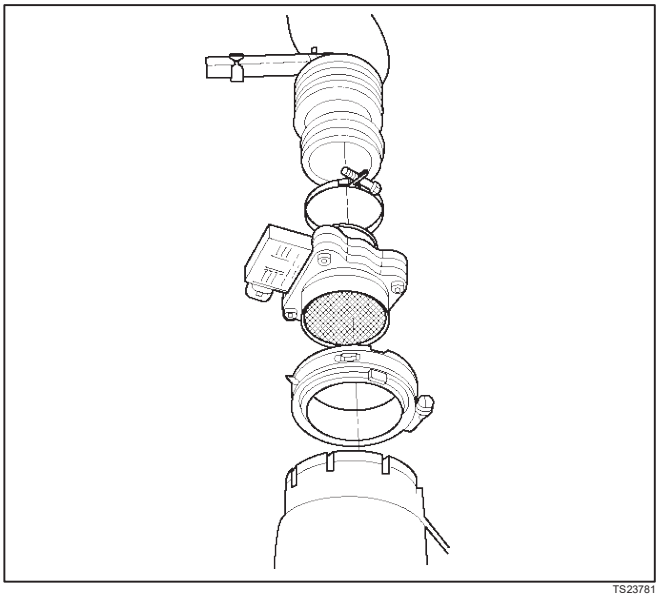
# Mass Air Flow (MAF) Sensor

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAF sensor.

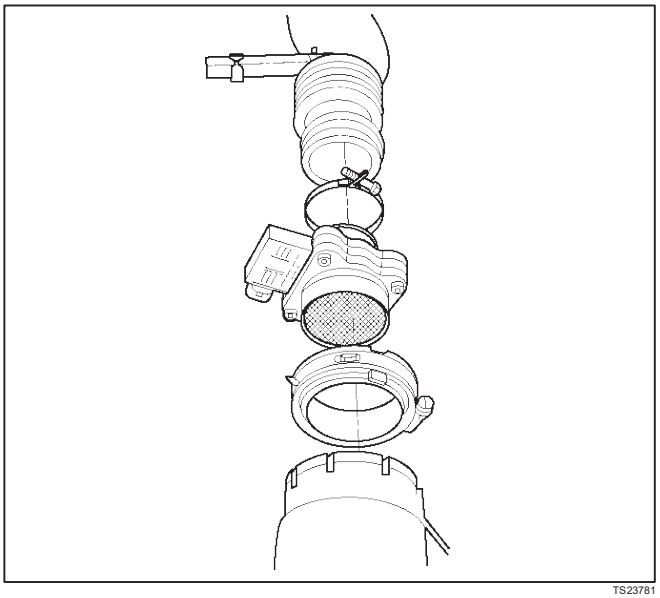

TS23740

3. Loosen the clamps which secure the intake air duct and the air cleaner to the MAF sensor.
4. Remove the intake air duct from the MAF sensor.
5. Remove the MAF sensor from the air cleaner.


TS23781

## Installation Procedure

1. Install the MAF sensor on the air cleaner with the clamp.
2. Install the intake air duct and the clamp on the MAF sensor.

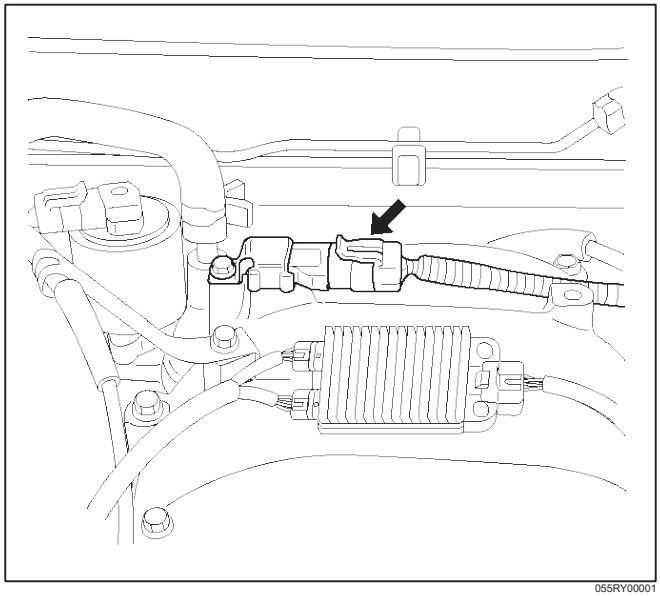

TS23781

3. Tighten the clamps to secure the MAF sensor to the intake air duct and the air cleaner.
4. Connect the MAF electrical connector.
5. Connect the negative battery cable.

# Manifold Absolute Pressure (MAP) Sensor

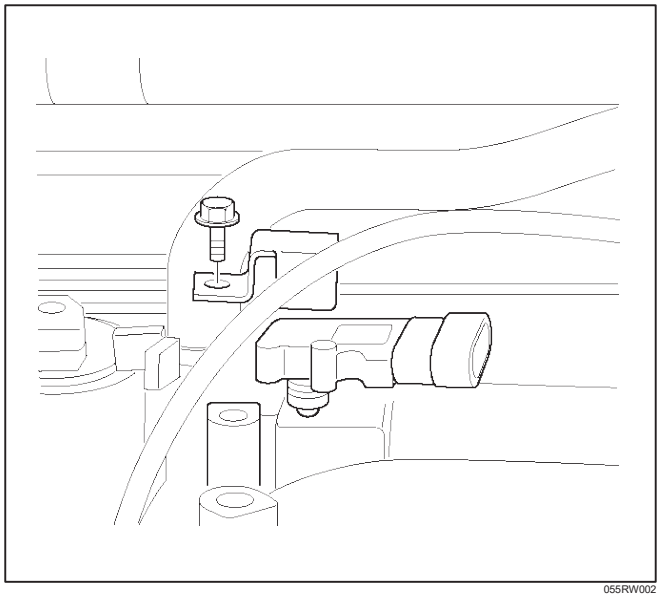
## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAP sensor.



055RY00001

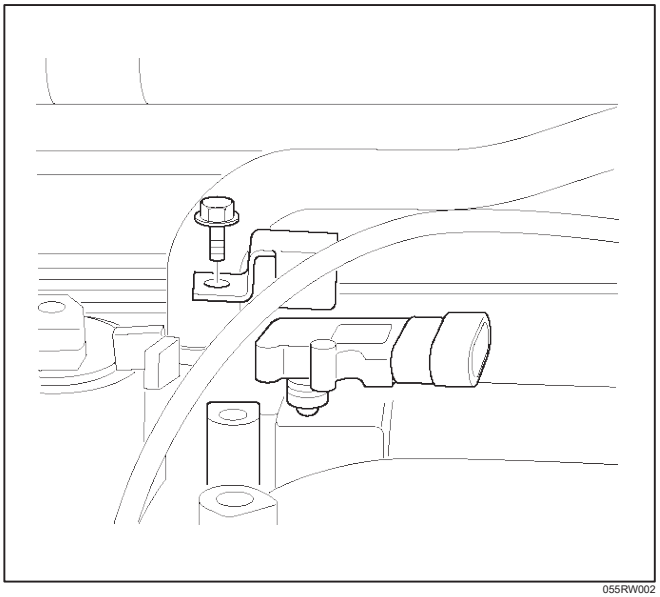
3. Remove the bolt securing the MAP sensor to the mounting bracket on the common chamber.
4. Remove the MAP sensor from the mounting bracket.



055RW002

## Installation Procedure

1. Install the MAP sensor in the mounting bracket.



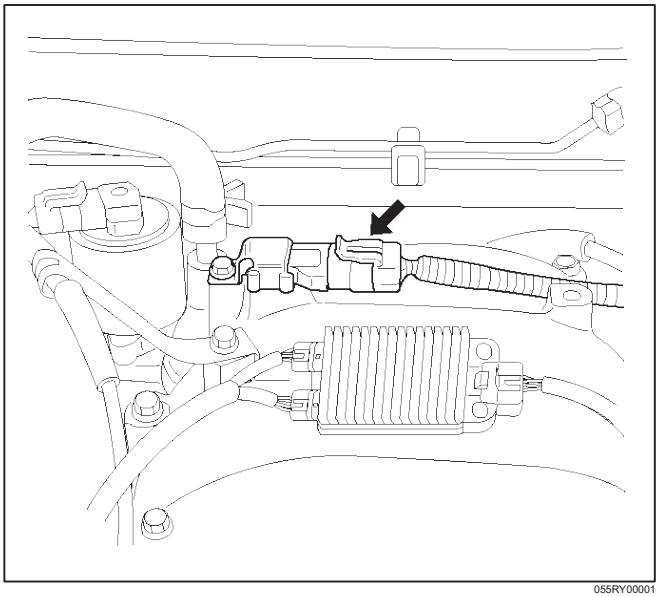
055RW002

2. Install the mounting bracket retaining bolt on the common chamber.

**Tighten**

- **Tighten the bolt to 20 N·m (12 lb ft.).**

3. Connect the MAP electrical connector.



055RY00001

4. Connect the negative battery cable.

# Malfunction Indicator Lamp (MIL)

## Removal and Installation Procedure

Refer to Warning light bulb, indicator light valve, illumination light bulb, A/T indicator light bulb in Meter and Gauge.

# Reduced Power Lamp

The reduced power lamp (RPL) turns on when the ignition key is moved to the ON position. It should turn off in approximately 3 seconds or immediately after the engine starts.
If the RPL turns on during vehicle operation, a vehicle system failure resulting in reduced engine output is indicated.
If both the reduced RPL and the check engine light turn on, a serious problem affecting vehicle performance is indicated.
Refer to the *OBD system check NO and RPL "ON" steady* in this manual.

# Powertrain Control Module (PCM)

## Service Precaution

NOTE: To prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

## Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.
There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.
Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

NOTE: To prevent internal PCM damage, the ignition must be in the "OFF" position in order to disconnect or reconnect power to the PCM (for example: battery cable, PCM pigtail, PCM fuse, jumper cables, etc.).

**IMPORTANT:** When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on the metal PCM cover.

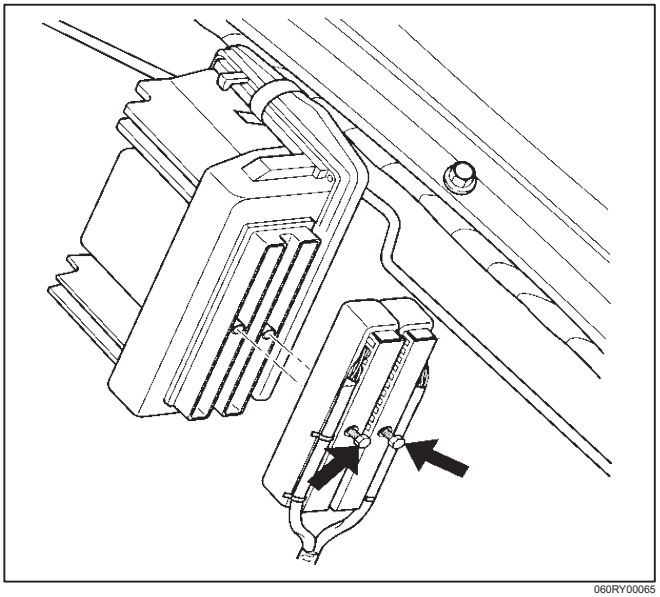
**IMPORTANT:** The ignition should always be in the "OFF" position in order to install or remove the PCM connectors.

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for the PCM to be replaced, the PCM should be checked first to ensure it is the correct part. If it is, remove the faulty PCM and install the new service PCM.

The service PCM EEPROM will not be programmed. DTC P0601 indicates the check sum error.

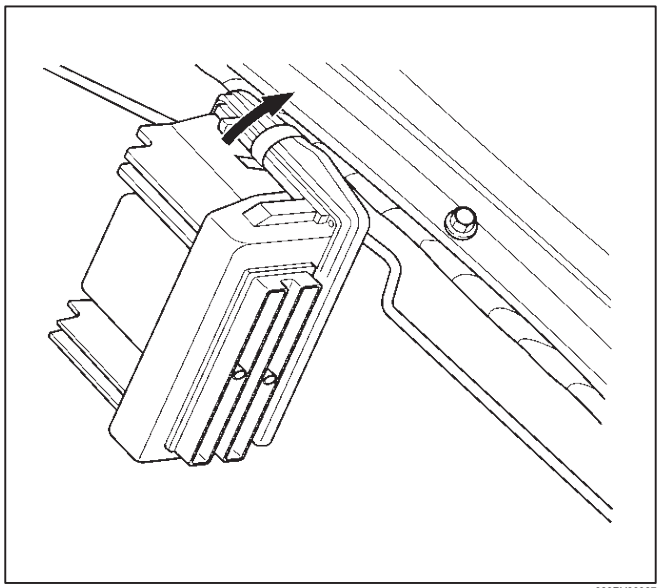
### Removal Procedure

1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove the two screws from the PCM electrical connectors.
4. Disconnect the PCM electrical connectors.



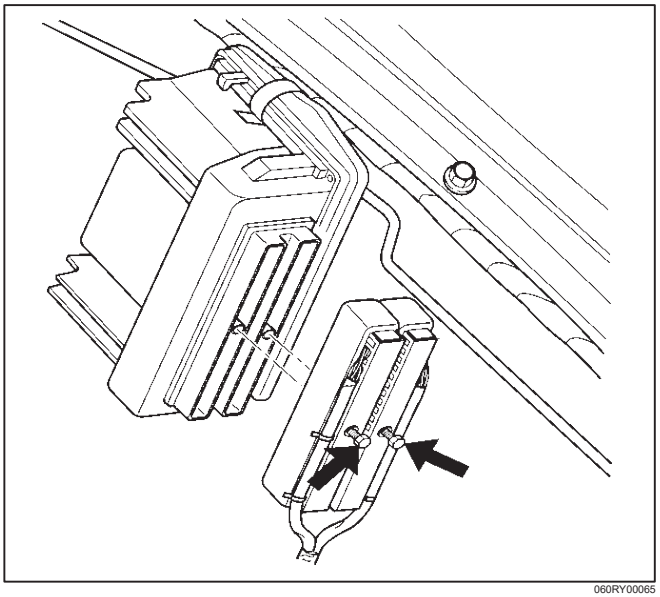
060RY00065

5. After removing the clip which fixes the PCM to the bracket, remove PCM.



060RY00067

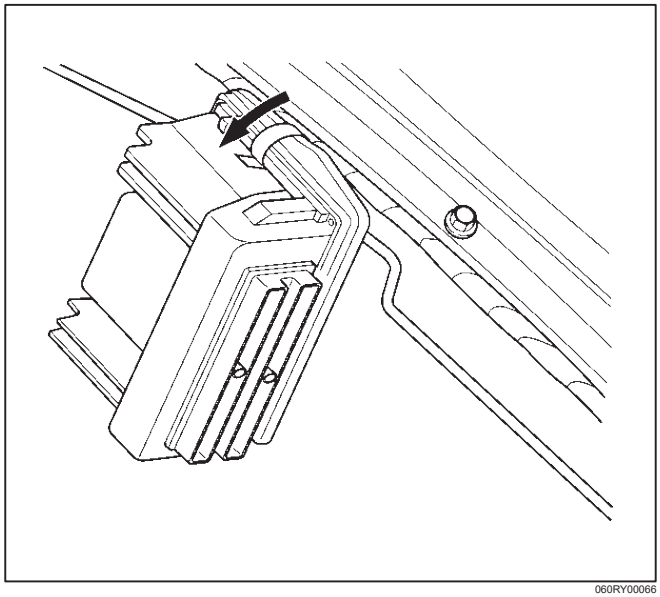
2. Connect the PCM electrical connectors.
3. Install the two screws to PCM electrical connectors.



060RY00065

## Installation Procedure

1. Install the PCM to bracket and fix with the clip.



060RY00066

# EEPROM

## General Description

The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control powertrain operation.

## EEPROM Programming

1. Set-up – Ensure that the following conditions have been met:
   - The battery is fully charged.
   - The ignition is “ON.”
   - The Vehicle Interface Module cable connection at the DLC is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment user’s instructions.
3. If the PCM fails to program, proceed as follows:
   - Ensure that all PCM connections are OK.
   - Check the Techline equipment for the latest software version.
   - Attempt to program the PCM. If the PCM still cannot be programmed properly, replace the PCM. The replacement PCM must be programmed.

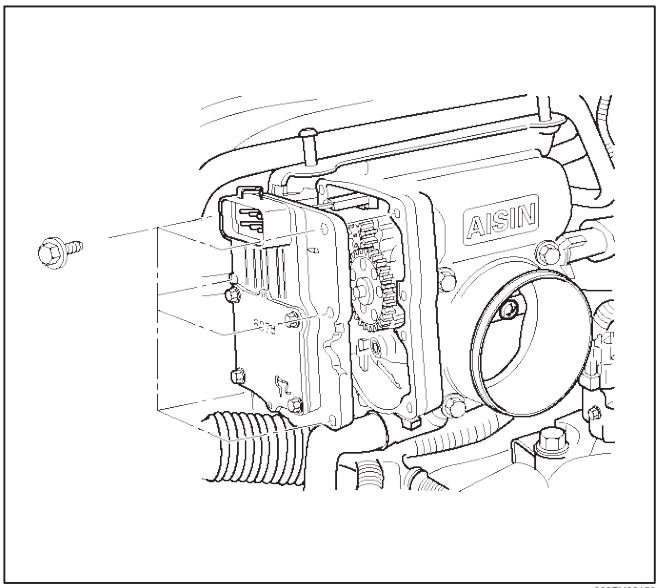
## Functional Check

1. Perform the On-Board Diagnostic System Check.
2. Start the engine and run for one minute.
3. Scan for DTCs using the Tech 2.

# Throttle Position (TP) Sensor

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.
3. Remove the bolts and the TP sensor from the throttle body.




060RY00159

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

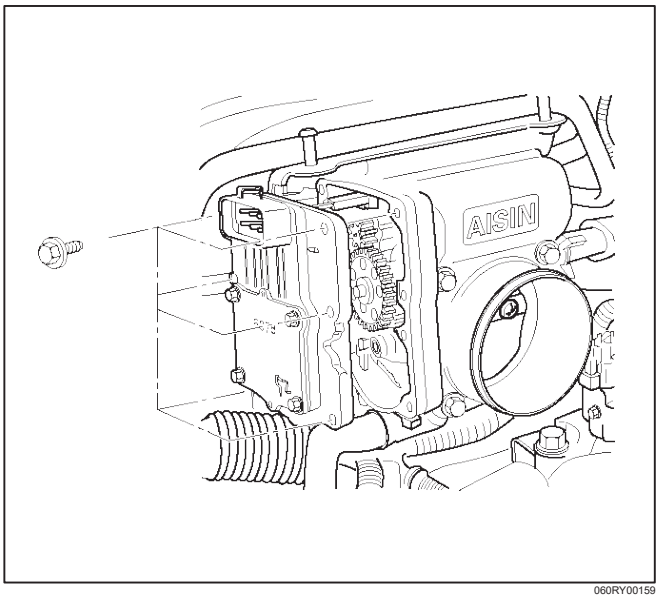
## Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

- The voltage should be TP1 about 0.4V, TP2 about 4.6V and TP3 about 4.6V.
- If the reading is abnormal value, check the throttle shaft to see if it is binding.

## Installation Procedure

1. Install the TP sensor on the throttle body with the bolts.




060RY00159

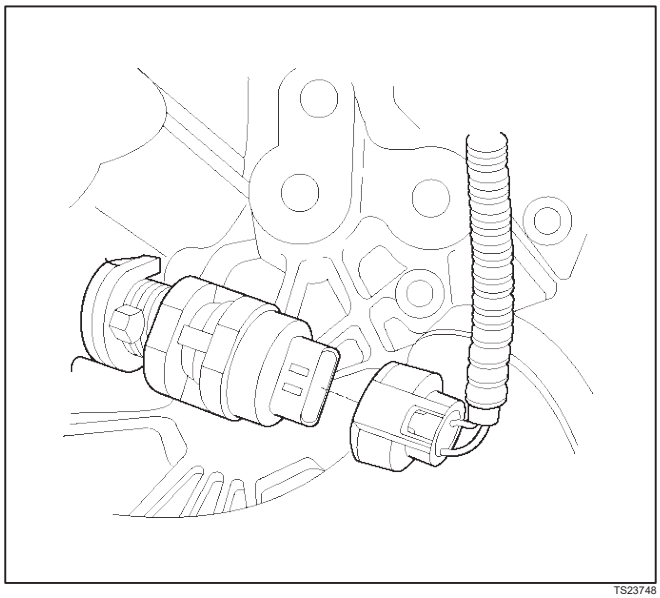
2. Connect the TP electrical connector.
3. Install the negative battery cable.

# Vehicle Speed Sensor (VSS)

## Removal Procedure

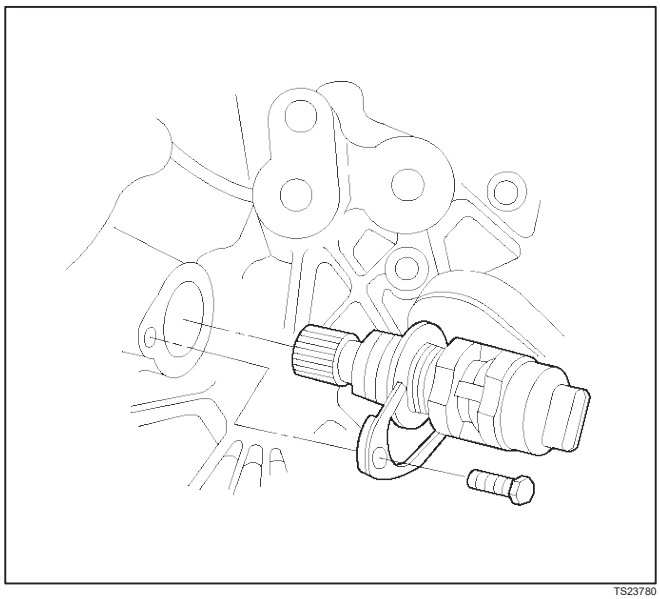
**CAUTION: The VSS is located on the right side of the transfer case just ahead of the rear propeller shaft and very close to the exhaust pipes for 4WD and on the extension cover for 2WD. Be sure that the exhaust pipes are cool enough to touch before trying to remove the VSS. If the pipes are hot, you could be burned.**

1. Disconnect the negative battery cable.
2. Disconnect the VSS electrical connector.


TS23748

3. Remove the bolt and the clamp securing the VSS in place.

**IMPORTANT:** Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case for 4WD and on the extension cover for 2WD.


TS23780

4. Remove the VSS from the transfer case by wiggling it slightly and pulling it straight out.

## Inspection Procedure

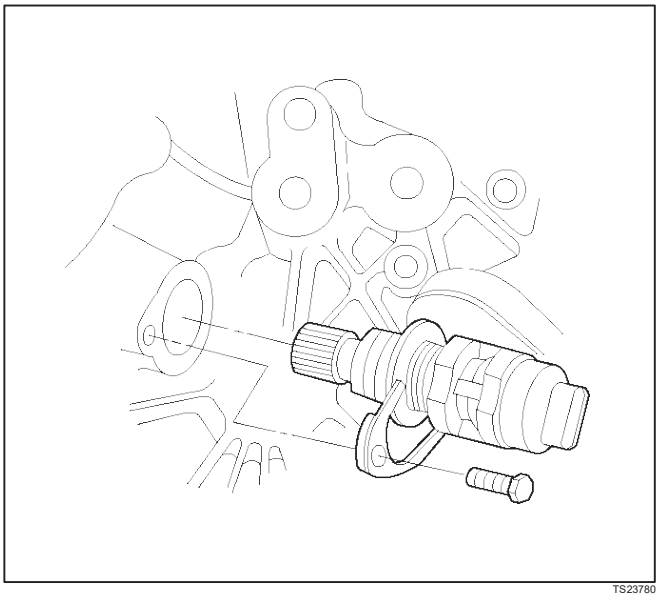
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O-ring for wear, nicks, tears, or looseness. Replace the O-ring if necessary.

## Installation Procedure

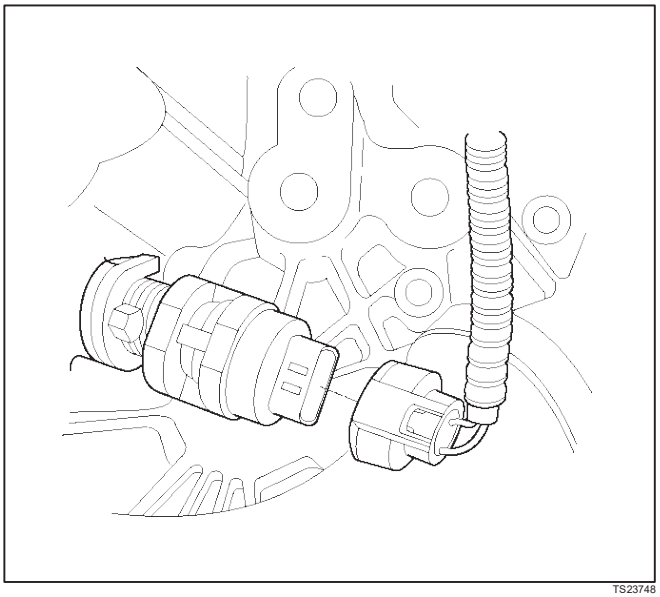
1. Install the VSS in the transfer case with the notch for the connector facing the rear.
2. Secure the VSS in place with the clamp and the bolt.

**Tighten**

- **Tighten the bolt to 16 N·m (12 lb ft.).**


TS23780

3. Connect the VSS electrical connector.

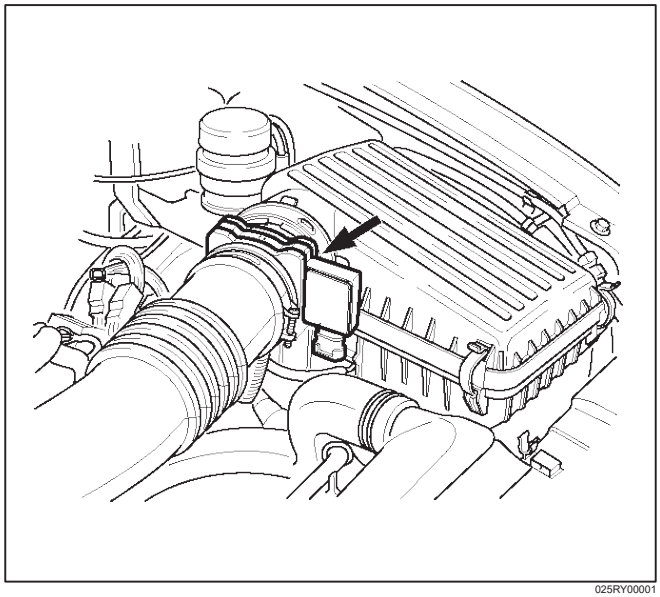

TS23748

4. Check the transfer case oil level. Add fluid if necessary.
5. Connect the negative battery cable.

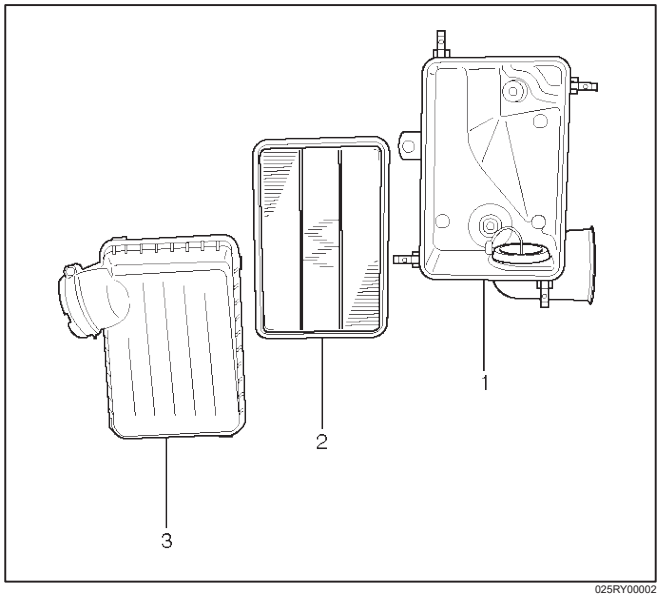
# Air Cleaner/Air Filter

## Removal Procedure

1. Loosen the clamp between the air cleaner lid and the mass air flow sensor.


025RY00001

2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.
4. Remove the air filter element.
5. Remove the retaining bolts and the air cleaner housing from the vehicle.



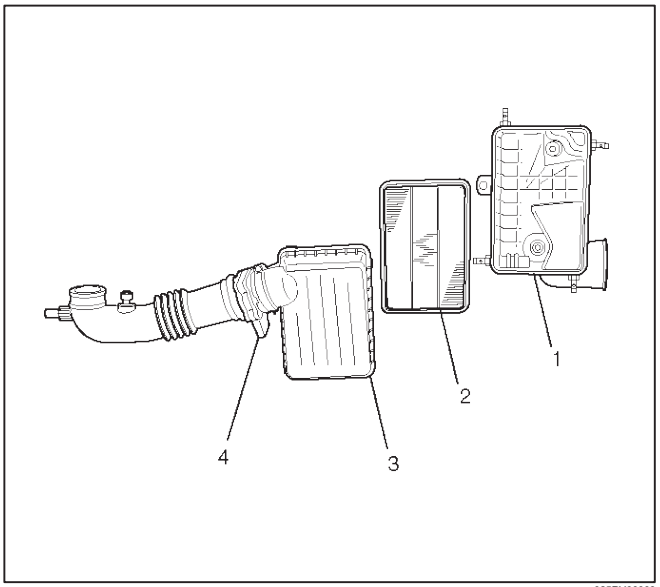
025RY00002

**Legend**

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid

## Installation Procedure

1. Install the air cleaner housing in the vehicle with the retaining bolts.
2. Install the air filter element in the air cleaner housing.
3. Install the air cleaner lid on the MAF sensor and the air cleaner housing.



025RY00003

**Legend**

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid
(4) Mass Air Flow Sensor

4. Tighten the clamp and secure the four latches between the lid and the air cleaner housing.

# Common Chamber

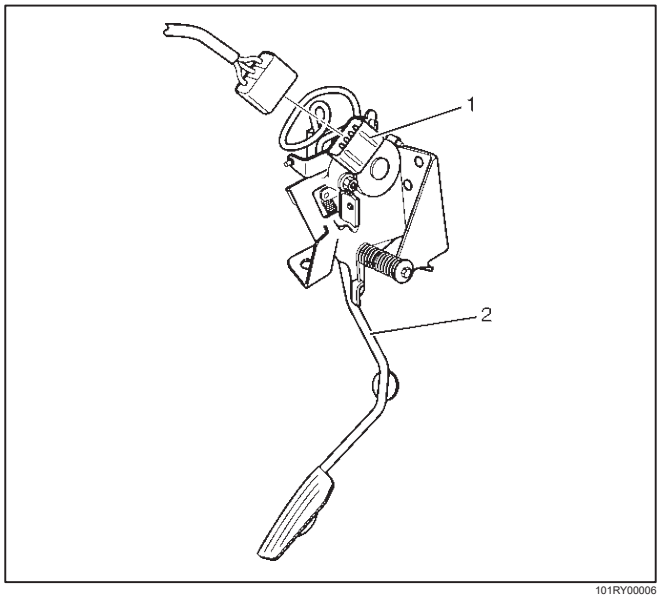
## Removal and Installation Procedure

Refer to Common Chamber in Engine Mechanical section.

# Accelerator Pedal Replacement

## Removal Procedure

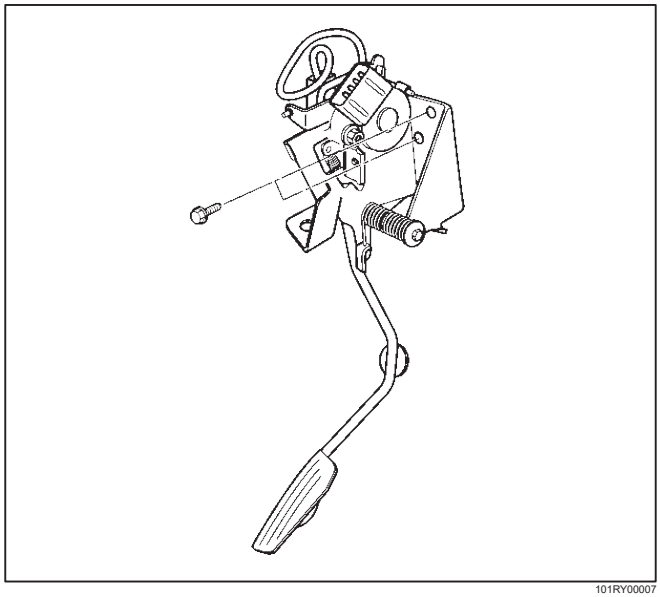
1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the accelerator position sensor.



101RY00006

**Legend**
(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

3. Remove the two screws from the accelerator pedal assembly.

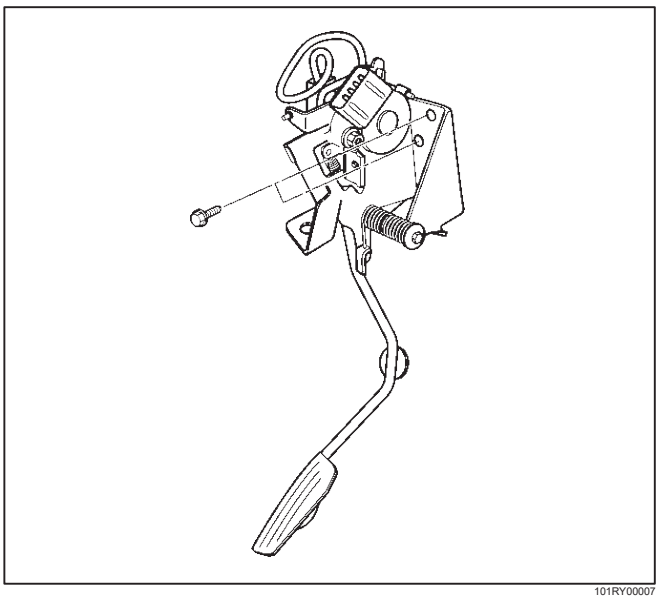

101RY00007

4. Remove the accelerator pedal assembly from the bulkhead.

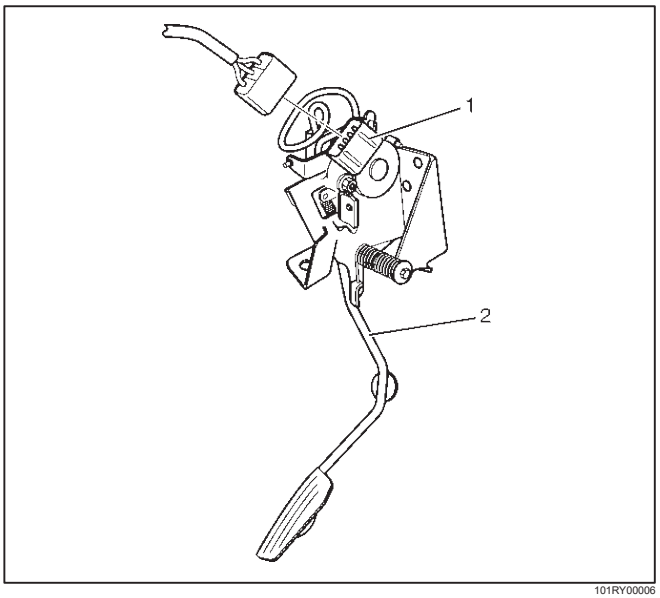
## Installation Procedure

1. Install the accelerator pedal assembly on the bulkhead.
2. Install the two screws to the accelerator pedal assembly.

**Tighten**
- **Tighten the screws to 22 N·m (16 lb ft.).**


101RY00007

3. Connect the electrical harness to the accelerator position sensor.



101RY00006

**Legend**
(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

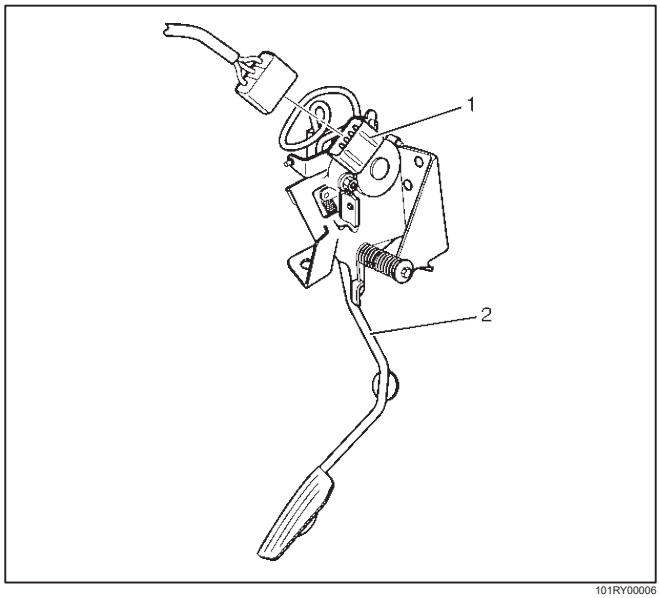
4. Install the negative battery cable.

# Accelerator Position Sensor Replacement

**CAUTION: Remove the Accelerator (A) pedal assembly as a unit to have it serviced. Do not remove the Accelerator Position (AP) sensor on the A pedal. If the AP sensor is removed for emergency cause, refer to following items as necessary.**

## Removal Procedure

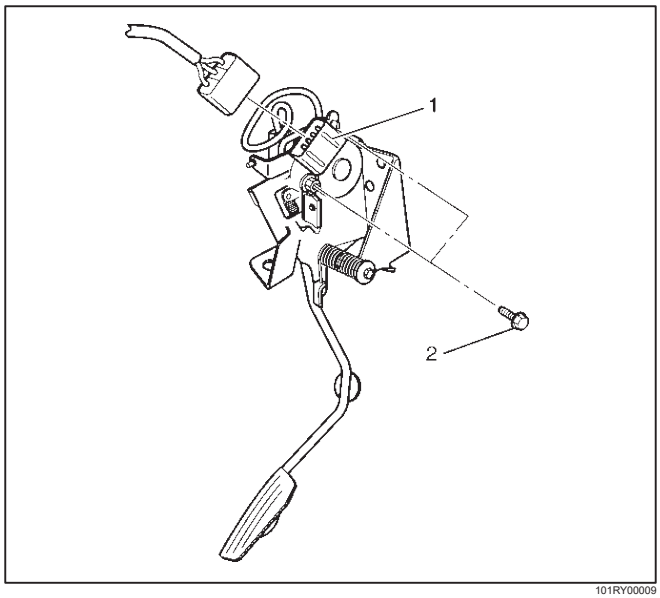
1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the AP sensor.




101RY00006

**Legend**
(1) AP Sensor
(2) A Pedal Assembly

3. Remove the AP sensor.




101RY00009

**Legend**
(1) AP Sensor
(2) AP Screw

## Installation Procedure

1. Install the accelerator position (AP) sensor to bolts with accelerator (A) pedal.
2. Connect the connector to AP sensor.
3. Install the negative battery cable.

# Accelerator Position Sensor Adjustment

AP sensor is controled three maltiple control system, and adjust the idle position and WOT position are between A and B for AP sensor 1, AP sensor 2, and AP sensor 3. Refer to *"How to adjust for AP sensor".*

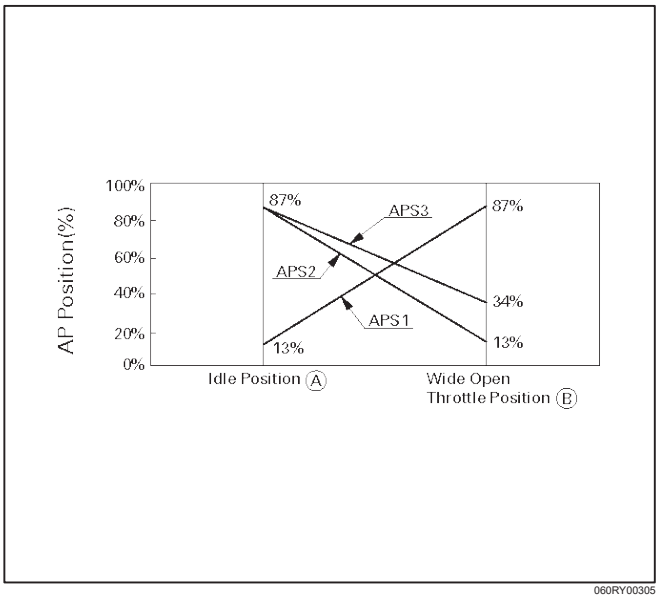
## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the AP sensor.

## How To Adjust For AP Sensor

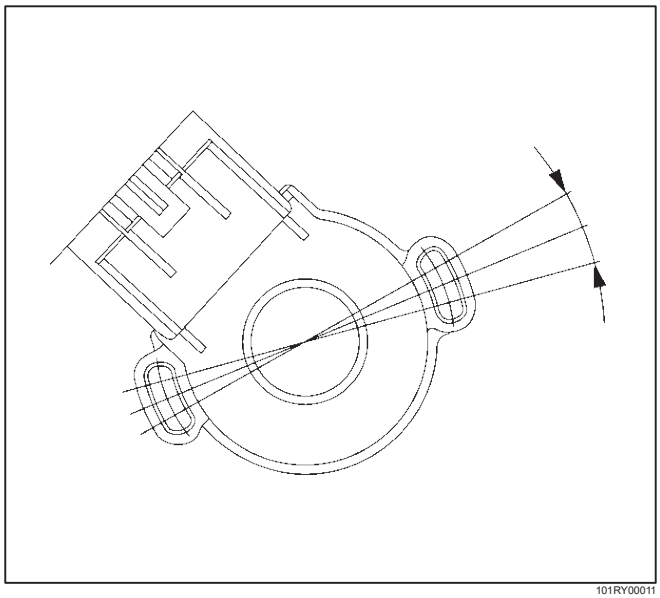
1. Connect the Tech 2 to DLC on vehicle.
2. Ignition "ON," engine "OFF.".
3. Display the APS date list. Check the following item for AP position (%).

| | AP position (%) | |
|---|---|---|
| | Idle position A | WOT position B |
| APS1 | 13% | 87 ± 2% |
| APS2 | 87 ± 2% | 13 ± 2% |
| APS3 | 87 ± 1% | 34 ± 2% |




060RY00305

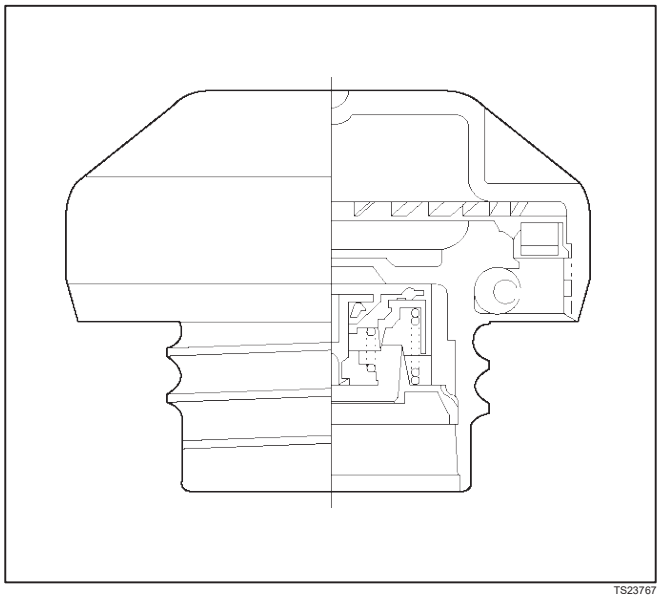
4. If the problem was found, adjust as necessary.


101RY00011

# Fuel Filler Cap

## General Description

The fuel filler cap includes a vacuum valve and a pressure valve.
If high vacuum or high pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage to the tank.


TS23767

## Inspection Procedure

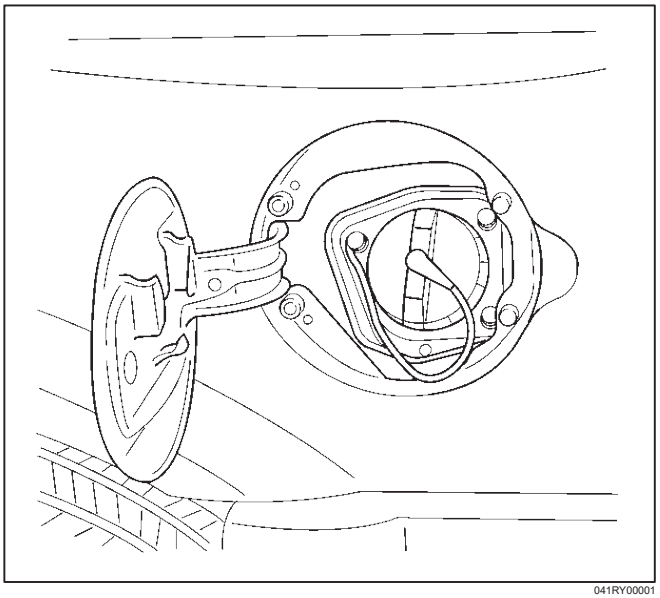
NOTE: Replace the fuel filler cap with the same type of filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

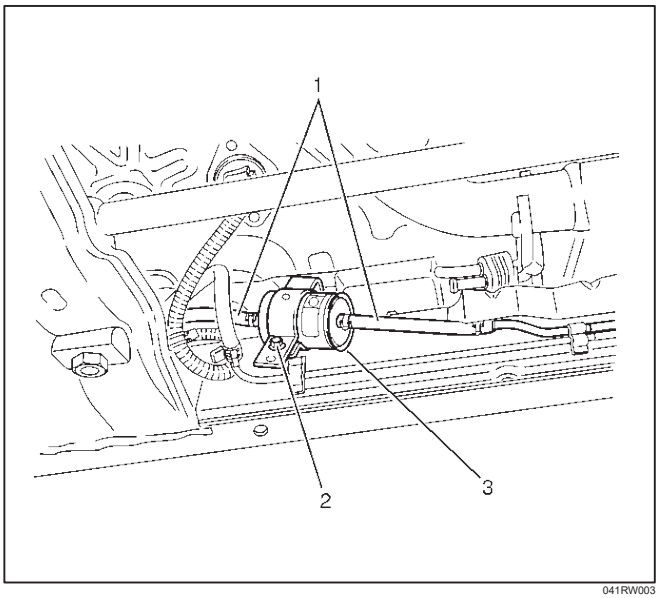
# Fuel Filter

## Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.


041RY00001

3. Disconnect the fuel hose from the fuel filter on the engine side.
4. Disconnect the fuel hose from the fuel filter on the fuel tank side.
5. Remove the bolt on the fuel filter holder.



041RW003

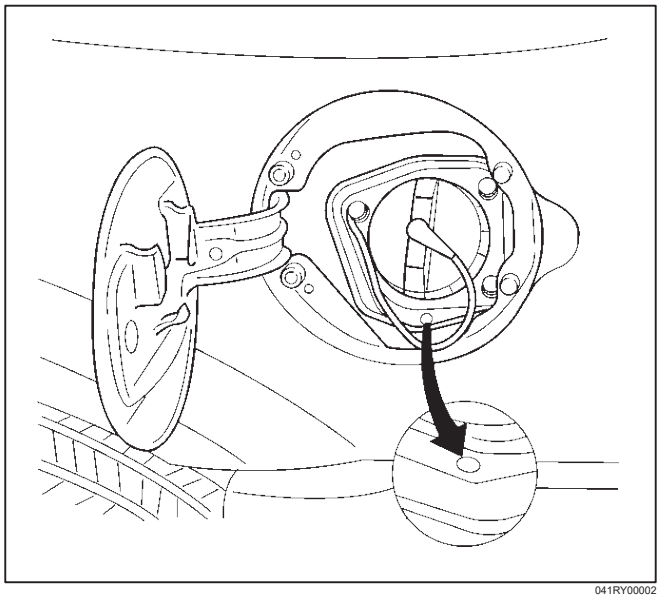
**Legend**

(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

6. Remove the fuel filter.

## Inspection Procedure

1. Replace the fuel filter when the following occur:
   - Fuel leaks from the fuel filter body.
   - The fuel filter body is damaged.
   - The fuel filter is clogged with dirt or sediment.
2. If the drain hole is clogged, clean the drain.


041RY00002

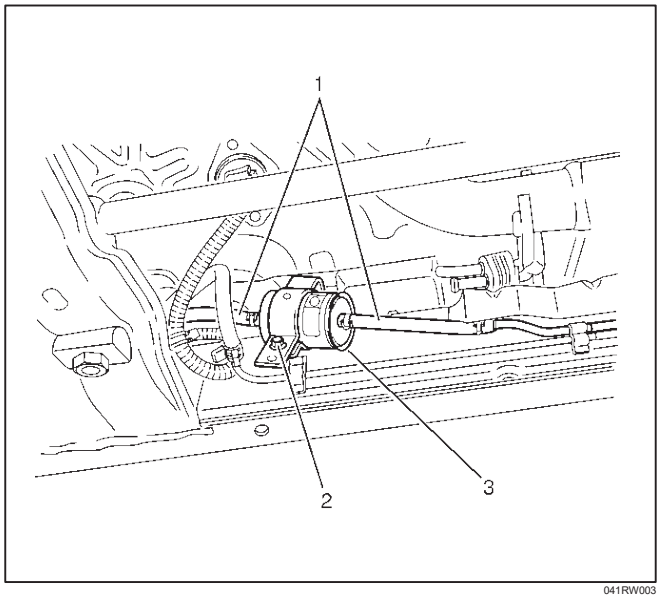
## Installation Procedure

1. Install the fuel filter in the correct direction.
2. Install the bolt on the fuel filter holder.

**Tighten**

- **Tighten the screws to 20 N·m (14 lb ft.).**

3. Connect the fuel hose on the engine side.
4. Connect the fuel hose on the fuel tank side.

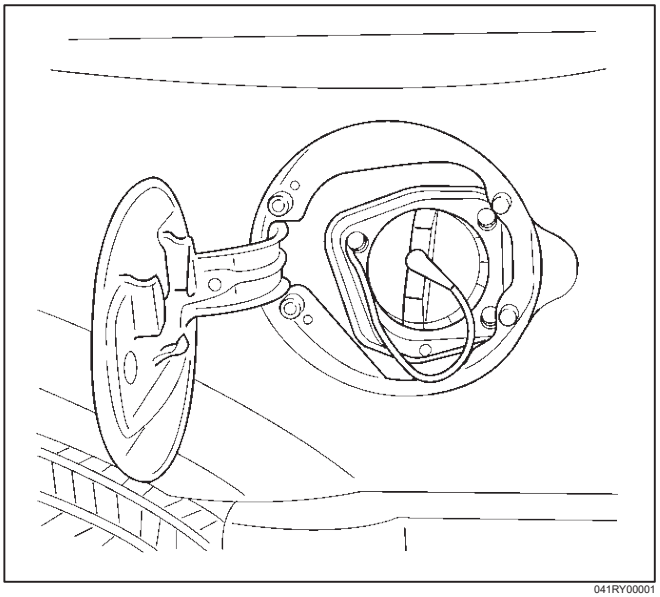


041RW003

**Legend**

(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

5. Install the fuel filler cap.

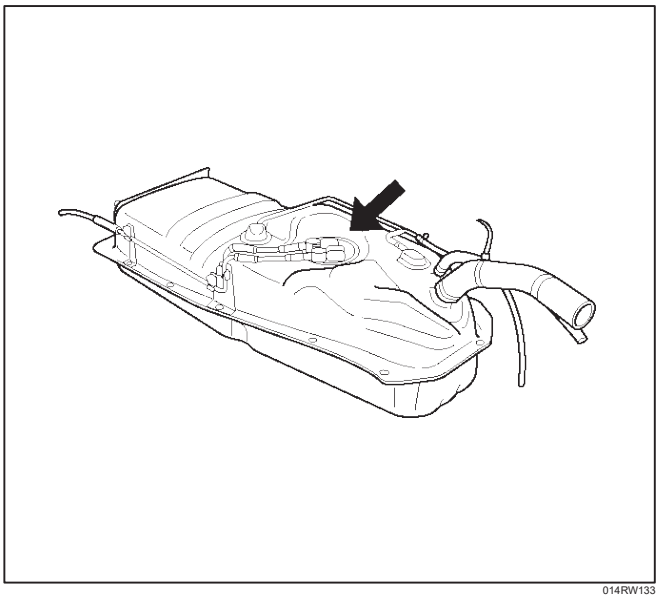

041RY00001

6. Connect the negative battery cable.

# Fuel Gauge Unit

## Removal Procedure

Refer to *Fuel Gauge Unit Engine Fuel* section.


014RW133

# Fuel Injectors

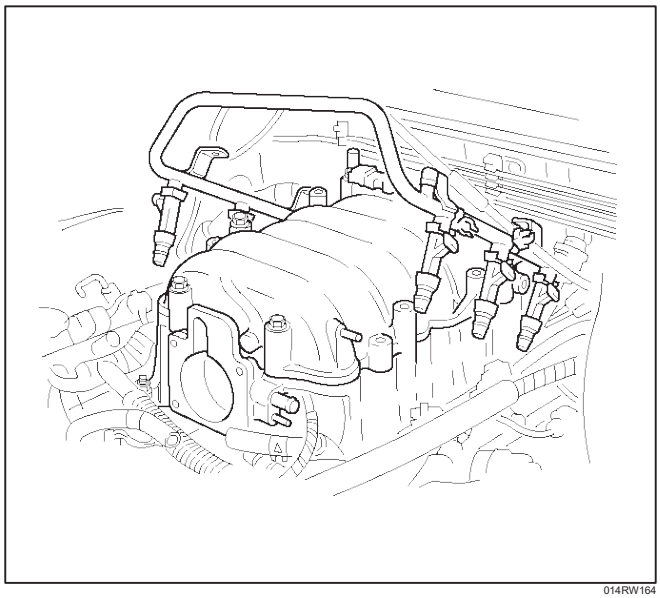
## Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and the filter if necessary.

NOTE: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

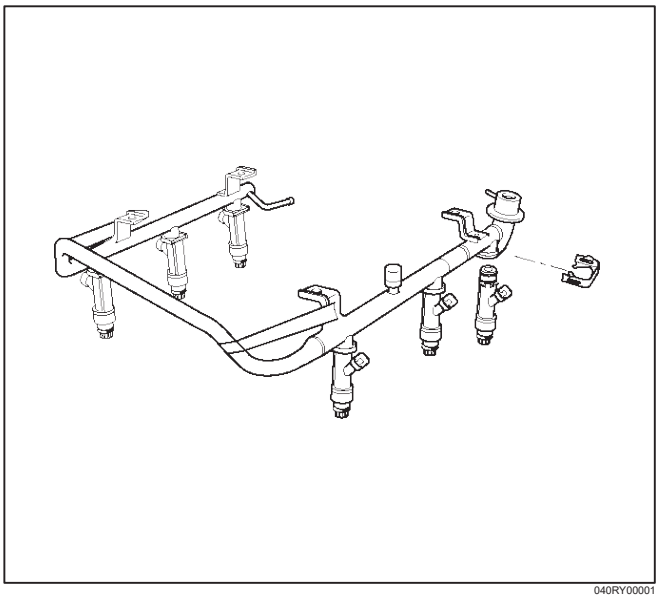
**IMPORTANT:** Fuel injectors are serviced as a complete assembly only.

1. Disconnect the negative battery cable.
2. Remove the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
3. Remove the fuel rail. Refer to *Fuel Rail* section.



014RW164

4. Remove the injector retainer clip.



040RY00001

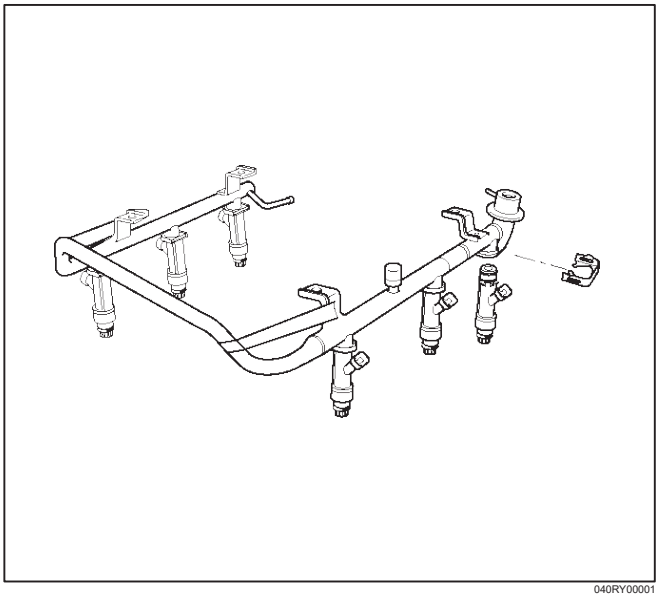
5. Remove the fuel injector assembly.
6. Remove the O-ring from the fuel injector.
7. Remove the O-ring backup from the fuel injector .

## Inspection Procedure

1. Inspect the O-rings for cracks or leaks.
2. Replace worn or damaged O-rings.
3. Lubricate the new O-rings with engine oil before installation.

## Installation Procedure

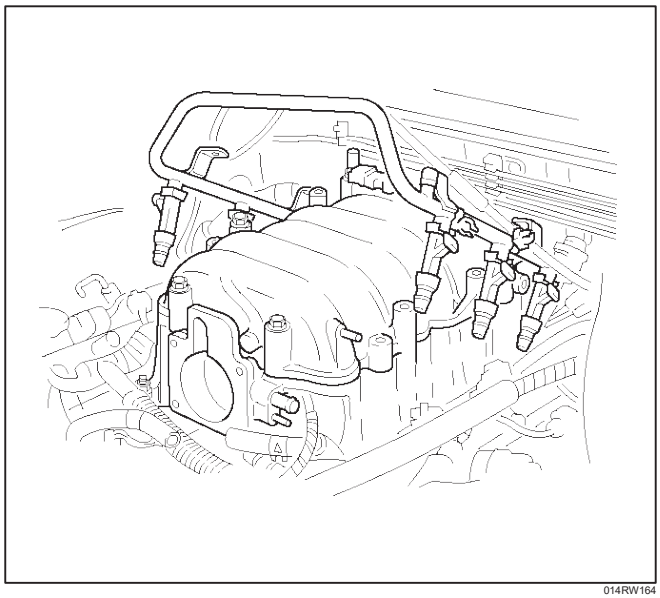
1. Install the O-ring backup on the fuel injector.
2. Install the new O-ring on the fuel injector.
3. Install the fuel injector on the fuel rail.



040RY00001

4. Use new fuel injector retainer clips to retain the fuel injector to the fuel rail.
5. Coat the end of the fuel injector with gasoline.

6. Install the fuel rail. Refer to *Fuel Rail* section.




7. Install the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
8. Install the engine cover.
9. Connect the negative battery cable.

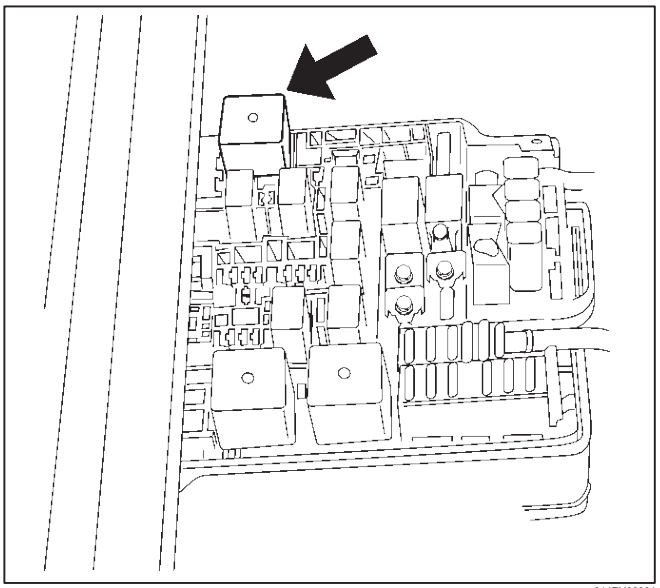
# Fuel Metering System

## Fuel Pressure Relief Procedure

**CAUTION: To reduce the risk of fire and personal injury, there are necessary to relieve the fuel system pressure before filler and gauge unit servicing the fuel system components.**

**CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before you disconnect the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.**

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay box. Refer to *Fuel Pump Relay* section.

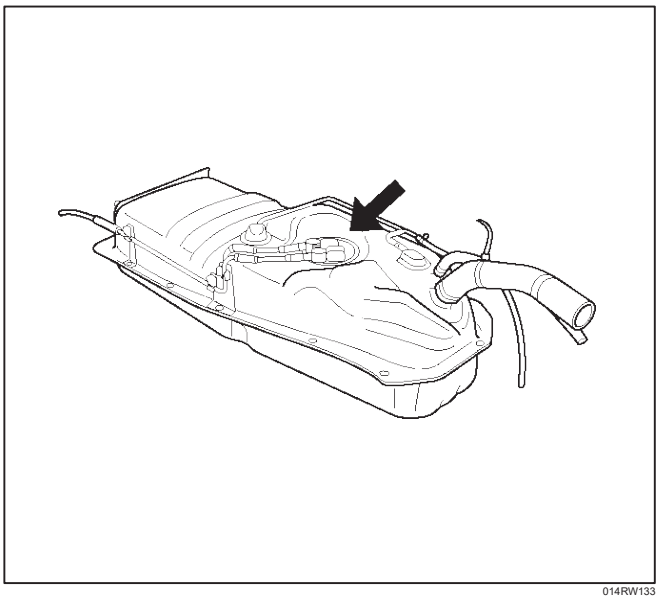



3. Start the engine and allow it to stall.
4. Crank the engine for 30 seconds.
5. Disconnect the negative battery cable.

# Fuel Pump Assembly

## Removal Procedure

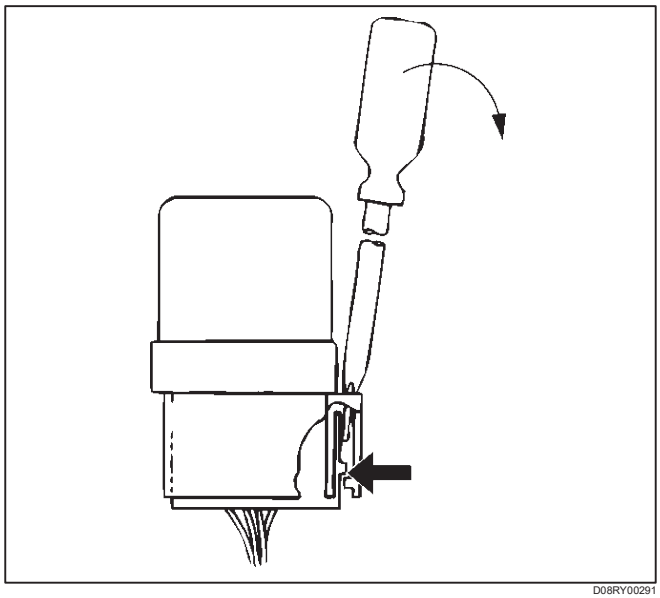
Refer to *Fuel Tank In Fuel Pump Relay* section.



# Fuel Pump Relay

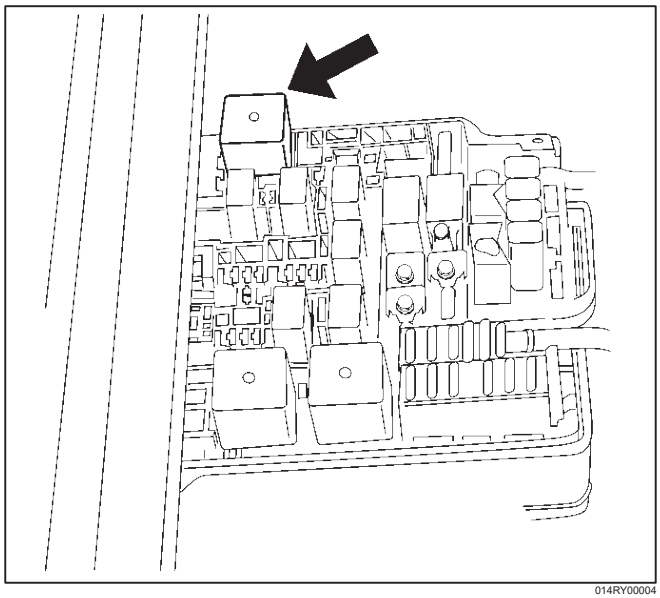
## Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   - The screwdriver blade will release the catch inside.



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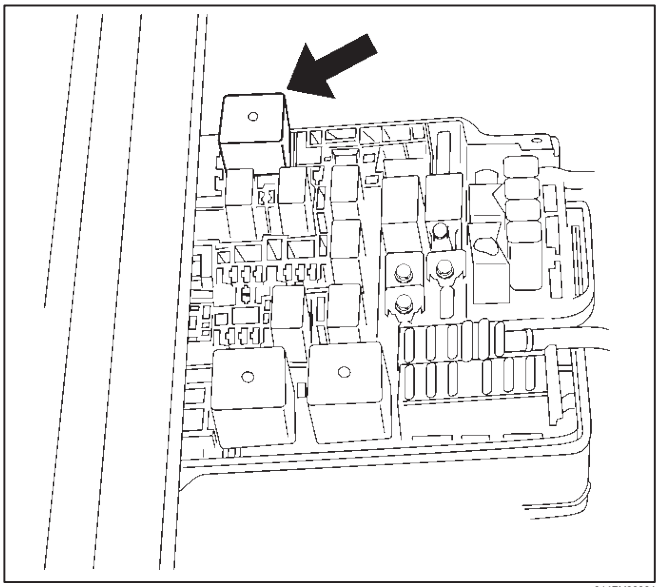
4. Pull the relay straight up and out of the fuse and relay box.



014RY00004

## Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   - An audible “click” will be heard.



014RY00004

3. Install the fuse and relay box cover.

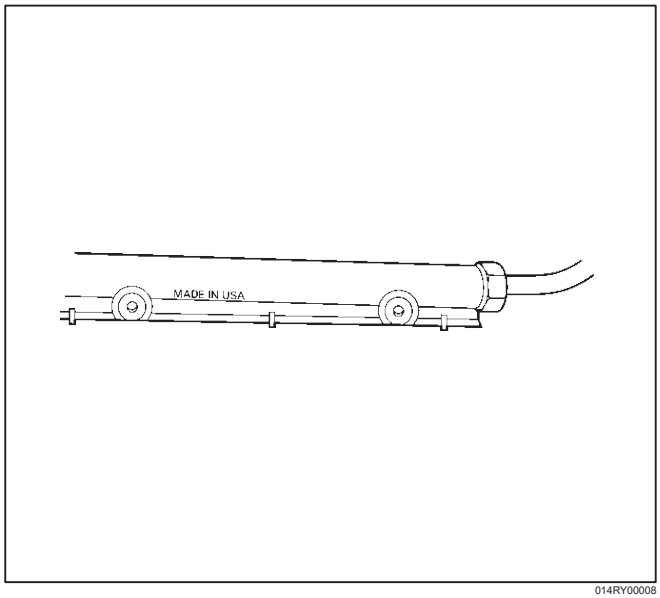
# Fuel Rail Assembly

## Removal Procedure

NOTE:

- Do not attempt to remove the fuel inlet fitting on the fuel rail. It is staked in place. Removing the fuel inlet fitting will result in damage to the fuel rail or the internal O-ring seal.
- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminals and the injector spray tips.
- Fittings should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passages.

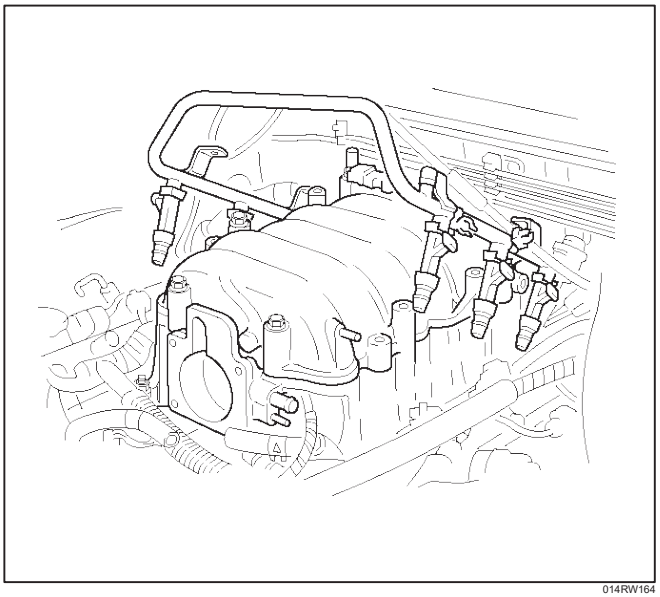
**IMPORTANT:** An eight-digit identification number is stamped on the side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.



014RY00008

Before removal, the fuel rail assembly may be cleaned with a spray type engine cleaner. Follow the spray package instructions. Do not immerse the fuel rails in liquid cleaning solvent.

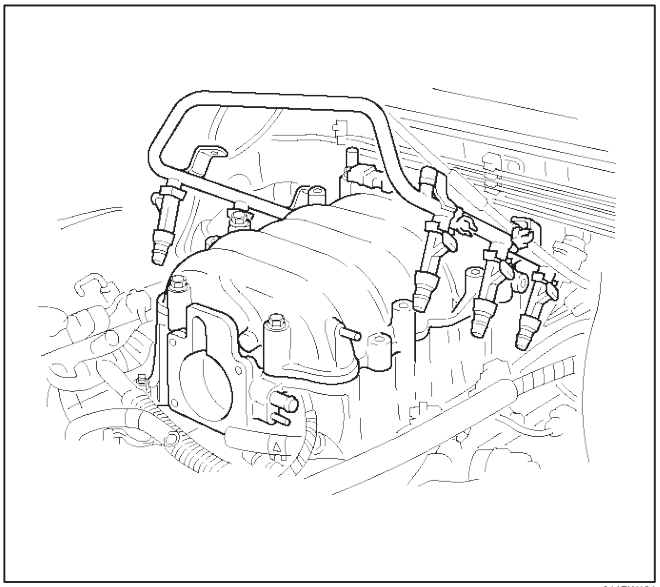
1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure in this Section.
2. Disconnect the negative battery cable.
3. Remove the engine cover.
4. Disconnect the throttle position sensor electrical connector from throttle body.
5. Disconnect the connectors from manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Disconnect the vacuum hose on canister VSV and positive crankcase ventilation hose.
7. Remove the common chamber. Refer to the common chamber in Engine Mechanical section.
   1. Lift up carefully on the fuel injectors. Do not separate the fuel injectors from the fuel rail.
   2. If an injector becomes separated from the fuel rail, the infector O-ring seals and the retainer clip must be replaced.
   3. Drain residual fuel into an approved container.


014RW164

8. If removal of the fuel pressure regulator is necessary, refer to *Fuel Pressure Regulator* section.
9. If removal of the fuel injectors is necessary, refer to *Fuel Injectors* section.

## Installation Procedure

1. If the fuel injectors were removed, install them. Refer to *Fuel Injectors* section.
2. If the fuel pressure regulator was removed, install it. Refer to *Fuel Pressure Regulator* section.
3. Install the common chamber. Refer to common chamber in engine Mechanical section.


014RW164

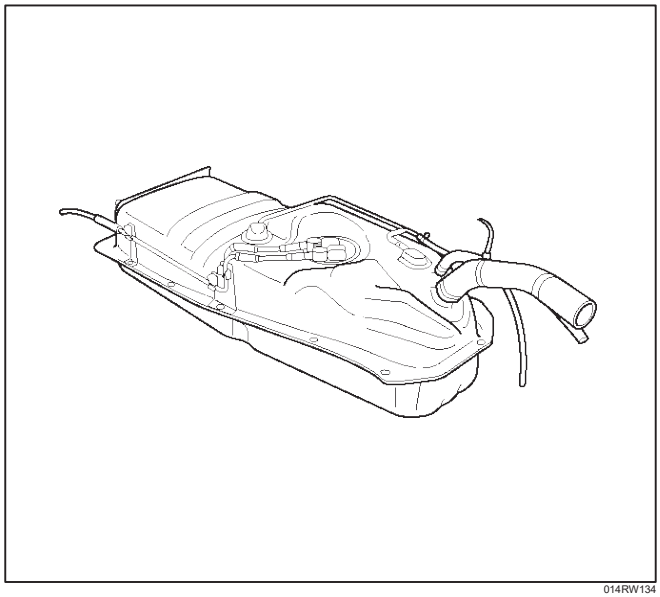
4. Connect the vacuum hose on Canister VSV and positive crankcase ventilation hose.

5. Connect the connectors to manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Connect the throttle position sensor electrical connector to throttle body.
7. Install the engine cover.
8. Connect the negative battery cable.
9. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel rail and in the injectors.

# Fuel Tank

## Removal Procedure

Refer to *Fuel Tank In Fuel Pump Relay*

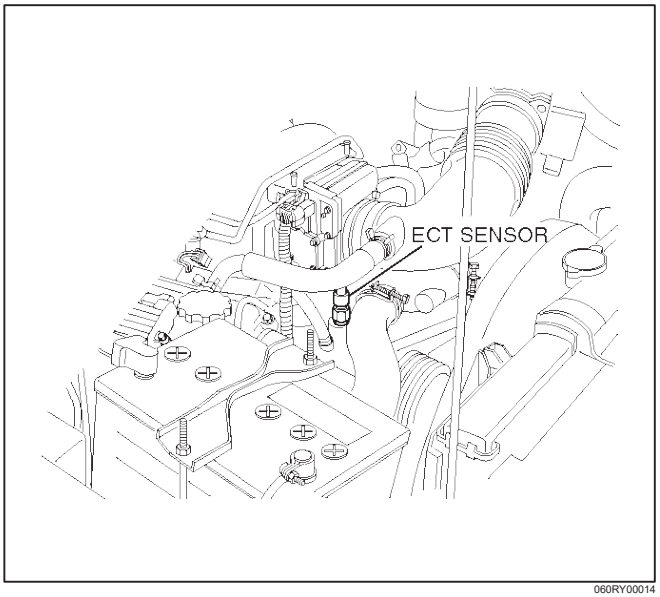


014RW134

# Throttle Body (TB)

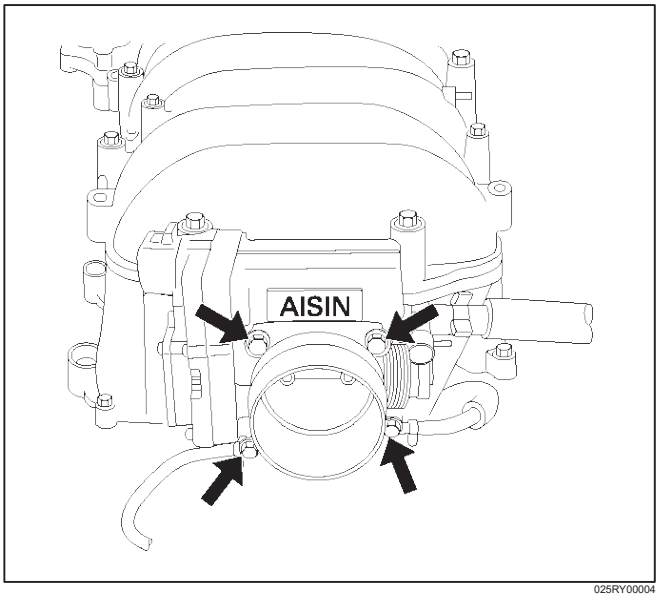
## Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Cooling System* section.
3. Disconnect the electrical connectors:
   - Throttle position (TP) sensor.
   - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.




060RY00014

4. Disconnect the vacuum hose below the air horn.
5. Remove the intake air duct clamp.
6. Disconnect the intake air duct.
7. Disconnect the coolant lines from the throttle body.
8. Remove the bolts from the common chamber.
9. Remove the throttle body from the common chamber.
10. Remove the gasket from the common chamber.




025RY00004

11. Remove the TP sensor. Refer to *Throttle Position (TP) Sensor* section.

## Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surfaces and the throttle body assembly may be damaged as a result.

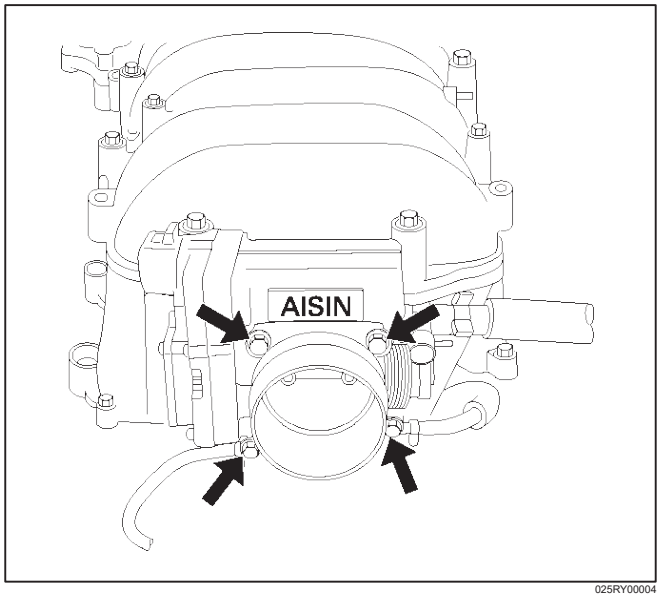
- If the throttle body gasket needs to be replaced, remove any gasket material that may be stuck to the mating surfaces of the manifold.
- Do not leave any scratches in the aluminum casting.

## Installation Procedure

1. Install the TP sensor. Refer to *Throttle Position (TP) Sensor* section.
2. Install the gasket on the common chamber.
3. Install the throttle body on the common chamber.
4. Secure the gasket and the throttle body with the four bolts.
   - The vacuum lines must be properly routed under the throttle body before tightening the mounting bolts.

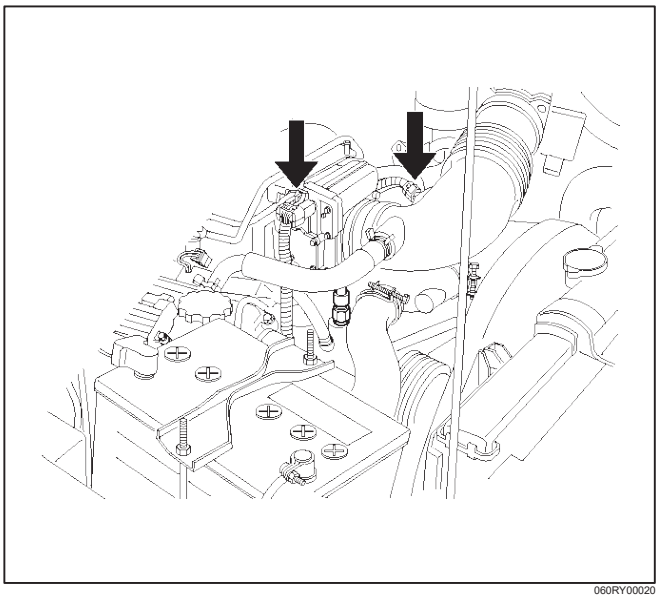
**Tighten**

- **Tighten the throttle body mounting bolts to 10 N·m (87 lb in).**



025RY00004

5. Install the coolant lines.
6. Connect all the vacuum lines.
7. Install the intake air duct.
8. Tighten the intake air duct clamp.
9. Connect all the electrical connectors:
   - Throttle position (TP) sensor.
   - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.

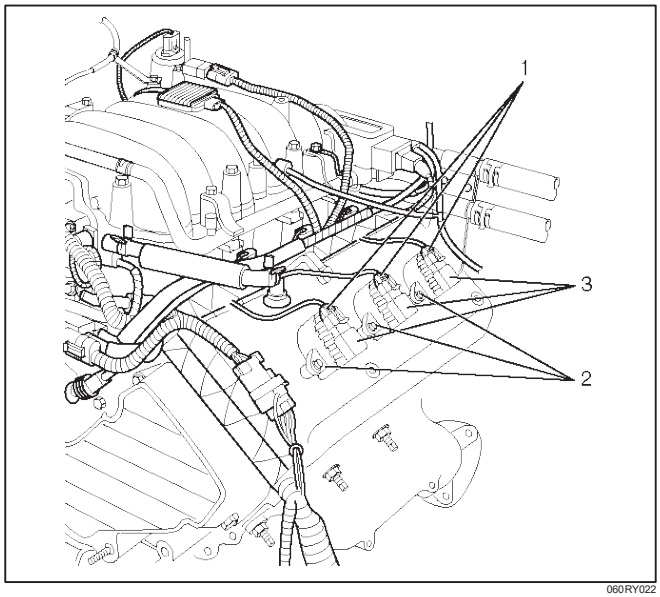

060RY00020

10. Install the accelerator cable assembly. Refer to *Accelerator Cable in Engine Speed Control System* section.
11. Fill the cooling system. Refer to *Cooling System* section.
12. Install the negative battery cable.

# Electronic Ignition System

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ignition coil connector at the ignition coil assemblies.
3. Remove the two screws that secure the ignition coil assemblies to the rocker cover.




060RY022

**Legend**

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Remove the ignition coil assemblies and the spark plug boot from the spark plug.
   - Twist the ignition coil assemblies while pulling it straight up.
5. Use the appropriate spark plug socket in order to remove the spark plug from the engine.

## Installation Procedure

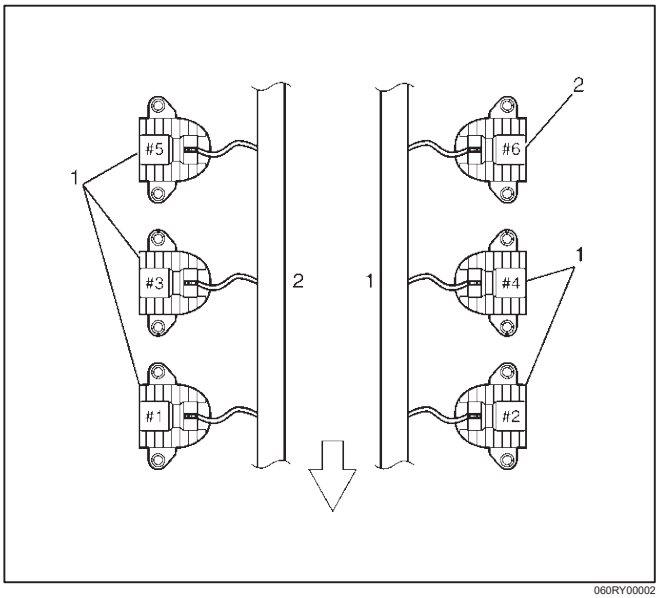
NOTE: The plug must thread smoothly into the cylinder head and be fully seated. Use a thread chaser if necessary to clean the threads in the cylinder head. Cross-threading or failure to fully seat the spark plug can cause plug overheating, exhaust blow-by gases, or thread damage. Do not overtighten the spark plugs. Over tightening can cause aluminum threads to strip.

1. Install the spark plug in the engine. Use the appropriate spark plug socket.

   **Tighten**

   - **Tighten the spark plug to 18 N·m (13 lb ft.).**
2. Install the ignition coil assemblies and spark plug boot over the spark plug.

**CAUTION: Ignition coil assembly #6 is different from ignition coil assembly #1 to #5. Ignition coil assemblies #6 is short type. Be careful it when installing ignition coil assembly of #6.**



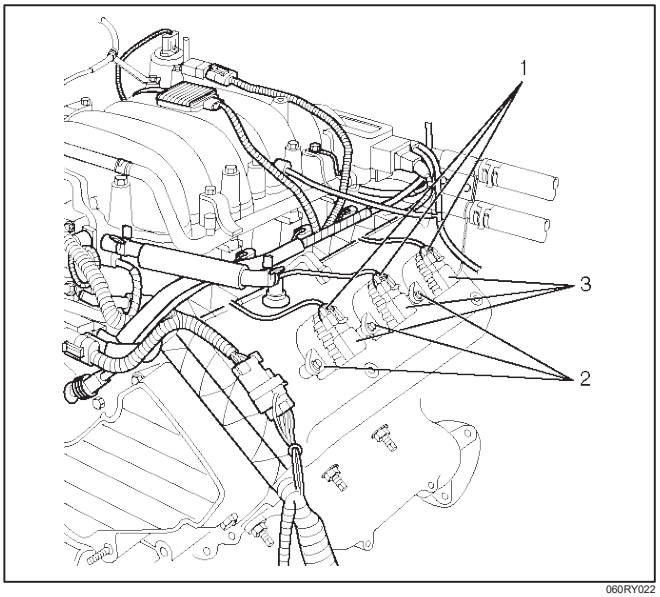

060RY00002

**Legend**

(1) Long Type Ignition Coil Assemblies (#1 ~ #5)
(2) Short Type Ignition Coil Assembly (#6)

3. Install ignition coil assemblies and tighten the fixing bolts to the specified torque.

   **Torque: 4 N·m (35.4 lb in)**




060RY022

**Legend**

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Connect the ignition coil connector at the ignition coil assemblies.
5. Connect the negative battery cable.

# Catalytic Converter

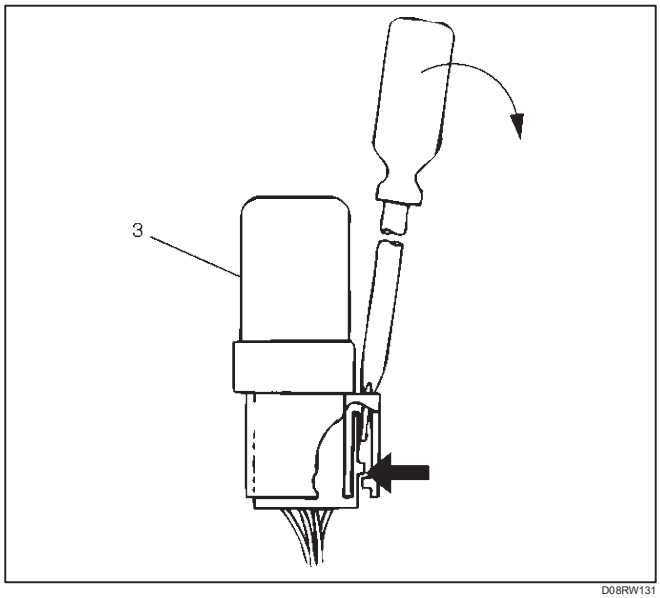
## Removal and Installation Procedure

Refer to *Engine Exhaust in Engine* section.

# Air Conditioning Thermo Relay

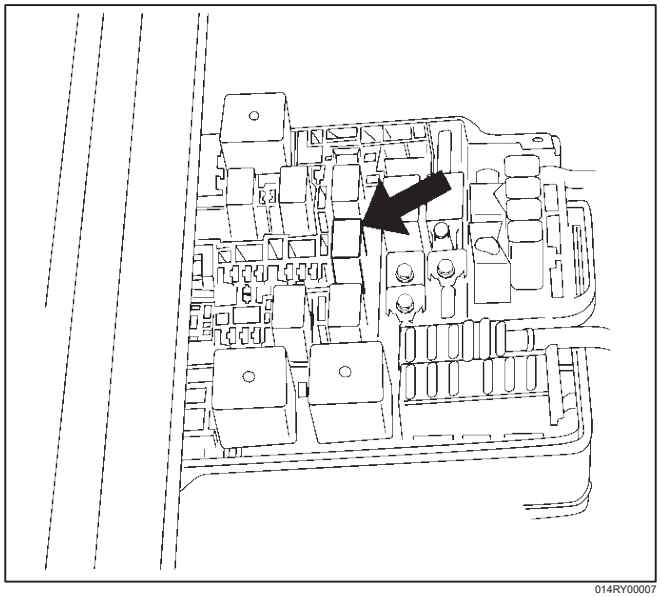
## Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   - The screwdriver blade will release the catch inside.




D08RW131

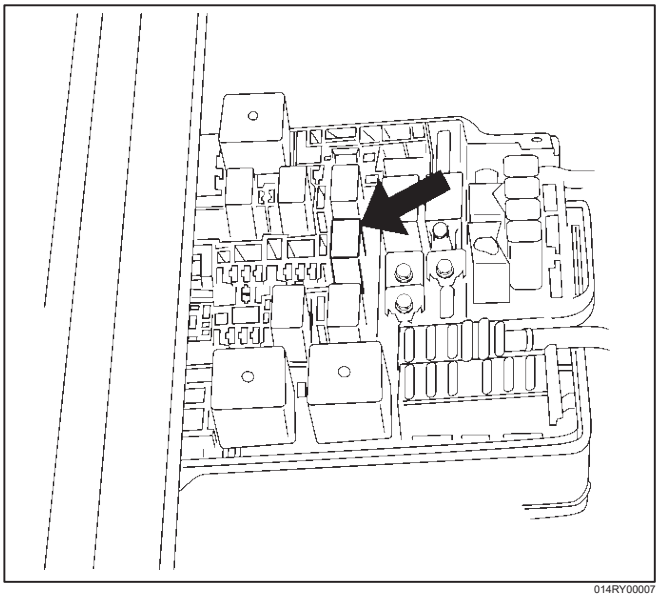
4. Pull the relay straight up and out of the fuse and relay box.



014RY00007

## Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   - An audible “click” will be heard.
3. Install the fuse and relay box cover.



014RY00007

# EVAP Canister Hoses

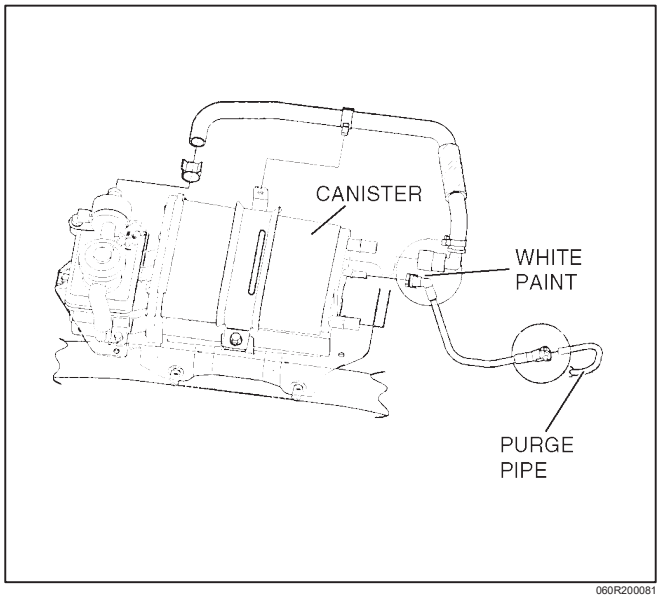
## Service Information

To view the routing of the EVAP canister hoses, refer to *Vehicle Emission Control Information* in *Diagnosis*. Use 6148M or equivalent when you replace the EVAP canister hoses.

# EVAP Canister

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the two hoses from the EVAP canister.
3. Disconnect the fuel vapor connector and the purge hose from the EVAP canister vent solenoid.
4. Remove the two retaining bolts the EVAP canister to the mounting bracket on the cross member.
5. Remove the retaining bolt on the mounting bracket the slide the canister out of mounting bracket.



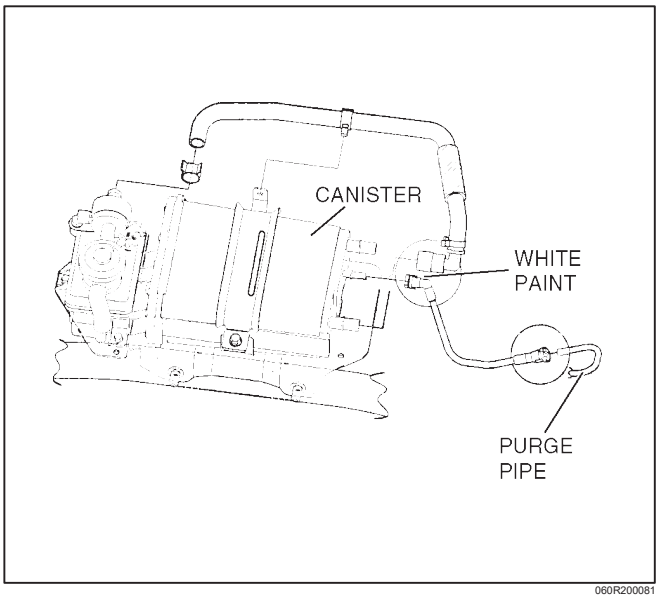
060R200081

## Inspection Procedure

1. Inspect the hoses for cracks and leaks.
2. Inspect the canister for a damaged case.

## Installation Procedure

1. Slide the canister into mounting bracket and install the mounting bracket bolt.
2. Install the retaining bolts the EVAP canister to the mounting bracket on the cross member.
3. Connect the fuel vapor connector to the EVAP canister vent solenoid.
4. Connect the two hoses to the EVAP canister.



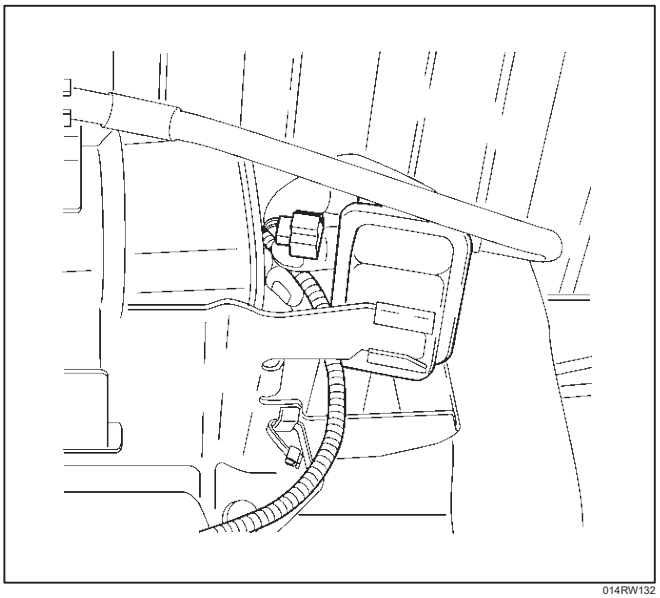
060R200081

5. Disconnect the negative battery cable.

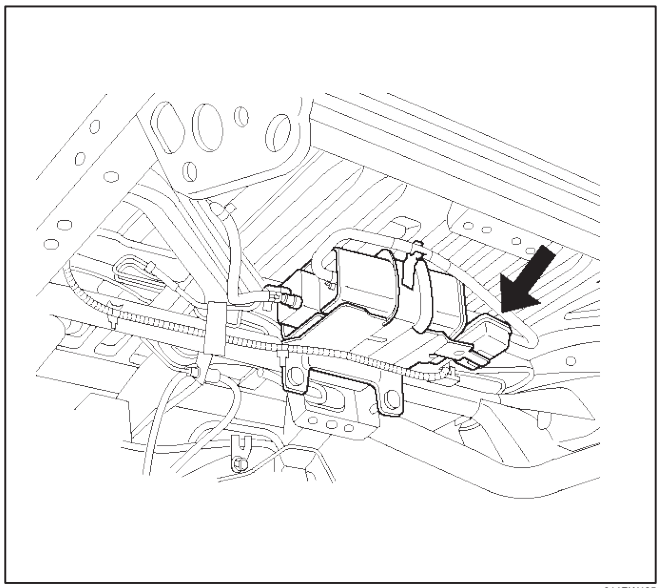
# EVAP Canister Vent Solenoid

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the connector and hose.


014RW132

3. Slide the out of EVAP canister vent solenoid from mounting bracket.

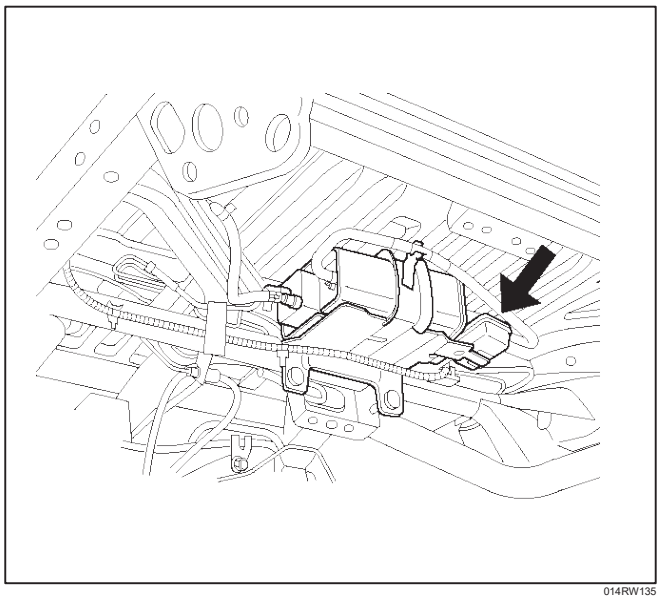

014RW135

## Inspection Procedure

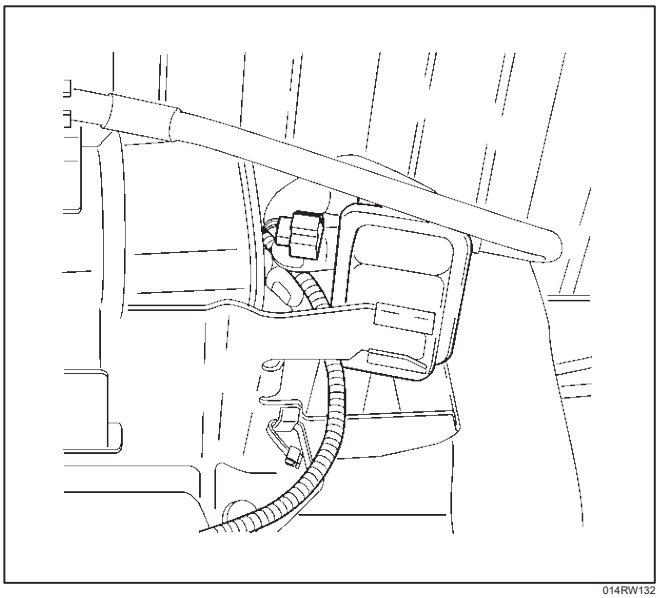
1. Check for cracks or leaks.
2. Energize the solenoid and try to blow through it. The solenoid should not allow passage of air when energized. (J 35616 Connector Test Kit can be used to easily attach jumper wires from the battery to the solenoid).

## Installation Procedure

1. Slide the into EVAP canister vent solenoid into the mounting bracket.


014RW135

2. Connect the connector and hose.

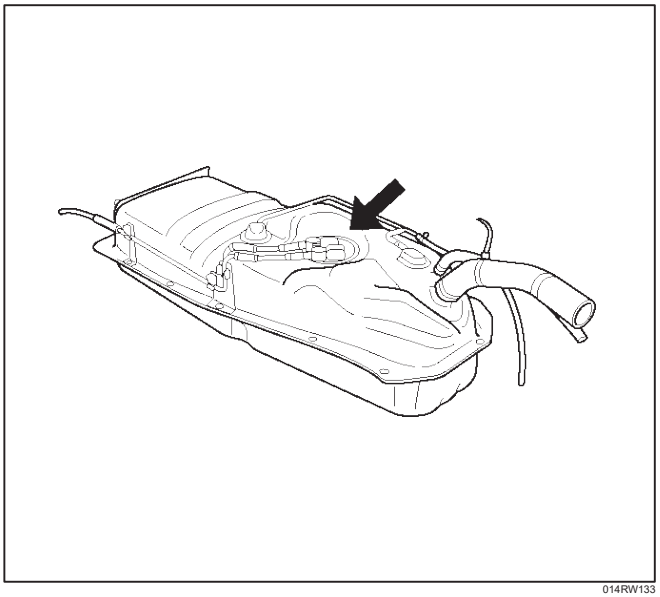

014RW132

3. Connect the negative battery cable.

# Fuel Tank Pressure (Vapor Pressure) Sensor

## Removal Procedure

1. Remove the fuel pump assembly. Refer to *Fuel Tank In Fuel Pump*.
2. Carefully pry the fuel tank pressure sensor out of the top of the fuel pump assembly.

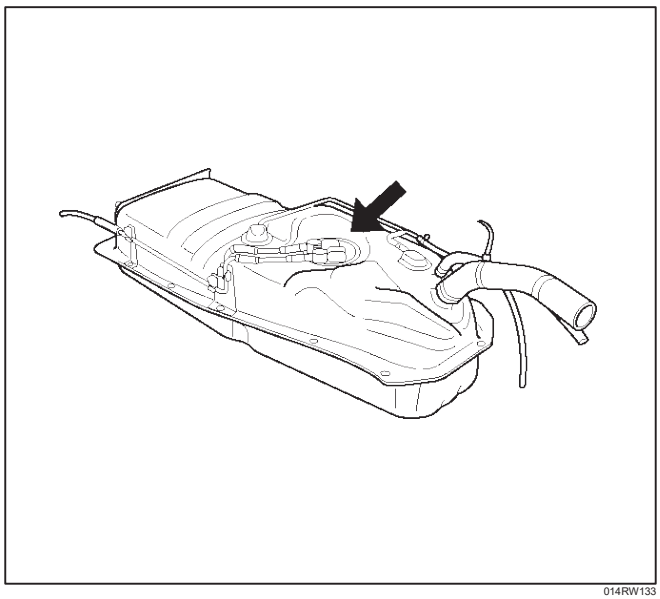

014RW133

## Inspection Procedure

1. Inspect the vapor pressure sensor for cracks in the housing and corrosion on the electrical terminals.
2. Inspect the rubber grommet for tears and signs of rot.

## Installation Procedure

1. Install the rubber grommet on the fuel pump assembly.

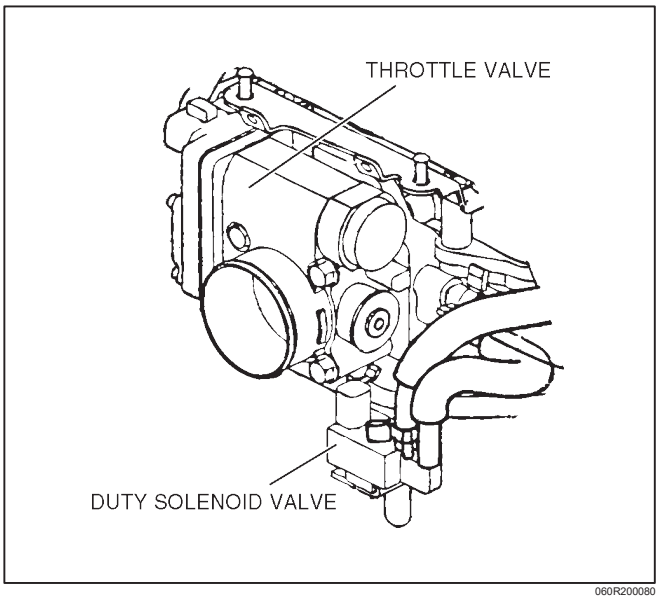



2. Install the fuel tank vapor pressure sensor on the fuel pump assembly.
   - Insert the sensor nipple firmly into the grommet.
   - Keep twisting and pushing the sensor until the wide portion of the nipple shows on the other side of the grommet.
3. Install the fuel pump assembly on the fuel tank. Refer to *Fuel Tank In Fuel Pump*..

# EVAP Canister Purge Solenoid (Purge Duty Solenoid Valve)

## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the EVAP canister purge solenoid.
3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.

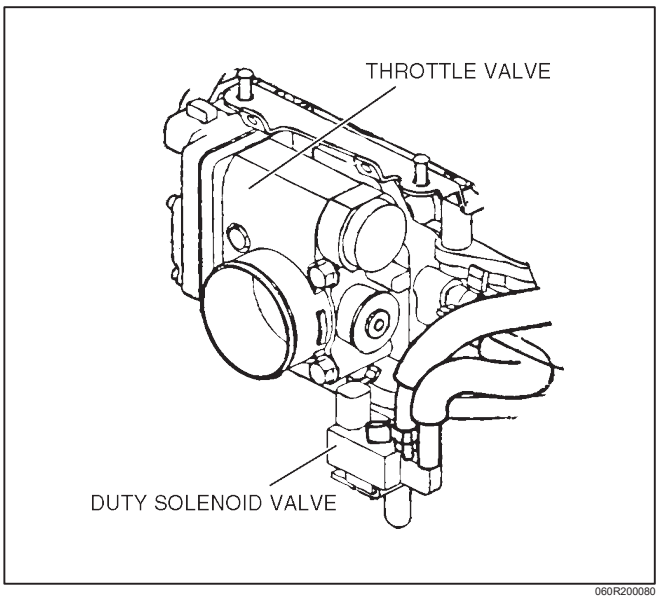



4. Remove the EVAP canister purge solenoid retaining bolt from the common chamber.
5. Remove the EVAP canister purge solenoid.

## Installation Procedure

1. Install the EVAP canister purge solenoid on the upper intake manifold.
2. Install the EVAP canister purge solenoid retaining bolt.

   **Tighten**
   - **Tighten the bolts to 20 N·m (16 lb ft.).**
3. Connect the vacuum hoses to the EVAP canister purge solenoid.
4. Connect the electrical connector to the EVAP canister purge solenoid.



# Fuel Tank Vent Valve (Vent Solenoid Valve)

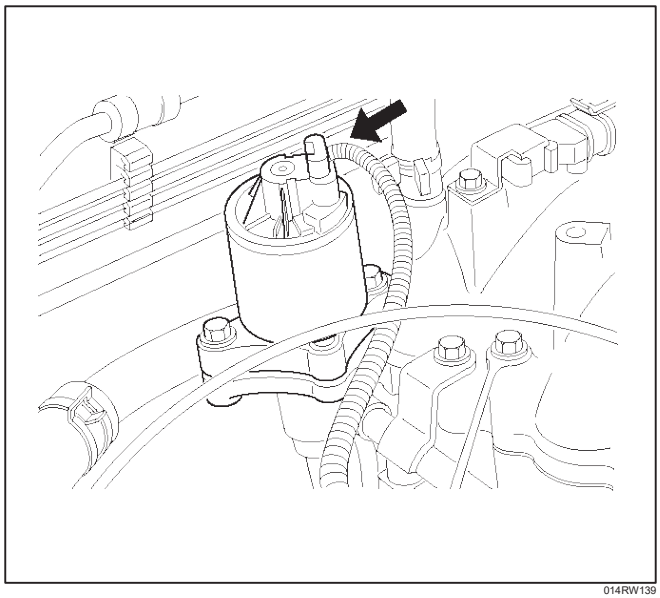
## Removal and Installation Procedure

Refer to *Fuel Pump* section.

# Linear Exhaust Gas Recirculation (EGR) Valve

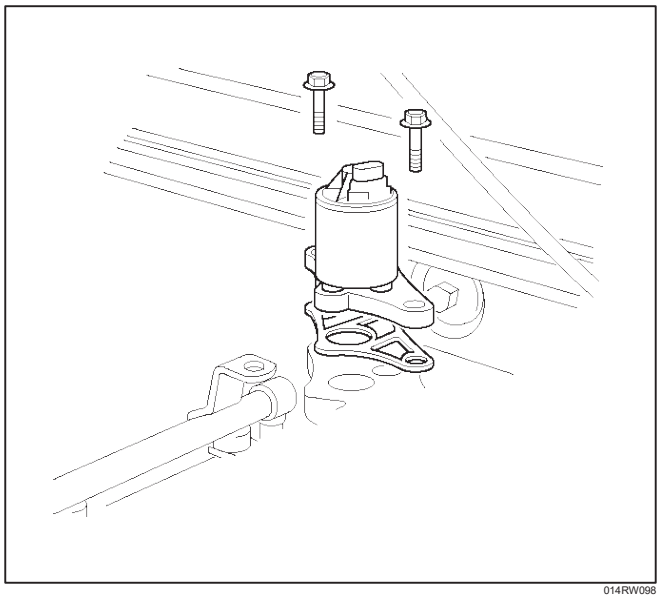
## Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector at the EGR valve.



014RW139

3. Remove the bolts from the common chamber.



014RW098

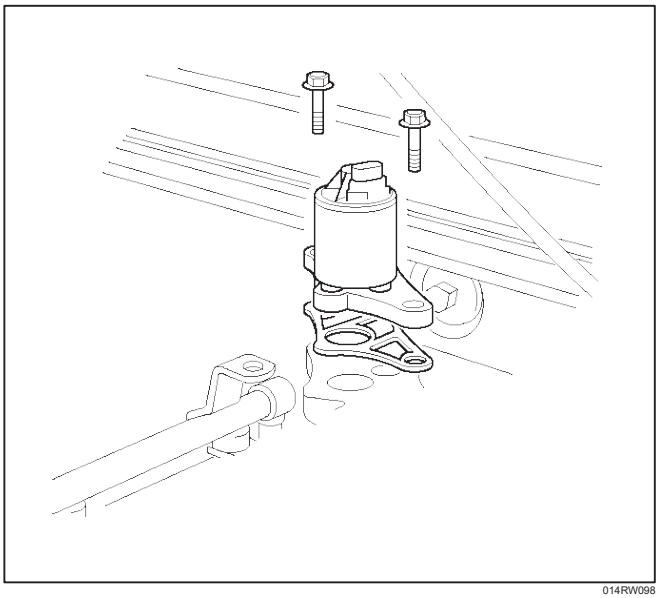
4. Remove the EGR valve from the common chamber manifold.
5. Remove the gasket from the common chamber manifold.

## Installation Procedure

1. Install the gasket on the common chamber.
2. Install the EGR valve on the common chamber.
3. Secure the EGR valve and the gasket with the bolts.

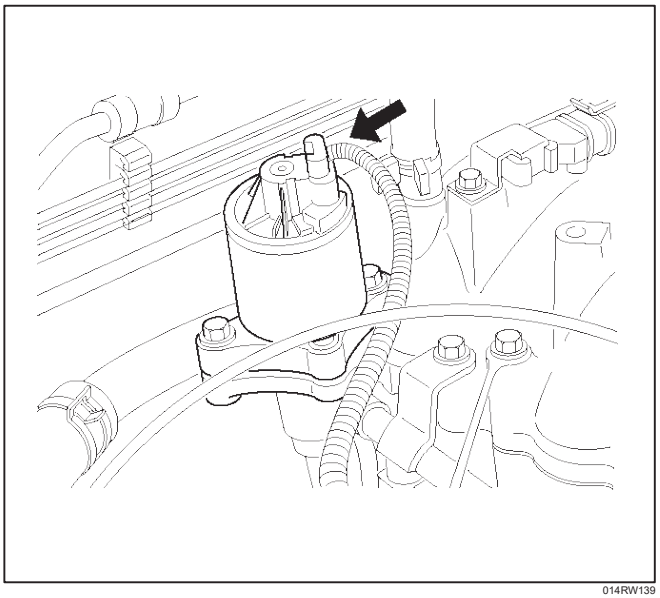
   **Torque: 25 N·m (18 lb ft)**

NOTE: It is possible to install the EGR valve rotated 180° from the correct position. Make sure that the base of the valve is placed so that it aligns with the mounting flange.



014RW098

4. Connect the electrical connector at the EGR valve.



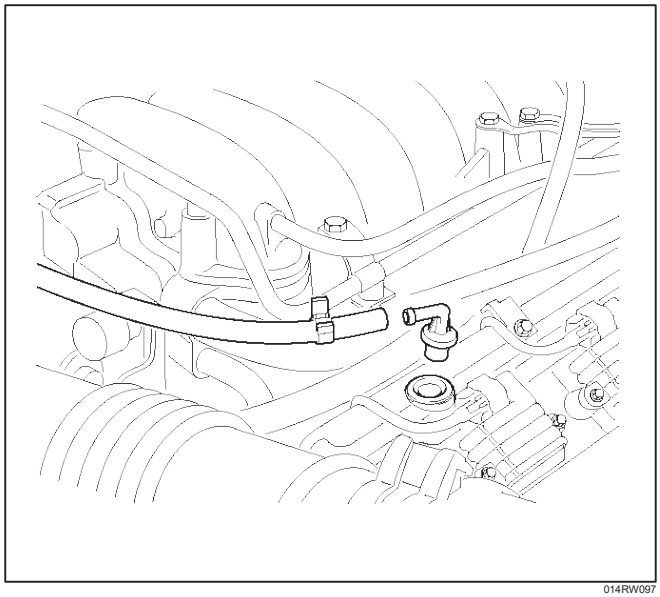
014RW139

5. Connect the negative battery cable.

# Positive Crankcase Ventilation (PCV) Valve

## Removal Procedure

1. Remove the vacuum hose at the PCV valve.
   - Slide the clamp back to release the hose.
2. Pull the PCV valve from the rubber grommet in the right valve cover.



014RW097

## Inspection Procedure

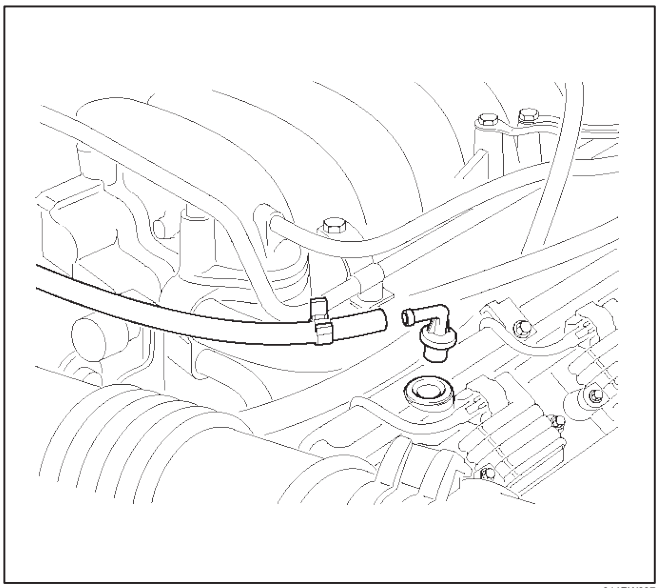
Before inspecting the PCV valve, make sure that the hoses are connected properly and are in good condition. Also check that the oil pan and rocker cover gaskets are sealing properly.

### PCV Valve

1. Run the engine at normal operating temperature.
2. Disconnect the valve from the rocker cover.
   **RESULT:** A hissing noise should be heard from the valve. If no noise is heard, the PCV valve or hose is plugged.
3. Remove the PCV valve from the engine.
   a. Blow air into the rocker cover side of the valve.
   **RESULT:** Air should pass freely.
   b. Blow air into the air cleaner side of the valve.
   **RESULT:** Air should not pass through the valve.
4. Re-install the PCV valve and remove the oil filler cap.
   **RESULT:** A small vacuum should be felt at the oil filler hole.

## Installation Procedure

1. Push the PCV valve into the rubber grommet in the left valve cover.
2. Install the vacuum hose on the PCV valve and secure the vacuum hose with the clamp.



014RW097

# Wiring and Connectors

## Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.
Replace wire harnesses with the proper part number replacement.
Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.
The following wire harness repair information is intended as a general guideline only. Refer to *Chassis Electrical* section for all wire harness repair procedures.

## Connectors and Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.
Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.
Be certain of the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com-Pack III terminals look similar, but are serviced differently.

# PCM Connectors and Terminals

## Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

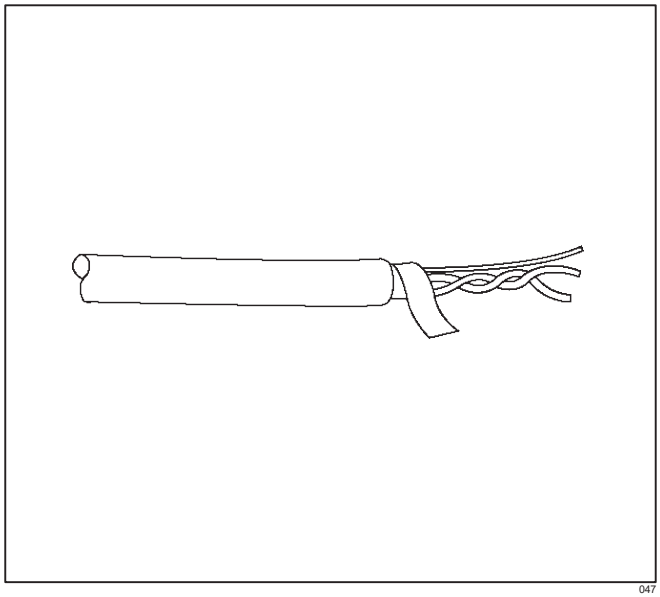
## Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulled into position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

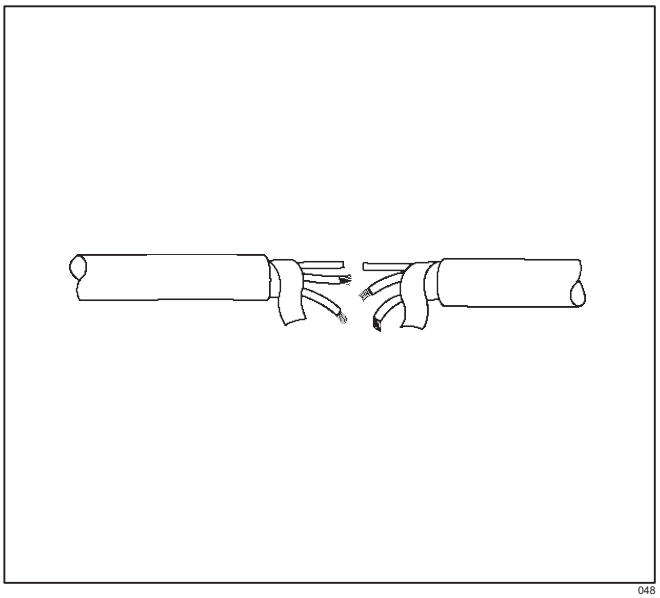
# Wire Harness Repair: Twisted Shielded Cable

## Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.

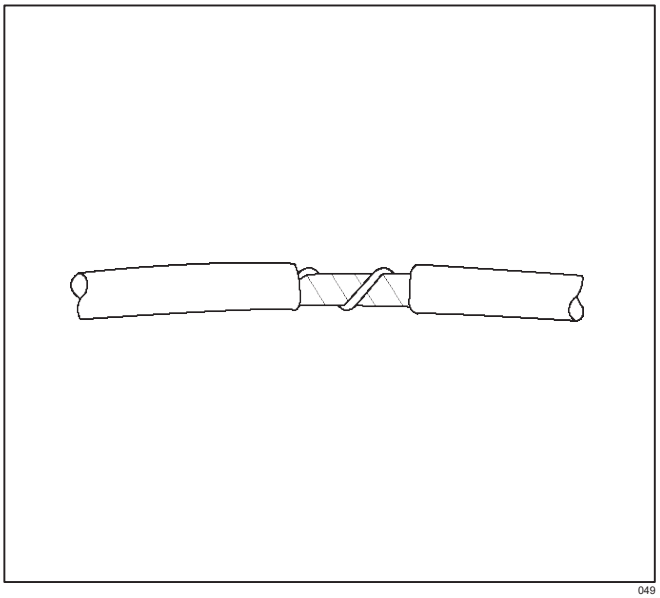



3. Untwist the conductors.
4. Strip the insulation as necessary.

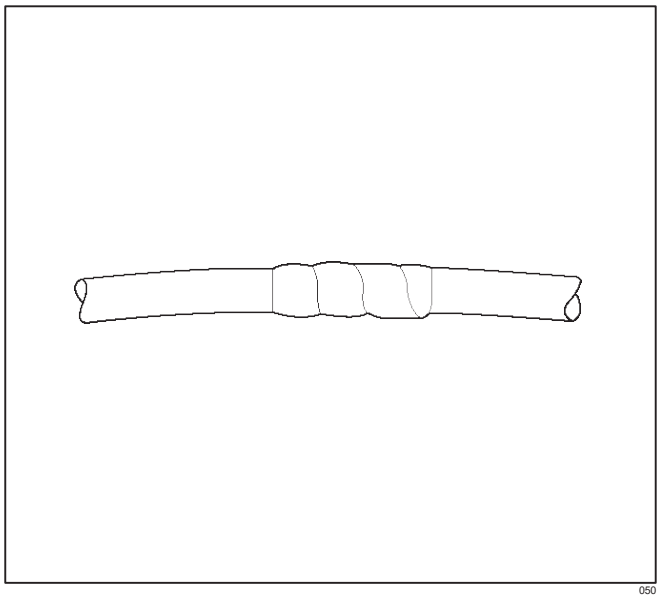



## Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.



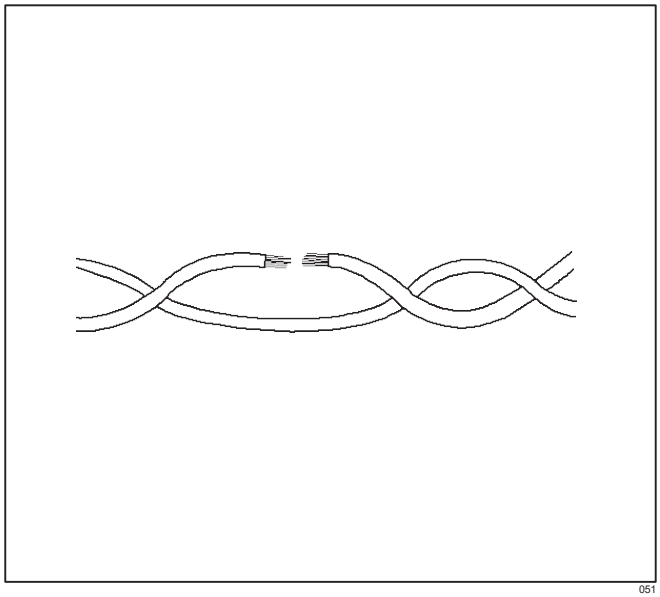
4. Tape over the whole bundle to secure.




# Twisted Leads

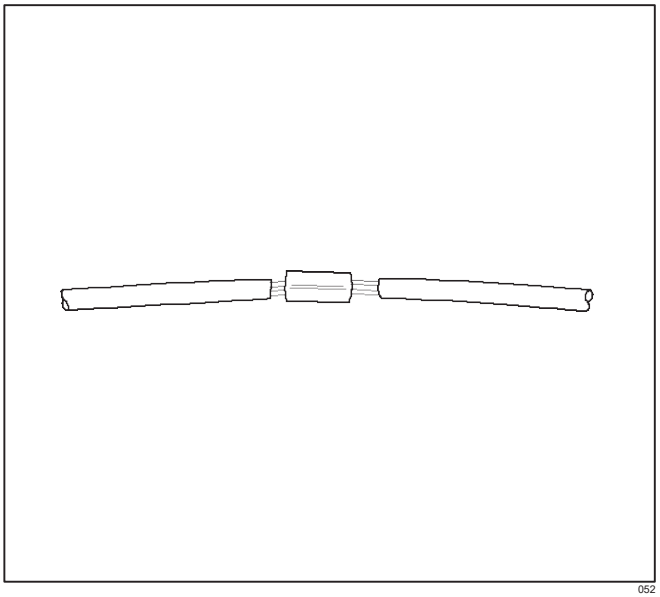
## Removal Procedure

1. Locate the damaged wire.
2. Remove the insulation as required.

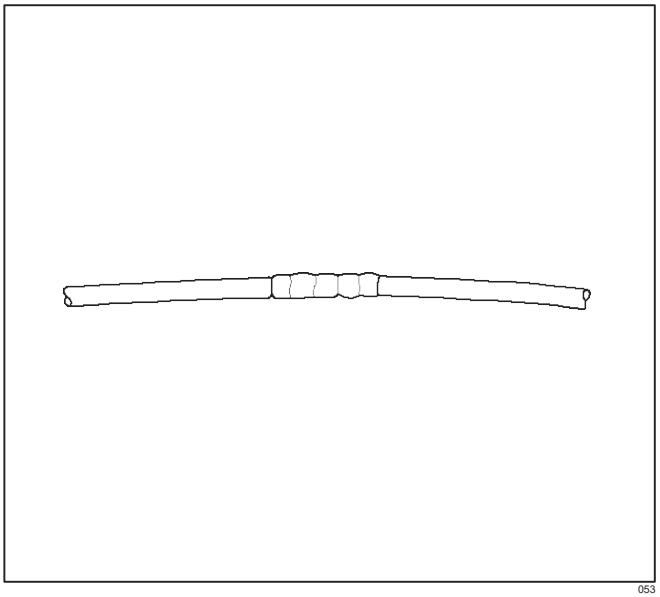



## Installation Procedure

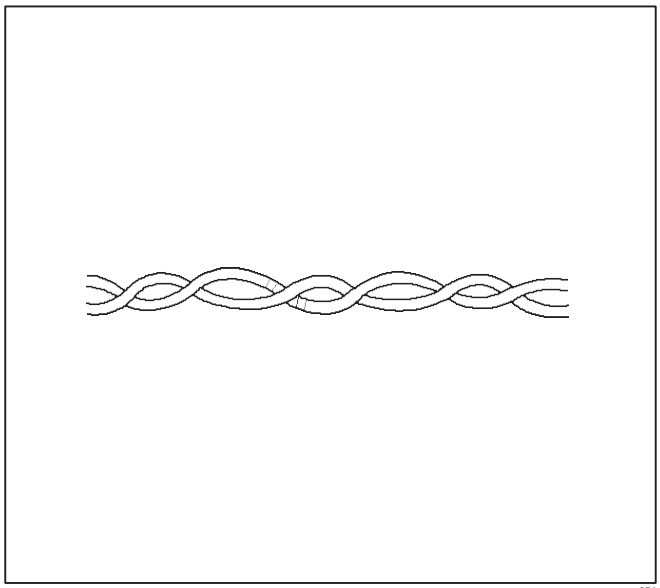
1. Use splice clips and rosin core solder in order to splice the two wires together.



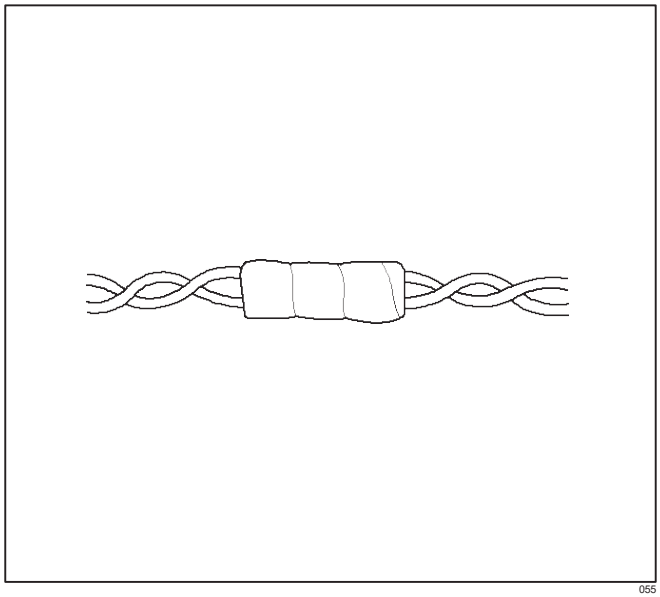

2. Cover the splice with tape in order to insulate it from the other wires.



3. Twist the wires as they were before starting this procedure.




4. Tape the wires with electrical tape. Hold in place.




# Weather-Pack Connector

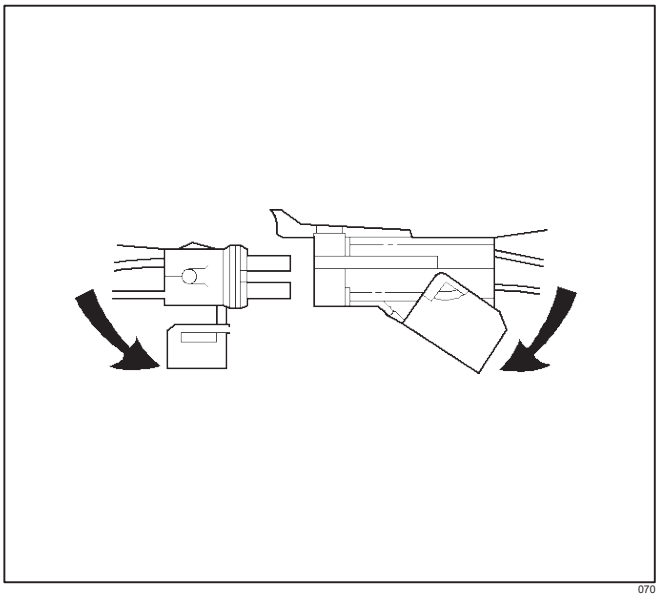
## Tools Required

J 28742-A Weather-Pack II Terminal Remover

## Removal Procedure

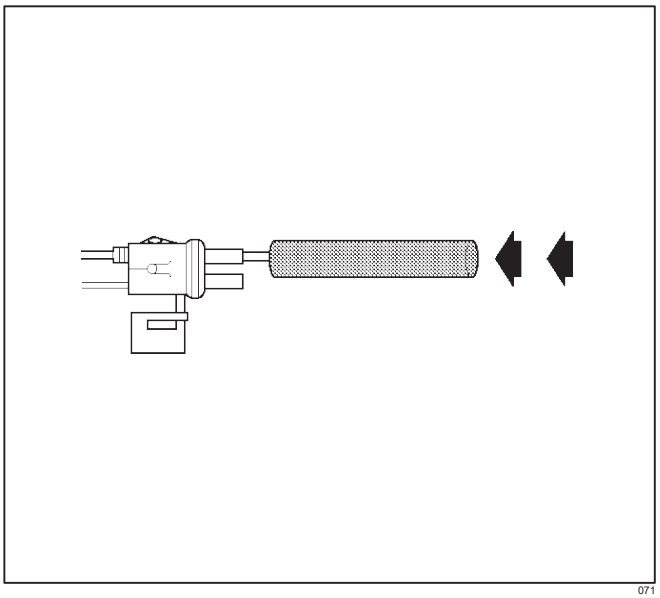
A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could form oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

1. Open the secondary lock hinge on the connector.

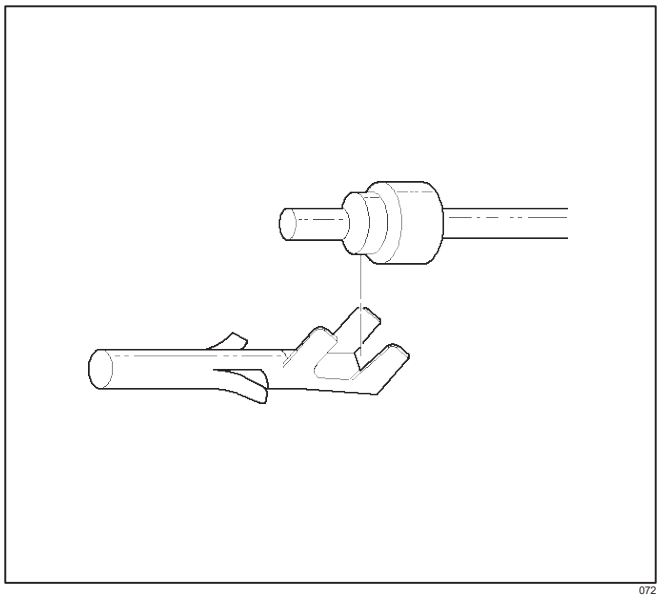



2. Use tool J 28742-A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742-A to release.

NOTE: Do the use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



3. Cut the wire immediately behind the cable seal.

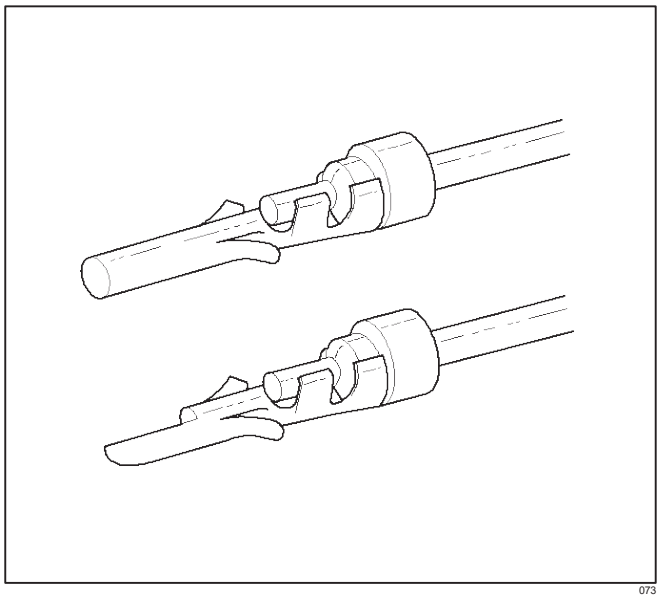



## Installation Procedure

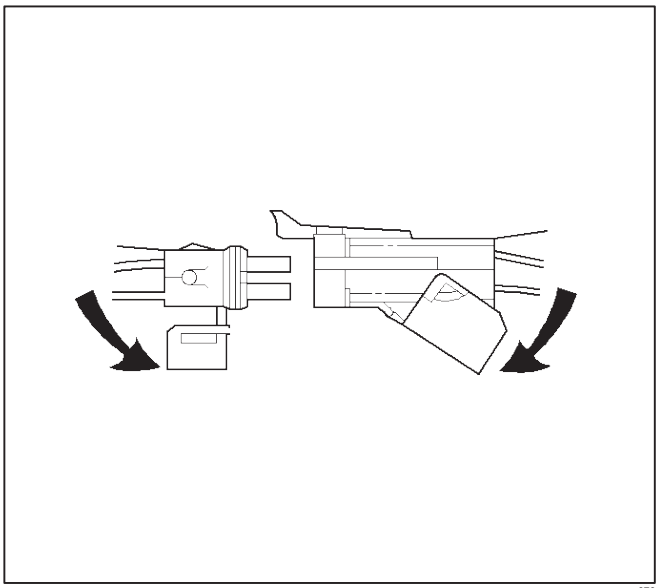
Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

Do not replace the Weather-Pack connections with standard connections. Read the instructions provided with the Weather-Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2”) of insulation from the wire.
4. Crimp the terminal over the wire and the seal.




5. Push the terminal and the connector to engage the locking tangs.




6. Close the secondary locking hinge.

# Com-Pack III

## General Information

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A or equivalent. These will damage the terminals.

# Metri-Pack

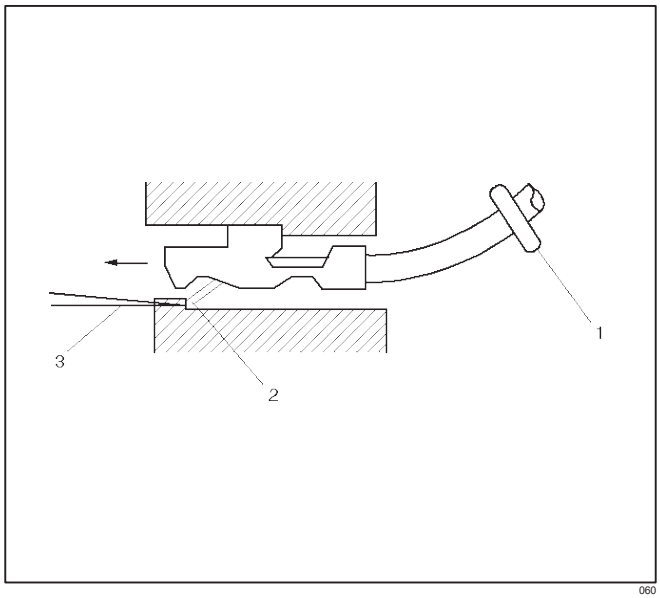
## Tools Required

J 35689 Terminal Remover

## Removal Procedure

Some connectors use terminals called Metri-Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.
2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).

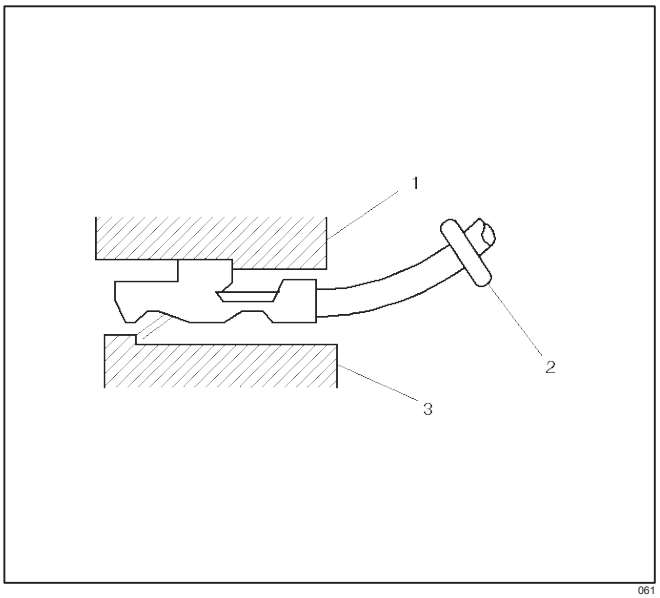



3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

## Installation Procedure

Metri-Pack terminals are also referred to as “pull-to-seat” terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.




3. Then the terminal is pulled back into the connector to seat it in place.

# General Description (PCM and Sensors)

## 58X Reference PCM Input

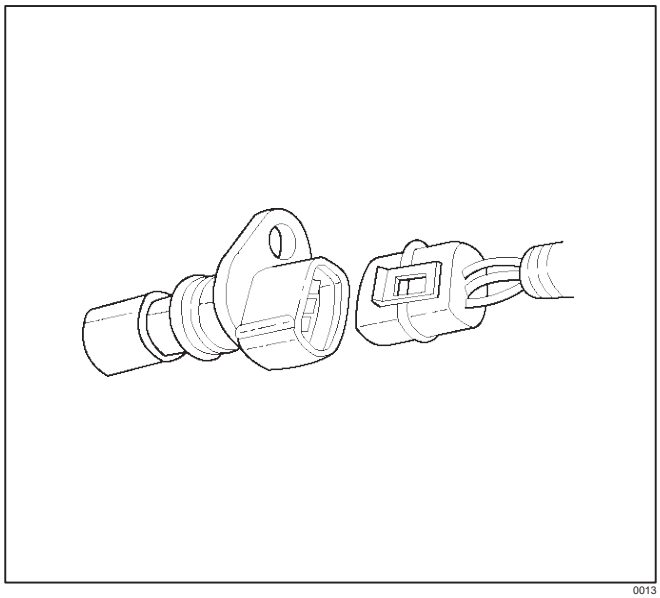
The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all engine speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. The engine will not start and run without using the 58X reference signal.

## A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning “ON” the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for the A/C electrical system.

## Crankshaft Position (CKP) Sensor

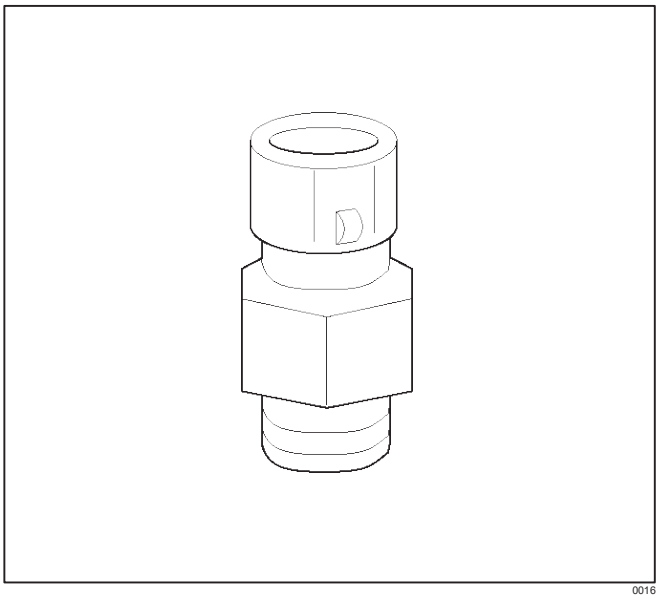
The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position.
Refer to *Electronic Ignition System* section for additional information.



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## Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of 100,000 ohms at –40˚C (–40˚F). High temperature causes a low resistance of 70 ohms at 130˚C (266˚F). The PCM supplies a 5-volt signal to the ECT sensor through resistors in the PCM and measures the voltage. The signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.
The Tech 2 displays engine coolant temperature in degrees. After engine start-up, the temperature should rise steadily to about 85˚C (185˚F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0177 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.



0016

## Electrically Erasable Programmable Read Only Memory (EEPROM)

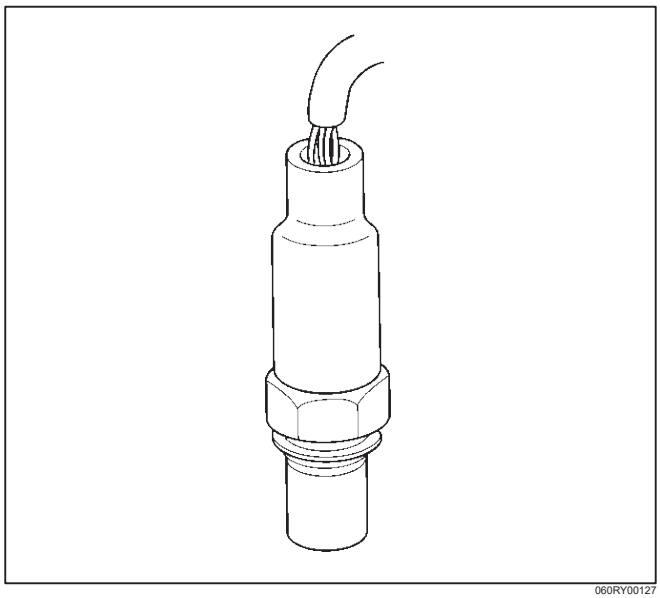
The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

## Fuel Control Heated Oxygen Sensors

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are mounted in the exhaust stream where they can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with a Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and the Tech 2 will display a constant voltage between 400-500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. Faults in the Bank 2 HO2S 1 signal circuit will cause DTC 0154 (open circuit), DTC P0151 (grounded circuit), or DTC P0152 (signal voltage high) to set. A fault in the Bank 1 HO2S 1 heater circuit will cause DTC P0135 to set. A fault in the Bank 2 HO2S 1 heater circuit will cause DTC P0155 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.

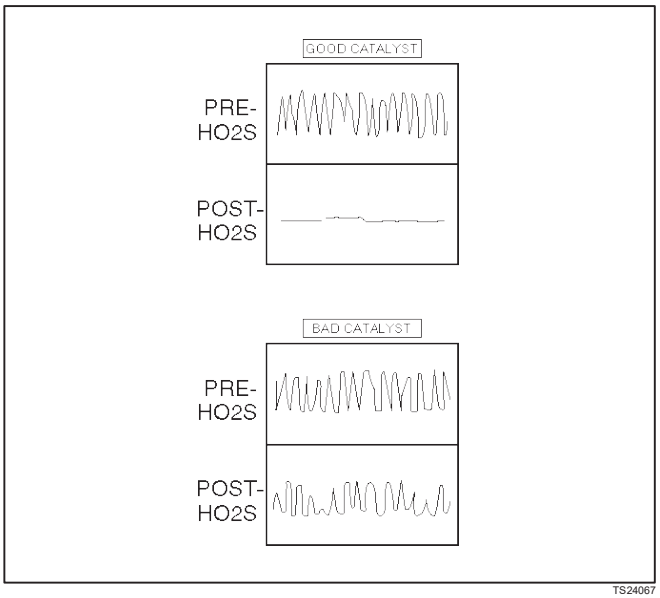

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## Catalyst Monitor Heated Oxygen Sensors

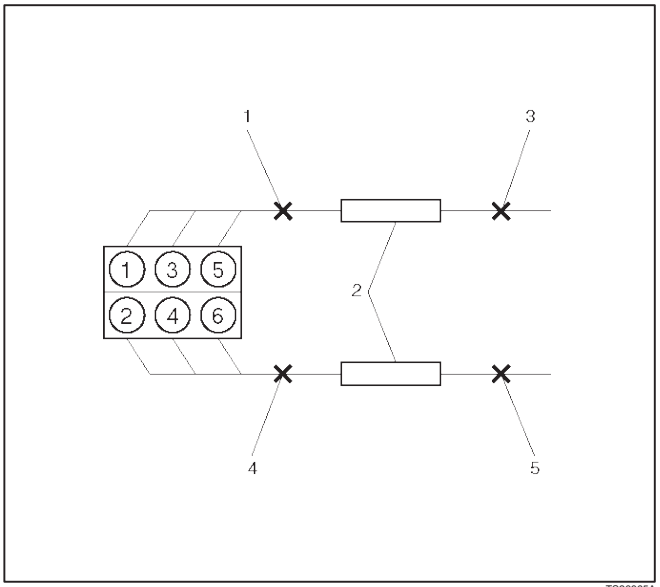
Three-way catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The PCM can monitor this process using the Bank 1 HO2S 2 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 and the Bank 2 HO2S 1 sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors produce an output signal which indicates the oxygen storage capacity of the catalyst. This indicates the catalyst's ability to efficiently convert exhaust gases. If the catalyst is operating efficiently, the Bank 1 HO2S 1 and the Bank 2 HO2S 1 signals will be more active than the signals produced by the Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors.

The catalyst monitor sensors operate the same as the fuel control sensors. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors' main function is catalyst monitoring, but they also have a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mV bias voltage for an extended period of time, the PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit will set DTC P0137, P0138, or P0140, depending on the specific condition. A problem with the Bank 2 HO2S 2 signal circuit will set DTC P0157, P0158, or P0160, depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower sensor response. This may cause incorrect catalyst monitor diagnostic results.



TS24067



TS23365A

**Legend**

(1) Bank 1 Sensor 1 (Fuel Control)
(2) Catalytic Converter
(3) Bank 1 Sensor 2 (Catalyst Monitor)
(4) Bank 2 Sensor 1 (Fuel Control)
(5) Bank 2 Sensor 2 (Catalyst Monitor)

## Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high

resistance of 100,000 ohms at –40˚C (–40˚F). High temperature causes low resistance of 70 ohms at 130˚C (266˚F) . The PCM supplies a 5-volt signal to the sensor through a resistor in the PCM and monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.
The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A fault in the IAT sensor circuit will set DTC P0112 or DTC P0113.

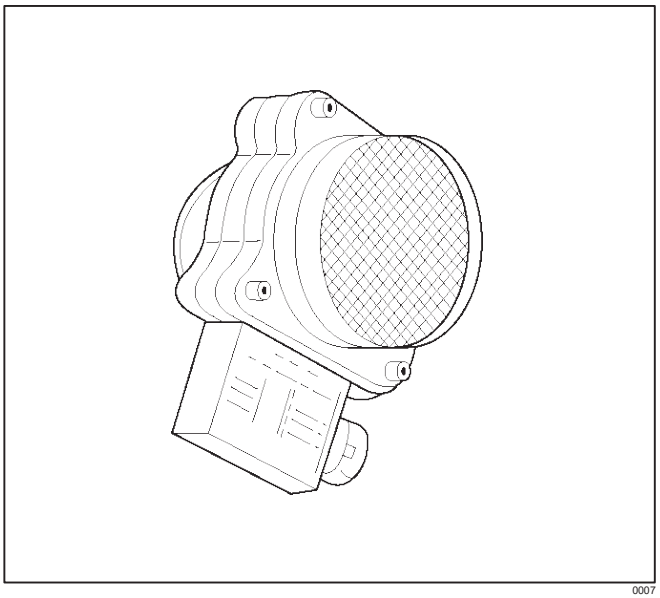
## Linear Exhaust Gas Recirculation (EGR) Control

The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

## Mass Air Flow (MAF) Sensor

The mass air flow (MAF) sensor measures the difference between the volume and the quantity of air that enters the engine. “Volume” means the size of the space to be filled. “Quantity” means the number of air molecules that will fit into the space. This information is important to the PCM because heavier, denser air will hold more fuel than lighter, thinner air. The PCM adjusts the air/fuel ratio as needed depending on the MAF value. The Tech 2 reads the MAF value and displays it in terms of grams per second (gm/s). At idle, the Tech 2 should read between 4-7 gm/s on a fully warmed up engine. Values should change quickly on acceleration. Values should remain stable at any given RPM. A failure in the MAF sensor or circuit will set DTC P0101, DTC P0102, or DTC P0103.

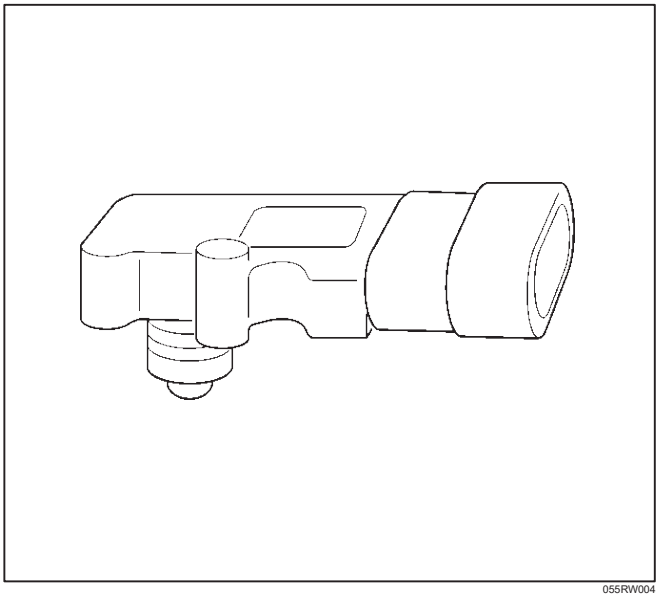

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## Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide-open throttle (low vacuum).
The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to *DTC P0401*.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.


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## Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

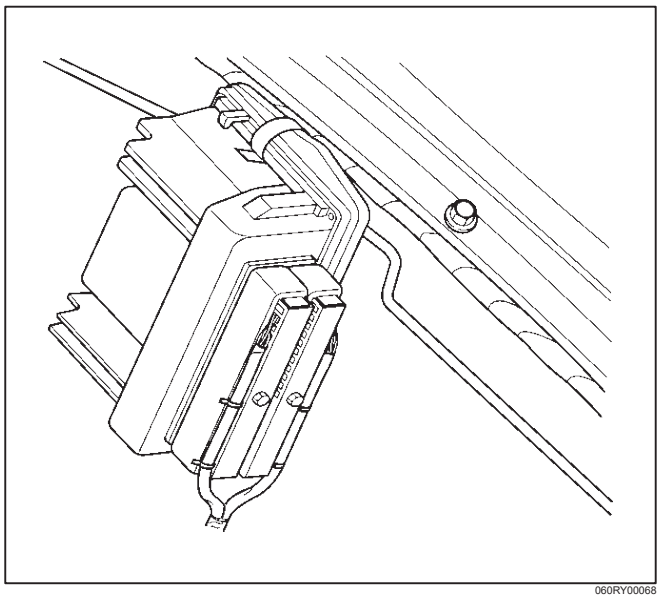
- Fuel metering system.
- Transmission shifting (automatic transmission only).
- Ignition timing.
- On-board diagnostics for powertrain functions.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Check Engine lamp), and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.

## PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megohms input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement. The PCM controls output circuits such as the injectors, fan relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)



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## PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- ION sensing module
- Automatic transmission shift functions
- Cruise control
- Evaporative emission (EVAP) purge
- A/C clutch control

## PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistance in the PCM is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10-megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON.” These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs. Not all outputs are always used.

## PCM Input/Outputs

**Inputs – Operating Conditions Read**

- Air Conditioning “ON” or “OFF”
- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Electronic Ignition
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Mass Air Flow
- Engine Knock
- Acceleration Position

**Outputs – Systems Controlled**

- EVAP Canister Purge
- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Control
- ION Sensing Module
- Electric Fuel Pump
- Air Conditioning

- Diagnostics
  - Malfunction Indicator Lamp
  - Data Link Connector (DLC)
  - Data Output
- Transmission Control Module

## PCM Service Precautions

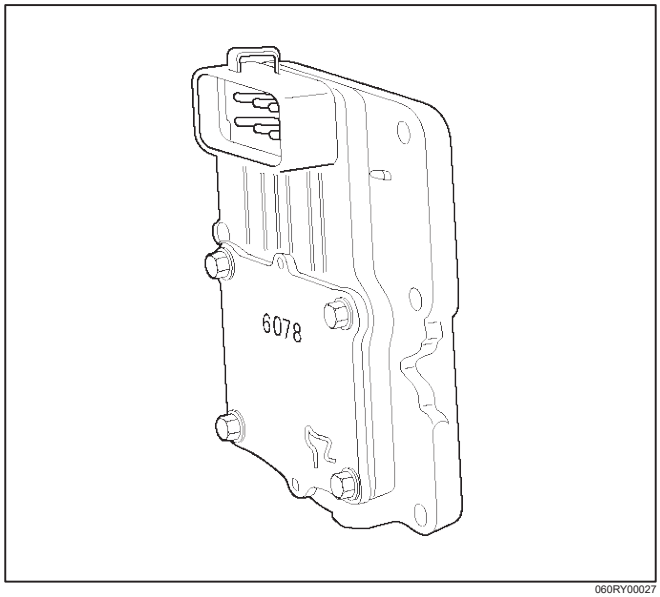
The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM's circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200. The PCM should remain connected to the PCM or to a recommended breakout box.

## Reprogramming The PCM

Reprogramming of the PCM is done without removing it from the vehicle . This provides a flexible and cost-effective method of making changes in software calibrations.
Refer to the latest Techline information on reprogramming or flashing procedures.

## Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of the TP1 sensor is low. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be above 92% (Tech 2 Display).
The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving.



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## Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature sensor is a thermistor which changes its resistance based on the temperature of the transmission fluid. For a complete description of the TFT sensor, refer to *4L30-E Automatic Transmission Diagnosis* section.
A failure in the TFT sensor or associated wiring will cause DTC P0712 or DTC P0713 to set. In this case, engine coolant temperature will be substituted for the TFT sensor value and the transmission will operate normally.

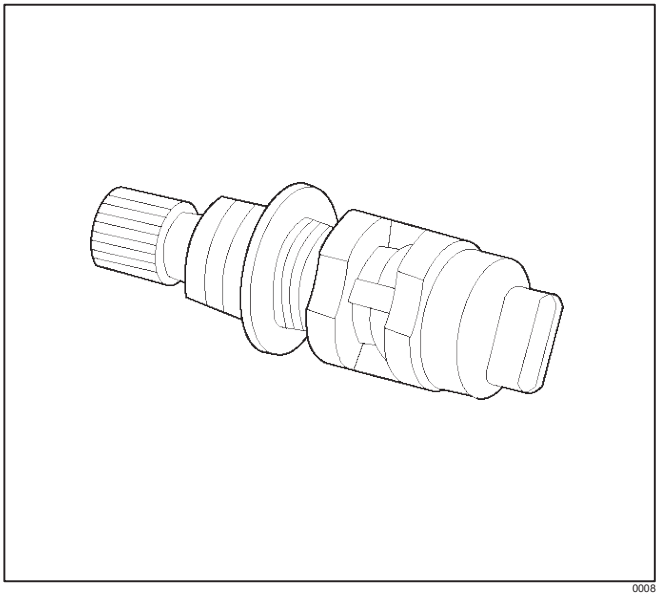
## Transmission Range Switch (Mode Switch)

**IMPORTANT:** The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR operation.
For more information on the transmission on the transmission range switch, refer to *4L30-E Automatic Transmission* section.

## Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a pulsing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the cruise control, speedometer, and the TCC and shift solenoids in the transmission. For more information on the TCC and shift solenoids, refer to *4L30-E Automatic Transmission* section.


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## Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

## Aftermarket Electrical and Vacuum Equipment

Aftermarket (add-on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

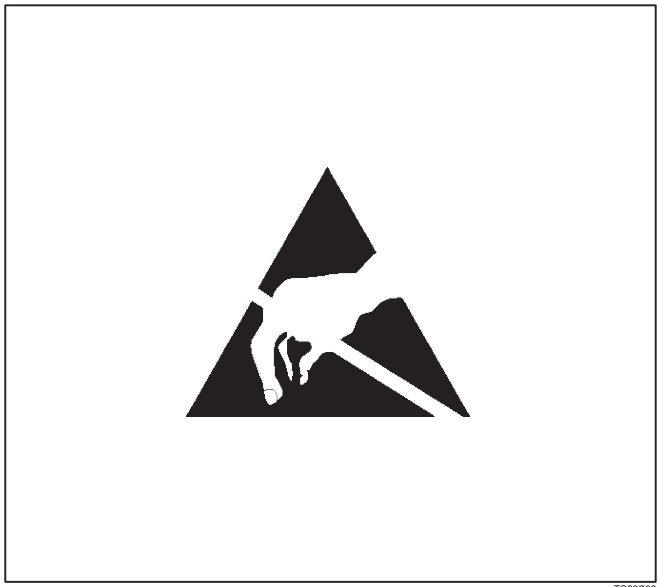
NOTE: No add-on vacuum equipment should be added to this vehicle.

NOTE: Add-on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

## Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.



TS23793

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well insulated shoes stands near a highly charged object and momentary touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

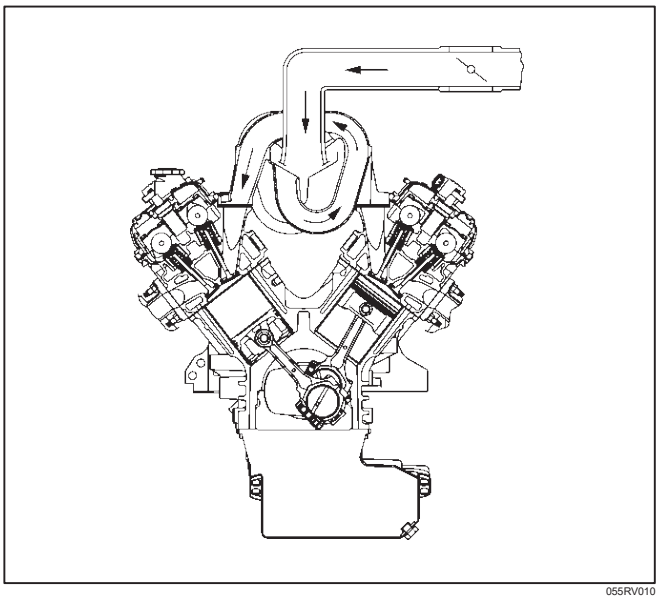
- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

# General Description (Air Induction)

## Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote-mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by to following steps:

1. Through the throttle body.
2. Into the common chamber.
3. Through the cylinder head intake ports.
4. Into the cylinders.



055RV010

# General Description (Fuel Metering)

## Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

## Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.
- Ignition dwell time.

## Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de-energizes the fuel injectors. The PCM holds the fuel injectors de-energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors “ON” and “OFF,” allowing fuel into the cylinders.

## Deceleration Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

## Engine Speed/Vehicle Speed/Fuel Disable Mode

The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increases above 6400 RPM. The fuel injectors are turned back on when engine speed decreases below 6150 RPM.

## Fuel Cutoff Mode

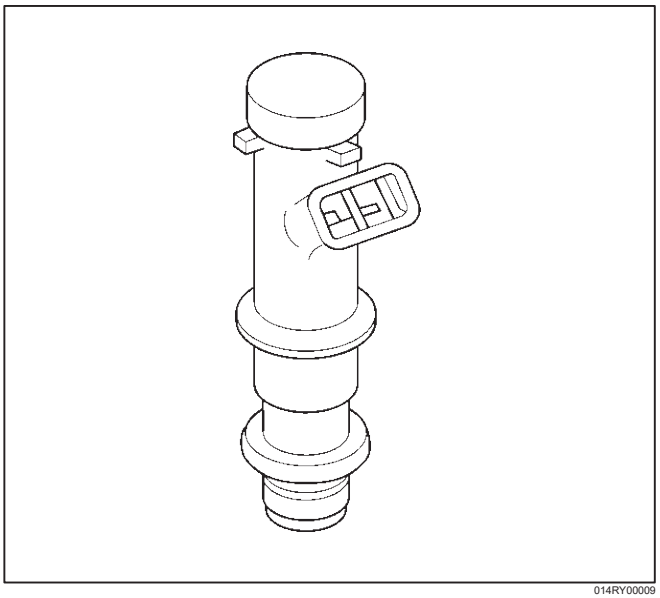
No fuel is delivered by the fuel injectors when the ignition is “OFF.” This prevents engine run-on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

## Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid-operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.

The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



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## Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.
- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The ION sensing module.
- The fuel pump.
- The fuel pump relay.

### Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in-line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to *Section 6C* for further information on the fuel tank, line filter, and fuel pipes.

## Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

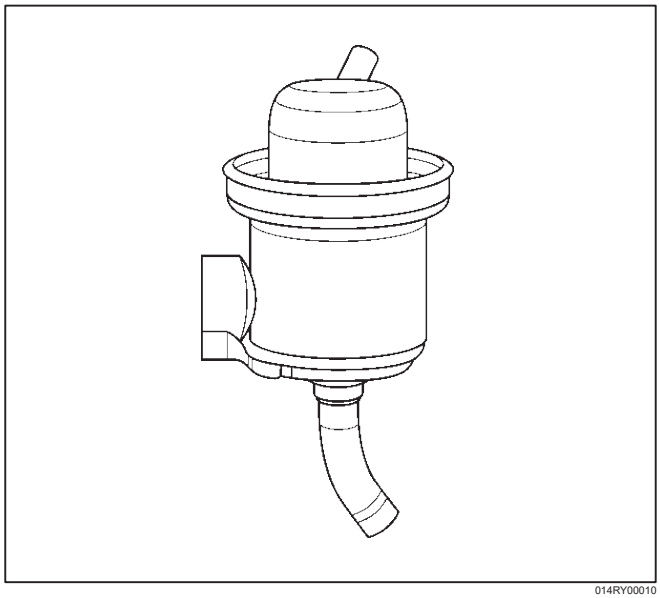
The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that fuel injector is “ON.” The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a “closed loop” system.

The PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called “modes.” All modes are controlled by the PCM.

## Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm-operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separtely.

If the pressure is too low, poor performance and a DTC P0131, DTC P0151,DTC P0171 or DTC P1171 will be the result. If the pressure is too high, excessive odor and/or a DTC P0132, DTC P0152,DTC P0172 will be the result. Refer to *Fuel System Diagnosis* for information on diagnosing fuel pressure conditions.



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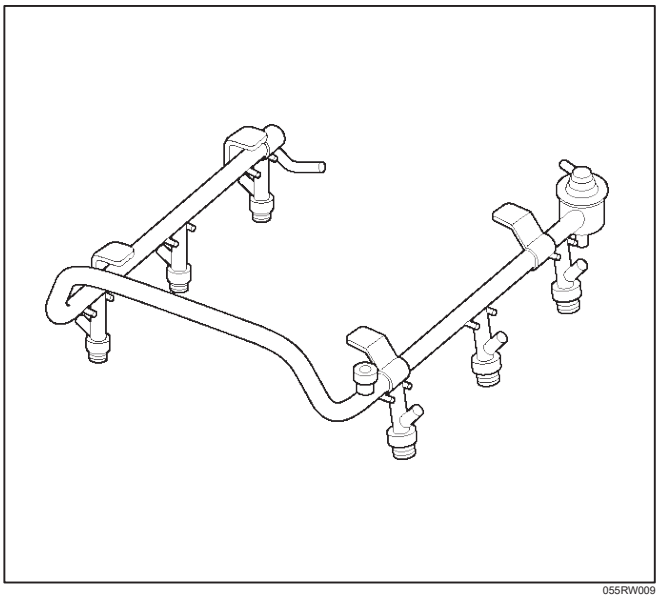
## Fuel Pump Electrical Circuit

When the key is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to build up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58 X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in-tank fuel pump.

An inoperative fuel pump will cause a “no-start” condition. A fuel pump which does not provide enough pressure will result in poor performance.

## Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure regulator. The fuel pressure regulator maintains a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



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## Run Mode

The run mode has the following two conditions:

- Open loop
- Closed loop

When the engine is first started the system is in “open loop” operation. In “open loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAF sensors.

The system remains in “open loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start-up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters “closed loop” operation. In “closed loop,” the PCM calculates the air/fuel ratio (injector on-time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

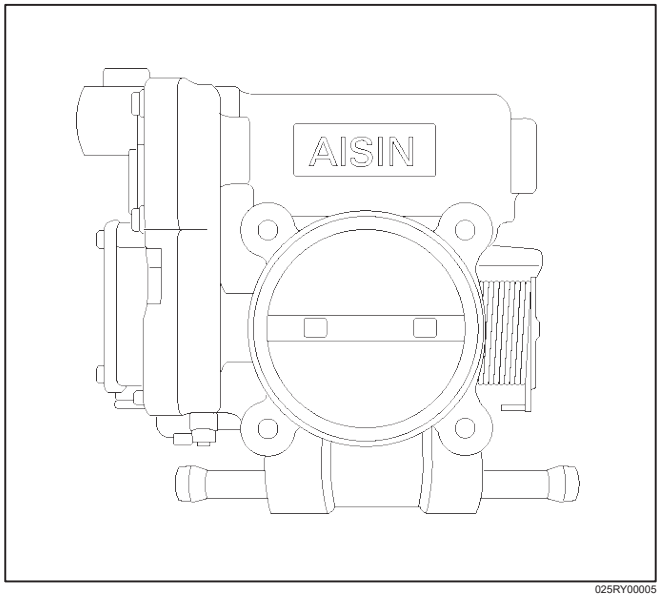
## Starting Mode

When the ignition is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

### Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor are also mounted on the throttle body. Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components.
Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.



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## General Description (Electronic Ignition System)

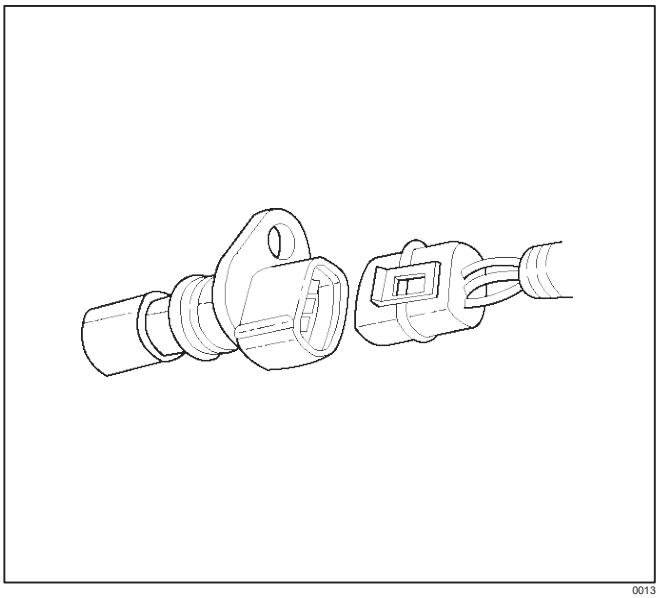
### Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. Refer to *Electronic Ignition System* section for additional information.

### Electronic Ignition

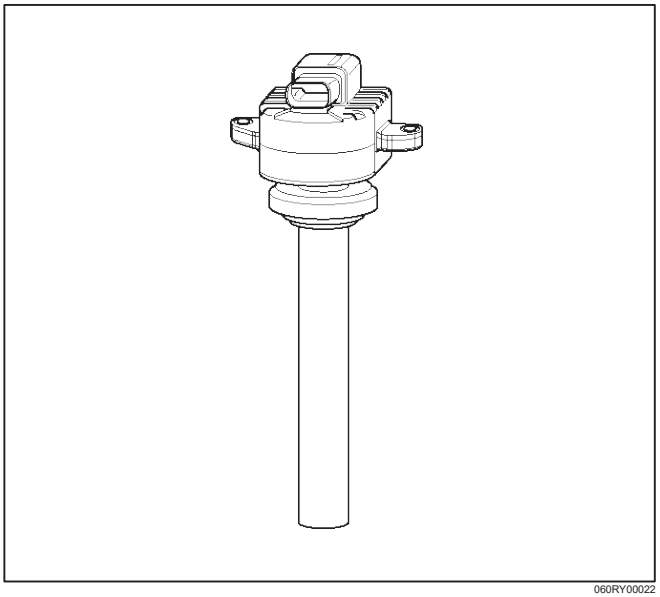
The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.


0013

### Ignition Coils

A separate coil-at-plug module is located at each spark plug. The coil-at-plug module is attached to the engine with two screws. It is installed directly to the spark plug by an electrical contact inside a rubber boot. A three-way connector provides 12-volt primary supply from the 15-amp ignition fuse, a ground-switching trigger line from the PCM, and a ground.

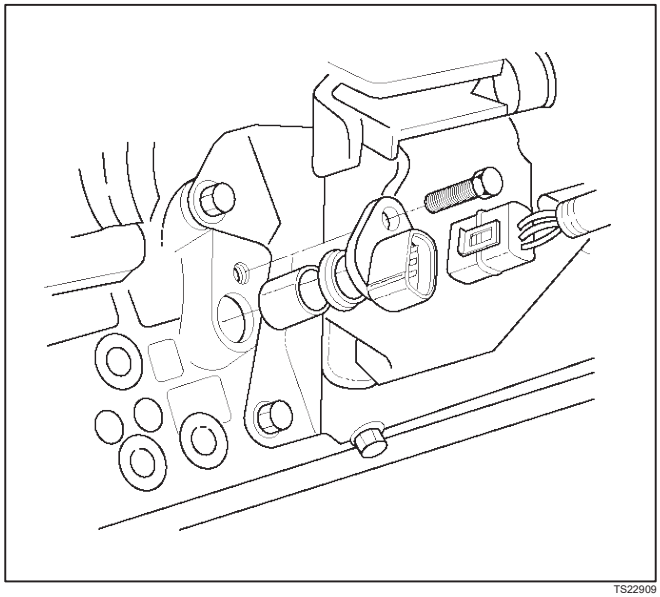

060RY00022

### Ignition Control

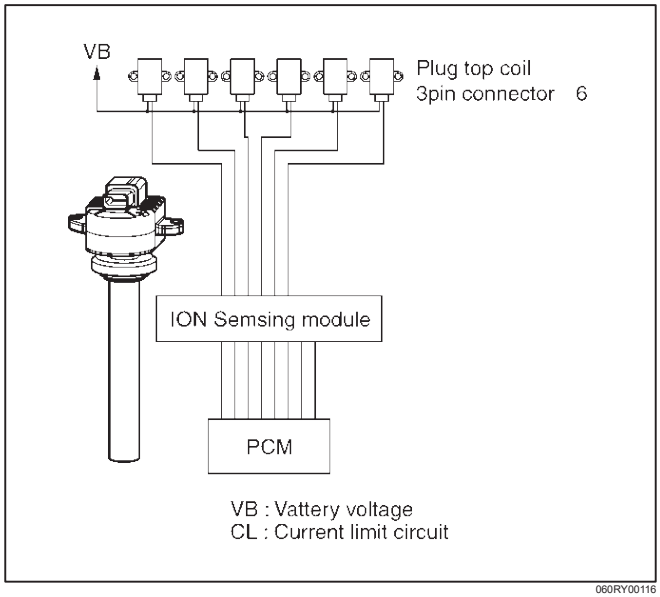
The ignition control (IC) spark timing is the PCM's method of controlling the spark advance and the ignition dwell.
The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

- Engine speed.
- Crankshaft position (58X reference).
- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- ION sensing module.
- Park/Neutral position (PRNDL input).

- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.
- The crankshaft position (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.


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Based on these sensor signals and engine load information, the PCM sends 5V to each ignition coil.



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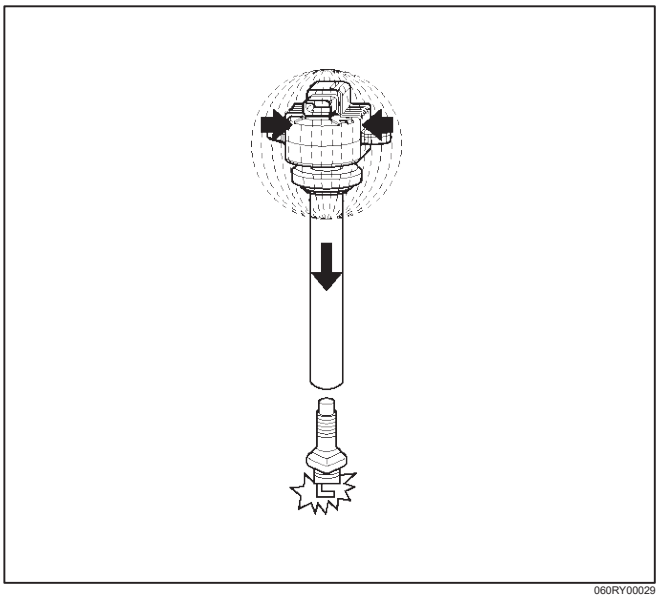
This module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The Throttle PCM controls ignition timing and dwell time.

Continuity and out-or-range value check:

This diagnosis detects open circuit or short-circuiting in the Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

Diagnosis enabling conditions are as follows:

- RPM is higher than the specified threshold.
- EST line is enabled.


060RY00029

## Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5-volt output signal to the ignition control (IC) module. Each spark plug has its own primary and secondary ignition coil assembly (”coil-at-plug”) located at the spark plug itself. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil-at -plug module. When the PCM shuts off the 5-volt signal to the ION sensing module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture.

The circuit between the PCM and the ignition coil is monitored for open circuits, shorts to voltage, and shorts to ground. If the PCM detects one of these events, it will set one of the following DTCs:

- P0351: Ignition coil Fault on Cylinder #1
- P0352: Ignition coil Fault on Cylinder #2
- P0353: Ignition coil Fault on Cylinder #3
- P0354: Ignition coil Fault on Cylinder #4
- P0355: Ignition coil Fault on Cylinder #5
- P0356: Ignition coil Fault on Cylinder #6

## Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Mass air flow (MAF) sensor.
- PRNDL input from transmission range switch.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS) .

- Crankshaft position (CKP) sensor.

## Spark Plug

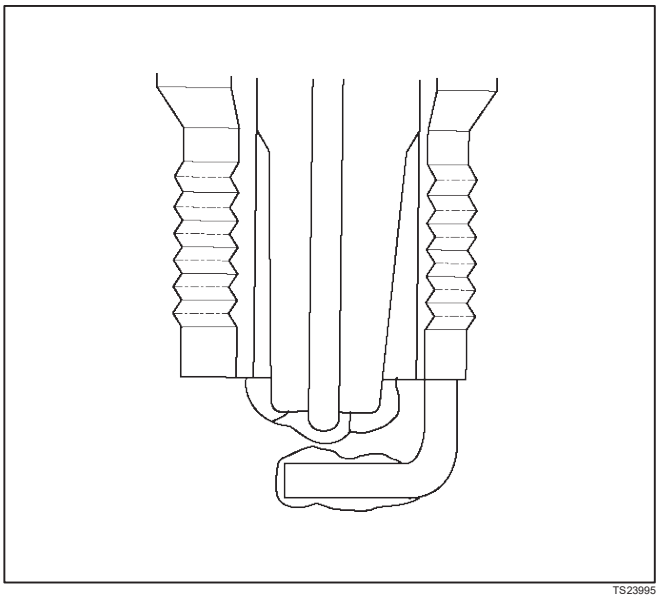
Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequency fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to *Maintenance and Lubrication* section.

Normal spark plug operation will result in brown to grayish-tan deposits appearing on the insulator portion of the spark plug. A small amount of red-brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by-products of fuels and lubricating oils with additives. Some electrode wear will also occur. Engines which are not running properly are often referred to as “misfiring.” This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Refer to *DTC P0300*. Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as “pre-ignition.”

Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.

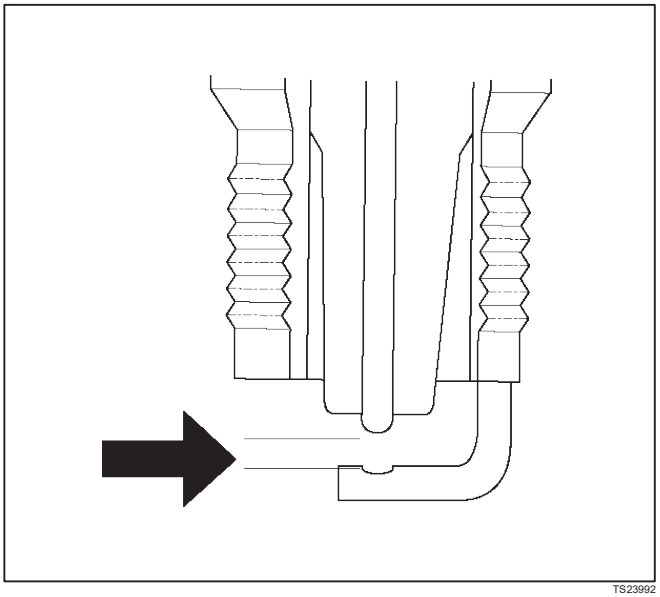
Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause. Refer to DTC P0172.

Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break-in of new or newly overhauled engines. Deposit fouling of the spark plug occurs when the normal red-brown, yellow or white deposits of combustion by products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.



TS23995

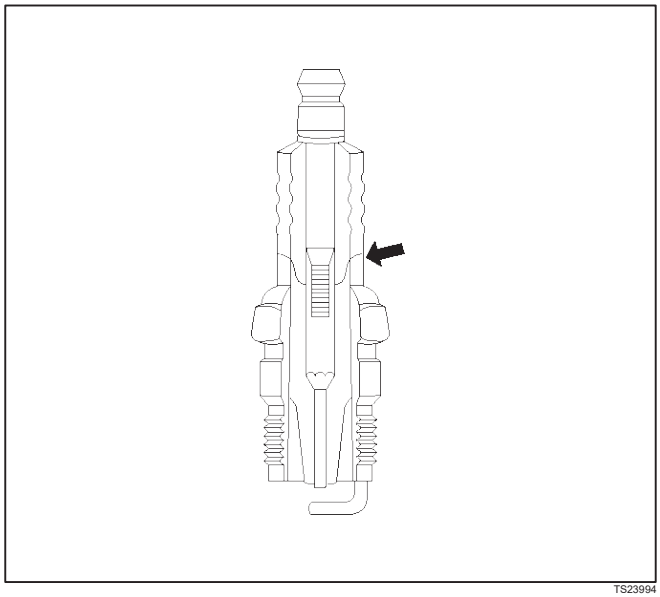
Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.



TS23992

Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact

between the seats. In extreme cases, exhaust blow-by and damage beyond simple gap wear may occur.
Cracked or broken insulators may be the result of improper installation, damage during spark plug re-gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.


TS23994

# A/C Clutch Diagnosis

## A/C Clutch Circuit Operation

A 12-volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.
The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The throttle is greater than 90%.
- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119°C (246°F).
- The IAT is less than 5°C (41°F).
- The throttle is more than 80% open.

## A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improvises idle quality during compressor clutch engagement.
- It improvises wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

- The A/C control head.
- The A/C refrigerant pressure switches.
- The A/C compressor clutch.
- The A/C compressor clutch relay.
- The PCM.

## A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for A/C electrical system.

# General Description (Evaporative (EVAP) Emission System)

## EVAP Emission Control System Purpose

The basic evaporative emission (EVAP) control system used on all vehicles is the charcoal canister storage method. Gasoline vapors from the fuel tank flow into the canister through the inlet labeled “TANK.” These vapors are absorbed into the activated carbon (charcoal) storage device (canister) in order to hold the vapors when the vehicle is not operating. The canister is purged by PCM control when the engine coolant temperature is over 60°C (140°F), the IAT reading is over 10°C (50°F), and the engine has been running. Air is drawn into the canister through the air inlet grid. The air mixes with the vapor and the mixture is drawn into the intake manifold.

## EVAP Emission Control System Operation

The EVAP canister purge is controlled by a solenoid valve that allows the manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge on). The EVAP purge solenoid control is pulse-width modulated (PWM) (turned on and off several times a second). The duty cycle (pulse width) is determined by engine operating conditions including load, throttle positron, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM. The output is commanded when the appropriate conditions have been met. These conditions are:

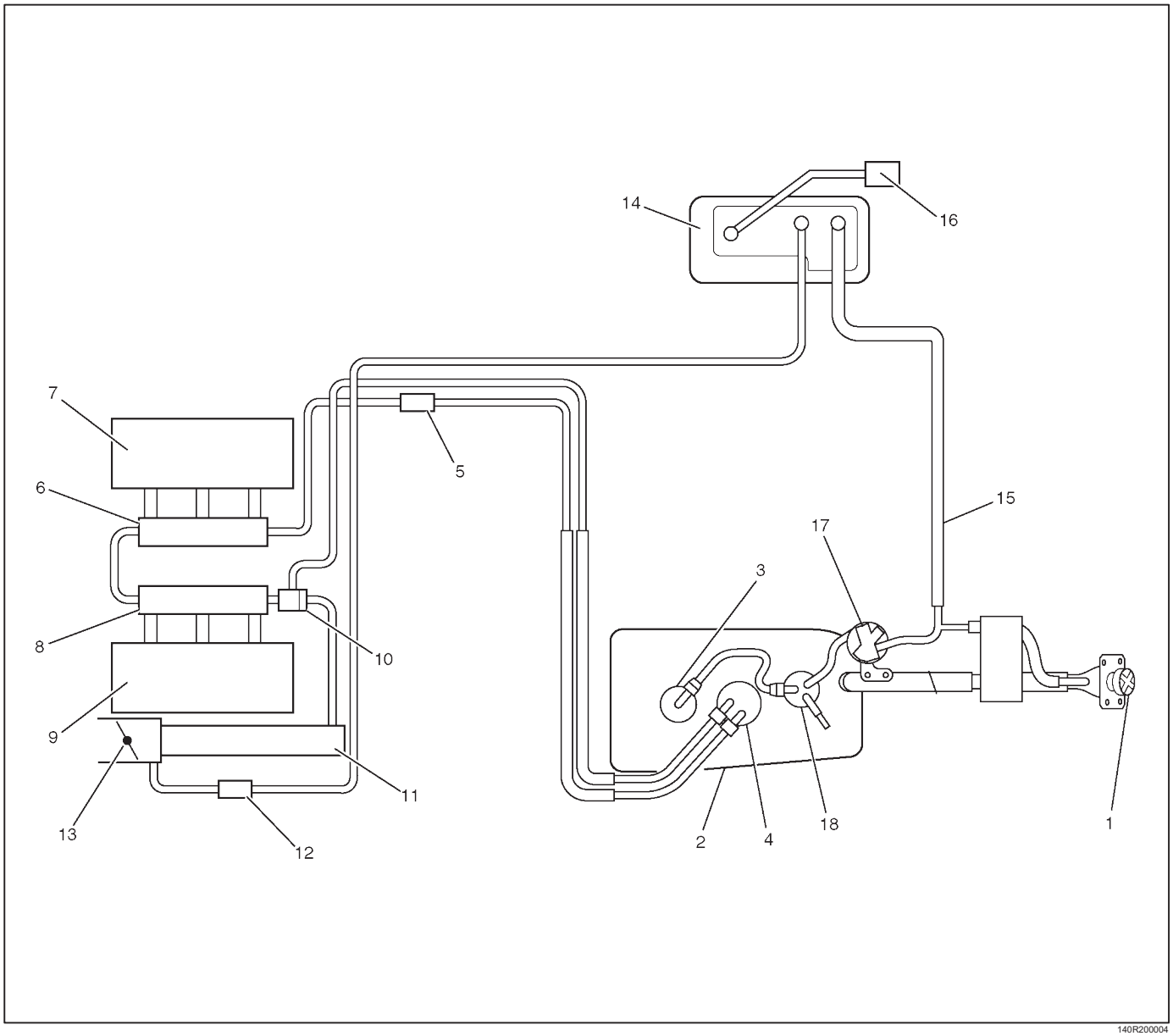
- The engine is fully warmed up.
- The engine has been running for a specified time.
- The IAT reading is above 10°C (50°F).

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441.
Poor idle, stalling and poor driveability can be caused by:

- A malfunctioning purge solenoid.
- A damaged canister.
- Hoses that are split, cracked, or not connected properly.

## Enhanced Evaporative Emission Control System

The basic purpose of the Enhanced Evaporative Emissions control system is the same as other EVAP systems. A charcoal-filled canister captures and stores gasoline fumes. When the PCM determines that the time is right, it opens a purge valve which allows engine vacuum to draw the fumes into the intake manifold.
The difference between this and other systems is that the PCM monitors the vacuum and/or pressure in the system to determine if there is any leakage. If the PCM determines that the EVAP system is leaking or not functioning properly, it sets a Diagnostic Trouble Code (DTC) in the PCM memory.
The enhanced EVAP system is required to detect evaporative fuel system leaks as small as 0.020 in. (1.0 mm) between the fuel filler cap and purge solenoid. The system can test the evaporative system integrity by applying a vacuum signal (ported or manifold) to the fuel tank to create a small vacuum. The PCM then monitors the ability of the system to maintain the vacuum. If the vacuum remains for a specified period of time, there are no evaporative leaks and a PASS report is sent to the diagnostic executive. If there is a leak, the system either will not achieve a vacuum, or a vacuum cannot be maintained. Usually, a failure can only be detected after a cold start with a trip of sufficient length and driving conditions to run the needed tests. The enhanced EVAP system diagnostic will conduct up to eight specific sub-tests to detect fault conditions. If the diagnostic fails a sub-test, the PCM will store a Diagnostic Trouble Code (DTC) to indicate the type of detected.




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**Legend**

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve (EVAP Purge Solenoid)
(13) Throttle Valve
(14) Canister (EVAP Canister)
(15) Vent Hose
(16) Vent Solenoid Valve
(17) Separator
(18) Shut off Valve (With Over Pressure Relief Valve) and Vapor Pressure Sensor

**Electrical Components**

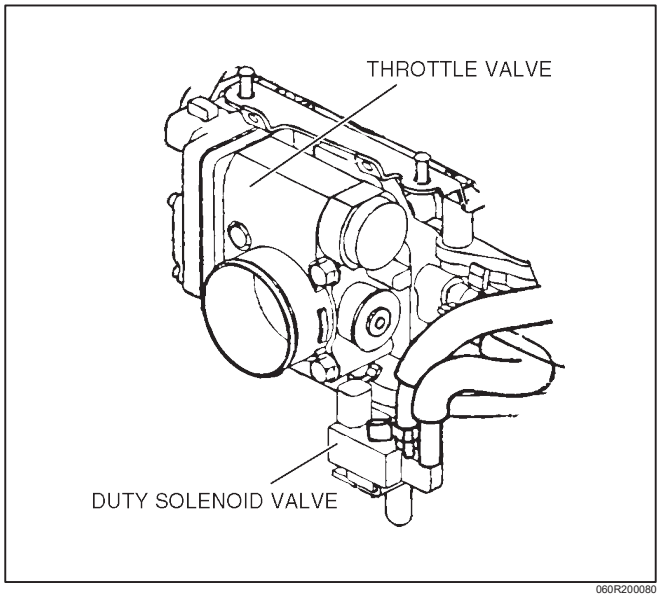
The electrical components that make up the enhanced EVAP system are:

- Fuel Tank (Vapor) Pressure Sensor. The fuel tank pressure sensor is a three-wire strain gauge sensor similar to a common MAP sensor. However, the fuel tank pressure sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure.

  The sensor mounts at the top of the fuel pump assembly. A three-wire electrical harness connects it to the PCM. The PCM supplies a five-volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

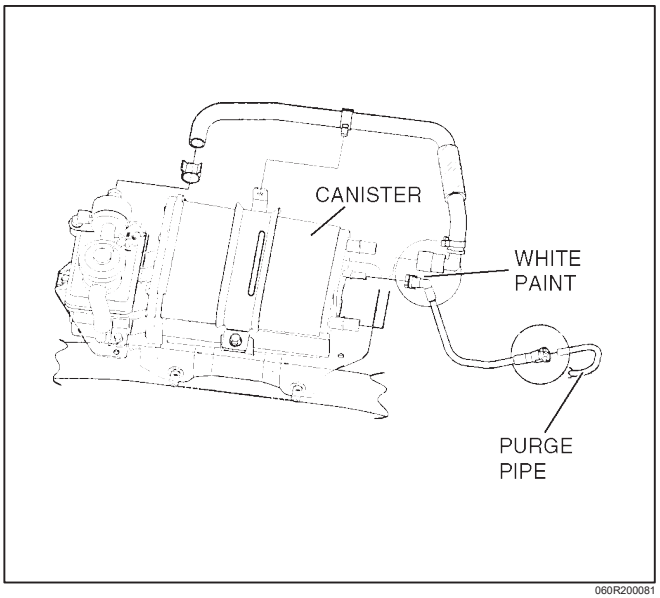
  When the air pressure in the fuel tank is 4.5 in. H2O (1.25 kPa), the sensor output voltage will be 0.5 ± 0.2 V. When there is neither vacuum nor pressure in the fuel tank, the sensor voltage will be 1.5 V. At –14 in. H2O (–3.75 kPa), the sensor voltage will be 4.5 ± 0.2 V.

- EVAP Canister Purge Solenoid. Normally closed, the purge solenoid opens upon the PCM's signal to allow engine vacuum to purge gasoline fumes from the canister. Mounted on the water pipe to front of the engine assembly.



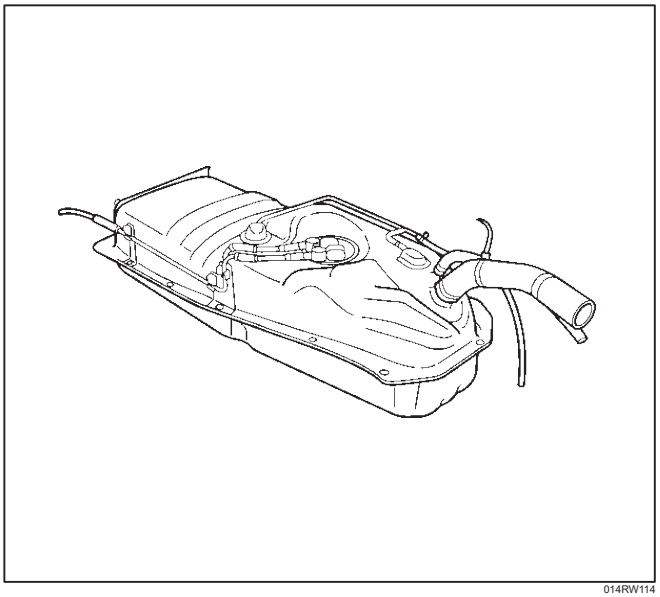
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- EVAP Canister Vent Solenoid. Located next to the canister, the vent solenoid opens to allow air into the EVAP system. Fresh air is necessary to completely remove gasoline fumes from the canister during purge. The EVAP vent solenoid closes to seal off the evaporative emissions system for leak testing.

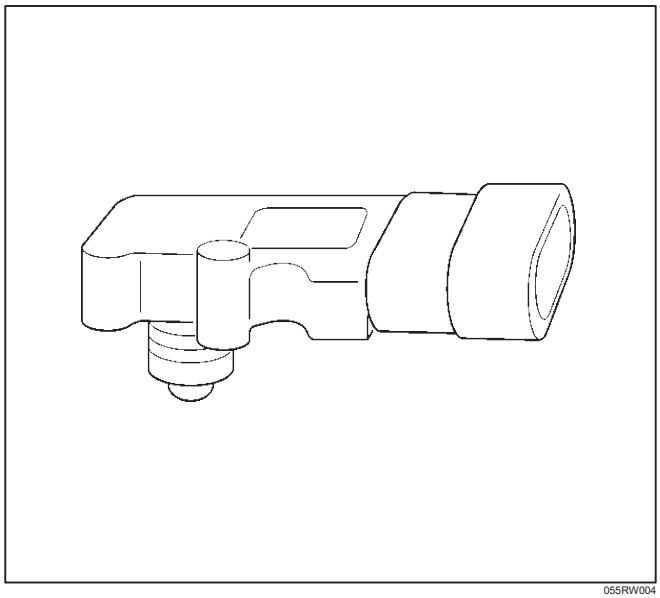


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- Fuel Level Sensor. The fuel level sensor is an important input to the PCM for the enhanced EVAP system diagnostic. The PCM needs fuel level information to know the volume of fuel in the tank. The fuel level affects the rate of change of air pressure in the EVAP system. Several of the enhanced EVAP system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is less than 15% or more than 85% full. Be sure to diagnose any Fuel Level Sensor DTCs first, as they can cause other DTCs to set.

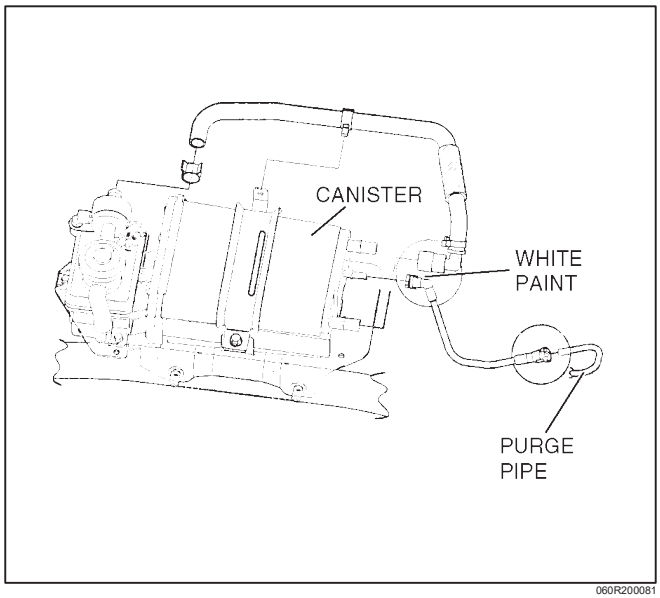

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- Manifold Absolute Pressure (MAP) Sensor. The PCM compares the signals from the fuel tank pressure sensor and the MAP sensor to ensure that a relative vacuum is maintained the EVAP system.


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**Non-Electrical Components**

- Purge/Vacuum Hoses. Made of rubber compounds, these hoses route the gasoline fumes from their sources to the canister and from the canister to the intake air flow.
- EVAP Canister. Mounted on a bracket ahead of the fuel tank, the canister stores fuel vapors until the PCM determines that engine conditions are right for them to be removed and burned.
- Fuel Tank. The tank has a built-in air space designed for the collection of gasoline fumes.



060R200081

- Vacuum Source. The vacuum source is split between two ports, one on either side of the throttle body.
- Fuel Cap. The fuel cap is designed to be an integral part of the EVAP system.

**System Fault Detection**

The EVAP leak detection strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor. At an appropriate time, the EVAP purge solenoid and the EVAP vent solenoid are turned “ON,” allowing the engine vacuum to draw a small vacuum on the entire evaporative emission system.

After the desired vacuum level has been achieved, the EVAP purge solenoid is turned “OFF,” sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated.

Leaks can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP purge solenoid
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

A restricted or blocked EVAP vent path is detected by drawing vacuum into the EVAP system, turning “OFF” the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid “OPEN,” EVAP purge Pulse Width Modulate (PWM) “0%”) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage like this will set DTC P0446 and can be caused by the following conditions:

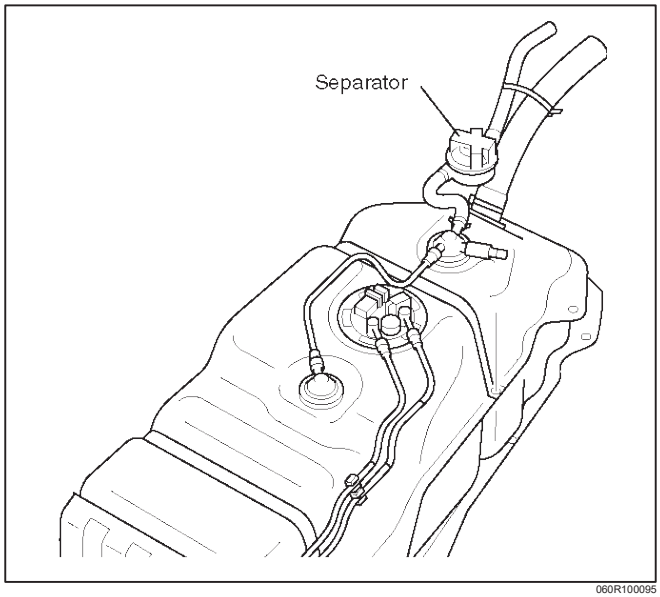
- Faulty EVAP vent solenoid (stuck closed)
- Plugged, kinked or pinched vent hose
- Shorted EVAP vent solenoid driver circuit
- Plugged EVAP canister

The PCM supplies a ground to energize the purge solenoid (purge “ON”). The EVAP purge control is PWM, or turned “ON” and “OFF,” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid “ON” and the EVAP purge solenoid “OFF” (EVAP vent solenoid “CLOSED,” EVAP purge PWM “0%”). If fuel tank vacuum level increases during the test, a continuous purge flow condition is indicated, which will set a DTC P1441. This can be cause by the following conditions:

- EVAP purge solenoid leaking
- EVAP purge and engine vacuum lines switched at the EVAP purge solenoid
- EVAP purge solenoid driver circuit grounded

**Fuel vapor recovery system**



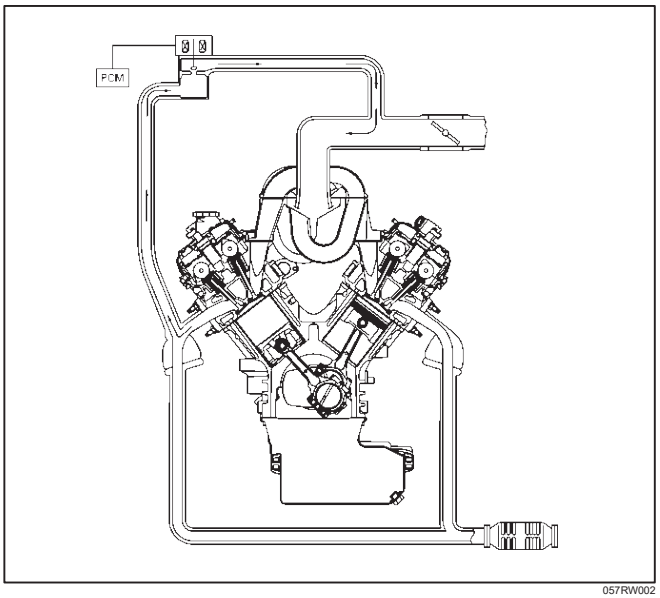

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Separator attaches after hose evaporative fuel. It protects EVAP Canister from liquid fuel. It guarantees EVAP Canister performance. When vibration bounces fuel level, liquid fuel will accrete to EVAP Canister. It separates liquid fuel.

# General Description (Exhaust Gas Recirculation (EGR) System)

## EGR Purpose

The exhaust gas recirculation (EGR) system is use to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.




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## Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

## Linear EGR Control

The PCM monitors the EGR actual positron and adjusts the pintle position accordingly. The uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

## Linear EGR Valve Operation and Results of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a Tech 2 as “Actual EGR Pos.” “Actual EGR Pos.” should always be near the commanded EGR position (”Desired EGR Pos.”). If a problem with the EGR system will not allow the PCM to control the pintle position properly, DTC P1406 will set. The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTCs P0401 and/or P1406 are set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

- Warm engine operation.
- Above-idle speed.

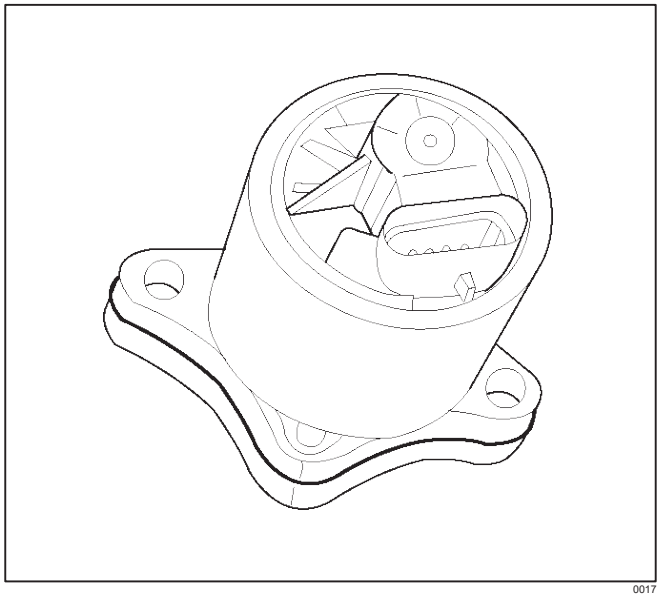
Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.

- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR flow test).
- Poor fuel economy.


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### EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to endure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P1406.

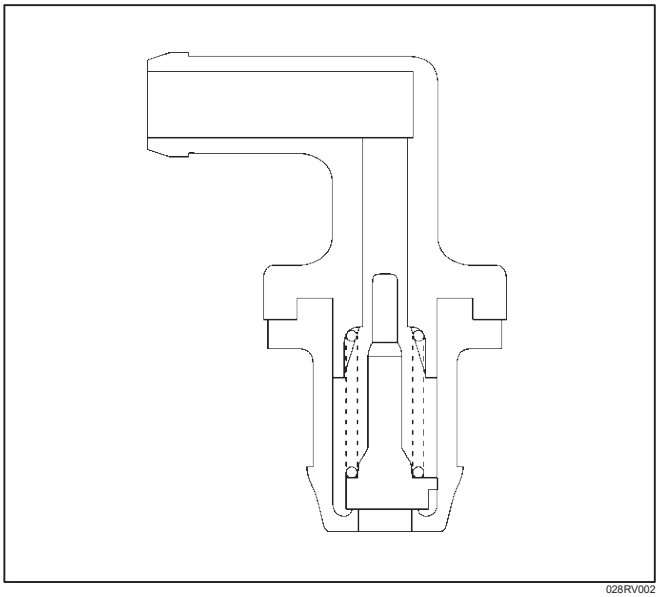
## General Description (Positive Crankcase Ventilation (PCV) System)

### Crankcase Ventilation System Purpose

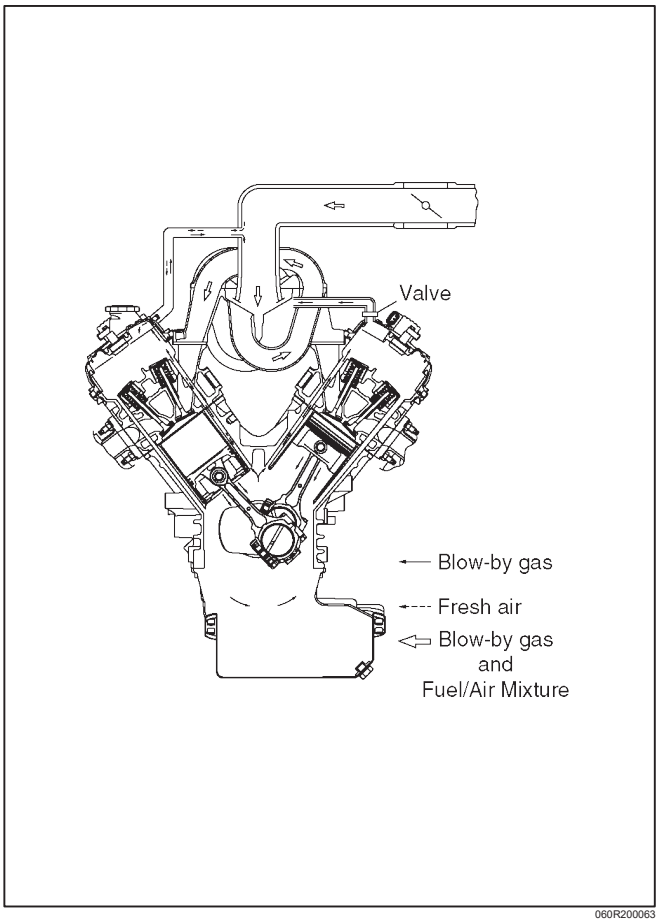
The crankcase ventilation system is use to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow-by gases. This mixture is then passed through the positive crankcase ventilation (PCV) valve into the common chamber.

### Crankcase Ventilation System Operation

The primary control is through the positive crankcase ventilation (PCV) valve. The PCV valve meters the flow at a rate that depends on the intake vacuum. The PCV valve restricts the flow when the inlet vacuum is highest. In addition, the PCV valve can seal the common chamber off in case of sudden high pressure in the crankcase.


028RV002

While the engine is running, exhaust fuses and small amounts of the fuel/air mixture escape past the piston rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



060R200063

During normal, part-throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

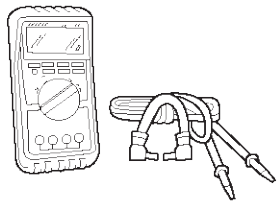
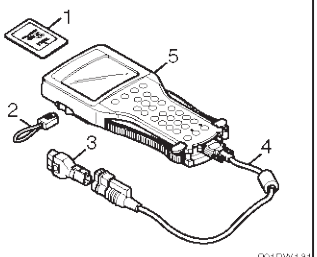
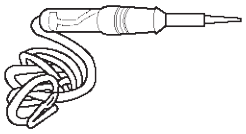
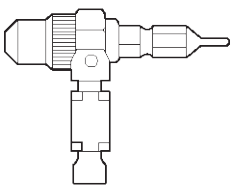
A plugged valve or PCV hose may cause the following conditions:

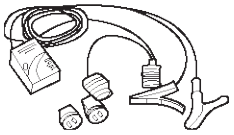
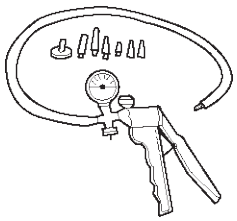
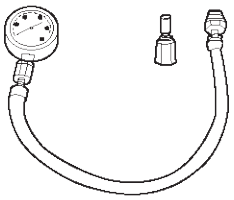
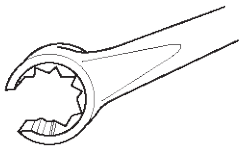
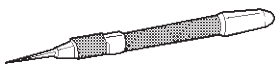
- Rough idle.
- Stalling of slow idle speed.
- Oil leaks.
- Sludge in the engine.

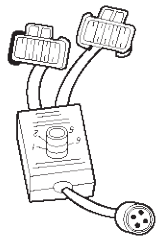
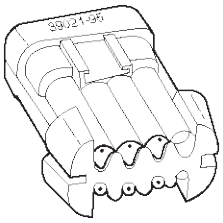
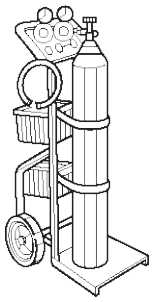
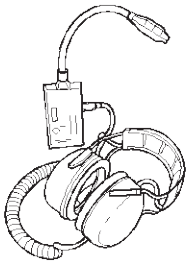
A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

## Special Tools

| ILLUSTRATION | **TOOL NO.** TOOL NAME |
|---|---|
|  | **J 39200** High Impedance Multimeter (Digital Voltmeter – DVM) |
|   | (1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH–2 |
|  | **J 34142-B** Unpowered Test Light |
|  | Connector Test Adapter Kit J 35616-A/BT-8637 |
|  | **J 26792/BT-7220-1** Spark Tester |
|  | **J 34730-E** Port Fuel Injection Diagnostic Kit |

| ILLUSTRATION | **TOOL NO.** TOOL NAME |
|---|---|
|  | **J 37027-A** IAC Motor Analyzer |
|  | **J 23738-A** Vacuum Pump with Gauge |
|  | **BT-8515/8515V** Exhaust Back Pressure Tester |
|  | **J 39194-B** Heated Oxygen Sensor Wrench |
|  | **J 35689-A** Terminal Remover |
|  | **J 28742-A** Weather Pack II Terminal Remover |

| ILLUSTRATION | **TOOL NO.** TOOL NAME |
|---|---|
|  | **J 39021-90** Injector Switch Box |
|  | **J 39021-65** Injector Test Light |
|  | **J 41413**[1] EVAP Pressure/Purge Diagnostic Station |
|  | **J 41416**[2] Ultrasonic Leak Detector |

1. J 41413 EVAP Pressure/Purge Diagnostic Station is a multipurpose tool which is used to perform several diagnostic procedures for enhanced emission testing. The station will accommodate a nitrogen gas filled cylinder which is used to pressurize the vehicle EVAP system for a leakdown test and leak location test when a vehicle is repaired for leakage in the enhanced evaporative emission control system. It also has two additional gauges (inches of mercury and inches of water) which are used to measure both source vacuum and EVAP canister purge vacuum to verify correct operation and vapor flow within the canister purge circuit.
2. J 41416 Ultrasonic Leak Detector is a microprocessor-based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the J 41413 EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the J 41416. The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.

AXIOM

# ENGINE

## ENGINE EXHAUST (6VE1 3.5L)

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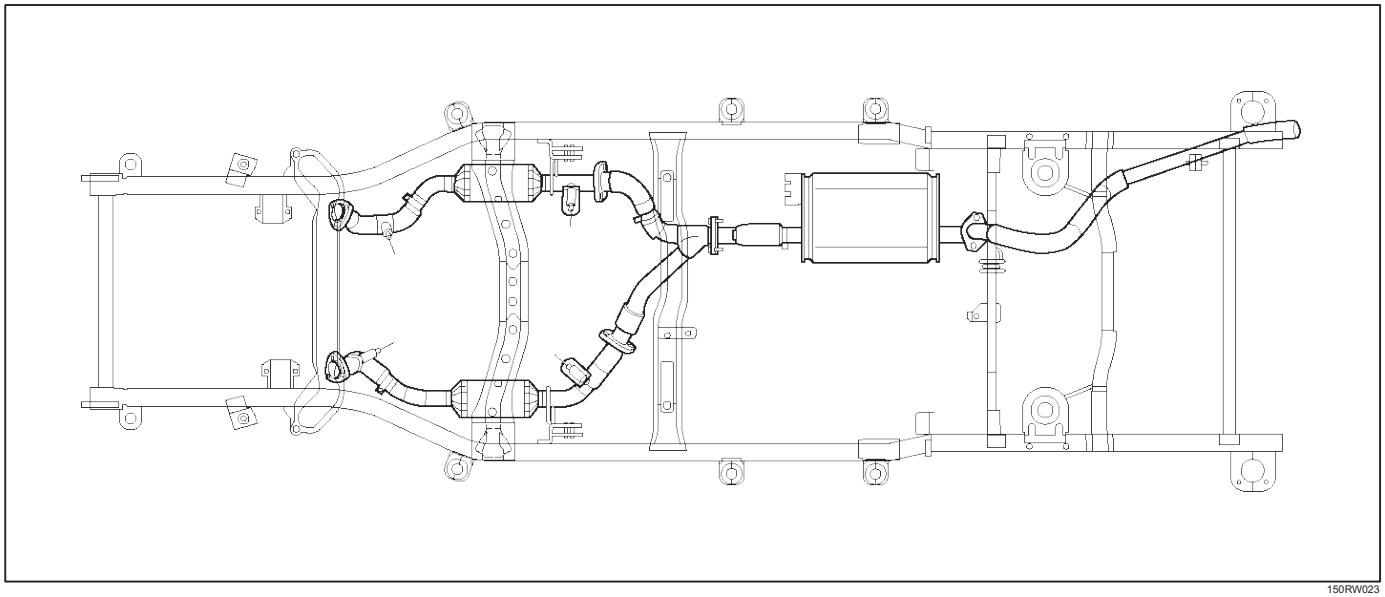

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## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# General Description



150RW023

When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

## Hangers

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

## Three Way Catalytic Converter

The three way catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust gas stream.

**CAUTION: The catalytic converter requires the use of unleaded fuel only.**

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

A dual bed monolith catalytic converter is used in combination with three way catalytic converter.

Catalytic Converter Types:

Three way (Reduction/Oxidation) catalyst

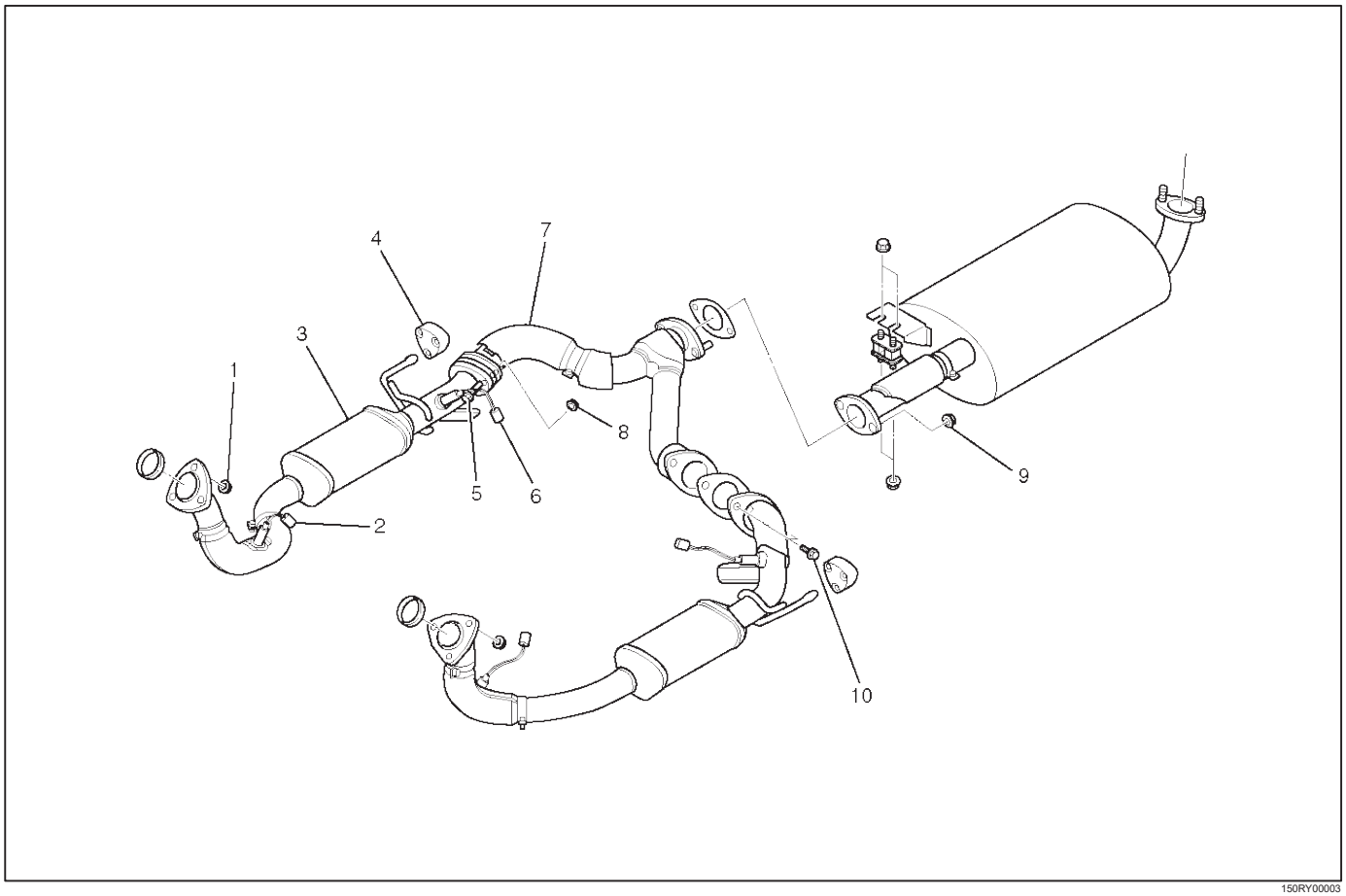
The catalyst coating on the three way (reduction) converter contains platinum and rhodium which lowers the levels of nitrous oxide (NOx) as well as hydrocarbons (HC) and carbon monoxide (Co).

## Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or catalytic converter is installed.

# Three Way Catalytic Converter RH and Forked Exhaust Pipe

## Three Way Catalytic Converter RH and Forked Exhaust Pipe and Associated Parts




150RY00003

**Legend**

(1) Front Exhaust Pipe Assembly Fixing Nuts
(2) $O_2$ Sensor Terminal Connector
(3) Three Way Catalytic Converter RH
(4) Mounting Rubber
(5) Forked Exhaust Pipe Fixing Bolts
(6) $O_2$ Sensor Terminal Connector
(7) Forked Exhaust Pipe
(8) Forked Exhaust Pipe Fixing Nuts
(9) Exhaust Silencer Fixing Nuts
(10) Forked Exhaust Pipe Fixing Bolts

## Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Disconnect $O_2$ sensor harness connectors (2) (6).
4. Remove the forked exhaust pipe fixing bolts and nuts (5) (8) (10) and the exhaust silencer fixing nuts (9), then remove the forked exhaust pipe (7) and the mass damper.
5. Remove the front exhaust pipe assembly fixing nuts (1) and the mounting rubber (4), then remove the three way catalytic converter (3).

## Installation

1. Install the three way catalytic converter (3) and the mounting rubber (4), and tighten the fixing nuts (1) to the specified torque.

   **Torque**

   **Nuts : 67 N·m (49 lb ft)**
2. Install the forked exhaust pipe (7), and tighten the fixing bolts (5) & nuts (8) (9) to the specified torque.

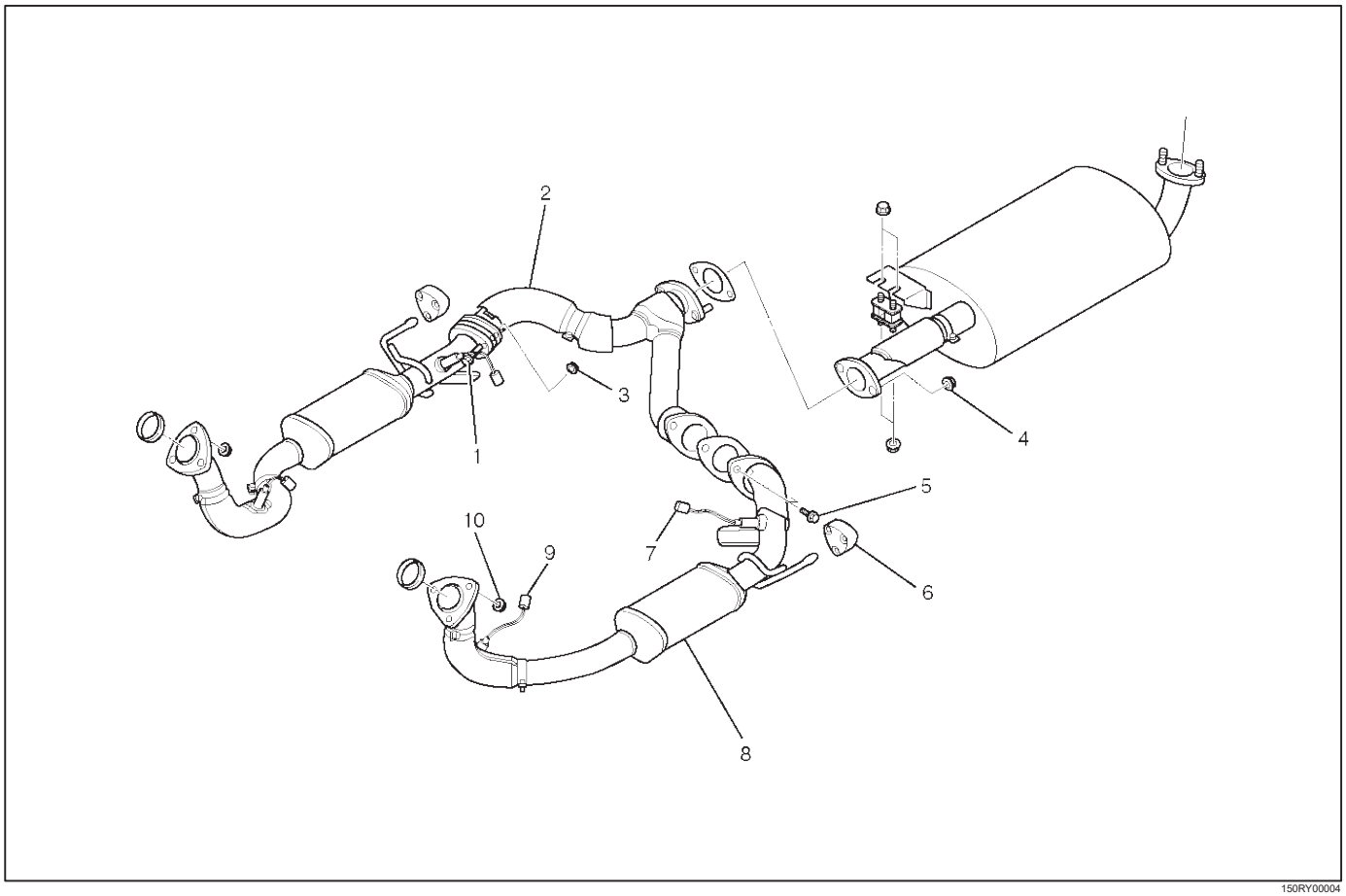
   **Torque**

   **Bolts&Nuts : 43 N·m (32 lb ft)**

   **Nuts : 43 N·m (32 lb ft)**
3. Connect the $O_2$ sensor connectors (2) (6).

# Three Way Catalytic Converter LH and Forked Exhaust Pipe

## Three Way Catalytic Converter LH and Forked Exhaust Pipe and Associated Parts




150RY00004

**Legend**

(1) Forked Exhaust Pipe Fixing Bolts
(2) Forked Exhaust Pipe
(3) Forked Exhaust Pipe Fixing Nuts
(4) Exhaust Silencer Fixing Nuts
(5) Forked Exhaust Pipe Fixing Bolts
(6) Mounting Rubber
(7) $O_2$ Sensor Terminal Connector
(8) Three Way Catalytic Converter LH
(9) $O_2$ Sensor Terminal Connector
(10) Front Exhaust Pipe Assembly Fixing Nuts

## Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Disconnect $O_2$ sensor harness connectors (7) (9).
4. Remove the forked exhaust pipe fixing bolts and nuts (1) (3) (5) and the exhaust silencer fixing nuts (4), then remove the forked exhaust pipe (2).
5. Remove the front exhaust pipe assembly fixing nuts (10) and the mounting rubber (6), then remove the three way catalytic converter (8).

## Installation

1. Install the three way catalytic converter (8) and the mounting rubber (6), and tighten the fixing nuts (10) to the specific torque.

   **Torque**

   **Nuts: 67 N·m (49 lb ft)**
2. Install the forked exhaust pipe (2) and tighten the fixing bolts (1) (5) and nuts (3) (4) to the specified torque.

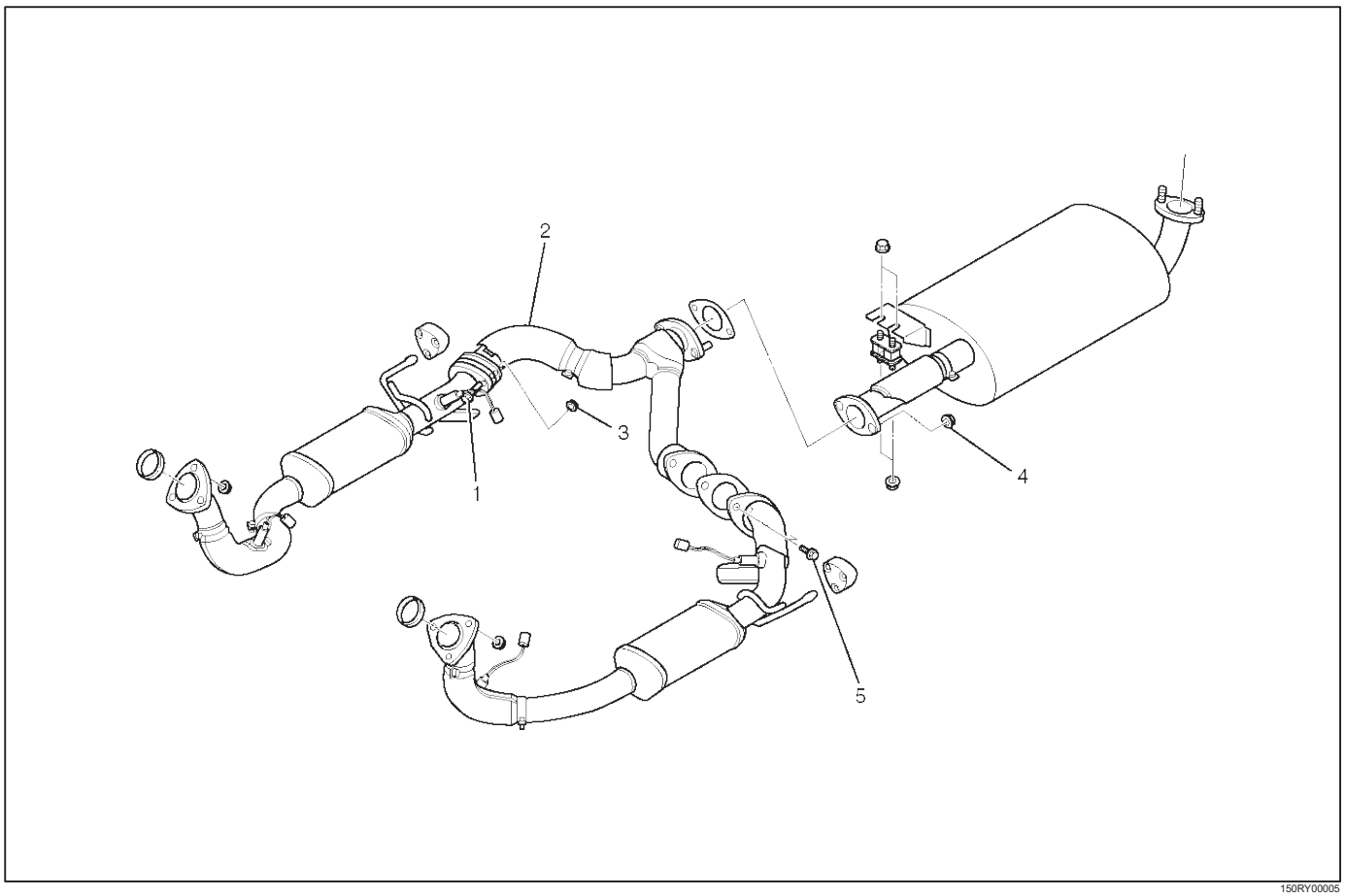
   **Torque**

   **Bolts&Nuts: 43 N·m (32 lb ft)**

   **Nuts: 43 N·m (32 lb ft)**
3. Connect the $O_2$ sensor connectors (7) (9).

# Forked Exhaust Pipe

## Forked Exhaust Pipe and Associated Parts




150RY00005

**Legend**

(1) Forked Exhaust Pipe Fixing Bolts
(2) Forked Exhaust Pipe
(3) Forked Exhaust Pipe Fixing Nuts
(4) Exhaust Silencer Fixing Nuts
(5) Forked Exhaust Pipe Fixing Bolts

## Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the forked exhaust pipe fixing bolts & nuts (1) (3) (5) and the exhaust silencer fixing nuts (4), then remove the forked exhaust pipe (2).

## Installation

1. Install the forked exhaust pipe (2), and tighten the fixing bolts (1) (5) and the nuts (3) (4) to the specified torque.

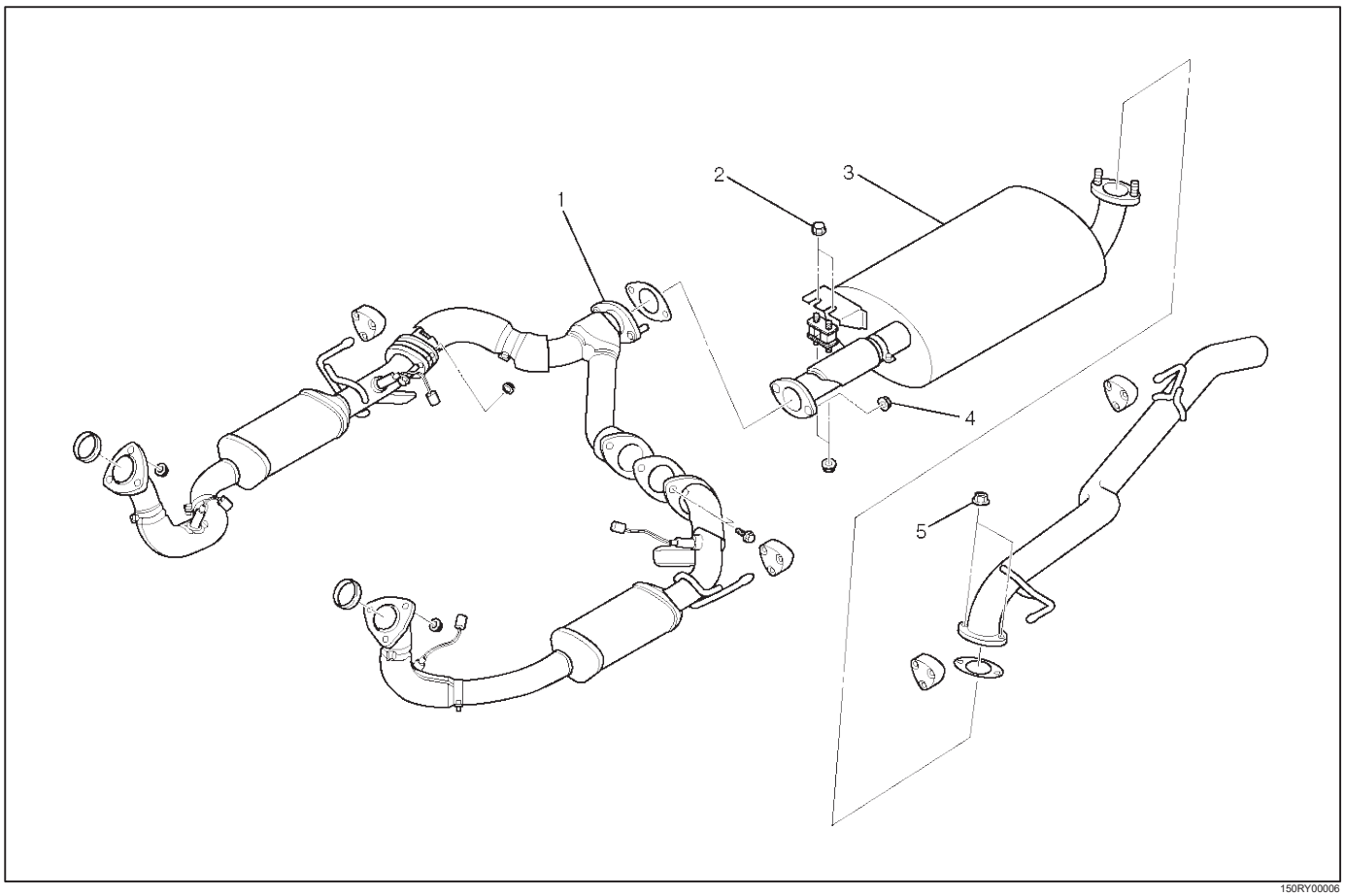
**Torque**

**Bolts&nuts : 43 N·m (32 lb ft)**

**Nuts : 43 N·m (32 lb ft)**

# Exhaust Silencer

## Exhaust Silencer and Associated Parts




**Legend**

(1) Forked Exhaust Pipe
(2) Support Rubber Fixing Nuts
(3) Exhaust Silencer
(4) Exhaust Silencer Fixing Nuts
(5) Rear Exhaust Pipe Fixing Nuts

## Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the support rubber fixing nuts (2), the exhaust silencer fixing nuts (4) and rear exhaust pipe fixing nuts (5), then remove the exhaust silencer (3).

## Installation

1. Install the exhaust silencer (3) and tighten the fixing nuts (4) (5) to the specified torque.

   **Torque**

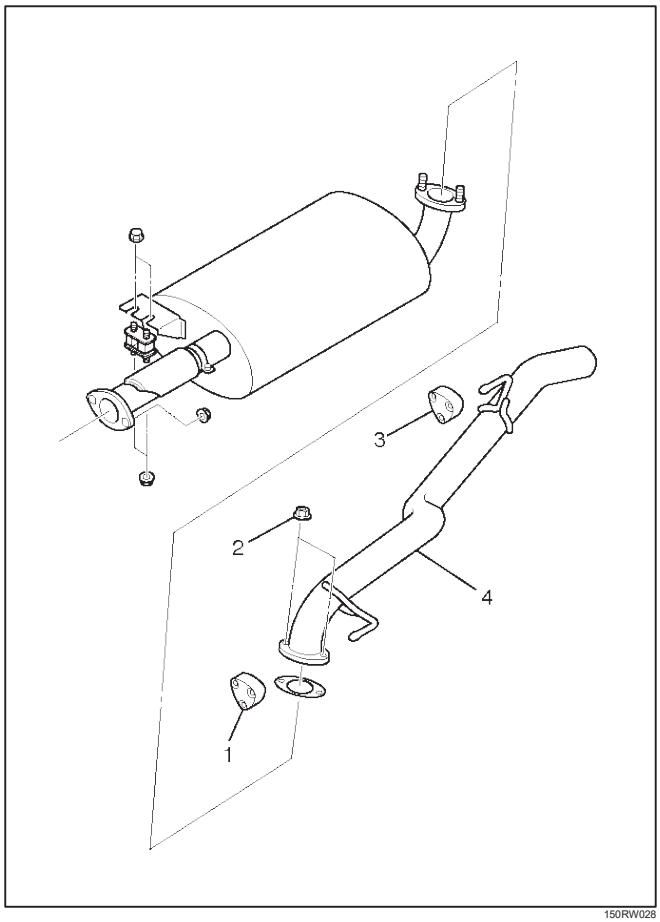
   **Nuts: 43 N·m (32 lb ft)**
2. Tighten the support rubber fixing nuts (2) to the specified torque.

   **Torque**

   **Bolts: 15 N·m (11 lb ft)**

# Rear Exhaust pipe

## Rear Exhaust pipe and Associated Parts




**Legend**

(1) Mounting Rubber
(2) Rear Exhaust Pipe Fixing Nuts
(3) Mounting Rubber
(4) Rear Exhaust Pipe

## Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the rear exhaust fixing nuts (2) and the mounting rubbers (1) (3), then remove the rear exhaust pipe (4).

## Installation

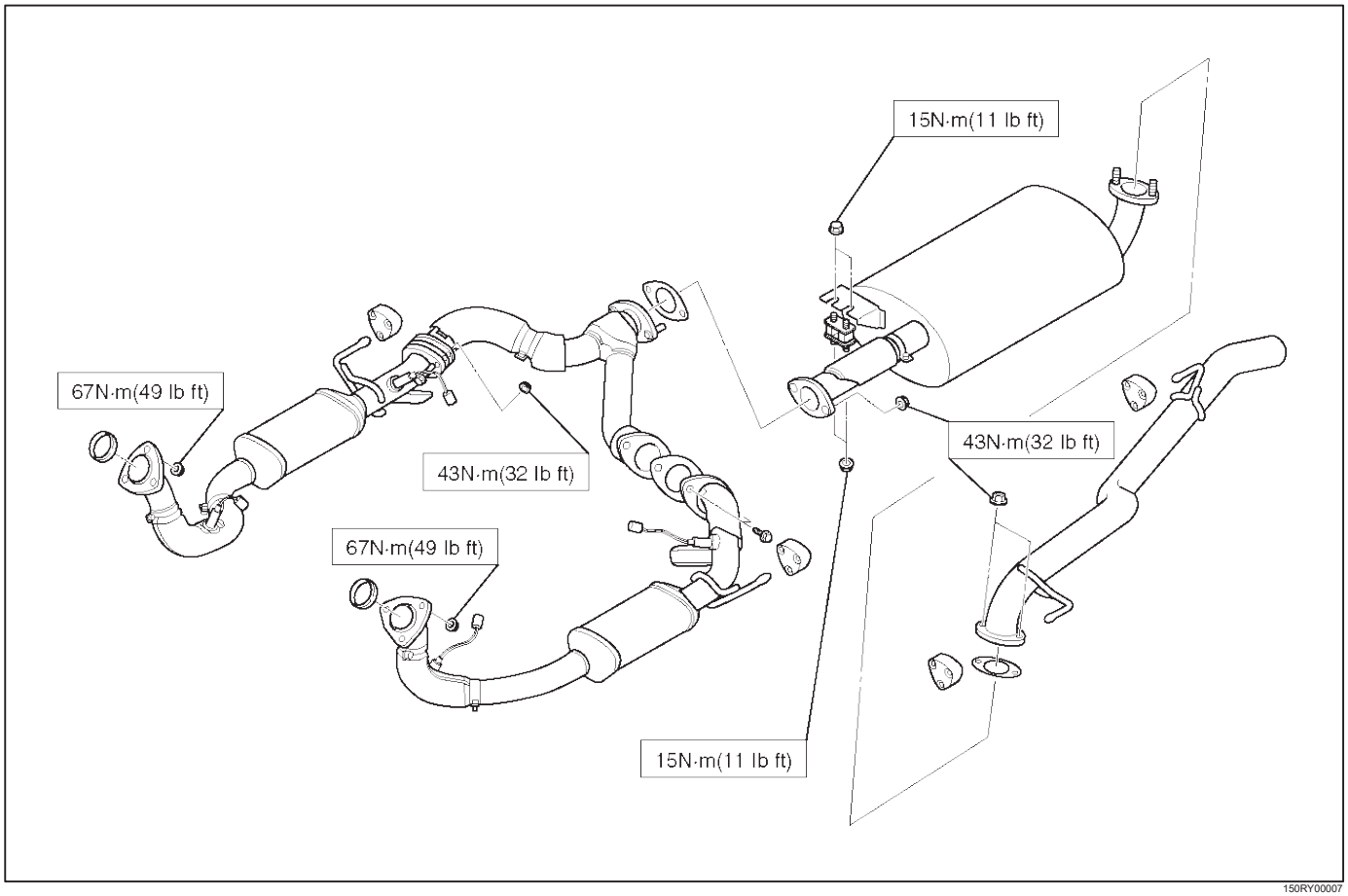
1. Install the rear exhaust pipe (4) and the mounting rubbers (1) (3), then tighten the fixing nuts (2) to the specified torque.

**Torque**

**Nuts: 43 N·m (32 lb ft)**

# Main Data and Specifications

## Torque Specifications



AXIOM

# ENGINE

## ENGINE LUBRICATION (6VE1 3.5L)

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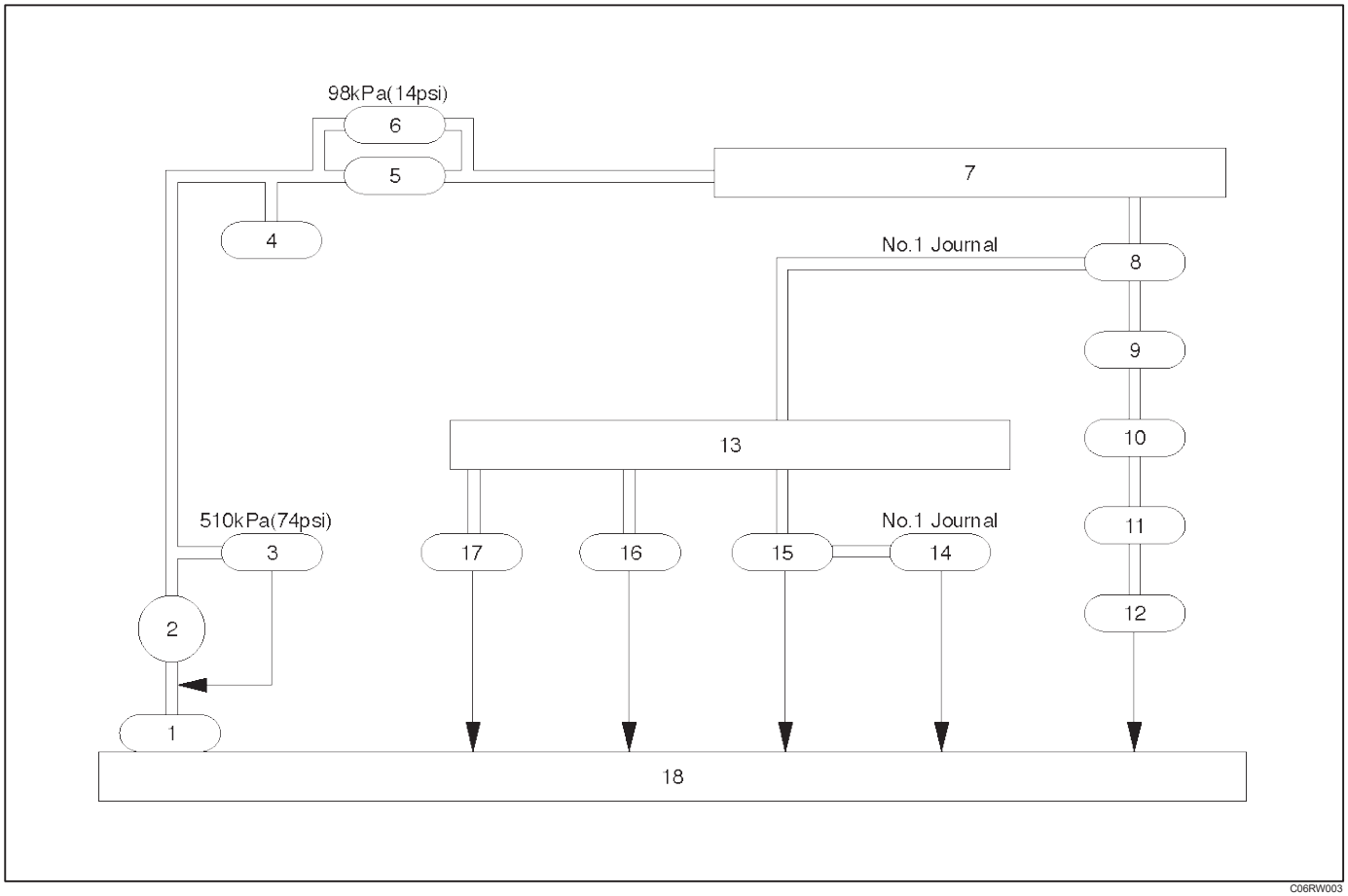

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# General Description



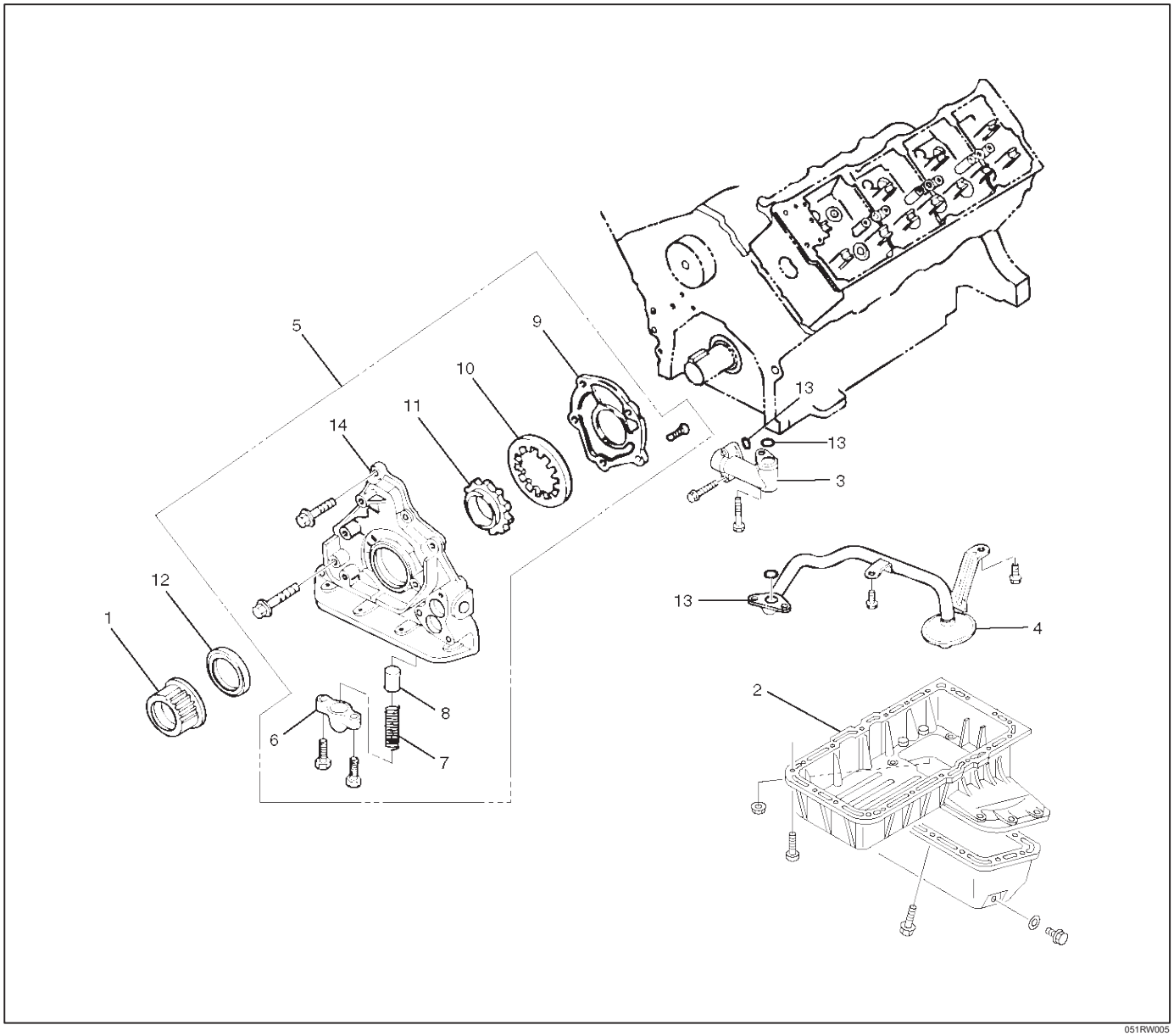

C06RW003

**Legend**

(1) Oil Strainer
(2) Oil Pump
(3) Relief Valve
(4) Oil Pressure Switch
(5) Oil Filter
(6) Safety Valve
(7) Oil Gallery
(8) Crankshaft Bearing
(9) Crankshaft
(10) Connecting Rod Bearing
(11) Connecting Rod
(12) Piston
(13) Oil Gallery; Cylinder Head
(14) Camshaft
(15) Camshaft Journal
(16) Front Journal; Camshaft Drive Gear
(17) Rear Journal; Camshaft Drive Gear
(18) Oil Pan

# Oil Pump

## Oil Pump and Associated Parts




051RW005

**Legend**

(1) Crankshaft Timing Pulley
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Pump Assembly
(6) Plug
(7) Spring
(8) Relief Valve
(9) Oil Pump Cover
(10) Driven Gear
(11) Drive Gear
(12) Oil Seal
(13) O-ring
(14) Oil Pump Body

## Disassembly

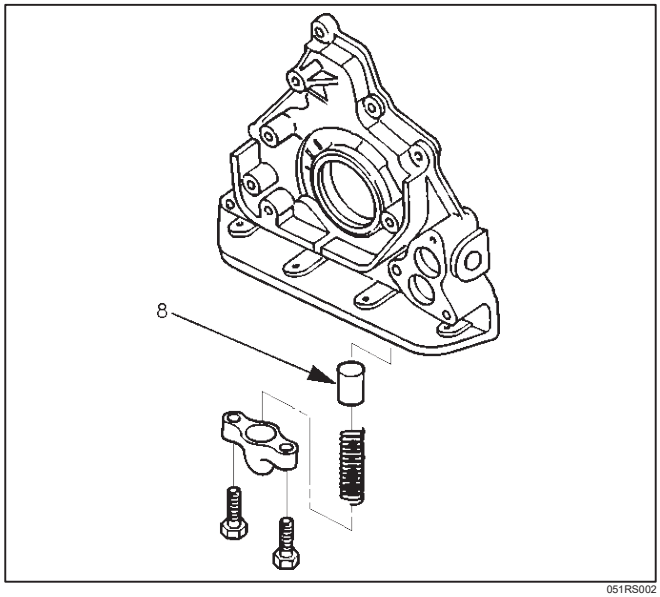
1. Remove crankshaft timing pulley.
2. Remove crankcase with oil pan.
3. Remove oil pipe.
4. Remove oil strainer.
5. Remove oil pump assembly.
6. Remove plug.
7. Remove spring.
8. Remove relief valve.
9. Remove oil pump cover.
10. Remove driven gear.
11. Remove drive gear.
12. Remove oil seal.
13. Remove O-ring.

## Inspection and Repair

**CAUTION: Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found during inspection.**

### Relief Valve

- Check to see that the relief valve slides freely.
- The oil pump must be replaced if the relief valve does not slide freely.
- Replace the spring and/or the oil pump assembly (5) if the spring is damaged or badly worn.



051RS002

### Body and Gears

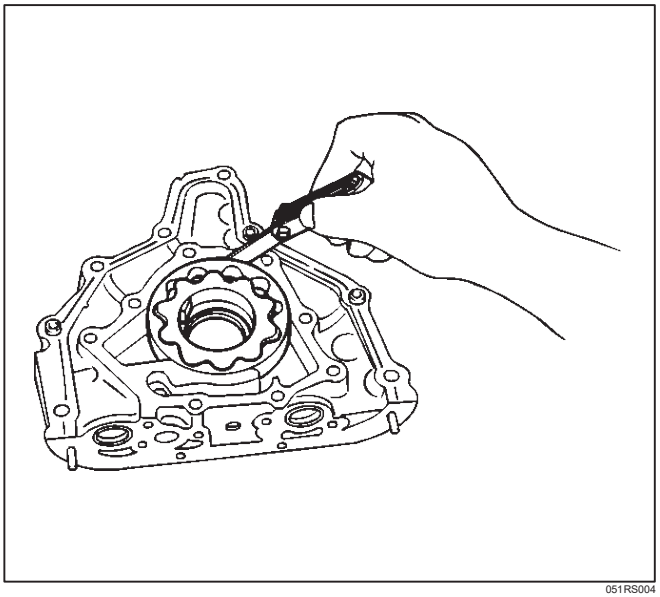
The pump assembly must be replaced if one or more of the conditions below is discovered during inspection.

- Badly worn or damaged driven gear (10).
- Badly worn drive gear (11) driving face.
- Badly scratched or scored body sliding face (14) or driven gear (10).
- Badly worn or damaged gear teeth.

Measure the clearance between the body and the driven gear with a feeler gauge.

**Standard : 0.10 mm–0.18 mm (0.0039 in.–0.0070 in)**

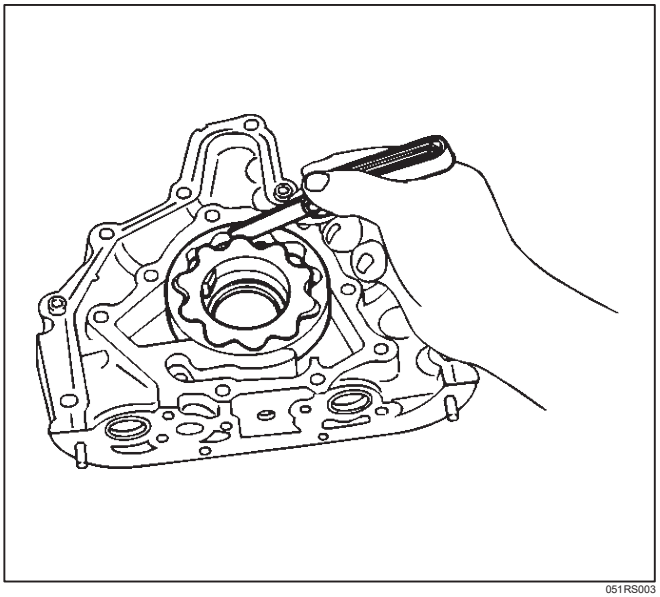
**Limit : 0.20mm (0.0079 in)**


051RS004

- Measure the clearance between the drive gear and driven gear with a feeler gauge.

**Standard : 0.11 mm–0.24 mm (0.0043 in–0.0094 in)**

**Limit : 0.35mm (0.0138 in)**

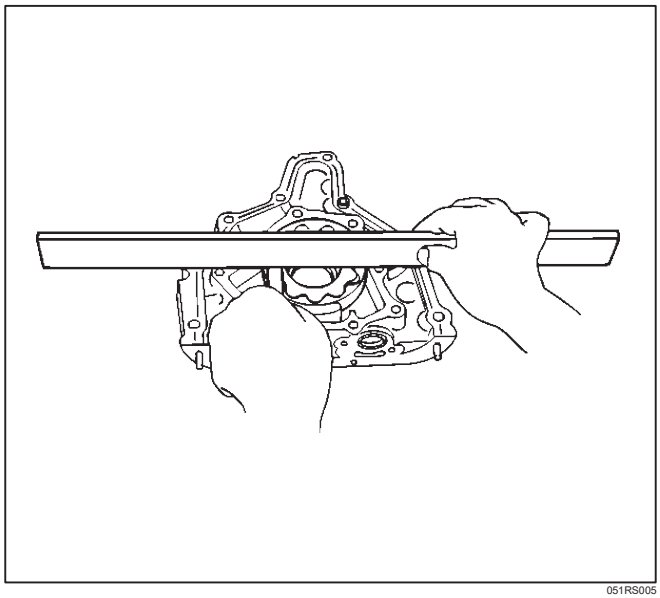

051RS003

- Measure the side clearance with a precision straight edge and a feeler gauge.

**Clearance**

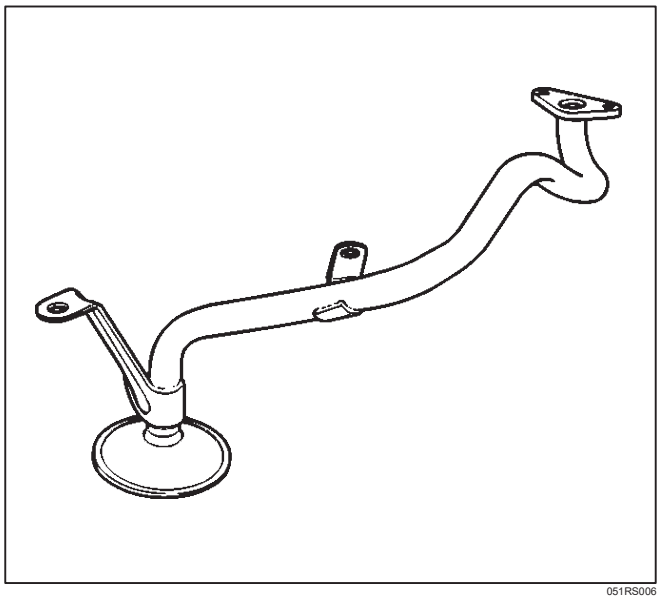
**Standard : 0.03 mm–0.09 mm (0.0011 in–0.0035 in)**

**Limit : 0.15mm (0.0059 in)**


051RS005

## Oil Strainer

Check the oil strainer for cracking and scoring. If cracking and scoring are found, the oil strainer must be replaced.


051RS006

# Reassembly

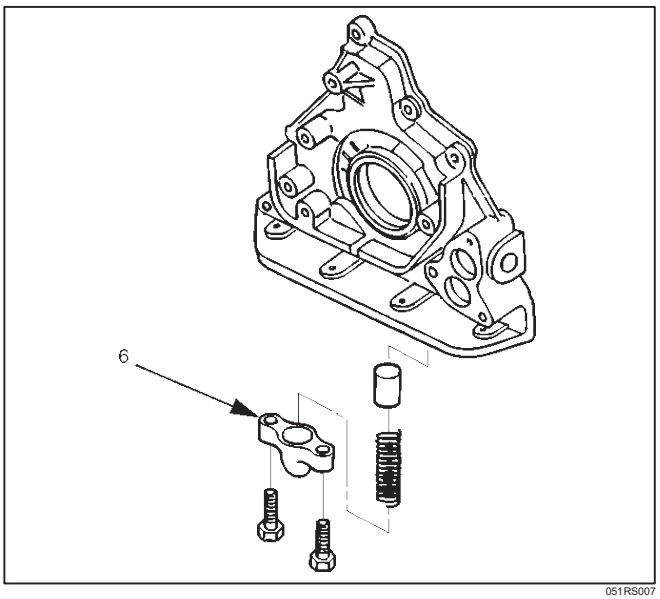
1. Install drive gear (11).
2. Install driven gear (10).
3. Install oil pump cover (9) and first, loosely tighten all of the attaching screws. Next, tighten the attaching screws to the specified torque.

**Torque : 10 N·m (87 lb in)**

After installation, check that the gear rotates smoothly.

4. Install relief valve (8) and apply engine oil to the relief valve and spring (7).
5. Install spring (7).
6. Install the plug (6).

**Torque : 8 N·m (69 lb in)**



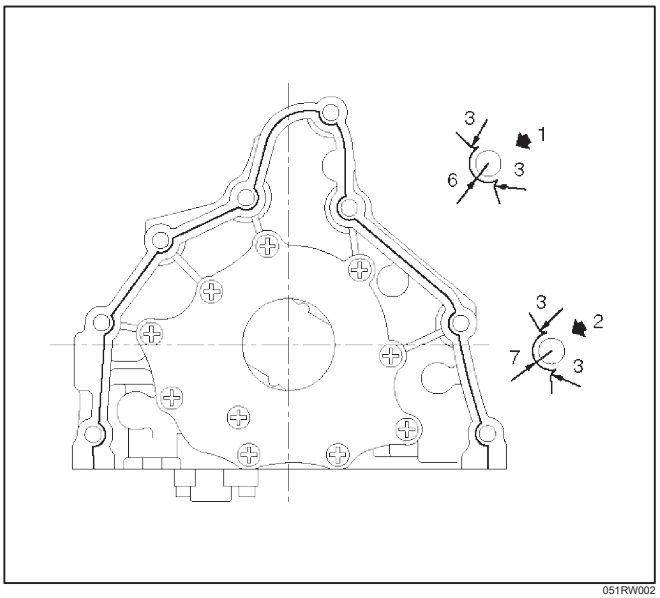
051RS007

7. Install oil pump assembly (5).
   - Carefully remove any oil from the cylinder body and the pump. Apply sealant (TB–1207B or equivalent) to the pump fitting face as shown in illustration. Take care that sealant is not applied to oil port surfaces. The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

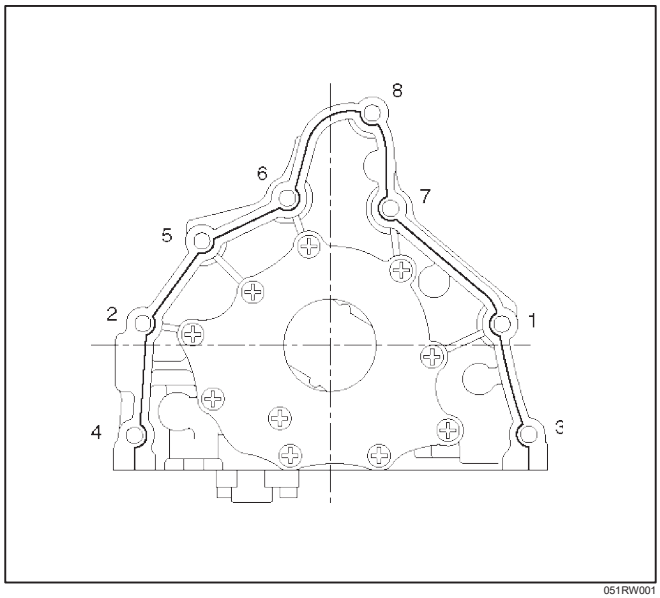
**CAUTION: Do not apply an excessive amount of sealant to the contact surface. Applying too much sealant will overflow the contact surfaces. This could cause serious damage to the engine.**

- **Attach oil pump assembly to cylinder body.**
- **Tighten the oil pump fixing bolts.**

**Torque : 25 N·m (18 lb·ft)**



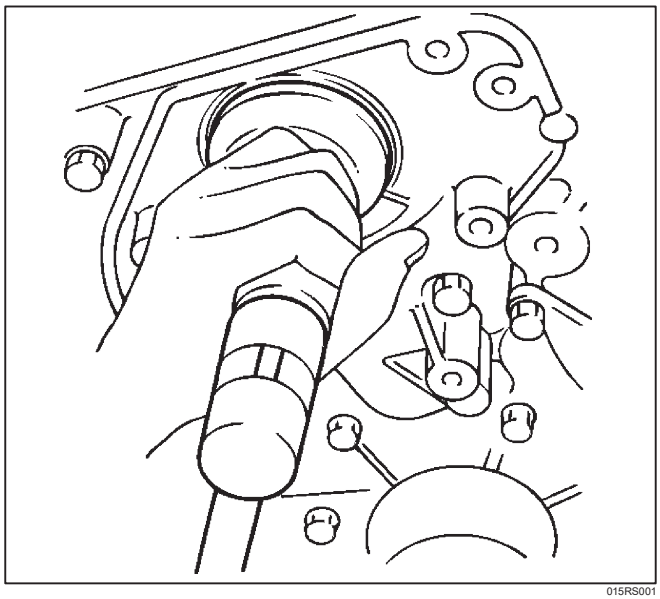
051RW002



051RW001

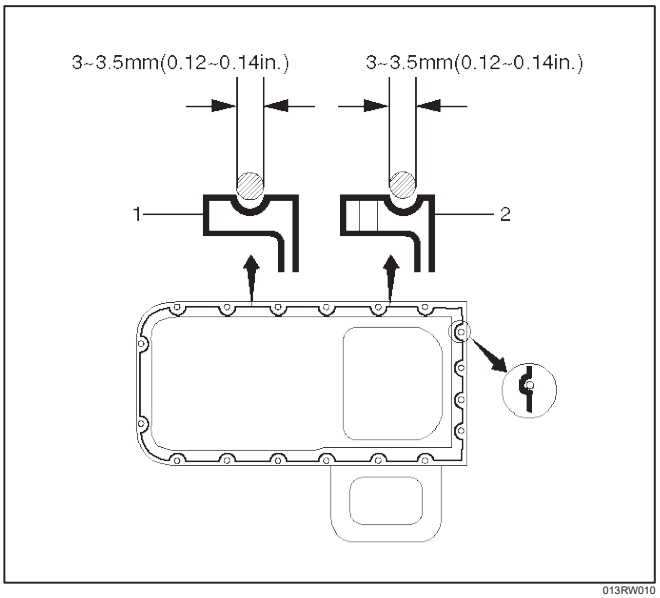
**Legend**
(1) Around Bolt Holes
(2) Around Dowel Pin

8. Install the new oil seal (12). Apply engine oil to the oil seal lip before installation then use J–39202 oil seal Installer, install oil seal.


015RS001

9. Install oil strainer (4) with O-ring (13).
   **Torque: 25 N·m (18 lb ft)**
10. Install oil pipe (3) with O-ring (13).
    **Torque: 25 N·m (18 lb ft)**
11. Install crankcase with oil pan (2).
    - Remove oil on crankcase mounting surface and dry the surface.
    - Apply a proper 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
    - The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    - Tighten fixing bolts to the specified torque.

    **Torque : 10 N·m (87 lb in)**



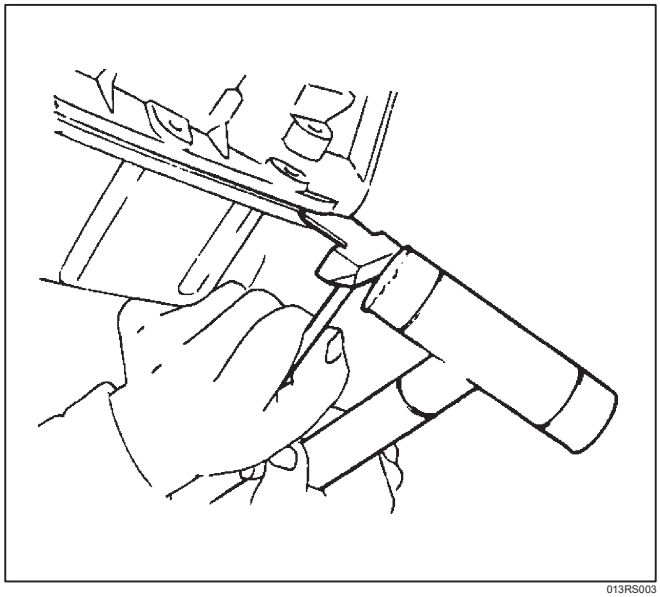
013RW010

12. Install crankshaft timing pulley.

# Oil Pan and Crankcase

## Removal

1. Disconnect battery ground cable.
2. Lift vehicle by supporting the frame.
3. Remove under cover.
4. Drain engine oil.
5. Remove front wheels.
6. Remove oil level dipstick from level gauge tube.
7. Remove radiator under fan shroud.
8. Remove shift on the fly from axle housing.
9. Remove suspension cross member fixing bolts, 2 pcs each per side and remove suspension cross member.
10. Remove axle housing assembly four fixing bolts from housing isolator side and mounting bolts from wheel side. At this time support the axle with a garage jack and remove axle housing assembly. (for 4×4)
11. Remove the steering unit assembly.
12. Remove starter fixing bolts.
13. Remove oil pan fixing bolts.
14. Remove oil pan, using J-37228 sealer cutter, remove oil pan.

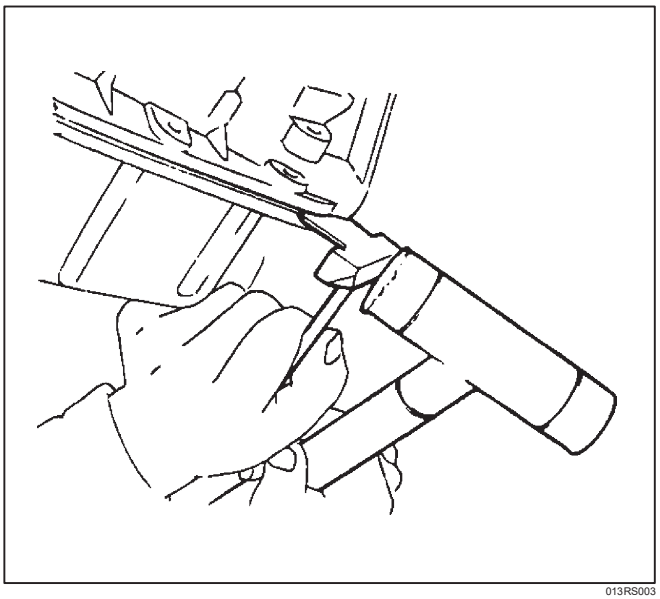


013RS003

15. Remove crankcase fixing bolts.
16. Remove crankcase, using J-37228 sealer cutter, remove crankcase.

NOTE: Do not deform or damage the flange of oil pan and crankcase.

Replace the oil pan and/or crankcase if deformed or damaged.

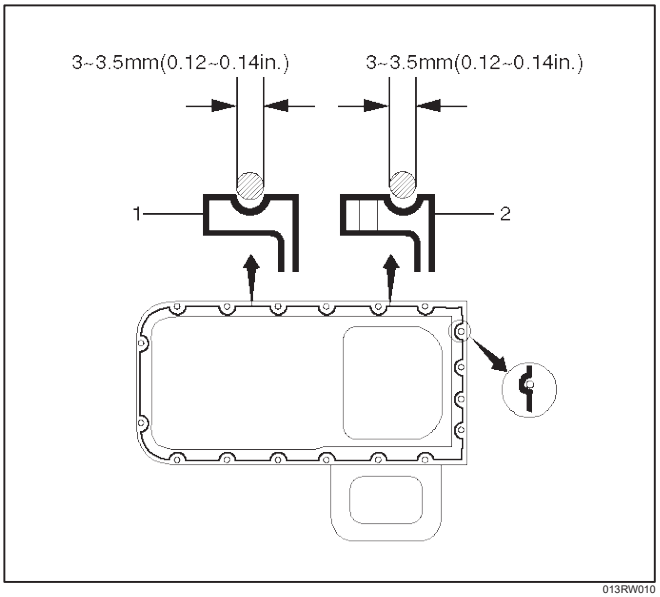


013RS003

## Installation

1. Install crankcase.
   A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
   B. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of crankcase.
   Sealant bead must be continuous.

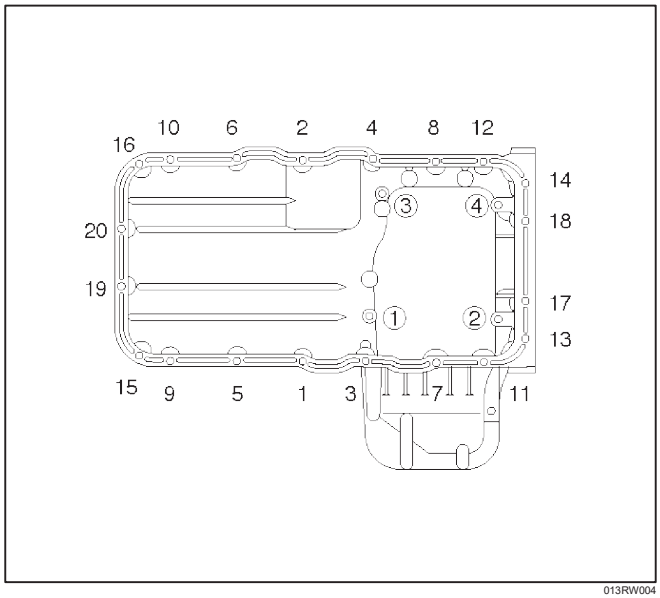
● The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.




013RW010

C. Install crankcase, tighten crankcase fixing bolts to the specified torque.

**Torque : 10 N·m (87 lb in)**




013RW004

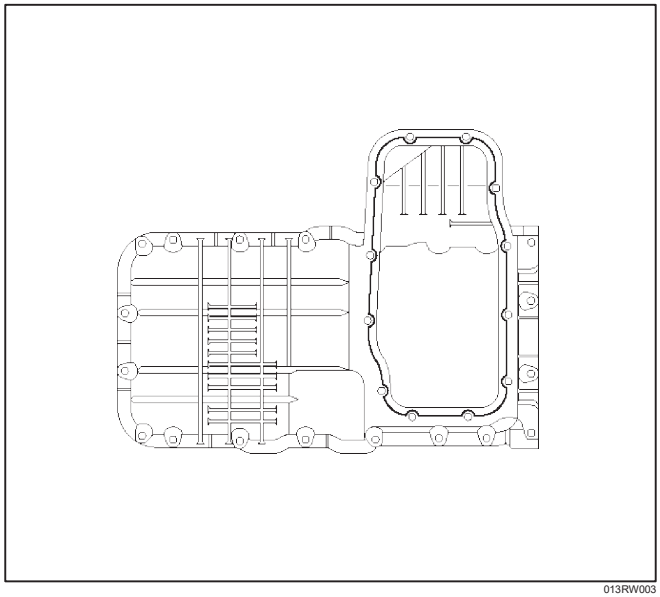
2. Install oil pan

A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.

B. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of oil pan.

Sealant beat must be continuous.

- The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



013RW003

C. Install oil pan, tighten oil pan fixing bolts to the specified torque.

**Torque : 10 N·m (87 lb in)**

3. Install starter and tighten fixing bolts.

**Torque: 40 N·m (30 lb ft)**

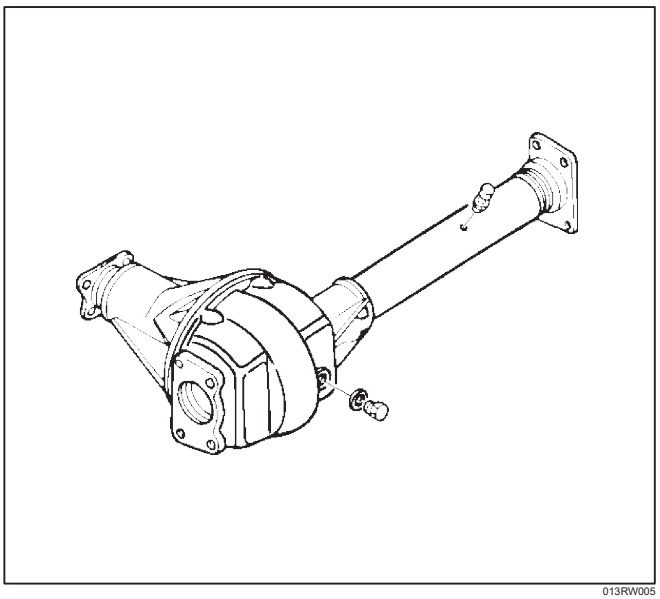
4. Install axle housing assembly and tighten fixing bolts to the specified torque. (for 4×4)

**Axle case bolts**

**Torque : 82 N·m (61 lb ft)**

**Mounting bolts**

**Torque : 152 N·m (112 lb ft)**



013RW005

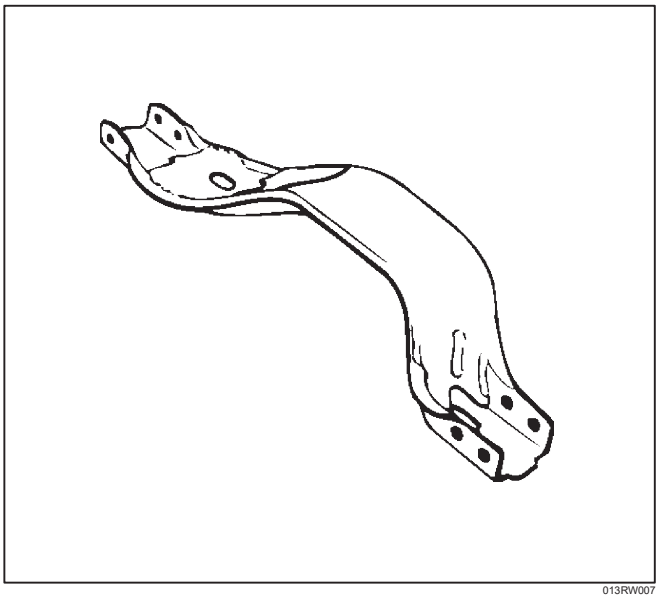
5. Install the shift on the fly.

6. Install relay lever assembly and tighten fixing bolts.

**Torque: 44 N·m (33 lb ft)**

7. Install suspension cross member and tighten fixing bolts to the specified torque.

**Torque : 78 N·m (58 lb ft)**



013RW007

8. Install radiator under fan shroud.

9. Install under cover.

10. Install engine oil level dipstick.

11. Fill engine oil until full level on engine oil gauge dipstick.

# Oil Pump

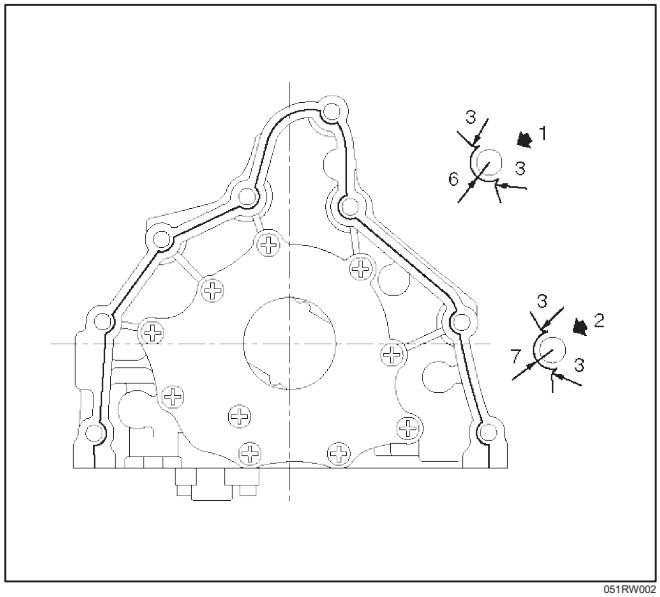
## Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankcase assembly.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
5. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
6. Remove timing pulley from crankshaft.
7. Remove four fixing bolts from oil filter assembly.
8. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.
9. Remove three bolts from oil pipe and O-ring.
10. Remove eight oil pump fixing bolts, then oil pump assembly.
11. Remove sealant from mounting surface of oil pump assembly, cylinder block and take care not to damage mounting surfaces of oil pump and cylinder block.

## Installation

1. Install oil pump assembly
   - Apply sealant (TB-1207B or equivalent) to the oil pump mounting surfaces as shown in the illustration.
   - The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

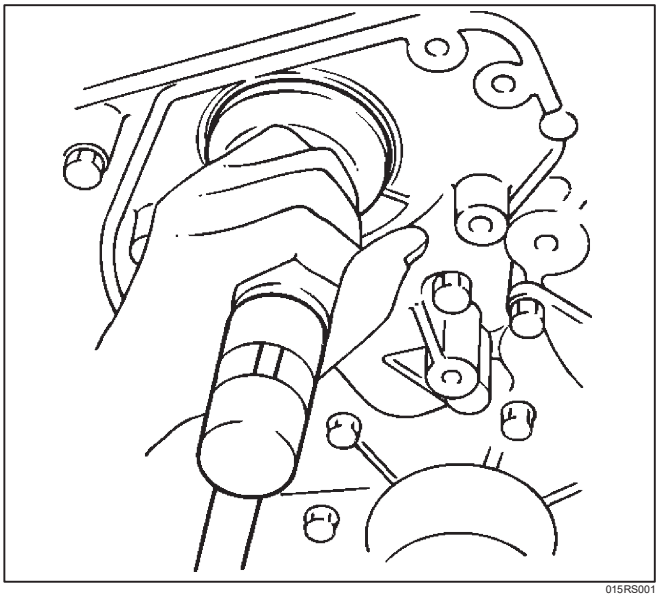
NOTE: Do not apply sealant to the oil ports.



051RW002

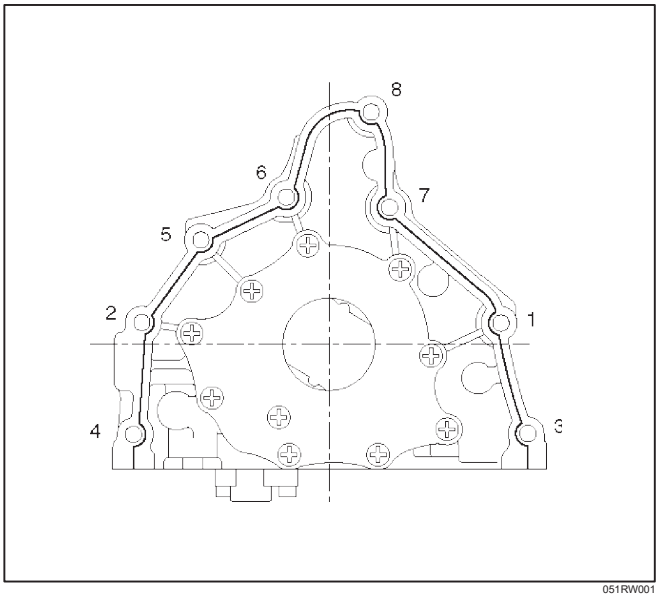
- Use J-39202 installer when installing new oil seal.
- Apply engine oil to oil seal lip.
- Install oil pump assembly to the cylinder block.

NOTE: Do not damage oil seal during installation of oil pump assembly.


015RS001

- Tighten fixing bolts to the specified torque.

**Torque : 25 N·m (18 lb ft)**



051RW001

2. Install oil pipe with O-ring, tighten fixing bolt to the specified torque.

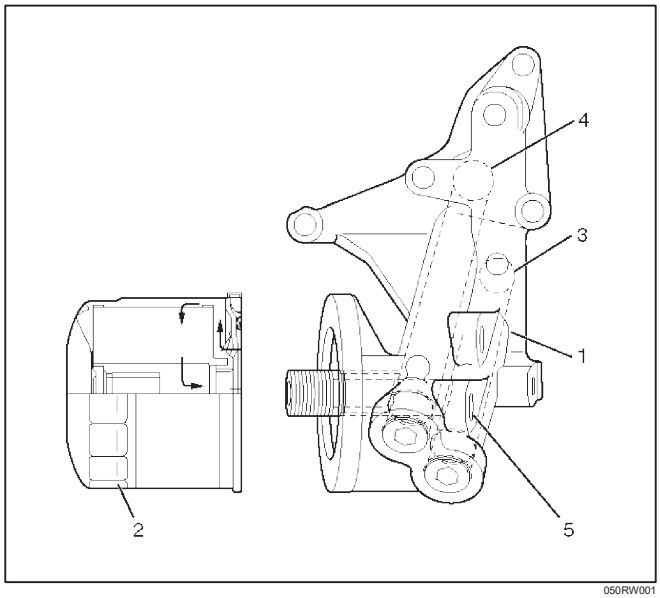
   **Torque : 10 N·m (87 lb in)**

3. Install oil strainer with O-ring, tighten fixing bolt to the specified torque.

   **Torque : 25 N·m (18 lb ft)**

4. Install oil filter assembly and tighten bolts to the specified torque.

**Torque : 25 N·m (18 lb ft)**




050RW001

**Legend**

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

5. Install timing pulley on crankshaft.
   Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   - Refer to install procedure for Crankshaft Pulley in this manual.
7. Install crankcase assembly.
   - Refer to installation procedure for Oil Pan and Crankcase in this manual.
8. Refill engine oil until full level on engine oil dipstick.

# Oil Pump Oil Seal

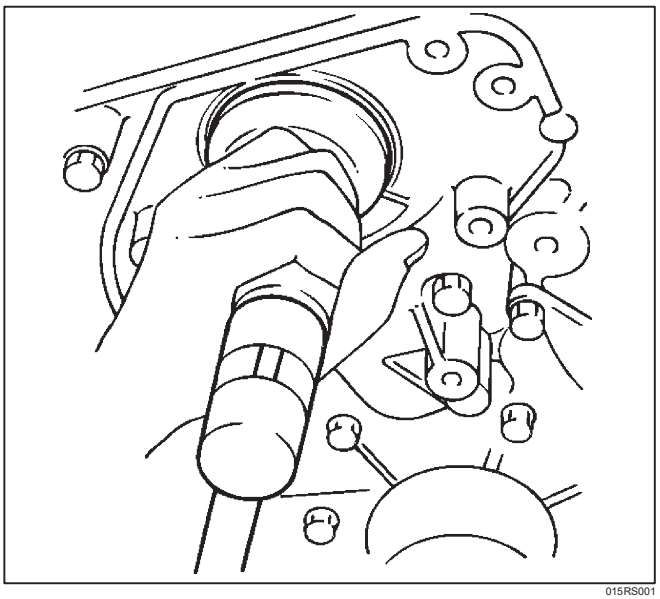
## Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
4. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
5. Remove timing pulley from crankshaft.
6. Remove oil pump oil seal using a sealer puller.

NOTE: Take care not to damage sealing surfaces of oil pump and crankshaft when removing oil seal.

## Installation

1. Install oil pump oil seal, apply engine oil to oil seal lip, then install oil seal using J-39202 installer.




2. Install timing pulley to crankshaft.
3. Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
4. Install crankshaft pulley.
   - Refer to installation procedure for CRANKSHAFT PULLEY in this manual.
5. Refill engine oil until full level.

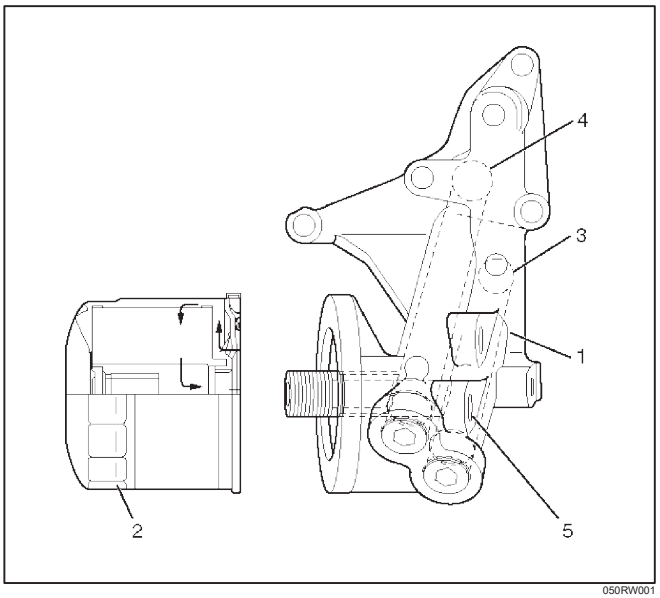
# Oil Filter

## Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove oil filter using J-36390 filter wrench.

## Installation

1. Apply a light coat of engine oil to the oil filter gasket.
2. Hand tighten the filter until the gasket contacts the sealing face.
3. Using J–36390 filter wrench, tighten the filter an additional 7/8 turn or by torque 22 N·m (16 lb ft).




050RW001

**Legend**

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Filter
(5) To Filter

4. Fill the oil to the proper lever by following the oil level check procedures.
5. Reconnect battery ground cable.
6. Run the engine and inspect for leaks.

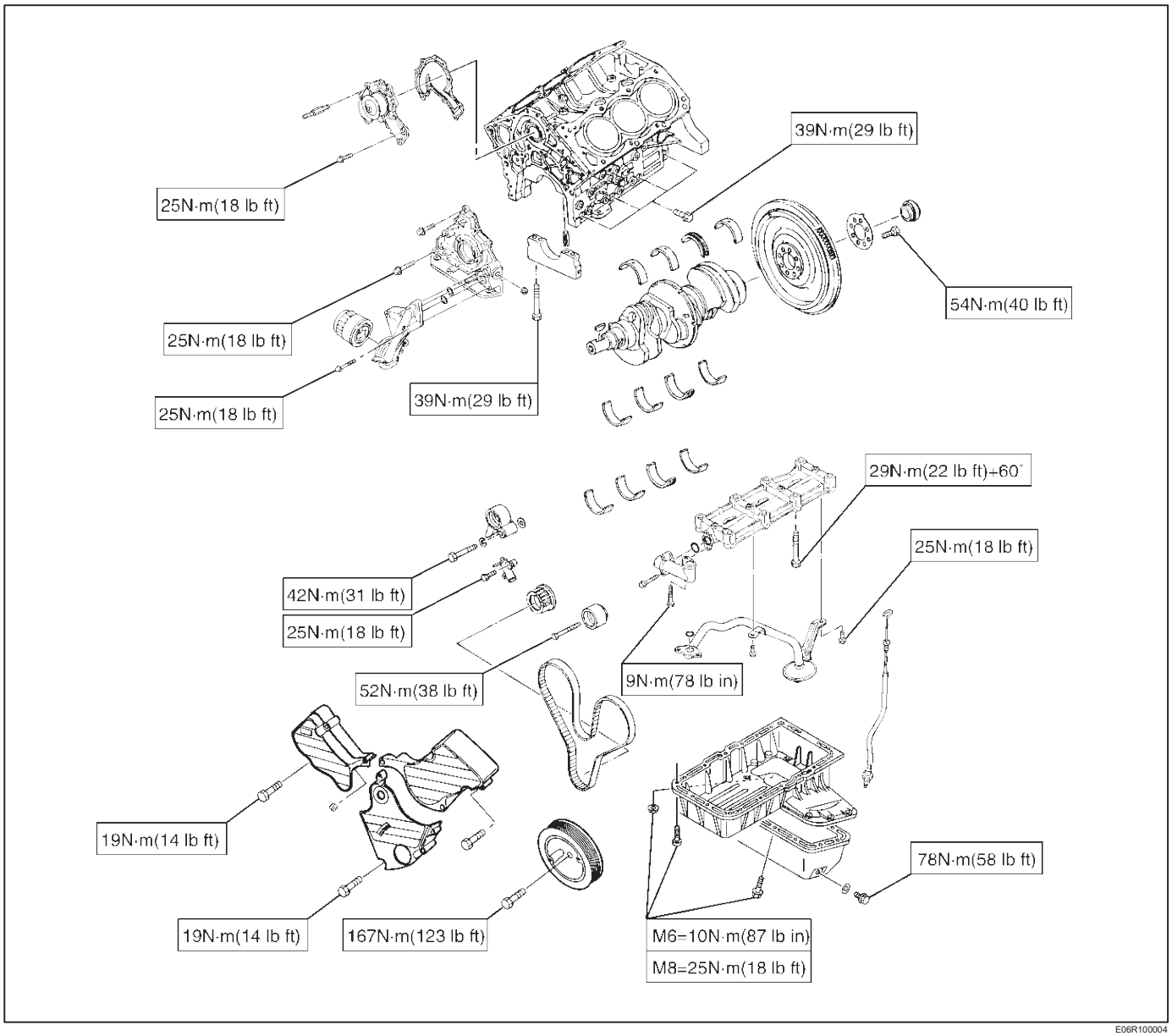
# Main Data and Specification

## General Specification

| Item | Specifications |
|---|---|
| | 6VE1 |
| Oil capacity | 5.3 liters |

## Torque Specifications

**Crankcase, Oil pan, Timing belt tensioner, Timing pulley, Timing belt cover, Oil pump, Oil gallery, Oil strainer**




E06R100004

AXIOM

# ENGINE

## ENGINE SPEED CONTROL SYSTEM

### CONTENTS

Service Precaution . . . . . 6H–1
Accelerator Pedal . . . . . 6H–2
Accelerator Pedal and Associated Parts . . 6H–2
Removal . . . . . 6H–2
Installation . . . . . 6H–2

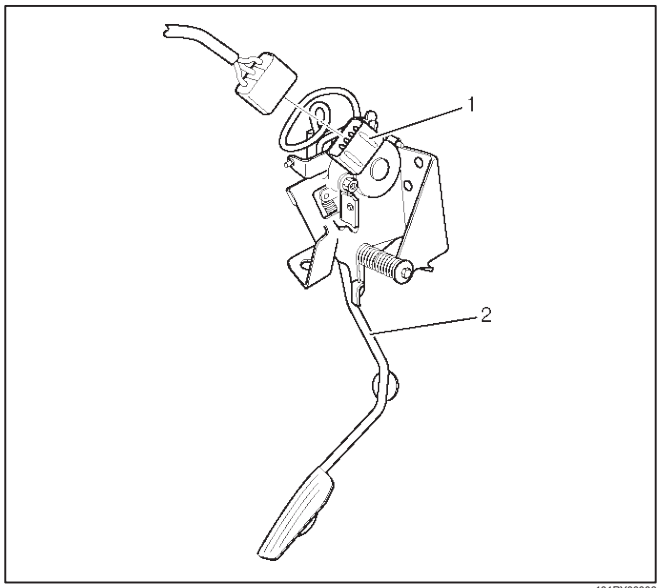
## Service Precaution

**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

**CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.**

# Accelerator Pedal

## Accelerator Pedal and Associated Parts




**Legend**

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

## Removal

1. Disconnect battery ground cable.
2. Disconnect Accelerator position (AP) sensor (1) connector from Accelerator pedal assembly.
3. Remove Accelerator pedal assembly (2).

## Installation

1. Install Accelerator pedal assembly (2).
2. Connect AP sensor (1) harness connector.
3. Connect battery ground cable.

AXIOM

# ENGINE

## INDUCTION (6VE1 3.5L)

### CONTENTS

Service Precaution ..... 6J–1
Air Cleaner Element ..... 6J–2
Removal ..... 6J–2
Inspection ..... 6J–2
Installation ..... 6J–2

## Service Precaution

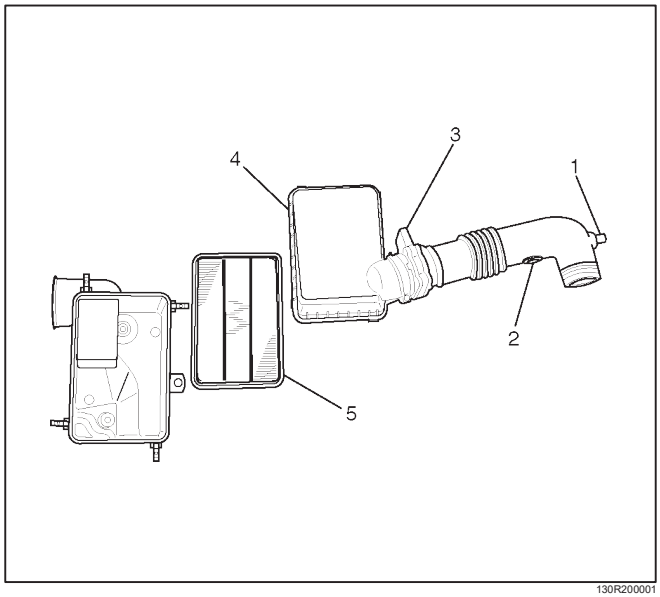
**WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.**

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# Air Cleaner Element

## Removal

1. Remove positive ventilation hose connector(1).
2. Remove intake air temperature sensor(2).
3. Remove air flow sensor(3).
4. Remove air cleaner duct assembly(4).
5. Remove air cleaner element(5).



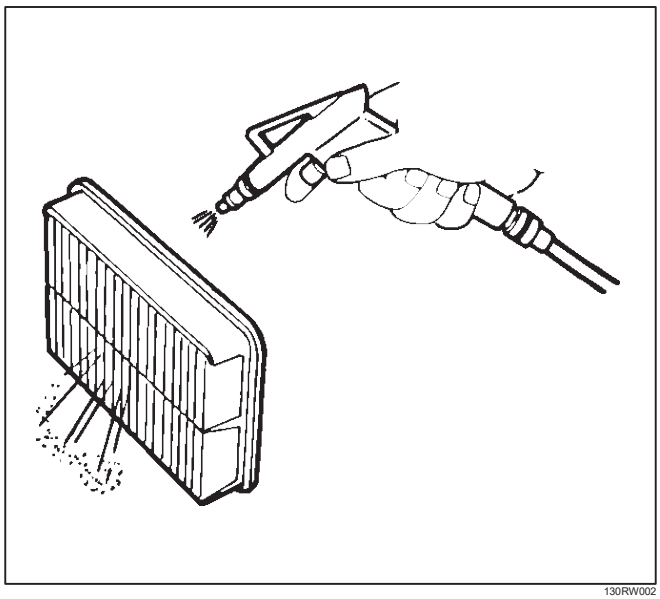
130R200001

## Inspection

Check the air cleaner filter for damage or dust clogging. Replace if it is damaged, or clean if it is clogged.

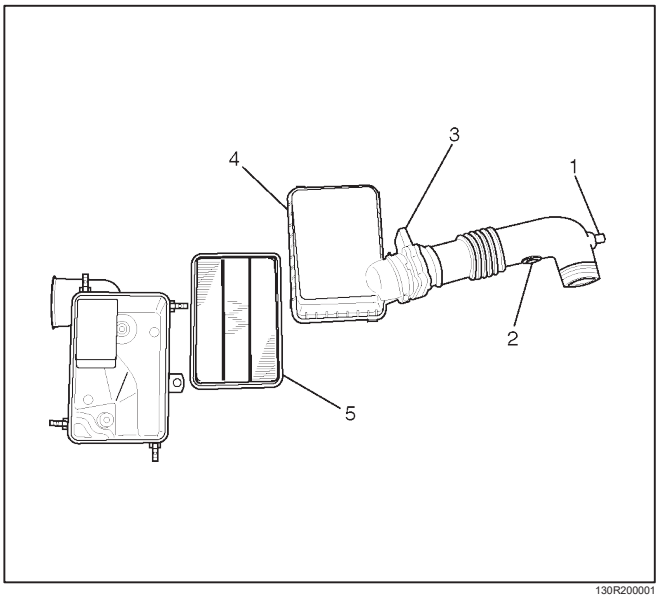
### Cleaning Method

Tap the air cleaner filter gently so as not to damage the paper filter, or clean the element by blowing with compressed air of about 490 kPa (71 psi) from the clean side if it is extremely dirty.


130RW002

## Installation

1. Install air cleaner element(5).
2. Attach the mass air cleaner duct cover to the body completely, then clamp it with the clip(4).
3. Install air flow sensor(3).
4. Install air temprature sensor(2).
5. Install positive crankcase ventilation hose connector(1).



130R200001