SECTION 1A

GENERAL ENGINE INFORMATION

TABLE OF CONTENTS

DESCRIPTION AND SYSTEMOPERATION

CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten–thousandths of an inch. When any internal engine parts are serviced, care and cleanliness are important. A liberal coating of engine oil should be applied to friction areas during assembly, to protect and lubricate the surfaces on initial operation. 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.

Whenever valve train components are removed for service, they should be kept in order. They should be installed in the same locations, and with the same mating surfaces, as when they were 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.

ON-ENGINE SERVICE

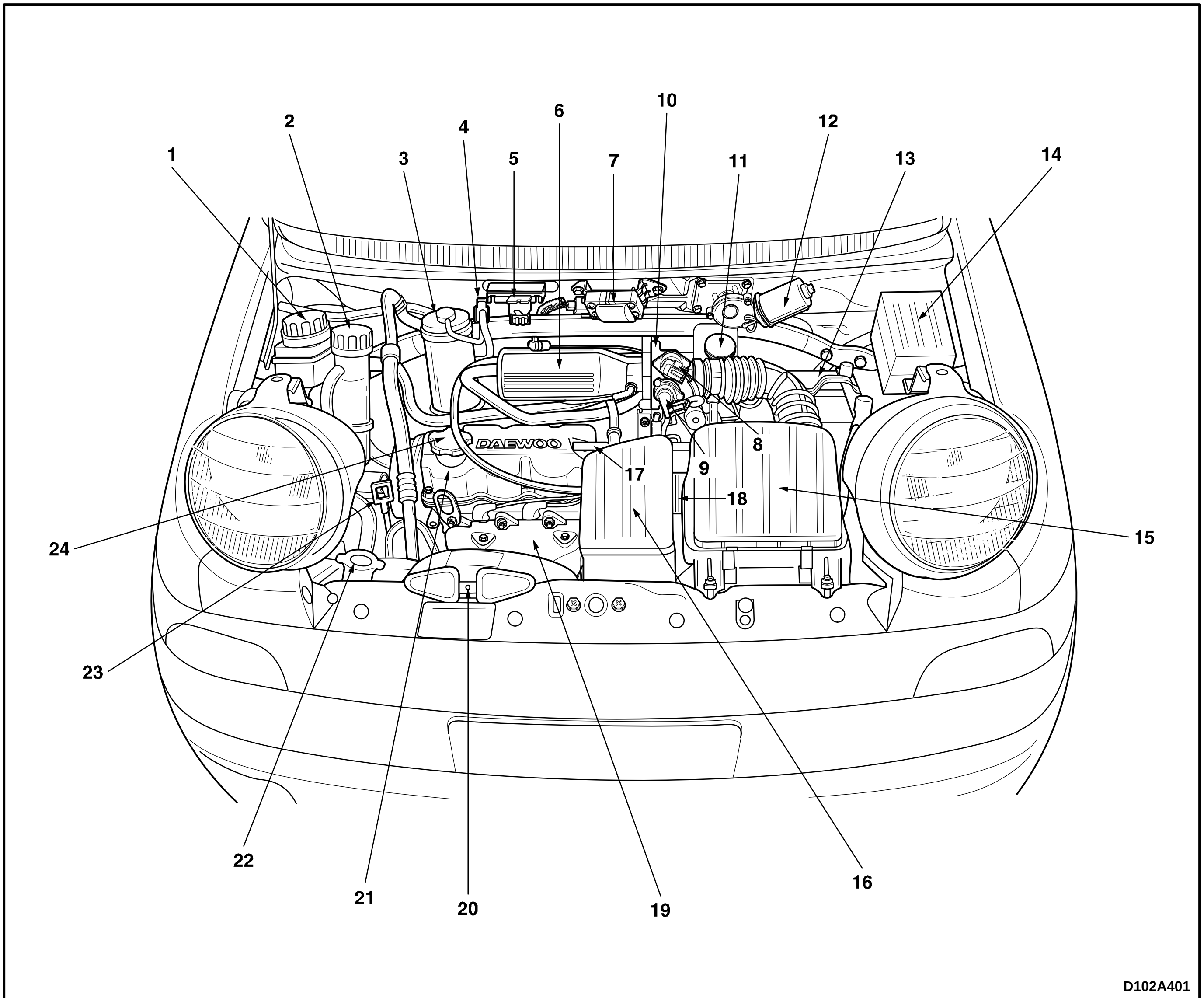
Caution: Disconnect the negative battery cable before removing or installing any electrical unit, or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in B unless otherwise noted.

Notice: Any time the air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material, which could follow the intake passage into the cylinder and cause extensive damage when the engine is started.

COMPONENT LOCATOR

ENGINE COMPARTMENT (TYPICAL)

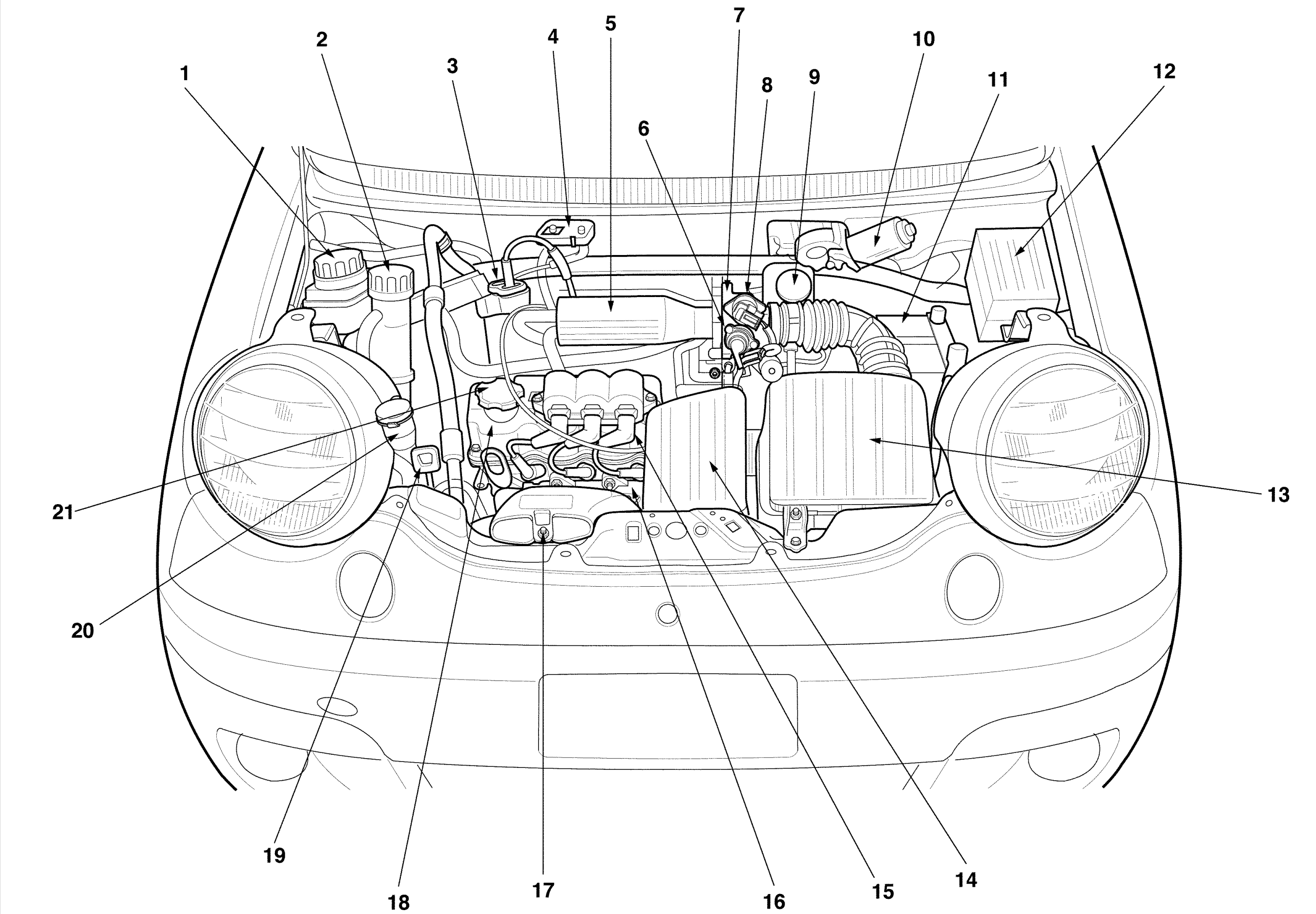
(Left–Hand Drive Shown, Right–Hand Drive Similar)



1 Power Steering Oil Reservoir
2 Coolant Reservoir
3 Canister
4 Canister Solenoid
5 Manifold Absolute Pressure (MAP) Sensor
6 Intake Manifold
7 Ignition Coil
8 Idle Air Control (IAC) Valve
9 Throttle Position (TP) Sensor
10 Throttle Body
11 Brake Fluid Reservoir
12 Wiper Motor
13 Battery
14 Fuse Box
15 Air Cleaner Housing
16 Resonator
17 PCV Hose
18 Distributor
19 Exhaust Manifold
20 Snorkel
21 Engine
22 Washer Fluid Reservoir
23 Oil Level Gauge
24 Oil Filler Cap

ENGINE COMPARTMENT (EURO III)

(Left–Hand Drive Shown, Right–Hand Drive Similar)



1 Power Steering Oil Reservoir
2 Coolant Reservoir
3 Canister Purge Solenoid
4 Manifold Absolute Pressure (MAP) Sensor
5 Intake Manifold
6 Throttle Position (TP) Sensor
7 Throttle Body
8 Idle Air Control (IAC) Valve
9 Brake Fluid Reservoir
10 Wiper Motor
11 Battery
12 Fuse Box
13 Air Cleaner Housing
14 Resonator
15 Electronic Ignition System Ignition Coil
16 Exhaust Manifold
17 Snorkel
18 Engine
20 Washer Fluid Reservoir
19 Oil Level Gauge
21 Oil Filler Cap

DIAGNOSTIC INFORMATION PROCEDURE

GENERAL DIAGNOSIS

Condition		Probable cause	Correction
Hard Starting (With normal cranking)	Malfunction of Ignition System	• Faulty fuse.	• Replace the fuse.
		• Faulty spark plug.	• Clean, adjust the plug gap or replace.
		• Electric leakage at the high tension cable.	• Replace the cable.
		• Poor connection of the high tension cable or lead wires.	• Replace the cable or wires.
		• Worn distributor cap or accumulated carbon in the distributor cap.	• Replace or clean the distributor cap.
		• Damaged distributor rotor or cap.	• Replace the rotor or the cap.
		• Improper ignition timing.	• Adjust the ignition timing.
		• Faulty ignition coil.	• Replace the ignition coil.
	Malfunction of Fuel System	• Lock of fuel in the fuel tank.	• Feed the fuel.
		• Dirty or clogged fuel filter.	• Replace the filter.
		• Clogged fuel pipe.	• Clean the fuel pipe.
		• Malfunction of the fuel pump.	• Replace the fuel pump.
		• Malfunction of the fuel injector.	• Replace the injector.
		• The foreign material in the fuel tank.	• Clean the fuel tank.
	Decline of Compression Pressure	• Poor tightening spark plug.	• Tighten to the specified torque.
		• Cracked cylinder head gasket.	• Replace the gasket.
		• Inadequate the valve clearance.	• Adjust the clearance.
		• Leakage of the valve clearance.	• Repair the valve.
		• Interference of the valve stem.	• Replace the valve or the valve guide.
		• Low elasticity or damage of the valve spring.	• Replace the valve spring.
		• Abnormal interference of pistons and cylinders.	• Replace the piston ring.
		• Excessive wear of pistons, rings, or cylinders.	• Replace the ring or the piston and boring or replace the cylinder.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Hard Starting (With normal cranking)	Others	• Broken timing belt.	• Replace the belt.
		• Malfunction of Positive Crankcase Ventilation (PCV) valve.	• Check and replace Positive Crankcase Ventilation (PCV) valve if needed.
		• Loosening, damage or leakage of the vacuum hose.	• Connect the hose correctly or replace it.
		• Leakage of intake system.	• Replace intake system.
Lack of Engine Power	Decline of Compression Pressure	• Refer to "Page 1A–5".	• Refer to "Page 1A–5".
	Malfunction of Ignition System	• Improper ignition timing.	• Adjust the ignition timing.
		• Faulty spark plug.	• Adjust or replace the spark plug.
		• Malfunction of the distributor.	• Repair or replace the distributor. Check the rotor.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
	Malfunction of Fuel System	• Clogged fuel pipe.	• Clean the pipe.
		• Clogged or contaminated fuel filter.	• Replace the filter.
	Others	• Clogged exhaust system.	• Check and repair the system.
		• Clogged or contaminated air cleaner element.	• Clean or replace the air cleaner element.
		• Leak of the intake manifold gasket.	• Replace the gasket.
		• Dragging brakes.	• Repair or replace the brakes.
		• Slipping clutch.	• Adjust or replace the clutch.
Rough Engine Idling	Decline of Compression Pressure	• Refer to "Page 1A–5".	• Refer to "Page 1A–5".
	Malfunction of Fuel System	• Clogged fuel pipe.	• Clean the pipe.
		• Clogged or contaminated fuel filter.	• Replace the filter.
		• Malfunction of the fuel pressure regulator.	• Replace the regulator.
	Malfunction of Ignition System	• Malfunction of the spark plug.	• Adjust or replace the spark plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
		• Worn distributor cap terminal or accumulated carbon in the distributor cap.	• Replace or clean the distributor cap.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Rough Engine Idling	Malfunction of Ignition System	• Loosening or damage of the distributor rotor or cap.	• Replace the rotor or cap.
		• Poor ignition timing.	• Adjust the ignition timing.
		• Malfunction of the ignition coil.	• Replace the ignition coil.
	Others	• Clogged or contaminated air cleaner element.	• Clean or replace the air cleaner element.
		• Leak of the intake manifold gasket.	• Replace the gasket.
		• Malfunction of Positive Crankcase Ventilation (PCV) valve.	• Check the valve or replace it if needed.
		• Poor connection or damage or leakage of the vacuum hose.	• Connect the hose correctly or replace it.
Engine Hesitate (Upon pressing accelerating pedal, the engine makes delayed response. This situation is remarkable when cruising or starting.)	Decline of Compression Pressure	• Refer to "Page 1A–5".	• Refer to "Page 1A–5".
	Malfunction of Ignition System	• Poor ignition timing.	• Adjust the ignition timing.
		• Poor spark plug or poor adjustment of the plug gap.	• Replace the plug or adjust the gap.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
	Others	• Malfunction of the air cleaner system.	• Clean or replace the air cleaner system.
		• Leak of the intake manifold gasket.	• Replace the gasket.
Engine Surging (Engine power makes fluctuation in a fixed speed and speed changes without operating the accelerating pedal.)	Decline of Compression Pressure	• Refer to "Page 1A–5".	• Refer to "Page 1A–5".
	Malfunction of Fuel System	• Clogged fuel pipe.	• Clean the pipe.
		• Clogged or contaminated fuel filter.	• Replace the filter.
		• Malfunction of the fuel pressure regulator.	• Replace the fuel pressure regulator.
	Malfunction of Ignition System	• Malfunction of the spark plug.	• Adjust or replace the spark plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
		• Worn distributor cap terminal or accumulated carbon in the distributor cap.	• Clean or replace the distributor cap.
		• Loosening or damage of the distributor rotor or the cap.	• Replace the distributor rotor or the cap.
		• Poor ignition timing.	• Adjust the ignition timing.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Engine Surging (Engine power makes fluctuation in a fixed speed and speed changes without operating the accelerating pedal.)	Others	• Leak of the intake manifold gasket.	• Clean or replace the gasket.
		• Leakage of the vacuum hose.	• Connect the hose correctly or replace it.
Excessive Detonation (According to the opening range of throttle valve, knocking sound of metallic is made with abnormal explosion.)	Overheated Engine	• Refer to "Overheat" in this page.	• Refer to "Overheat" in this page.
	Malfunction of Ignition System	• Abnormal spark plug.	• Replace the spark plug.
		• Poor ignition timing.	• Adjust the ignition timing.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable correctly or replace it.
	Malfunction of Fuel System	• Clogged or contaminated fuel filter and fuel pipe.	• Clean or replace the fuel filter and the fuel pipe.
	Others	• Leak of the intake manifold gasket.	• Replace the gasket.
		• Excessive carbon deposit due to abnormal combustion.	• Remove the carbon.
Overheat	Malfunction of Cooling System	• Lack of coolant.	• Refill coolant.
		• Malfunction of the thermostat.	• Replace the thermostat.
		• Malfunction of the cooling fan.	• Check or replace the cooling fan.
		• Poor water pump performance.	• Replace the pump.
		• Clogged or leaky radiator.	• Clean, repair or replace the radiator.
	Malfunction of Lubrication System	• Poor engine oil.	• Replace engine oil with the specified one.
		• Blocking oil filter or strainer.	• Clean or replace the oil filter or the strainer.
		• Lack of engine oil.	• Refill oil.
		• Poor oil pump performance.	• Replace or repair the pump.
		• Leakage of oil.	• Repair.
	Other	• Damaged cylinder head gasket.	• Replace the gasket.
Poor Fuel Consumption	Decline of Compression Pressure	• Refer to "Page 1A–5".	• Refer to "Page 1A–5".
	Malfunction of Fuel System	• Leakage of the fuel tank or the fuel pipe.	• Repair or replace the fuel tank or the fuel pipe.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Poor Fuel Consumption	Malfunction of Ignition System	• Improper ignition timing.	• Adjust the ignition timing.
		• Abnormal spark plug (Excessive carbon deposit, inadequate gap, burnt electrode).	• Replace the plug.
		• Electric leakage or poor connection of the high tension cable.	• Connect the cable normally or replace it.
	Malfunction of Cooling System	• Malfunction of the thermostat.	• Replace the thermostat.
	Others	• Improperly installed valve.	• Repair or replace the valve.
		• Slipping clutch.	• Repair or replace the clutch.
		• Low pressure of tires.	• Adjust the pressure of tires.
Excessive Consumption of Engine Oil	Leakage of Engine Oil	• Loosened oil drain plug.	• Tighten the plug.
		• Loosened oil pan bolt.	• Tighten the bolt.
		• Loosened oil filter.	• Tighten the filter.
		• Loosened oil pressure switch.	• Tighten the switch.
		• Leakage of camshaft front oil seal.	• Replace the seal.
		• Leakage of crankshaft front oil seal.	• Replace the seal.
		• Leakage at the cylinder head cover gasket.	• Replace the gasket.
		• Damage of the cylinder head gasket.	• Replace the gasket.
	Oil Mixing in Combustion Chamber	• Stuck piston ring.	• Remove carbon and replace the ring.
		• Worn piston or cylinder.	• Replace the piston or the cylinder.
		• Worn piston ring or ring groove.	• Replace the piston or ring.
		• Inadequate position of the piston ring cutting part.	• Adjust the position.
		• Abrasion or damage of the valve system.	• Replace the valve system.
Low Oil Pressure	Malfunction of Lubrication System	• Inadequate oil viscosity.	• Replace with the specified one.
		• Loosening of the oil pressure switch.	• Tighten the switch.
		• Lack of engine oil.	• Refill oil.
		• Blocking oil strainer.	• Clean the strainer.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Low Oil Pressure	Malfunction of Lubrication System	• Lowered function of the oil pump.	• Replace the pump.
		• Abrasion or damage of the oil pump relief valve.	• Replace the valve.
Engine Noise	Valve Noise	• Inadequate valve clearance.	• Adjust the valve clearance.
		• Abrasion of valve stem or guide.	• Replace the valve stem or the guide.
		• Weak valve spring.	• Replace the spring.
	Piston, Ring, Cylinder Noise	• Abrasion of the piston, the ring or the cylinder.	• Boring the cylinder or replace the piston, the ring or the cylinder.
	Connecting Rod Noise	• Abrasion of the connecting rod bearing.	• Replace the bearing.
		• Loosened the connecting rod nut.	• Tighten to the specified torque.
	Crankshaft Noise	• Abrasion of the crankshaft bearing.	• Replace the bearing.
		• Abrasion of the crankshaft journal.	• Grind or replace the crankshaft journal.
		• Loosened bearing cap bolt.	• Tighten to the specified torque.
		• Excessive clearance of the crankshaft thrust bearing.	• Adjust or replace.
		• Low oil pressure.	• Refer to "Low Oil Pressure" in this section.

CHECKING ENGINE FLUID LEVEL

Check the engine fluid level or condition. If needed, refill or replace the oil.

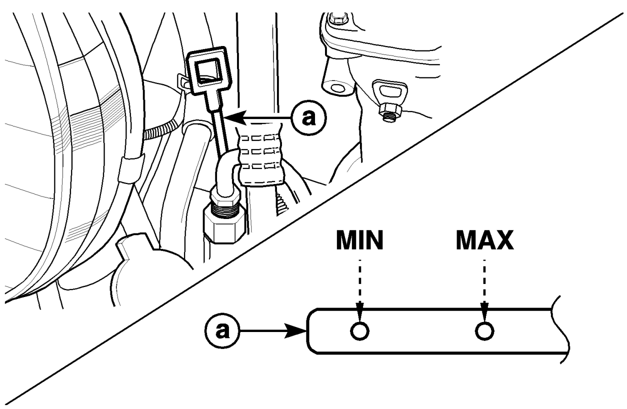
Check the engine oil level within engine normal operating temperature as follows ;

1. After stopping the engine, wait for a few minutes to accumulate oil into the oil pan.
2. After pulling out the oil level gauge (a), check the oil level.
3. Clean the oil level gauge and insert the gauge into guide.
4. After pulling out the oil level gauge again, recheck the oil level and insert the gauge into guide again.

Important: Oil level should be between “MIN” mark and “MAX” mark.

5. If oil level is below the “MIN” mark, refill engine oil as much as the demanded quantify.

Important: If checking oil level under the engine cold condition, oil is not accumulated into oil pan quickly and correct level checking can not be performed. Therefore, wait until temperature reaches the normal operating condition and check the engine oil level.



D102A301

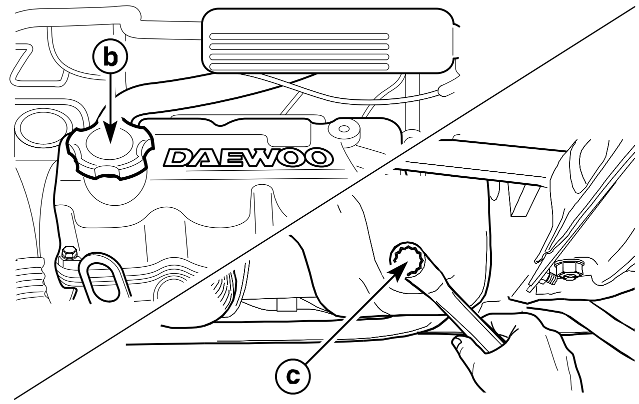
CHANGING ENGINE OIL OR OIL FILTER

Tools Required

09915–47341 Oil Filter Wrench.

When checking engine oil level or condition, if needed, change engine oil (including the filter) as follows ;

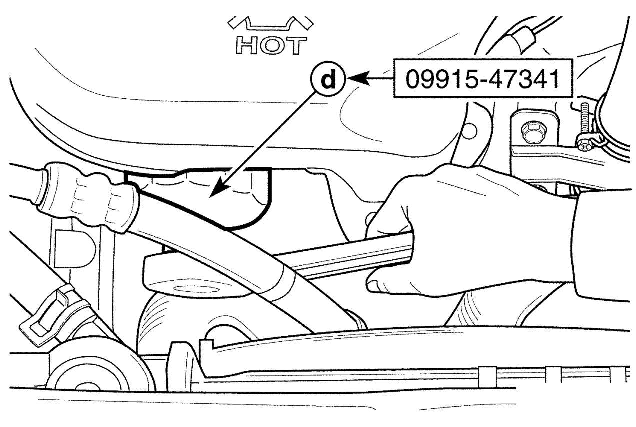
1. After stopping the engine, wait for a few minutes to accumulate oil into the oil pan.
2. Remove the oil filter cap (b).
3. Remove the oil drain plug (c) and draw oil off.



D102A302

4. After drawing oil completely, tighten the oil drain plug to 30–40 N•m (22–30 lb-ft).
5. Replace the oil filter using the oil filter wrench 09915–47341 (d).
   - Remove the air cleaner/resonator/snorkel assembly.
   - After removing the bolts, remove the heat shield.
   - Loosen the power steering pump cap screw and pull the power steering hose into the front.
   - Remove the oil filter.

Important: Whenever changing engine oil, replace the oil filter. When replacing new oil filter, apply engine oil on oil filter sealing.



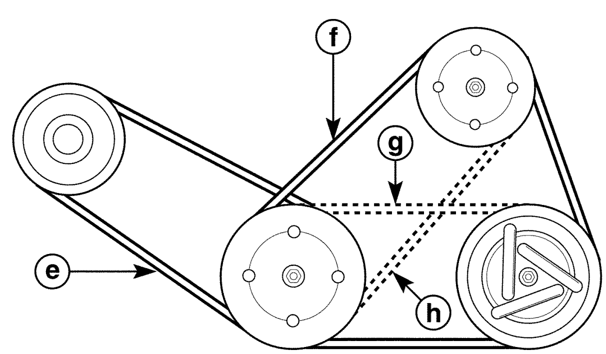
D102A303

CHECKING ENGINE TIMING BELT

After checking the timing belt for looseness, crack, wear or tension, replace the belt if necessary.

CHECKING ACCESSORY BELT

After checking the alternator belt (e), air conditioning/ power steering belt (f), air conditioning belt (g), power steering belt (h), for looseness, crack, wear or tension, replace the belt if necessary.



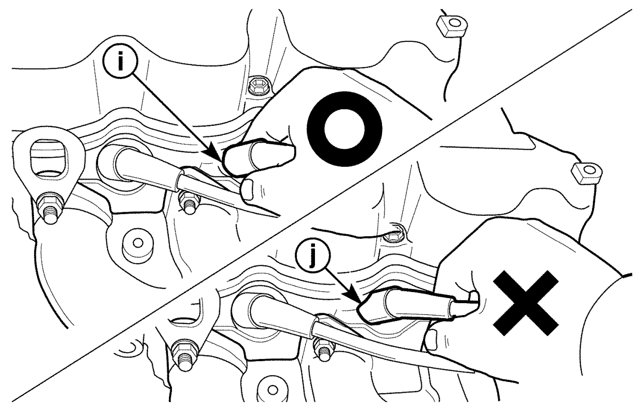
D102A304

CHECKING SPARK PLUG

After checking the spark plug for bad clearance, excessive carbon deposit, worn electrode or damaged insulator, replace the new one if necessary.

Remove and check the spark plug as follows ;

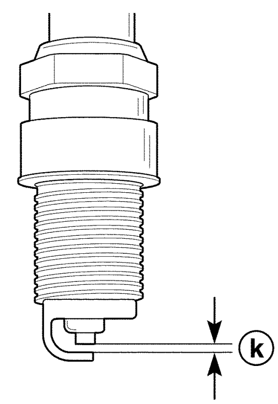
1. Pull the high tension cable cap portion (i), and disconnect the high tension cable from the spark plug.
   If pulling the high tension cable (j), circuit could be disconnected. Therefore, the cap portion should be used.



D102A305

2. Remove the spark plugs from cylinder head using a wrench.
3. Measure the spark plug clearance (k) with the filler gauge. If measured value is not within the specified value, adjust the grounding electrode.

   When installing new spark plug, check the clearance for equality and install it.



D102A306

CHECKING AIR CLEANER ELEMENT

If the air cleaner element becomes dirty, engine efficiency could be deteriorated.

Be sure to check the element often.

Especially, if a vehicle frequently runs on a dusty road, check and replace the element often.

CHECKING FUEL FILTER

If fuel filter is used over the specified period, engine efficiency is deteriorated by dust or foreign material.

Therefore, replace a new one within the specified period.

CHECKING FUEL SYSTEM

Check the fuel system as follows ;

- Check the fuel line or line connection portion for damage or leakage.
- Check the fuel hose surface for damage.
- Check the fuel cap for looseness.

CHECKING HOSE SYSTEM

Check the engine vacuum hose, PCV hose or canister hose as follows ;

- Check the hose surface for damage by heat or machine.
- Check the hose for hardening, crack, tear, or coming off.

SPECIFICATIONS

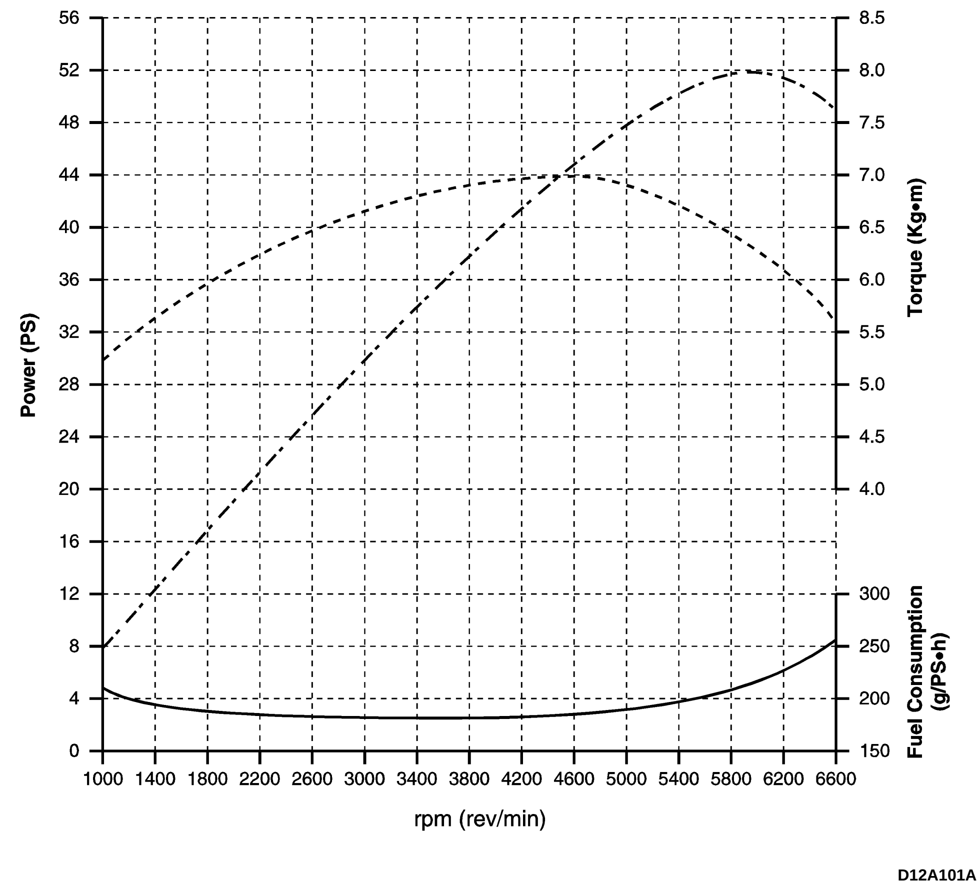
GENERAL SPECIFICATIONS

Application			Description
Vehicle Capacity	Maximum Speed		144 km/h (90 mph)
	Gradeability		0.420 tan θ
	Minimum Turning Radius		4.5 m (14.8 ft)
Engine Information	Bore × Stroke		68.5 × 72.0 mm (2.70 × 2.83 inch)
	Displacement		796 cm^3 (48.6 in^3)
	Compression Ratio		9.3 : 1
	Maximum Power		37.5 KW (6,000 rpm)
	Maximum Torque		68.6 N•m (50.59 lb-ft) (at 4,600 rpm)
	Ignition Timing (Ignition Sequence)		5° BTDC (1–3–2) / 10° BTDC (1–3–2)
	Idle Speed	Air Conditioning System (ON)	1,000 ± 50 rpm
		Air Conditioning System (OFF)	950 rpm
Engine Part Type	Engine		Overhead Cam L–3
	Ignition Type		Direct Ignition System (DIS) / High Energy Ignition (HEI)
	Distributor		Optical Sensor Type
	Starter		SD 80
	Spark–Plug	Unleaded	BPR5EY–11, RN9YC4, WR8DCX
		Leaded	BPR5EY, RN9YC, WR8DC
	Fuel Injection Type		MPI
	Fuel Pump		Electric Motor Pump
	Fuel Filter		Cartridge
	Lubricating Type		Forced Feed Type
	Oil Pump		Rotary Pump Type
	Cooling Type		Forced Water Circulation
	Radiator		Cross – Flow
	Water Pump		Centrifugal
	Thermostat		Pellet Type
	Air Cleaner Element		Non Woven Fablic
	Muffler		Catalytic Converter, Closed Circuit
	Battery		MF
Engine Part Capacity	Engine Oil		SJ Grade SAE 5W30, SAE 10W30, SAE 15W40
	Refrigerant		Four Seasons
Engine Information	Engine Oil	Engine Disassembly	3.0 L (3.17 qt)
		Oil Change (Including filter)	2.7 L (2.85 qt)
		Oil Change (Not including filter)	2.5 L (2.64 qt)
		Oil Level Gauge	1 L (1.06 qt) (MIN to MAX)
	Coolant		3.8 L (4.02 qt)
	Battery		12V–35 AH, 246 CCA
	Generator		65 A
	Starter		0.8 kW
	Fuel Pump	Output Capacity	90 – 133 Lph
		Output Pressure	380 kPa (55.1 Psi)
	Fuel Tank Capacity		35 L (9.2 gal), 38 L (10 gal)

ENGINE PERFORMANCE CURVE

- Maximum Power
  : 51 PS (37.5 KW)
  (at 6,000 rpm)

- Maximum Torque
  : 7 Kg•m (68.6 N•m)
  (at 4,600 rpm)



SECTION 1B

SOHC ENGINE MECHANICAL

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in B unless otherwise noted.

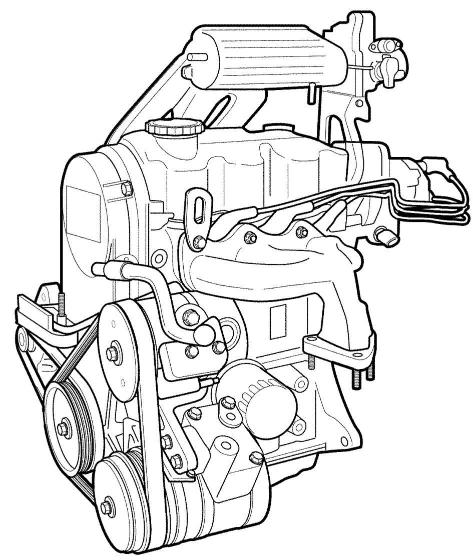
TABLE OF CONTENTS

DESCRIPTION AND OPERATION

ENGINE TYPE

The engine is 4-cycle, water-cooled, in-line 3 cylinders with displacement of 796cc (68.5×72.0mm) (2.70× 2.83 in.).

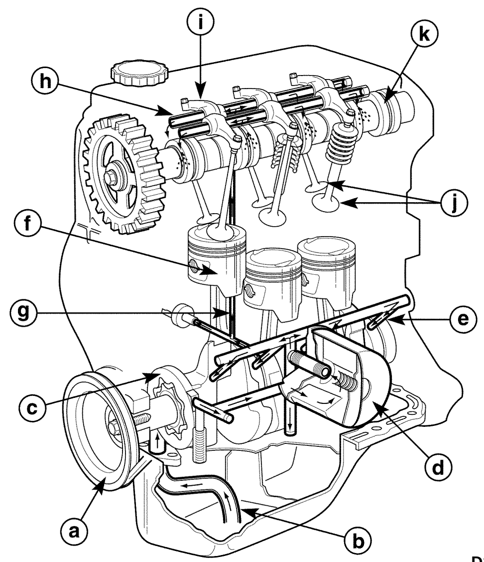
Engine model (Specifications)	F8C Type SOHC / 2 Valve (MPI)
Maximum power (kw/rpm)	37.5 / 6,000
Maximum torque (N•m/rpm)	68.6 / 4,600
Compression ratio	9.3 : 1



D102B001

ENGINE LUBRICATION

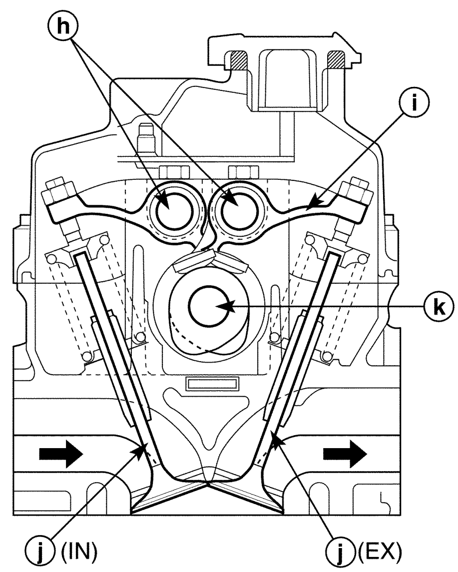
The engine lubrication is of the wetsump method to draw up the oil forced by the oil pump. The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side (a). Oil is drawn up through oil pump pickup tube (b) and passed through pump (c) to oil filter (d). The filtered oil flows into two paths in engine block. In one path (e), oil reaches crankshaft journal bearings. Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston (f), rings, and cylinder wall. In another path (g), oil goes up to cylinder head and lubricates rocker arm (i), valve (j), camshaft (k), etc. through the oil hole provided on the rocker arm shaft (h).



D102B002

CYLINDER HEAD AND VALVE TRAIN

The cylinder head is made of cast aluminum alloy for better strength in hardness with lightweight, and camshaft (k) and rocker arm shaft (h) arranged in-line support.



D102B003

The combustion chambers are formed into the manifold combustion chambers with increased squish parts for better combustion efficiency and its intake and exhaust parts are installed in the cross flow arrangement. The rocker arm (i) operates in seesaw motion to close and open the intake and exhaust valves (j) with camshaft by turning the rocker arm shaft of each intake and exhaust part.

ENGINE BLOCK

As the largest part of the engine components. the block (l) has all the necessary parts attached to outer surface of it.

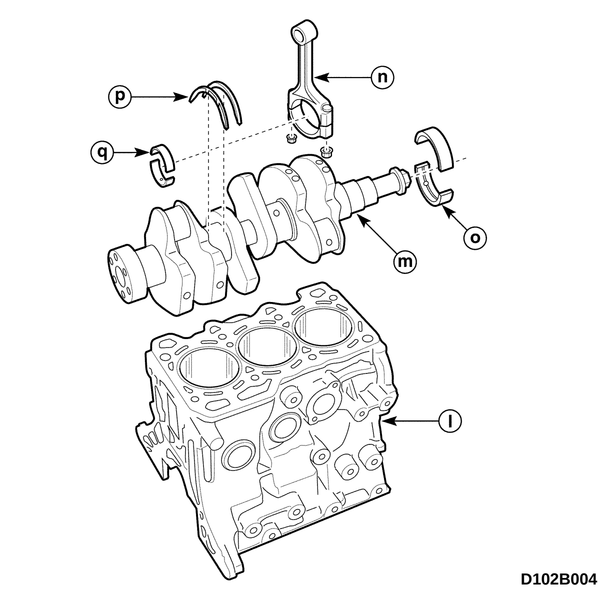
On the inside surface of block, there are bore surfaces by horning, which are cylinders, and on the periphery of the cylinders, there are the passages to prevent the over-heated and to lubricate the engine block.

CRANKSHAFT

The crankshaft (m) is to convert the rectilinear motion into the rotation motion through the connecting rod (n) which transmits the power generated by combustion.

On the one side of it, oil pump, crankshaft pulley and timing belt pulley are attached, and oil seal housing and flywheel are on the other side.

A special steel of high grade cast iron is used for the material to stand the bending load and distortion. The material of the main bearing (o) is aluminum alloy. The split thrust bearings (p) are inserted in the journal bearing part (No.3).



D102B004

CONNECTING ROD

The connecting rods (n) are made of forged steel, and its section is typed "I" with its big end connected to crankshaft (m) and its small end to piston pin to transmit the power.

The big end is detachable, and its upper and lower parts are fastened by bolting after the metal bearings (q) are inserted.

PISTON, PISTON RING AND PISTON PIN

Piston

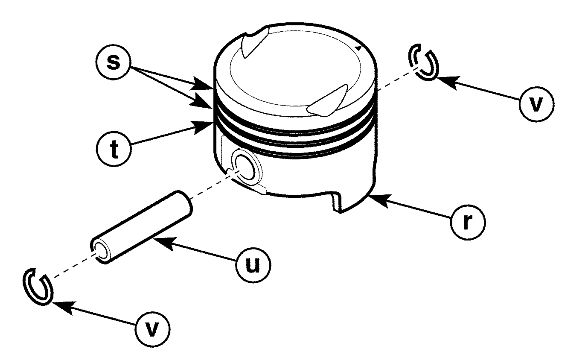
The piston (r) is of the open skirt type and its crown is exposed in the combustion chamber to generate power. Its land and skirt parts are made of coat aluminum alloy which is light and has excellent heat conductivity in order to meet its continuous and high speed reciprocation movement.

Piston Ring

It is composed of two compression rings (s) and one oil ring (t) and installed between the grooves of the piston to make the high speed reciprocating movement maintaining a remarkable air tightness as well as cylinders. It is a critical parts to affect the compression pressure, oil consumption, compression, blow by pressure and engine performance.

Piston Pin

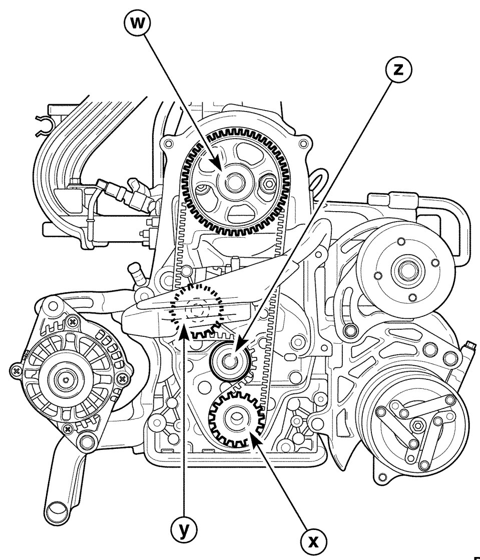
The pin (u) is not fixed to the piston or connecting rod and its both ends are assembled by the circlip (v) in the full floating type. The pin is used to transmit the power from the crown part of piston to connecting rod.



D102B005

TIMING BELT AND PULLEY

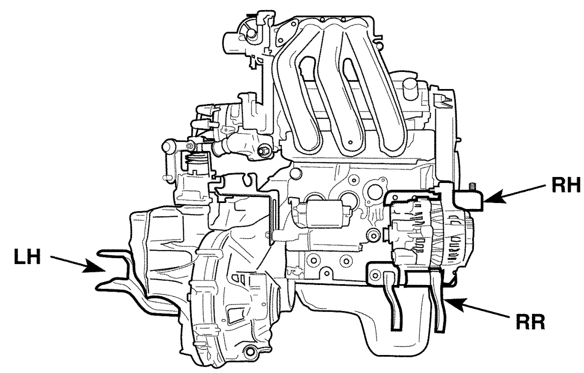
The timing belt connects the camshaft timing pulley (w) and the crankshaft timing pulley (x). The timing belt coordinates the crankshaft and the camshaft and keeps them synchronized. The timing belt also turns the coolant pump (y). The timing belt and the pulleys are toothed so that there is no slippage between them. There is a tension pulley (z) that maintains the correct timing belt tension. The timing belt is made of a tough reinforced rubber similar to that used on the serpentine drive belt. The timing belt requires no lubrication.



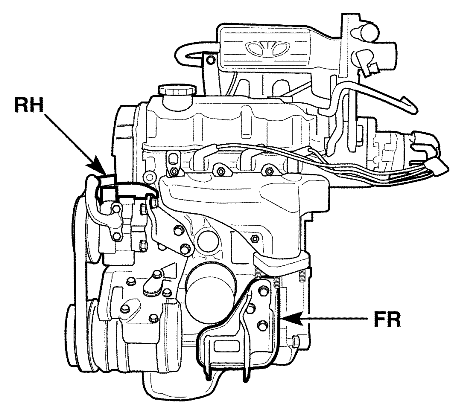
D102B006

ENGINE MOUNT

This is to absorb or reduce the engine vibration and impact from the wheeled road. Engine mount is attached to the engine–front side, the engine-right side and the engine-rear side and one transaxle mount is attached to the transaxle side.



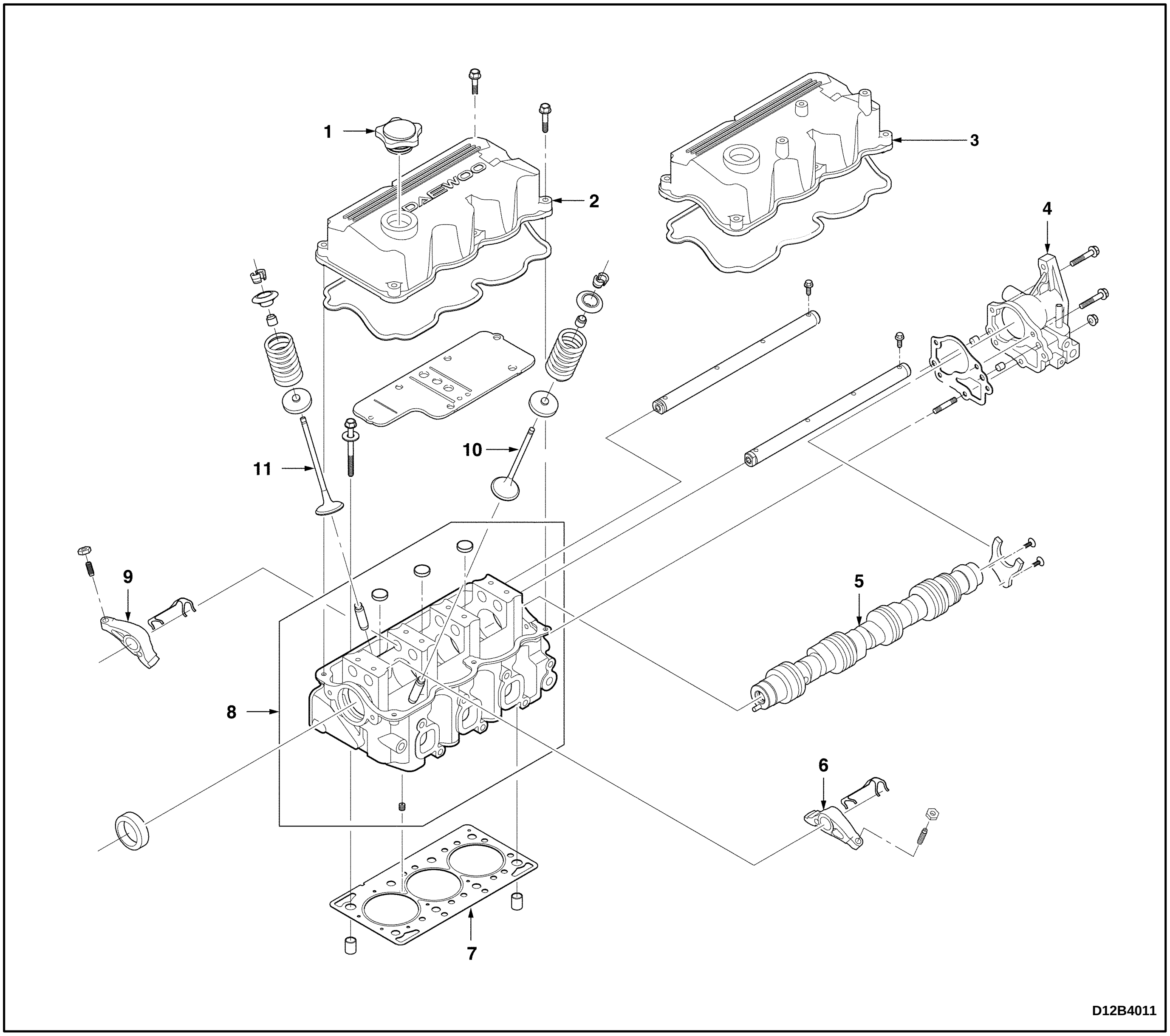
D102B007



D102B008

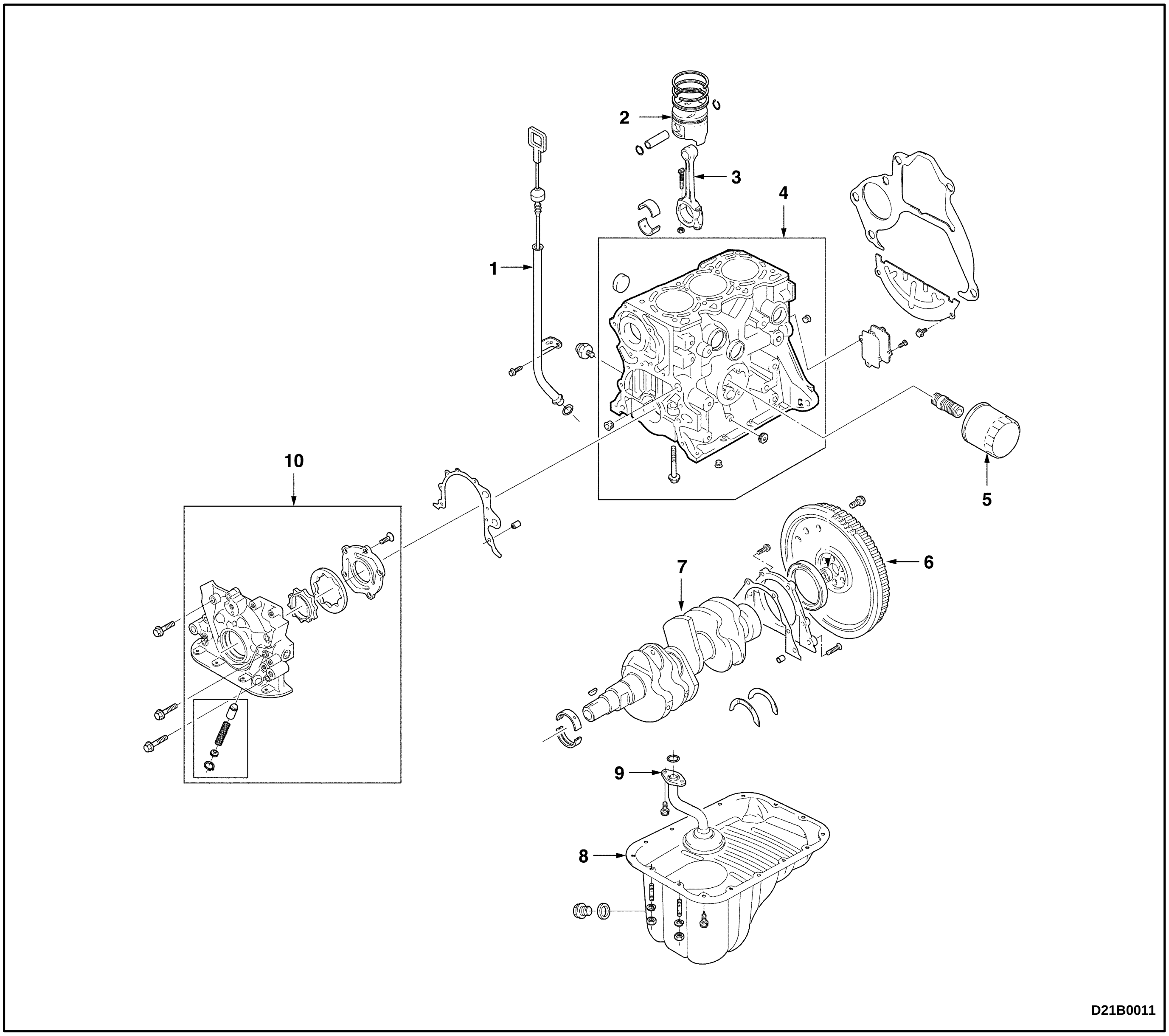
COMPONENT LOCATOR

CYLINDER HEAD



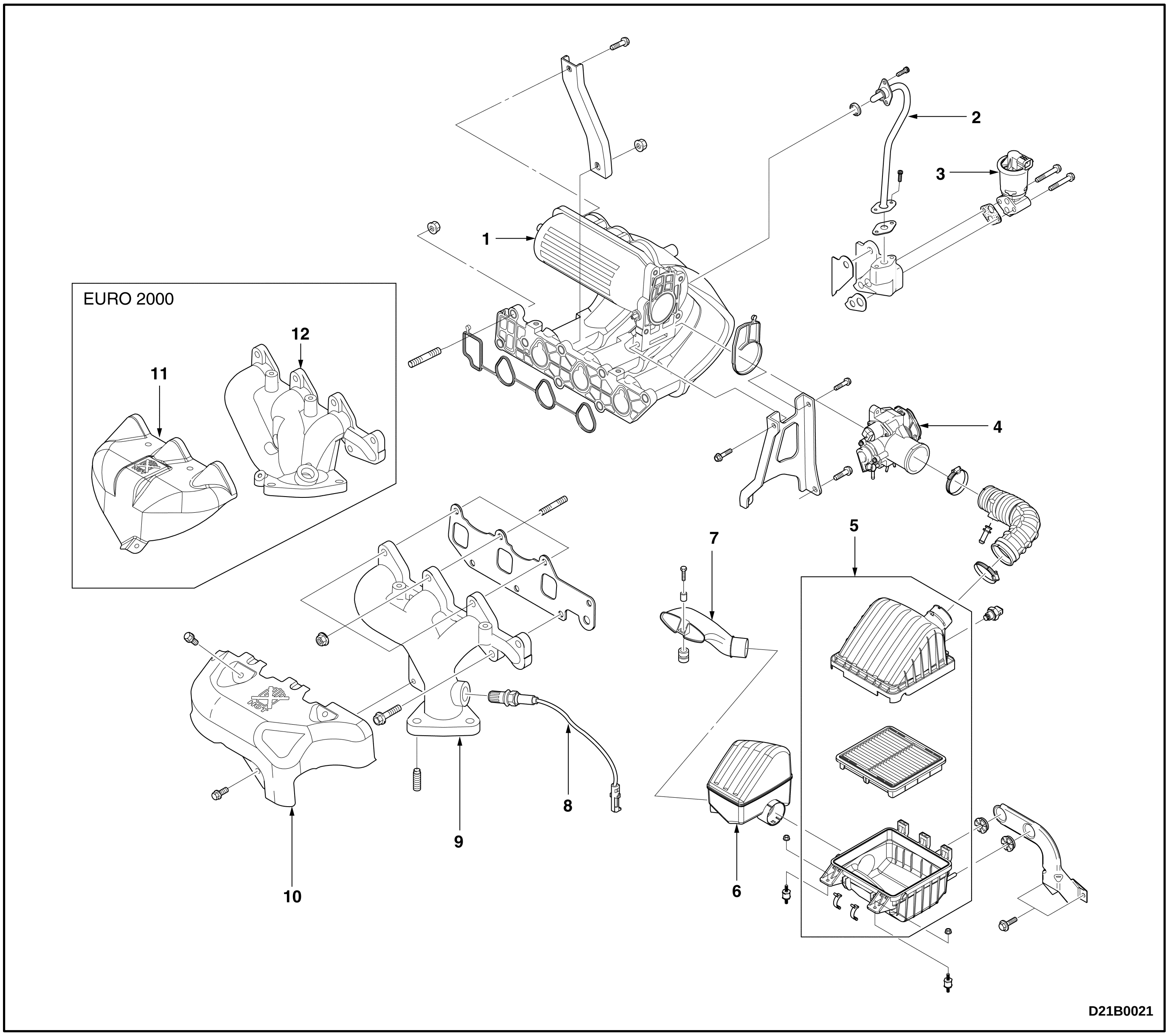
1 Oil Filler Cap
2 Cylinder Head Cover
3 Cylinder Head Cover (Euro III)
4 Distributor Case
5 Camshaft
6 Exhaust Rocker Arm
7 Cylinder Head Gasket
8 Cylinder Head
9 Intake Rocker Arm
10 Exhaust Valve
11 Intake Valve

ENGINE BLOCK



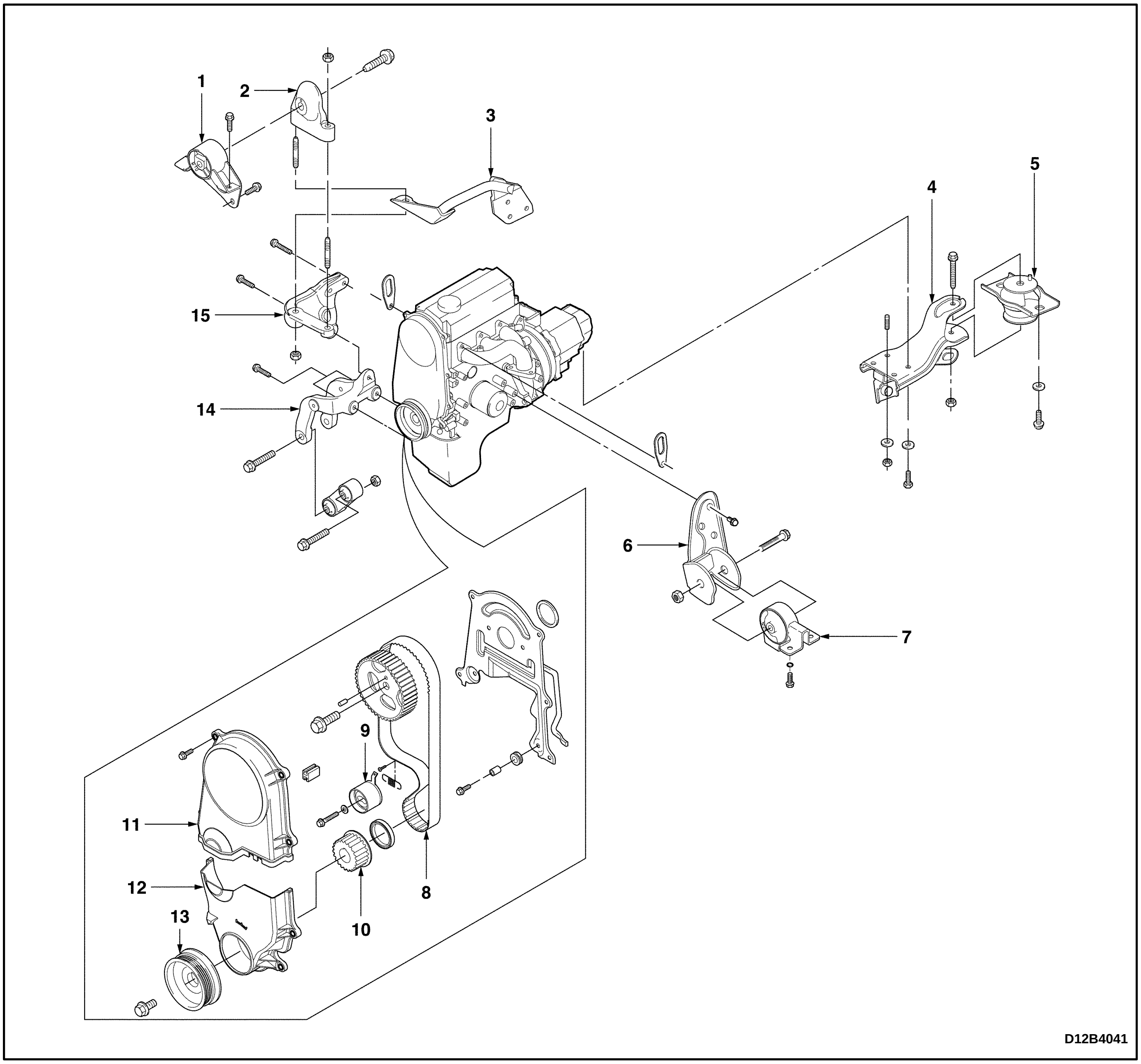
1 Oil Level Gauge Stick
2 Piston
3 Connecting Rod
4 Engine Block
5 Oil Filter
6 Flywheel
7 Crankshaft
8 Oil Pan
9 Oil Pump Strainer
10 Oil Pump Assembly

MANIFOLD & AIR FLOW SYSTEM



1 Intake Manifold
2 Exhaust Gas Recirculation (EGR) Pipe
3 Exhaust Gas Recirculation (EGR) Valve and Solenoid
4 Throttle Body Assembly
5 Air Filter Assembly
6 Resonator
7 Snorkel
8 Oxygen Sensor
9 Exhaust Manifold
10 Exhaust Manifold Heat Shield
11 Exhaust Manifold Heat Shield (Euro III)
12 Exhaust Manifold (Euro III)

TIMING BELT & ENGINE MOUNT



1 Engine Mount Damping Block
2 Engine Mount Intermediate Bracket
3 Engine Mount Brace Bracket
4 Transaxle Mount Bracket
5 Transaxle Mount Damping Block
6 Engine Mount Front Bracket
7 Engine Mount Front Damping Bush
8 Timing Belt
9 Timing Belt Tensioner
10 Crankshaft Gear
11 Timing Belt Upper Front Cover
12 Timing Belt Lower Front Cover
13 Crankshaft Pulley
14 Engine Mount Lower Bracket
15 Engine Mount Upper Bracket

DIAGNOSTIC INFORMATION AND PROCEDURE

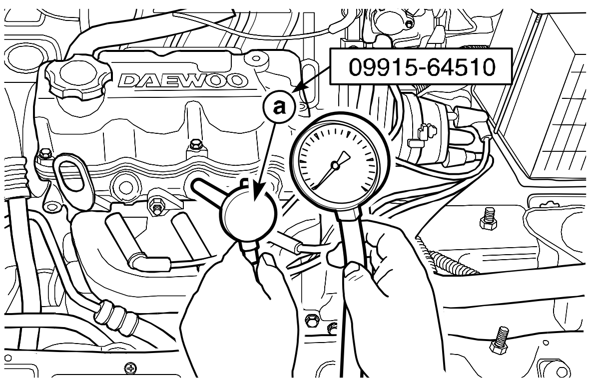
COMPRESSION PRESSURE CHECK

Tools Required

09915–64510 Compression Pressure Gauge

Check the compression pressure in the following procedures:

1. Warm up the engine to the normal operating temperature (Cooling temperature : 80–90°C (176–194°F)).
2. Stop the engine and then remove the high tension cable and the spark plug.
3. Disconnect the distributor optical sensor connector.
4. Install the compression pressure gauge 09915–64510 (a) in the hole of spark plug.



D12B301A

5. Disengage the clutch in Neutral (to lighten starting load on engine upon cranking), and depress the accelerator all the way to make the throttle fully open.
6. Crank the engine with the starting motor, and read the highest pressure on the compression pressure gauge.

- The difference of measured value between cylinders is 98.06kPa (14.22 psi) and less.
- On checking, make the connection perfectly airtight between the hole of spark plug and compression pressure gauge.

	Unit	Standard	Limit
Compression Pressure – 400 rpm	kPa(psi)	1,225.75 (177.73)	1,176.72–1,274.78 (170.62–184.84)

7. After checking, remove the gauge and install the removed parts.

OIL PRESSURE CHECK

Tools Required

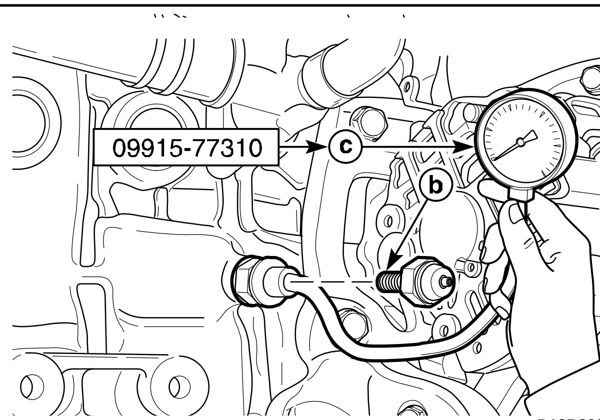
09915–77310 Oil Pressure Gauge

Prior to check oil pressure, check the followings:

- Check oil level and add if required.
- Replace the discolored, deteriorated or diluted oil.
- Check any oil leakage and repair the defective parts.

Check the compression pressure in the following procedures:

1. Remove the oil pressure switch (b) from the cylinder block.
2. Install the oil pressure gauge 09915–77310 (c) to the mounting place of the oil pressure switch.



D12B302A

3. Start the engine and warm up to the normal operating temperature.
4. Raise the engine speed up to 2,000rpm and then read oil pressure.

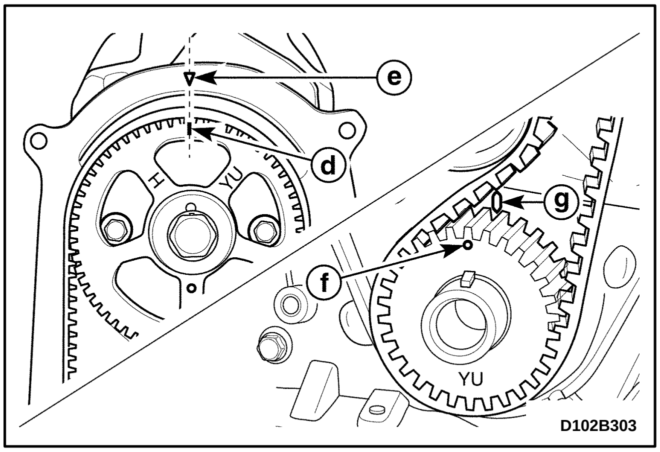
Item	Unit	Standard
Oil Pressure – 2000rpm	kPa (psi)	245.15–294.18 (35.55–42.66)

5. After checking, wrap the threads of oil pressure switch with a seal tape and tighten it to the specified torque 12–16 N•m (106–144 lb-in).
6. Start the engine and check oil pressure switch for oil leakage.

ADJUSTMENT OF VALVE CLEARANCE

Adjust the valve clearance in the following procedures:

1. Remove the air filter/resonator assembly and the relevant parts installed on the cylinder head cover.
2. Remove the cylinder head cover hexagon bolts and remove the cover.
3. Turn over the crankshaft to make No.1 cylinder matched with the compression top dead center. (When the camshaft sprocket notch (d) is aligned with the timing belt rear cover triangle pointer (e) and the crankshaft sprocket point (f) is aligned with the oil pump housing point (g), the compression top dead center is on the ignition sequence for No. 1 cylinder.)

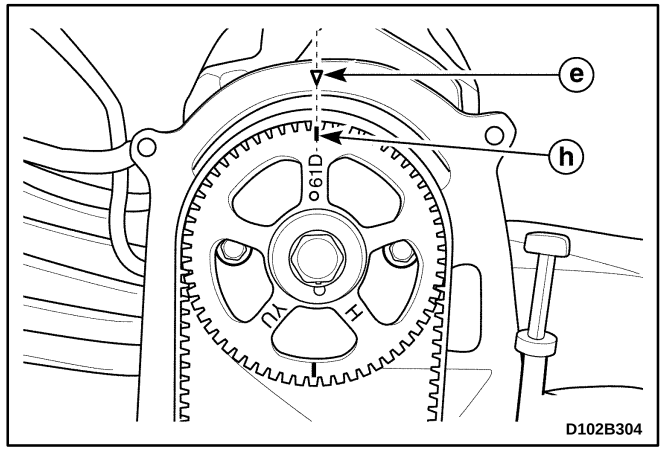


4. Check the valve clearance for No. 1 cylinder compression top dead center.

Condition	Cylinder No.	1	2	3
Compression top dead center of No.1 cylinder	Intake	○	○	
	Exhaust	○		○

∗ ○ marks indicates the place where the valve clearance can be checked and adjusted.

5. If the checking for the valve clearance of No.1 cylinder compression top dead center is over, position No.1 cylinder on the exhaust top dead center as rotating the crankshaft in a 360–degree arc. (When the camshaft sprocket point (h) is aligned with the timing belt rear cover triangle pointer (e), the exhaust top dead center is on the ignition sequence for No. 1 cylinder.)

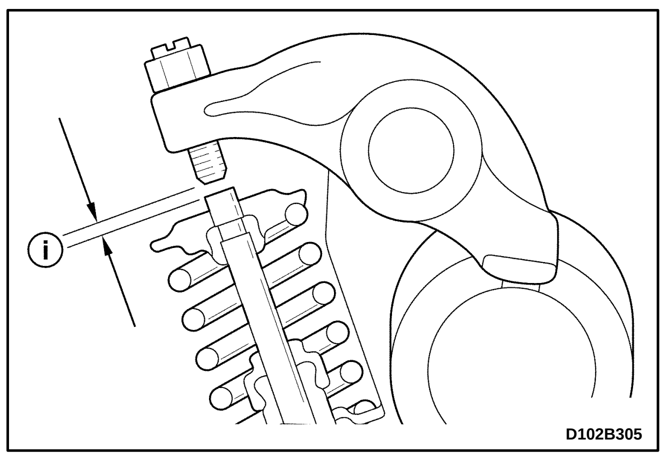


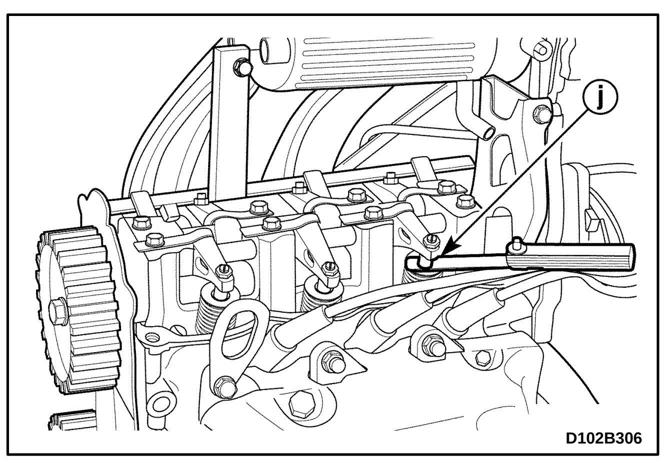
6. Check the valve clearance for the No. 1 cylinder exhaust top dead center.

Condition	Cylinder No.	1	2	3
Exhaust top dead center of No.1 cylinder	Intake			○
	Exhaust		○	

∗ ○ marks indicates the place where the valve clearance can be checked and adjusted.

- Check and adjust the valve clearance (i) using thickness gauge (j).





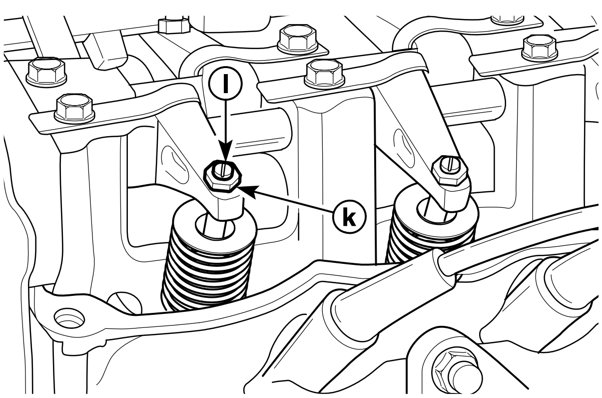
The measured value of valve clearance should meet the specified value. If not, adjust the valve clearance.

Important: In case of hot engine, warm up the engine until the electric cooling fan begins to work and stop the engine to adjust the clearance with 20–30 minutes there from.

Unit : mm (in.)

Item			Specified value
Valve Clearance	Cold	Intake	0.15±0.02 (0.0059±0.0008)
		Exhaust	0.32±0.02 (0.0126±0.0008)
	Hot	Intake	0.25±0.02 (0.0098±0.0008)
		Exhaust	0.42±0.02 (0.0165±0.0008)

8. When adjusting the valve clearance, loosen the adjust nut (k) and then tighten or loosen the adjust rod (l) properly.



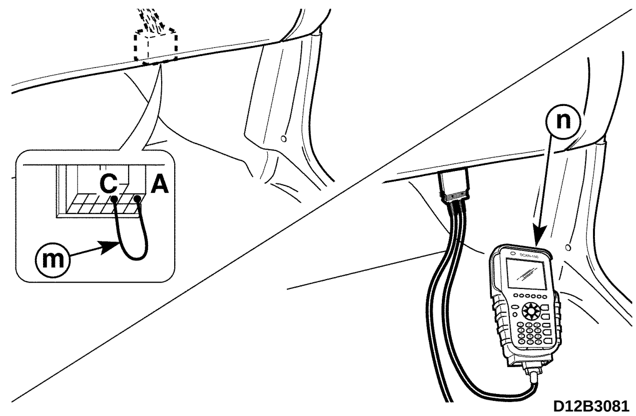
D102B307

IGNITION TIMING CHECK AND ADJUSTMENT (TYPICAL)

Note: Ignition timing could not be adjusted for Direct Ignition System (Euro Stage III).

Check and adjust the ignition timing in the following procedures:

1. Warm up the engine to the normal operating temperature.
2. Turn off the lamp and audio system and shift the shift gear lever in Neutral.

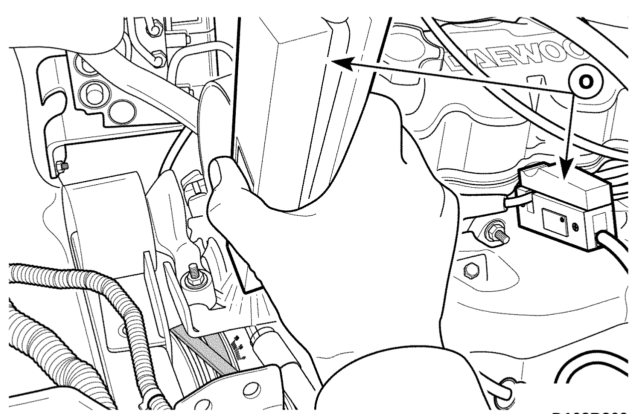


D12B3081

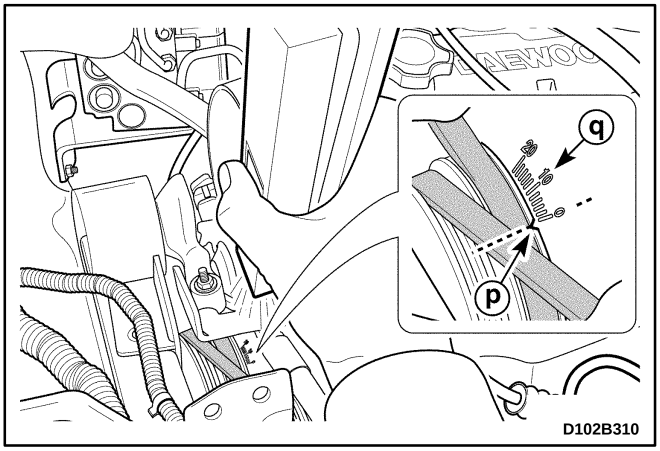
3. Connect terminal A and terminal C of ALDL connector using the wire (m) or connect the scan tool (n) with ALDL connector.
4. Connect the timing light (o) with No. 1 cylinder high tension cable and check the specified value for the ignition timing, flashing notch on the crankshaft pulley.

Item	Specified Value
Ignition timing – 950rpm	10° BTDC

Important: In flashing the timing light, if crankshaft pulley notch (p) is matched with the mark (10) for timing check, the ignition timing is 10° BTDC.

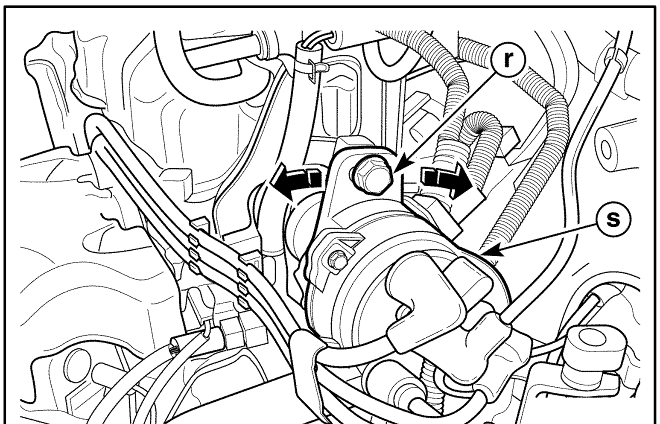


D102B309



D102B310

5. If the ignition timing exceeds the specified value, loosen the distributor bolts and adjust it to the specified ignition timing by turning the distributor body (s).

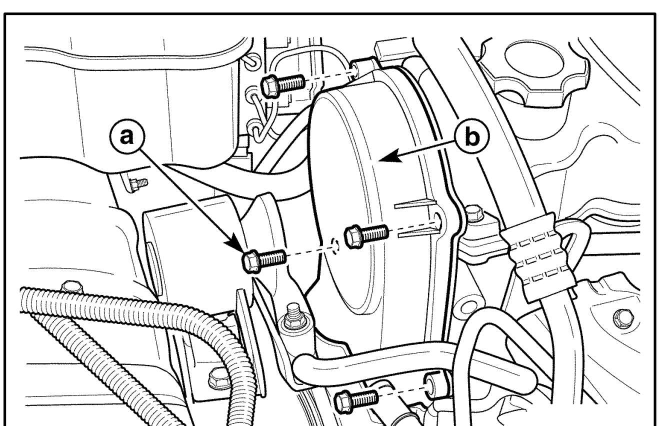


D102B311

VALVE TIMING CHECK AND ADJUSTMENT

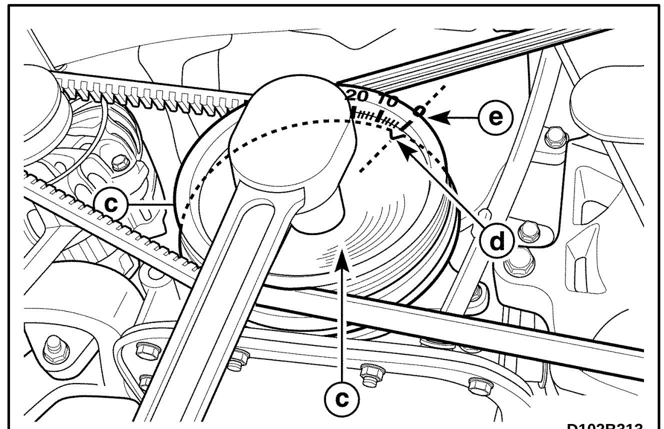
Check the valve timing in the following procedures:

1. After removing the high headlamp, loosen the bolts (a) and remove the timing belt front upper cover (b).



D102B312

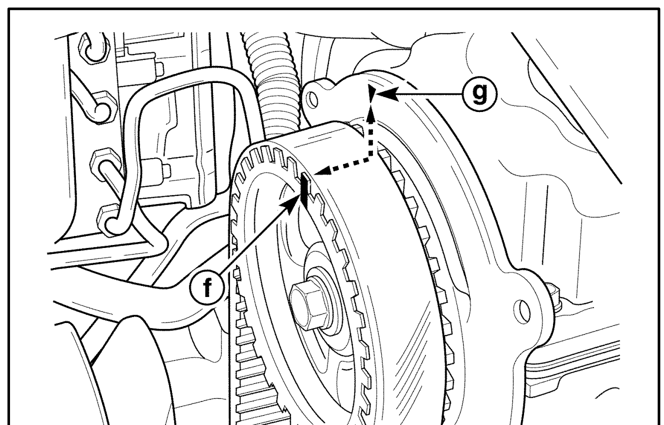
2. Turning the crankshaft clockwise twice, align the notch (d) on the crankshaft pulley (c) with the mark 0 (e) for the timing check on the timing belt front lower cover.



D102B313

3. Check if the notch (f) on the camshaft sprocket is aligned with the triangle pointer (g) on the timing belt rear cover.

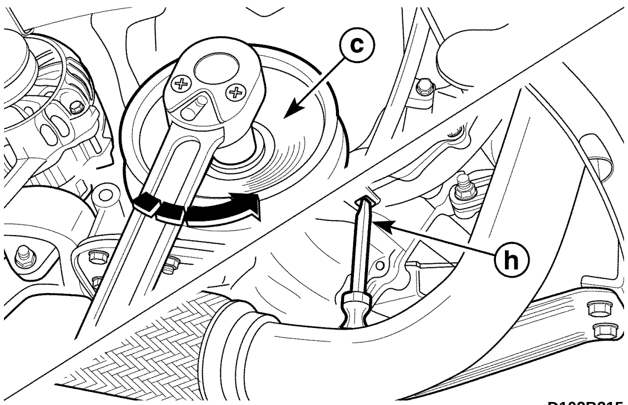
Important: Notch (f) should be aligned with pointer (g) to set the valve timing normally.



D102B314

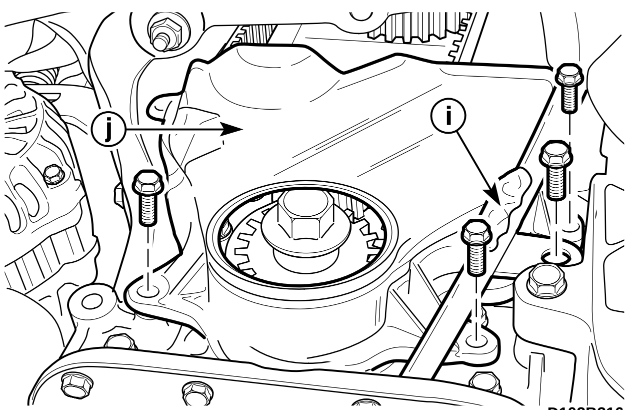
Adjust the valve timing in the following procedures:

1. Loosen the bolt and remove the timing belt pulley (c). In loosening the bolt, use the driver (h) in the picture shown.



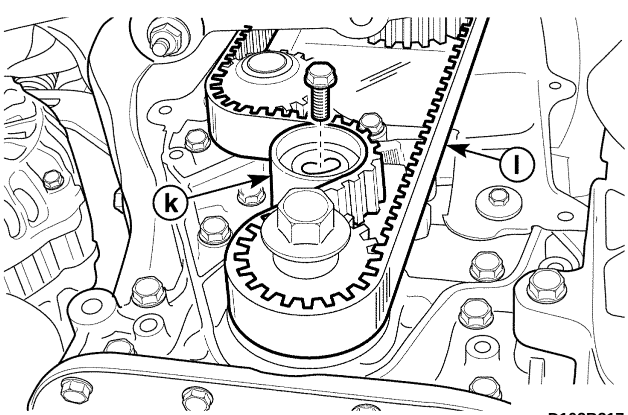
D102B315

2. Remove the oil level gauge guide tube (i) and the timing belt front lower cover (j).



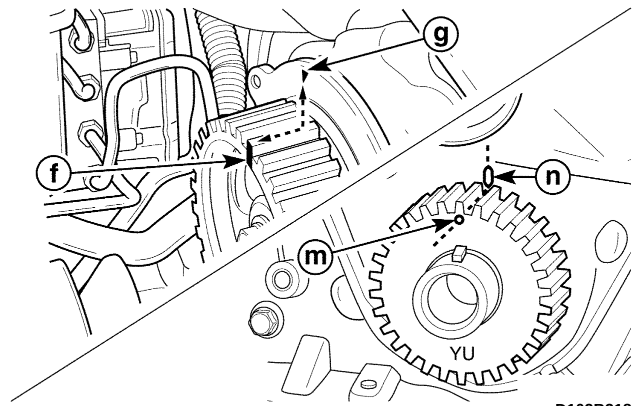
D102B316

3. Remove the timing belt tensioner (k) and the timing belt (l).



D102B317

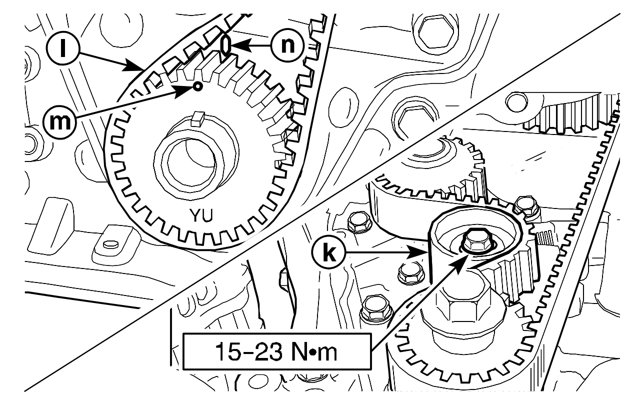
4. Using the bolt, turn the crankshaft clockwise to align the mark (m) on the crankshaft sprocket with the pointer (n) on the oil pump housing. Then, turn the camshaft to align the notch (f) with the pointer (g).



D102B318

5. Install the timing belt (l) and the tensioner (k). (Do not tighten the tensioner bolt completely.)

   Turning the crankshaft clockwise twice, align the mark (m) with the pointer (n) and tighten the tensioner bolt to 15–23 N•m (11–17 lb-ft).



D12B319A

6. Install all removed parts.

SECTION 1D

ENGINE COOLING

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in B unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The cooling system maintains the engine temperature at an efficient level during all engine operating conditions. When the engine is cold the cooling system cools the engine slowly or not at all. This slow cooling of the engine allows the engine to warm up quickly.

The cooling system includes a radiator(a) and cooling fan(b), a thermostat and housing(c), a coolant pump(d), a coolant pump drive belt and coolant hose. The timing belt drives the coolant pump.

All components must function properly in order for the cooling system to operate. The coolant pump draws the coolant from the radiator. The coolant then circulates through water jackets in the engine block and the cylinder head, distributor case(e), throttle body(f). When the coolant reaches the operating temperature of the thermostat, the thermostat opens. The coolant then goes back to the radiator where it cools.

This system directs some coolant through the hoses to the heater core(g). This provides for heating and defrosting. The surge tank(h) is connected to the radiator and throttle body to recover the coolant displaced by expansion from the high temperatures. The surge tank maintains the correct coolant level.

The cooling system for this vehicle has no radiator cap and drain cock. The coolant is added to the cooling system through the surge tank. To drain the cooling system, disconnect the lower radiator hose and drain the coolant.

RADIATOR

This vehicle has a lightweight tube-and-fin aluminum radiator.

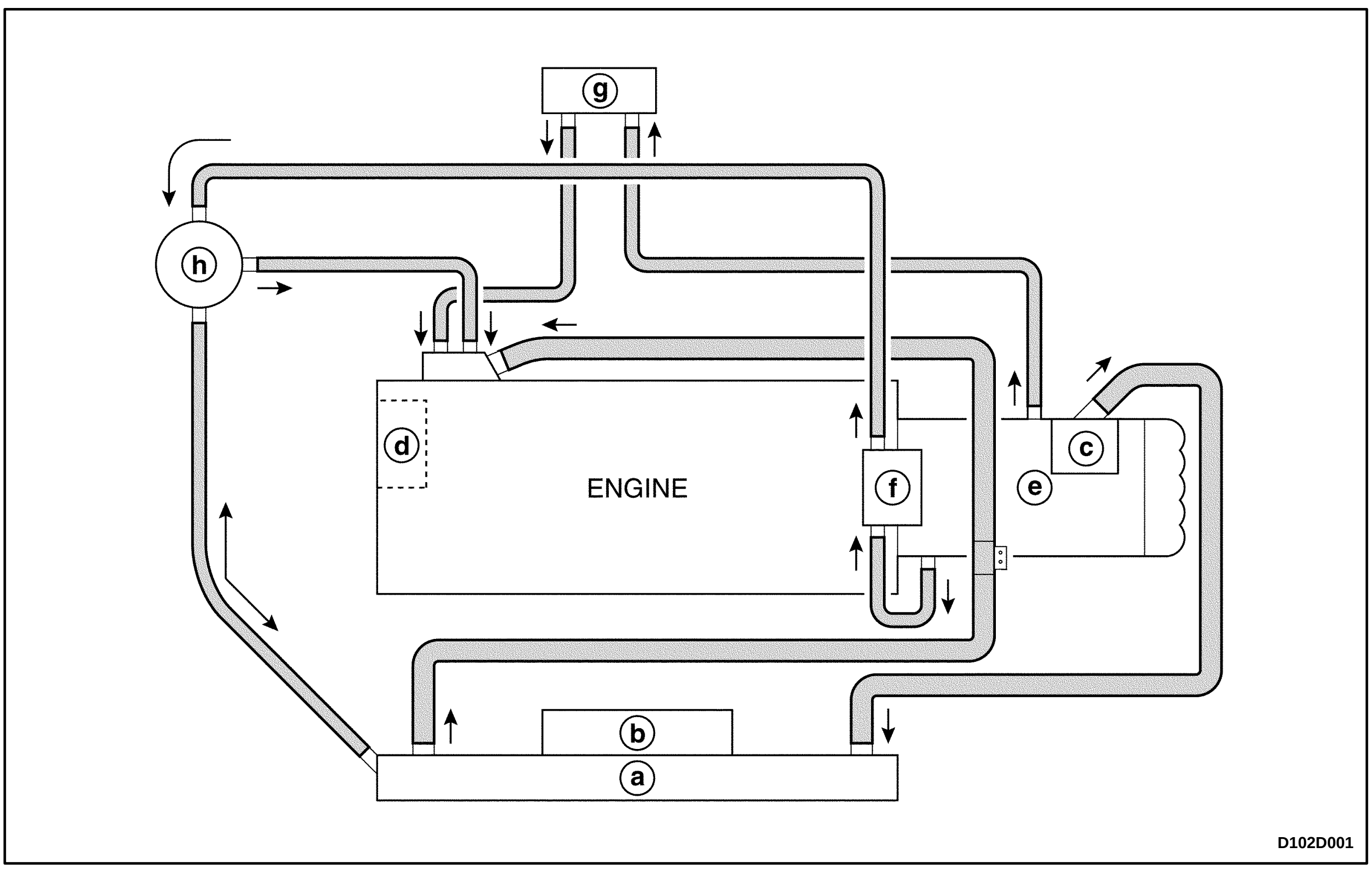
SURGE TANK

The surge tank is a transparent plastic reservoir, similar to the windshield washer reservoir.

The surge tank is connected to the radiator and throttle body by a hose. As the vehicle is driven, the engine coolant heats and expands. The portion of the engine coolant displaced by this expansion flows from the radiator into the surge tank. The air trapped in the radiator is degassed into the surge tank.

When the engine is stops, the engine coolant cools and contracts. The displaced engine coolant is then drawn back into the radiator. This keeps the radiator filled with the coolant to the desired level at all times and increases the cooling efficiency.

Maintain the coolant level between the MIN and the MAX marks on the surge tank when the system is cold.



COOLANT PUMP

The belt-driven centrifugal coolant pump consists of an impeller, a drive shaft, and a belt pulley.

The impeller is supported by a completely sealed bearing.

The coolant pump is serviced as an assembly and, therefore, cannot be disassembled.

THERMOSTAT

A wax pellet-type thermostat controls the flow of the engine coolant through the engine cooling system. The thermostat(i) is mounted in the thermostat housing.

The thermostat stops the flow of the engine coolant from the engine to the radiator in order to provide faster warm-up, and to regulate the coolant temperature. The thermostat remains closed while the engine coolant is cold, preventing circulation of the engine coolant through the radiator. At this point, the engine coolant is allowed to circulate only throughout the heater core to warm it quickly and evenly.

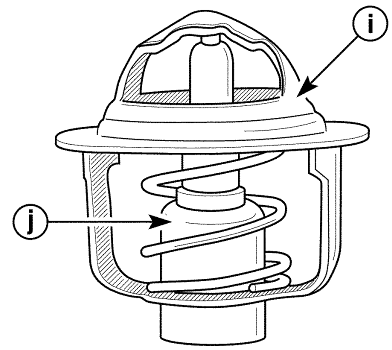
As the engine warms, the thermostat opens. This allows the engine coolant to flow through the radiator, where the heat is dissipated through the radiator. This opening and closing of the thermostat permits enough engine coolant to enter the radiator to keep the engine within proper engine temperature operating limits.

The wax pellet in the thermostat is hermetically sealed in a metal case(j). The wax element of the thermostat expands when it is heated and contracts when it is cooled.

As the vehicle is driven and the engine warms, the engine coolant temperature increases. When the engine coolant reaches a specified temperature, the wax pellet element in the thermostat expands and exerts pressure against the metal case, forcing the valve open. This allows the engine coolant to flow through the engine cooling system and cool the engine.

As the wax pellet cools, the contraction allows a spring to close the valve.

The thermostat begins to open at 82°C (180°F) and is fully open at 95°C (203°F). The thermostat closes at 80°C (176°F).



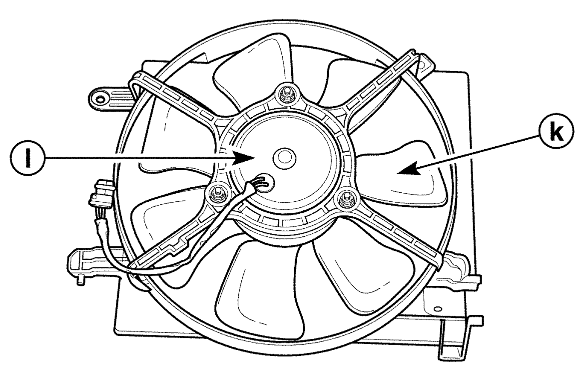
D102D002

ELECTRIC COOLING FAN

Caution: Keep hands, tools, and clothing away from the engine cooling fans to help prevent personal injury. This fan is electric and can turn ON whether or not the engine is running.

Caution: If a fan blade is bent or damaged in any way, no attempt should be made to repair or reuse the damaged part. A bent or damaged fan assembly should always be replaced with a new one.

The cooling fans are mounted behind the radiator in the engine compartment. The electric cooling fans increase the flow of air across the radiator fan and across the condenser on air conditioner (A/C)-equipped vehicles. This helps to speed cooling when the vehicle is at idle or moving at low speeds.



D102D003

The main fan size is 320 mm (12.6 in.) in diameter with seven blades(k) to aid the air flow through the radiator and the condenser. An electric motor(l) attached to the radiator support drives the fan.

A/C OFF or Non-A/C Model

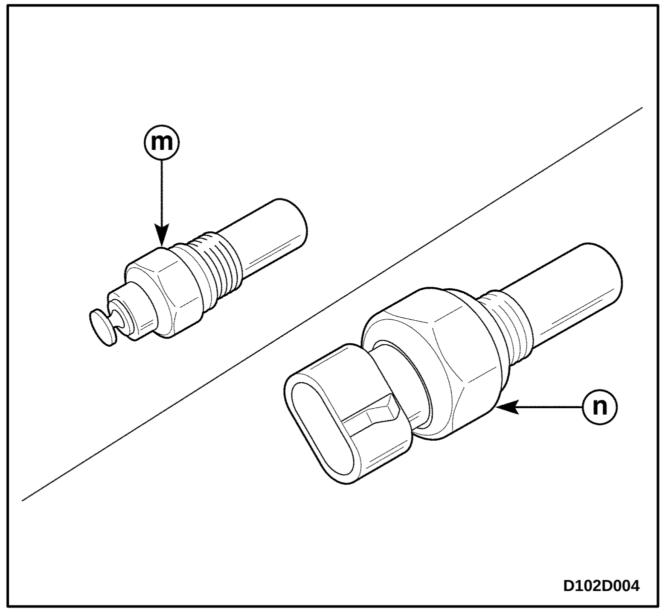
- The cooling fan is actuated by the electronic control module (ECM) using a low speed cooling fan relay and a high speed cooling fan relay. On A/C equipped vehicles, a series/parallel cooling fan relay is also used.
- The ECM will turn the cooling fan on at low speed when the coolant temperature reaches 93°C (199°F) and high speed at 100°C (212°F).
- The ECM will change the cooling fan from high speed to low speed at 97°C (207°F) and turn the cooling fans off at 90°C (194°F).

A/C ON

- The ECM will only turn the cooling fan on at high speed when the A/C system is on regardless of any condition.

ENGINE COOLANT TEMPERATURE SENSOR

The engine coolant temperature (ECT) sensor (n) uses a thermistor to control the signal voltage to the engine control module (ECM).

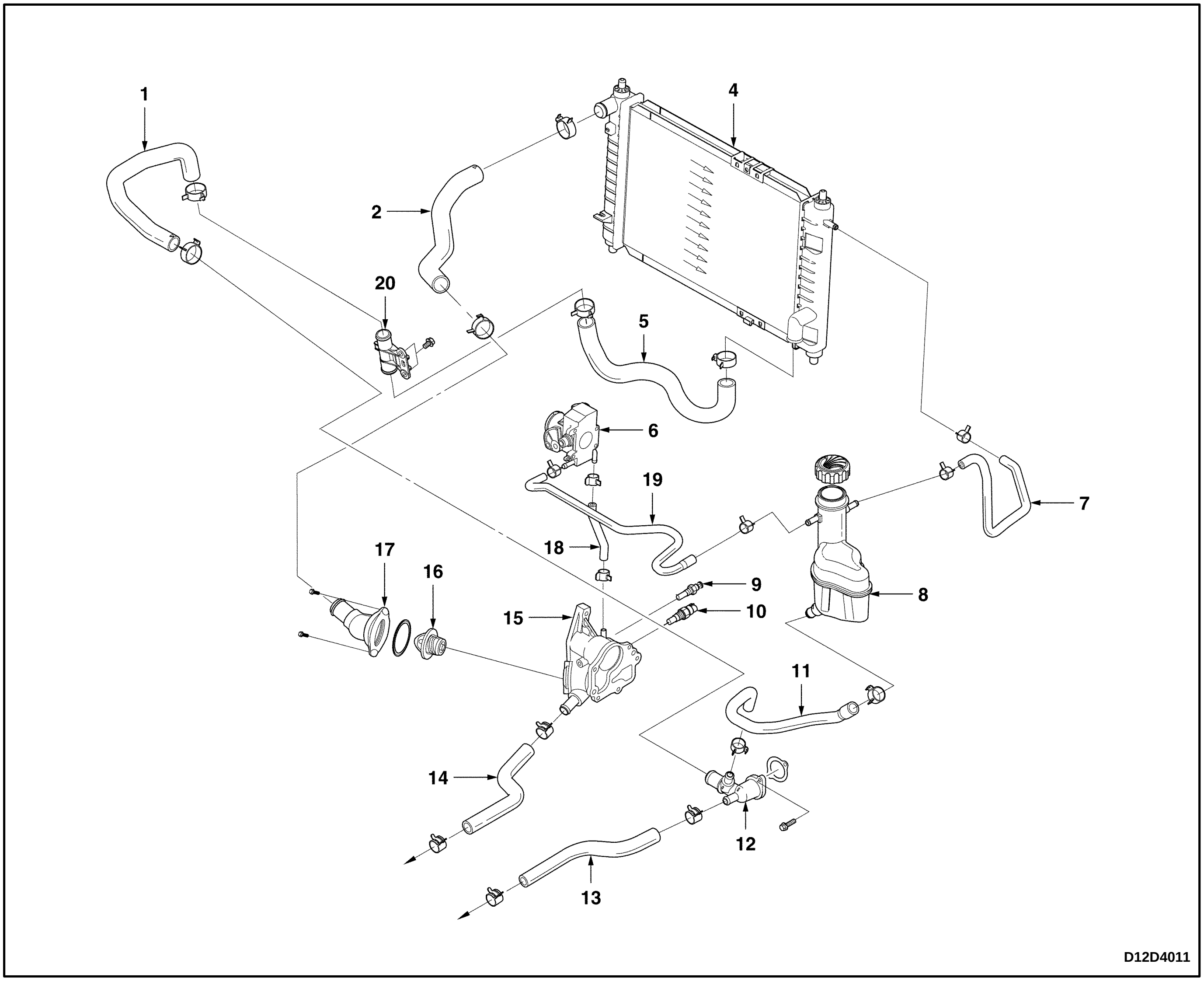


COOLANT TEMPERATURE SENSOR

The coolant temperature sensor(m) controls the instrument panel temperature indicator. The coolant temperature sensor is located on the distributor case with the ECT sensor on an SOHC engine.

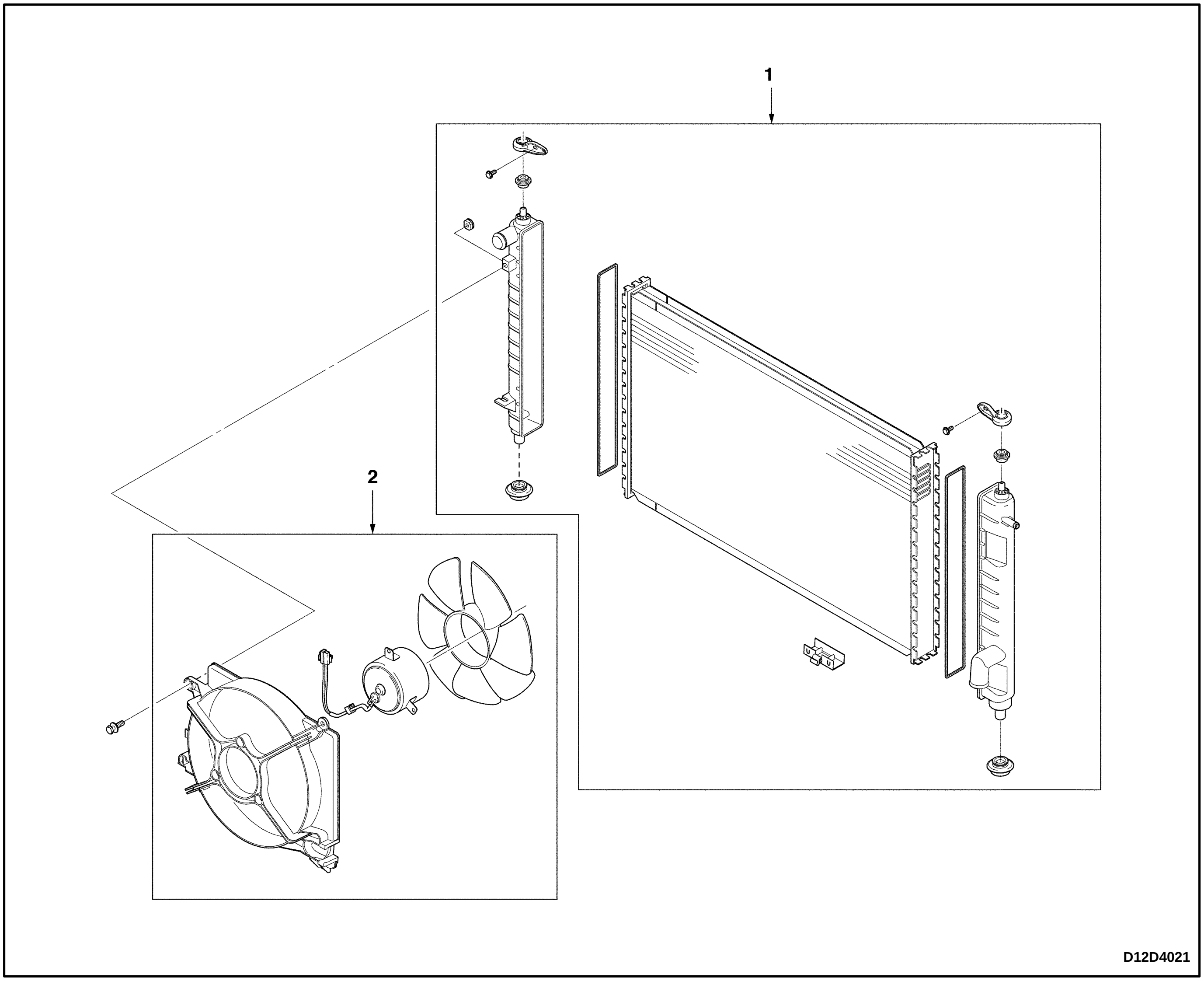
COMPONENT LOCATOR

COOLANT HOSE AND COMPONENTS



1 Radiator Coolant Return Hose
2 Upper Radiator Hose
3 Not Used
4 Radiator Assembly
5 Lower Radiator Hose
6 Throttle Body Assembly
7 Surge Tank hose
8 Surge Tank
9 Coolant Temperature Sensor
10 Engine Coolant Temperature Sensor
11 Surge Tank Return Hose
12 Water Inlet Cap
13 Heater Outlet Hose
14 Heater Inlet Hose
15 Distributor Case
16 Thermostat
17 Thermostat Housing
18 Throttle Body Inlet Hose
19 Throttle Body Outlet Hose
20 Hose Bracket

RADIATOR/FAN



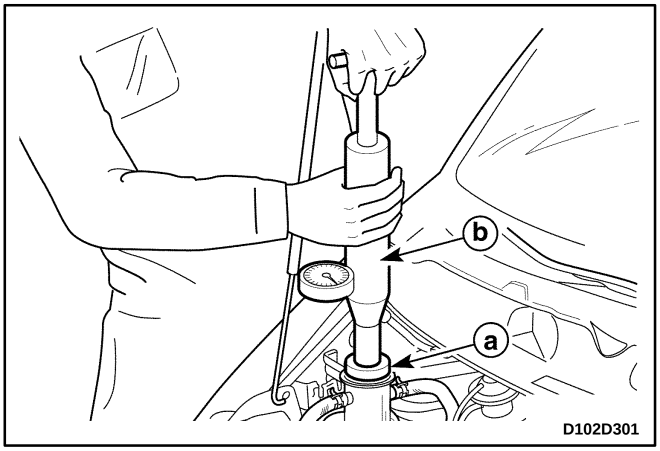
1 Radiator Assembly

2 Electric Cooling Fan Assembly

DIAGNOSTIC INFORMATION AND PROCEDURE

COOLANT LEAKS TEST

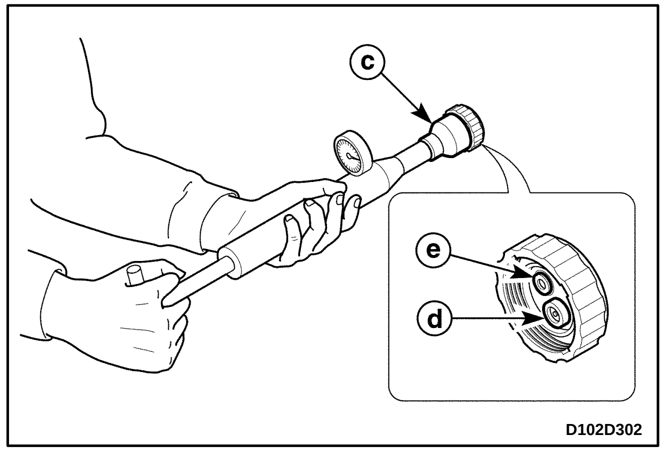
1. Remove the surge tank cap after the engine cools.
2. Check the coolant level.
3. Install a suitable cooling system pressure tester(b) to the surge tank filler neck using the adapter(a) and pressurize (110–120 kPa (16.0–17.4 psi)).
4. Check the coolant leaks on the hoses and connections during 2 minutes.
5. If the leak is checked, replace the parts or repair the connections.



SURGE TANK CAP TEST

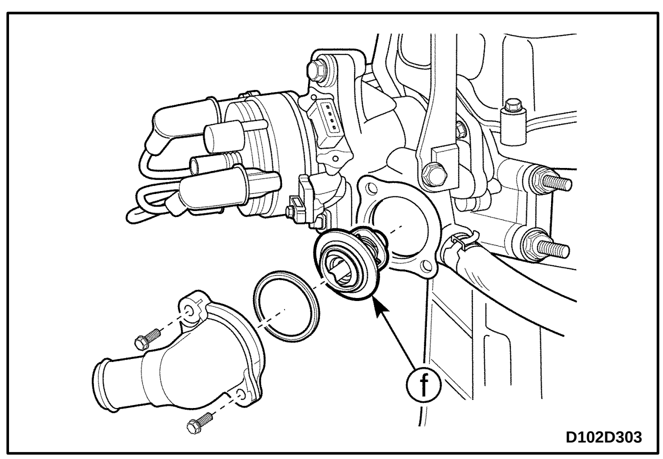
The surge tank cap(c) is equipped with the pressure valve(d) and the vacuum valve(e). Therefore, the surge tank cap maintains proper pressure. And The surge tank cap protects the system from high-pressure by opening a pressure valve, and protects the coolant hoses from collapsing because of a vacuum.

1. Wash any sludge from the surge tank cap and the valve seat of the vacuum pressure valve for the surge tank cap.
2. Check for any damage or deformity to the vacuum pressure valve for the surge tank cap. If any damage or deformity is found, replace the cap.
3. Install a suitable cooling system pressure tester(b) to the cap using the Adapter(a).
4. Pull the vacuum pressure valve to the open position. If the surge tank cap does not seal properly, replace the surge tank cap.
5. Pressurize the cap to 90 to 120kPa (13 to 17psi).
6. Wait 10 seconds and check the pressure held by the tank cap tester.
7. If the pressure held by the cooling system pressure tester falls below 80kPa (11.6psi) replace the surge tank cap.



THERMOSTAT TEST

1. Remove the thermostat(f) from the vehicle. Refer to“Thermostat” in this section.
2. Make sure the valve spring is tight when the thermostat is fully closed. If the spring is not tight, replace the thermostat.
3. Suspend the thermostat and a thermometer in a pan of 50/50mixture of ethylene glycol and water. Do not let the thermostat or the thermometer rest on the bottom of the pan because the uneven concentration of heat on the bottom could result in inaccurate temperature measurements.
4. Heat the pan on a burner.
5. Use the thermometer to measure the temperature of the heated solution.
6. The thermostat should begin to open at 82°C (180°F) and it should be fully open at 95°C (203.4°F) and it should be fully close at 80°C (176.4°F). If it does not open or close at these temperature, replace the thermostat. Also, the thermostat rod’s stroke from the initially open to the fully open should be 8mm (0.31 in.).

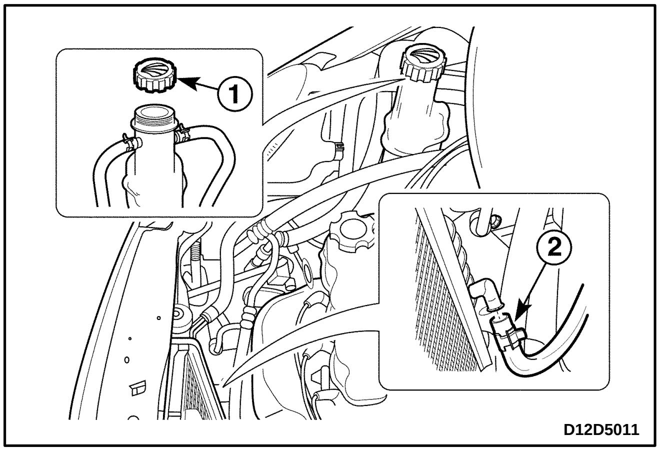


COOLING SYSTEM DIAGNOSIS

Condition	Probable Cause	Correction
Engine Overheats	• A loss of the coolant.	• Add the coolant.
	• A weak coolant solution.	• Confirm that the coolant solution is a 50/50 mixture of ethylene glycol and water.
	• Any dirt, any leaves, or any insects on the front of the radiator.	• Clean the front of the radiator.
	• The leakage from the hoses, the coolant pump, the heater, the thermostat housing, the radiator, the heater core, or the head gasket.	• Replace any damaged components.
	• A faulty thermostat.	• Replace a damaged thermostat.
	• Retarded ignition timing.	• Perform an ECM code diagnosis. • Confirm the integrity of the timing belt.
	• An improperly operating electric cooling fan.	• Replace the electric cooling fan.
	• Plugged or rotted radiator hoses.	• Replace any damaged radiator hoses.
	• A faulty water pump.	• Replace a faulty water pump.
	• A faulty surge tank cap.	• Replace a faulty surge tank cap.
	• A cracked or plugged cylinder head or engine block.	• Repair the damaged cylinder head or the damaged engine block.
	• A faulty radiator.	• Replace a faulty radiator.
Loss of Coolant	• A leak in the radiator.	• Replace a damaged radiator.
	• A leak in the surge tank or the hose.	• Replace the surge tank or the hose.
	• Looseness or damage of radiator hoses, heater hoses, or connections.	• Reseat the hoses. • Replace the hoses or the clamps.
	• Leaks in the coolant pump seal.	• Replace the coolant pump seal.
	• Leaks in the coolant pump gasket.	• Replace the coolant pump gasket.
	• An improper cylinder head torque.	• Tighten the cylinder head bolts to specifications. • Replace the cylinder head gasket, if needed.
	• Leaks in the intake manifold, cylinder head gasket, heater core.	• Repair or replace any components, as needed to correct the leak.
Engine Fails to Reach Normal Operating Temperature or Cool Air from the Heater	• Thermostat to be stuck open or to be wrong type.	• Install a new thermostat of the correct type and heat range.
	• The coolant level below the MIN mark on the surge tank.	• Add sufficient coolant to raise the fluid to the specified mark on the surge tank.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

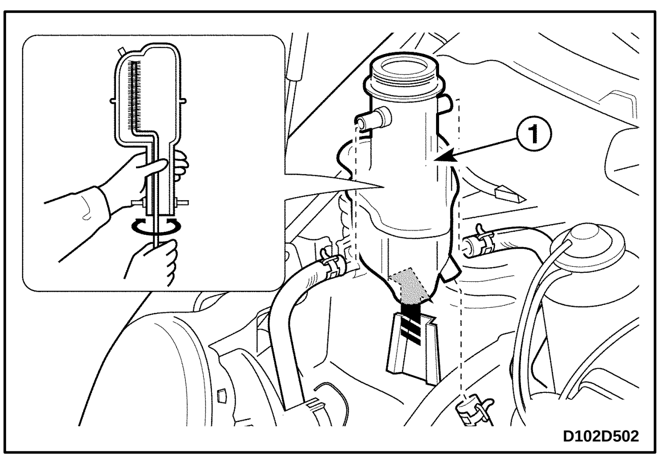


DRAINING AND REFILLING THE COOLING SYSTEM

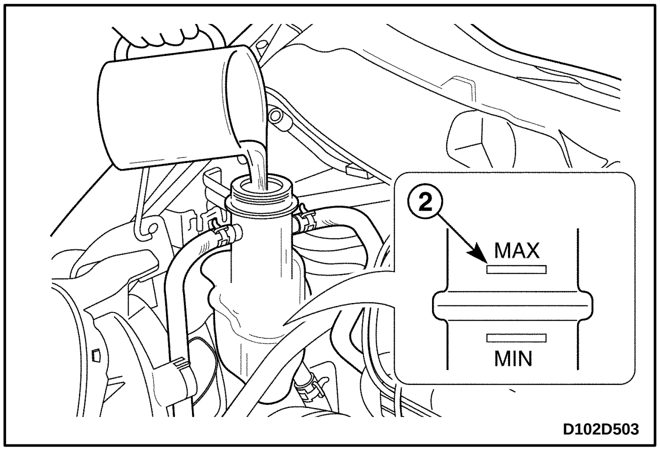
Caution: Do not remove the surge tank cap while the engine and the radiator are hot. Scalding fluid and steam may be blown out under pressure.

1. Place a pan below the vehicle to catch the draining coolant.
2. Drain the coolant.
   - Remove the surge tank cap (1).
   - Disconnect the lower radiator hose (2).

Caution: Dispose of the used coolant to a used coolant holding tank to be picked up with the used oil for disposal. Never pour the used coolant down the drain. Ethylene glycol antifreeze is an extremely toxic chemical. Disposing of it into the sewer system or the ground water can contaminate the local environment.



3. Connect the lower radiator hose.
4. Clean the cooling system.
   - Remove all sludge and dirt from inside the surge tank. And install the surge tank. Refer to “Surge Tank” in this section (1).

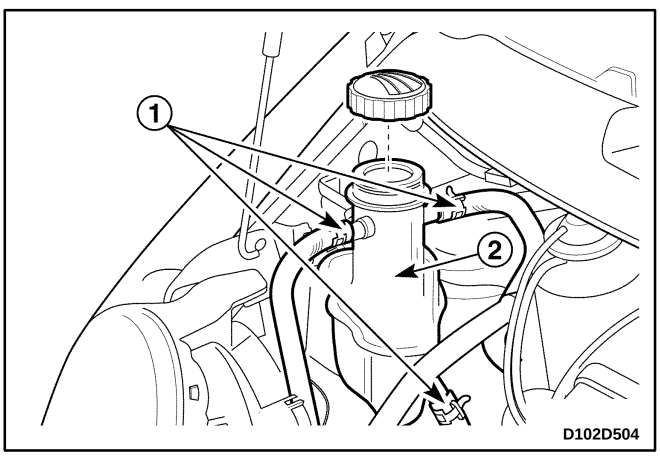


- Add the clean water to the surge tank (2).

5. Run the engine until the thermostat opens. You can tell the thermostat is open when both radiator hoses are hot to the touch.
6. Stop the engine and disconnect the lower radiator hose to drain the coolant.
7. Repeat steps 3 through 6 until the drained water is clear and free of coolant and rust.

Notice: Never use an antifreeze mixture more concentrated than 60 percent antifreeze to 40 percent water. The solution freezing point increases above this concentration.

8. Fill the cooling system through the surge tank with a mixture of ethylene glycol antifreeze and water. The mixture must be at least 50 percent antifreeze, but not more than 60 percent antifreeze for cold weather operation.
9. Fill the surge tank to the specified MAX fill mark on the outside of the tank.
10. Install the surge tank cap.

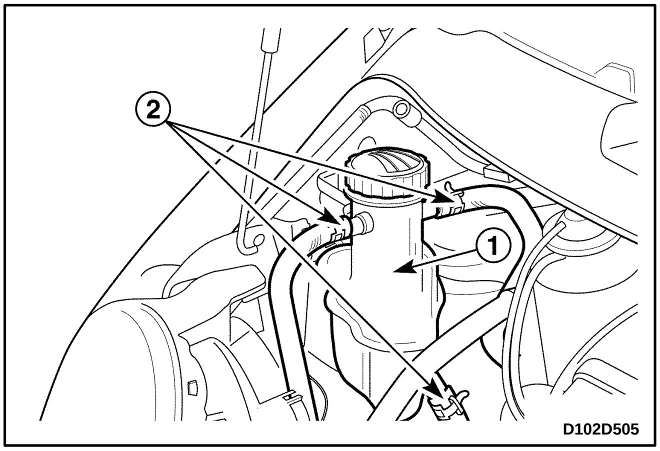


SURGE TANK

Removal Procedure

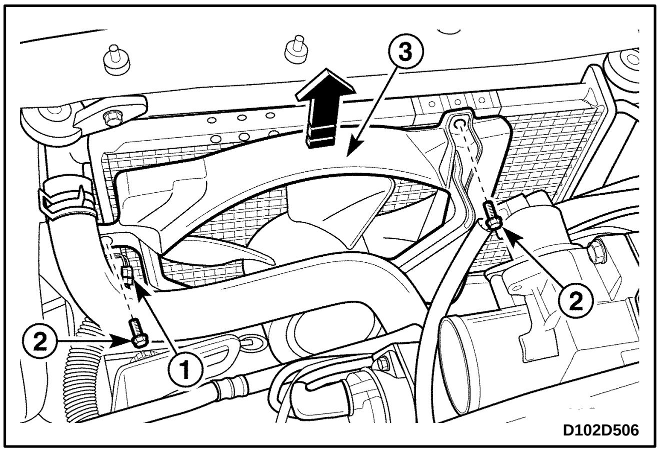
Caution: To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot, because the heat causes the system to remain under pressure scalding fluid and steam may be blown out under pressure.

1. Drain the engine coolant to below the level of the surge tank.
2. Remove the surge tank.
   - Loosen the overflow hose clamps and disconnect the overflow hoses from the surge tank (1).
   - Remove the surge tank (2).
3. Clean the inside and the outside of the surge tank and the surge tank cap with soap and water.
4. Rinse the surge tank and the cap thoroughly.
5. Check the surge tank and the cap for crack or other damage.



Installation Procedure

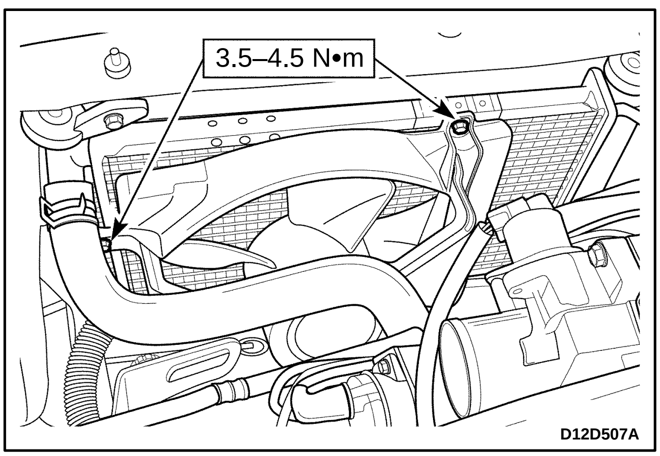
1. Install the surge tank to the vehicle.
   - Install the surge tank with pressing down (1).
   - Connect the overflow hoses to the surge tank (2).
2. Secure the overflow hoses to the surge tank with the hose clamps.
3. Fill the surge tank with coolant to the MAX mark.



ELECTRIC COOLING FAN

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the electric cooling fan assembly.
   - Disconnect the cooling fan electrical connector (1).
   - Remove the bolts (2).
   - Remove the electric cooling fan assembly (3).

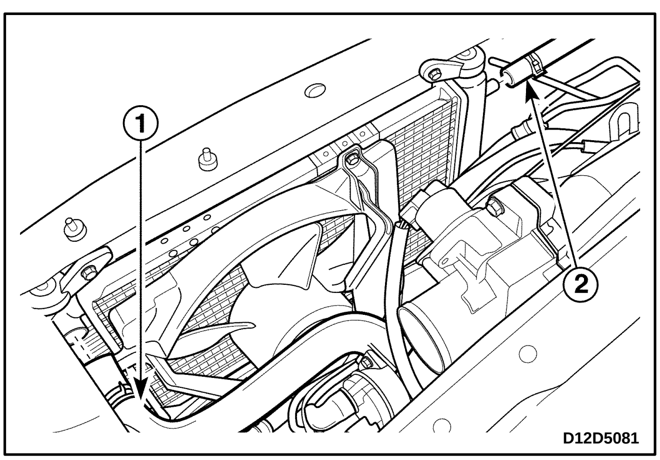


Installation Procedure

1. Install the electric cooling fan assembly with the bolts.

   Tighten

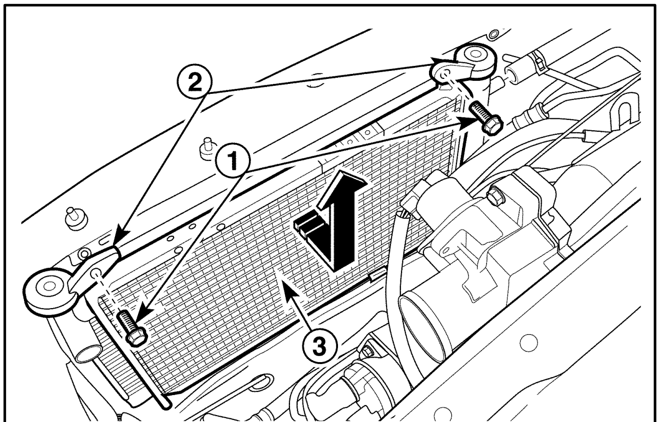
   Tighten the bolts to 3.5–4.5 N•m (31–40 lb-in).
2. Connect the cooling fan electrical connector.
3. Connect the negative battery cable.



RADIATOR

Removal Procedure

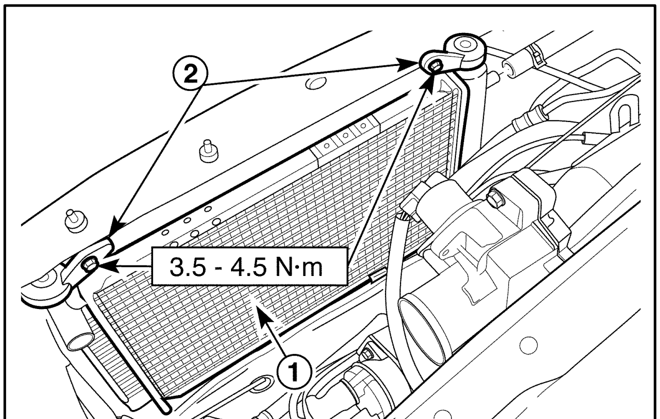
1. Disconnect the negative battery cable.
2. Disconnect the lower radiator hose and drain the engine cooling system. Refer to “Draining and Refilling the Cooling System” in this section.
3. Disconnect the upper radiator hose and the surge tank hose.
   - Loosen the upper radiator hose clamp and disconnect the upper radiator hose (1).
   - Loosen the surge tank hose clamp and disconnect the surge tank hose (2).



D12D5091

4. Remove the electric cooling fan.
   Refer to “Electric Cooling Fan” in this section.
5. Remove the radiator.
   - Remove the bolts (1).
   - Remove the radiator support brackets (2).
   - Remove the radiator (3).
6. Check the radiator for breaking, clog or other damage.

Important: The radiator still contains a substantial amount of coolant. Drain the remainder of the coolant from the radiator into a drain pan.



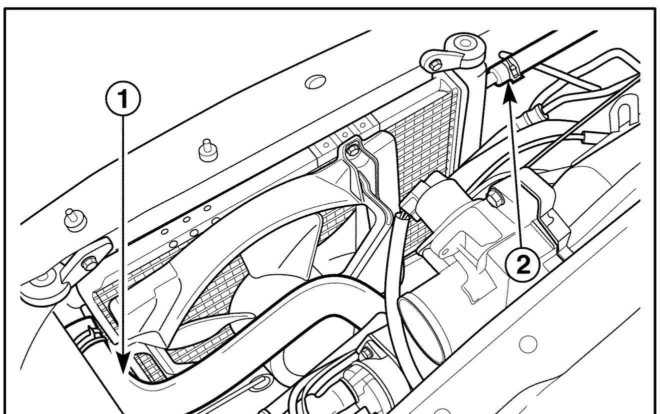
D12D5101

Installation Procedure

1. Install the radiator with the mounting bolts (1) and the support brackets (2).

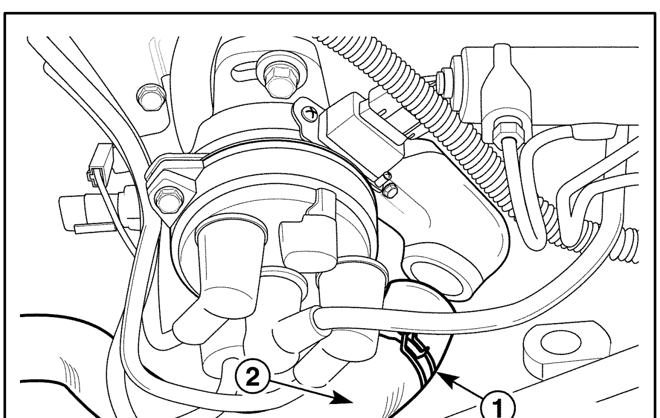
   Tighten

   Tighten the support bracket bolts to 3.5–4.5 N•m (31–40 lb-in).
2. Install the electric cooling fan.
   Refer to “Electric Cooling Fan” in this section.



D12D5111

3. Connect the upper radiator hose to the radiator (1).
4. Connect the surge tank hose to the radiator (2).
5. Secure each hose with hose clamps.
6. Refill the engine cooling system. Refer to “Draining and Refilling the Cooling System” in this section.
7. Connect the negative battery cable.



D102D512

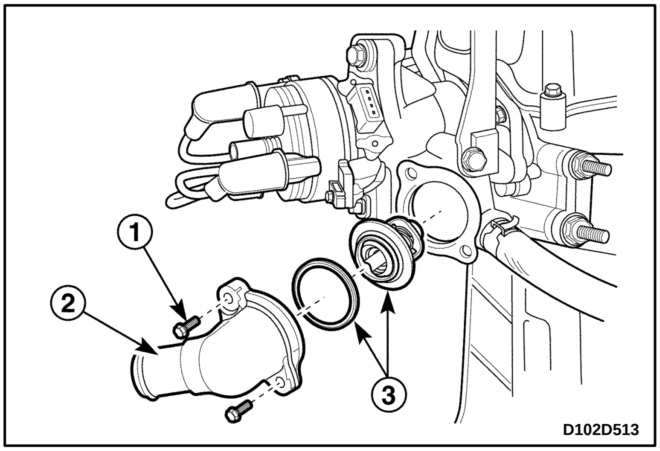
THERMOSTAT (TYPICAL)

Removal Procedure

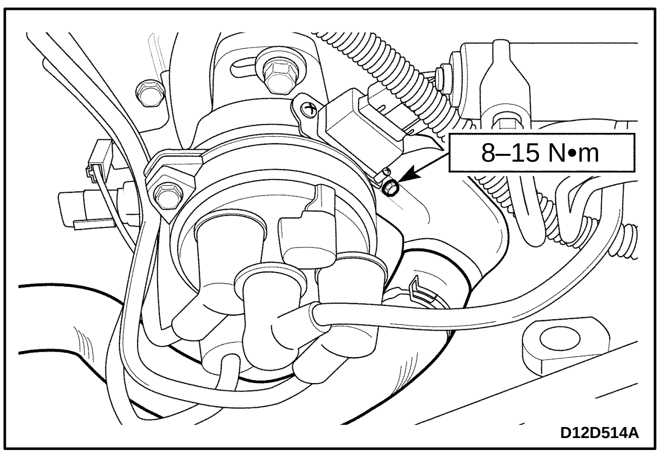
Caution: To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot because the heat causes the system to remain under pressure. Scalding fluid and steam may be blown out under pressure.

1. Remove air filter assembly. Refer to *Section 1B, SOHC Engine Mechanical.*
2. Disconnect the lower radiator hose and drain the coolant. Refer to “Drain and Refilling the Cooling System”
3. Disconnect the upper radiator hose.

- Loosen the hose clamp (1).
- Disconnect the upper radiator hose (2).



4. Remove the thermostat.
   - Remove the bolts (1).
   - Remove the thermostat housing (2).
   - Remove the thermostat with the gasket (3).
5. Check the gasket for crack or other damage.
6. Inspect the valve seat for foreign matter that could prevent the valve from seating properly.
7. Inspect the thermostat for proper operation. Refer to “Thermostat Test” in this section.

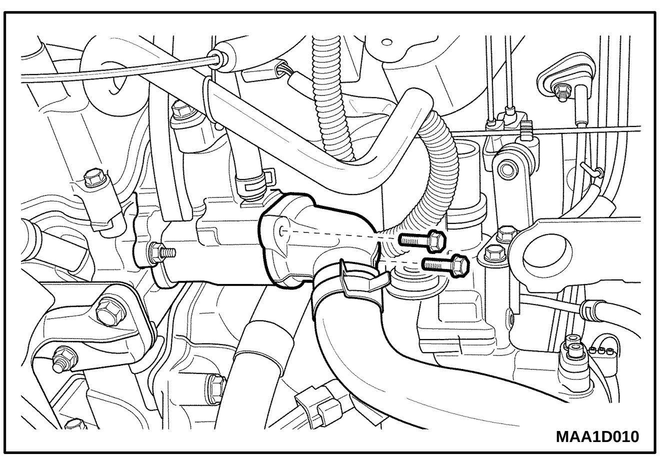


Installation Procedure

1. Install the thermostat with the bolts and the thermostat housing.

   ### Tighten

   Tighten the mounting bolts to 8–15 N•m (71–130 lb-in).
2. Secure the upper radiator hose to the thermostat housing with a hose clamp.
3. Refill the engine cooling system. Refer to “Draining and Refilling the Cooling System” in this section.

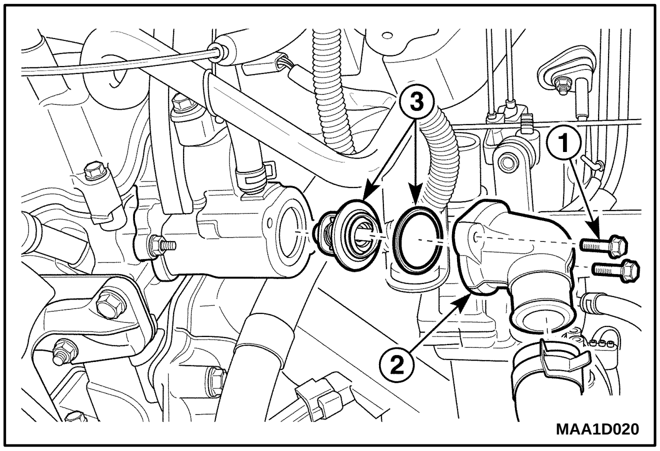


THERMOSTAT (EURO III)

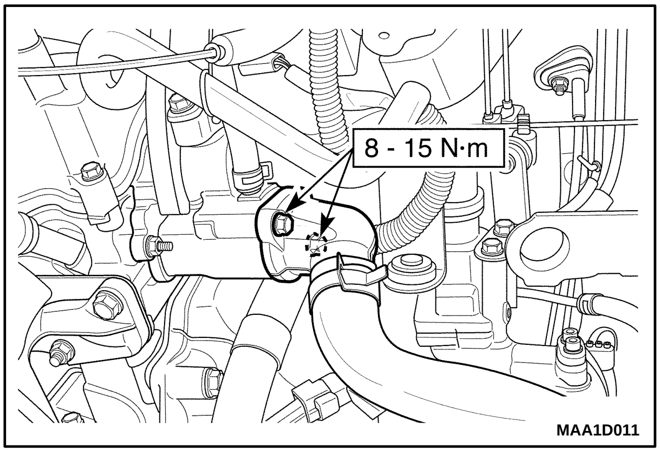
Removal Procedure

Caution: To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot because the heat causes the system to remain under pressure. Scalding fluid and steam may be blown out under pressure.

1. Remove air filter assembly. Refer to *Section 1B, SOHC Engine Mechanical.*
2. Disconnect the lower radiator hose and drain the coolant. Refer to “Drain and Refilling the Cooling System”
3. Disconnect the upper radiator hose.



4. Remove the thermostat.
   - Remove the bolts.
   - Remove the thermostat housing.
   - Remove the thermostat with the gasket.
5. Check the gasket for crack or other damage.
6. Inspect the valve seat for foreign matter that could prevent the valve from seating properly.
7. Inspect the thermostat for proper operation. Refer to “Thermostat Test” in this section.

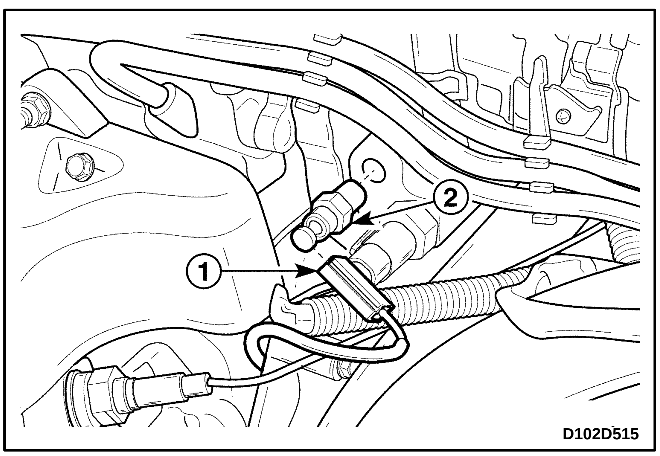


Installation Procedure

1. Install the thermostat with the bolts and the thermostat housing.

   Tighten

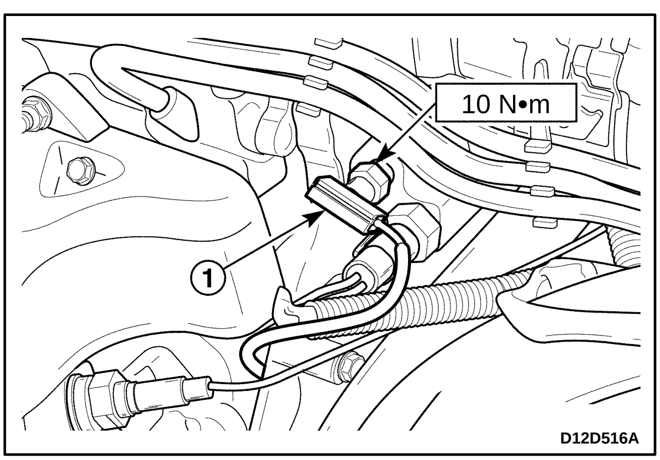
   Tighten the mounting bolts to 8–15 N•m (71–130 lb-in).
2. Secure the upper radiator hose to the thermostat housing with a hose clamp.
3. Refill the engine cooling system. Refer to “Draining and Refilling the Cooling System” in this section.
4. Install the air filter assembly. Refer to *Section 1B, SOHC Engine Mechanical.*



COOLANT TEMPERATURE SENSOR

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the lower radiator hose and drain the coolant. Refer to “Draining and Refilling the Cooling System” in this section.
3. Remove the coolant temperature sensor.
   - Disconnect the electrical connector (1).
   - Remove the coolant temperature sensor (2).



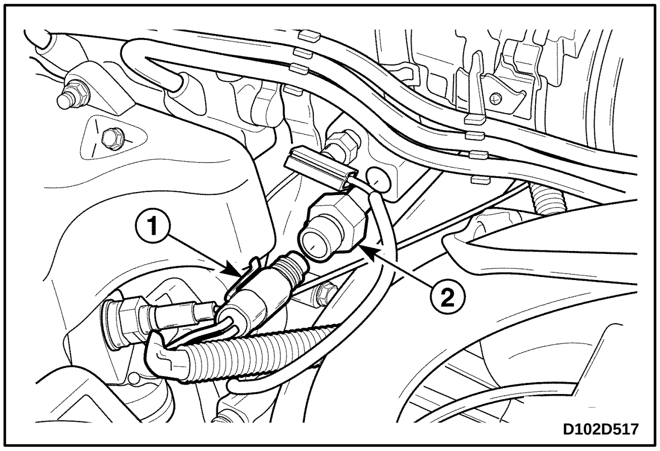
Installation Procedure

1. Install the coolant temperature sensor into the threaded hole in the intake manifold.

   Tighten

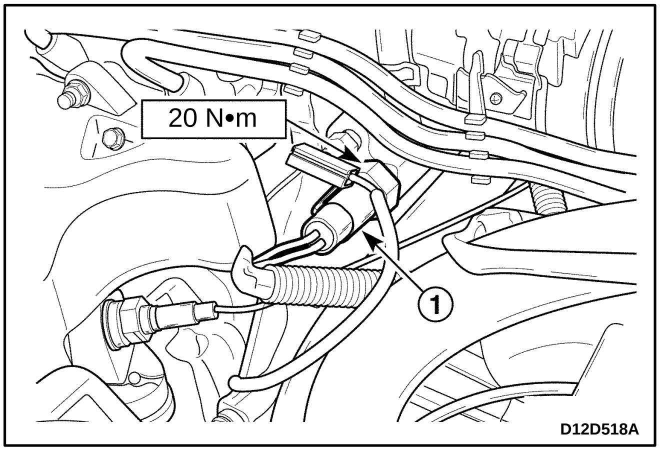
   Tighten the coolant temperature sensor to 10 N•m (89 lb-in).
   - Connect the electrical connector to the coolant temperature sensor (1).
2. Connect the lower radiator hose and refill the coolant. Refer to “Draining and refilling the cooling system” in this section.
3. Connect the negative battery cable.

ENGINE COOLANT TEMPERATURE SENSOR



Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the lower radiator hose and drain the coolant "Draining and Refilling the Cooling System" in this section.
3. Remove the engine coolant temperature (ECT) sensor.
   - Disconnect the electrical connector (1).
   - Remove the ECT sensor (2).



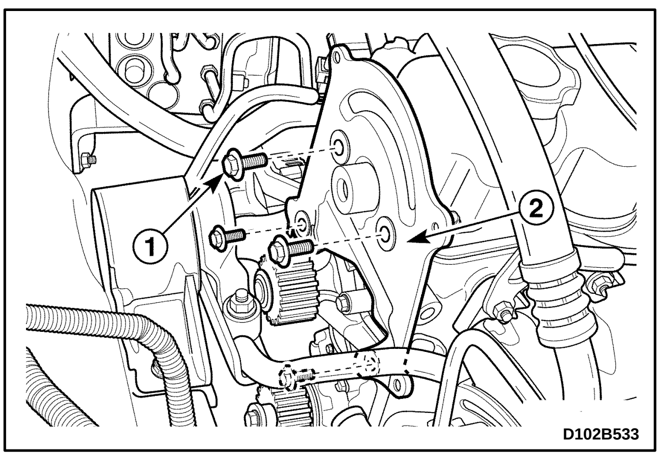
Installation Procedure

1. Install the ECT sensor.

   Tighten

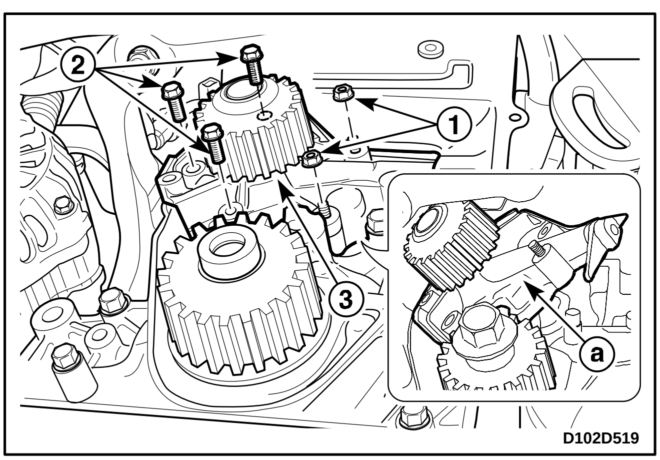
   Tighten the ECT sensor to 20 N•m (15 lb-ft).
   - Connect the electrical connector to the ECT sensor (1).
2. Connect the lower radiator hose and refill the coolant. Refer to "Draining and Refilling the Cooling System" in this section.
3. Connect the negative battery cable.

COOLANT PUMP



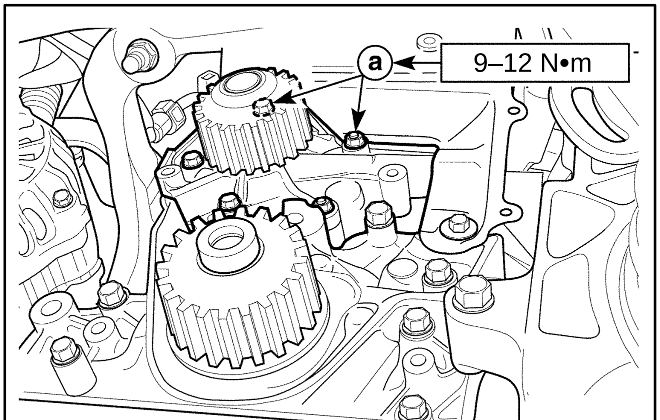
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the lower radiator hose and drain the coolant. Refer to "Draining and Refilling the Cooling System" in this section.
3. Remove the timing belt. Refer to *Section 1B, Engine Mechanical.*
4. Remove the rear timing belt cover.
   - Remove the bolts (1).
   - Remove the rear timing belt cover (2).



5. Remove the coolant pump.
   - Remove the nuts (1).
   - Remove the bolts (2).
   - Remove the coolant pump (3).
   - Remove the gasket.

Notice: Remove the coolant pump as shown figure (a).



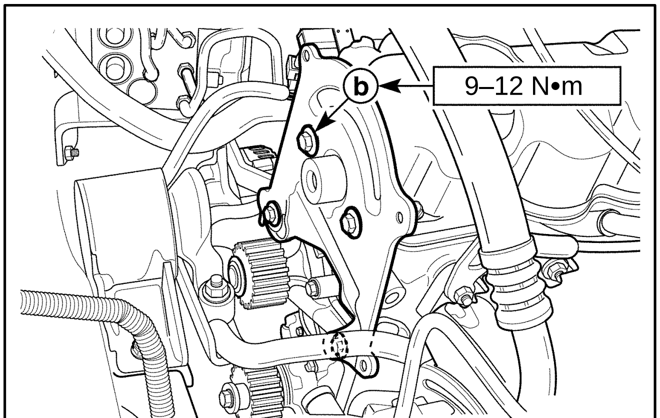
D12D520A

Installation Procedure

1. Install the coolant pump with the new gasket.

   Tighten

   Tighten the bolts and the nuts to 9–12 N•m (80–106 lb-in) (a).



D12D521A

2. Install the rear timing belt cover.

   Tighten

   Tighten the bolts to 9–12 N•m (80–106 lb-in) (b).
3. Install the timing belt. Refer to *Section 1B, Engine Mechanical.*
4. Connect the lower radiator hose and drain the coolant. Refer to “Draining and Refilling the Cooling System” in this section.
5. Connect the negative battery cable.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Description	Unit	Standard	Limit
Cooling System	Cooling Type	–	Forced Water Circulation	
Coolant	Coolant Capacity	L/qt	3.8/4.00	
Thermostat	Thermostat Type	–	Pellet Type	
	Temperature(opened initially)	°C(°F)	82(180)	
	Temperature(perfectly opened)	°C(°F)	95(203.4)	
	Temperature(perfectly closed)	°C(°F)	80(176.4)	
	Stroke(perfectly opened)	mm(in.)	8 (0.32)	
Electric Cooling Fan	Cooling Fan Type	–	Electric	
	Blade Number	EA	6	
	Cooling Fan Diameter	mm(inch)	300(11.8)	
	Temperature At Low Speed ON	°C(°F)	93(199.8)	
	Temperature At Low Speed OFF	°C(°F)	90(194.4)	
	Temperature At High Speed ON	°C(°F)	100(212.4)	
	Temperature At High Speed OFF	°C(°F)	97(207)	
Surge Tank	Open Pressure of The Pressure Valve	kPa (psi)	120–150 (17.4–21.8)	
	Open Pressure of The Vacuum Valve	kPa (psi)	10 (1.5)	
Coolant Pump	Water Pump Type	–	Centrifugal	
	Impeller Diameter	mm(in.)	60(2.36)	
	Impeller Blade Number	EA	7	
Radiator	Radiator Type	–	Cross–Flow	
	Core Width	mm(in.)	458(18.03)	
	Core Height	mm(in.)	295(11.61)	
	Core Depth (Standard/Heavy Duty)	mm(in.)	16/27(0.63/1.06)	
Coolant Temperature Sensor	Resistance (Coolant Temperature 50°C(122.4°F))	Ω	185.2	
	Resistance (Coolant Temperature 85°C(185.4°F))	Ω	49.2	
	Resistance (Coolant Temperature 105°C(221.4°F))	Ω	27.5	
Engine Coolant Temperature Sensor	Resistance (Coolant Temperature 20°C(68.4°F))	Ω	3,520	
	Resistance (Coolant Temperature 80°C(176.4°F))	Ω	332	

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Engine Coolant Temperature Sensor	10	–	89
Coolant Temperature Sensor	20	15	–
Coolant Pipe Bolt	8 – 15	–	71 – 130
Electric Cooling Fan Motor Nut	3.0 – 3.2	–	27 – 28
Electric Cooling Fan Assembly Bolt	3.5 – 4.5	–	31 – 40
Distributor Case Bolt/Nut	8 – 12	–	71 – 106
Radiator Mounting Bracket Bolt	3.5 – 4.5	–	31 – 40
Thermostat Housing Bolt	8 – 15	–	71 – 130
Water Inlet Cap Bolt	8 – 12	–	71 – 106
Coolant Pump Bolt/Nut	9–12	–	80 – 106
Coolant Pump Stud Bolt	9–12	–	80 – 106

SECTION 1E

ENGINE ELECTRICAL

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in B unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

BATTERY

The battery has three major functions in the electrical system. First, the battery provides a source of energy for cranking the engine. Second, the battery acts as a voltage stabilizer for the electrical system. Finally, the battery can, for a limited time, provide energy when the electrical demand exceeds the output of the generator.

The sealed battery is standard on all cars. There are no vent plugs in the cover. The battery is completely sealed, except for two small vent holes in the sides. These vent holes allow the small amount of gas produced in the battery to escape.

The sealed battery has the following advantages over conventional batteries:

- No water need be added for the life of the battery.
- It is protected against overcharge. If too much voltage is applied to the battery, it will not accept as much current as a conventional battery. In a conventional battery, the excess voltage will still try to charge the battery, leading to gassing, which causes liquid loss.
- It is not as liable to self-discharge as a conventional battery. This is particularly important when a battery is left standing for long periods of time.
- It has more power available in a lighter and a smaller case.

RATINGS

A battery has two ratings: (1) A reserve capacity rating designated at 27°C (81°F), which is the time a fully charged battery will provide 25 amperes current flow at or above 10.5 volts; (2) A cold cranking amp rating determined under testing at -18°C (0°F), which indicates the cranking load capacity.

RESERVE CAPACITY

The reserve capacity is the maximum length of time it is possible to travel at night with the minimum electrical load and no generator output. Expressed in minutes, Reserve Capacity (or RC rating) is the time required for a fully charged battery, at a temperature of 27°C (81°F) and being discharged at a current of 25 amperes, to reach a terminal voltage of 10.5 volts.

COLD CRANKING AMPERAGE

The cold cranking amperage test is expressed at a battery temperature of -18°C (0°F). The current rating is the minimum amperage, which must be maintained by the battery for 30 seconds at the specified temperature, while meeting a minimum voltage requirement of 7.2 volts. This rating is a measure of cold cranking capacity.

The battery is not designed to last indefinitely. However, with proper care, the battery will provide many years of service.

If the battery tests well, but fails to perform satisfactorily in service for no apparent reason, the following factors may point to the cause of the trouble:

- Vehicle accessories are left on overnight.
- Slow average driving speeds are used for short periods.
- The vehicle's electrical load is more than the generator output, particularly with the addition of aftermarket equipment.
- Defects in the charging system, such as electrical shorts, a slipping generator belt, a faulty generator, or a faulty voltage regulator.
- Battery abuse, including failure to keep the battery cable terminals clean and tight, or a loose battery hold-down.
- Mechanical problems in the electrical system, such as shorted or pinched wires.

BUILT-IN HYDROMETER

The sealed battery has a built-in, temperature-compensated hydrometer in the top of the battery. This hydrometer is to be used with the following diagnostic procedure:

1. When observing the hydrometer, make sure that the battery has a clean top.
2. Under normal operation, two indications can be observed:
   - GREEN DOT VISIBLE – Any green appearance is interpreted as a "green dot," meaning the battery is ready for testing.
   - DARK GREEN DOT IS NOT VISIBLE – If there is a cranking complaint, the battery should be tested. The charging and electrical systems should also be checked at this time.
3. Occasionally, a third condition may appear:
   - CLEAR OR BRIGHT YELLOW – This means the fluid level is below the bottom of the hydrometer. This may have been caused by excessive or prolonged charging, a broken case, excessive tipping, or normal battery wear. Finding a battery in this condition may indicate high charging by a faulty charging system. Therefore, the charging and the electrical systems may need to be checked if a cranking complaint exists. If the cranking complaint is caused by the battery, replace the battery.

CHARGING PROCEDURE

1. Batteries with the green dot showing do not require charging unless they have just been discharged, such as in cranking a vehicle.
2. When charging sealed-terminal batteries out of the vehicle, install the adapter kit. Make sure all the charger connections are clean and tight. For best results, batteries should be charged while the electrolyte and the plates are at room temperature. A battery that is extremely cold may not accept current for several hours after starting the charger.
3. Charge the battery until the green dot appears. The battery should be checked every half-hour while charging. Tipping or shaking the battery may be necessary to make the green dot appear.
4. After charging, the battery should be load tested. Refer to “Starter Motor” in this section.

CHARGING TIME REQUIRED

The time required to charge a battery will vary depending upon the following factors:

- **Size of Battery** – A completely discharged large heavy-duty battery requires more than twice the recharging as a completely discharged small passenger car battery.
- **Temperature** – A longer time will be needed to charge any battery at -18°C (0°F) than at 27°C (81°F). When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first. The battery will accept a higher current rate as the battery warms.
- **Charger Capacity** – A charger which can supply only 5 amperes will require a much longer charging period than a charger that can supply 30 amperes or more.
- **State-of-Charge** – A completely discharged battery requires more than twice as much charge as a one-half charged battery. Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the current accepted by the battery is very low at first. Later, as the charging current causes the electrolyte acid content to increase, the charging current will likewise increase.

CHARGING A COMPLETELY DISCHARGED BATTERY (OFF THE VEHICLE)

Unless this procedure is properly followed, a perfectly good battery may be needlessly replaced.

The following procedure should be used to recharge a completely discharged battery:

1. Measure the voltage at the battery terminals with an accurate voltmeter. If the reading is below 10 volts, the charge current will be very low, and it could take some time before the battery accepts the current in excess of a few milliamperes. Refer to “Charging Time Required” in this section, which focuses on the factors affecting both the charging time required and the rough estimates in the table below. Such low current may not be detectable on ammeters available in the field.
2. Set the battery charger on the high setting.

Important: Some chargers feature polarity protection circuitry, which prevents charging unless the charger leads are correctly connected to the battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly, making it appear that the battery will not accept charging current. Therefore, follow the specific charger manufacturer’s instruction for bypassing or overriding the circuitry so that the charger will turn on and charge a low-voltage battery.

3. Battery chargers vary in the amount of voltage and current provided. The time required for the battery to accept a measurable charger current at various voltages may be as follows:

Voltage	Hours
16.0 or more	Up to 4 hours
14.0–15.9	Up to 8 hours
13.9 or less	Up to 16 hours

- If the charge current is not measurable at the end of the above charging times, the battery should be replaced.
- If the charge current is measurable during the charging time, the battery is good, and charging should be completed in the normal manner.

Important: It is important to remember that a completely discharged battery must be recharged for a sufficient number of ampere hours (AH) to restore the battery to a usable state. As a general rule, using the reserve capacity rating (RC) as the number of ampere hours of charge usually brings the green dot into view.

- If the charge current is still not measurable after using the charging time calculated by the above method, the battery should be replaced.
- If the charge current is measurable during the charging time, the battery is good, and charging should be completed in the normal manner.

JUMP STARTING PROCEDURE

1. Position the vehicle with the good (charged) battery so that the jumper cables will reach from one battery to the other.
2. Turn off the ignition, all the lights, and all the electrical loads in both vehicles. Leave the hazard flasher on if there may be other traffic and any other lights needed for the work area.

3. In both vehicles, apply the parking brake firmly.

Notice: Make sure the cables are not on or near pulleys, fans, or other parts that will move when the engine starts, damaging the parts.

4. Shift a manual transaxle to NEUTRAL.

Caution: Do not use cables that have loose or missing insulation, or injury could result.

5. Clamp one end of the first jumper cable to the positive terminal on the battery. Make sure it does not touch any other metal parts. Clamp the other end of the same cable to the positive terminal on the other battery. Never connect the other end to the negative terminal of the discharged battery.

Caution: Do not attach the cable directly to the negative terminal of the discharged battery. Doing so could cause sparks and possible battery explosion.

6. Clamp one end of the second cable to the negative terminal of the booster battery. Make the final connection to a solid engine ground, such as the engine lift bracket, at least 450 millimeters (18 inches) from the discharged battery.
7. Start the engine of the vehicle with the good battery. Run the engine at a moderate speed for several minutes. Then start the engine of the vehicle which has the discharged battery.
8. Remove the jumper cables by reversing the above sequence exactly. Remove the negative cable from the vehicle with the discharged battery first. While removing each clamp, take care that it does not touch any other metal while the other end remains attached.

GENERATOR

The Delco-Remy CS charging system has several models available, including the ∅114D (A-type) or CS114D (B-type). The number denotes the outer diameter in millimeters of the stator lamination.

CS generators are equipped with internal regulators. The Y connection (A-type) or Delta (B-type) stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier generators. A conventional pulley and fan are used. There is no test hole.

Unlike three-wire generators, the ∅114D (A-type) or CS114D (B-type) may be used with only two connections: battery positive and an ''L'' terminal to the charge indicator lamp.

As with other charging systems, the charge indicator lamp lights when the ignition switch is turned to ON, and goes out when the engine is running. If the charge indicator is on with the engine running, a charging system defect is indicated.

The regulator voltage setting varies with temperature and limits the system voltage by controlling the rotor field current. The regulator switches rotor field current on and off. By varying the on-off time, correct average field current for proper system voltage control is obtained. At high speeds, the on-time may be 10 percent and the off-time 90 percent. At low speeds, with high electrical loads, on-time may be 90 percent and the off-time 10 percent.

CHARGING SYSTEM

The Delco-Remy CS charging system has several models available, including the ∅114D (A-type) or CS114D (B-type). The number denotes the outer diameter in millimeters of the stator laminations.

CS generators use a new type of regulator that incorporates a diode trio. The Y connection (A-type) or Delta (B-type) stator, a rectifier bridge, and a rotor with slip rings and brushes are electrically similar to earlier generators. A conventional pulley and fan are used. There is no test hole.

STARTER

Wound field starter motors have pole pieces, arranged around the armature, which are energized by wound field coils.

Enclosed shift lever cranking motors have the shift lever mechanism and the solenoid plunger enclosed in the drive housing, protecting them from exposure to dirt, icy conditions, and splashes.

In the basic circuit, solenoid windings are energized when the switch is closed. The resulting plunger and shift lever movement causes the pinion to engage the engine flywheel ring gear. The solenoid main contacts close. Cranking then takes place.

When the engine starts, pinion overrun protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage. To prevent excessive overrun, the switch should be released immediately after the engine starts.

STARTING SYSTEM

The engine electrical system includes the battery, the ignition, the starter, the generator, and all the related wiring. Diagnostic tables will aid in troubleshooting system faults. When a fault is traced to a particular component, refer to that component section of the service manual.

The starting system circuit consists of the battery, the starter motor, the ignition switch, and all the related electrical wiring. All of these components are connected electrically.

DISTRIBUTOR

Distributor distributes the high tension voltage induced from ignition coil, to each spark plug of each cylinder in the sequence of ignition order. It also adjusts the ignition timing according to the engine condition.

This vehicle uses the distributor (optical sensor type) which controls the preminary current of the ignition coil by the ECM.
The ignition timing change is controlled electronically by the ECM.

When diagnosing the ignition system, refer to *Section 1F, Engine Controls.*

IGNITION COIL

Ignition coil is a sort of transformer to generate high voltage (15,000–25,000V) which can bring spark at the spark plugs and has an iron cored closed magnetic type.

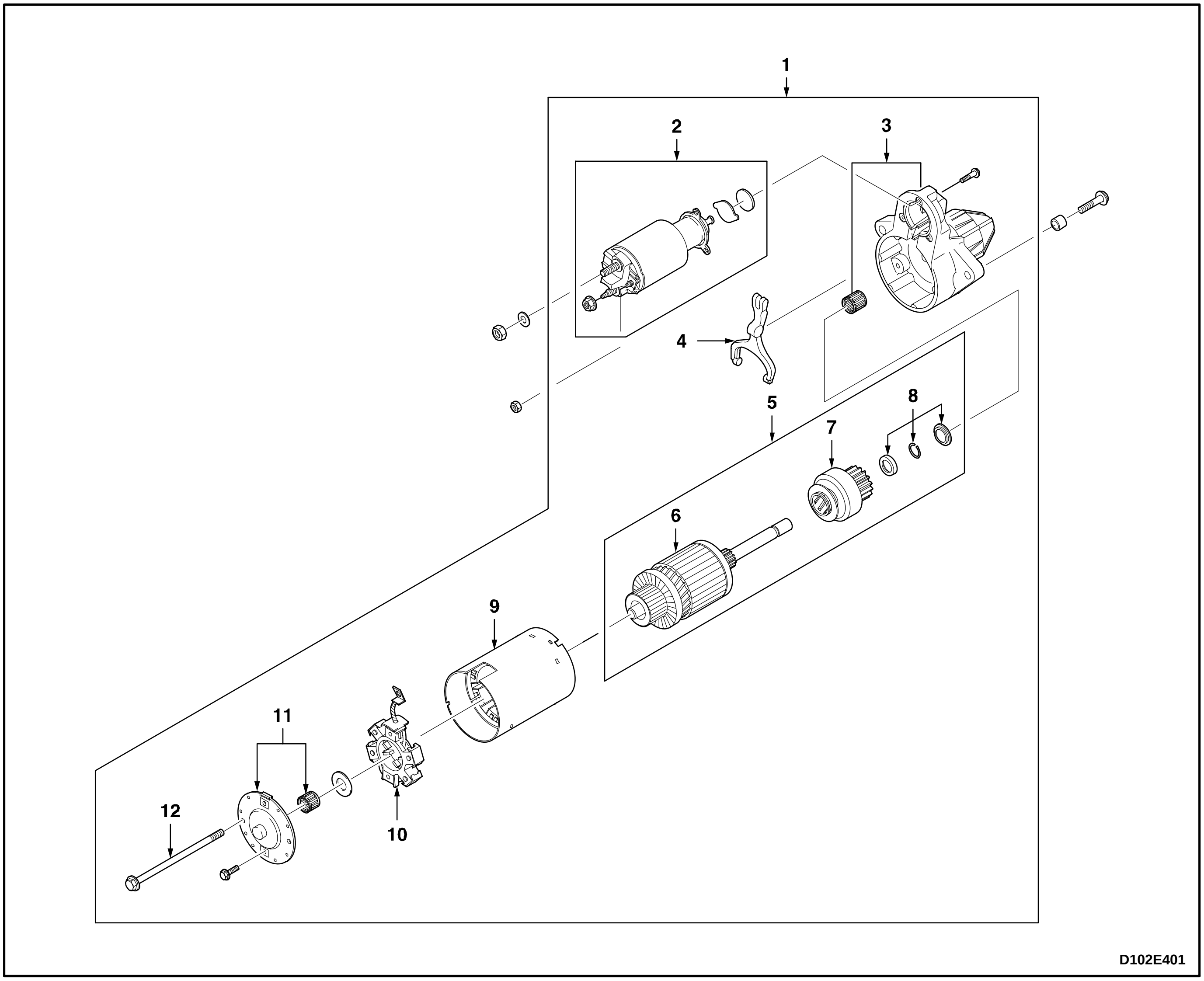
The closed magnetic typed ignition coil is used for the High Energy Ignition (H.E.I) system. Comparing with the iron cored open magnetic type, the closed type almost has no loss of magnetic flux, and smaller in size, so it produces the high voltage of secondary voltage.

SPARK PLUG

It is a part of ignition secondary current, and it burns the compressed mixture by sparking the high voltage induced from the ignition coil.

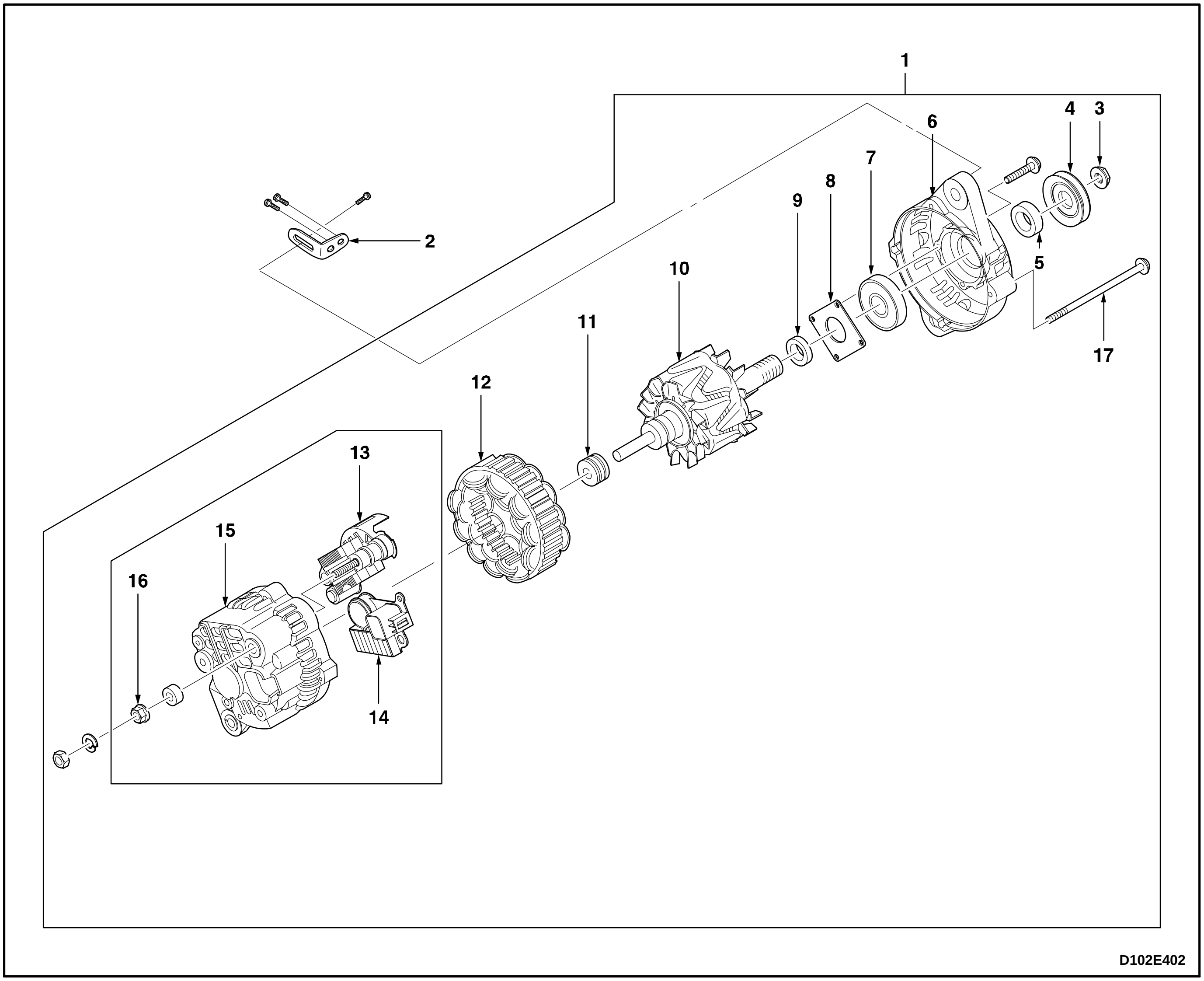
COMPONENT LOCATOR

STARTING SYSTEM



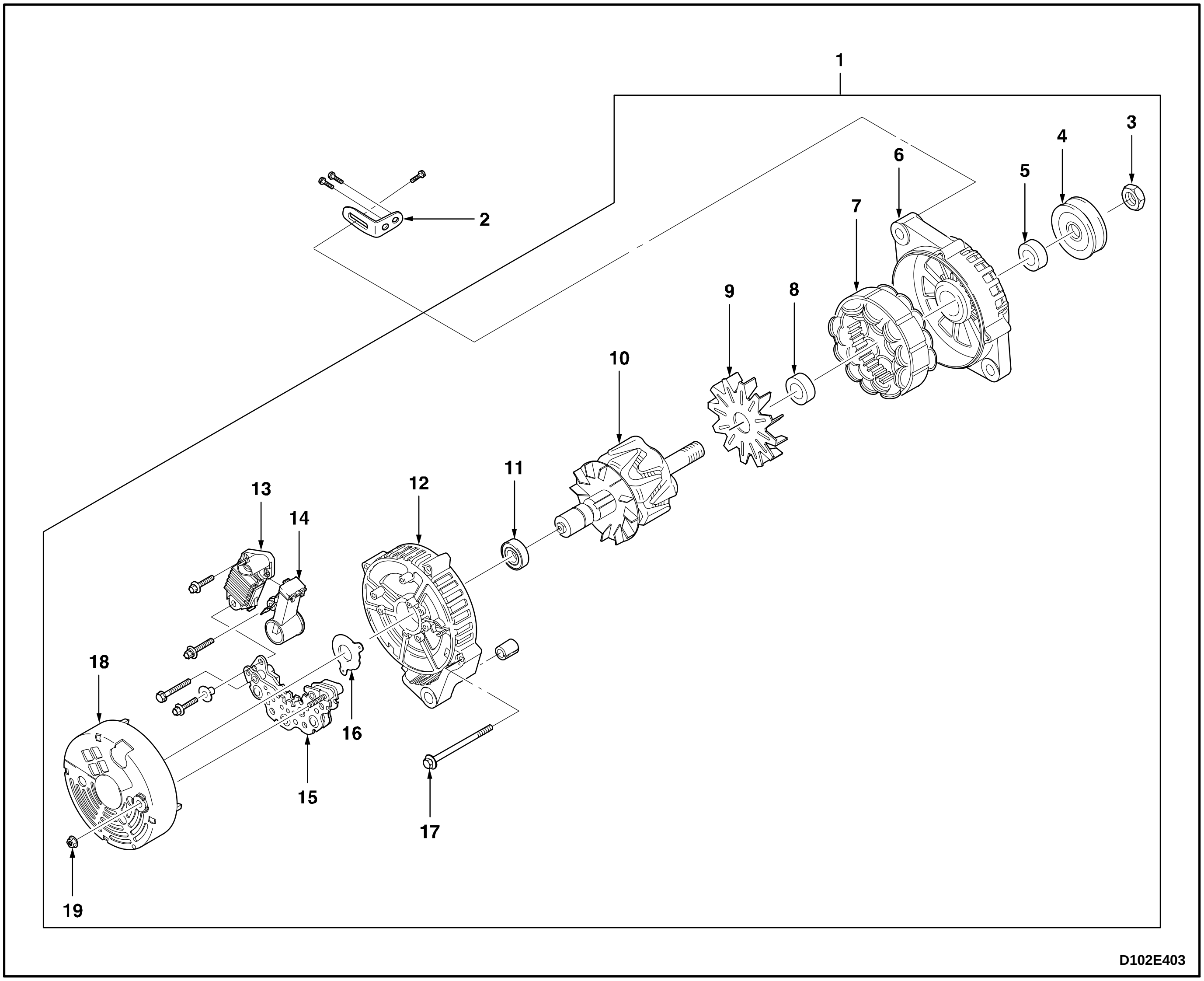
1 Starter Motor Assembly	7 Pinion Gear Assembly
2 Starter Solenoid Assembly	8 Ring Set
3 Starter Housing	9 Field Frame Assembly
4 Shift Lever	10 Brush Holder Assembly
5 Armature Set	11 Contact End Frame Assembly
6 Armature	12 Starter Through - Bolts

CHARGING SYSTEM (A-TYPE : MANDO)



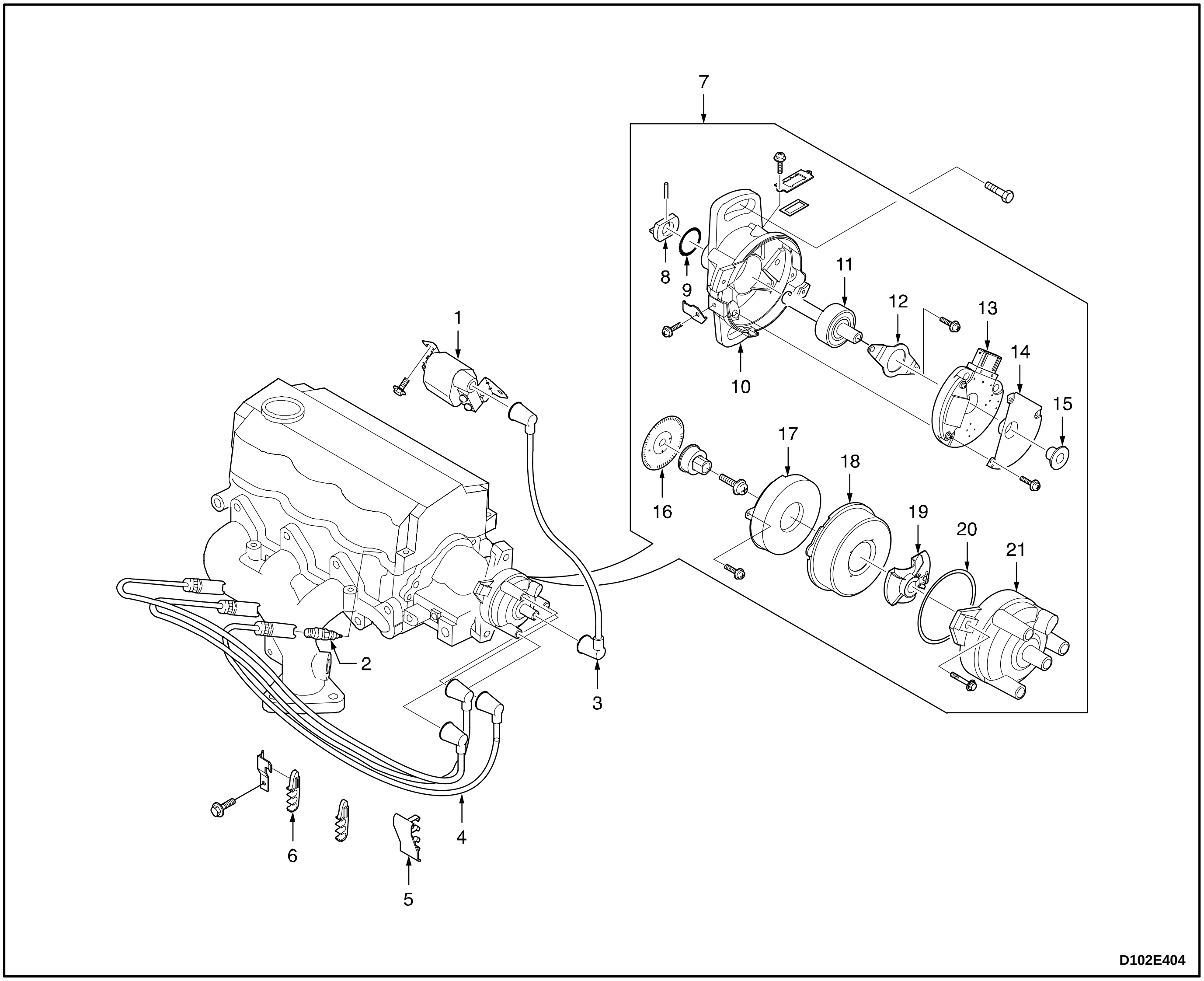
1 Generator Assembly
2 Generator Shackle
3 Generator Drive End Nut
4 Generator Pully
5 Generator Collar (Large)
6 Generator Front Bracket
7 Front Bearing
8 Bearing Spot Plate
9 Generator Collar (Small)
10 Generator Rotor Assembly
11 Rear Bearing
12 Generator Stator Assembly
13 Rectifier Assembly
14 Voltage Regulator / Brush Holder Assembly
15 Generator Rear Bracket
16 Battery Positive Terminal Nut
17 Through Bolt

CHARGING SYSTEM (B-TYPE : DAC)



1 Generator Assembly
2 Generator Shackle
3 Generator Drive End Nut
4 Generator Pully
5 Generator Collar
6 Generator Drive End Bracket
7 Generator Stator Assembly
8 Frame Bearing
9 Generator Fan
10 Generator Rotor Assembly
11 Frame Bearing
12 Generator Frame
13 Regulator Assembly
14 Brush Holder Assembly
15 Rectifier Assembly
16 Shield
17 Through - Bolt
18 Generator Cover
19 Battery Positive Terminal Nut

IGNITION SYSTEM



1 Ignition Coil
2 Spark Pulg
3 Ignitoin Wire (#0)
4 Ignition Wires (#1, #2, #3)
5 Support Clamp
6 Mounting Clamp
7 Distributor Assembly
8 Coupling
9 Distributor Oil Seal
10 Distributor Housing
11 Distributor Shaft
12 Plate
13 Optical Sensor Unit
14 Plate
15 Bushing
16 Disc Wheel
17 Inner Cover
18 Outer Cover
19 Distributor Rotor
20 Distributor Cap Seal
21 Distributor Cap

DIAGNOSTIC INFORMATION AND PROCEDURE

IGNITION SYSTEM

Condition	Probable Cause	Correction
No Crank	• Low battery voltage.	• Charging the battery or Replace the battery.
	• Battery cable is loose, corroded, or damaged.	• Repair or Replace the battery cable.
	• Faulty starter motor or starter motor circuit is open.	• Repair or Replace the starter motor/starter motor circuit.
	• Faulty ignition switch or fuse Ef2 is blown.	• Replace the ignition switch or fuse Ef2.
	• Ground short.	• Repair the ground short.
Crank OK, But Too Slow	• Low battery voltage.	• Charging the battery or Replace the battery.
	• Batter. • Battery cables is loose, corroded, or damaged.	• Repair or Replace the battery cable.
	• Faulty starter motor.	• Repair or Replace the starter motor.
Starter Motor Does Not Stop	• Faulty starter motor.	• Repair or Replace the starter motor.
	• Faulty ignition switch.	• Replace the ignition switch.
Starter Motor Running, But Not Cranking	• Broken the clutch pinion gear or faulty starter motor.	• Replace the starter motor.
	• Broken the flywheel ring gear.	• Replace the flywheel.
	• Connected circuit is open.	• Repair the open circuit.
Overcharging Battery	• Faulty the IC regulator.	• Replace the IC regulator.
Battery Discharge	• Loosen the generator drive belt.	• Adjust the belt tension or Replace the belt.
	• The circuit is open or a short.	• Repair the open or a short circuit.
	• Faulty IC regulator.	• Replace the IC regulator.
	• Battery run down.	• Replace the battery.
	• Open ground circuit.	• Repair the open ground circuit.
Charging Indicator Lamp Does Not Work When the Ignition Switch ON (Engine Does Not Work)	• Fault IC regulator.	• Replace the IC regulator.
	• Charging indicator lamp is blown or fuse F8 is blown.	• Repair or Replace the charging indicator lamp/fuse F8.
	• Faulty ignition switch.	• Replace the ignition switch.
	• Generator ground circuit is open or a short.	• Repair the circuit.
Charging Indicator Lamp Does Not Put Out Lights After Starting the Engine	• Faulty IC regulator.	• Replace the IC regulator.
	• Battery cable is corroded or damaged.	• Repair or Replace the battery cable.
	• Loosen the generator drive belt.	• Adjust the belt tension or Replace the belt.
	• Faulty wiring harness.	• Repair the wiring harness.

IGNITION SYSTEM (Cont'd)

Condition	Probable Cause	Correction
Hard to Starting the Engine	• Faulty ignition coil.	• Replace the ignition coil.
	• Faulty distributor (include the optical sensor).	• Replace the distributor or the optical sensor.
	• Faulty spark plug.	• Replace the spark plug or Adjust the gap.
	• Poor ignition timing.	• Reset the valve timing.
Engine Idling State is Unstable	• Faulty spark plug.	• Replace the spark plug or Adjust the gap.
	• Faulty ignition coil.	• Replace the ignition coil.
	• Poor ignition timing.	• Reset the valve timing.
Poor Engine Accelerating	• Poor ignition timing.	• Reset the valve timing.

BATTERY LOAD TEST

1. Check the battery for obvious damage, such as a cracked or broken case or cover, which could permit the loss of electrolyte. If obvious damage is noted, replace the battery.

Caution: Do not charge the battery if the hydrometer is clear or light yellow. Instead, replace the battery. If the battery feels hot or if violent gassing or spewing of electrolyte through the vent hole occurs, discontinue charging or reduce the charging rate to avoid injury.

2. Check the hydrometer. If the green dot is visible, go to the load test procedure. If the indicator is dark but green is not visible, charge the battery. For charging a battery removed from the vehicle, refer to “Charging a Completely Discharged Battery” in this section.
3. Connect a voltmeter and a battery load tester across the battery terminals.
4. Apply a 300-ampere load for 15 seconds to remove any surface charge from the battery.
5. Remove the load.
6. Wait 15 seconds to let the battery recover, and apply a 270-ampere load.

Important: The battery temperature must be estimated by touch and by the temperature condition the battery has been exposed to for the preceding few hours.

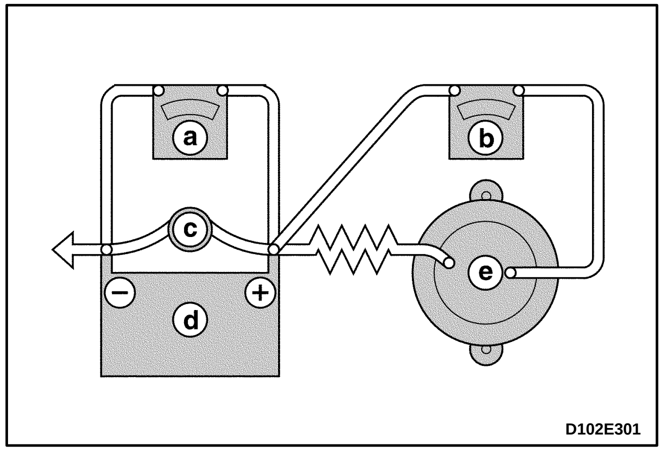
7. If the voltage does not drop below the minimum listed, the battery is good and should be reinstalled. If the voltage is less than the minimum listed, replace the battery. Refer to “Battery Specifications” in this section.

GENERATOR OUTPUT TEST

1. Perform the generator system test. Refer to “Generator System Check” in this section.
2. Replace the generator if it fails that test. Refer to “Generator” in the On-Vehicle Service section. If it passes the test, perform the on-vehicle output check which follows.

Important: Always check the generator for output before assuming that a grounded “L” terminal circuit has damaged the regulator.

3. Attach a digital multimeter (a), an ammeter (b), and a carbon pile load (c) to the battery (d) and the generator (e) of the rehicle.



Important: Be sure the vehicle battery is fully charged, and the carbon pile load is turned off.

4. With the ignition switch in the OFF position, check and record the battery voltage.
5. Remove the harness connector from the generator.
6. Turn the ignition switch to the ON position with the engine not running. Use a digital multimeter to check for voltage in the harness connector “L” terminal.
7. The reading should be near the specified battery voltage of 12 volts. If the voltage is too low, check the indicator “L” terminal circuits for open and grounded circuits causing voltage loss. Correct any open wires, terminal connections, etc., as necessary. Refer to “Charging System” in this section.
8. Attach the generator harness connector.
9. Run the engine at a moderate idle, and measure the voltage across the battery terminals. The reading should be above that recorded in Step 4 but less than 15 volts. If the reading is over 15 volts or below the previous reading, replace the generator. Refer to “Generator” in the On-Vehicle Service section.
10. Run the engine at a moderate idle, and measure the generator amperage output.
11. Turn on the carbon pile, and adjust it to obtain the maximum amps while maintaining the battery voltage above 13 volts.
12. If the reading is within 15 amps of the generator’s rating noted on the generator, the generator is good. If not, replace the generator. Refer to “Generator” in the On-Vehicle Service section.
13. With the generator operating at the maximum output, measure the voltage between the generator housing and the battery negative terminal. The voltage drop should be 0.5 volt or less. If the voltage drop is more than 0.5 volt, check the ground path from the generator housing to the negative battery cable.
14. Check, clean, tighten, and recheck all of the ground connections.

GENERATOR SYSTEM CHECK

When operating normally, the generator indicator lamp will come on when the ignition switch is in the ON position and go out when the engine starts. If the lamp 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 that allows a lamp, such as a trunk or glove box lamp, to stay on.

Diagnose the generator with the following procedure:

1. Visually check the belt and wiring.
2. With the ignition switch in the ON position and the engine stopped, the charge indicator lamp should be on. If not, detach the harness at the generator and ground the ''L'' terminal in the harness with a fused, 5-ampere jumper lead.
   - If the lamp lights, replace the generator. Refer to "Generator" in the On-Vehicle Service section.
   - If the lamp does not light, locate the open circuit between the ignition switch and the harness connector. The indicator lamp bulb may be burned out.
3. With the ignition switch in the ON position and the engine running at moderate speed, the charge indicator lamp should be off. If not, detach the wiring harness at the generator.
   - If the lamp goes off, replace the generator. Refer to "Generator" in the On-Vehicle Service section.
   - If the lamp stays on, check for a short to ground in the harness between the connector and the indicator lamp.

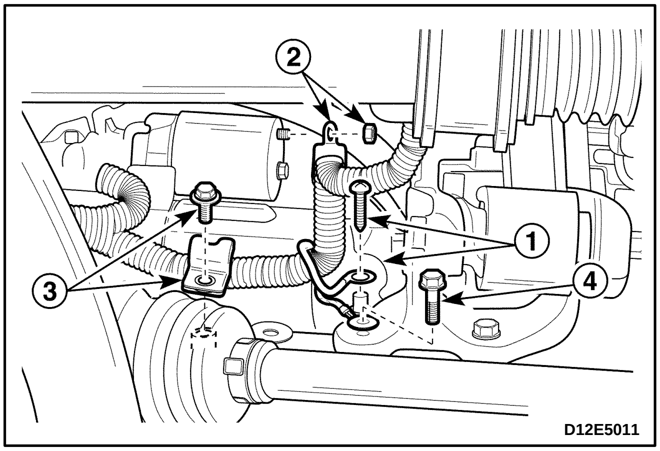
Important: Always check the generator for output before assuming that a grounded ''L'' terminal circuit has damaged the regulator. Refer to "Generator" in the Unit Repair section.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

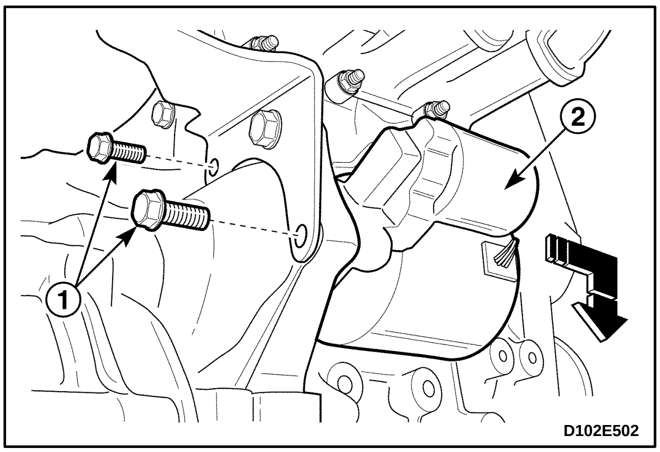
STARTER

Removal Procedure



D12E5011

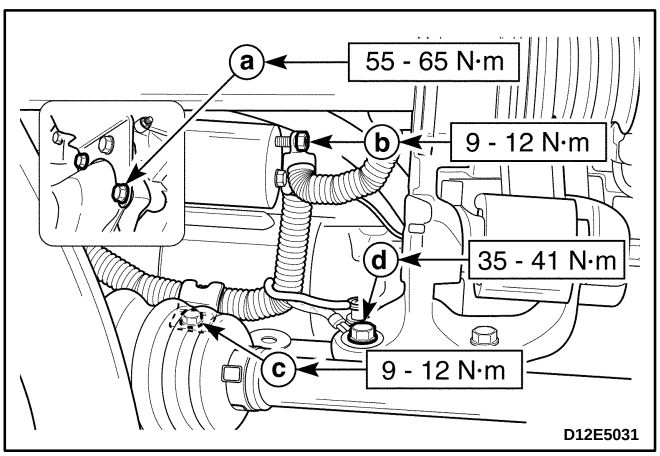
1. Disconnect the negative battery cable.
2. Disconnect the electrical connector and clip around the starter.
   - Remove the engine oil temperature sensor to disconnect the harness connector (1).
   - Remove the starter solenoid nut to disconnect the electrical cable (2).
   - Remove the harness clip bolt to disconnect the harness clip (3).
   - Remove the ground bolt (4).



D102E502

3. Remove the starter assembly.
   - Remove the starter mounting bolts (1).
   - Remove the starter assembly (2).

Installation procedure



D12E5031

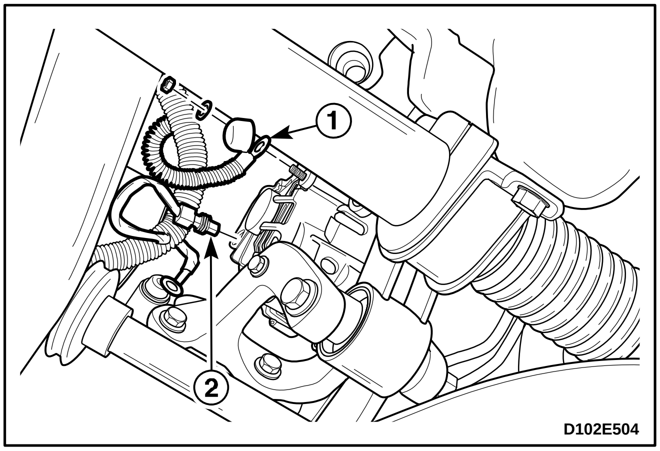
1. Install in the reverse order of removal.
2. Install the starter mounting bolts and starter solenoid nut.

Tighten

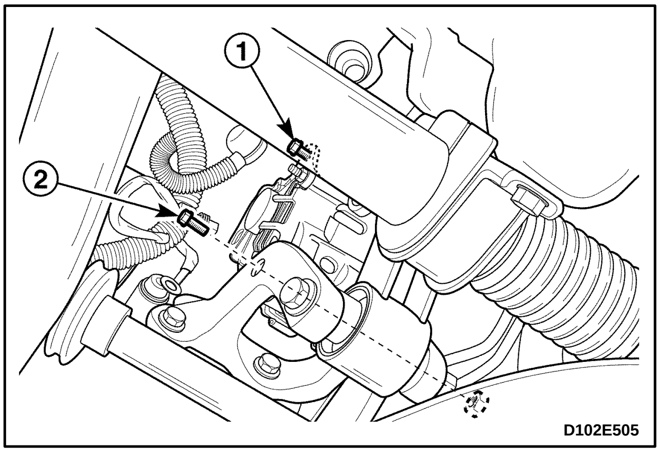
- Tighten the starter mounting bolts to 55–65 N•m (41–48 lb-ft) (a).
- Tighten the starter solenoid nut to 9–12 N•m (80–106 lb-in) (b).
- Tighten the harness clip bolt to 9–12 N•m (80–106 lb-in) (c).
- Tighten the ground bolt to 35–41 N•m (26–30 lb-ft) (d).

GENERATOR

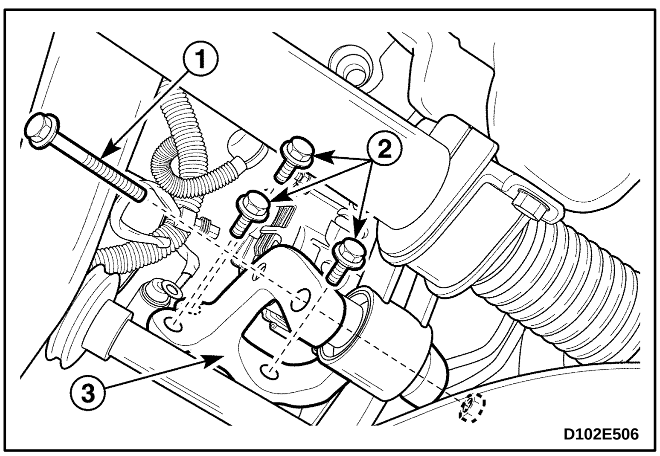
Removal Procedure



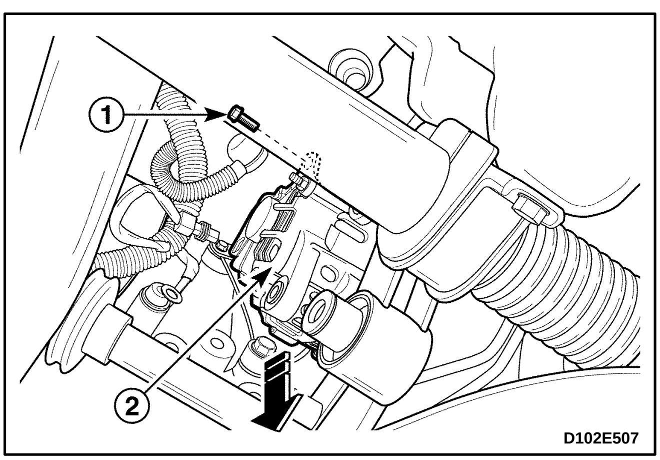
1. Disconnect the negative battery cable.
2. Disconnect the harness connector.
   - Remove the battery harness connector nut to disconnect the battery positive connector (1).
   - Disconnect the generator harness connector (2).



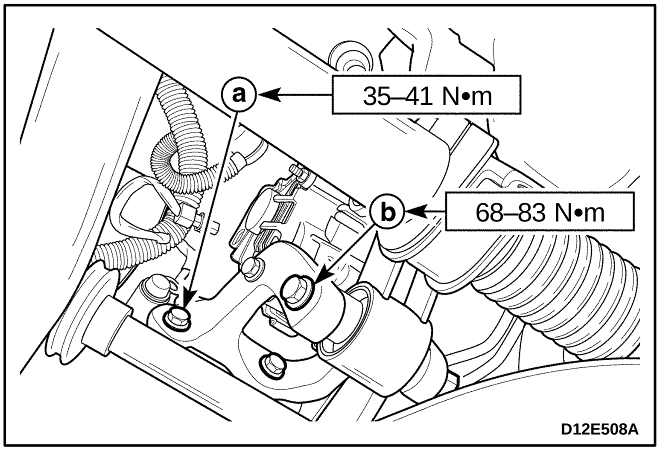
3. Remove the generator drive belt.
   - Loosen the generator adjusting bolt (1).
   - Remove the lower bracket-to-generator bolt and nut (2).
   - Separate the generator drive belt from the generator.



4. Remove the engine mounting lower bracket.
   - Remove the engine mounting lower bracket, attaching reaction rod bolt and nut (1).
   - Remove the engine mounting lower bracket bolts (2).
   - Remove the engine mounting lower bracket (3).



5. Remove the generator.
   - Remove the generator adjusting bolt (1).
   - Carefully remove the genrator (2).

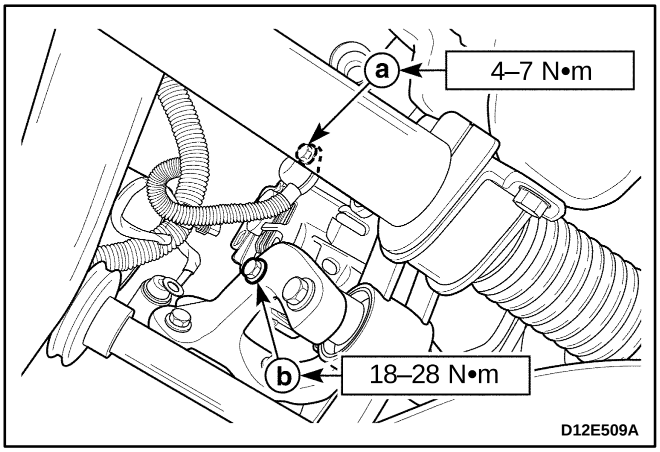


Installation Procedure

1. Install in the reverse order of removal except generator driver velt.
2. Install the engine mounting lower bracket bolts and nut.

Tighten

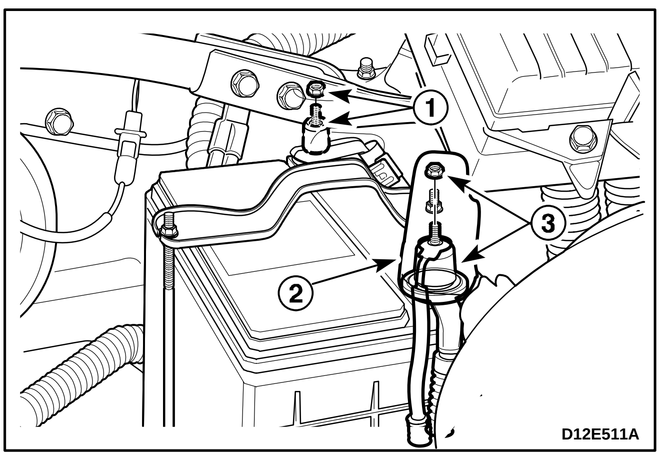
- Tighten the engine mounting lower bracket bolts to 35–41 N•m (25–30 lb-ft) (a).
- Tighten the engine mounting lower bracket, attaching reaction rod bolt and nut to 68–83 N•m (50–61 lb-ft) (b).



3. Install the bolts and nut.

Tighten

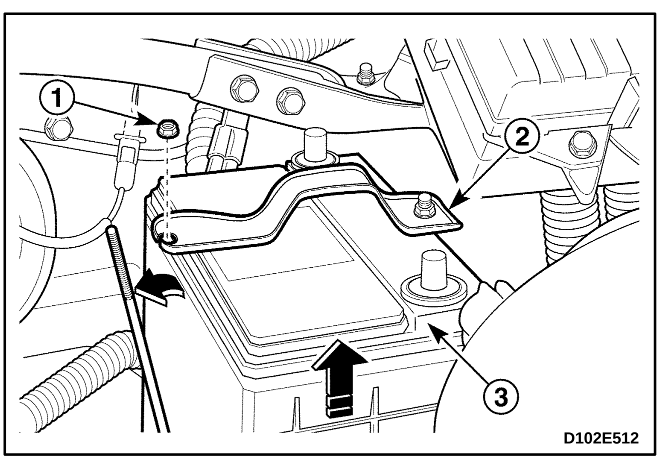
- Tighten the generator adjusting bolt to 4–7 N•m (35–62 lb-in) (a).
- Tighten the generator lower bracket bolt and nut to 18–28 N•m (13–21 lb-ft) (b).
- Inspect the generator drive belt tension.



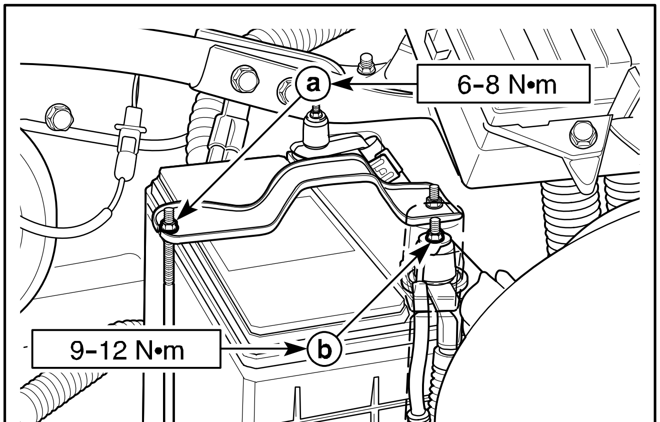
BATTERY

Removal Procedure

1. Disconnect the negative battery cable and then disconnect the positive battery cable.
   - Remove the battery cable nut to disconnect the negative battery cable (1).
   - Remove the battery terminal cap (2).
   - Remove the battery cable nut to disconnect the positive battery cable (3).



2. Remove the battery.
   - Remove the battery rod nut (1).
   - Remove the battery rod (2).
   - Remove the battery (3).



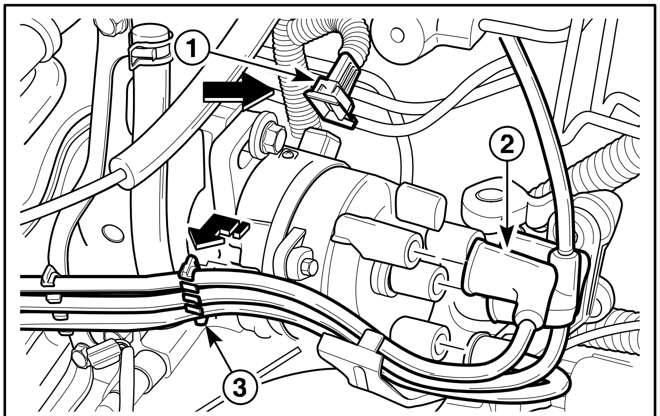
D12E513A

Installation Procedure

1. Install in the reverse order of removal.
2. Install the battery rod and cable nuts.

Tighten

- Tighten the battery rod nut to 6–8 N•m (53–71 lb-in) (a).
- Tighten the battery cable nut to 9-12 N•m (80–106 lb-in) (b).

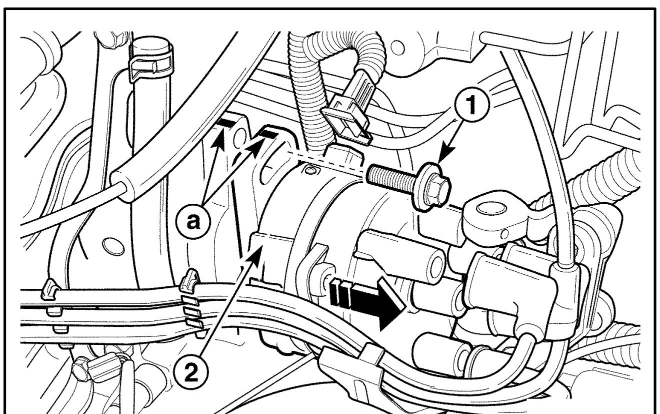


D12E514A

DISTRIBUTOR

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air filter, resonator with snorkel assembly. Refer to *Section 1B, SOHC Engine Mechanical.*
3. Disconnect the ignition wires and electrical connector.
   - Disconnect the optical sensor connector (1).
   - Disconnect the ignition wires (2).
   - Remove the ignition wire clip (3).

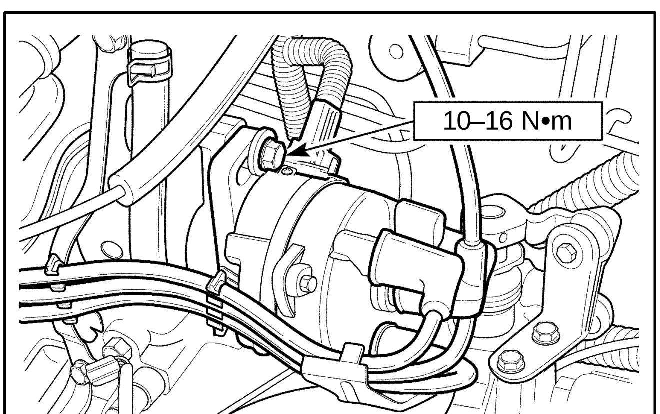


D102E515

4. Remove the distributor.

Important: Mark on the distributor housing and case before remove distributor (a).

- Remove the distributor bolts (1).
- Carefully remove the distributor assembly (2).



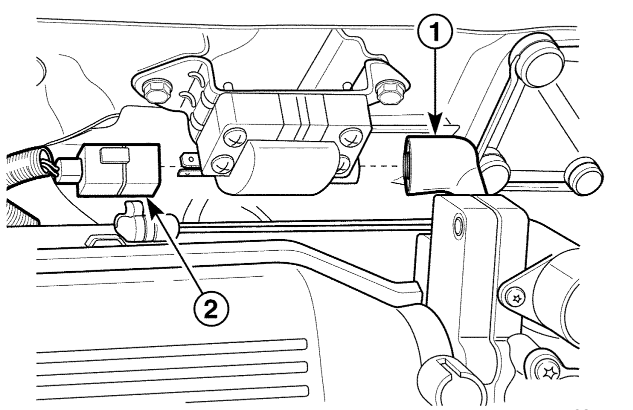
D12E516A

Installation Procedure

1. Install in the reverse order of removal.
2. Install the distributor bolts.

Tighten

Tighten the distributor bolts to 10–16 N•m (89–142 lb-in).

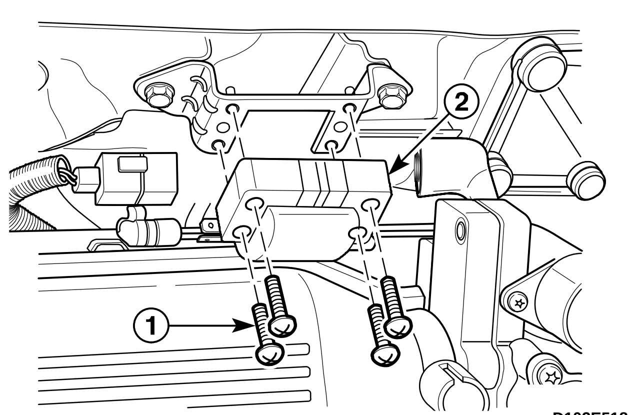


D102E517

IGNITION COIL

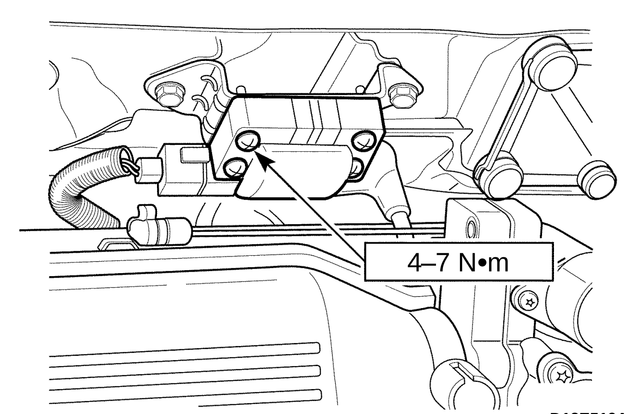
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ignition wires and ignition coil connector.
   - Disconnect the ignition wire (1).
   - Disconnect the ignition coil connector by pushing the connector's lock(2).



D102E518

3. Remove the ignition coil.
   - Remove the screws (1).
   - Remove the ignition coil (2).



D12E519A

Installation Procedure

1. Install in the reverse order of removal.
2. Install the ignition coil screws.

Tighten

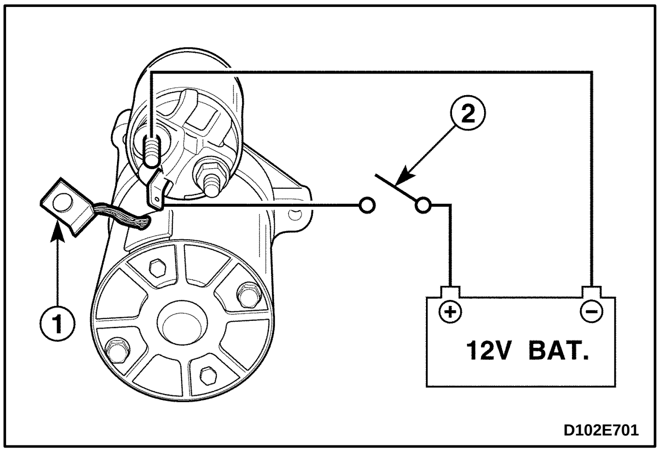
Tighten the ignition coil screws to 4–7 N•m (35–62 lb-in).

REPAIR INSTRUCTIONS

UNIT REPAIR

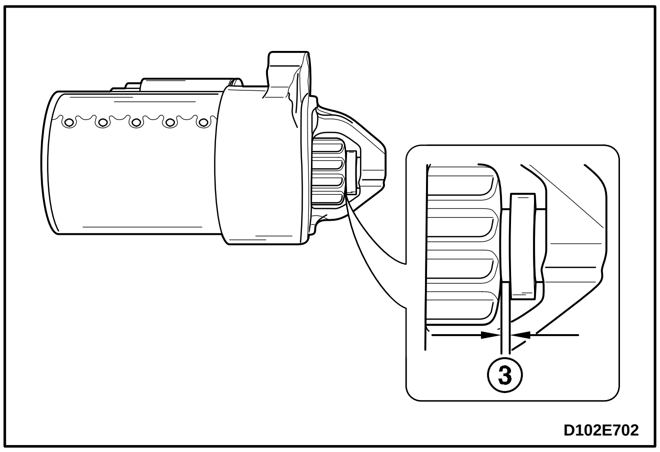
STARTER MOTOR

Inspection / Measurement (Before the Overhaul)

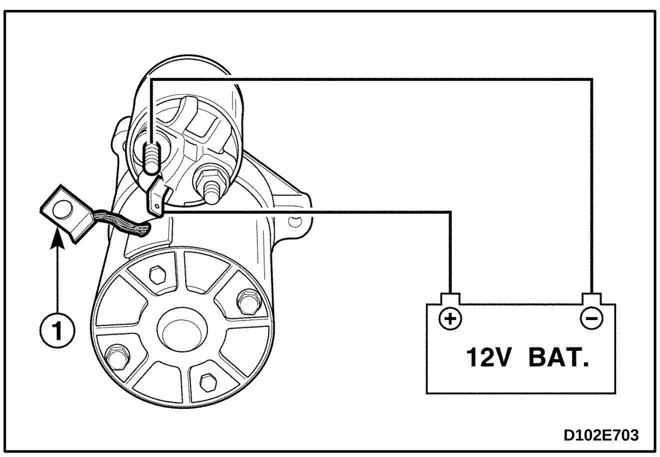


1. Remove the starter. Refer to “Starter” in this section.
2. Pinion clearance inspection.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminals M and S.

Notice: Complete the testing in a minimum amount of time to prevent overheating and damaging the solenoid. (in 10 seconds)

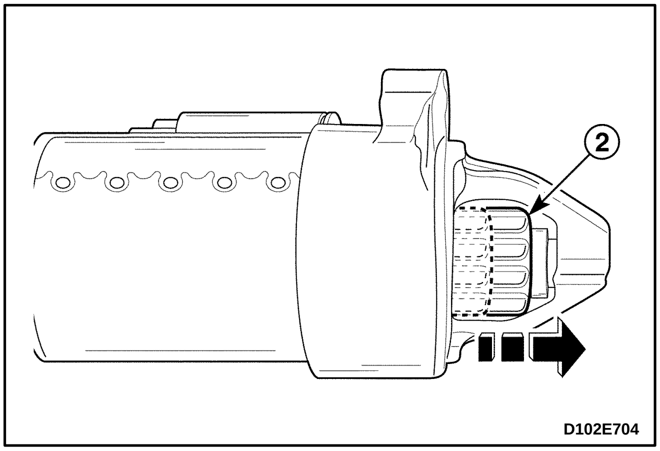


   - Switch on to move the pinion gear (2).
   - Now check the clearance between the pinion and the stopper with the filler gauge (3).
   - If the clearance does not fall within the limits, check for improper installation and replace all worn parts.

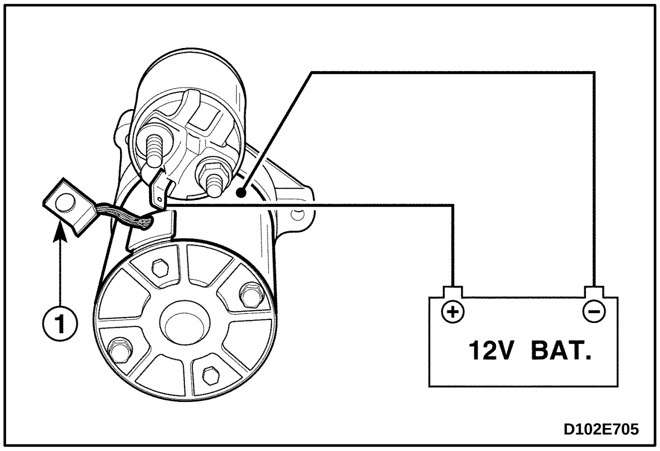


3. Magnetic switch pull-in test.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminals M and S.

Notice: Complete the testing in a minimum amount of time to prevent overheating and damaging the solenoid. (in 10 seconds)

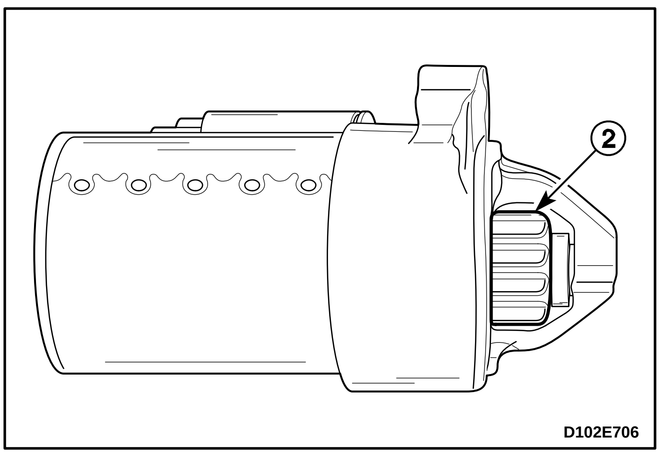


- Inspect the pinion gear's moving to the outside (2).
- If the pinion gear does not move outside, replace the magnetic switch.

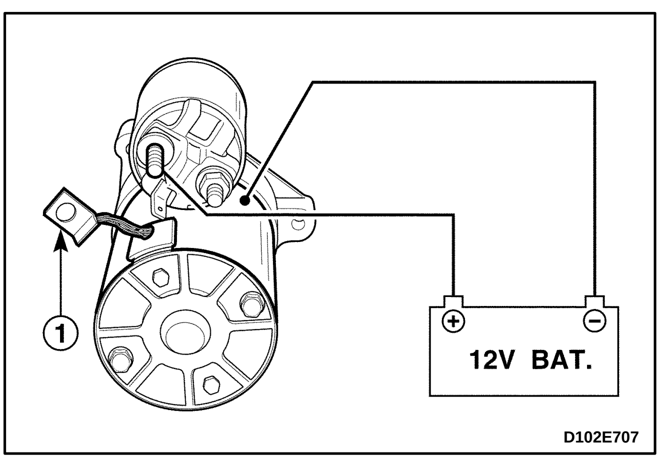


4. Solenoid hold-in test.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminal S and body.

Notice: Complete the testing in a minimum amount of time to prevent overheating and damaging the solenoid.

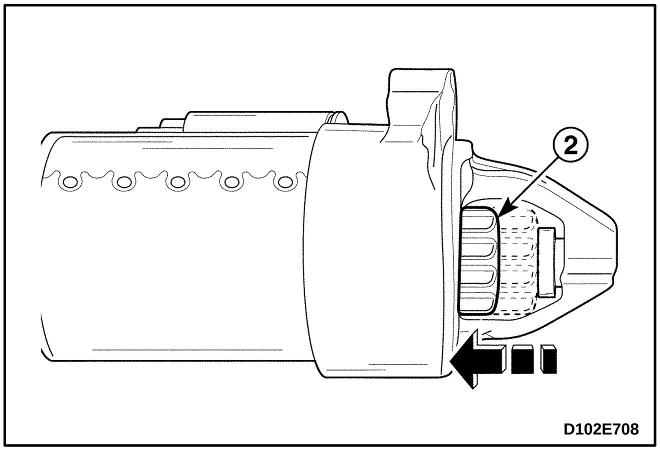


- Check the pinion gear's moving to the outside (2).
- If the pinion gear move to the inside, the circuit is open. Replace the magnetic switch.

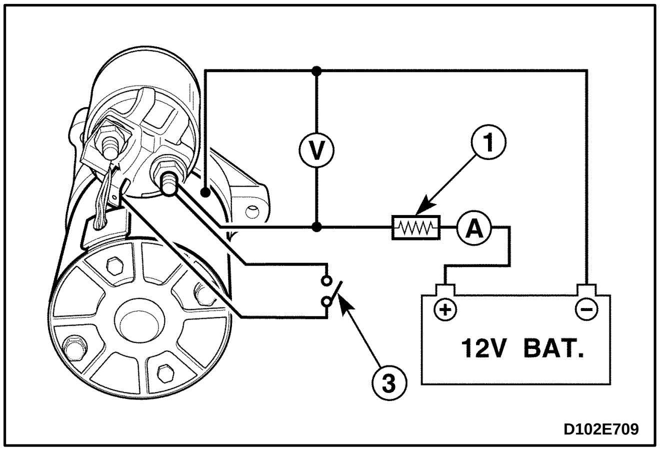


5. Solenoid return test.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminal S and body.

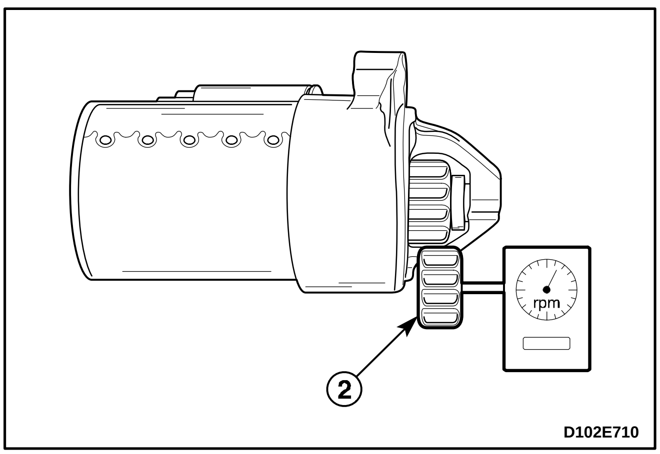
Notice: Complete the testing in a minimum amount of time to prevent overheating and damaging the solenoid.



- Check the returning speed of pinion gear (2).
  If the returning speed is fast, the operation is normal.
- Replace the solenoid if the operation is abnormal.

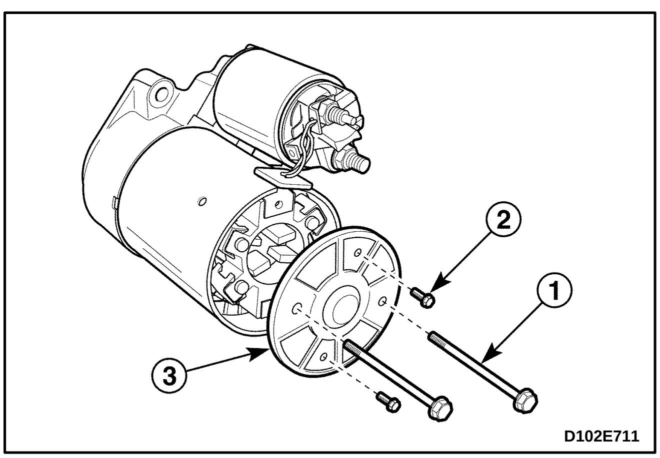


5. No-road test.
   - Connect the 12-volt battery lead to the starter circuit.
   - Connect the current and the voltage (1).
   - Install the starter motor rpm gage (2).
   - Start the starter motor with the switch on (3).
   - Measure the speed of pinion gear and the current.
   - If the measurement satisfy the limit, the starter motor is normal.



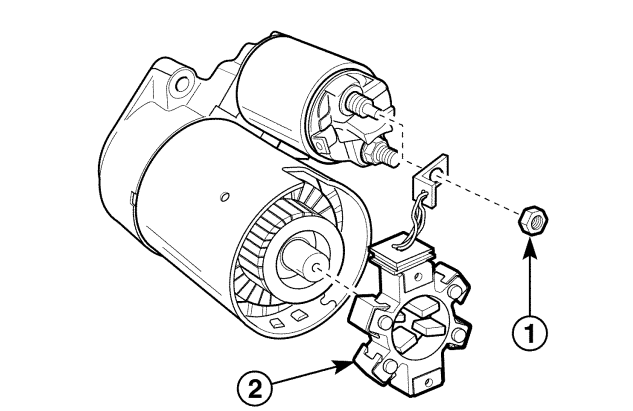
Desciption	Limit
The speed of pinion gear	Minimum: 2,000 rpm
Condition: Voltage/Current	Maximum: 9V / 150A

- Replace the starter motor if necessary.



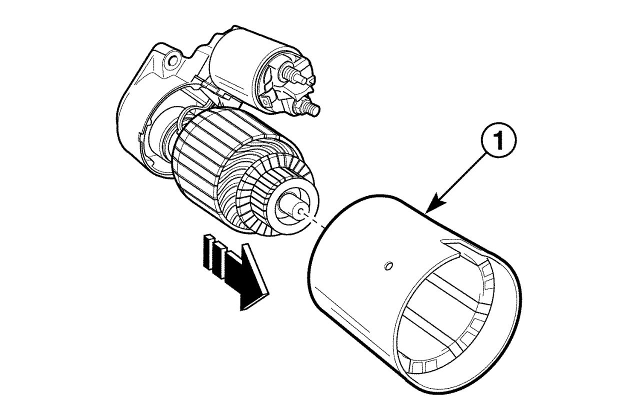
Disassembly Procedure

1. Remove the starter contact end frame.
   - Remove the through-bolts (1).
   - Remove the contact end frame bolts (2).
   - Remove the frame with the spacer (3).



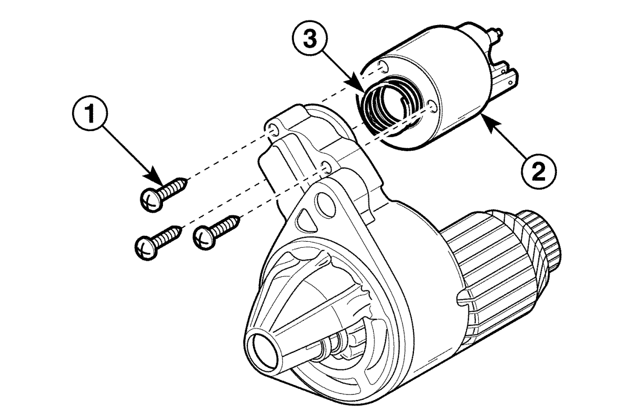
D102E712

2. Remove the brush holder assembly.
   - Remove the starter motor terminal M nut (1).
   - Remove the brush holder assembly (2).



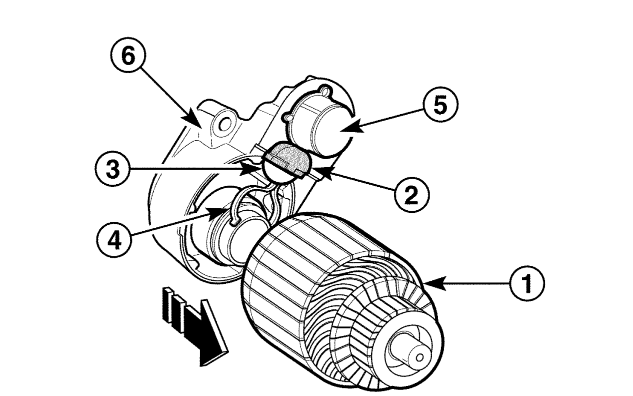
D102E713

3. Remove the field frame assembly from the armature set (1).



D102E714

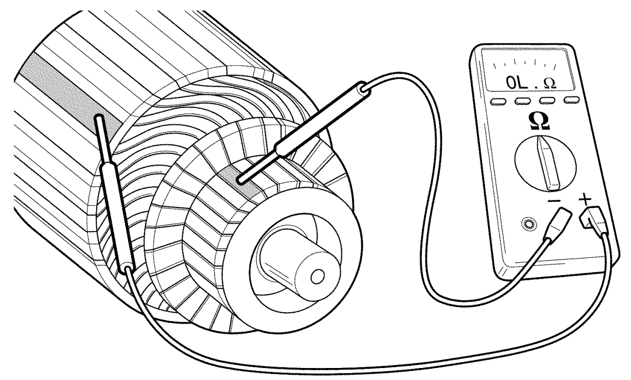
4. Remove the solenoid assembly.
   - Remove the solenoid screws (1).
   - Remove the magnetic switch (2).
   - Remove the spring (3).



D102E715

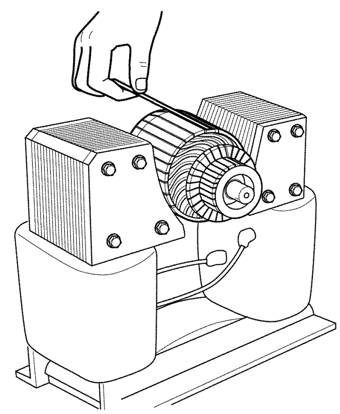
5. Remove the armature set and solenoid from the starter housing.
   - Remove the armature set (1).
   - Remove the rubber sealer (2).
   - Remove the shift lever plate (3).
   - Remove the shift lever (4).
   - Remove the solenoid (5).
   - Remove the gasket (6).

Inspection / Measurement (After the Overhaul)



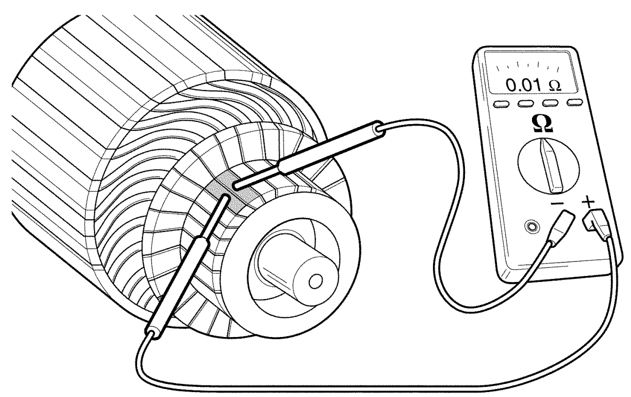
D102E716

1. Ground test for armature coil.
   - Inspect the insulation between commutator and armature coil using the voltmeter.
   - Replace the armature assembly if necessary.



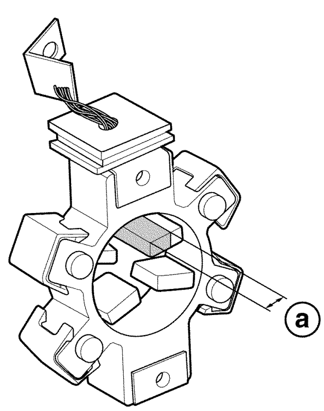
D102E717

2. Short circuit test for armature coil.
   - If test equipment is available, check the armature for short circuit by placing it on a growler, and holding back a saw blade over the armature core while the armature is rotated. If the saw blade vibrates, replace the armature.



D102E718

3. Open circuit test for armature coil.
   - Check the continuity between the commutator bars using multimeter.
   - Replace the armature assembly if necessary.

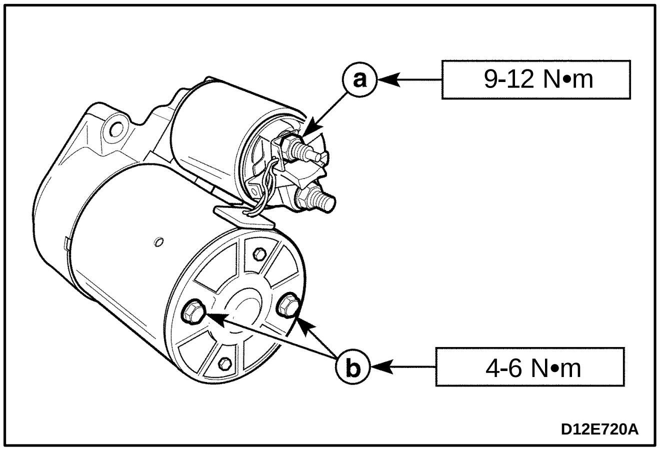


D102E719

4. Inspect the brushes wear.
   - Inspect the brushes, the pop-out springs and the brush holder for wear and damage. Replace the brushes, if necessary.

   a. Brushes wear limit.

Desciption	Standard	Limit
Brushes wear	11.3–11.5 mm (0.445–0.453 in)	7.0–7.25 mm (0.275–0.285 in)



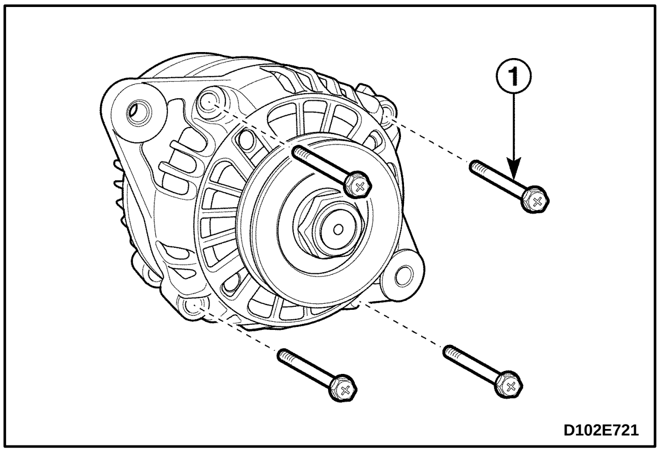
Assembly Procedure

1. Install in the reverse order of removal.
2. Install the bolts / nuts.

Tighten

Tighten the starter motor terminal M nut to 9–12 N•m (80–106 lb-in) (a).

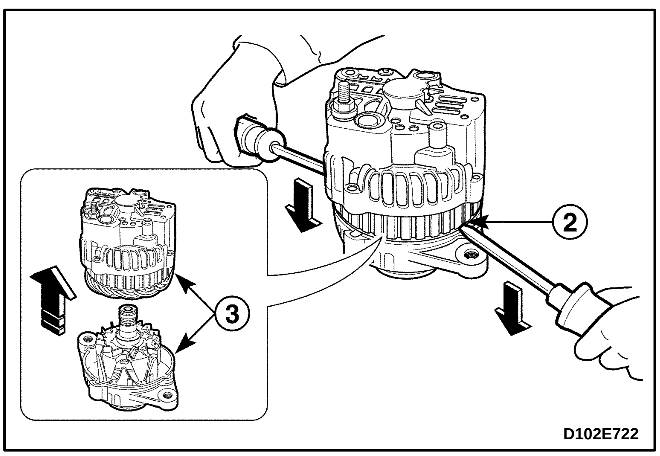
Tighten the through-bolts to 4–6 N•m (35–53 lb-in) (b).



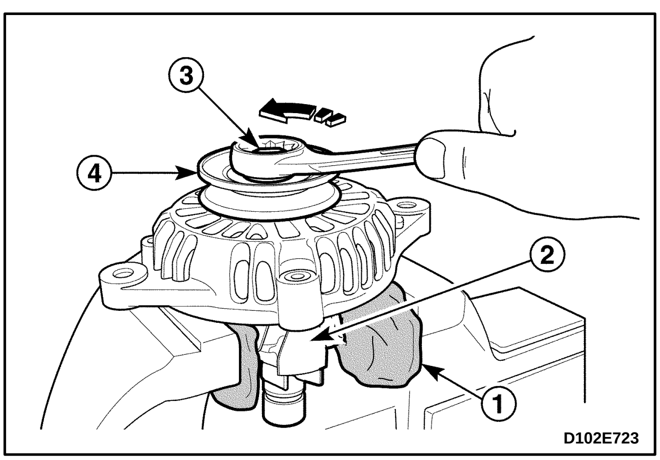
GENERATOR (A-TYPE : MANDO)

Disassembly Procedure

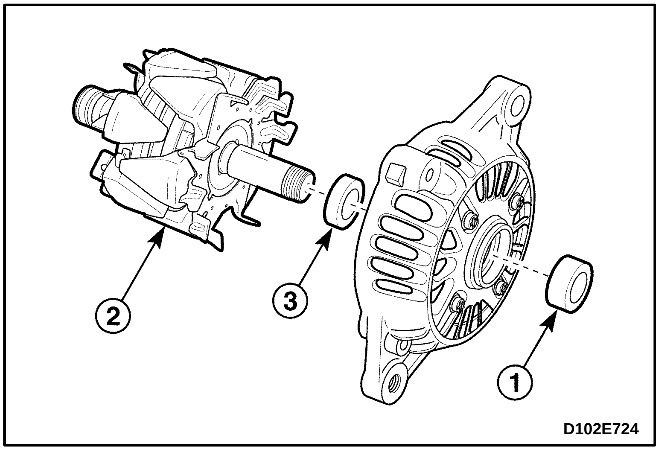
1. Remove the generator. Refer to “Generator” in this section.
2. Remove the front bracket and rear bracket.
   - Remove the through-bolts (1).



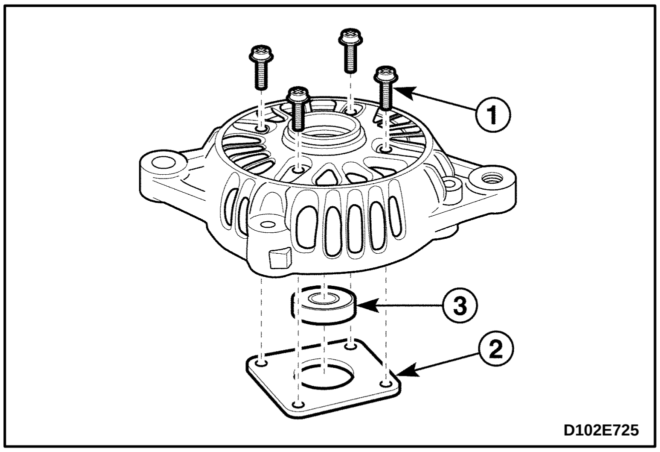
   - Pry front bracket downwards using a screwdriver (2).
   - Separate the front bracket and rear bracket (3).



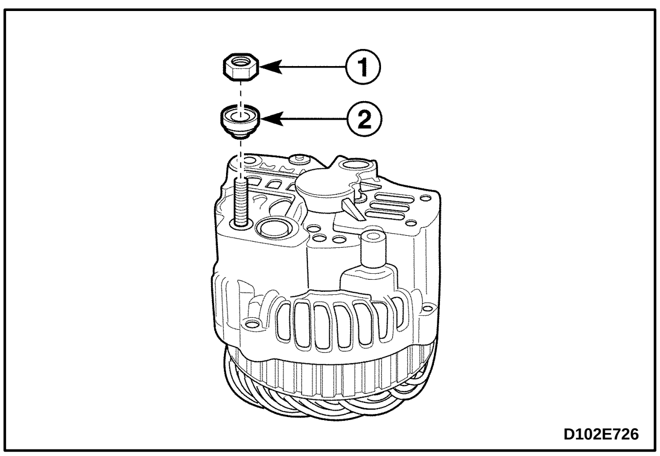
3. Remove the pulley and rotor assembly from the front bracket.
   - Cover the rotor with the cloth (1).
   - Place the pulley upwards and vice the rotor (2).
   - Remove the pulley nut (3).
   - Remove the pulley (4).



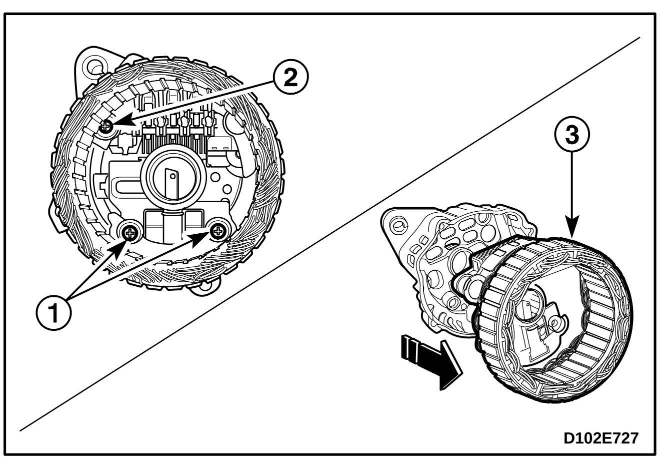
4. Remove the front bracket, rotor and collar.
   - Remove the collar (large) (1).
   - Remove the rotor from the front bracket (2).
   - Remove the collar (small) from the rotor shaft (3).



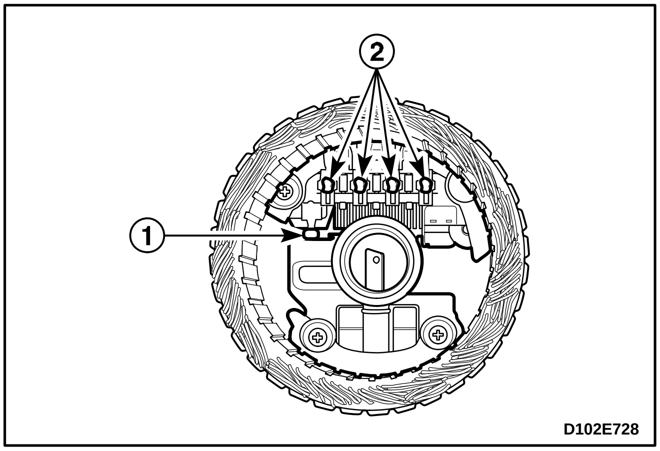
5. Remove the front bearing.
   - Remove the support plate screws (1).
   - Remove the plate (2).
   - Remove the front bearing using the press (3).



6. Remove the battery positive terminal nut from the rear bracket.
   - Remove the battery position terminal nut (1).
   - Remove the washer (2).

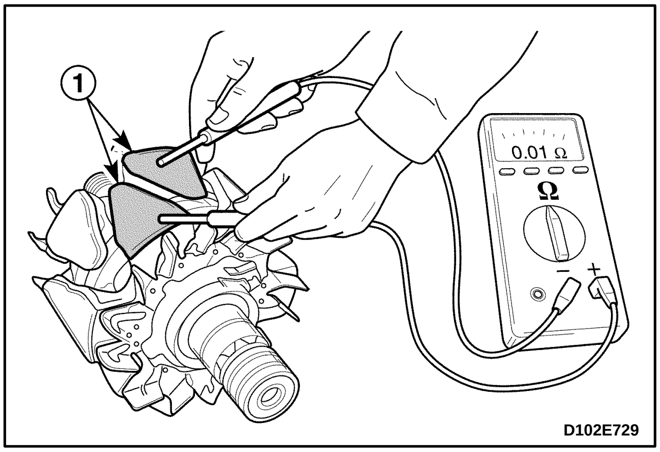


7. Remove the stator assembly from the rear bracket.
   - Remove the rectifier screw (1).
   - Remove the brush holder and regulator assembly screws (2).
   - Remove the stator assembly with the rectifier / brush holder / regulator (3).



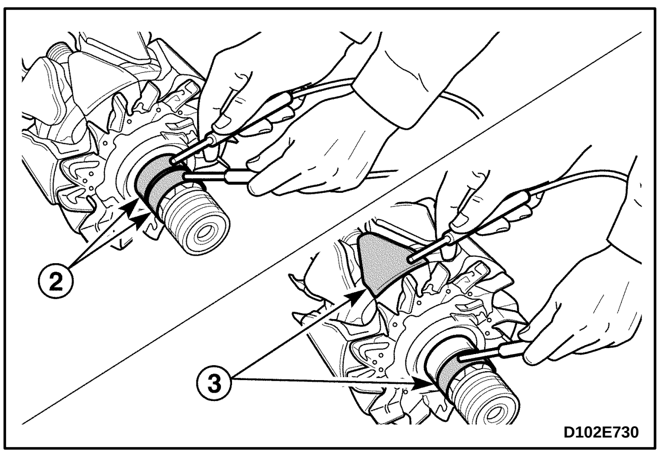
8. Remove the rectifier / brush holder / regulator from the stator.
   - Remove the rectifier / brush holder / regulator connections (1).
   - Remove the stator and rectifier connections (2).

Notice: If the stator connections are welded, melt the lead. Avoid overheating as it can damage the diodes.



Inspection / Measurement

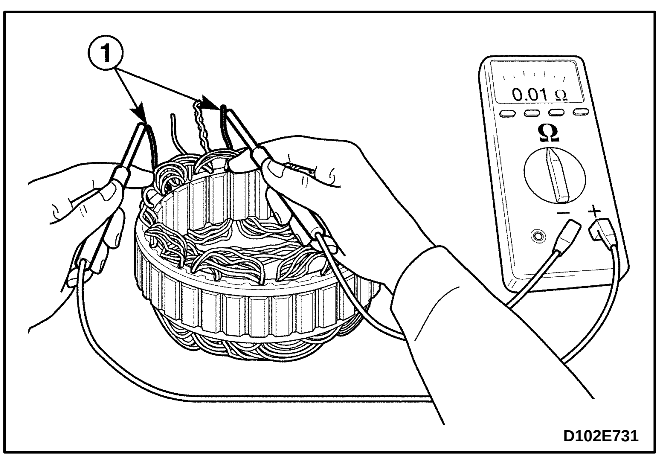
1. Inspect the rotor assembly.
   - Test the rotor for an open circuit by using the ohmmeter (1). Replace the rotor if necessary.



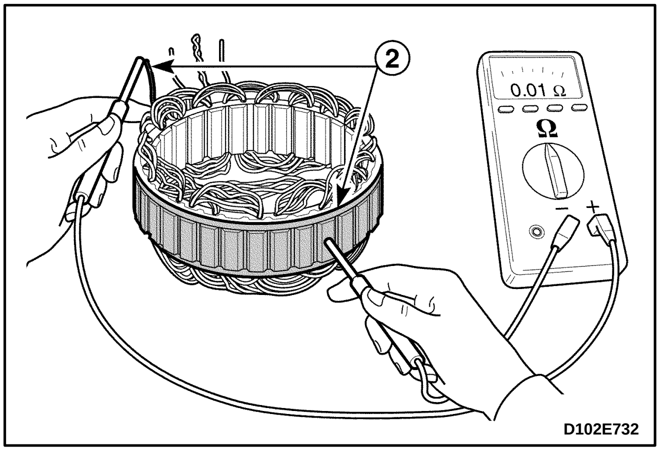
   - Test the rotor for open or short circuit (2).

Desciption	Limit
The measured resistance	2.9Ω

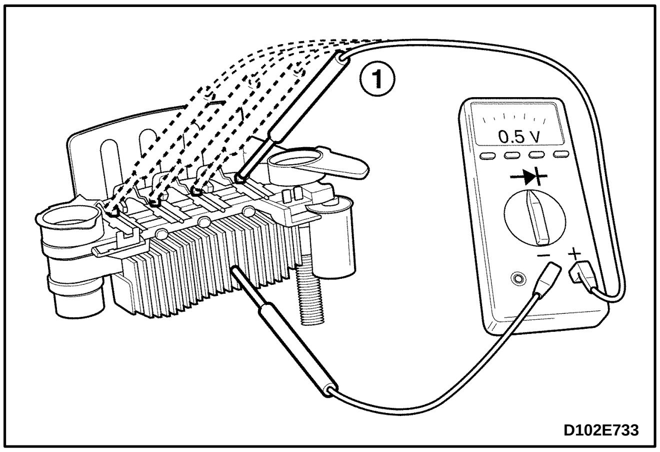
   - Replace the rotor if necessary.
   - Test the rotor for open or ground circuit by using the ohmmeter (3). Replace the rotor if necessary.



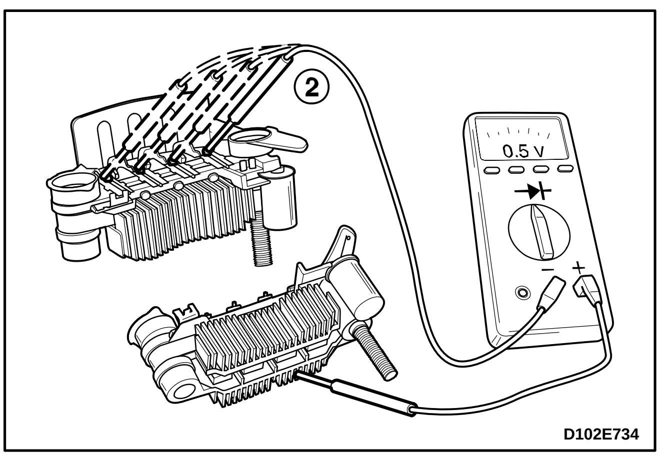
2. Inspect the stator.
   - Test the stator for an open circuit by using the ohmmeter (1). Replace the stator if necessary.



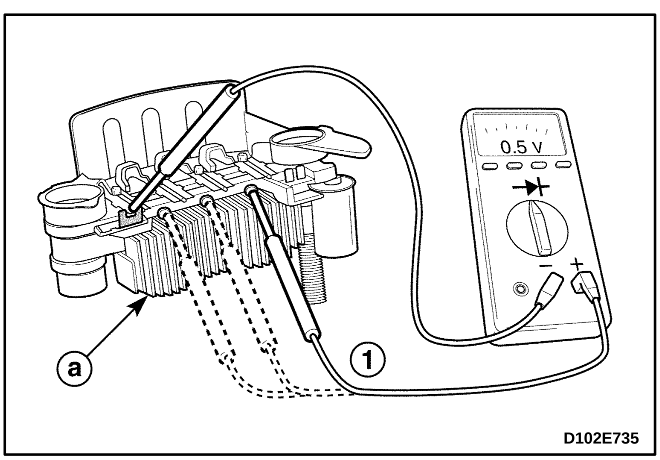
- Test the stator for open or ground circuit by using the ohmmeter (2). Replace the starter if necessary.



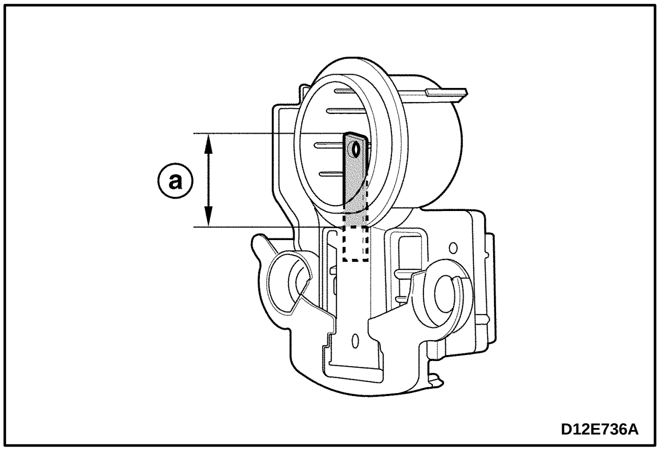
3. Inspect the rectifier.
   - Positive rectifier test:
     Inspect the open circuit for stator coil lead terminals using the ohmmeter (1).
     Replace the rectifier if necessary.



   - Negative rectifier test:
     Inspect the open circuit for stator coil lead terminals using the ohmmeter (2).
     Replace the rectifier if necessary.

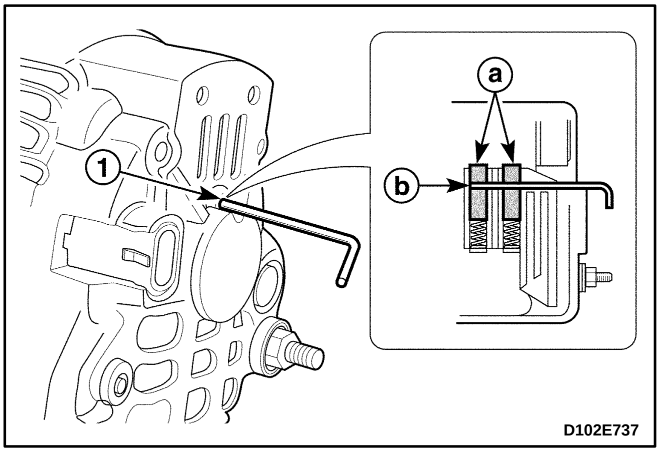


4. Inspect trio diodes.
   - Inspect the open circuit for trio diodes using the ohmmeter (1).
   - Replace the heat sink if necessary (a).



5. Inspect the brush wear.
   - If the brush wear exceeds the specified valve (a), replace the brush.

Desciption	Standard	Limit
Brushes wear	18.5 (0.73)	13.5 (0.53)

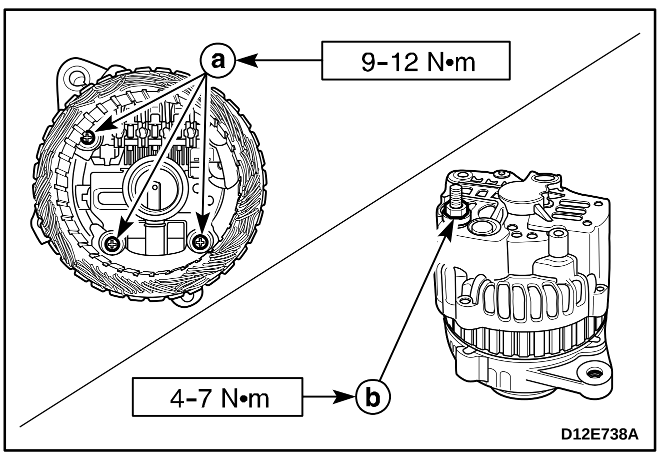


Assembly Procedure

1. Install in the reverse order of removal.
   - Assemble the stator assembly into the rear bracket and rotor assembly.

   a. Brushes.

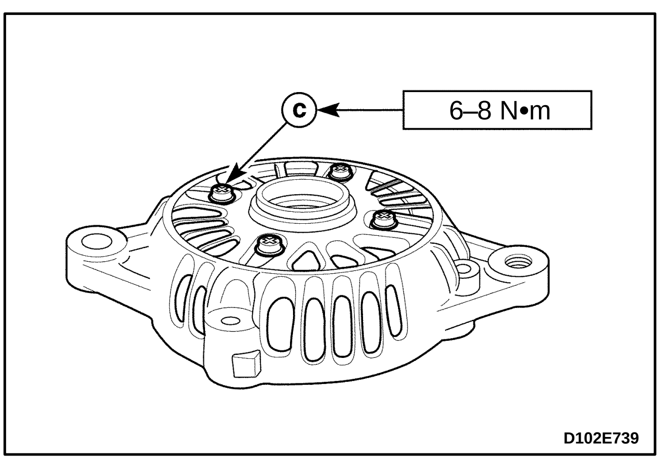
   b. Hole.



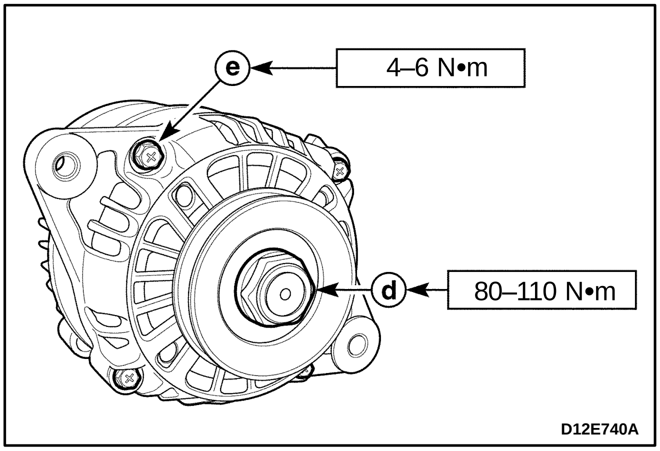
2. Install the bolts / nuts / screws.

   Tighten

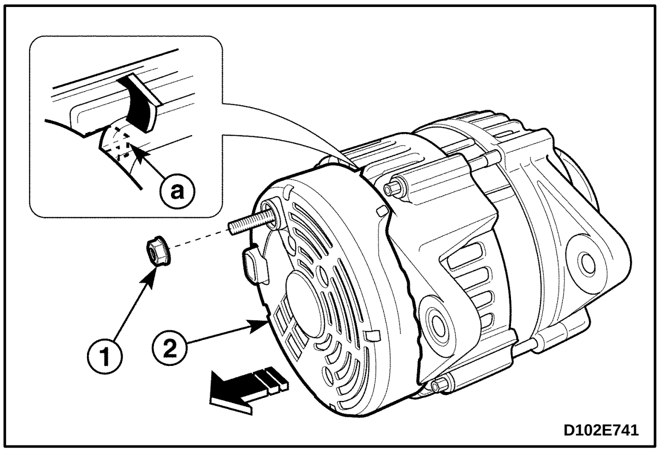
   - Tighten the brush holder / regulator / rectifier screws to 9–12 N•m (80–106 lb-in) (a).
   - Tighten the battery positive terminal nut to 4–7 N•m (35–62 lb-in) (b).



   - Tighten the front bearing spot plate screws to 6–8 N•m (53–71 lb-in) (c).



- Tighten the generator pulley nut to 80–110 N•m (59–81 lb-ft) (d).
- Tighten the through-bolts to 4–6 N•m (35–53 lb-in) (e).

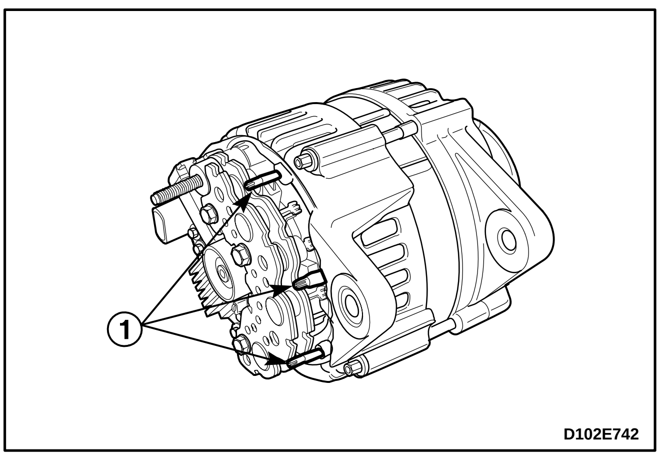


GENERATOR (B-TYPE: DAC)

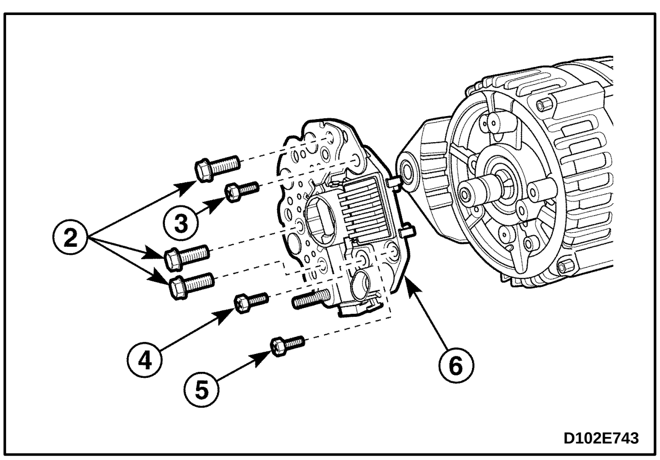
Disassembly Procedure

1. Remove the generator. Refer to “Generator” in this section.
2. Remove the cover from the generator.
   - Remove the battery positive terminal nut (1).
   - Remove the cover (2).

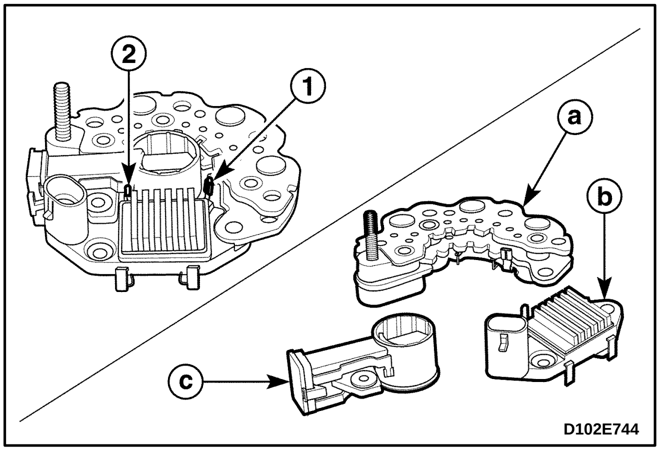
   a. Cover.



3. Remove the regulator / brush holder / rectifier assembly.
   - Remove the stator coil lead and rectifier diode lead connections (1).

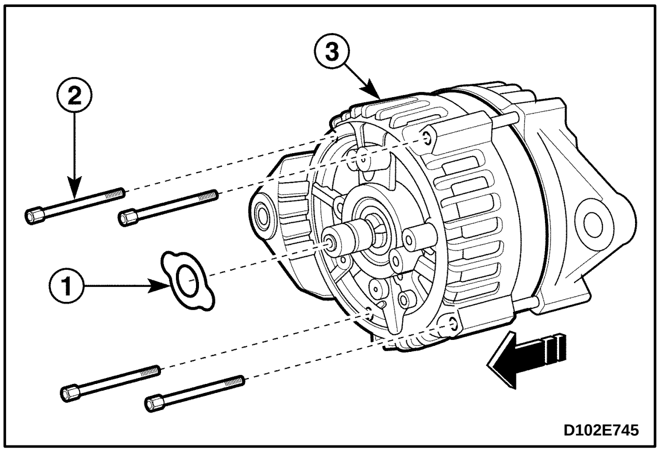


- Remove the rectifier bolts (2).
- Remove the rectifier / regulator screw (3).
- Remove the brush holder / regulator screw (4).
- Remove the regulator screw (5).
- Remove the regulator / brush holder / rectifier assembly (6).

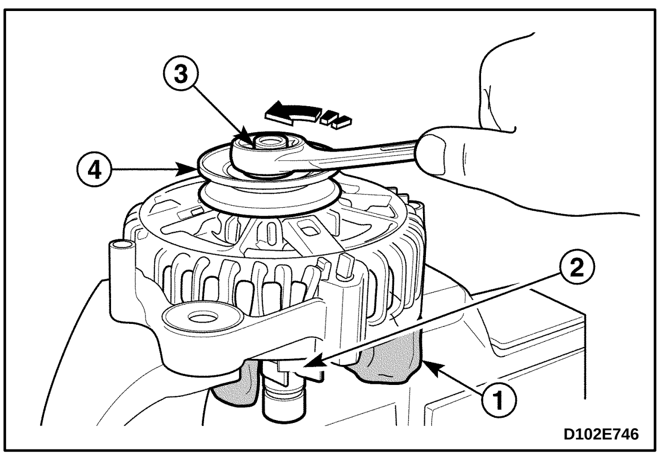


4. Remove the regulator / brush holder / rectifier.
   - Remove the rectifier and regulator connection (1).
   - Remove the regulator and brush holder connection (2).
   - Visibly inspect the rectifier / regulator / brush holder for damage or broken.

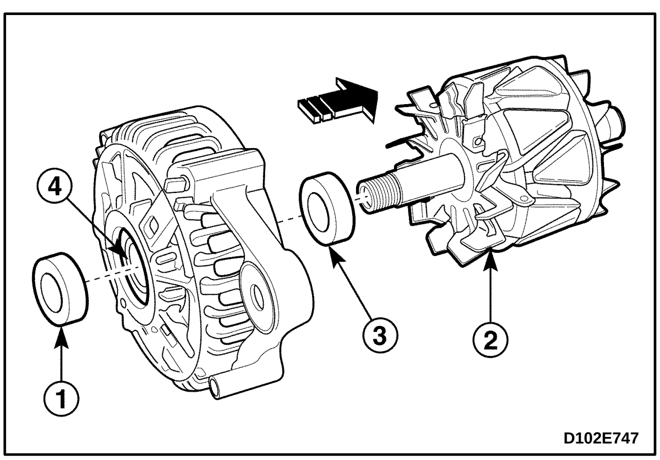
   a. Rectifier.
   b. Regulator.
   c. Brush holder.



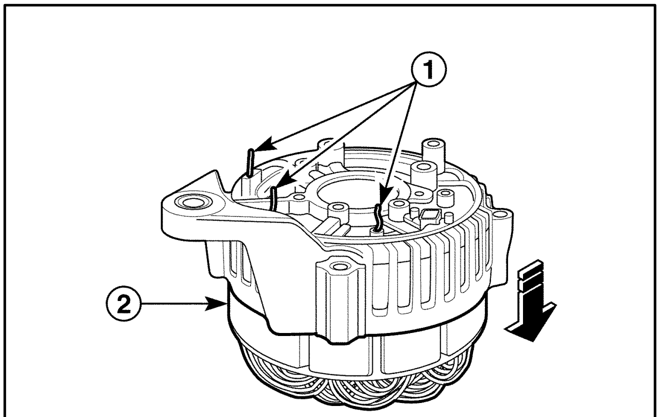
5. Remove the shield before the drive end bracket and the frame.
   - Remove the shield (1).
   - Remove the through-bolts (2).
   - Remove the frame from the drive end bracket (3).



6. Remove the pulley and rotor assembly from the drive end bracket.
   - Cover the rotor with the cloth (1).
   - Place the pulley upwards and vice the rotor (2).
   - Remove the pulley nut (3).
   - Remove the pulley (4).

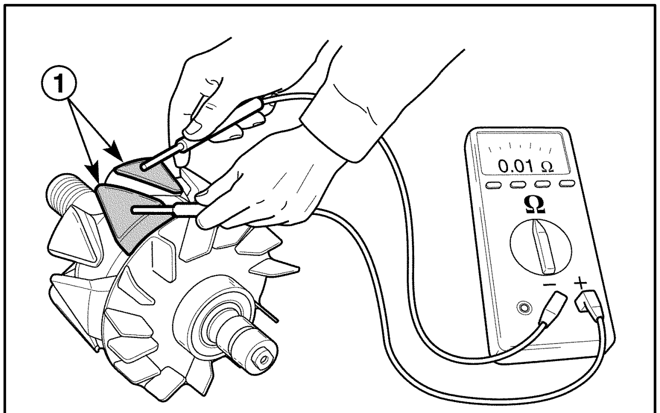


7. Remove the drive end bracket, rotor and space.
   - Remove the collar (1).
   - Remove the rotor from the driver end bracket (2).
   - Remove the collar from the rotor shaft (3).
   - Inspect the front bearing for corrosion, wear, noisy and other damage (4).



D102E748

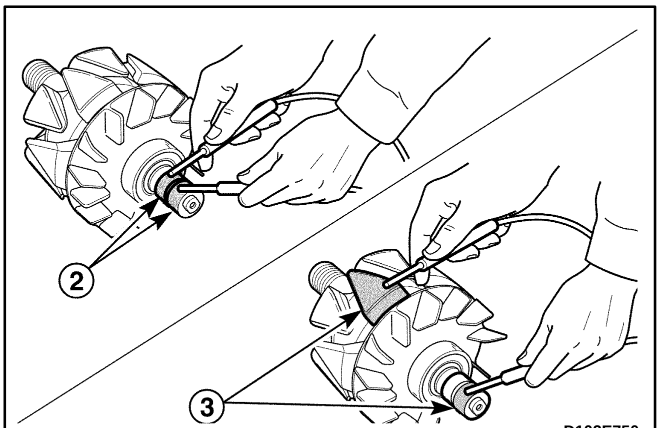
8. Remove the stator assembly from the frame.
   - Remove the remains after the welding.
   - Remove the stator assembly (2).



D102E749

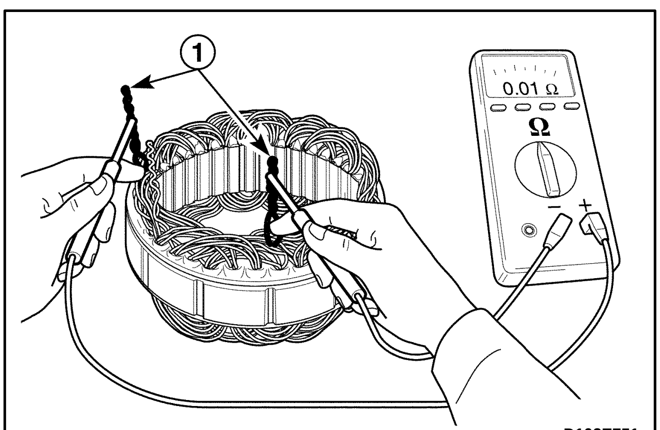
Inspection / Measurement

1. Inspect the rotor assembly.
   - Test the rotor coil for an open circuit by using the ohmmeter. The reading should be sufficiently low, or the rotor must be replaced (1).



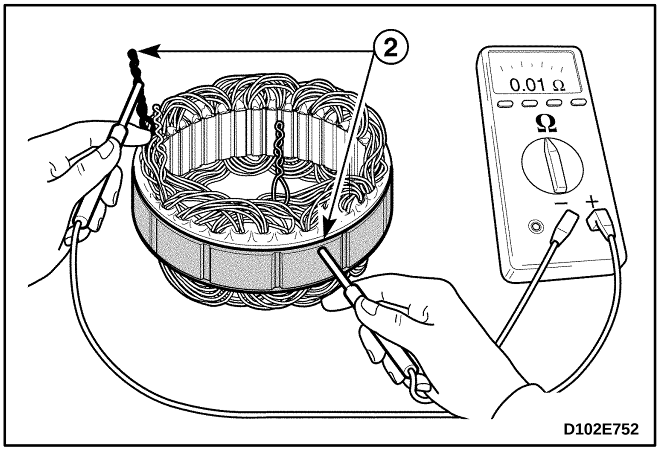
D102E750

   - Test the rotor for open or short circuits. The reading should be 2.6 to 2.8 ohms, or the rotor should be replaced (2).
   - Test the rotor for open or ground circuits by using the ohmmeter. The reading should be sufficiently high, or the rotor must be replaced (3).
   - Inspect the fan blade for damage.

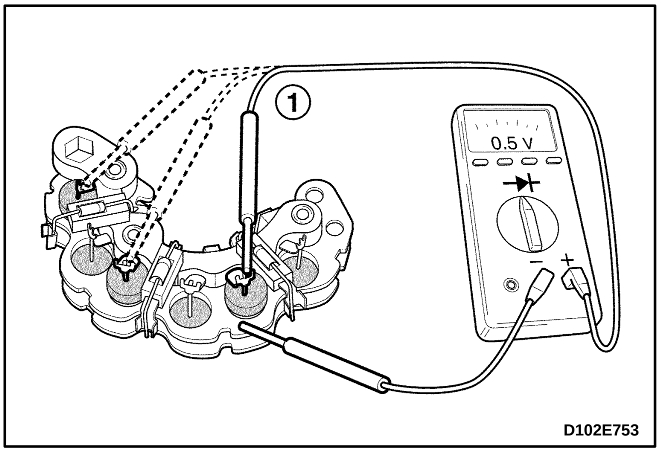


D102E751

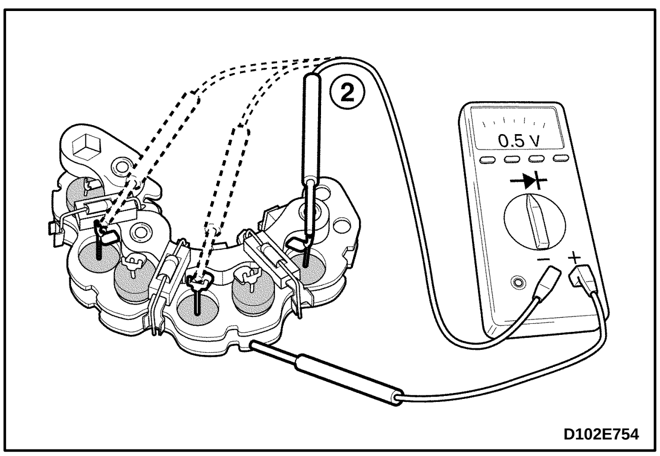
2. Inspect the stator.
   - Test the rotor for an open circuit by using the ohmmeter. The reading should be sufficiently low, or the stator must be replaced (1).



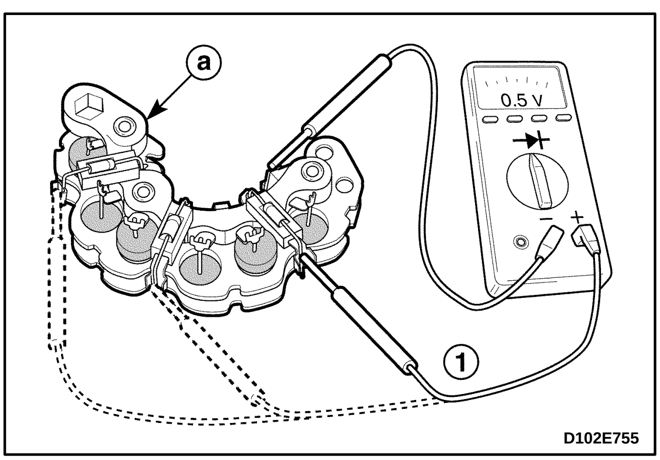
- Test the stator for open or ground circuits by using the ohmmeter. The reading should be sufficiently high, or the stator must be replaced (2).



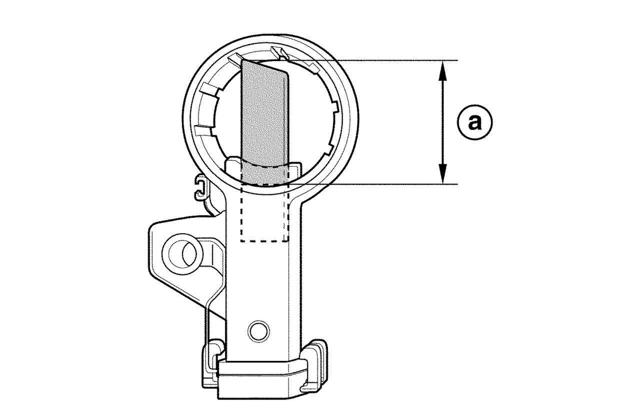
3. Inspect the rectifier.
   - Positive rectifier test:
     Inspect the open circuit for stator coil lead terminals using the ohmmeter (1).
     Replace the rectifier if necessary.



   - Negative rectifier test:
     Inspect the open circuit for stator coil lead terminals using the ohmmeter (2).
     Replace the rectifier if necessary.



4. Inspect trio diodes.
   - Inspect the open circuit for trio diodes using the ohmmeter (1).
     Replace the heat sink if necessary (a).

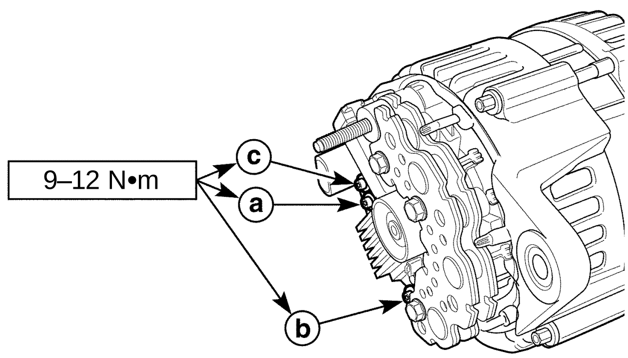


D12E756A

5. Inspect the brush wear
   - If the brush wear exceeds the specified value, replace the brush.

   a. Brush wear limit.

Desciption	Standard	Limit
Brushes wear	20 (0.79)	14 (0.55)



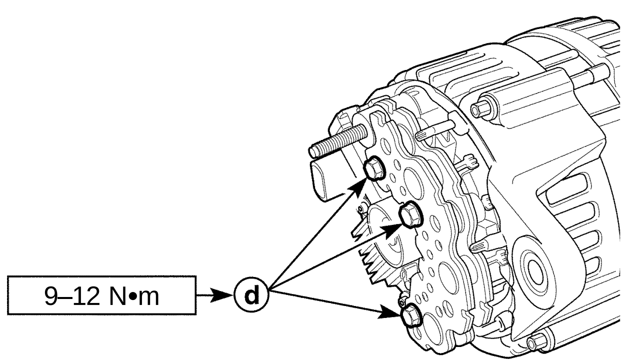
D12E757A

Assembly Procedure

1. Install in the reverse order of removal.
2. Install the screws / nuts / bolts.

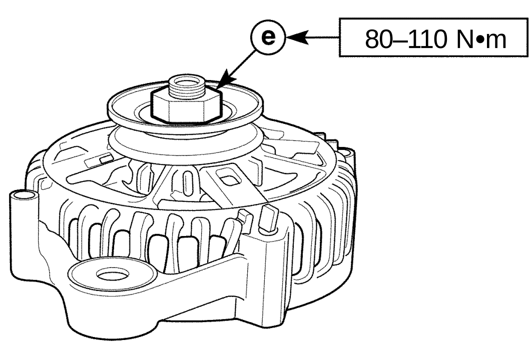
Tighten

- Tighten the regulator screw to 9–12 N•m (80–106 lb-in) (a).
- Tighten the rectifier / regulator screw to 9–12 N•m (80–106 lb-in) (b).
- Tighten the brush holder / regulator screw to 9–12 N•m (80–106 lb-in) (c).



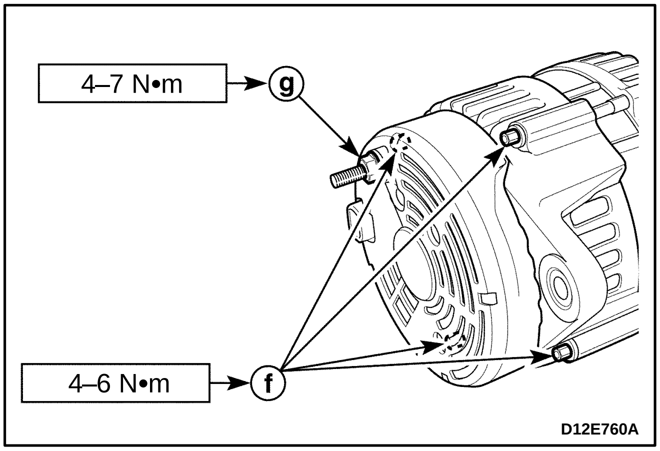
D12E758A

- Tighten the rectifier bolts to 9–12 N•m (80–106 lb-in) (d).



D12E759A

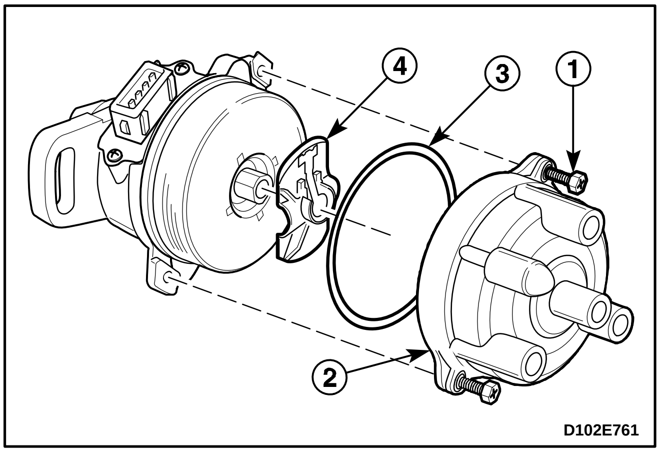
- Tighten the pulley nut to 80-110 N•m (59–81 lb-ft) (e).



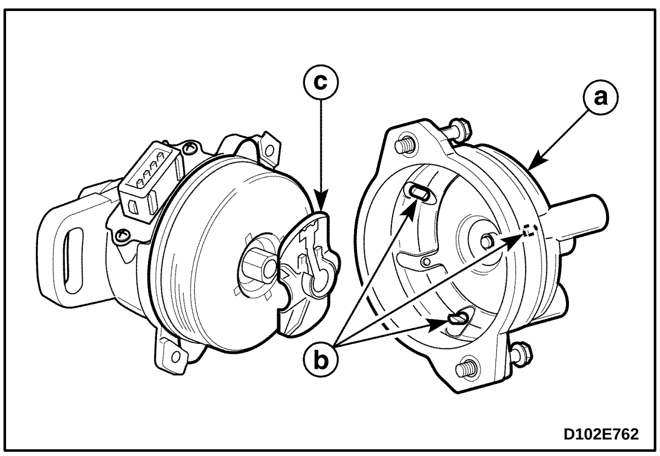
- Tighten the through-bolts to 4–6 N•m (35–53 lb-in) (f).
- Tighten the battery positive terminal nut to 4–7 N•m (35–62 lb-in) (g).

DISTRIBUTOR ASSEMBLY

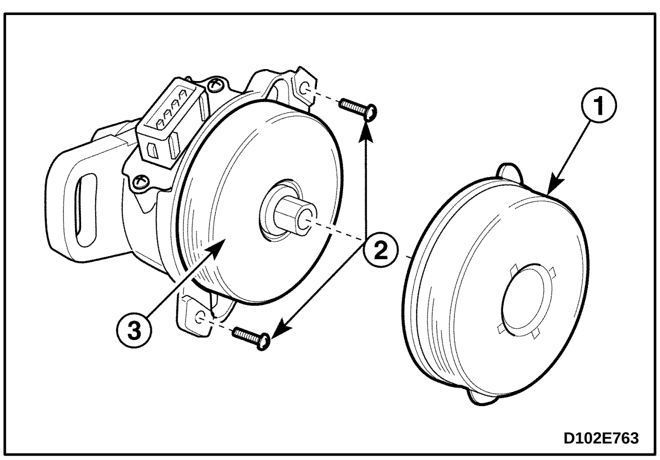
Disassembly Procedure



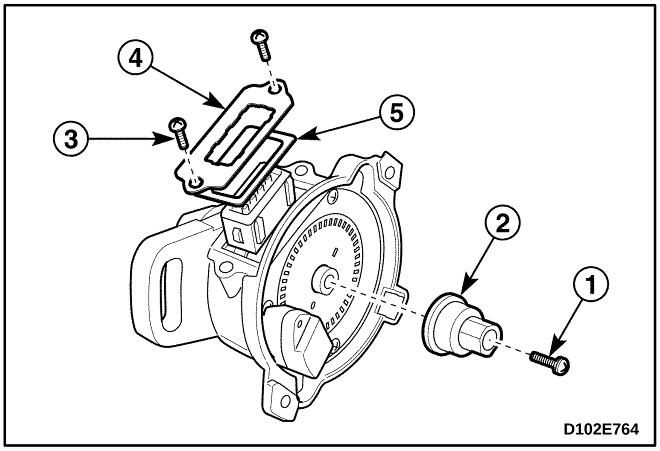
1. Remove the distributor. Refer to “Distributor” in this section.
2. Remove the cap, seal and rotor from the distributor housing.
   - Remove the bolts (1).
   - Remove the distributor cap (2).
   - Remove the seal (3).
   - Remove the rotor (4).



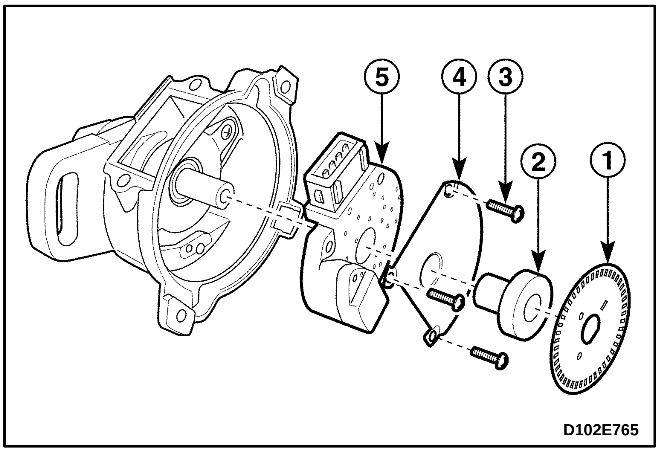
- Inspect the cap for cracks or damage (a).
- Inspect the cap electrode for damage / wear or carbon traces (b).
- Inspect the rotor for damage or carbon traces (c).



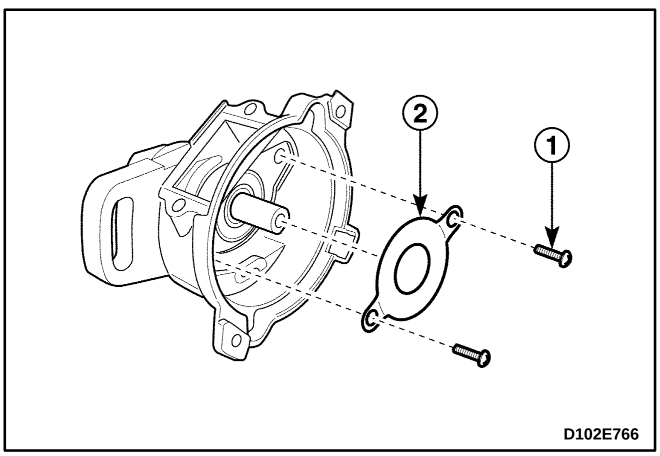
3. Remove the inner / outer cover from the distributor housing.
   - Remove the outer cover (1).
   - Remove the screws (2).
   - Remove the inner cover (3).



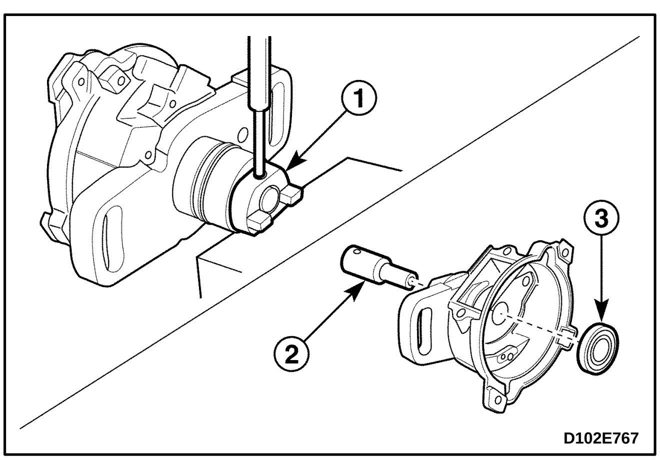
4. Remove the optical sensor cover and adaptor from the distributor housing.
   - Remove the screw (1).
   - Remove the adaptor (2).
   - Remove the screws (3).
   - Remove the cover (4).
   - Remove the gasket (5).



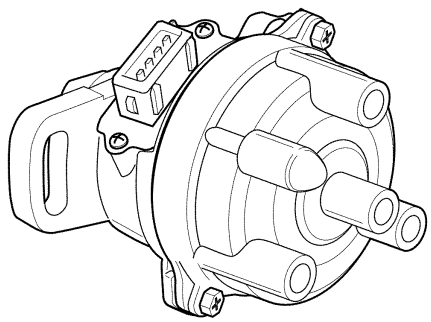
5. Remove the optical sensor unit from the distributor housing.
   - Carefully remove the disc wheel (1).
   - Remove the bushing (2).
   - Remove the screws (3).
   - Remove the optical sensor unit plate (4).
   - Remove the optical sensor unit (5).



6. Remove the bearing plate from the distributor housing.
   - Remove the screws (1).
   - Remove the bearing plate (2).



7. Remove the coupling, shaft and bearing from the distributor housing.
   - Remove the coupling (1).
   - Remove the shaft using the press (2).
   - Remove the bearing (3).



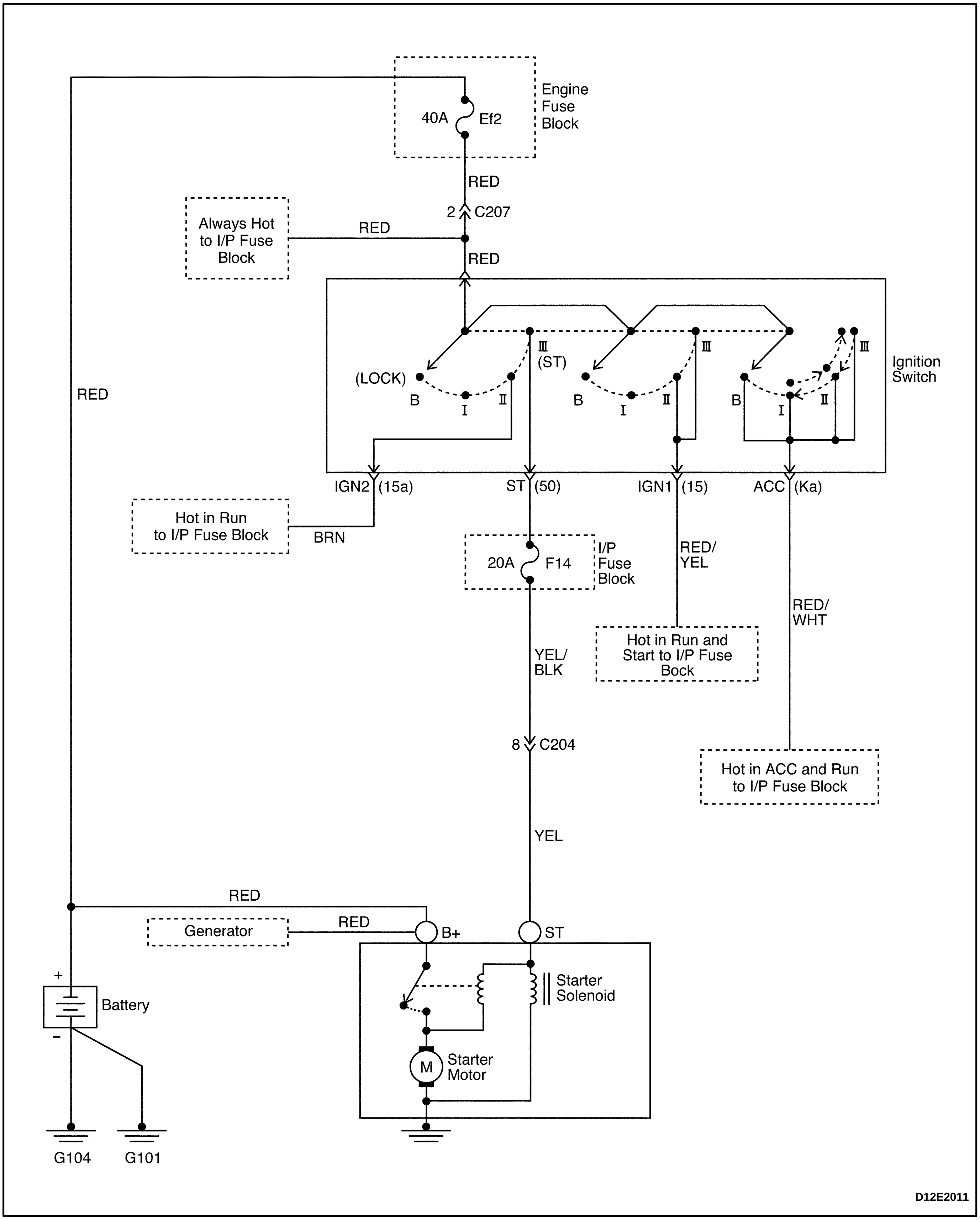
D102E768

Assembly Procedure

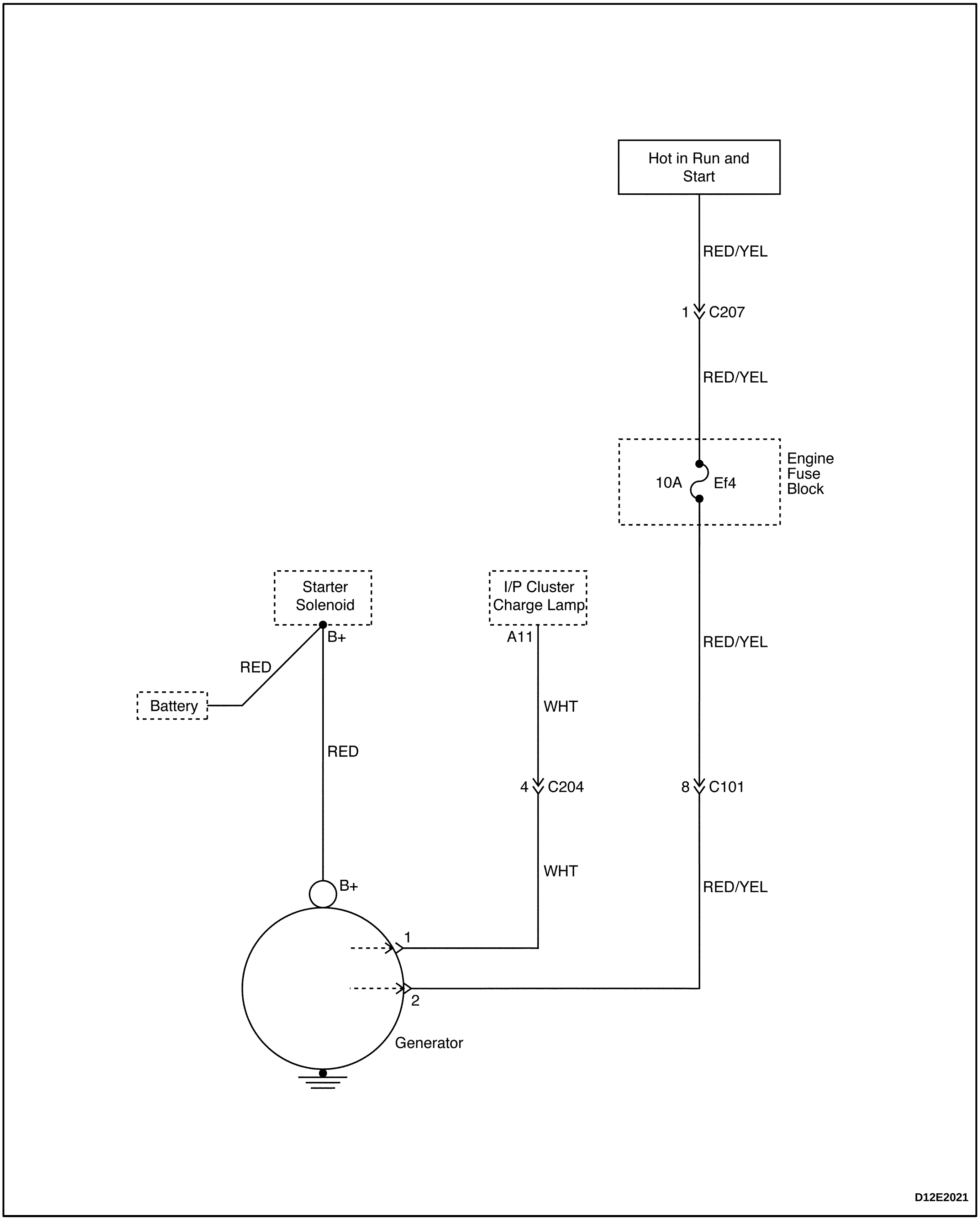
1. Install in the reverse order of removal.
   - Lubricate the shaft with clean engine oil.

SCHEMATIC AND ROUTING DIAGRAMS

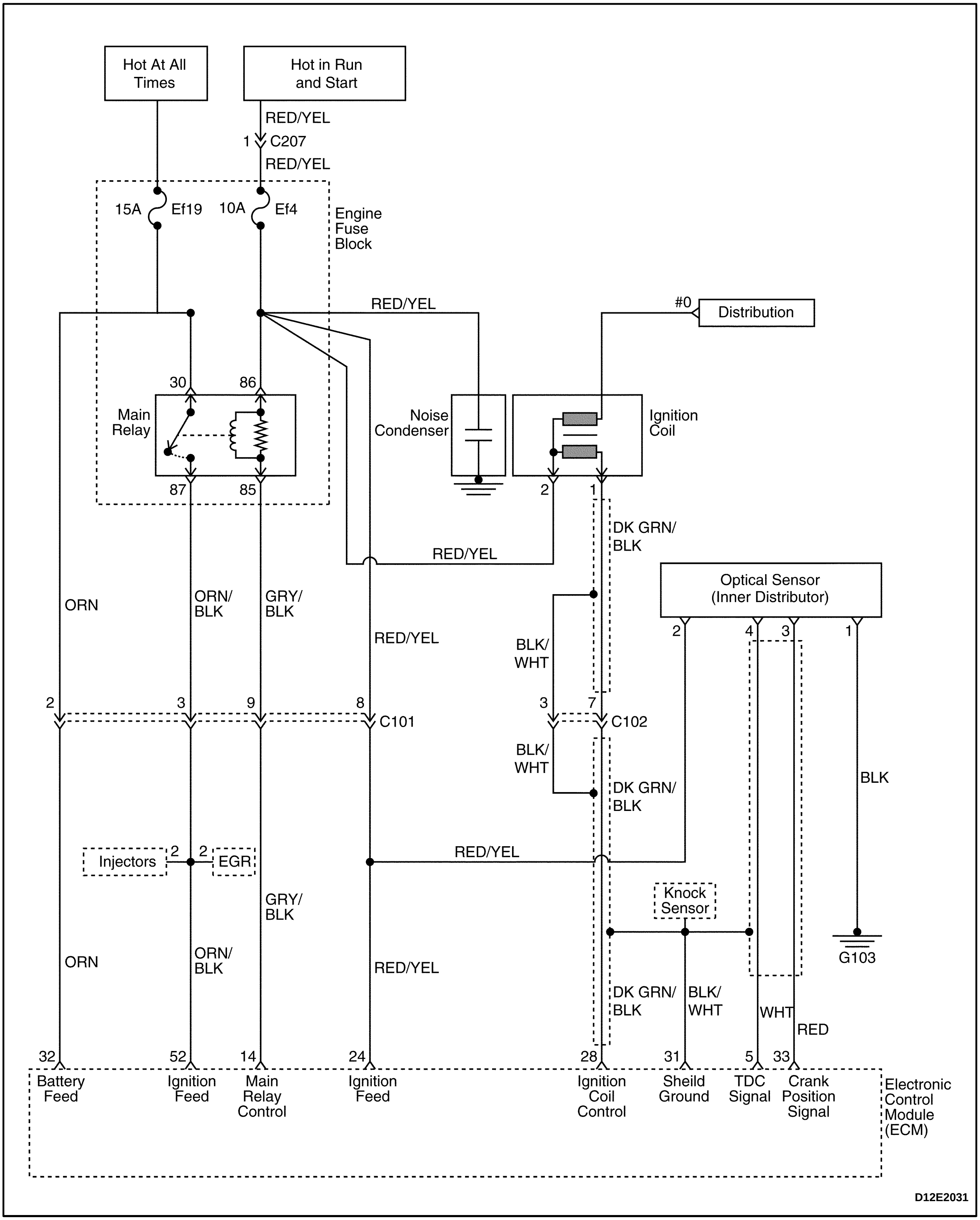
STARTING SYSTEM



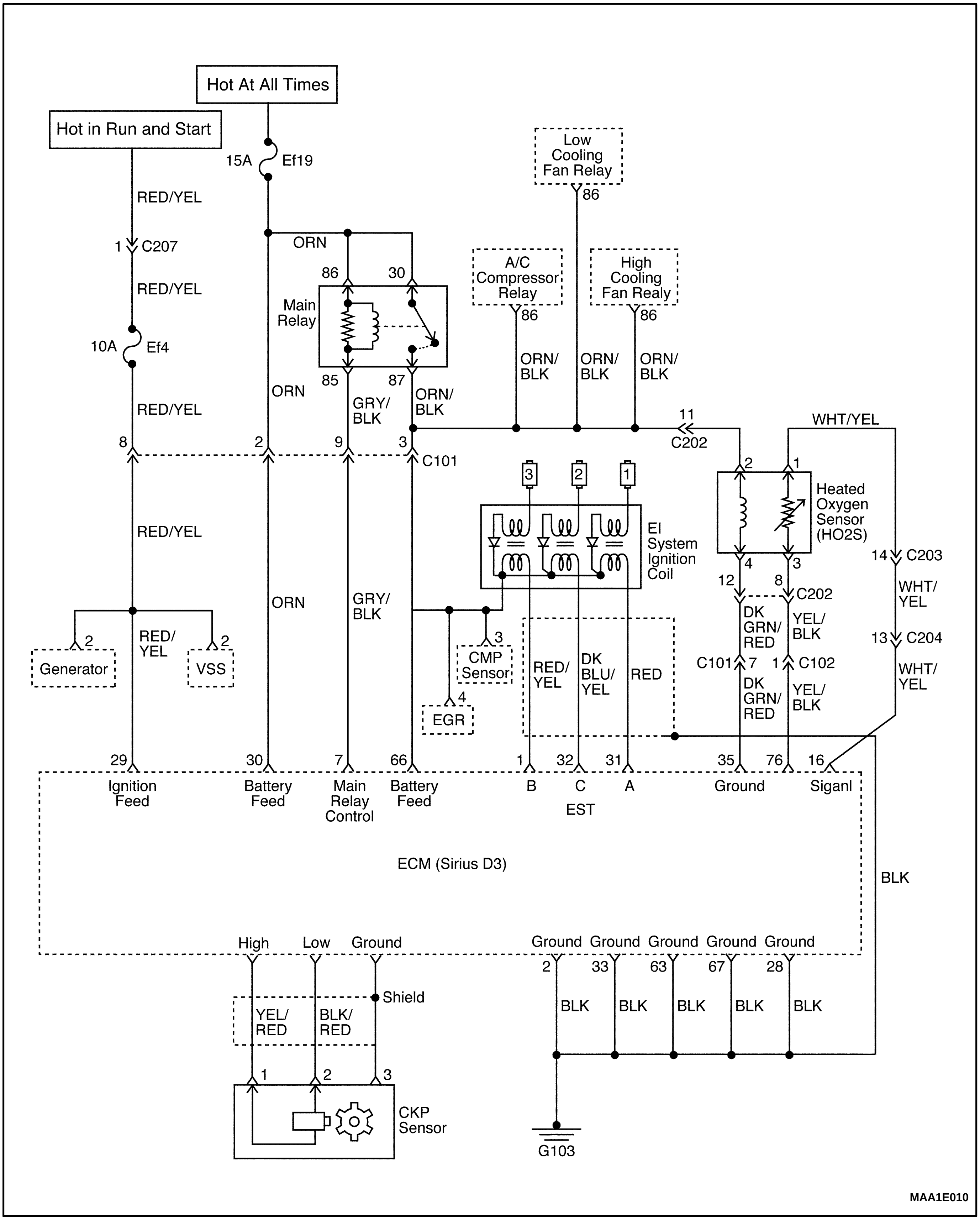
CHARGING SYSTEM



IGNITION SYSTEM CIRCUIT – TYPICAL



IGNITION SYSTEM CIRCUIT – EURO III



SPECIFICATIONS

STARTER SPECIFICATIONS

Application	Description	Unit	Standard	Limit
Starter Motor	Type	–	SD 80	–
	Output(Capacity)	kW	0.8	–
	No Load Test @ 9 volts Drive Pinion Speed	A RPM	150 2,000	–
	Brushes Length	mm (in.)	11.3–11.5 (0.445–0.453)	7.0–7.25 (0.275–0.285)

GENERATOR SPECIFICATIONS

Application	Description		Unit	Standard	Limit
Generator	Type	A-Type B-Type	–	J114D(MANDO) CS114D(DAC)	–
	Regulator Voltage	A-Type B-Type	V	14.4–15.0 14.3–4.9	–
	Brushes Length	A-Type B-Type	mm (in.)	18.5 (0.728) 20.0 (0.787)	13.5 (0.531) 14 (0.551)
	Output (Capacity)	A-Type B-Type	–	12V, 65A 12V, 65A	–

IGNITION SYSTEM SPECIFICATIONS

Application	Description		Unit	Standard	Limit
Ignition Coil	Type		–	Closed Magnetic Type	–
	First Coil Resistance		Ω	1.2 ± 10%	–
	Second Coil Resistance		KΩ	12.1 ± 15%	–
Distributor	Type		–	Optical Sensor Type	–
Spark Plug	Type	Unlead	–	BPR5EY-11	–
				RN9YC4	–
				WR8DCX	–
	Type	Lead	–	BPR5EY	–
				RN9YC	–
				WR8DC	–
Spark Plug	Gap	Unlead	mm (in.)	1.1 (0.043)	–
				1.2 (0.047)	–
		Lead	mm (in.)	0.8 (0.031)	–
Ignition Wire	Ignition Wire Resistance		KΩ/m	2.5–12.0	–

BATTERY SPECIFICATIONS

Application	Description	Unit	Standard	Limit
Battery	Type	–	MF	–
	Capacity	AH	35	–
	Cold Cranking Amps	CCA	246	–

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Distributor Bolts	10–16	–	89–142
Battery Retainer Clamp–to–Battery Rod Nuts	6–8	–	53–71
Battery Carrier Tray Bolts	9–12	–	80–106
Battery Cable Nuts	9–12	–	80–106
Starter field Connector Nut	9–12	–	80–106
Starter Through–Bolts	4–6	–	35–53
Starter Mounting Bolts	55–65	41–48	–
Starter Solenoid Assembly Screws	6–8	–	53–71
Starter Solenoid Nuts	9–12	–	80–106
Spark Plug	20–30	15–22	–
Generator Through–Bolts	4–6	–	35–53
Generator Drive End Nut	80–110	59–81	–
Generator Battery Lead Connector Nut	4–7	–	35–62
Generator Bearing Plate Bolt	6–8	–	53–71
Generator Brush Holder / Rectifier Screw	9–12	–	80–106
Generator Belt Tension Adjusting Bolt	18–28	13–21	–
Generator Shackle Bracket Bolt	45–55	33–41	–
Generator Lower Bracket–to–Generator Bolt/Nut	18–28	13–21	–
Ground Bolt	35–41	26–30	–
Ignition Coil Screw	4–7	–	35–62
Ignition Coil Bracket Bolt	9–12	–	80–106

SECTION 1F

ENGINE CONTROLS

CAUTION: Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

IGNITION SYSTEM OPERATION

This ignition system does not use a conventional distributor and coil. It uses a crankshaft position sensor input to the Engine Control Module (ECM). The ECM then determines Electronic Spark Timing (EST) and triggers the electronic ignition system ignition coil.

This type of distributorless ignition system uses a "waste spark'' method of spark distribution. Each cylinder is individural with coil per cylinder.

These systems use the EST signal from the ECM to control the EST. The ECM uses the following information:

- Engine load (manifold pressure or vacuum).
- Atmospheric (barometric) pressure.
- Engine temperature.
- Intake air temperature.
- Crankshaft position.
- Engine speed (rpm).

ELECTRONIC IGNITION SYSTEM IGNITION COIL

The Electronic Ignition (EI) system ignition coil is mounted near on the cylinder head.

A terminals of the EI system ignition coil provides the spark for each spark plug. The EI system ignition coil is not serviceable and must be replaced as an assembly.

CRANKSHAFT POSITION SENSOR

This Electronic Ignition (EI) system uses a magnetic crankshaft position sensor. This sensor protrudes through its mount to within approximately 1.3 mm (0.05 inch) of the crankshaft reluctor. The reluctor is a special wheel attached to the crankshaft with 58 slots machined into it, 57 of which are equally spaced in 6-degree intervals. The last slot is wider and serves to generate a "sync pulse." As the crankshaft rotates, the slots in the reluctor change the magnetic field of the sensor, creating an induced voltage pulse. The longer pulse of the 58th slot identifies a specific orientation of the crankshaft and allows the Engine Control Module (ECM) to determine the crankshaft orientation at all times. The ECM uses this information to generate timed ignition and injection pulses that it sends to the ignition coils and to the fuel injectors.

CAMSHAFT POSITION SENSOR

The Camshaft Position (CMP) sensor sends a CMP signal to the Engine Control Module (ECM). The ECM uses this signal as a "sync pulse" to trigger the injectors in the proper sequence. The ECM uses the CMP signal to indicate the position of the #1 piston during its power stroke. This allows the ECM to calculate true sequential fuel injection mode of operation. If the ECM detects an incorrect CMP signal while the engine is running, Diagnostic Trouble Code (DTC) P0341 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the calculated sequential mode with a 1-in-6 chance of the injector sequence being correct.

IDLE AIR SYSTEM OPERATION

The idle air system operation is controlled by the base idle setting of the throttle body and the Idle Air Control (IAC) valve.

The Engine Control Module (ECM) uses the IAC valve to set the idle speed dependent on conditions. The ECM uses information from various inputs, such as coolant temperature, manifold vacuum, etc., for the effective control of the idle speed.

FUEL CONTROL SYSTEM OPERATION

The function of the fuel metering system is to deliver the correct amount of fuel to the engine under all operating conditions. The fuel is delivered to the engine by the individual fuel injectors mounted into the intake manifold near each cylinder.

The main fuel control sensors are the Manifold Absolute Pressure (MAP) sensor, the oxygen sensor (O2S), and the heated oxygen sensor (HO2S).

The MAP sensor measures or senses the intake manifold vacuum. Under high fuel demands, the MAP sensor reads a low vacuum condition, such as wide open throttle. The Engine Control Module (ECM) uses this information to enrich the mixture, thus increasing the fuel injector on-time, to provide the correct amount of fuel. When decelerating, the vacuum increases. This vacuum change is sensed by the MAP sensor and read by the ECM, which then decreases the fuel injector on-time due to the low fuel demand conditions.

The O2S is located in the exhaust manifold. The HO2S is located in the exhaust pipe. The oxygen sensors indicate to the ECM the amount of oxygen in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best air/fuel ratio to minimize exhaust emissions is 14.7:1, 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 ECM uses voltage inputs from several sensors to determine how much fuel to provide to the engine. The fuel is delivered under one of several conditions, called “modes.”

Starting Mode

When the ignition is turned ON, the ECM turns the fuel pump relay on for 2 seconds. The fuel pump then builds fuel pressure. The ECM also checks the Engine Coolant Temperature (ECT) sensor and the Throttle Position (TP) sensor and determines the proper air/fuel ratio for starting the engine. The ECM controls the amount of fuel delivered in the starting mode by changing how long the fuel injector is turned on and off. This is done by “pulsing” the fuel injectors for very short times.

Run Mode

The run mode has two conditions called “open loop” and “closed loop.”

Open Loop

When the engine is first started and it is above 400 rpm, the system goes into “open loop” operation. In “open loop,” the ECM ignores the signal from the O2S and calculates the air/fuel ratio based on inputs from the ECT sensor and the MAP sensor. The ECM stays in ”open loop” until the following conditions are met:

- The O2S has a varying voltage output, showing that it is hot enough to operate properly.
- The ECT sensor is above a specified temperature.
- A specific amount of time has elapsed after starting the engine.

Closed Loop

The specific values for the above conditions vary with different engines and are stored in the Electronically Erasable Programmable Read-Only Memory (EEPROM). When these conditions are met, the system goes into “closed loop” operation. In “closed loop,” the ECM calculates the air/fuel ratio (fuel injector on-time) based on the signals from the oxygen sensors. This allows the air/fuel ratio to stay very close to 14.7 to 1.

Acceleration Mode

The ECM responds to rapid changes in throttle position and airflow and provides extra fuel.

Deceleration Mode

The ECM responds to changes in throttle position and airflow and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods of time.

Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for a weak spark delivered by the ignition module by using the following methods:

- Increasing the fuel injector pulse width.
- Increasing the idle speed rpm.
- Increasing the ignition dwell time.

Fuel Cut-Off Mode

No fuel is delivered by the fuel injectors when the ignition is off. This prevents dieseling or engine run-on. Also, the fuel is not delivered if there are no reference pulses received from the CKP sensor. This prevents flooding.

EVAPORATIVE EMISSION CONTROL SYSTEM OPERATION

The basic Evaporative Emission (EVAP) control system used is the charcoal canister storage method. This method transfers fuel vapor from the fuel tank to an activated carbon (charcoal) storage canister which holds the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake airflow and consumed in the normal combustion process.

Gasoline vapors from the fuel tank flow into the tube labeled TANK. These vapors are absorbed into the carbon. The canister is purged by Engine Control Module (ECM) when the engine has been running for a specified amount of time. Air is drawn into the canister and mixed with the vapor. This mixture is then drawn into the intake manifold.

The ECM supplies a ground to energize the controlled charcoal canister purge solenoid valve. This valve is Pulse Width Modulated (PWM) or turned on and off several times a second. The controlled charcoal canister purge PWM duty cycle varies according to operating conditions determined by mass airflow, fuel trim, and intake air temperature.

Poor idle, stalling, and poor driveability can be caused by the following conditions:

- An inoperative controlled canister purge valve.
- A damaged canister.
- Hoses that are split, cracked, or not connected to the proper tubes.

CONTROLLED CHARCOAL CANISTER

The controlled charcoal canister is an emission control device containing activated charcoal granules. The controlled charcoal canister is used to store fuel vapors from the fuel tank. Once certain conditions are met, the Engine Control Module (ECM) activates the controlled charcoal canister purge solenoid, allowing the fuel vapors to be drawn into the engine cylinders and burned.

POSITIVE CRANKCASE VENTILATION CONTROL SYSTEM OPERATION

A Positive Crankcase Ventilation (PCV) control system is used to provide complete use of the crankcase vapors. Fresh air from the air cleaner is supplied to the crankcase. The fresh air is mixed with blowby gases which then pass through a vacuum hose into the intake manifold.

Periodically inspect the hoses and the clamps. Replace any crankcase ventilation components as required.

A restricted or plugged PCV hose may cause the following conditions:

- Rough idle
- Stalling or low idle speed
- Oil leaks
- Oil in the air cleaner
- Sludge in the engine

A leaking PCV hose may cause the following conditions:

- Rough idle
- Stalling
- High idle speed

ENGINE COOLANT TEMPERATURE 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 (100,000 ohms at –40°C [–40°F]) while high temperature causes low resistance (70 ohms at 130°C [266°F]).

The Engine Control Module (ECM) supplies 5 volts to the ECT sensor through a resistor in the ECM and measures the change in voltage. The voltage will be high when the engine is cold and low when the engine is hot. By measuring the change in voltage, the ECM can determine the coolant temperature. The engine coolant temperature affects most of the systems that the ECM controls. A failure in the ECT sensor circuit should set a Diagnostic Trouble Code (DTC) P0117 or P0118. Remember, these DTC indicate a failure in the ECT circuit, so proper use of the chart will lead either to repairing a wiring problem or to replacing the sensor to repair a problem properly.

THROTTLE POSITION SENSOR

The Throttle Position (TP) sensor is a potentiometer connected to the throttle shaft of the throttle body. The TP sensor electrical circuit consists of a 5-volt supply line and a ground line, both provided by the Engine Control Module (ECM). The ECM calculates the throttle position by monitoring the voltage on this signal line. The TP sensor output changes as the accelerator pedal is moved, changing the throttle valve angle. At a closed throttle position, the output of the TP sensor is low, about 0.4–0.8 volt. As the throttle valve opens, the output increases so that, at Wide Open Throttle (WOT), the output voltage will be about 4.5–5 volts.

The ECM can determine fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor can cause intermittent bursts of fuel from the injector and an unstable idle, because the ECM thinks the throttle is moving. A problem in any of the TP sensor circuits should set a Diagnostic Trouble Code (DTC) P0122 or P0123. Once the DTC is set, the ECM will substitute a default value for the TP sensor and some vehicle performance will return.

CATALYST MONITOR 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 ECM can monitor this process using the oxygen sensor (O2S) and heated oxygen sensor (HO2S). These sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering and leaving the three-way converter. This indicates the catalyst's ability to efficiently convert exhaust gasses. If the catalyst is operating efficiently, the O2S signals will be more active than the signals produced by the HO2S. The catalyst monitor sensors operate the same way as the fuel control sensors. The 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 Engine Control Module (ECM) will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the O2S circuit will set DTC P0131, P0132, P0133 or P0134 depending on the special condition. A problem with the HO2S signal will set DTC P0137, P0138, P0140 or P0141 depending on the special condition.

A fault in the heated oxygen sensor (HO2S) heater element or its ignition feed or ground will result in lower oxygen sensor response. This may cause incorrect catalyst monitor diagnostic results.

ELECTRIC EXHAUST GAS RECIRCULATION VALVE

The Electric Exhaust Gas Recirculation (EEGR) system is used on engines equipped with an automatic transaxle to lower oxides of nitrogen (NOx) emission levels caused by high combustion temperature. The main element of the system is the EEGR valve, controlled electrically by the Engine Control Module (ECM). The EEGR valve feeds small amounts of exhaust gas into the intake manifold to decrease combustion temperature. The amount of exhaust gas recirculated is controlled by variations in vacuum and exhaust back pressure. If too much exhaust gas enters, combustion will not take place. For this reason, very little exhaust gas is allowed to pass through the valve, especially at idle.

The EEGR valve is usually open under the following conditions:

- Warm engine operation.
- Above idle speed.

Results of Incorrect Operation

Too much EEGR flow tends to weaken combustion, causing the engine to run roughly or to stop. With too much EEGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- The engine stops after a cold start.
- The engine stops at idle after deceleration.
- The vehicle surges during cruise.
- Rough idle.

If the EEGR valve stays open all the time, the engine may not idle. Too little or no EEGR flow allows combustion temperatures to get too high during acceleration and load conditions. This could cause the following conditions:

- Spark knock (detonation)
- Engine overheating
- Emission test failure

INTAKE AIR TEMPERATURE SENSOR

The Intake Air Temperature (IAT) sensor is a thermistor, a resistor which changes value based on the temperature of the air entering the engine. Low temperature produces a high resistance (100 kohms at –40°C [–40°F]), while high temperature causes a low resistance (70 ohms at 130°C [266°F]).

The Engine Control Module (ECM) provides 5 volts to the IAT sensor through a resistor in the ECM and measures the change in voltage to determine the IAT. The voltage will be high when the manifold air is cold and low when the air is hot. The ECM knows the intake IAT by measuring the voltage.

The IAT sensor is also used to control spark timing when the manifold air is cold.

A failure in the IAT sensor circuit sets a diagnostic trouble code P0112 or P0113.

IDLE AIR CONTROL VALVE

Notice: Do not attempt to remove the protective cap and readjust the stop screw. Misadjustment may result in damage to the Idle Air Control (IAC) valve or to the throttle body.

The IAC valve is mounted on the throttle body where it controls the engine idle speed under the command of the Engine Control Module (ECM). The ECM sends voltage pulses to the IAC valve motor windings, causing the IAC valve pintle to move in or out a given distance (a step or count) for each pulse. The pintle movement controls the airflow around the throttle valves which, in turn, control the engine idle speed.

The desired idle speeds for all engine operating conditions are programmed into the calibration of the ECM. These programmed engine speeds are based on the coolant temperature, the park/neutral position switch status, the vehicle speed, the battery voltage, and the A/C system pressure, if equipped.

The ECM “learns” the proper IAC valve positions to achieve warm, stabilized idle speeds (rpm) desired for the various conditions (park/neutral or drive, A/C on or off, if equipped). This information is stored in ECM ”keep alive” memories (information is retained after the ignition is turned off). All other IAC valve positioning is calculated based on these memory values. As a result, engine variations due to wear and variations in the minimum throttle valve position (within limits) do not affect engine idle speeds. This system provides correct idle control under all conditions. This also means that disconnecting power to the ECM can result in incorrect idle control or the necessity to partially press the accelerator when starting until the ECM relearns idle control.

Engine idle speed is a function of total airflow into the engine based on the IAC valve pintle position, the throttle valve opening, and the calibrated vacuum loss through accessories. The minimum throttle valve position is set at the factory with a stop screw. This setting allows enough airflow by the throttle valve to cause the IAC valve pintle to be positioned a calibrated number of steps (counts) from the seat during “controlled” idle operation. The minimum throttle valve position setting on this engine should not be considered the “minimum idle speed,” as on other fuel injected engines. The throttle stop screw is covered with a plug at the factory following adjustment.

If the IAC valve is suspected as being the cause of improper idle speed, refer to “Idle Air Control System Check” in this section.

MANIFOLD ABSOLUTE PRESSURE SENSOR

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes and converts these to a voltage output.

A closed throttle on engine coast down produces a relatively low MAP output. MAP is the opposite of vacuum. When manifold pressure is high, vacuum is low. The MAP sensor is also used to measure barometric pressure. This is performed as part of MAP sensor calculations. With the ignition ON and the engine not running, the Engine Control Module (ECM) will read the manifold pressure as barometric pressure and adjust the air/fuel ratio accordingly. This compensation for altitude allows the system to maintain driving performance while holding emissions low. The barometric function will update periodically during steady driving or under a wide open throttle condition. In the case of a fault in the barometric portion of the MAP sensor, the ECM will set to the default value.

A failure in the MAP sensor circuit sets a diagnostic trouble codes P0107, P0108 or P0106.

ENGINE CONTROL MODULE

The Engine Control Module (ECM), is the control center of the fuel injection system. It constantly looks at the information from various sensors and controls the systems that affect the vehicle's performance. The ECM also performs the diagnostic functions of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store diagnostic trouble code(s) which identify the problem areas to aid the technician in making repairs.

There are no serviceable parts in the ECM. The calibrations are stored in the ECM in the Programmable Read Only Memory (PROM).

The ECM supplies either 5 or 12 volts to power the sensors or switches. This is done through resistance in the ECM which are so high in value that a test light will not come on 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. You must use a digital voltmeter with a 10 megohm input impedance to get accurate voltage readings. The ECM controls output circuits such as the fuel injectors, the Idle Air Control (IAC) valve, the A/C clutch relay, etc., by controlling the ground circuit through transistors or a device called a "quad-driver."

FUEL INJECTOR

The Multi-port Fuel Injection (MFI) assembly is a solenoid-operated device controlled by the Engine Control Module (ECM) that meters pressurized fuel to a single engine cylinder. The ECM energizes the fuel injector or solenoid to a normally closed ball or pintle valve. This allows fuel to flow into the top of the injector, past the ball or pintle valve, and through a recessed flow director plate at the injector outlet.

The director plate has six machined holes that control the fuel flow, generating a conical spray pattern of finely atomized fuel at the injector tip. Fuel from the tip is directed at the intake valve, causing it to become further atomized and vaporized before entering the combustion chamber. A fuel injector which is stuck partially open would cause a loss of fuel pressure after the engine is shut down. Also, an extended crank time would be noticed on some engines. Dieseling could also occur because some fuel could be delivered to the engine after the ignition is turned off.

FUEL CUT-OFF SWITCH

The fuel cutoff switch is a safety device. In the event of a collision or a sudden impact, it automatically cuts off the fuel supply and activates the door lock relay. After the switch has been activated, it must be reset in order to restart the engine. Reset the fuel cutoff switch by pressing the rubber top of the switch. The switch is located near the right side of the passenger's seat.

KNOCK SENSOR

The knock sensor detects abnormal knocking in the engine. The sensor is mounted in the engine block near the cylinders. The sensor produces an AC output voltage which increases with the severity of the knock. This signal is sent to the Engine Control Module (ECM). The ECM then adjusts the ignition timing to reduce the spark knock.

VARIABLE RELUCTANCE (VR) SENSOR

The variable reluctance sensor is commonly refered to as an "inductive" sensor.

The VR wheel speed sensor consists of a sensing unit fixed to the left side front macpherson strut, for non-ABS vehicle.

The ECM uses the rough road information to enable or disable the misfire diagnostic. The misfire diagnostic can be greatly affected by crankshaft speed variations caused by driving on rough road surfaces. The VR sensor generates rough road information by producing a signal which is proportional to the movement of a small metal bar inside the sensor.

If a fault occurs which causes the ECM to not receive rough road information between 30 and 70 km/h (1.8 and 43.5 mph), Diagnostic Trouble Code (DTC) P1391 will set.

OCTANE NUMBER CONNECTOR

The octane number connector is a jumper harness that signal to the engine control module (ECM) the octane rating of the fuel.

The connector is located on the next to the ECM. There are two different octane number connector settings available. The vehicle is shipped from the factory with a label attached to the jumper harness to indicate the octane rating setting of the ECM. The ECM will alter fuel delivery and spark timing based on the octane number setting. The following table shows which terminal to jump on the octane number connector in order to achieve the correct fuel octane rating. Terminal 2 is ground on the octane number connector. The find the appropriate wiring diagram. Refer to “ECM Wiring Diagrams” in this Section.

	95	91
Terminal 49	Ground	Open

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 on how to proceed with a diagnosis:

Verify the customer complaint. To verify the customer complaint, the technician should know the normal operation of the system.

- Perform preliminary checks as follows:
- Conduct a thorough visual inspection.
- Review the service history.
- Detect unusual sounds or odors.
- Gather Diagnostic Trouble Code (DTC) information to achieve an effective repair.
- Check bulletins and other service information. This includes videos, newsletters, etc.
- Refer to service information (manual) system check(s).
- Refer to service diagnostics.

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.

Re-examine the complaints.

When the complaints cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in “intermittents,” or could be normal.

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 resolved under following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify the repair be duplicating conditions present when the DTC was set as noted in Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with Euro On-Board Diagnostic (EOBD) system diagnostics. Following a repair, the technician should perform the following steps:

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

- Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Fame data will only be stored for an A, B and E type diagnostic and only if the Malfunction Indicator Lamp has been requested).
- Clear the DTC(s).
- Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
- Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

EOBD SERVICEABILITY ISSUES

Based on the knowledge gained from Euro On-Board Diagnostic (OBD) experience in the 1994 and 1995 model years in United Status, this list of non-vehicle faults that could affect the performance of the Euro On-Board Diagnostic (EOBD) system has been compiled. These non-vehicle faults vary from environmental conditions to the quality of fuel used. With the introduction of EOBD across the entire passenger car, illumination of the Malfunction Indicator Lamp (MIL) 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 with EOBD 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 set Diagnostic Trouble Code (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.

Using fuel with the wrong octane rating for your vehicle may cause driveability problems. Many of the major fuel companies advertise that using “premium” gasoline will improve the performance of your 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

The EOBD system has been calibrated to run with Original Equipment Manufacturer (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 Electric Exhaust Gas Recirculation (EEGR) valve and thereby turn on the MIL. Small leaks in the exhaust system near the heated oxygen sensor (HO2S) can also cause the MIL to turn on.

Aftermarket electronics, such as cellular phones, stereos, and anti-theft devices, may radiate Electromagnetic Interference (EMI) into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL.

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.

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 with a set DTC P0300.

Poor Vehicle Maintenance

The sensitivity of the EOBD will cause the MIL 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 EOBD. Poor vehicle maintenance can not be classified as a "non-vehicle fault," but with the sensitivity of the EOBD, vehicle maintenance schedules must be more closely followed.

Severe Vibration

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

Related System Faults

Many of the EOBD system diagnostics will not run if the Engine Control Module (ECM) detects a fault on a related system or component. One example would be that if the ECM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until the Misfire fault was repaired. If the Misfire fault is severe enough, the catalytic converter can be damaged due to overheating and will never set a Catalyst DTC until the Misfire fault is repaired and the Catalyst diagnostic is 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.

SERIAL DATA COMMUNICATIONS

Keyword 2000 Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the "Keyword 2000" 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 Keyword 2000 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 the other scan tool 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.

EURO ON-BOARD DIAGNOSTIC (EOBD)

Euro 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 Diagnostic Trouble Code (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.

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 Manifold Absolute Pressure (MAP) voltage. Input components may include, but are not limited to, the following sensors:

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

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

Output Components

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable. Output components to be monitored include, but are not limited to the following circuit:

- Idle Air Control (IAC) Motor.
- Controlled Canister Purge Valve.
- A/C relays.
- Cooling fan relay.
- VSS output.
- Malfunction Indicator Lamp (MIL) control.

Refer to *“Engine Control Module”* and the sections on 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 Electric Exhaust Gas Recirculation (EEGR) diagnostic active test will force the EEGR valve open during closed throttle deceleration and/or force the EEGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any Euro 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.

Failure Records

Failure Records data is an enhancement of the EOBD 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 Euro On-Board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

COMMON EOBD TERMS

Diagnostic

When used as a noun, the word diagnostic refers to any Euro 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 (O2S)
- Heated oxygen sensor (HO2S)
- Electric Exhaust Gas Recirculation (EEGR)
- 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 Diagnostic Trouble Code (DTC) description 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
- Engine Coolant Temperature (ECT)
- Manifold Absolute Pressure (MAP)
- Barometric Pressure (BARO)
- Intake Air Temperature (IAT)
- Throttle Position (TP)
- High canister purge
- Fuel trim
- A/C on

Trip

Technically, a trip is a key-on run key-off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle cruise at a steady highway speed, some run only when the vehicle is at idle. 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 is operated in such a way as to satisfy the enable 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.

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 not multiple faults present.

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

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) is required by Euro On-Board Diagnostics (EOBD) to illuminate under a strict set of guidelines.

Basically, the MIL is turned on when the Engine Control Module (ECM) detects a DTC that will impact the vehicle emissions.

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

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after three 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 ECM memory (both Freeze Frame and Failure Records) until forty (40) warm-up cycles after no faults have been completed.

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

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

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

The MIL is on the instrument panel and has the following functions:

- It informs the driver that a fault affecting the vehicle’s emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a 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, an EOBD System Check must be performed. The procedures for these checks are given in EOBD System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

Data Link Connector (DLC)

The provision for communicating with the control module is the Data Link Connector (DLC). The DLC is used to connect to a scan tool. Some common uses of the scan tool are listed below:

- Identifying stored DTCs.
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.

DTC TYPES

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

Type A

- Emissions related.
- Requests illumination of the Malfunction Indicator. Lamp (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 trip with a fail.
- “Disarmed” after one 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).

Type Cnl

- Non-Emissions related.
- Does not request illumination of any lamp.
- Stores a History DTC on the first trip with a fail .
- Does not store a Freeze Frame.
- Stores Fail Record when test fails.
- Updates the Fail Record each time the diagnostic test fails.

Type E

- Emissions related.
- “Armed” after two consecutive trip with a fail.
- “Disarmed” after one trip with a pass.
- Requests illumination of the MIL on the third consecutive trip with a fail.
- Stores a History DTC on the third consecutive trip with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Important: For 0.8 SOHC engine eight 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” as a rate of once per seconds 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 (ECT) are recorded.

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

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

READING DIAGNOSTIC TROUBLE CODES

The procedure for reading Diagnostic Trouble Code(s) (DTC) 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 Engine Control Module (ECM) memory.

To clear DTCs, use the diagnostic scan tool.

It can't cleared DTCs without the diagnostic scan tool. So you must use the diagnostic scan tool.

Notice: 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 ECM connectors, etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other Euro On-Board memory data, such as preset radio tuning.)

DTC Modes

On Euro On-Board Diagnostic (EOBD) passenger cars there are five options available in the scan tool DTC mode to display the enhanced information available. A description of the new modes, DTC Info and Specific DTC, follows. After selecting DTC, the following menu appears:

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

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

DTC Information Mode

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

To get a complete description of any status, press the "Enter" key before pressing the desired F-key. For example, pressing "Enter" then an F-key will display a definition of the abbreviated scan tool status.

DTC Status

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

Fail This Ign. (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 ECM's history memory. It will not display Type B DTCs that have not requested the Malfunction Indicator Lamp (MIL). It will display all type A, B and E 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 Fail

This selection will display only DTCs that have failed the last time the test ran. 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.

MIL 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 and E DTCs only after the MIL has been requested.

Not Run SCC (Not Run Since Code Clear)

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

Test Fail SCC (Test Failed Since Code Clear)

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.

Specific DTC Mode

This mode is used to check the status of individual diagnostic tests by DTC number. This selection can be accessed if a DTC has passed, failed or both. Many EOBD DTC mode descriptions are possible because of the extensive amount of information that the diagnostic executive monitors regarding each test. Some of the many possible descriptions follow with a brief explanation.

The "F2" key is used, in this mode, to display a description of the DTC. The "Yes" and "No" keys may also be used to display more DTC status information. This selection will only allow entry of DTC numbers that are supported by the vehicle being tested. If an attempt is, made to enter DTC numbers for tests which the diagnostic executive does not recognize, the requested information will not be displayed correctly and the scan tool may display an error message. The same applies to using the DTC trigger option in the Snapshot mode. If an invalid DTC is entered, the scan tool will not trigger.

Failed Last Test

This message display indicates that the last diagnostic test failed for the selected DTC. For type A, B and E DTCs, this message will be displayed during subsequent ignition cycles until the test passes or DTCs are cleared. For type C and type D DTCs, this message will clear when the ignition is cycled.

Failed Since Clear

This message display indicates that the DTC has failed at least once within the last 40 warm-up cycles since the last time DTCs were cleared.

Failed This Ig. (Failed This Ignition)

This message display indicates that the diagnostic test has failed at least once during the current ignition cycle. This message will clear when DTCs are cleared or the ignition is cycled.

History DTC

This message display indicates that the DTC has been stored in memory as a valid fault. A DTC displayed as a History fault may not mean that the fault is no longer present. The history description means that all the conditions necessary for reporting a fault have been met (maybe even currently), and the information was stored in the control module memory.

MIL Requested

This message display indicates that the DTC is currently causing the MIL to be turned ON. Remember that only type A B and E DTCs can request the MIL. The MIL request cannot be used to determine if the DTC fault conditions are currently being experienced. This is because the diagnostic executive will require up to three trips during which the diagnostic test passes to turn OFF the MIL.

Not Run Since Cl (Not Run Since Cleared)

This message display indicates that the selected diagnostic test has not run since the last time DTCs were cleared. Therefore, the diagnostic test status (passing or failing) is unknown. After DTCs are cleared, this message will continue to be displayed until the diagnostic test runs.

Not Run This Ig. (Not Run This Ignition)

This message display indicates that the selected diagnostic test has not run during this ignition cycle.

Test Ran and Passed

This message display indicates that the selected diagnostic test has done the following:

- Passed the last test.
- Run and passed during this ignition cycle.
- Run and passed since DTCs were last cleared.

If the indicated status of the vehicle is “Test Ran and Passed” after a repair verification, the vehicle is ready to be released to the customer.

If the indicated status of the vehicle is “Failed This Ignition” after a repair verification, then the repair is incomplete and further diagnosis is required.

Prior to repairing a vehicle, status information can be used to evaluate the state of the diagnostic test, and to help identify an intermittent problem. The technician can conclude that although the MIL is illuminated, the fault condition that caused the code to set is not present. An intermittent condition must be the cause.

PRIMARY SYSTEM-BASED DIAGNOSTICS

There are primary system-based diagnostics which evaluate the 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 oxygen sensor (O2S) is diagnosed for the following conditions:

- Few switch count (rich to lean or lean to rich).
- Slow response (average transient time lean to rich or rich to lean).
- Response time ratio (ratio of average transient time rich(lean) to lean(rich)).
- Inactive signal (output steady at bias voltage approximately 450 mV).
- Signal fixed high.
- Signal fixed low.

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

- Heater performance (current during IGN on).
- 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 O2S pigtail wiring, connector or terminal are damaged, the entire O2S 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 O2S wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade the O2S performance.

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The Engine Control Module (ECM) determines crankshaft rotational velocity using the Crankshaft Position (CKP) sensor and the Camshaft Position (CMP) sensor. When a cylinder misfires, the crankshaft slows down momentarily. By monitoring the CKP and CMP sensor signals, the ECM can calculate when a misfire occurs.

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

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

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

A rough road sensor, or “G sensor,” works together with the misfire detection system. The rough road sensor produces a voltage that varies along with the intensity of road vibrations. When the ECM detects a rough road, the misfire detection system is temporarily disabled.

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 Current #1–4) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Histtory #1–4) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 200 cylinder firing events. A misfire counter is maintained for each cylinder.

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

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

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

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

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 controlled charcoal canister. In order to meet EOBD 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 a scan tool 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 a scan tool to observe fuel trim counts while the problem is occurring.

DIAGNOSTIC INFORMATION AND PROCEDURES

SYSTEM DIAGNOSIS

DIAGNOSTIC AIDS

If an intermittent problem is evident, follow the guidelines below.

Preliminary Checks

Before using this section you should have already performed the “Euro On-Board Diagnostic (EOBD) System Check.”

Perform a thorough visual inspection. This inspection can often lead to correcting a problem without further checks and can save valuable time. Inspect for the following conditions:

- Engine Control Module (ECM) grounds for being clean, tight, and in their proper location.
- Vacuum hoses for splits, kinks, collapsing and proper connections as shown on the Vehicle Emission Control Information label. Inspect thoroughly for any type of leak or restriction.
- Air leaks at the throttle body mounting area and the intake manifold sealing surfaces.
- Ignition wires for cracks, hardness, proper routing, and carbon tracking.
- Wiring for proper connections.
- Wiring for pinches or cuts.

Diagnostic Trouble Code Tables

Do not use the Diagnostic Trouble Code (DTC) tables to try and correct an intermittent fault. The fault must be present to locate the problem.

Incorrect use of the DTC tables may result in the unnecessary replacement of parts.

Faulty Electrical Connections or Wiring

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful inspection of suspect circuits for the following:

- Poor mating of the connector halves.
- Terminals not fully seated in the connector body.
- Improperly formed or damaged terminals. All connector terminals in a problem circuit should be carefully inspected, reformed, or replaced to insure contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body.

Road Test

If a visual inspection does not find the cause of the problem, the vehicle can be driven with a voltmeter or a scan tool connected to a suspected circuit. An abnormal voltage or scan tool reading will indicate that the problem is in that circuit.

If there are no wiring or connector problems found and a DTC was stored for a circuit having a sensor, except for DTC P0171 and DTC P0172, replace the sensor.

Intermittent Malfunction Indicator Lamp (MIL)

An intermittent Malfunction Indicator Lamp(MIL) with no DTC present may be caused by the following:

- Improper installation of electrical options such as lights, two way radios, sound, or security systems.
- MIL driver wire intermittently shorted to ground.

Fuel System

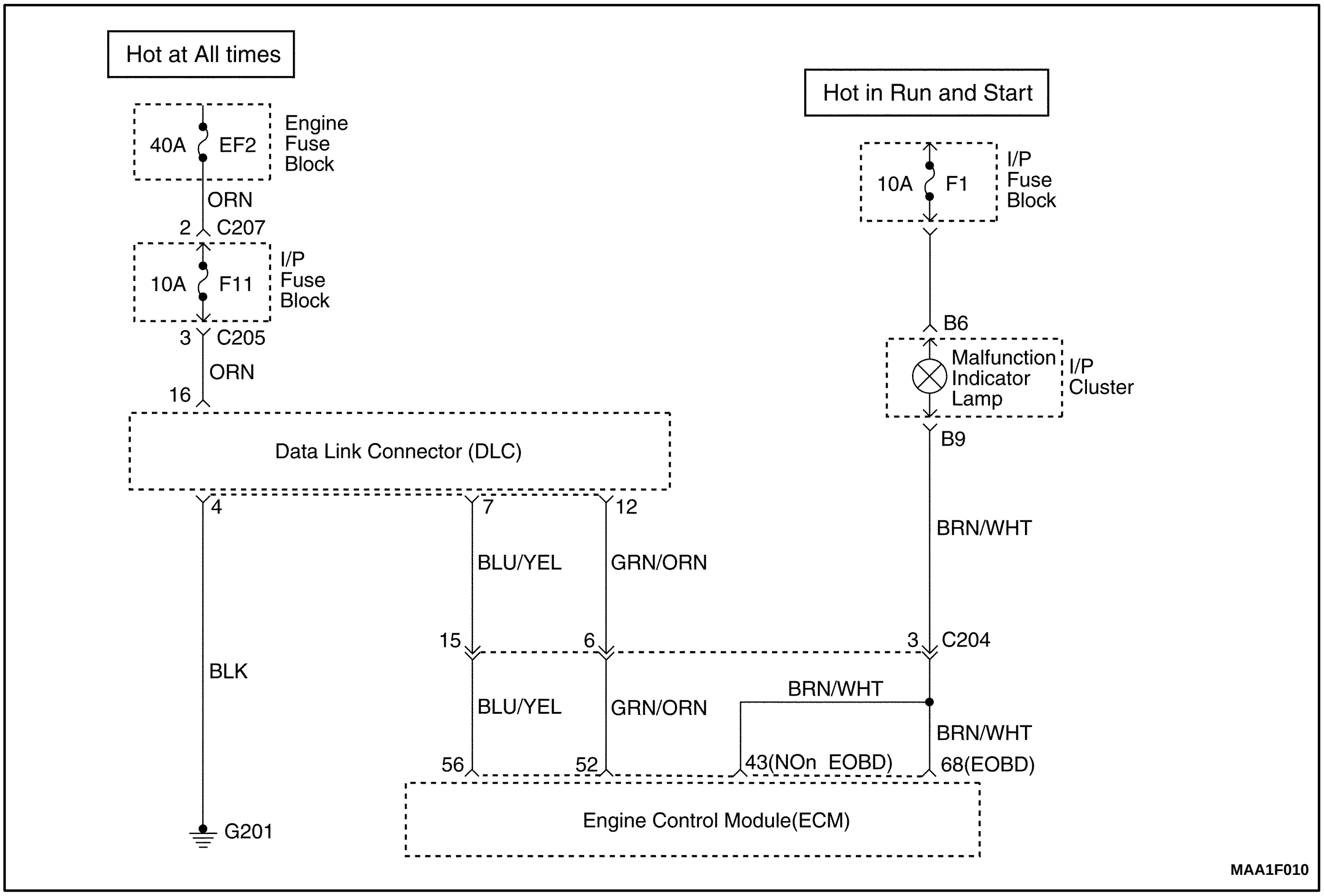
Some intermittent driveability problems can be attributed to poor fuel quality. If a vehicle is occasionally running rough, stalling, or otherwise performing badly, ask the customer about the following fuel buying habits:

- Do they always buy from the same source? If so, fuel quality problems can usually be discounted.
- Do they buy their fuel from whichever fuel station that is advertising the lowest price? If so, check the fuel tank for signs of debris, water, or other contamination.

IDLE LEARN PROCEDURE

Whenever the battery cables, the Engine Control Module (ECM), or the fuse is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 10 seconds.
2. Turn the ignition OFF for 10 seconds.



EURO ON-BOARD DIAGNOSTIC (EOBD) SYSTEM CHECK

Circuit Description

The Euro On-Board Diagnostic (EOBD) System Check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the Engine Control Module (ECM) and the engine grounds for cleanliness and tightness.

The EOBD 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 ECM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connections, and damaged harness.

Euro On-Board Diagnostic (EOBD) System Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition ON with the engine OFF. 2. Observe the Malfunction Indicator Lamp (MIL). Is the MIL on?	–	Go to *Step 2*	Go to “No Malfunction Indicator Lamp”
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Turn the ignition ON. 4. Attempt to display the Engine Control Module (ECM) engine data with the scan tool. Does the scan tool display the ECM engine data?	–	Go to *Step 3*	Go to *Step 8*
3	1. Using the scan tool output test function, select the MIL lamp control and command the MIL off. 2. Observe the MIL. Does the MIL turn off?	–	Go to *Step 4*	Go to “Malfunction Indicator Lamp on Steady”
4	Attempt to start the engine. Does the engine start and continue to run?	–	Go to *Step 5*	Go to “Engine Cranks But Will Not Run”
5	Select DISPLAY DTC with the scan tool. Are any Diagnostic Trouble Codes stored?	–	Go to *Step 6*	Go to *Step 7*
6	Check the display for DTCs P0107, P0108, P0113, P0118, P0122, P0123, P0172, P1392. Are two or more of the following DTCs stored?	–	Go to “Multiple ECM Information Sensor DTCs Set”	Go to applicable DTC table
7	Compare the ECM data values displayed on the scan tool to the typical engine scan data values. Are the displayed values normal or close to the typical values?	–	Go to “ECM Output Diagnosis”	Go to indicated component system check
8	1. Turn the ignition OFF and disconnect the ECM. 2. Turn the ignition ON with the engine OFF. 3. Check the serial data circuit for an open, short to ground, or short to voltage. Also check the Data Link Connector (DLC) ignition feed circuit for an open or short to ground, and check the DLC ground circuits for an open. Is a problem found?	–	Go to *Step 9*	Go to *Step 10*
9	Repair the open, short to ground, or short to voltage in the serial data circuit or the DLC ignition feed circuit. Is the repair complete?	–	System OK	–
10	1. Attempt to reprogram the ECM. 2. Attempt to display the ECM data with the scan tool. Does the scan tool display ECM engine data?	–	Go to *Step 2*	Go to *Step 11*
11	Replace the ECM. Is the repair complete?	–	System OK	–

ECM OUTPUT DIAGNOSIS

Circuit Description

The Engine Control Module (ECM) controls most components with electronic switches which complete a ground circuit when turned on. These switches are arranged in groups of 4 and 7, and they are called either a Surface Mounted Quad Driver Module, which can independently control up to 4 output terminals or an Output Driver Module (ODM), which can independently control up to 7 outputs. Not all of the outputs are always used.

Drivers are fault protected. If a relay or solenoid is shorted, having very low or zero resistance, or if the control side of the circuit is shorted to voltage, it would allow too much current flow into the ECM. The driver senses this and the output is either turned OFF or its internal resistance increases to limit current flow and protect the ECM and driver. The result is high output terminal voltage when it should be low. If the circuit from B+ to the component or the component is open, or the control side of the circuit is shorted to ground, terminal voltage will be low. Either of these conditions is considered to be a driver fault.

Drivers also have a fault line to indicate the presence of a current fault to the ECM's central processor. A scan tool displays the status of the driver fault lines as 0=OK and 1=Fault.

Diagnostic Aids

The scan tool has the ability to command certain components and functions ON and OFF. If a component or function does not have this capability, operate the vehicle during its normal function criteria to check for an open or shorted circuit.

An open or short to ground will appear in the open positions on the scan tool only when it is not commanded by the ECM or the scan tool, while a short to voltage will appear in the short positions on the scan tool only while the component is being commanded by the ECM or scan tool.

ECM Output Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check”
2	Install the scan tool. Is there a number 1 (=fault) below any of the numbered positions in the OUTPUT DRIVERS?	–	Go to *Step 3*	Go to *Step 4*
3	Check for an open or shorted circuit in any corresponding position (circuit) that contained a number 1 and repair as necessary. Is a repair necessary?	–	Go to *Step 9*	Go to *Step 7*
4	Command the output being checked with a scan tool while watching the corresponding position for each circuit. Do any of the position changed to a 1?	–	Go to *Step 6*	Go to *Step 5*
5	Command the output being checked with a scan tool while watching the corresponding position for each circuit. Does the component or function operate when commanded?	–	Go to *Step 9*	Go to the appropriate component table for repair
6	Repair the short to voltage in the corresponding circuit for position (circuit) that displayed at a 1. Is the repair complete?	–	Go to *Step 9*	–
7	Disconnect the electrical connector to the component connected to the fault circuit. Is a 1 still displayed in the corresponding OUTPUT DRIVER position?	–	Go to *Step 8*	Go to the appropriate component table for repair
8	Replace the Engine control Module (ECM). Is the repair complete?	–	Go to *Step 9*	–
9	Operate the vehicle within the conditions under which the original symptom was noted. Does the system now operate properly?	–	System OK	Go to *Step 2*

MULTIPLE ECM INFORMATION SENSOR DTCS SET

Circuit Description

The Engine Control Module (ECM) monitors various sensors to determine engine operating conditions. The ECM controls fuel delivery, spark advance, transaxle operation, and emission control device operation based on the sensor inputs.

The ECM provides a sensor ground to all of the sensors. The ECM applies 5 volts through a pull-up resistor and monitors the voltage present between the sensor and the resistor to determine the status of the Engine Coolant Temperature (ECT) sensor, the Intake Air Temperature (IAT) sensor. The ECM provides the Electric Exhaust Gas Recirculation (EEGR) Pintle Position Sensor, the Throttle Position (TP) sensor, the Manifold Absolute Pressure (MAP) sensor, and the Fuel Tank Pressure Sensor with a 5 volt reference and a sensor ground signal. The ECM monitors the separate feedback signals from these sensors to determine their operating status.

Diagnostic Aids

Be sure to inspect the ECM and the engine grounds for being secure and clean.

A short to voltage in one of the sensor circuits can cause one or more of the following DTCs to be set: P0108, P0113, P0118, P0123, P1106.

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 ECM and the splice will cause one or more of the following DTCs to be set: P0108, P0113, P0118, P0123, P1106.

A short to ground in the 5 volt reference circuit or an open in the 5 volt reference circuit between the ECM and the splice will cause one or more of the following DTCs to be set: P0107, P0112, P0117, P0122, P1107.

Check for the following conditions:

- Inspect for a poor connection at the ECM. Inspect 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 an affected sensor's displayed value on the scan tool with the ignition ON and the engine OFF while moving connectors and wiring harnesses related to the affected sensors. A change in the affected sensor's displayed value will indicate the location of the fault.

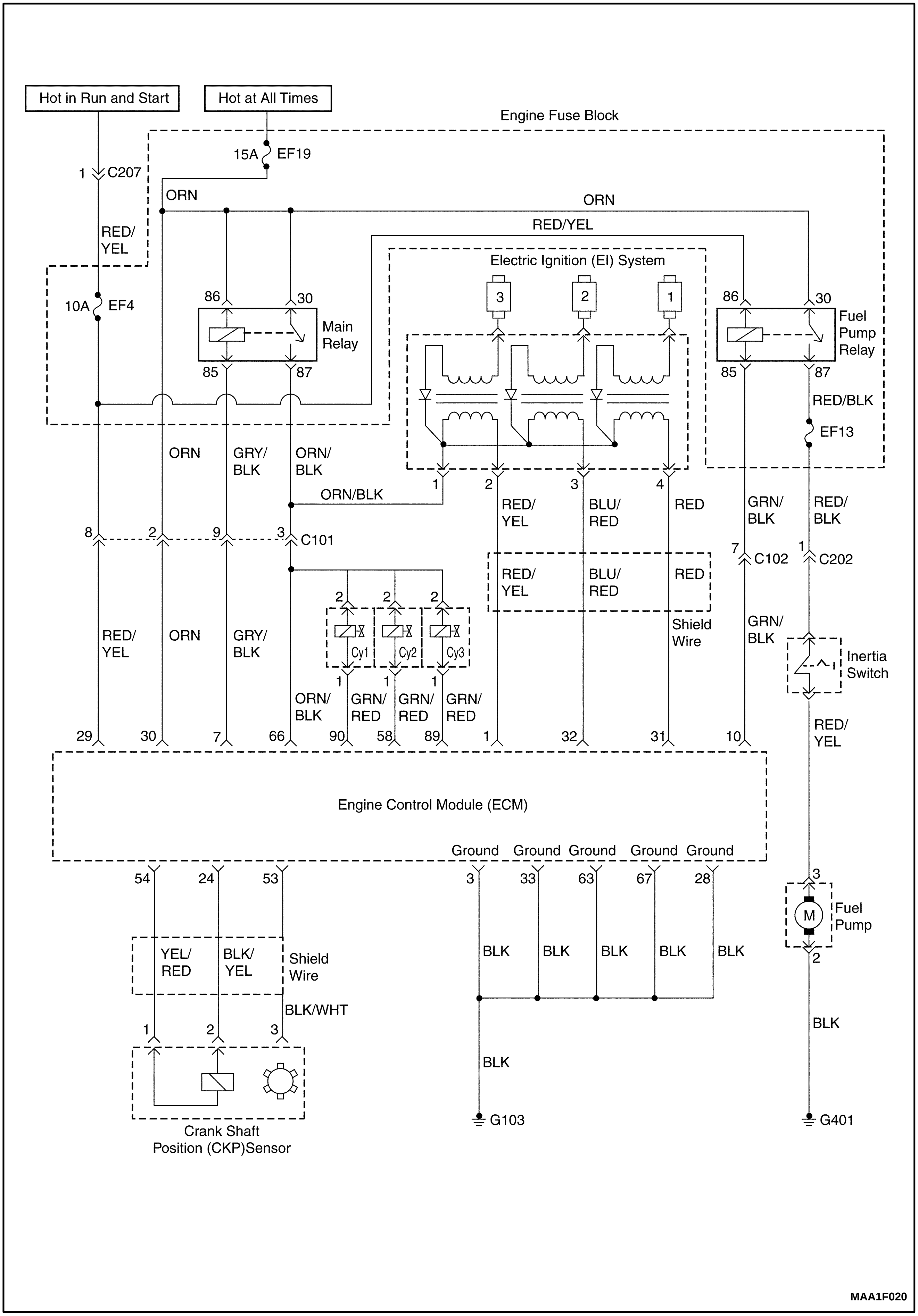
Multiple ECM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to "Euro On-Board Diagnostic System Check"
2	1. Turn the ignition OFF and disconnect the Engine Control Module (ECM). 2. Turn the ignition ON and check the 5 volt reference circuit for the following conditions: • Poor connection at the ECM. • Open between the ECM connector affected sensors shorted to ground or voltage. 3. If a problem is found, locate and repair the open or short circuit as necessary. Is a problem found?	–	Go to *Step 19*	Go to *Step 3*
3	1. Check the sensor ground circuit for the following conditions: • Poor connection at the ECM or affected sensors. • Open between the ECM connector and the affected sensors. 2. If a problem is found, repair it as necessary. Is a problem found?	–	Go to *Step 19*	Go to *Step 4*
4	Measure the voltage of the Electric Exhaust Gas Recirculation (EEGR) Pintle Position Sensor signal circuit between ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 5*	Go to *Step 9*
5	Measure the voltage of the Manifold Absolute Pressure (MAP) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 6*	Go to *Step 11*
6	Measure the voltage of the Throttle Position (TP) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 7*	Go to *Step 12*
7	Measure the voltage of the Intake Air Temperature (IAT) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 8*	Go to *Step 13*
8	Measure the voltage of the Engine Coolant Temperature (ECT) sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 16*	Go to *Step 14*
9	1. Disconnect the EEGR valve. 2. Measure the voltage of the EEGR Pintle Position sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 10*	Go to *Step 15*
10	Replace the EEGR valve. Is the repair complete?	–	Go to *Step 19*	–
11	Locate and repair the short to voltage in the MAP sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–

Multiple ECM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
12	Locate and repair the short to voltage in the TP sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
13	Locate and repair the short to voltage in the IAT sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
14	Locate and repair the short to voltage in the ECT sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
15	Locate and repair the short to voltage in the EEGR Pintle Position sensor circuit. Is the repair complete?	–	Go to *Step 19*	–
16	Measure the voltage of the Fuel Tank Pressure sensor signal circuit between the ECM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 18*	Go to *Step 17*
17	Locate and repair the short to voltage in the Fuel Tank Pressure sensor signal circuit. Is the repair complete?	–	Go to *Step 19*	–
18	Replace the ECM. Is the repair complete?	–	Go to *Step 19*	–
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTCs as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

ENGINE CRANKS BUT WILL NUT RUN



ENGINE CRANKS BUT WILL NOT RUN

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Important: If a no start condition exists, ensure the fuel cutoff switch has not been tripped prior to further diagnosis.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check”
2	Crank the engine. Does the engine start and continue to run?	–	System Ok	Go to *Step 3*
3	Perform a cylinder compression test. Is the cylinder compression for all of the cylinders at or above the value specified?	1250 kPa (181 psi)	Go to *Step 7*	Go to *Step 4*
4	Inspect the timing belt alignment. Is the timing belt in alignment?	–	Go to *Step 6*	Go to *Step 5*
5	Align or replace the timing belt as needed. Is the repair complete?	–	Go to *Step 2*	–
6	Repair internal engine damage as needed. Is the repair complete?	–	Go to *Step 2*	–
7	Inspect the fuel pump fuse. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Replace the fuse. Is the repair complete?	–	Go to *Step 2*	–
9	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	–	Go to *Step 23*	Go to *Step 10*
10	1. Measure the resistance of the ignition wires. 2. Replace any of the ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wire. Is spark present from all of the ignition wires?	5 kΩ	Go to *Step 2*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the crankshaft position (CKP) sensor connector. 3. Turn the ignition ON. 4. Measure the voltage between following terminals: ● Terminal 1 and 3 of the CKP sensor connector. ● Terminal 2 and 3 of the CKP sensor connector. ● Terminal 1 of the CKP sensor connector and ground. ● Terminal 2 of the CKP sensor connector and ground. Are the voltage measure within the value specified?	≈ 0.4 V	Go to *Step 13*	Go to *Step 12*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for an open or short in the wires between CKP sensor connector and ECM connector and repair as need. Is the repair complete?	–	Go to *Step 2*	–
13	1. Disconnect electronic Ignition (EI) system ignition coil connector to prevent the vehicle from starting. 2. Measure the voltage at ECM connector terminal 24 and 54 by backprobing the ECM connector. Are the voltage readings near the value specified?	0.4 V with ignition ON, 2.0 V during cranking	Go to *Step 15*	Go to *Step 14*
14	Replace the CKP sensor. Is the repair complete?	–	Go to *Step 2*	–
15	1. Turn the ignition OFF. 2. Disconnect the electrical connector at EI system ignition coil. 3. Connect a test light between terminal 1 of the EI system ignition coil connector and ground. 4. Turn the ignition ON. Is the test light on?	–	Go to *Step 17*	Go to *Step 16*
16	Check for open in wire between the battery and EI system ignition coil connector terminal 1 and repair as needed. Is the repair complete?	–	Go to *Step 2*	–
17	1. Turn the ignition OFF. 2. Disconnect ECM connector and EI system ignition coil connector. 3. Measure the resistance between following terminals: • Terminal 2 of ignition coil and terminal 1 of ECM connector. • Terminal 3 of ignition coil and terminal 32 of ECM connector. • Terminal 4 of ignition coil and terminal 31 of ECM connector. Are the resistance within the value specified?	0 Ω	Go to *Step 19*	Go to *Step 18*
18	Check for open circuit and repair as needed. Is the repair complete?	–	Go to *Step 2*	–
19	1. Measure the resistance between following terminals: • Terminal 1 and 2 of ignition coil. • Terminal 3 and 4 of ignition coil. Are the resistance within the value specified? 2. Remove the high tension cable. 3. Measure the resistance between second coil. • Between 1 and 4 • Between 2 and 3 Are the resistance within the value specified?	0.9Ω 5.3 kΩ	Go to *Step 21*	Go to *Step 20*
20	Replace the EI system ignition coil. Is the repair complete?	–	Go to *Step 2*	–

Engine Cranks But Will Not Run (Cont'd)

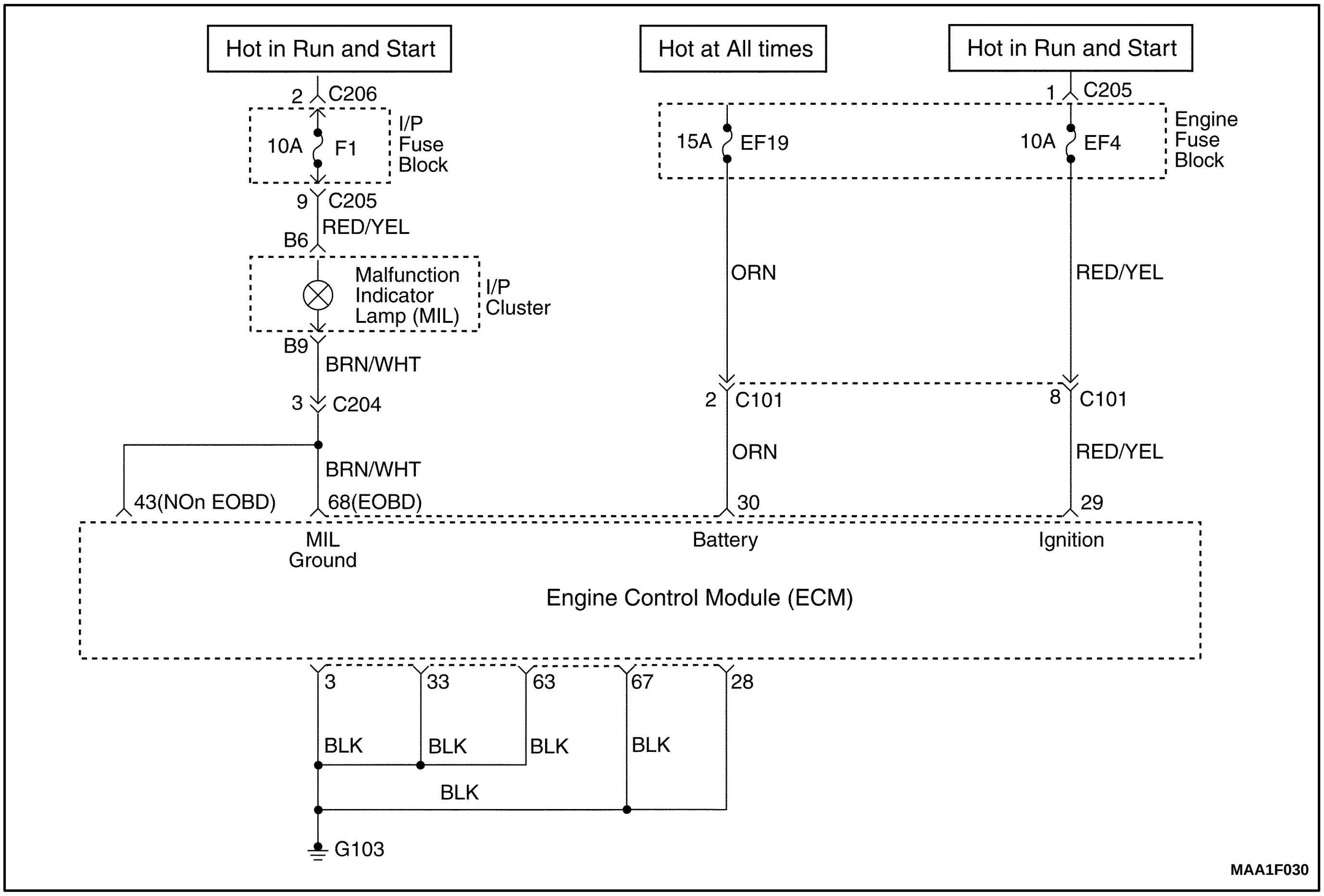
Step	Action	Value(s)	Yes	No
21	1. Check for any damages or poor connection in ignition wires and repair as needed. 2. Connect the Ei system ignition coil connector and ECM connector. 3. Check for the presence of spark from all of the ignition wires. Is the spark present from all of the ignition wires?	–	Go to *Step 2*	Go to *Step 22*
22	Replace ECM Is the repair complete?	–	Go to *Step 2*	–
23	1. Turn the ignition OFF. 2. Connect a fuel pressure gauge. 3. Crank the engine. Is any fuel pressure present?	–	Go to *Step 26*	Go to *Step 24*
24	1. Turn the ignition OFF. 2. Disconnect the electrical connector at the fuel pump. 3. Connect a test light between the fuel pump terminals 2 and 3. 4. Turn the ignition ON. 5. With the ignition ON, the test light should light for the time specified. Is the test light on?	2 sec.	Go to *Step 25*	Go to *Step 32*
25	Replace the fuel pump. Is the repair complete?	–	Go to *Step 2*	–
26	Is the fuel pressure within the value specified?	380 kPa (55 psi)	Go to *Step 27*	Go to *Step 29*
27	Check the fuel for contamination. Is the fuel contaminated?	–	Go to *Step 28*	Go to *Step 41*
28	1. Remove the contaminated fuel from the fuel tank. 2. Clean the fuel tank as needed. Is the repair complete?	–	Go to *Step 2*	–
29	1. Check the fuel filter for restriction. 2. Inspect the fuel lines for kinks and restrictions. 3. Repair or replace as needed. 4. Measure the fuel pressure. Is the fuel pressure within the value specified?	380 kPa (55 psi)	Go to *Step 2*	Go to *Step 30*
30	1. Disconnect vacuum line from the fuel pressure regulator. 2. Inspect the vacuum line for the presence of fuel. 3. Inspect the fuel pressure regulator vacuum port for the presence of fuel. Is any fuel present?	–	Go to *Step 31*	Go to *Step 32*
31	Replace the fuel pressure regulator. Is the repair complete?	–	Go to *Step 2*	–
32	1. Remove the fuel pump assembly from the fuel tank. 2. Inspect the fuel pump sender and the fuel coupling hoses for a restriction. 3. Inspect the in-tank fuel filter for restriction. Is the problem found?	–	Go to *Step 33*	Go to *Step 25*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
33	Replace the fuel pump sender, the in-tank fuel filter, and/or the fuel coupling hoses as needed. Is the repair complete?	–	Go to *Step 2*	–
34	1. Turn the ignition OFF. 2. Disconnect the electric connector at the fuel pump. 3. Connect a test light between fuel pump connector terminal 3 and ground. 4. Turn the ignition ON. 5. With the ignition ON, the test light should illuminate for the time specified. Is the test light on?	2 sec	Go to *Step 35*	Go to *Step 36*
35	Repair the open circuit between the fuel pump connector terminal 2 and ground. Is the repair complete?	–	Go to *Step 2*	–
36	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Turn the ignition ON. 4. Measure the voltage at terminal 30 and 85 of fuel pump relay. Is the voltage within the value specified?	11 – 14 V	Go to *Step 38*	Go to *Step 37*
37	Repair open or short circuit for power supply. Is the repair complete?	–	Go to *Step 2*	–
38	1. Turn the ignition OFF. 2. Disconnect ECM connector. 3. Using an ohmmeter, measure the resistance between following terminals. • Terminal 10 of ECM and terminal 85 of fuel pump relay. • Terminal 87 of fuel pump relay and terminal 3 of fuel pump. Does the resistance within the value specified?	0 Ω	Go to *Step 40*	Go to *Step 39*
39	1. Check for open circuit and fuel cut–off switch. 2. Reset fuel cut-off switch or repair open circuit as needed. Is the repair complete?	–	Go to *Step 2*	–
40	Replace the fuel pump relay. Is the repair complete?	–	Go to *Step 2*	–
41	1. Turn the ignition OFF. 2. Disconnect the fuel inject harness connectors from all of the fuel injectors. 3. Turn the ignition ON. 4. Connect test light between fuel injector harness connector 1 and ground. 5. Repeat step 4 for each of the remaining fuel injectors. Does the test light on at all of the fuel injectors?	–	Go to *Step 42*	Go to *Step 45*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
42	1. Turn the ignition OFF. 2. Connect test light between fuel injector harness connector 2 and battery positive. 3. Crank the engine. 4. Repeat step 2 and 3 for each of the remaining fuel injectors. Does the test light flash for all of the fuel injectors?	–	Go to *Step 43*	Go to *Step 46*
43	Measure the resistance of each fuel injectors. Is the resistance within the value specified. **Note:** the resistance will increase slightly at higher temperature.	13.75–15.25 Ω	System OK	Go to *Step 44*
44	Replace any of the fuel injectors with a resistance out of specification. Is the repair complete?	–	Go to *Step 2*	–
45	1. Inspect the fuse EF19 in engine fuse block. 2. Check for an open between the circuit from terminal 2 of the three fuel injectors and terminal 87 of main relay. Is the problem found?	–	Go to *Step 48*	Go to "Main Relay Circuit Check"
46	Measure the resistance between following terminals. ● Terminal 1 of injector 1 connector and terminal 30 of ECM connector. ● Terminal 1 of injector 2 connector and terminal 58 of ECM connector. ● Terminal 1 of injector 3 connector and terminal 89 of ECM connector. Does the resistance within the specified value?	0 Ω	Go to *Step 49*	Go to *Step 47*
47	Repair the open fuel injector harness wire(s). Is the repair complete?	–	Go to *Step 2*	–
48	Replace the fuse or repair the wiring as needed. Is the repair complete?	–	Go to *Step 2*	–
49	Replace the ECM. Is the repair complete?	–	Go to *Step 2*	–



NO MALFUNCTION INDICATOR LAMP

Circuit Description

When the ignition is turned ON, the Malfunction Indicator Lamp (MIL) will be turned ON and remain ON until the engine is running, if no Diagnostic Trouble Codes (DTCs) are stored. Battery voltage is supplied through the ignition switch directly to the MIL telltale. The Engine Control Module (ECM) controls the MIL by providing a ground path through the MIL control circuit to turn ON the MIL.

Diagnostic Aids

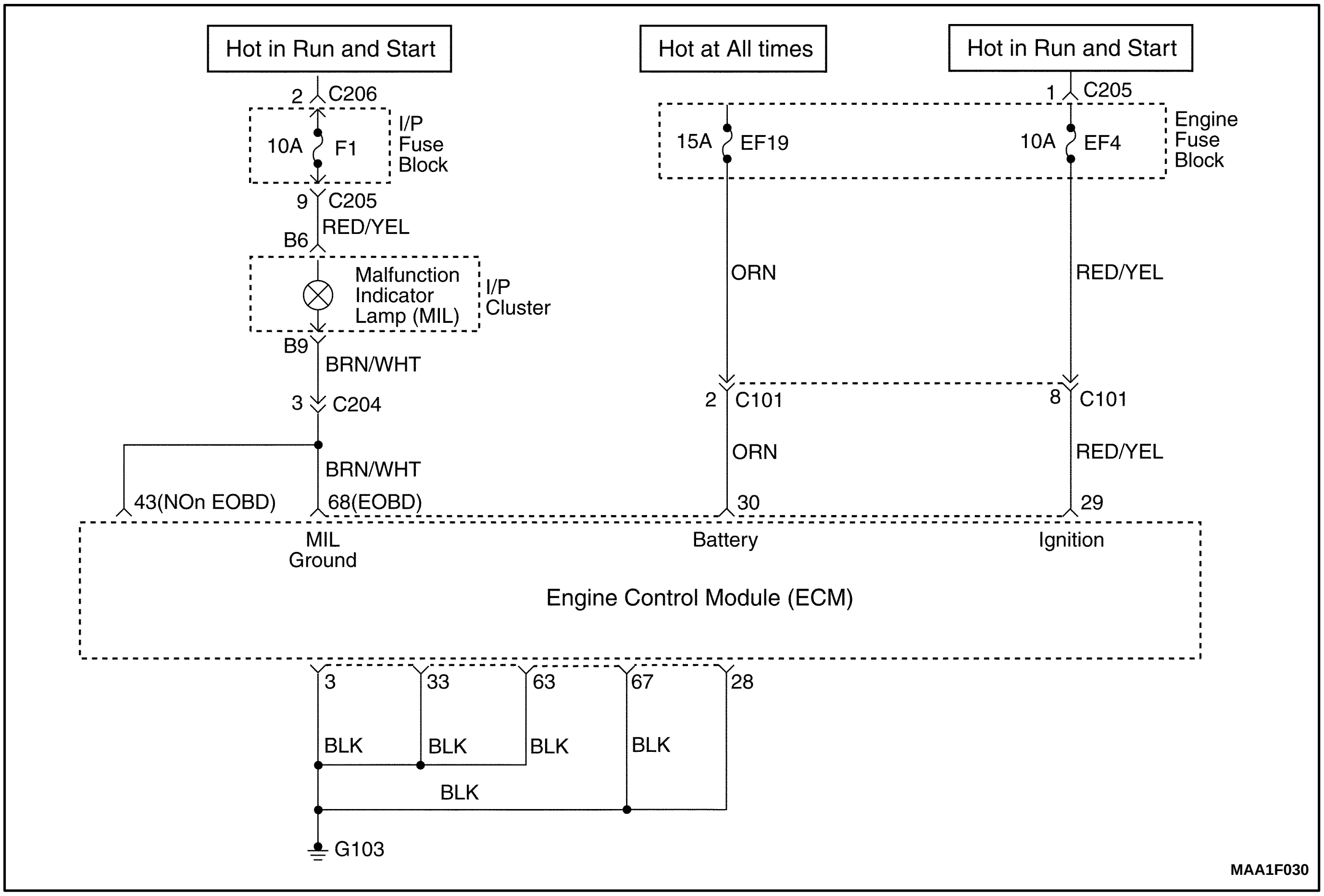
An open ignition F16 fuse will cause the entire cluster to be inoperative.

Check the battery and ignition feed circuits for poor connections if the MIL is intermittent.

Any circuitry, that is suspected as causing an intermittent complaint, should be thoroughly checked for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wiring connections or physical damage to the wiring harness.

No Malfunction Indicator Lamp

Step	Action	Value(s)	Yes	No
1	Attempt to start the engine. Does the engine start?	–	Go to *Step 2*	Go to “Engine Cranks But Will Not Run”
2	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition ON. 4. Connect a test light between terminal 68 of ECM connector and ground. Is the test light on?	–	Go to *Step 3*	Go to *Step 6*
3	Check terminals for damage or poor connection. Does any problem found?	–	Go to *Step 5*	Go to *Step 4*
4	Replace ECM Is the repair complete?	–	Go to “On Board Diagnostic System Check”	–
5	Repair any damaged terminals or poor connection. Is the repair complete?	–	Go to “On Board Diagnostic System Check”	–
6	Check the fuse F1. Is the fuse blown?	–	Go to *Step 7*	Go to *Step 8*
7	1. Check for a short to ground in the circuit and repair as needed. 2. Replace the blown fuse. Is the repair complete?	–	Go to “On Board Diagnostic System Check”	–
8	1. Check for an open circuit between fuse F16 and terminal 68 of ECM connector and repair as needed. 2. Check the MIL bulb and replace if blown. Is the repair complete?	–	Go to “On Board Diagnostic System Check”	–



MALFUNCTION INDICATOR LAMP ON STEADY

Circuit Description

When the ignition is turned ON, the Malfunction Indicator Lamp (MIL) will be turned ON and remain ON until the engine is running, if no Diagnostic Trouble Codes (DTCs) are stored. Battery voltage is supplied through the ignition switch directly to the MIL telltale. The Engine Control Module (ECM) controls the MIL by providing a ground path through the MIL control circuit to turn ON the MIL.

Malfunction Indicator Lamp On Steady

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the check complete.	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install the scan tool. 3. Command the Malfunction Indicator Lamp (MIL) on and off. Does the MIL turn on and off when commanded?	–	Go to *Step 7*	Go to *Step 3*
3	1. Turn the ignition OFF. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition ON. Is the MIL off?	–	Go to *Step 6*	Go to *Step 4*
4	Check the MIL control circuit for a short to ground and repair as needed. Is a repair necessary?	–	Go to *Step 7*	Go to *Step 5*
5	Replace the instrument panel cluster. Refer to *Section 9E, Instrumentation/Driver Information.* Is the repair complete?	–	Go to *Step 7*	–
6	Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Attempt to start the engine. Does the engine start and continue to run?	–	Go to *Step 8*	Go to *Step 1*
8	Allow the engine to idle until normal operating temperature is reached. Check if any DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

FUEL SYSTEM DIAGNOSIS

Circuit Description

The fuel pump is an in-tank type mounted to a fuel sender assembly. The fuel pump will remain on as long as the engine is cranking or running and the Engine Control Module (ECM) is receiving reference pulses from the crankshaft position (CKP) sensor. If there are no reference pulses, the ECM will turn off the fuel pump two seconds after the ignition switch is turned ON or two seconds after the engine stops running. The fuel pump delivers fuel to the fuel rail and the fuel injectors, where the fuel system pressure is controlled from 380 kPa (55 psi) by the fuel pressure regulator. The excess fuel is returned to the fuel tank.

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict nylon fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Fuel Pressure Relief Procedure

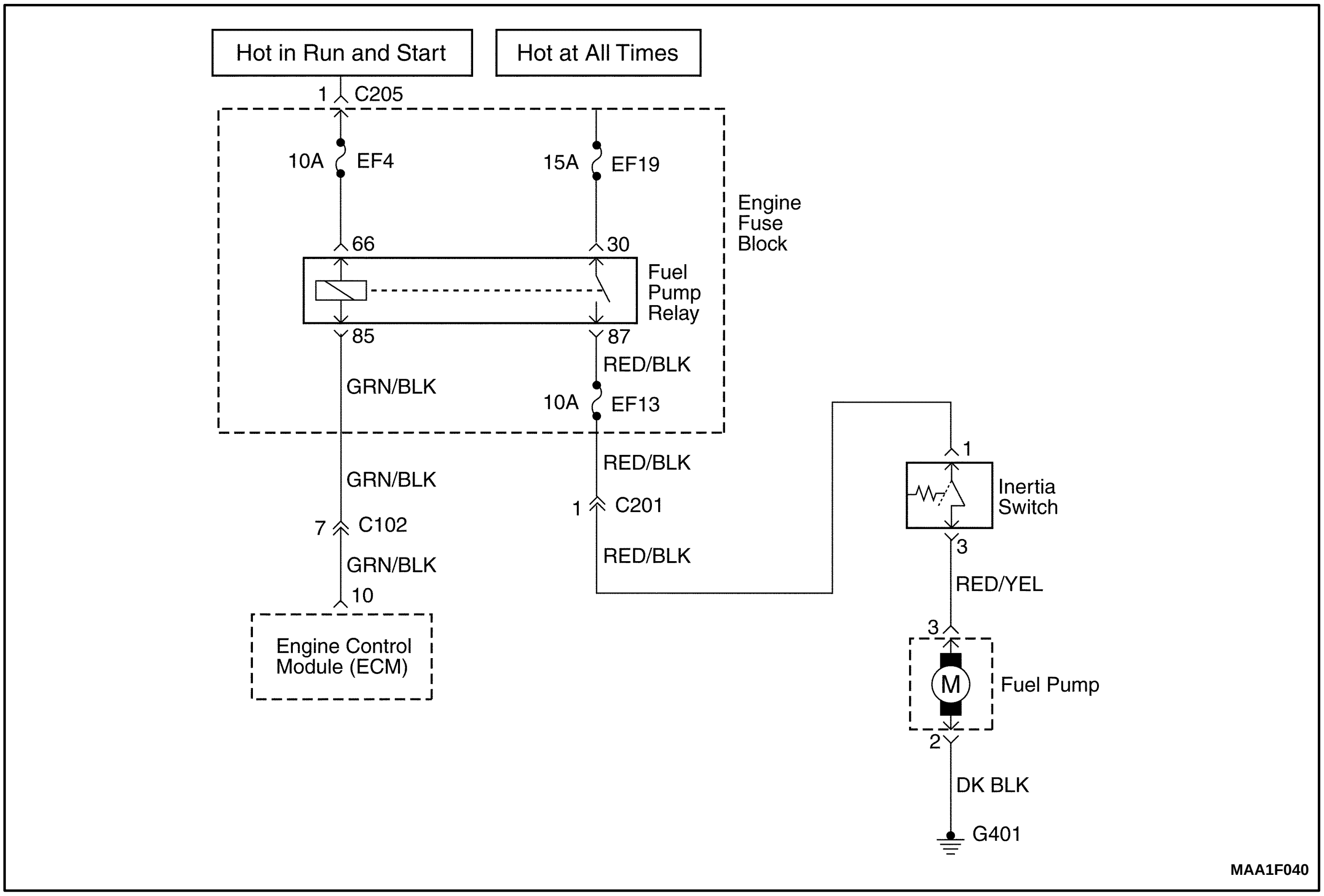
1. Remove the fuel cap.
2. Remove the fuel pump fuse EF23 from the engine fuse block.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

Fuel System Pressure Test

Step	Action	Value(s)	Yes	No
1	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	Go to *Step 2*
2	1. Relieve the fuel system pressure. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified but not holding steady?	380 kPa (55 psi)	Go to *Step 13*	Go to *Step 3*
3	Inspect the fuel lines for a leak. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Replace the fuel line(s) as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	–
5	1. Remove the fuel pump assembly. 2. With the fuel pump under pressure, inspect the fuel pump coupling hoses for leaking. Is the problem found?	–	Go to *Step 6*	Go to *Step 7*
6	1. Tighten or replace the fuel pump coupling hoses as needed. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	Go to Step 8
7	With the fuel system under pressure, inspect the fuel return outlet for leaking. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*

Fuel System Pressure Test (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Replace the fuel pressure regulator. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	–
9	With the fuel system under pressure, inspect the fuel return inlet for leaking. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
10	1. Replace the fuel pump assembly. 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	–
11	1. Remove the fuel rail and the fuel injectors as an assembly. 2. With the fuel system under pressure, inspect all of the fuel injectors for leaking. Is the problem found?	–	Go to *Step 12*	–
12	1. Replace the leaking fuel injector(s). 2. Install a fuel pressure gauge. 3. Turn the ignition ON. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	–
13	1. Replace the fuel pressure regulator. 2. Start the engine. 3. Allow the engine to idle. Is the fuel pressure around the values specified and holding steady?	380 kPa (55 psi)	System OK	–



FUEL PUMP RELAY CIRCUIT CHECK

Circuit Description

When the ignition switch is turned ON, the Engine Control Module (ECM) will supply battery voltage to activate the fuel pump relay and run the in-tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut off the fuel pump within 2 seconds after the ignition switch is turned ON.

Diagnostic Aids

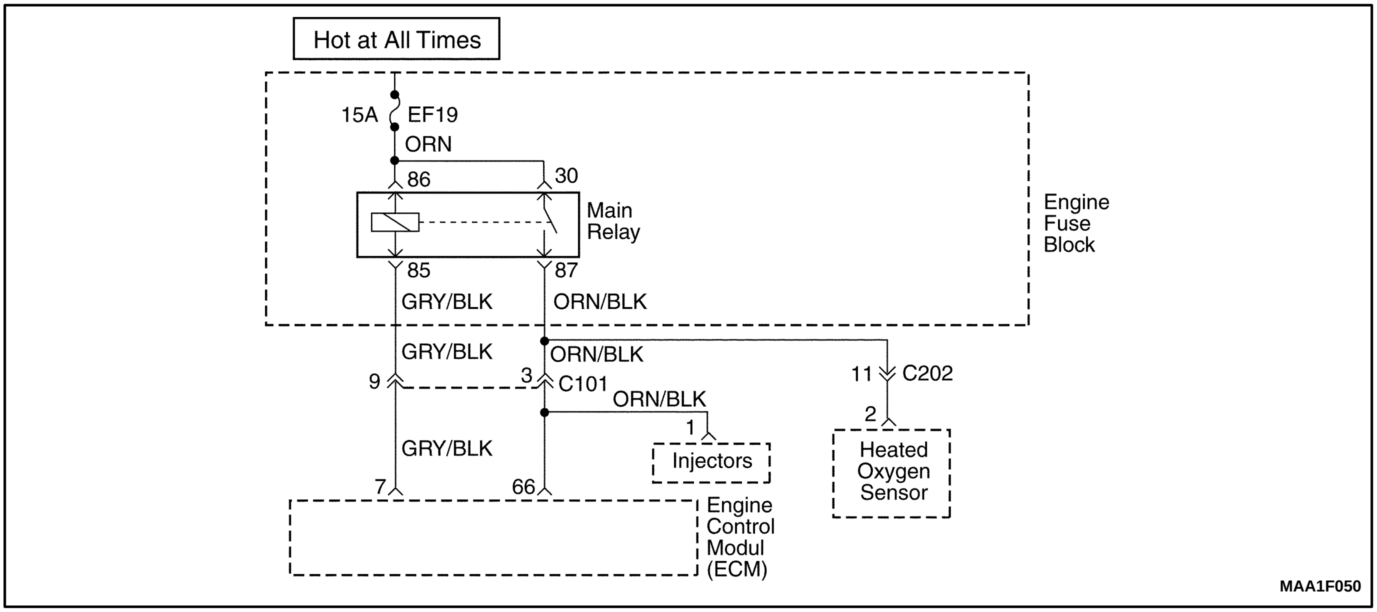
An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.

Fuel Pump Relay Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF for 10 seconds. 2. Turn the ignition ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate for the time specified?	2 sec	System OK	Go to *Step 2*
2	1. Turn the ignition OFF. 2. Connect battery positive to fuel pump test connect. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	–	Go to *Step 4*	Go to *Step 3*

Fuel Pump Relay Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Check for an open circuit between fuel pump test connector and ground G401, and repair as needed. 2. Check for the fuel cut-off switch and reset or replace the fuel cut off switch. Is the repair complete?	–	System OK	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 66 and battery positive. 4. Turn the ignition ON. Is the test light on?	–	Go to *Step 6*	Go to *Step 5*
5	Check for an open circuit between terminal 66 of fuel pump relay and battery positive and repair as needed. Is the repair complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 85 and ground. 3. Turn the ignition ON. Is the test light on?	2 sec	Go to *Step 8*	Go to *Step 7*
7	Check for an open circuit between terminal 85 of fuel pump relay and terminal 10 of ECM, and repair as needed. Is the repair complete?	–	System OK	–
8	1. Turn the ignition OFF. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light on?	–	Go to *Step 10*	Go to *Step 9*
9	1. Check the fuse EF19, if blown, repair short circuit between fuel pump relay 30 terminal. 2. Replace the fuse as needed. 3. Repair an open circuit as needed. Is the repair complete?	–	System OK	–
10	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: • Terminal 87 of fuel pump relay and terminal 1 of the fuel cut-off switch(or terminal 1 of connector C201). Does the resistance within the value specified.	0 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair an open circuit as needed. Is the repair complete?	–	System OK	–
12	Replace the fuel pump relay. Is the repair complete?	–	System OK	Go to *Step 13*
13	Replace the ECM. Is the repair complete?	–	System OK	–



MAIN RELAY CIRCUIT CHECK

Circuit Description

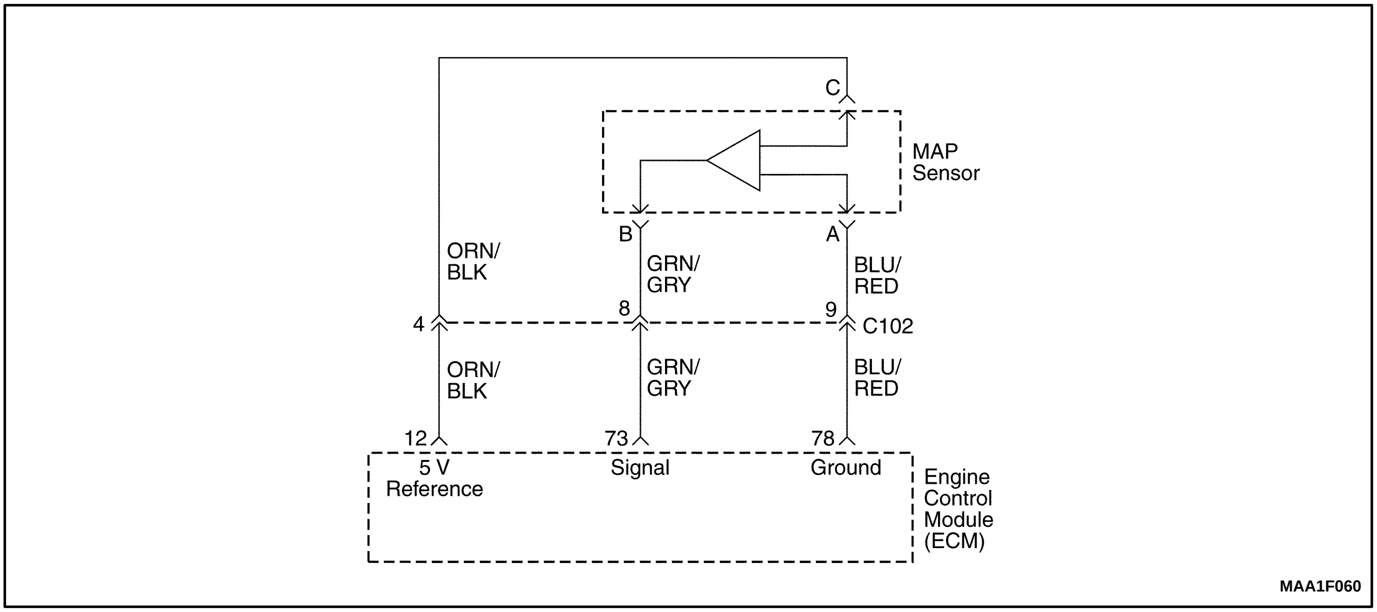
When the ignition is turned On or to the START position, the main relay is energized. The main relay then supply voltage to the engine fuse block fuse EF25 and EF26. The Electronic Ignition (EI) system ignition coil is supplied voltage through the engine fuse block fuse EF26. The fuel injectors are supplied voltage through the engine fuse block fuse EF25.

Diagnostic Aids

- An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.
- A fault main relay will cause a no start condition. There will be no voltage supplied to the EI system ignition coil, or the fuel injectors. Without voltage supplied to these components, they will not operate.

Main Relay Circuit Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Disconnect the engine fuse block fuse EF26. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the fuse terminals nearest the main relay for fuse EF19. Is the light on at both terminal?	–	System OK	Go to *Step 2*
2	Is the light on at only one terminal?	–	Go to *Step 3*	Go to *Step 4*
3	Repair the open in the wiring between the main relay connector terminal 30 and the fuse EF19 as needed. Is the repair complete?	–	System OK	–
4	1. Turn the ignition OFF. 2. Remove the main relay. 3. Turn the ignition ON. 4. With a test light connected to the ground, probe the main relay terminals 85 and 30. Is the light on at both terminals.	–	Go to *Step 8*	Go to *Step 5*
5	1. Turn the ignition OFF. 2. Check engine fuse block fuse EF19. Is one or both fuse blown?	–	Go to *Step 6*	Go to *Step 7*
6	1. Repair short circuit between terminal 87 of main relay and heated oxygen sensor 2. Replace fuse EF19. Is the repair complete?	–	System OK	–
7	Repair open circuit between terminal 30 of main relay and fuse EF19. Is the repair complete?	–	System OK	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Measure the resistance between following terminals. ● Terminal 86 of main relay and ground. ● Terminal 87 of main relay and ground. Is the resistance within the specified value	0 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair open circuit. Is the repair complete?	–	System OK	–
10	Replace the main relay. Is the repair complete?	–	System OK	–



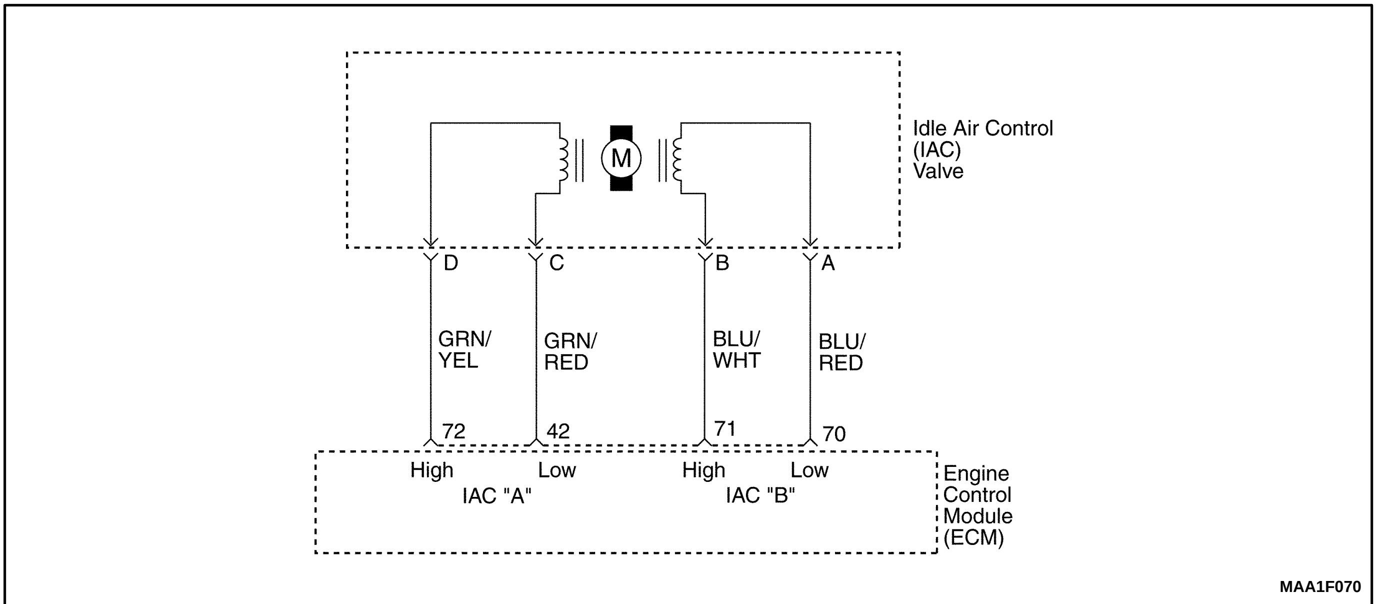
MANIFOLD ABSOLUTE PRESSURE CHECK

Circuit Description

The Manifold Absolute Pressure (MAP) sensor measure the changes in the intake manifold pressure which result from engine load (intake manifold vacuum) and rpm changes. The MAP sensor converts these changes into voltage output. The Engine Control Module (ECM) send a 5-volt reference voltage to the MAP sensor. As the intake manifold pressure changes, the output voltage of MAP sensor also changes. A low voltage (high vacuum) output of 1 to 1.5 volts is present at idle. A high voltage (low vacuum) output of 4.5 to 5.0 volts is present at wide open throttle. The MAP sensor is also used under certain conditions to measure barometric attitude changes. The ECM uses the MAP sensor for the delivery and ignition timing changes.

Manifold Absolute Pressure Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF. 2. Connect a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Compare the Manifold Absolute Pressure (MAP) sensor voltage reading from scanner with that from known good vehicle. Is the difference in the two voltage reading less than the value specified?	0.4 V	Go to *Step 2*	Go to *Step 5*
2	1. Turn the ignition OFF. 2. Connect a scan tool to the DLC. 3. Disconnect the MAP sensor vacuum line. 4. Connect a hand vacuum pump to the Map sensor. 5. Turn the ignition ON. 6. Note the MAP sensor voltage. 7. Apply 34kPa (10 in. Hg) of vacuum to the Map sensor and note the voltage change. Is the difference in voltage readings more than the value specified?	1.5 V	System OK	Go to *Step 3*
3	Inspect the MAP sensor connector terminals. Is the problem found.	–	Go to *Step 4*	Go to *Step 5*
4	Repair the MAP sensor connector terminals as needed. Is the repair complete?	–	System OK	–
5	Replace the MAP sensor. Is the repair complete?	–	System OK	–



IDLE AIR CONTROL SYSTEM CHECK

Circuit Description

The Engine Control Module (ECM) controls the engine idle speed with the Idle Air Control (IAC) valve. To increase the idle speed, the ECM pulls the IAC pintle away from its seat, allowing more air to pass by the throttle body. To decrease the idle speed, it extends the IAC valve pintle toward its seat, reducing bypass air flow. A scan tool will read the ECM commands to the IAC valve in counts. The higher counts indicate more air bypass (higher idle). The lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

If the idle is too high, stop the engine. Fully extend the Idle Air Control (IAC) valve with a IAC driver. Start the engine. If the idle speed is above 950 rpm, locate and repair the vacuum leak. Also, check for a binding throttle plate or throttle linkage or an incorrect base idle setting.

Idle Air Control Valve Reset Procedure

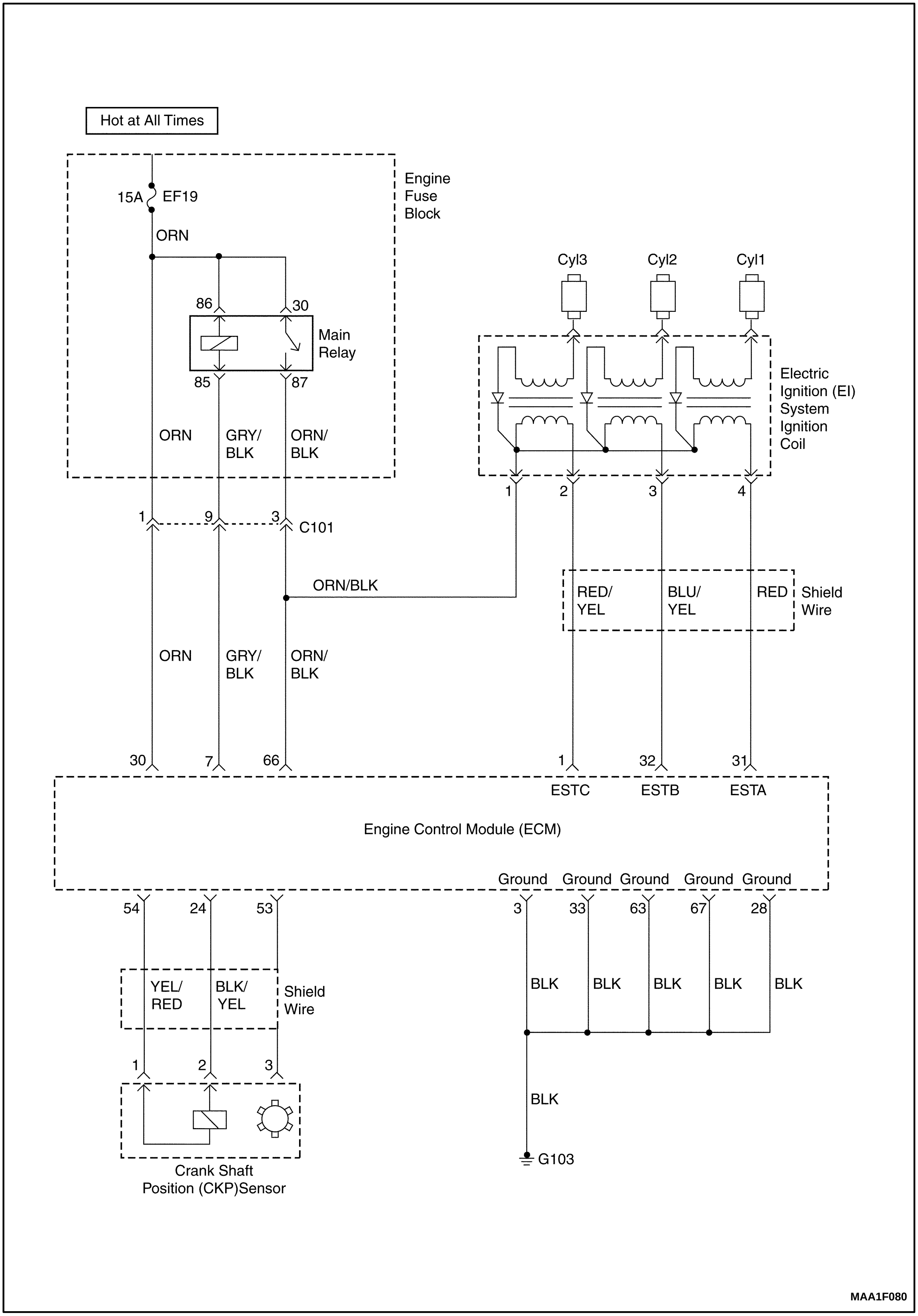
Whenever the battery cable or the Engine Control Module (ECM) connector or the ECM fuse EF6 is disconnected or replaced, the following idle learn procedure must be performed:

1. Turn the ignition ON for 5 seconds.
2. Turn the ignition OFF for 10 seconds.
3. Turn the ignition ON for 5 seconds.
4. Start the engine in park/neutral.
5. Allow the engine to run until the engine coolant is above 85°C (185°F).
6. Turn the A/C ON for 10 seconds, if equipped.
7. Turn the A/C OFF for 10 seconds, if equipped.
8. If the vehicle is equipped with an automatic transaxle, apply the parking brake. While pressing the brake pedal, place the transaxle in D (drive).
9. Turn the A/C ON for 10 seconds, if equipped.
10. Turn the A/C OFF for 10 seconds, if equipped.
11. Turn the ignition OFF. The idle learn procedure is complete.

Idle Air Control System Check

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) system check. Was the check performed?	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Remove Idle Air Control (IAC) valve. 3. Inspect the IAC passages for restrictions. Is the problem found?	–	Go to *Step 3*	Go to *Step 4*
3	Clean the IAC passages. Is the repair complete?	–	System OK	–
4	Measure the resistance between following terminals of IAC valve. ● Terminal A and B ● Terminal C and D Does the resistance equal to the value specified?	40–80 Ω	Go to *Step 6*	Go to *Step 5*
5	Replace the IAC valve. Is the repair complete?	–	System OK	–
6	1. Disconnect the Engine control Module (ECM) connector. 2. Check for an open or short in the wires between following terminals. ● Terminal A of IAC valve connector and terminal 70 of ECM connector ● Terminal B of IAC valve connector and terminal 71 of ECM connector ● Terminal C of IAC valve connector and terminal 42 of ECM connector ● Terminal D of IAC valve connector and terminal 72 of ECM connector Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Repair an open or short circuit as needed. Is the repair complete?	–	System OK	–
8	Inspect the IAC connector terminals and the ECM connector terminals. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
9	Repair or replace the throttle body assembly and/or ECM connector terminals as needed. Is the repair complete?	–	System OK	–
10	Replace the ECM. Is the repair complete?	–	System OK	–

IGNITION SYSTEM CHECK



IGNITION SYSTEM CHECK

Circuit Description

The Electronic Ignition (EI) system uses a waste spark method of spark distribution. In this type of EI system, the Crankshaft Position (CKP) sensor is mounted to the oil pump near a slotted wheel that is a part of the crankshaft pulley. The CKP sensor sends reference pulses to the Engine Control Module (ECM). The ECM then triggers the EI system ignition coil. Each cylinder is individual with coil per cylinder in sequence.

This leaves the remainder of the high voltage to be used to fire the spark plug in the cylinder on its compression stroke. Since the CKP sensor is in a fixed position, timing adjustments are not possible or needed.

Ignition System Check

Caution: Use only electrically insulated pliers when handling ignition wires with the engine running to prevent an electrical shock.

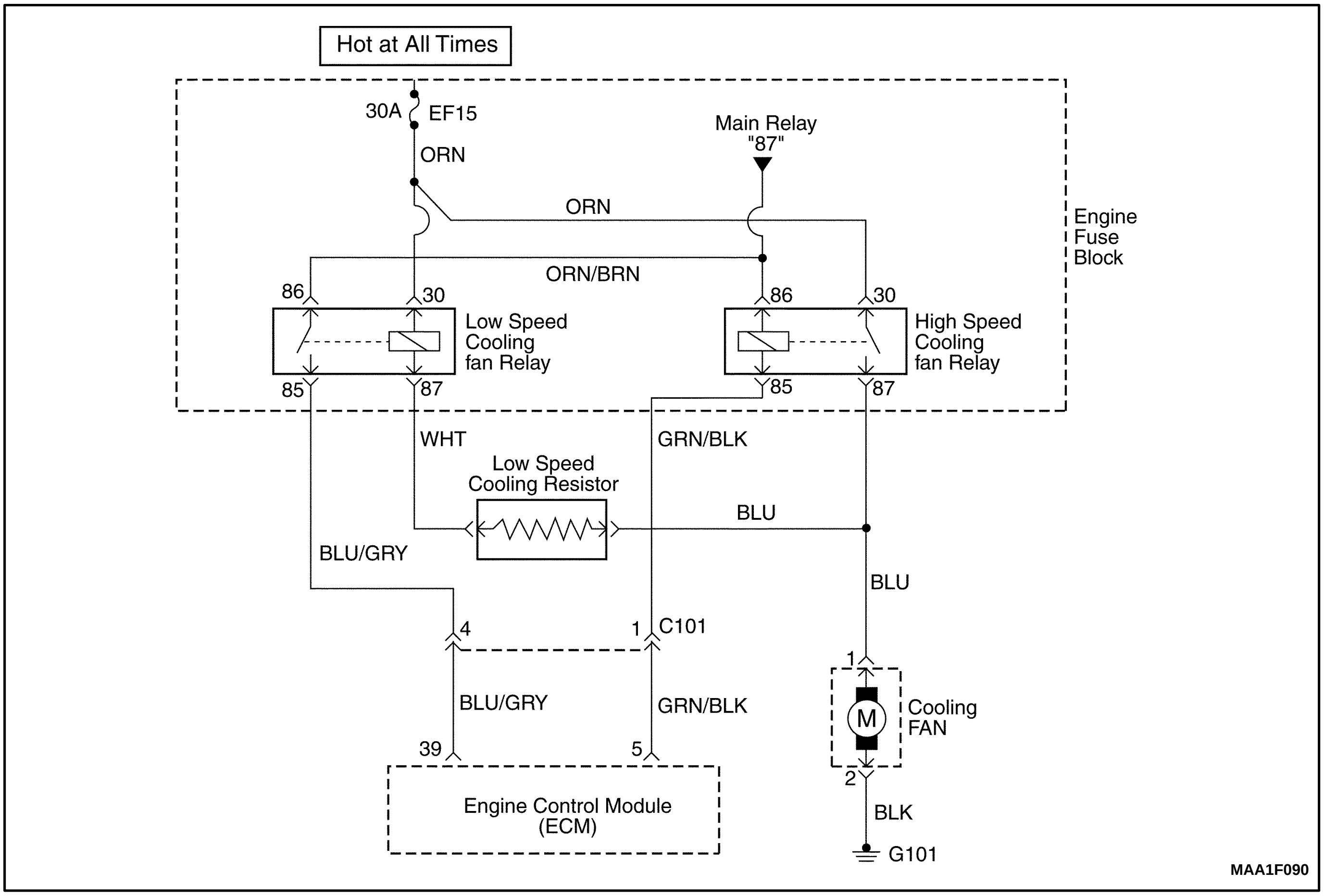
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	–	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the ignition wires while cranking the engine. Is spark present from all of the ignition wires?	–	System OK	Go to *Step 3*
3	1. Measure the resistance of the ignition wires. 2. Replace any ignition wire(s) with a resistance above the value specified. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	30000 Ω	System OK	Go to *Step 4*
4	Is spark present from at least one of the ignition wires, but not all of the ignition wires?		Go to Step 5	Go to Step 12
5	1. Turn the ignition OFF. 2. Disconnect the Electronic Ignition (EI) system ignition coil connector. 3. While cranking the engine, measure the voltage at the EI system ignition coil connector terminal 1. Does the voltage fluctuate within the values specified?	0.2–2.0 V	Go to *Step 8*	Go to *Step 6*
6	Check for an open in the wire from EI system ignition coil connector terminal 1 to the Engine Control Module (ECM) connector terminal 66. Is the problem found?	–	Go to *Step 7*	Go to *Step 11*
7	1. Repair the wiring as needed. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
8	While cranking the engine, measure the voltage at the EI system ignition coil connector terminal 2. Does the voltage fluctuate within the values specified?	0.2–2.0 V	Go to *Step 10*	Go to *Step 9*

Ignition System Check (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for an open in the wire from EI system ignition coil connector terminal 2 to the Engine Control Module (ECM) connector terminal 1. Is the problem found?	–	Go to *Step 7*	Go to *Step 11*
10	1. Replace the EI system ignition coil. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
11	1. Replace the ECM. 2. Connect the EI system ignition coil connector. 3. Check for the presence of spark from all of the ignition wires. Is spark present from all of the ignition wires?	–	System OK	–
12	1. Turn the ignition OFF. 2. Disconnect the crankshaft position (CKP) sensor connector. 3. Measure the resistance between the CKP sensor terminals 1 and 2. Is the resistance within the value specified? 4. Measure the resistance between following terminals. ● Terminals 1 and 3 of CKP sensor. ● Terminals 2 and 3 of CKP sensor. Is the resistance within the value specified?	400–600 Ω ∞	Go to *Step 14*	Go to *Step 13*
13	Replace the crankshaft position sensor. Is the repair complete?	–	System OK	–
14	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminals 1 and 3. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 20*	Go to *Step 15*
15	Measure the voltage between the CKP sensor connector terminal 1 and ground. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 18*	Go to *Step 16*
16	Check the wire between the CKP sensor connector terminal 1 and the ECM connector terminal 54 for an open or short. Is the problem found?	–	Go to *Step 17*	Go to *Step 10*
17	Repair the wire between the CKP sensor connector terminal 1 and the ECM connector terminal 54. Is the repair complete?	–	System OK	–
18	Check the wire between the CKP sensor connector terminal 3 and ground for an open or short. Is the problem found?	–	Go to *Step 19*	Go to *Step 11*
19	Repair the wire between the CKP sensor connector terminal 3 and ground. Is the repair complete?	–	System OK	–
20	1. Turn the ignition ON. 2. Measure the voltage between the CKP sensor connector terminals 2 and 3. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 24*	Go to *Step 21*

Ignition System Check (Cont'd)

Step	Action	Value(s)	Yes	No
21	Measure the voltage between the CKP sensor connector terminal 2 and ground. Is the voltage within the value specified?	0.95–1.10 V	Go to *Step 18*	Go to *Step 22*
22	Check the wire between the CKP sensor connector terminal 2 and the ECM connector terminal 24 for an open or short. Is the problem found?	–	Go to *Step 23*	Go to *Step 11*
23	Repair the wire between the CKP sensor connector terminal 2 and the ECM connector terminal 24. Is the repair complete?	–	System OK	–
24	1. Turn the ignition OFF. 2. Connect a test light between the EI system ignition coil connector terminal 2 and ground. 3. Turn the ignition ON. Is the test light on?	–	Go to *Step 27*	Go to *Step 25*
25	Check for an open in the wiring between the EI system ignition coil connector, terminal 1 and the main relay connector terminal 87. Is the problem found?	–	Go to *Step 26*	Go to "Main Relay Circuit Check"
26	Repair the open in the wiring between the EI system ignition coil connector terminal 1 and the main relay connector terminal 87. Is the repair complete?	–	System OK	–
27	Check for a damage in the terminal of the EI system ignition coil connector and repair as needed. Is the repair complete?	–	System OK	–



ENGINE COOLING FAN CIRCUIT CHECK

Circuit Description

The engine cooling fan circuit operates the cooling fan. The cooling fan is controlled by the engine control module (ECM) based on input from the coolant temperature sensor (CTS) and the A/C ON/OFF. The ECM controls the low speed cooling fan operation by internally grounding the ECM connector terminal 39. This energizes the low speed cooling fan relay and operates the cooling fan at low speed. The low speed cooling fan operation is achieved by the cooling fan resistor causing a drop in the voltage supplied to the cooling fan. The ECM controls the high speed cooling fan operation by internally grounding the ECM connector terminal 5. This energizes the high speed cooling fan relay, bypassing the radiator fan resistor. This results in high speed cooling fan operation.

Diagnostic Aids

- If the owner complained of an overheating problem, it must be determined if the complaint was due to an actual boil over, or the engine coolant temperature gauge indicated overheating. If the engine is overheating and the cooling fans are on, the cooling system should be checked.
- If the engine fuse block fuse EF15 become open (blown) immediately after installation, inspect for a short to ground in the wiring of the appropriate circuit. If the fuse become open (blown) when the cooling fans are to be turned on by the Engine Control Module (ECM), suspect a faulty cooling fan motor.
- The ECM will turn the cooling fan on at low speed when the coolant temperature is 93°C (199°F). The ECM will turn the cooling fans off when the coolant temperature is 90°C (194°F).
- The ECM will turn the cooling fans on at high speed when the coolant temperature is 100°C (212°F). The ECM will change the cooling fans from high speed to low speed when the coolant temperature is 97°C (207°F).

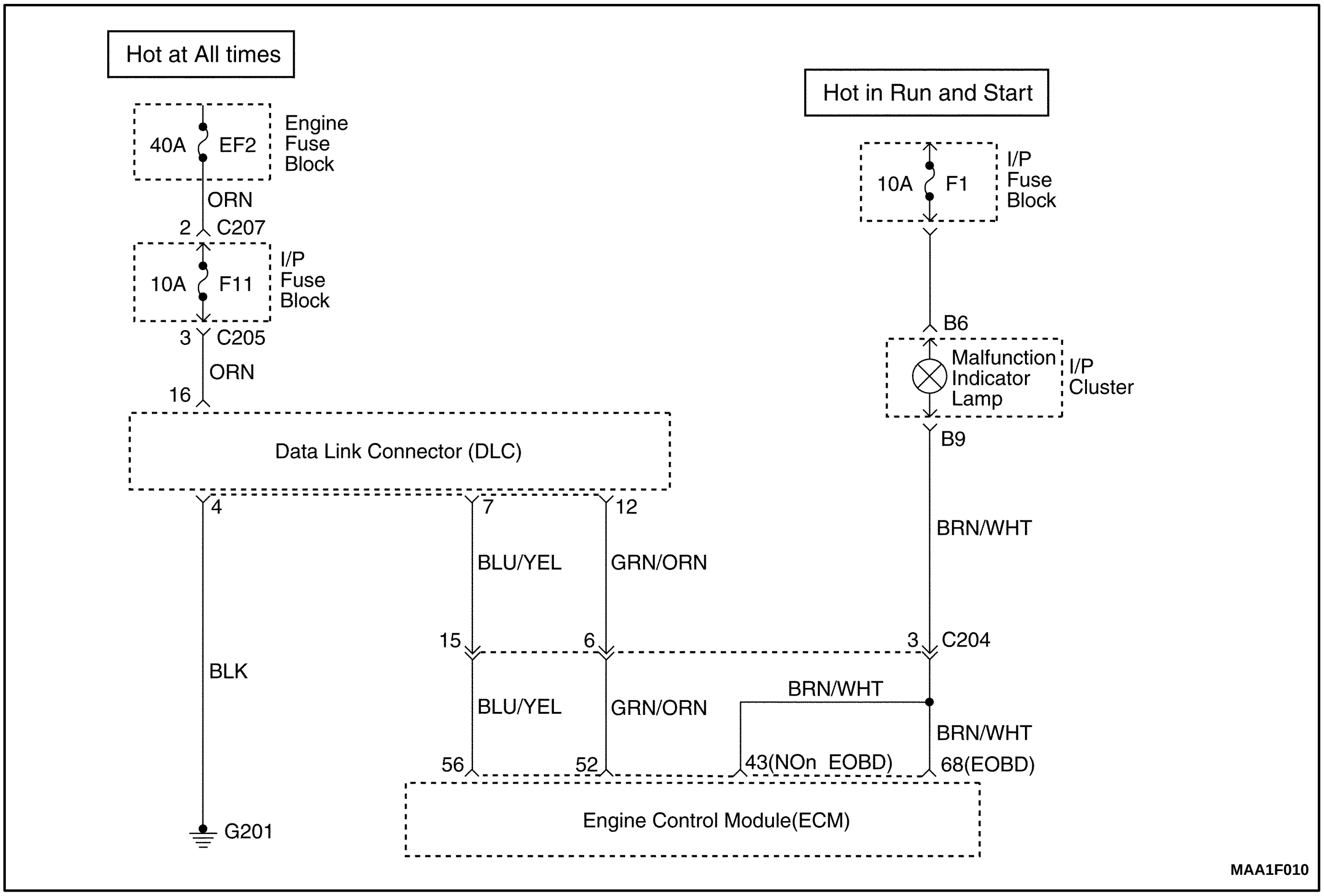
Engine Cooling Fan Circuit Check

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check.
2	1. Check the fuses EF3 and EF10 in engine fuse block. 2. Replace the fuse(s) as needed. Is the fuse(s) OK?	–	Go to *Step 3*	Go to “Diagnostic Aids”
3	1. Turn the ignition OFF. 2. Turn the A/C switch OFF. If equipped. 3. Connect a scan tool to the Data Link Connector (DLC). 4. Start the engine. 5. The main cooling fan should run at low speed when the coolant temperature reaches 96°C (205°F). Does the cooling fan run at low speed?	–	Go to *Step 4*	Go to *Step 8*
4	The cooling fans should run at high speed when the coolant temperature reaches 100°C (212°F). Do the cooling fans run at high speed?	–	Go to *Step 5*	Go to *Step 19*
5	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON. Does the cooling fan runs at low speed?	–	Go to *Step 7*	Go to *Step 6*
6	1. Diagnose the A/C compressor clutch circuit. 2. Repair the A/C compressor clutch circuit as needed. Is the repair complete?	–	System OK	–
7	1. Turn the ignition OFF. 2. Start the engine. 3. Turn the A/C switch ON and raise the rpm. 4. The cooling fan should run at high speed when the high side A/C pressure reaches 2068 kPa (300 psi). Do the cooling fans run at high speed?	–	System OK	–
8	1. Turn the ignition OFF. 2. Disconnect the cooling fan connector. 3. Turn the ignition ON. 4. Connect a test light between terminal 1 of cooling fan connector and ground. Is the test light on?	–	Go to *Step 9*	Go to *Step 12*
9	Connect a test light between terminal 2 of cooling fan connector and battery positive. Is the test light on?	–	Go to *Step 11*	Go to *Step 10*
10	Repair open circuit between terminal 2 of cooling fan connector and ground. Is the repair complete?	–	System OK	–
11	Check for a damaged terminals in main cooling fan connector and repair it or replace the main cooling fan. Is the repair complete?	–	System OK	–

Engine Cooling Fan Circuit Check (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Turn the ignition ON. 2. Connect a test light between terminals 86 and 30 of low speed cooling fan relay and ground. Does the test light on for both case?	–	Go to *Step 14*	Go to *Step 13*
13	Repair power supply circuit. ● Fuse EF15 and terminal 30 of low speed cooling fan relay. Is the repair complete?	–	System OK	Go to *Step 14*
14	1. Turn the ignition OFF. 2. Disconnect Engine Control Module (ECM) connectors. 3. Turn the ignition ON. 4. Connect a jump wire between terminal 5 and ground. Does the cooling fan run at low speed?	–	Go to *Step 15*	Go to *Step 16*
15	Replace the ECM. Is the repair complete?	–	System OK	–
16	1. Turn the ignition OFF. 2. Measure the resistance between following terminals: ● Terminal 85 of low speed cooling fan relay and terminal 39 of ECM connector. Are the resistance within the value specified?	0 Ω	Go to *Step 18*	Go to *Step 17*
17	Repair open circuit. Is the repair complete?	–	System OK	–
18	Replace the low speed cooling fan relay. Is the repair complete?	–	System OK	–

BLANK



DATA LINK CONNECTOR DIAGNOSIS

Circuit Description

The provision for communicating with the Engine Control Module (ECM) is the Data Link Connector (DLC). It is located under the instrument panel. The DLC is used to connect the scan tool. Battery power and ground is supplied for the scan tool through the DLC. The Keyword 2000 serial data circuit to the DLC allows the ECM to communicate with the scan tool. A Universal Asynchronous Receiver Transmitter (UART) serial data line is used to communicate with the other modules such as the Electronic Brake Control Module (EBCM), the Supplemental Inflatable Restraint (SIR) system. and the Instrument Panel Cluster.

Diagnostic Aids

Ensure that the correct application (model line, car year, etc.) has been selected on the scan tool. If communication still cannot be established, try the scan tool on another vehicle to ensure that the scan tool or cables are not the cause of the condition.

An intermittent may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.

Any circuitry that is suspected of causing an intermittent complaint should be thoroughly checked for the following conditions:

- Backed-out terminals.
- Improper mating of terminals.
- Broken locks.
- Improperly formed or damaged terminals.
- Poor terminal-to-wiring connection.
- Physical damage to the wiring harness.
- Corrosion.

Data Link Connector Diagnosis

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “Euro On-Board Diagnostic System Check.
2	With a test light connected to the ground, probe the Data Link Connector (DLC) battery feed terminal 16. Is the test light on?	–	Go to *Step 4*	Go to *Step 3*
3	Repair an open or short to ground in the DLC battery feed circuit . Is the repair complete?	–	Go to *Step 4*	–
4	With a test light connected to the battery, probe the Data Link Connector (DLC) ground terminal 4 and 5. Is the test light on?	–	Go to *Step 6*	Go to *Step 5*
5	Repair an open circuit . Is the repair complete?	–	Go to *Step 6*	–
6	1. Turn the ignition OFF. 2. Connect a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON. Does the scan tool power up?	–	Go to *Step 8*	Go to *Step 7*
7	Check for damages in the terminal of DLC and scan tool, and repair as needed. Is the repair complete?	–	Go to *Step 8*	–
8	Using a scan tool, request engine data of Engine Control Module (ECM). Does the scan tool display any data?	–	Go to *Step 12*	Go to *Step 9*
9	Install the scan tool on another vehicle and check for proper operation. Does the scan tool work properly on a different vehicle.	–	Go to *Step 11*	Go to *Step 10*
10	The scan tool is malfunctioning. Refer to the scan tool’s manual for repair. Is the repair complete?	–	Go to *Step 12*	–
11	Repair communication circuit between ECM and DLC. Is the repair complete?	–	Go to *Step 12*	–
12	1. Using a scan tool, clear the Diagnostic Trouble Codes(DTCs). 2. Attempt to start the engine. Does the engine and continue to run?	–	Go to *Step 13*	Go to *Step 1*
13	1. Allow the engine to idle until normal operation temperature reached. 2. Check if any DTCs are set? Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

FUEL INJECTOR BALANCE TEST

A fuel injector tester is used to energize the injector for a precise amount of time, thus spraying a measured amount of fuel into the intake manifold. This causes a drop in the fuel rail pressure that can be recorded and used to compare each of the fuel injectors. All of the fuel injectors should have the same pressure drop.

Fuel Injector Balance Test Example

Cylinder	1	2	3
First Reading	380 kPa (55 psi)	380 kPa (55 psi)	380 kPa (55 psi)
Second Reading	215 kPa (31 psi)	201 kPa (29 psi)	230 kPa (33 psi)
Amount Of Drop	165 kPa (24 psi)	179 kPa (26 psi)	151 kPa (22 psi)
Average Range: 156-176 kPa (22.5-25.5 psi)	Injector OK	Faulty Injector – Too Much Pressure Drop	Faulty Injector – Too Little Pressure Drop

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

Caution: Do not pinch or restrict fuel lines. Damage to the lines could cause a fuel leak, resulting in possible fire or personal injury.

Notice: In order to prevent flooding of the engine, do not perform the Injector Balance Test more than once (including any retest on faulty fuel injectors) without running the engine.

Test

Notice: An engine cool down period of 10 minutes is necessary in order to avoid irregular readings due to hot soak fuel boiling.

1. Connect the fuel pressure gauge carefully to avoid any fuel spillage.
2. The fuel pump should run about 2 seconds after the ignition is turned to the ON position.
3. Insert a clear tube attached to the vent valve of the fuel pressure gauge into a suitable container.
4. Bleed the air from the fuel pressure gauge and hose until all of the air is bled from the fuel pressure gauge.
5. The ignition switch must be in the OFF position at least 10 seconds in order to complete the electronic control module (ECM) shutdown cycle.
6. Turn the ignition ON in order to get the fuel pressure to its maximum level.
7. Allow the fuel pressure to stabilize and then record this initial pressure reading. Wait until there is no movement of the needle on the fuel pressure gauge.
8. Follow the manufacturer's instructions for the use of the adapter harness. Energize the fuel injector tester once and note the fuel pressure drop at its lowest point. Record this second reading. Subtract it from the first reading to determine the amount of the fuel pressure drop.
9. Disconnect the fuel injector tester from the fuel injector.
10. After turning the ignition ON, in order to obtain maximum pressure once again, make a connection at the next fuel injector. Energize the fuel injector tester and record the fuel pressure reading. Repeat this procedure for all the injectors.
11. Retest any of the fuel injectors that the pressure drop exceeds the 10 kPa (1.5 psi) specification.
12. Replace any of the fuel injectors that fail the retest.
13. If the pressure drop of all of the fuel injectors is within 10 kPa (1.5 psi), then the fuel injectors are flowing normally and no replacement should be necessary.
14. Reconnect the fuel injector harness and review the symptom diagnostic tables.

DIAGNOSTIC TROUBLE CODE DIAGNOSIS

CLEARING TROUBLE CODES

Notice: To prevent Engine Control Module (ECM) damage, the key must be OFF when disconnecting or reconnecting the power to the ECM (for example battery cable, ECM pigtail connector, ECM fuse, jumper cables, etc.).When the ECM sets a Diagnostic Trouble Code (DTC), the Malfunction Indicator Lamp (MIL) lamp will be turned on only for type A, B and E but a DTC will be stored in the ECM's memory for all types of DTC. If the problem is intermittent, the MIL will go out after 10 seconds if the fault is no longer present. The DTC will stay in the ECM's memory until cleared by scan tool. Removing battery voltage for 10 seconds will clear some stored DTCs.

DTCs should be cleared after repairs have been completed. Some diagnostic tables will tell you to clear the codes before using the chart. This allows the ECM to set the DTC while going through the chart, which will help to find the cause of the problem more quickly.

DIAGNOSTIC TROUBLE CODES

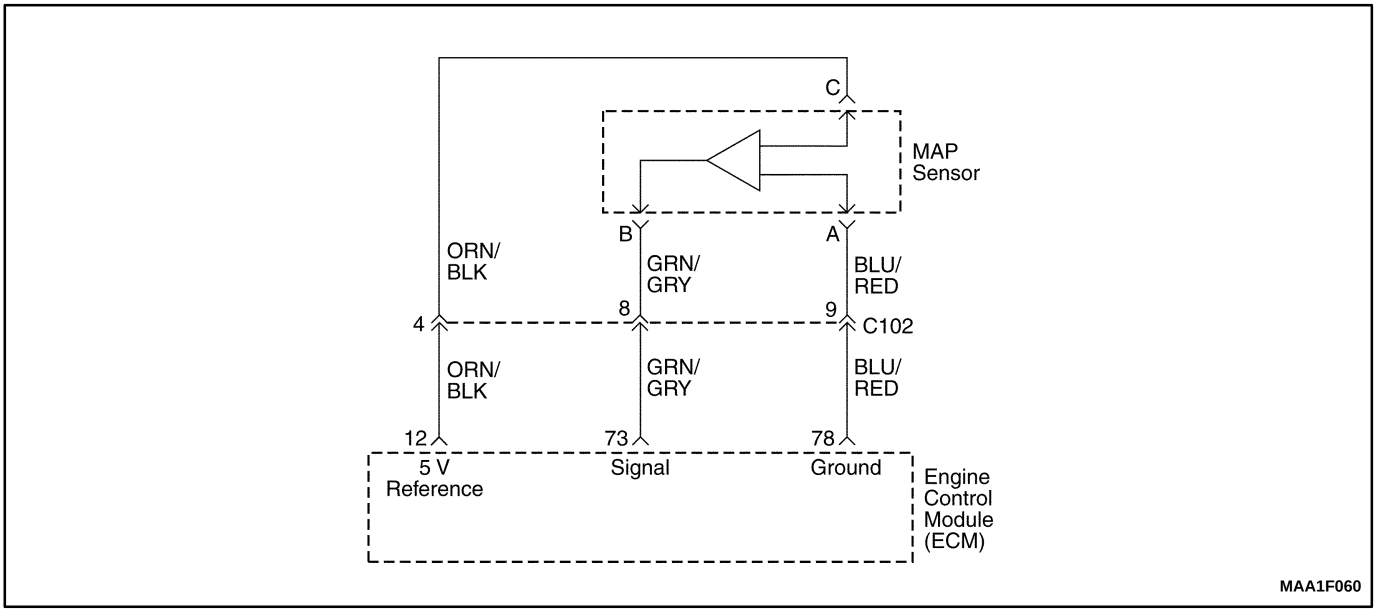
DTC	Function	Error Type	Illuminate MIL
P0107	Manifold Absolute Pressure Sensor Low Voltage	A	YES
P0108	Manifold Absolute Pressure Sensor High voltage	A	YES
P0112	Intake Air Temperature Sensor Low Voltage	E	YES
P0113	Intake Air Temperature Sensor High voltage	E	YES
P0117	Engine Coolant Temperature Sensor Low Voltage	A	YES
P0118	Engine Coolant Temperature Sensor High voltage	A	YES
P0122	Throttle Position Sensor Low Voltage	A	YES
P0123	Throttle Position Sensor Hig voltage	A	YES
P0131	Oxygen Sensor Low Voltage	A	YES
P0132	Oxygen Sensor High Voltage	A	YES
P0133	Oxygen Sensor No Activity	E	YES
P0137	Heated Oxygen Sensor Low Voltage	E	YES
P0138	Heated Oxygen Sensor high voltage	E	YES
P0140	Heated Oxygen Sensor No Activity	E	YES
P0141	Heated Oxygen Sensor Heater Malfuction	E	YES
P0171	Fuel Trim System Too Lean	E	YES
P0172	Fuel Trim System Too Rich	E	YES
P1230	Fuel Pump Relay Low Voltage	A	YES
P1231	Fuel Pump Relay High Voltage	A	YES
P0261	Injector 1 Low Voltage	A	YES
P0262	Injector 1 high voltage	A	YES
P0264	Injector 2 Low Voltage	A	YES
P0265	Injector 2 high voltage	A	YES
P0267	Injector 3 Low Voltage	A	YES
P0268	Injector 3 high voltage	A	YES
P0300	Multifle Cylinder Misfire	A/E	BLINKING/ON
P1320	Crankshatft Segment Period Segment Adaptation At Limit	E	YES
P1321	Crankshatft Segment Period Tooth Error	E	YES
P0327	Knock Sensor Circuit Fault	E	YES
P0335	Magnetic Crankshaft Position Sensor Electrical Error	E	YES

Diagnostic Trouble Codes (Cont'd)

DTC	Function	Error Type	Illuminate MIL
P0336	58X Crankshaft Position Sensor Extra/missing Pulse	E	YES
P0337	58X Crankshaft Sensor No Signal	E	YES
P0341	Camshaft Position Sensor Rationality	E	YES
P0342	Camshaft Position Sensor No Signal	E	YES
P0351	Ignition Signal Coil A Fault	A	YES
P0352	Ignition Signal Coil B Fault	A	YES
P0353	Ignition Signal Coil C Fault	A	YES
P1382	Rough Road Data Invalid (Non ABS)	Cnl	NO
P1382	Rrough Road Data Invalid (ABS)	Cnl	NO
P1385	Rough Road Sensor Circuit Fault (Non ABS)	Cnl	NO
P1385	Rough Road Sensor Circuit Fault (ABS)	Cnl	NO
P0400	Exhaust Gas Recirculation Out of Limit	E	YES
P1402	Exhaust Gas Recirculation Blocked	E	YES
P1403	Exhaust Gas Recirculation Valve Failure	E	YES
P0404	Electric Exhaust Gas Recirculation (EEGR) Opend	E	YES
P1404	Electric Exhaust Gas Recirculation (EEGR) Closed	E	YES
P0405	EEGR Pintle Position Sensor Low Voltage	E	YES
P0406	EEGR Pintle Position Sensor High voltage	E	YES
P0420	Catalyst Low Efficiency	E	YES
P0444	EVAP Purge Control Circuit No Signal	E	YES
P0445	EVAP Purge Control Circuit Fault	E	YES
P0462	Fuel Level Sensor Low Voltage	Cnl	NO
P0463	Fuel Level Sensor High voltage	Cnl	NO
P0480	Low Speed Cooling Fan Relay Circuit Fault (Without A/C)	Cnl	NO
P0480	Low Speed Cooling Fan Relay Circuit Fault (With A/C)	Cnl	NO
P0481	High Speed Cooling Fan Relay High Voltage (Without A/C)	Cnl	NO
P0481	High Speed Cooling Fan Relay High Voltage (With A/C)	Cnl	NO
P0501	Vehicle Speed No Signal (M/T Only)	A	YES
P0505	Idle Air Control Valve (IACV) Error	E	YES
P1535	Evaporator Temperature Sensor High Voltage	Cnl	NO
P1536	Evaporator Temperature Sensor Low Voltage	Cnl	NO
P1537	A/C Compressor Relay High Voltage	Cnl	NO
P1538	A/C Compressor Relay Low Voltage	Cnl	NO
P0562	System Voltage (Engine Side) Too Low	Cnl	NO
P0563	System Voltage (Engine Side) Too High	Cnl	NO
P0601	Engine Control Module Checksum Error	E	YES
P0604	Engine Control Module RAM Error	E	YES
P0605	Engine Control Module NMVY Write Error	E	YES
P1610	Main Relay High Voltage	A	YES
P1611	Main Relay Low Voltage	A	YES
P1628	Immobilizer No Successful Communication	Cnl	NO
P1629	Immobilizer Wrong Computation	Cnl	NO
P0656	Fuel Level Gauge High Circuit Fault	Cnl	NO

Diagnostic Trouble Codes (Cont'd)

DTC	Function	Error Type	Illuminate MIL
P1660	Malfunction Indicator Lamp(MIL) High Voltage	E	YES
P1661	Malfunction Indicator Lamp(MIL) Low Voltage	E	YES



DIAGNOSTIC TROUBLE CODE (DTC) – P0107
MANIFOLD ABSOLUTE PRESSURE SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure, which results from engine load (intake manifold vacuum) and the rpm changes; and converts these into voltage outputs. The ECM sends a 5 volt-reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the MAP sensor also changes. By monitoring the MAP sensor output voltage, the ECM knows the manifold pressure. A low-pressure (low voltage) output voltage will be about 1.0 to 1.5 volts at idle, while higher pressure (high voltage) output voltage will be about 4.5 to 5.0 at wide open throttle (WOT). The MAP sensor is metric pressure, allowing the ECM to make adjustments for different altitudes.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.

(Case A)

- When the engine idling.
- No throttle position(TP) sensor fail conditions present.
- Engine speed(rpm) is less than 2,500rpm.
- The MAP is less than 15kPA.

(Case A)

- When the engine part load.
- The engine revolution speed is less than 4,000rpm.
- No Throttle Position (TP) Sensor fails conditions present.
- The Throttle Position (TP) angle greather than 20.0
- The MAP is less than 15 kPA.

An open or low voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will substitutes a fixed MAP value and use TP to control the fuel delivery (the scan tool will not show defaulted)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmosphere pressure and the signal voltage will be high.

The ECM as an indication of vehicle altitude uses this information. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4volt.

If a DTC P 0107 is intermittent, refer to *“Manifold Absolute Pressure Check”* in this Section for further diagnosis.

If the connections are OK monitor the manifold absolute pressure (MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

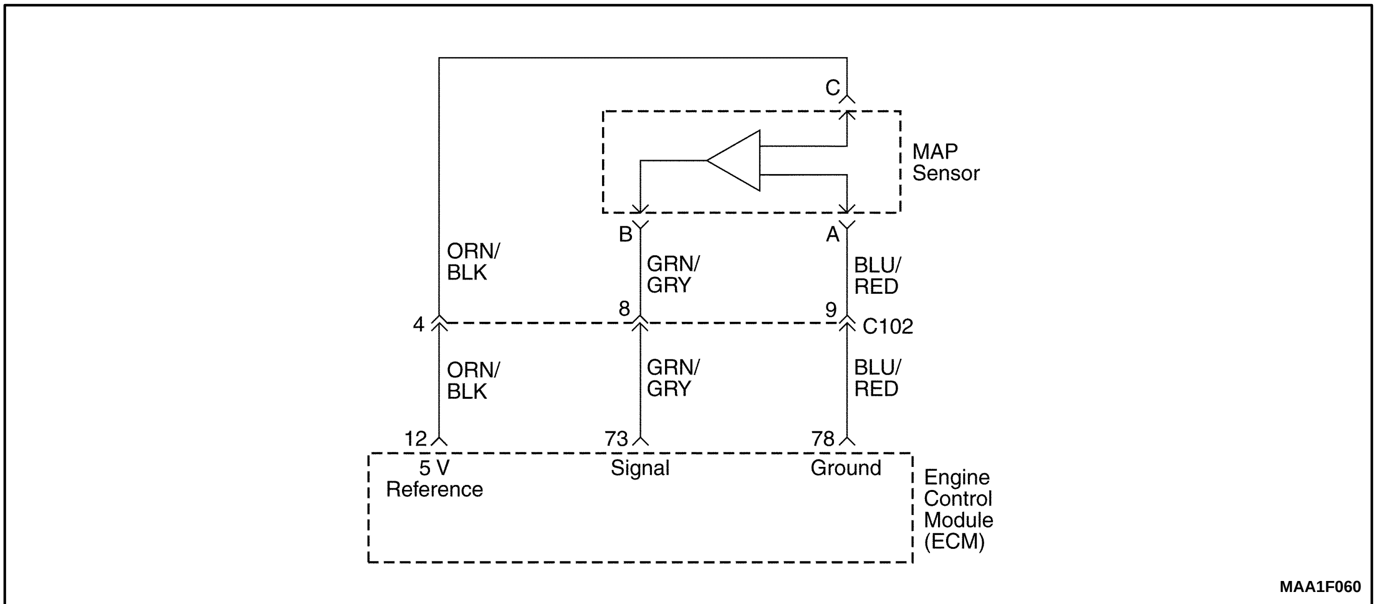
DTC P0107 – Manifold Absolute Pressure Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector (DLC). 2. Turn the ignition switch to ON. Does the scan tool show the manifold absolute pressure (MAP) sensor voltage above the value specified?	4V	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 88kPA (20in.of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0–1.5V	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the MAP sensor connector. 3. Turn the ignition switch to ON. 4. Measure the voltage between the MAP sensor connector terminals A and C. Does the voltage measure within the value specified?	4.5–5.0V	Go to *Step 5*	Go to *Step 6*
5	Connect a fused jumper between the MAP sensor connector terminals B and C. Does the scan tool show the MAP sensor voltage above the value specified?	4V	Go to *Step 11*	Go to *Step 9*
6	Measure the voltage between the MAP sensor connector terminal A and ground. Does the voltage measure within the value specified?	4.5–5.0V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Check for open wires between the MAP sensor connector terminal A and the ECM connector terminal 78. Is the problem found?	–	Go to *Step 10*	Go to *Step 12*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal C and the ECM connector terminal 12. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*
9	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal B and the ECM connector terminal 73. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*

DTC P0107 – Manifold Absolute Pressure Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
11	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
12	Replace the ECM. Is the replacement complete?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0108 MANIFOLD ABSOLUTE PRESSURE SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) uses the Manifold Absolute Pressure (MAP) sensor to control the fuel delivery and the ignition timing. The MAP sensor measures the changes in the intake manifold pressure, which results from engine load (intake manifold vacuum) and the rpm changes; and converts these into voltage outputs. The ECM sends a 5 volt-reference voltage to the MAP sensor. As the manifold pressure changes, the output voltage of the MAP sensor also changes. By monitoring the MAP sensor output voltage, the ECM knows the manifold pressure. A low-pressure (low voltage) output voltage will be about 1.0 to 1.5 volts at idle, while higher pressure (high voltage) output voltage will be about 4.5 to 4.8 at wide open throttle (WOT). The MAP sensor is metric pressure, allowing the ECM to make adjustments for different altitudes.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Engine speed is greater than 2,000rpm.
- No throttle position sensor (TPS) fail conditions present.
- The MAP is greater than 600m bar.
- A high voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The ECM will substitutes a fixed MAP value and use TP to control the fuel delivery (the scan tool will not show defaulted)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

With the ignition ON and the engine stopped, the manifold pressure is equal to atmosphere pressure and the signal voltage will be high.

The ECM as an indication of vehicle altitude uses this information. Comparison of this reading with a known good vehicle with the same sensor is a good way to check the accuracy of a suspect sensor. Readings should be the same ±0.4volt.

If a DTC P 0108 is intermittent, refer to *“manifold absolute pressure check”* in this Section for further diagnosis.

If the connections are OK monitor the manifold absolute pressure(MAP) sensor signal voltage while moving related connectors and the wiring harness. If the failure is induced, the display on the scan tool will change. This may help to isolate the location of an intermittent malfunction.

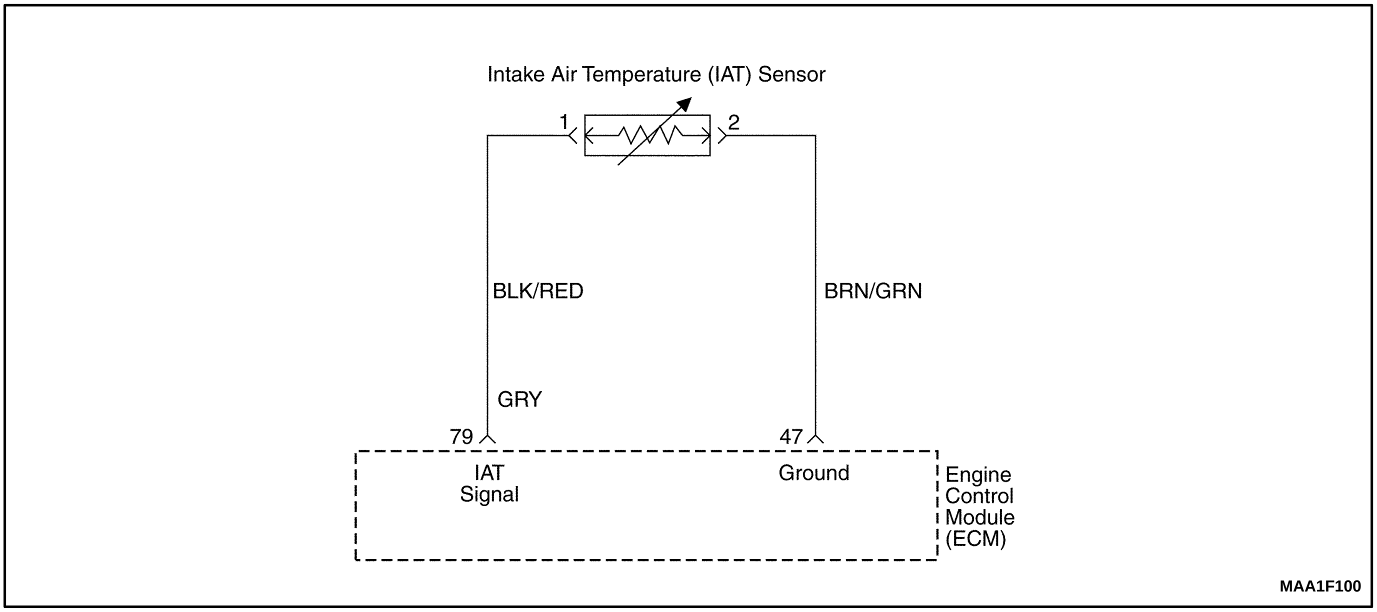
DTC P0108 – Manifold Absolute Pressure Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector (DLC). 2. Turn the ignition switch to ON. Does the scan tool show the manifold absolute pressure (MAP) sensor voltage above the value specified?	4V	Go to *Step 3*	Go to *Step 4*
3	1. Disconnect the vacuum line from the MAP sensor. 2. Apply 66kPA (20in.of Hg) of vacuum to the MAP sensor. Does the scan tool show the MAP sensor voltage within the value specified?	1.0–1.5V	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the MAP sensor connector. 3. Turn the ignition switch to ON. 4. Measure the voltage between the MAP sensor connector terminals A and C. Does the voltage measure within the value specified?	4.5–5.0V	Go to *Step 5*	Go to *Step 6*
5	Connect a fused jumper between the MAP sensor connector terminals B and C. Does the scan tool show the MAP sensor voltage above the value specified?	4V	Go to *Step 11*	Go to *Step 9*
6	Measure the voltage between the MAP sensor connector terminal A and ground. Does the voltage measure within the value specified?	4.5–5.0V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Check for open wires between the MAP sensor connector terminal A and the ECM connector terminal 78. Is the problem found?	–	Go to *Step 10*	Go to *Step 12*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal C and the ECM connector terminal 12. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*
9	1. Turn the ignition switch to LOCK. 2. Check for an open or short to ground in the wire between the MAP sensor connector terminal B and the ECM connector terminal 73. Is the problem found ?	–	Go to *Step 10*	Go to *Step 12*
10	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–

DTC P0108 – Manifold Absolute Pressure Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the manifold absolute pressure sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
12	Replace the ECM. Is the replacement complete?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0112 INTAKE AIR TEMPERATURE SENSOR LOW VOLTAGE

Circuit Description

The Intake Air Temperature (IAT) Sensor uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a 5 volt reference voltage and a ground to the sensor. When the air is cold, the resistance is high ; therefore IAT sensor signal voltage will be high. If the intake air is warm, resistance is low ; therefore the IAT sensor signal voltage will be low.

Conditions for Setting the DTC

- The engine rum time is greater than 3 seconds.
- IAT voltage is less than 0.01V

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).
- The ECM will default to 60°C(140°F)for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

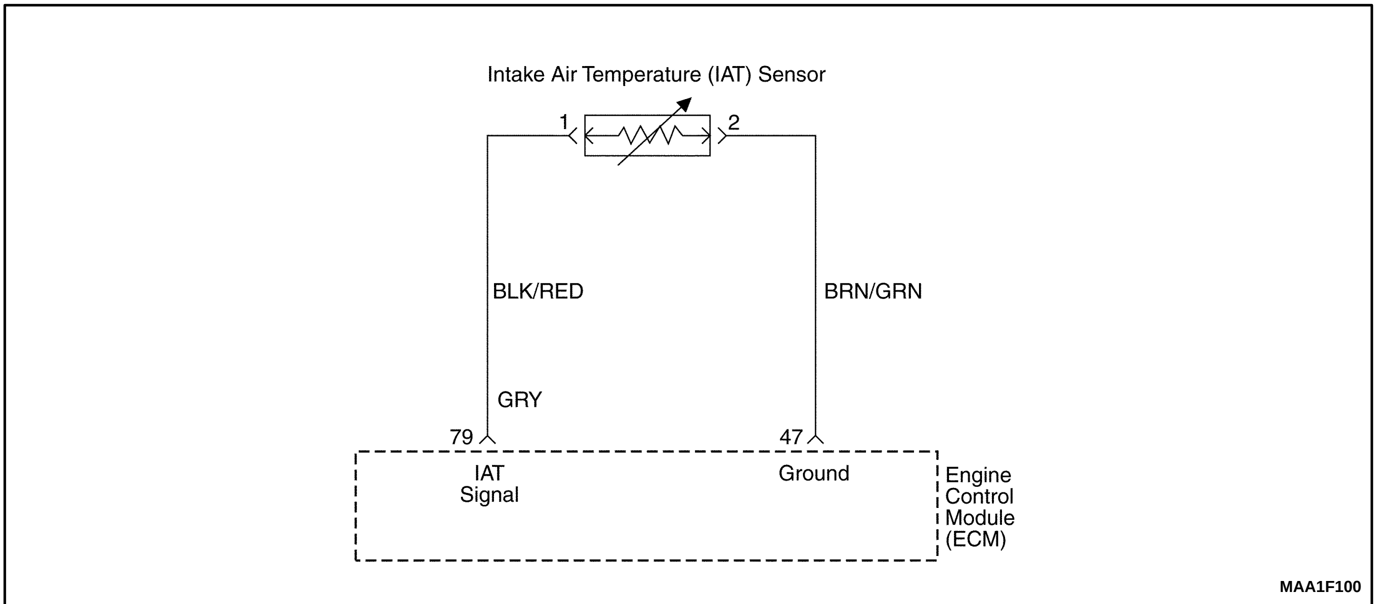
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic aids

If the vehicle is at ambient temperature, compare the IAT sensor to the engine coolant temperature(ECT) sensor. The IAT sensor and the ECT sensor should be relatively close to each other. Use the temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to *“Temperature vs. Resistance”* in this Section.

DTC P0112 – Intake Air Temperature Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector(DLC). 2. Run the engine until it reaches operating temperature. Does the scan tool show the IAT sensor reading within the value specified?	15–80°C	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the IAT sensor connector. 3. Turn the ignition switch to ON. Does the scan tool show the IAT sensor reading within the value specified?	≤ -30°C	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals at the IAT sensor connector. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
5	Check for wire for a short to ground between the IAT connector terminal 1 and the ECM connector terminal 79. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	Check for wire for a short to ECM reference voltage between the IAT sensor connector terminal 2 and the ECM connector terminal 47. Is the problem found?	4.5–5.0V	Go to *Step 7*	Go to *Step 9*
7	1. Turn the ignition switch to LOCK. 2. Repair the wire or the connector terminal as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to LOCK. 2. Replace the IAT sensor. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Turn the ignition switch to LOCK. 2. Replace the engine control module(ECM). 3. Run the engine until it reaches operating temperature. 4. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0113 INTAKE AIR TEMPERATURE SENSOR HIGH VOLTAGE

Circuit Description

The Intake Air Temperature (IAT) Sensor uses a thermistor to control the signal voltage to the engine control module (ECM). The ECM supplies a 5 volt reference voltage and a ground to the sensor . when the air is cold, the resistance is high ; therefore IAT sensor signal voltage will be high. If the intake air is warm, resistance is low ; therefore the IAT sensor signal voltage will be low.

Conditions for Setting the DTC

- The engine rum time is greater than 3 seconds.
- IAT voltage is greater than 4.99V.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).
- The ECM will default to last valid value for intake air temperature. The scan tool will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

If the vehicle is at ambient temperature, compare the IAT sensor to the engine coolant temperature (ECT) sensor. The IAT sensor and the ECT sensor should be relatively close to each other.

Use the temperature vs. Resistance Values table to evaluate the possibility of a skewed sensor. Refer to *“Temperature vs. Resistance”* in this Section.

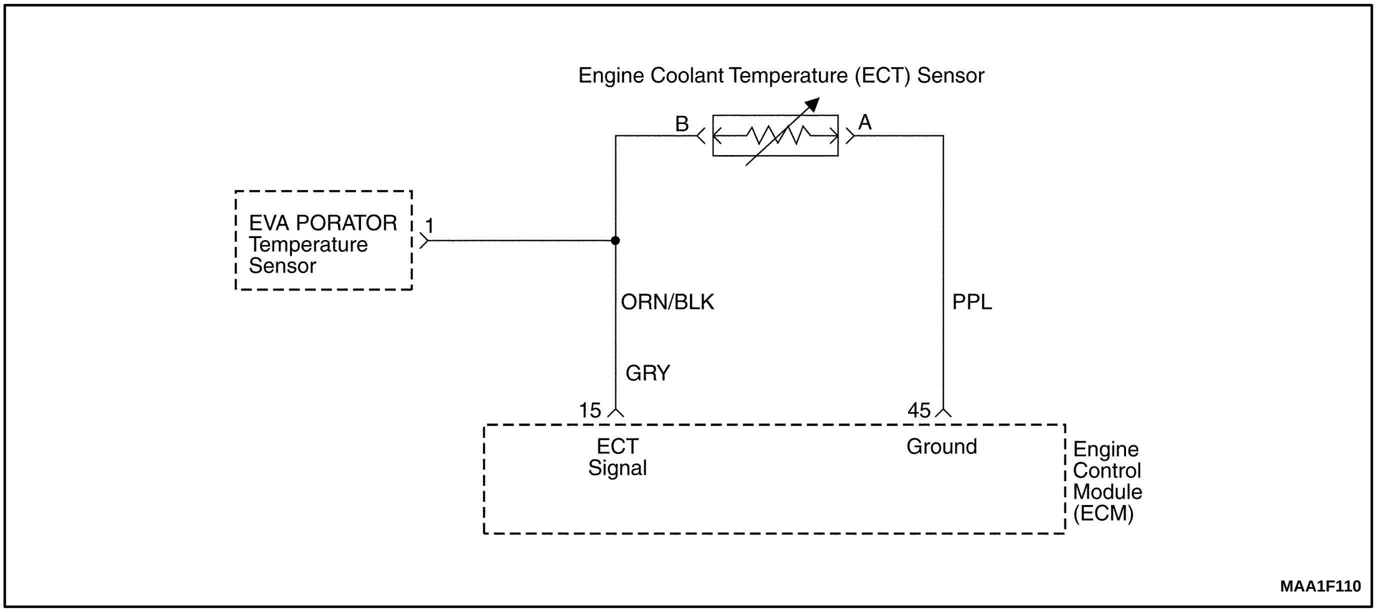
DTC P0113 – Intake Air Temperature Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine unit it reaches operating temperature. Does the scan tool show the intake air temperature (IAT) sensor reading within the value specified?	15~80°C (10~176°F)	Go to "Diagnostic Aids"	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the IAT sensor connector. 3. Jumper to IAT sensor connector terminals. 4. Turn the ignition switch to ON. Does the scan tool show the IAT sensor reading the value specified?	180°C (356°F)	Go to *Step 4*	Go to *Step 5*
4	Check for a faulty connector or terminals 1 and 2 of the IAT sensor connector. Is the problem found?	–	Go to *Step 10*	Go to *Step 9*
5	Measure the voltage between terminals 1 and 2 of IAT sensor connector. Does the voltage measure within the value specified?	4.5~5.5V	Go to *Step 11*	Go to *Step 6*
6	Measure the voltage between the IAT sensor connector terminal 2 and the battery ground(negative) post. Does the voltage measure within the value specified?	4.5~5.5V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Check for an open or short to battery voltage in the wire between the IAT sensor connector terminal 2 and the engine control module(ECM) connector terminal 47. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
8	1. Turn the ignition switch to LOCK. 2. Check for an open or short to battery voltage in the wire between the IAT sensor connector terminal 1 and the ECM connector terminal 79. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
9	1. Turn the ignition switch to LOCK 2. Replace the IAT sensor. 3. Clear any DTCs from the ECM. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
10	1. Turn the ignition switch to LOCK. 2.Repair the wire of the connector terminals as needed. 3. Clear any DTCs from the ECM. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–

DTC P0113 – Intake Air Temperature Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Replace the ECM 2. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 12*	–
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0117 ENGINE COOLANT TEMPERATURE SENSOR LOW VOLTAGE

Circuit Description

The Engine Coolant Temperature sensor (ECT) uses a thermistor to control the signal voltage to the engine control module (ECM).

The ECM supplies a voltage on the signal circuit to the sensor. When the engine coolant is cold, the resistance is high; therefore the ECT signal voltage will be high.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature, the voltage will be between 1.5 and 2.0 volts at the ECT signal terminal.

The ECT sensor is used to the following items:

- Fuel delivery.
- Lock Up Clutch (LUC).
- Ignition.
- Evaporator Emission (EVAP) Canister Purge Valve.
- Electric cooling fan.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- The engine rum time is greater than 3 seconds.
- A low voltage condition exits.
- ECT voltage is less than 0.03V.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will default to 20°C(68°F)for the first 60 seconds of the engine run time, and then 92°C(198°F).
- the scan ttol will not show the defaulted value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

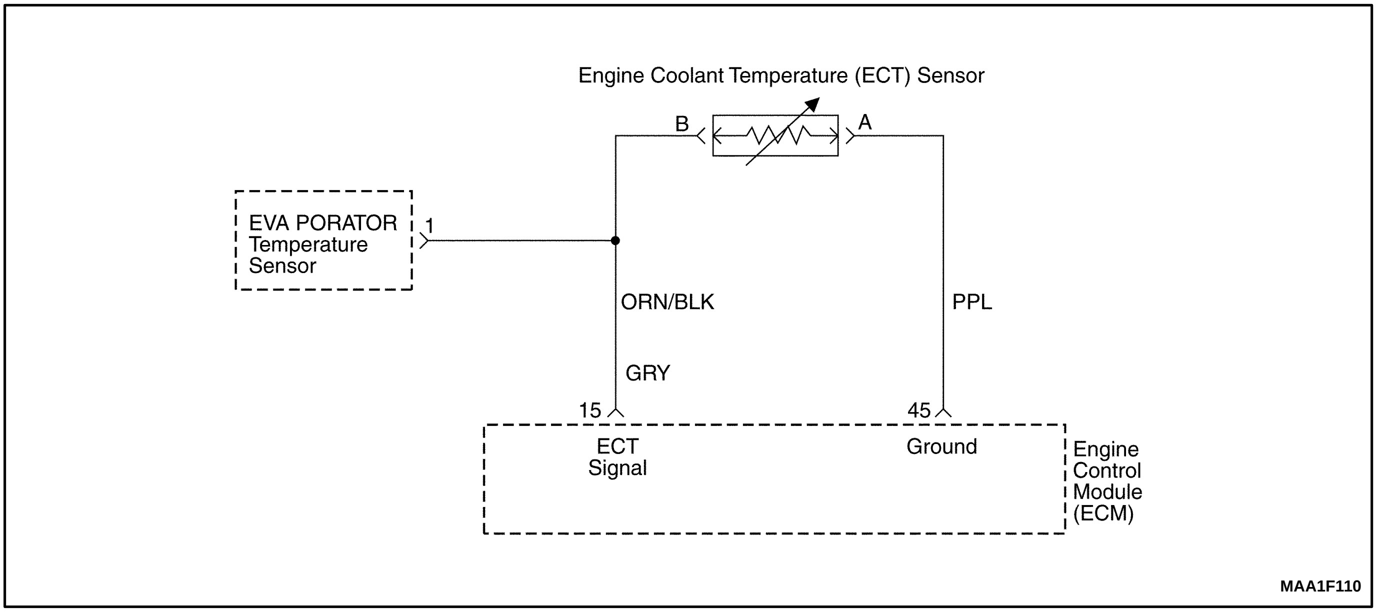
Diagnostic Aids

After the engine has started, the ECT should rise steadily to about 90°C(194°F) then stabilize when the thermostat opens.

Use the temperature vs. resistance values table to evaluate the possibility of a skewed sensor. Refer to *“Temperature vs. Resistance”* in this Section.

DTC P0117 – Engine Coolant Temperature Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine until it reaches operating temperature. Does the scan tool show the ECT sensor reading within the value specified?	80~110°C (176~230°F)	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the ECT sensor connector. 3. Turn the ignition switch to ON. Does the scan tool show the IAT sensor reading within the value specified?	≥-30°C(-22°F)	Go to *Step 4*	Go to *Step 6*
4	1. Jumper the ECT sensor signal circuits at terminal A and B. 2. Turn the ignition switch to ON. Does the scan tool show the ECT sensor reading within the value specified?	≥ 120°C	Go to *Step 5*	Go to *Step 6*
5	1. Replace the ECT sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
6	Measure the voltage between ECT terminal A and ground. Does the voltage measure within the value specified?	4.5–5.0V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring connector. 3. Check for a faulty connector or terminals at the ECT sensor connectors and ECM connectors for short to ECM reference voltage. Is the problem found?	–	Go to *Step 9*	Go to *Step 8*
8	1. Turn the ignition switch to LOCK. 2. Repair the wire of the connector terminals as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Replace the ECM. 2. Run the engine until it reaches operating temperature. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0118 ENGINE COOLANT TEMPERATURE SENSOR HIGH VOLTAGE

Circuit Description

The coolant temperature sensor (ECT) uses a thermistor to control the signal voltage to the engine control module (ECM).

The ECM supplies a voltage on the signal circuit to the sensor. When the air is cold, the resistance is high; therefore the ECT sensor signal voltage will be high.

As the engine warms, the sensor resistance becomes less, and the voltage drops. At normal engine operating temperature, the voltage will be between 1.5 and 2.0 volts at the ECT sensor signal terminal.

The ECT sensor is used to the following items:

- Fuel delivery.
- Lock Up Clutch (LUC).
- Ignition.
- Evaporator Emission (EVAP) Canister Purge Valve.
- Idle Air Control (IAC) valve.
- Electric cooling fan.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- The engine rum time is greater than 3 seconds.
- The ECT sensor indicates that the engine coolant temperature is less than –40°C(–40°F).
- ECT voltage is greater than 4.98V.
- A low voltage condition exits.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The coolant fan turns ON.
- The ECM will substitutes a fixed MAP value and use TP to control the fuel delivery (the scan tool will not show defaulted)

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

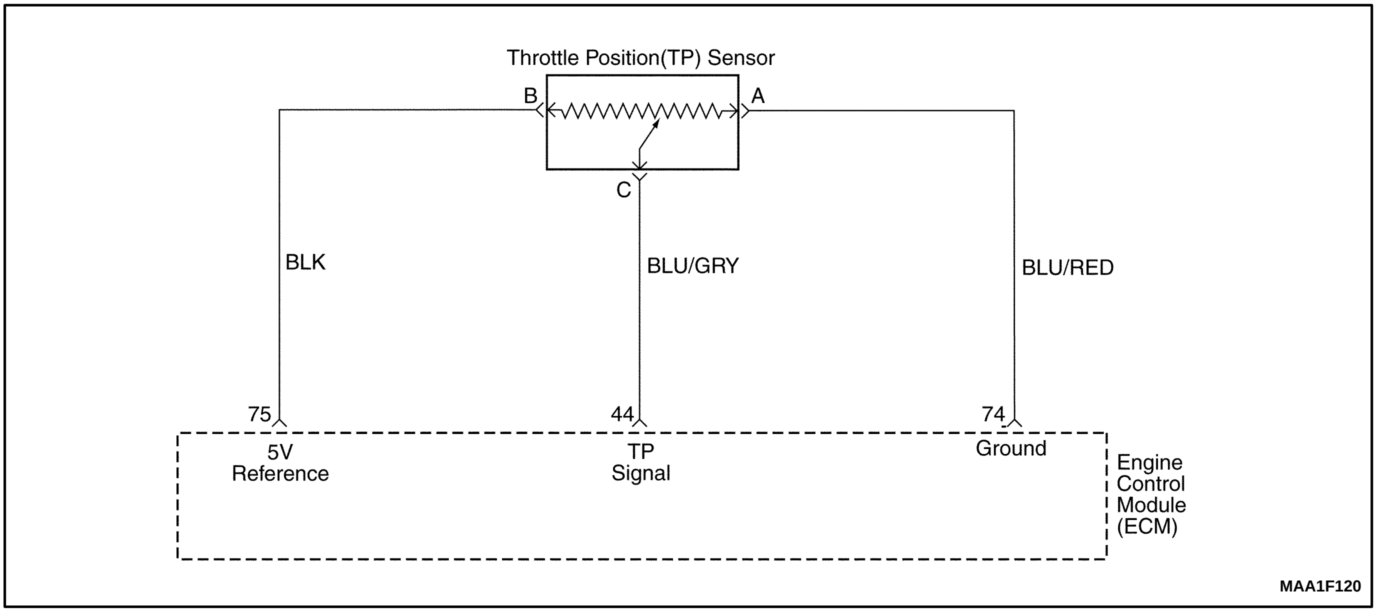
Diagnostic Aids

After the engine has started, the ECT should rise steadily to about 90°C(194°F) then stabilize when the thermostat opens.

Use the temperature vs. resistance values table to evaluate the possibility of a skewed sensor. Refer to *“Temperature vs. Resistance”* in this Section.

DTC P0118 – Engine Coolant Temperature Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine until it reaches operating temperature. Does the scan tool show the ECT sensor reading within the value specified?	80~110°C (176~230°F)	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the ECT sensor connector. 3. Turn the ignition switch to ON. Does the scan tool show the ECT sensor reading within the value specified?	≥ -30°C	Go to *Step 4*	Go to *Step 6*
4	1. Jumper the ECT sensor signal circuits at terminal B and A. 2. Turn the ignition switch to ON. Does the scan tool show the ECT sensor reading within the value specified?	≥180°C (356°F)	Go to *Step 5*	Go to *Step 6*
5	1. Replace the ECT sensor. 2. Clear any DTCs from the ECM. 3. Perform the diagnostic system check. Is the replacement complete?	–	System OK	–
6	Measure the voltage between ECT terminal B and ground. Does the voltage measure within the value specified?	4.5–5.0V	Go to *Step 7*	Go to *Step 8*
7	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring connector. 3. Check for a faulty connector or terminals at the ECT sensor connector terminal A and the ECM connector terminal 45 for an open or short to battery voltage. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	1. Turn the ignition switch to LOCK. 2. Repair the wire of the connector terminals as needed. 3. Clear any DTCs from the ECM. 4. Run the engine until it reaches operating temperature. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Replace the ECM. 2. Run the engine until it reaches operating temperature. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) P0122 THROTTLE POSITION SENSOR LOW VOLTAGE

Circuit Description

The Engine Control Module (ECM) supplies a 5 volt reference voltage signal and a ground to the Throttle Position (TP) sensor. The TP sensor sends a voltage signal back to the ECM relative to the throttle plate opening. The voltage signal will vary from approximately 0.33 volts at closed throttle, to over 4.3 volts at Wide Open Throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs.

Conditions for Setting the DTC

- TP sensor voltage indicates a throttle voltage less than 0.14 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The TP angle will default to 0% when the vehicle speed is less than 3 km/h (2 mph) and 10% when the vehicle speed is greater than 3 km/h (2 mph). The scan tool will not display the default value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC P0122 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use a scan tool information data to determine the status of the DTC. If the dc occurs intermittently, using the Diagnostic table may help isolate the problem.

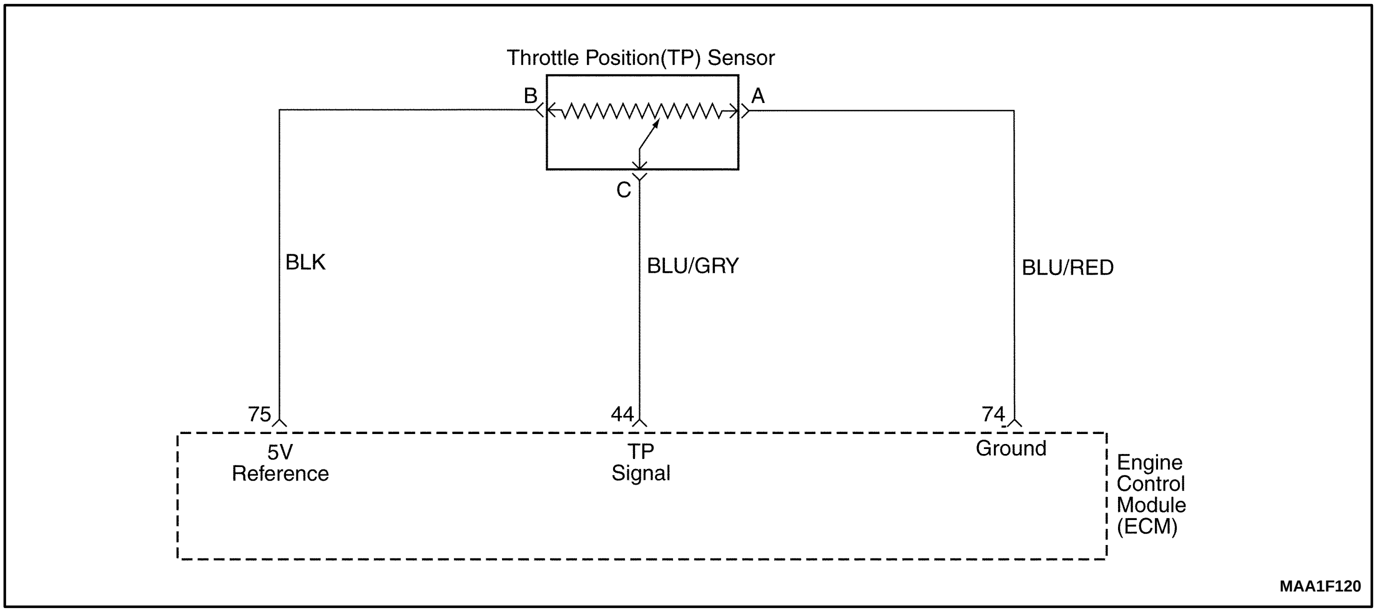
DTC P0122 – Throttle Position Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Throttle Position (TP) sensor voltage below the specified value?	0.20 V	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as noted. Is the TP sensor voltage below the specified value?	0.20 V	Go to *Step 4*	Go to *Step 12*
4	1. Turn the ignition OFF. 2. Disconnect the TP sensor connector. 3. Turn the ignition ON. 4. Jump the 5 volt reference circuit terminal B and the TP signal circuit terminal C at the TP sensor connector. Is the TP sensor voltage over the specified value?	4.0 V	Go to *Step 10*	Go to *Step 5*
5	Connect a test light between B+ and the TP sensor signal circuit terminal C. Is the TP sensor voltage greater than the specified value?	4.0 V	Go to *Step 6*	Go to *Step 8*
6	Check the TP sensor 5 volt reference circuit for an open or short to ground and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 7*
7	Check the 5 volt reference circuit for a poor connection at terminal 75 of the Engine Control Module (ECM) and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
8	Check the TP sensor signal circuit between terminal C of the TP sensor and terminal 44 of the ECM for an open or a short to ground and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
9	Check the TP sensor signal circuit, terminal 44 of the ECM for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
10	Replace the throttle body assembly. Is the action complete?	–	Go to *Step 12*	–
11	1. Turn the ignition switch OFF. 2. Replace the ECM. Is the action complete?	–	Go to *Step 12*	–

DTC P0122 – Throttle Position Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) P0123
THROTTLE POSITION SENSOR HIGH VOLTAGE

Circuit Description

The Engine Control Module (ECM) supplies a 5 volt reference voltage signal and a ground to the Throttle Position (TP) sensor. The TP sensor sends a voltage signal back to the ECM relative to the throttle plate opening. The voltage signal will vary from approximately 0.33 volts at closed throttle, to over 4.3 volts at Wide Open Throttle (WOT).

The TP signal is used by the ECM for fuel control and for most of the ECM controlled outputs. The TP signal is one of the most important inputs used by the ECM for fuel control and most of the ECM controlled outputs.

Conditions for Setting the DTC

- TP sensor voltage indicates a throttle voltage greater than 4.9 volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- The TP angle will default to 0% when the vehicle speed is less than 3 km/h (2 mph) and 10% when the vehicle speed is greater than 3 km/h (2 mph). The scan tool will not display the default value.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

If the DTC P0123 cannot be duplicated, the information included in the Freeze Frame data can be useful. Use a scan tool information data to determine the status of the DTC. If the dc occurs intermittently, using the Diagnostic table may help isolate the problem.

With ignition ON and the throttle at closed position, the voltage should read between 0.2 and 0.90 volts and increase steadily to over 4.3 volts at WOT.

DTCs P0123 and P0113 stored at the same time could be result of an open sensor ground circuit.

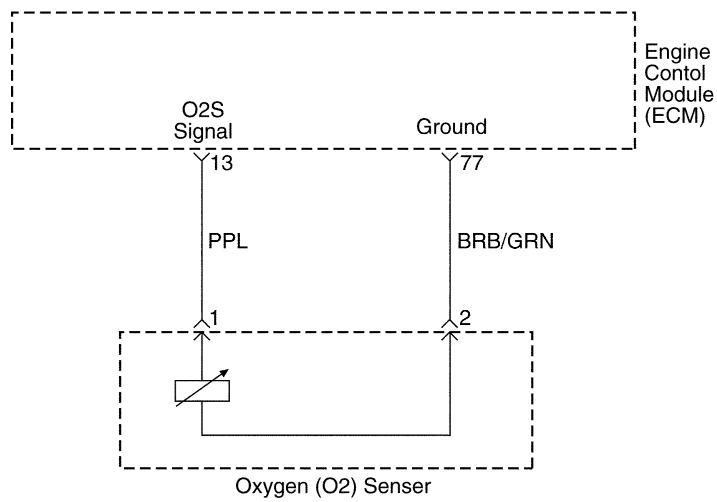
DTC P0123 – Throttle Position Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Is the Throttle Position (TP) sensor voltage greater than the specified value?	1.0 V	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting the DTC as noted. Is the TP sensor voltage greater than the specified value?	3.9 V	Go to *Step 4*	Go to *Step 12*
4	1. Turn the ignition OFF. 2. Disconnect the TP sensor connector. 3. Turn the ignition ON. Is the TP sensor voltage less than the specified value?	0.2 V	Go to *Step 5*	Go to *Step 6*
5	Probe the TP sensor ground circuit, terminal A at the TP sensor connector with a test light connected to B+. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 9*
6	Check the TP sensor signal circuit for an short to voltage and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
7	Check the 5 volt reference circuit for a short to B+ and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 8*
8	Check the TP sensor electric connector for a poor connection and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
9	Check the TP sensor ground circuit for an open and repair as needed. Is the repair complete?	–	Go to *Step 12*	Go to *Step 11*
10	Replace the throttle body assembly. Is the action complete?	–	Go to *Step 12*	–
11	1. Turn the ignition switch OFF. 2. Replace the Engine Control Module (ECM). Is the action complete?	–	Go to Step 12	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P0123 – Throttle Position Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0131 OXYGEN SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450m volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 350°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

(Case A)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The oxygen sensor voltage is below 0.07V for at least 40seconds.
- DTCs P0107, P0108, P0117, P0118, P0122, P0123, P0335, P0336, P0341, P0342, P0400, P0404, P0405, P0406, P0445, P0444 are NOT SET.

(Case B)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The oxygen sensor voltage is between 0.352 and 0.499 at least 10seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 0.1volts and 0.9 volts while in closed loop.

Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.

Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.

Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.

Vacuum of crankcase leaks will cause a lean running condition.

An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

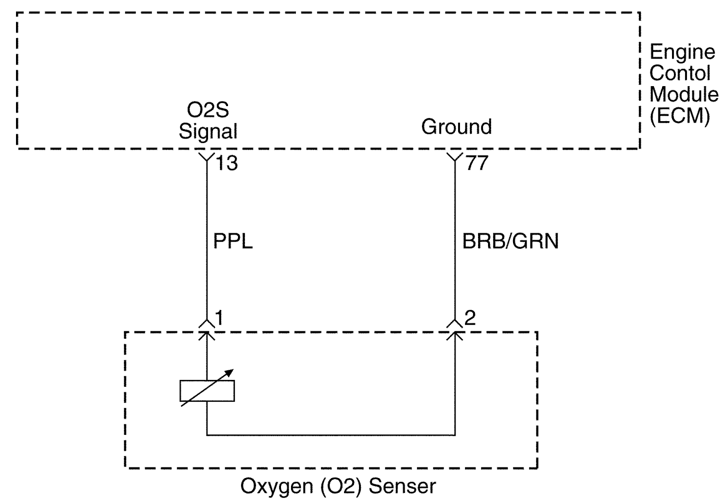
DTC P0131 – Oxygen Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector(DLC). 2. Run the engine until it reaches operating temperature. 3. Check for closed loop operation. Does the engine control module(ECM) go into closed loop?	–	Go to *Step 3*	Go to *Step 9*
3	1. Run the until until it reaches operating temperature? 2. Run the engine at 1,200rpm. Does the scan tool read the upstream oxygen(O_2) sensor signal voltage between the valve specified?	0.15~0.7V	Go to *Step 5*	Go to *Step 4*
4	Does the scan tool read the Oxygen sensor signal voltage fixed below the valve specified?	0.01V	Go to *Step 7*	Go To "Diagnostic Aids"
5	1. Disconnect the Oxygen sensor connector. 2. Run the warm engine at idle. Does the scan tool read the Oxygen sensor signal voltage between the valve specified?	0.15~0.7V	Go To "Diagnostic Aids"	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check the Oxygen sensor wire between the Oxygen sensor and the ECM connector terminal 77 and 13 is open. Is the problem found?	–	Go to *Step 8*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Check the Oxygen sensor wire between the Oxygen sensor and the ECM connector terminal 77 for a short to ground. Is the problem found?	–	Go to *Step 8*	Go to *Step 11*
8	1. Repair the wire or the connector terminal as needed. 2. Clear the any DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Turn the ignition switch to LOCK. 2. Disconnect the Oxygen sensor connector. 3. Turn the ignition switch to ON. Does the scan tool the Oxygen sensor signal voltage between the valve specified?	0.15~0.7V	Go to *Step 11*	Go to *Step 10*
10	1. Replace the Oxygen sensor. 2. Clear the DTCs from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
11	1. Replace the ECM. 2. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 12*	–

DTC P0131 – Oxygen Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0132 OXYGEN SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 350°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- The oxygen sensor voltage is more than 4.8V for at least 0.2 seconds.
- A high voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

Normal scan tool voltage varies between 0.1volts and 0.9volts while in closed loop.

Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.

Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.

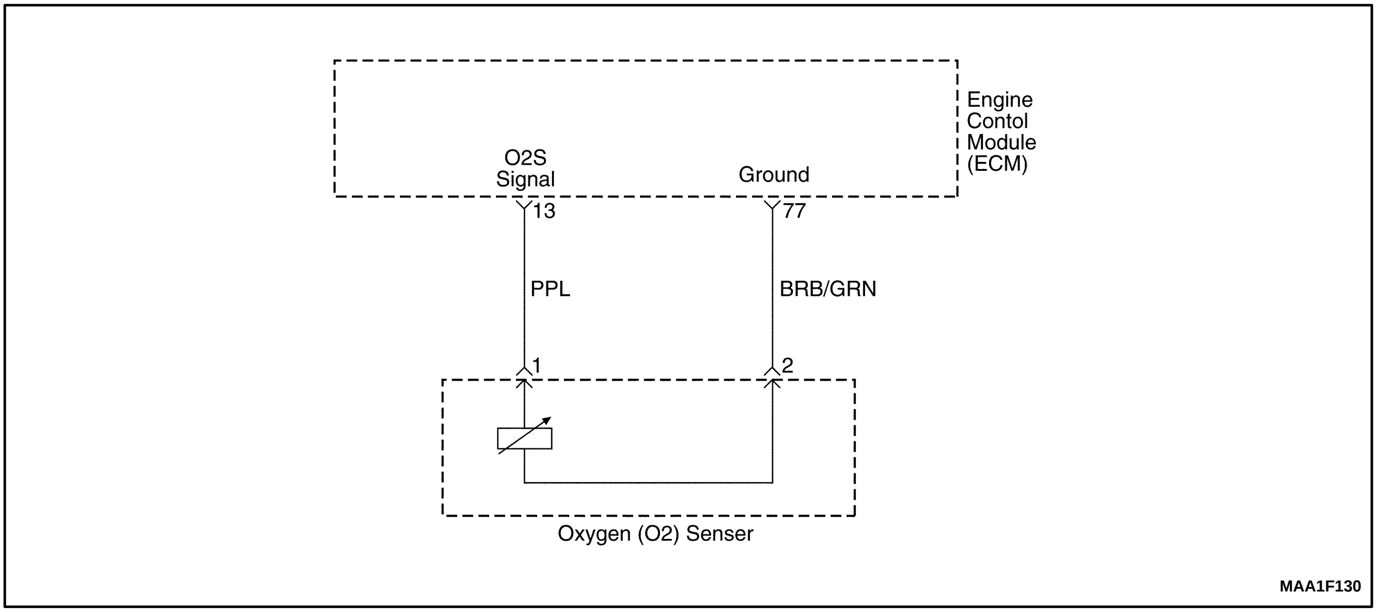
Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.

Vacuum of crankcase leaks will cause a lean running condition.

An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0132 – Oxygen Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON, with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. 4. Run the engine at 1,200rpm. Does the scan tool the upstream oxygen(O2) sensor1 voltage within the value specified?	More than 1.2V	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the O2 sensor connector and engine control module (ECM) connector. 3. Check the O2 sensor wire between the O2 sensor and ECM connector terminal 13 for short to battery voltage. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
6	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
7	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0133 OXYGEN SENSOR NO ACTIVITY

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes "open loop" operation.

Conditions for Setting the DTC

- The engine controls system is in closed loop.
- Engine Coolant Temperature is higher than 60°C (140°F).
- The mass air flow(MAF) is between 75mg/tdc and 100mg/tdc.
- The engine speed is between 3,008rpm and 3,500rpm.
- The vehicle speed is between 45km/h(27.96mph) and 55km/h(34.2mph).
- The manifold air pressure is higher than 90kPa.
- The ignition is at 10 volts.
- The upstream O_2 sensor periods higher than 1.6 seconds.
- A number of glitches higher than 5 during the test.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0131, P0132, P0137, P0138, P1671, P0300, P0335, P0336, P0341, P0400, P0404, P0405, P0444, P0445 are NOT SET.

Action Taken when the DTC Sets

- Emission related.
- "Armed" after two trip with a fail.
- "Disarmed" after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Normal scan tool voltage varies between 0.15 to 8.5mV while in Closed Loop. If DTC P0133 is intermittent, refer to *"Intermittent"* in this Section.

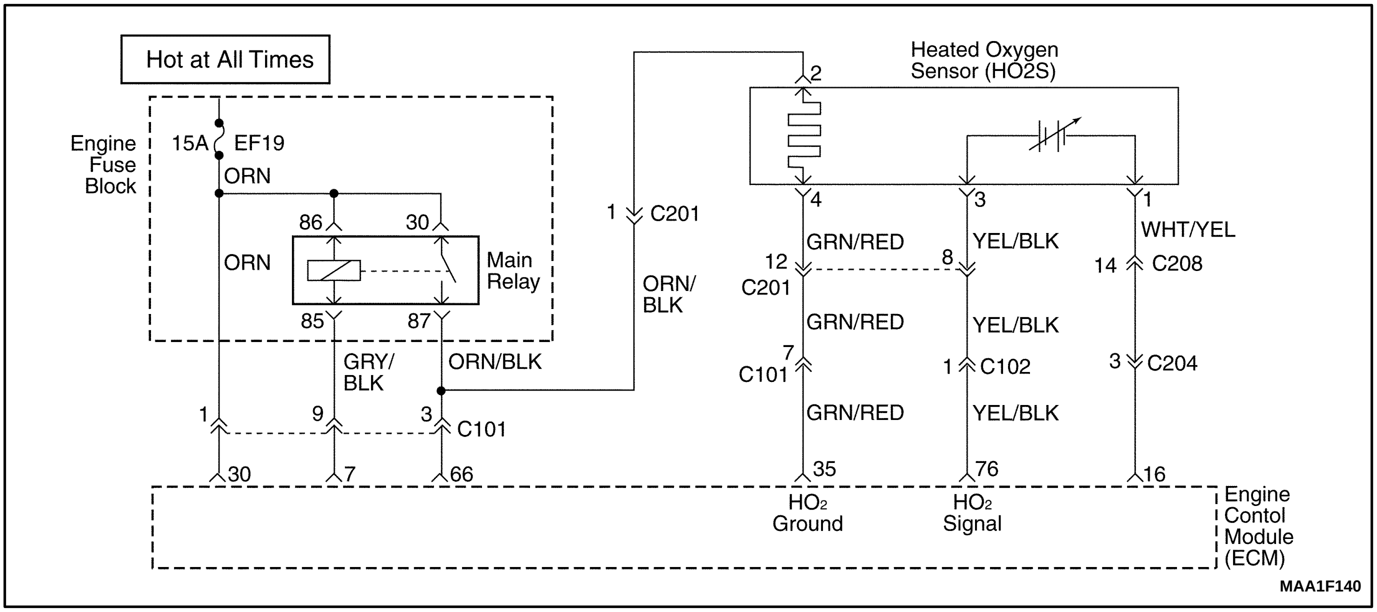
DTC P0133 – Oxygen Sensor No Activity

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Connect the scan tool to the data link connector (DLC). 2. Run the engine until it reaches operating temperature. 3. Check for the closed loop operation. Does the scan tool indicate the closed loop?	–	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition switch to LOCK. 2. Review the freeze frame data and note the parameters. 3. Operate the vehicle within the freeze frame conditions and Conditions for Setting the DTC. Does the scan tool indicate the closed loop?	–	Go to *Step 12*	Go to *Step 4*
4	1. Disconnect the upstream oxygen(O_2) sensor connector 2. Jumper the oxygen sensor connector terminal 1 to ground. 3. Turn the ignition switch to ON. Does the scan tool read the oxygen sensor signal voltage the specified valve?	0.4~0.5V	Go to *Step 5*	Go to *Step 8*
5	Check the oxygen sensorconnector for malfunction terminals or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 6*
6	1. Run the engine at idle. 2. Remove the jumper wire. 3. Measure the voltage between the oxygen sensor connector terminal 2 and ground. Does the oxygen sensor voltage measure above the specified value?	0.6V	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK 2. Measure the voltage between the upstream O_2 sensor connector terminal 2 and ground. Does the oxygen sensor voltage measure above the specified value?	0.3V	Go to *Step 9*	Go to *Step 11*
8	Repair the wire or the connector between the upstre O_2 sensor terminal 1 and the engine control module (ECM) terminal 13 is open or a short to ground. Is the repair complete?	–	Go to *Step 11*	Go to *Step 9*
9	Repair the wire and the connector terminal between the oxygen sensor connector terminal 2 and the ECM connector terminal 77 is open or a short to ground. Is the repair complete?	–	Go to *Step 12*	Go to *Step 10*
10	1. Turn the ignition switch to LOCK 2. Replace the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–

DTC P0133 – Oxygen Sensor No Activity (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the O_2 sensor. Is the repair complete?	–	Go to *Step 12*	–
12	1. Clear any DTCs from the ECM 2. Perform the diagnostic system check Is the repair complete	–	Go to *Step 13*	–
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0137 HEATED OXYGEN SENSOR LOW VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

(Case A)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The heated oxygen sensor voltage is below 0.07V for at least 40 seconds.
- DTCs P0107, P0108, P0117, P0118, P0122, P0123, P0335, P0336, P0341, P0342, P0400, P0404, P0405, P0406 are NOT SET.

(Case B)

- The engine controls system is in closed loop.
- Engine speed is less than 6,000rpm.
- The heated oxygen sensor voltage is between 0.352 and 0.499 at least 60 seconds.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

- Normal scan tool voltage varies between 0.1 volts and 0.9 volts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.
- Perform an injector balance test to determine if a restricted fuel injector may be causing the lean condition.
- Vacuum of crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

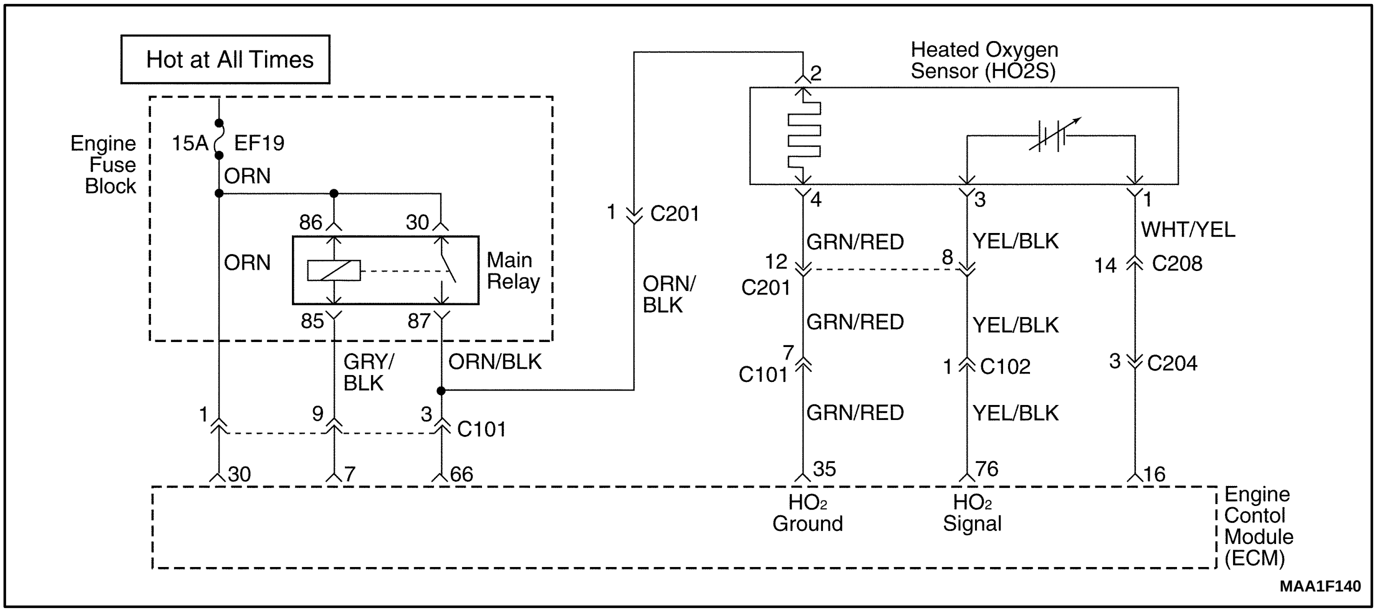
DTC P0137 – Heated Oxygen Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON, with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. 4. Run the engine at 1,200rpm. Does the scan tool the downstream oxygen (O2) sensor1 voltage within the value specified?	0.07–0.352V	Go to *Step 4*	Go to *Step 3*
3	Does the scan tool the heated oxygen (O2) sensor1 voltage within the value specified?	0.1V	Go to *Step 9*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the Heated O2 sensor wire between the Heated O2 sensor connector terminal 4 and ECM connector terminal 35 for short to ground. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
6	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the O2 sensor wire between the O2 sensor connector terminal 3 and ECM connector terminal 76 for short to ground. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 10*	–
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 10*	–

DTC P0137 – Heated Oxygen Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0138 HEATED OXYGEN SENSOR HIGH VOLTAGE

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 64 and 13. The Heated oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The Heated O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- The Heated oxygen sensor voltage is more than 4.8V for at least 0.2 seconds.
- A high voltage condition exists.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

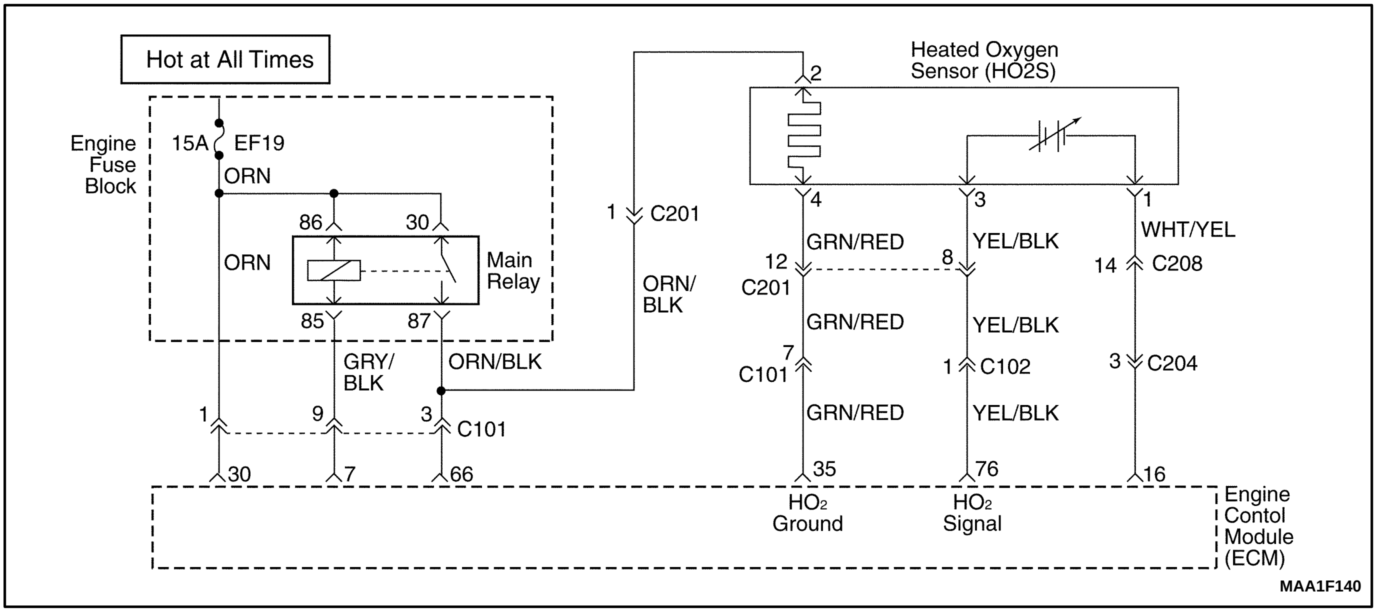
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

- Normal scan tool voltage varies between 0.1volts and 0.9volts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.
- Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.
- Vacuum of crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0138 – Heated Oxygen Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON, with the engine OFF. 2. Install a scan tool. 3. Engine at operating temperature. 4. Run the engine at 1,200rpm. Does the scan tool the Heated oxygen(O2) sensor voltage within the value specified?	More than 1.2V	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the Heated O2 sensor wire between the Heated O2 sensor connector terminal 4 and ECM connector terminal 35 for an open or short to battery voltage. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
6	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
7	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0140 HEATED OXYGEN SENSOR NO ACTIVITY

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 64 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- The engine controls system is in closed loop.
- Engine Coolant Temperature is higher than 70°C (140°F).
- The mass air flow(MAF) is between 25kg/h and 50kg/h.
- The engine speed is between 2,400rpm and 300rpm.
- The vehicle speed is between 64km/h(12.4mph) and 80km/h(24.9mph).
- The manifold air pressure is higher than 70kPa.
- The ignition is at 10 volts.
- No transition from rich side to lean side or lean side to rich side during 7.8 seconds even with a forcing of O_2 sensor controller.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0137, P0138, P0137, P0138, P0137, P0138, P1671, P0300, P0335, P0336, P0341, P0400, P0404, P0405, P0644, P0645 are NOT SET.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

- Normal scan tool voltage varies between 0.15 to 8.5mV while in Closed Loop. If DTC P0140 is intermittent, refer to *“Intermittent”* in this Section.

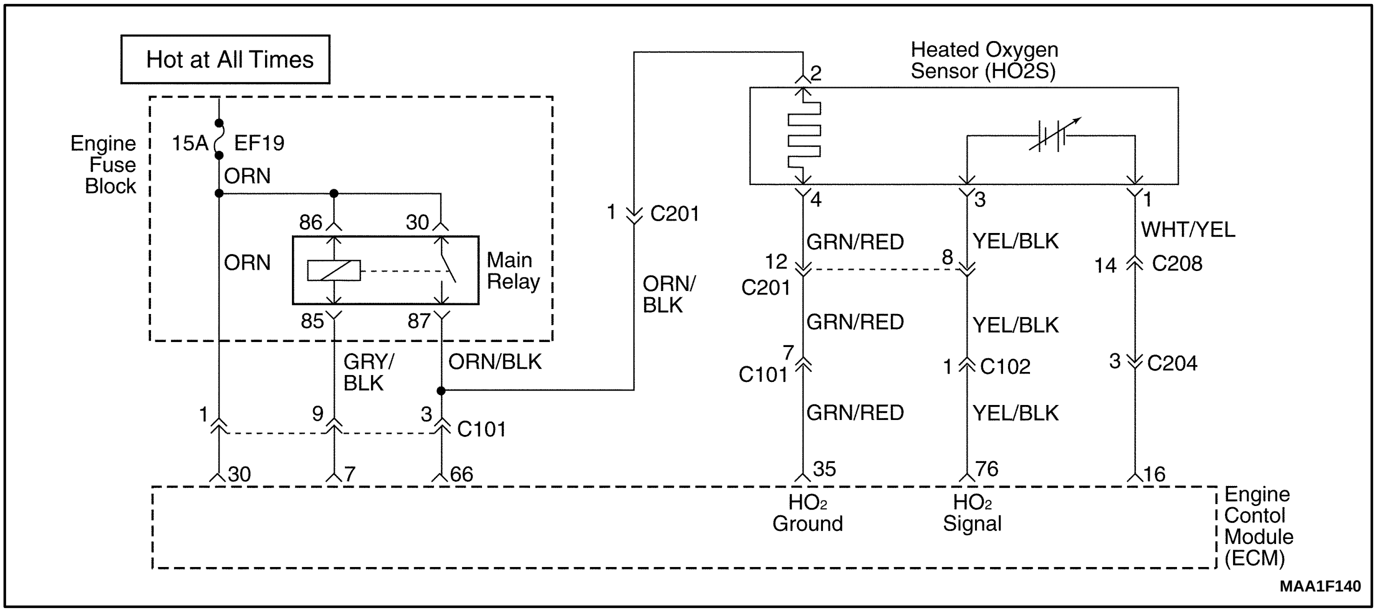
DTC P0140 – Heated Oxygen Sensor No Activity

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Run the engine to above the specified operating temperature. 2. Install a scan tool. 3. Operate the engine above the specified rpm for 2minuets. Does the scan tool the indicate Closed Loop?	80°C(176°F) 1,200 rpm	Go to *Step 3*	Go to *Step 4*
3	1. Turn the Turn the ignition switch to ON. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the freeze frame conditions and Conditions for Setting the DTC as noted? Does the scan tool the indicate Closed Loop?	–	Go to *Step 12*	Go to *Step 4*
4	Disconnect the Heated O2 sensor connector and jumper the Heated O2 sensor low circuit, terminal 4 to ground. Is the HO2 voltage below the specified value and does the scan tool indicate the heated oxygen sensor heater voltage within the specified value?	0.5V	Go to *Step 5*	Go to *Step 6*
5	Check the Heated O2 sensor connector for malfunction terminals or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 9*
6	1. Turn the ignition switch to On. 2. Remove the jumper wire. 3. Using a digital voltmeter(DVM), measure the voltage between the Heated O2 sensor signal circuit, terminal 3 to ground. Does the Heated O2 sensor voltage measure above the specified value?	0.6V	Go to *Step 10*	Go to *Step 9*
7	Does the Heated O2 sensor voltage measure below the specified value?	0.3V	Go to *Step 11*	Go to *Step 8*
8	Check the Heated O2 sensor ground circuit, terminal 4 for an open or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 8*
11	Check the Heated O2 sensor signal circuit, terminal 3 for an open or poor connection and repair as necessary. Is repair necessary?	–	Go to *Step 12*	Go to *Step 8*
10	1. If disconnected, reconnect Heated O2 sensor connector. 2. Using the scan tool, clear the DTCs. 3. Start the engine and idle at normal operating temperature. 4. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicated that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P0140 – Heated Oxygen Sensor No Activity (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 15*	–
12	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 15*	–
13	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0141 HEATED OXYGEN SENSOR HEATER MALFUNCTION

Circuit Description

The engine control module (ECM) supplies a voltage of about 450mm volts between the ECM terminals 44 and 13. The oxygen (O_2) sensor varies the voltage within a range of about 1volt if the exhaust is rich, down to about 100mm volts if the exhaust is lean. The O_2 sensor is like an open circuit and produces no voltage when it is below 360°C(600°F). An open O_2 sensor circuit or a cold O_2 sensor causes “open loop” operation.

Conditions for Setting the DTC

- Heated oxygen sensor 5V reference voltage supply circuit high voltage or ground.
- Heated oxygen sensor 5V reference voltage supply circuit open.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

- Normal scan tool voltage varies between 0.1volts and 0.9 volts while in closed loop.
- Inspect the oxygen (O_2) sensor wire. The O_2 sensor may be positioned incorrectly and contacting the exhaust manifold.
- Check for an intermittent ground in the wire between the O_2 sensor and the engine control module.
- Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.
- Vacuum of crankcase leaks will cause a lean running condition.
- An exhaust manifold gasket leak of a cracked exhaust manifold may cause outside air to be pulled into the exhaust and past the sensor.

DTC P0141 – Heated Oxygen Sensor Heater Malfunction

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the Heated O2 sensor connector and engine control module (ECM) connector. 3. Check the Heated O2 sensor heater wire between the Heated O2 sensor connector terminal 4 and ECM connector terminal 35 for an open or short to ground. Is the problem found?	–	Go to *Step 3*	Go to *Step 4*
3	1. Repair the wire of the connector terminal as needed. 2. Clear the DTCs from the ECM. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
4	1. Turn the ignition switch to LOCK. 2. Replace the Heated O2 sensor. 3. Road tests the vehicle. 4. Perform the diagnostic system check. Is the replacement complete?	–	Go to *Step 6*	–
5	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0171 FUEL TRIM SYSTEM TOO LEAN

System 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 Engine Control Module (ECM) monitors the oxygen sensor (O2S) signal voltage and adjusts fuel delivery based on signal voltage. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with the scan tool. Ideal fuel trim values are around 128 (0%). If the O2S signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 128 (0% to 100%). If a rich condition is detected, the fuel trim values will be below 128 (0% to –100%), indicating that the ECM is reducing the amount of fuel delivered. If exhaust emissions reach an excessive level due to a lean or rich condition, a fuel trim Diagnostic Trouble Code (DTC) is set.

Conditions for Setting the DTC

- No intrusive tests active.
- DTCs P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0125, P0131, P0132, P0133, P0134, P0137, P0138, P0140, P0141, P1167, P1171, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0402, P0404, P1404, P0405, P0406, P0443, P0506, and P0507are not set.
- The average of short term fuel trim value is greater than or equal to 120.
- Throttle Position (TP) is less than 95%.
- Engine speed is between 700 and 6000 rpm.
- Barometric Pressure (BARO) is greater than 92.0 kPa (10.4 psi).
- Coolant temperature is between 80°C (176°F) and 115°C (239°F).
- Manifold Absolute Pressure (MAP) is more than 90 kPa (10.2 psi).
- System is in closed loop.
- Adaptive index is ready.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Important: After repairs, use the scan tool Fuel Trim Reset function to reset the long-term fuel trim to 128 (0%).

- Fuel pressure – The system will be lean if the pressure is too low. It may be necessary to monitor fuel pressure while driving the vehicle at various road speeds and/or loads to confirm.
- Map sensor – An output that causes the ECM to sense a lower than normal manifold pressure (high vacuum) can cause the system to go lean. Disconnecting the MAP sensor will allow the ECM to substitute a fixed (default) value for the MAP sensor. If the lean condition is gone when the sensor is disconnected, substitute a known good sensor and recheck.
- Fuel contamination – Water, in even small amounts, near the in-tank fuel pump inlet can be delivered to the injector. The water causes a lean exhaust and can set DTC P0171.

Check for poor O2S or MAP sensor connection at the ECM. Inspect the harness connectors for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection

Inspect the wiring harness for damage. If the harness appears to be OK, observe the O2S display on the scan tool while moving the connectors and the wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

Check the brake power booster check valve for possible leaks.

DTC P0171 – Fuel Trim System Too Lean

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install the scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON. Are any component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	With the engine running, operate the vehicle until the LOOP STATUS indicates closed. Is the Long Term Fuel Trim value below the specified value?	–22%	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Long Term Fuel Trim value go below the specified value while operating under the specified conditions?	–22%	Go to *Step 16*	Go to *Step 5*
5	Visually/physically check the following items: • Vacuum hoses for splits, kinks and improper connections. • Crankcase ventilation oil/air separator for proper installation. • Exhaust system for corrosion, leaks, loose or missing hardware. • Oxygen sensor (O2S) is installed securely and the pigtail harness is not contacting exhaust manifold or engine. • Fuel for excessive water, alcohol, or other contaminants. • Engine Control Module (ECM) and sensor grounds are clean, tight, and in their proper locations. Do any of the above checks isolate a condition requiring repair?	–	Go to *Step 7*	Go to *Step 6*
6	1. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 2. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim value. Is the Long Term Fuel Trim value below the specified value?	–22%	Go to *Step 15*	Go to *Step 9*
7	1. Repair the malfunction found in Step 5. 2. Recheck the Long Term Fuel Trim value while operating the engine. Is the Long Term Fuel Trim value below the specified value?	–22%	Go to *Step 8*	Go to *Step 9*
8	Lean condition is not present. Does a driveability problem exist?	–	Go to “Symptom Diagnosis”	Go to *Step 16*

DTC P0171 – Fuel Trim System Too Lean (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually/physically inspect the following items for vacuum leaks: • Intake manifold. • Throttle body. • Injector O-rings. 2. Repair any leaks found as necessary. Is the repair complete?	–	Go to *Step 16*	Go to *Step 16*
10	Allow the engine to idle. Are the Idle Air Control (IAC) counts above the specified value?	5	Go to *Step 11*	Go to *Step 12*
11	Check the fuel for excessive water, alcohol, or other contaminants and correct the contaminated fuel condition if present. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
12	Check the IAC valve performance. Refer to *"DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed"* or *"DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed"* in this section and repair as necessary. Is the repair complete?	–	Go to *Step 16*	Go to *Step 13*
13	1. Connect a fuel pressure gauge to the fuel system. 2. Turn the ignition OFF for at least 10 seconds. 3. Turn the ignition ON, with the engine OFF. The fuel pump will run for approximately 2–3 seconds. It may be necessary to cycle the ignition switch ON more than once to obtain maximum fuel pressure. 4. Note the fuel pressure with the fuel pump running. The pressure should be within the specified value. When the fuel pump stops, the pressure may vary slightly then hold steady. Is the fuel pressure steady and does the fuel pressure hold?	380 KPa (55 psi)	Go to *Step 14*	Go to "Fuel System Diagnosis"
14	1. Start and idle the engine at normal operating temperature. 2. The fuel pressure noted in the above step should drop by the indicated value. Does the fuel pressure drop by the indicated value?	21–69 KPa (3–10 psi)	Go to "Fuel Injector 2alance Test"	Go to "Fuel System Diagnosis"
15	Replace the MAP sensor. Is the action complete?	–	Go to *Step 16*	–
16	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 17*	Go to *Step 2*
17	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0172 FUEL TRIM SYSTEM TOO RICH

System 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 Engine Control Module (ECM) monitors the oxygen sensor (O2S) signal voltage and adjusts fuel delivery based on signal voltage. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with the scan tool. Ideal fuel trim values are around 128 (0%). If the O2S signal is indicating a lean condition, the ECM will add fuel resulting in fuel trim values above 128 (0% to 100%). If a rich condition is detected, the fuel trim values will be below 128 (0% to –100%), indicating that the ECM is reducing the amount of fuel delivered. If exhaust emissions reach an excessive level due to a lean or rich condition, a fuel trim Diagnostic Trouble Code (DTC) is set.

Conditions for Setting the DTC

- No intrusive tests active.
- DTCs P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P0134, P0137, P0138, P1167, P1171, P0300, P0336, P0337, P0341, P0342, P0402, P0404, P1404, P0405, P0406, P0443, P0506, and P0507are not set.
- The average of short term fuel trim value is greater than or equal to 120.
- Throttle Position (TP) is less than 95%.
- Engine speed is between 700 and 6000 rpm.
- Barometric Pressure (BARO) is greater than 90.0 kPa (10.4 psi).
- Coolant temperature is between 80°C (176°F) and 115°C (239°F).
- Manifold Absolute Pressure (MAP) is more than 70 kPa (10.2 psi).
- System is in closed loop.
- Adaptive index is ready.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Important: After repairs, use the scan tool Fuel Trim Reset function to reset the long-term fuel trim to 128 (0%).

Check for poor connection at the ECM. Inspect the harness connectors for the following conditions:

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the O2S display on the scan tool while moving the connectors and the wiring harness related to the engine harness. A change in the display will indicate the location of the fault.

If a DTC P1404 is also set, check the 5 volt reference circuits for a short to voltage.

Check for a restricted exhaust system.

A shorted 5 volt reference circuit may cause a DTC P0172 to set. Check the 5 volt reference sensors for abnormal readings.

DTC P0172 – Fuel Trim System Too Rich

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Install the scan tool to the Data Link Connector (DLC). Turn the ignition ON. Are any component related Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. With the engine running, operate the vehicle until the LOOP STATUS indicates closed. Is the Long Term Fuel Trim value above the specified value?	30%	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting The DTC as noted. Does the Long Term Fuel Trim value above the specified value while operating under the specified conditions?	30%	Go to *Step 21*	Go to *Step 5*
5	Visually/physically check the air cleaner filter for excessive dirt or being plugged and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 6*
6	Visually/physically check the air intake system for collapsed or restricted and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 7*
7	Inspect the throttle body inlet for damaged or foreign objects which may partially block the airflow and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Inspect the throttle bore, throttle plate and Idle Air Control (IAC) passages for clocking and foreign objects and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 9*
9	Start the engine with the vehicle in park or neutral and A/C off and note the idle quality. Is a low or unsteady idle being experienced?	–	Go to *Step 10*	Go to *Step 12*
10	Idle the engine. Are the IAC counts below the specified value?	100	Go to *Step 12*	Go to *Step 11*
11	1. Turn the ignition OFF. 2. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 3. Start the engine. 4. Operate the vehicle in Closed Loop while monitoring the Long Term Fuel Trim value. Does the Long Term Fuel Trim value increase above the specified value?	30%	Go to *Step 20*	Go to *Step 12*

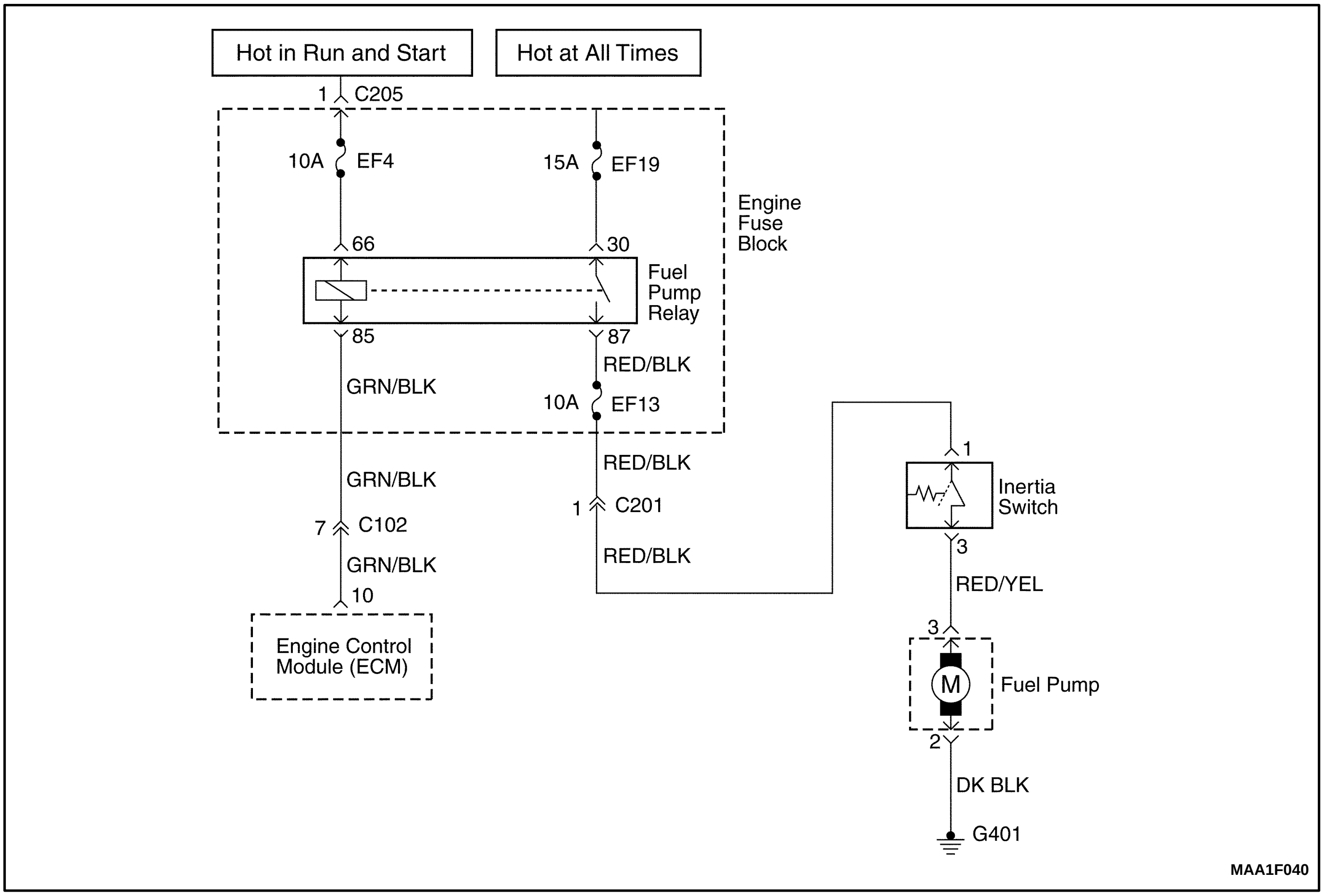
DTC P0172 – Fuel Trim System Too Rich (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check the IAC valve performance. Refer to *"DTC P0506 Idle Speed RPM Lower Than Desired Idle Speed"* or *"DTC P0507 Idle Speed RPM Higher Than Desired Idle Speed"* in this section and repair as necessary. Is the repair complete?	–	Go to *Step 21*	Go to *Step 13*
13	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is presence in the vacuum hose, replace the fuel pressure regulator. Is the repair complete?	–	Go to *Step 21*	Go to *Step 14*
14	1. Turn the ignition ON. 2. Slowly press the acceleration pedal. Does the Throttle Position (TP) sensor display increase steady and evenly from its minimum voltage at closed throttle to its maximum voltage at Wide-Open Throttle (WOT).	–	Go to *Step 15*	Go to *Step 19*
15	1. Perform the Fuel System Diagnosis. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 16*
16	1. Perform the Evaporative Emission (EVAP) Control System Diagnosis. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 17*
17	1. Perform the Fuel Injector balance Test. 2. If the table isolate a problem, repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to *Step 18*
18	1. Remove the Oxygen Sensor (O2S) 2. Visually/physically inspect the O2S for silicone contamination. 3. Note: this will be indicated by a powdery white deposit on the portion of the O2S exposed to the exhaust stream. 4. If contamination is present on the O2S, find the source and repair as needed. Is the repair complete?	–	Go to *Step 21*	Go to "Diagnostic Aids"
19	1. Check the TP sensor mounting screws. 2. If they are too loose or missing tighten or replace them as needed. 3. If the screws are OK, replace the TP sensor. Is the repair complete?	–	Go to *Step 21*	–
20	1. Turn the ignition OFF. 2. Replace the MAP sensor. Is the repair complete?	–	Go to *Step 21*	–

DTC P0172 – Fuel Trim System Too Rich (Cont'd)

Step	Action	Value(s)	Yes	No
21	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 21*	Go to *Step 2*
22	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1230 FUEL PUMP RELAY LOW VOLTAGE

Circuit Description

When the ignition switch is turned ON, the ECM will activate the fuel pump relay and run the in-tank fuel pump.

The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- An open or low voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.
- Coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

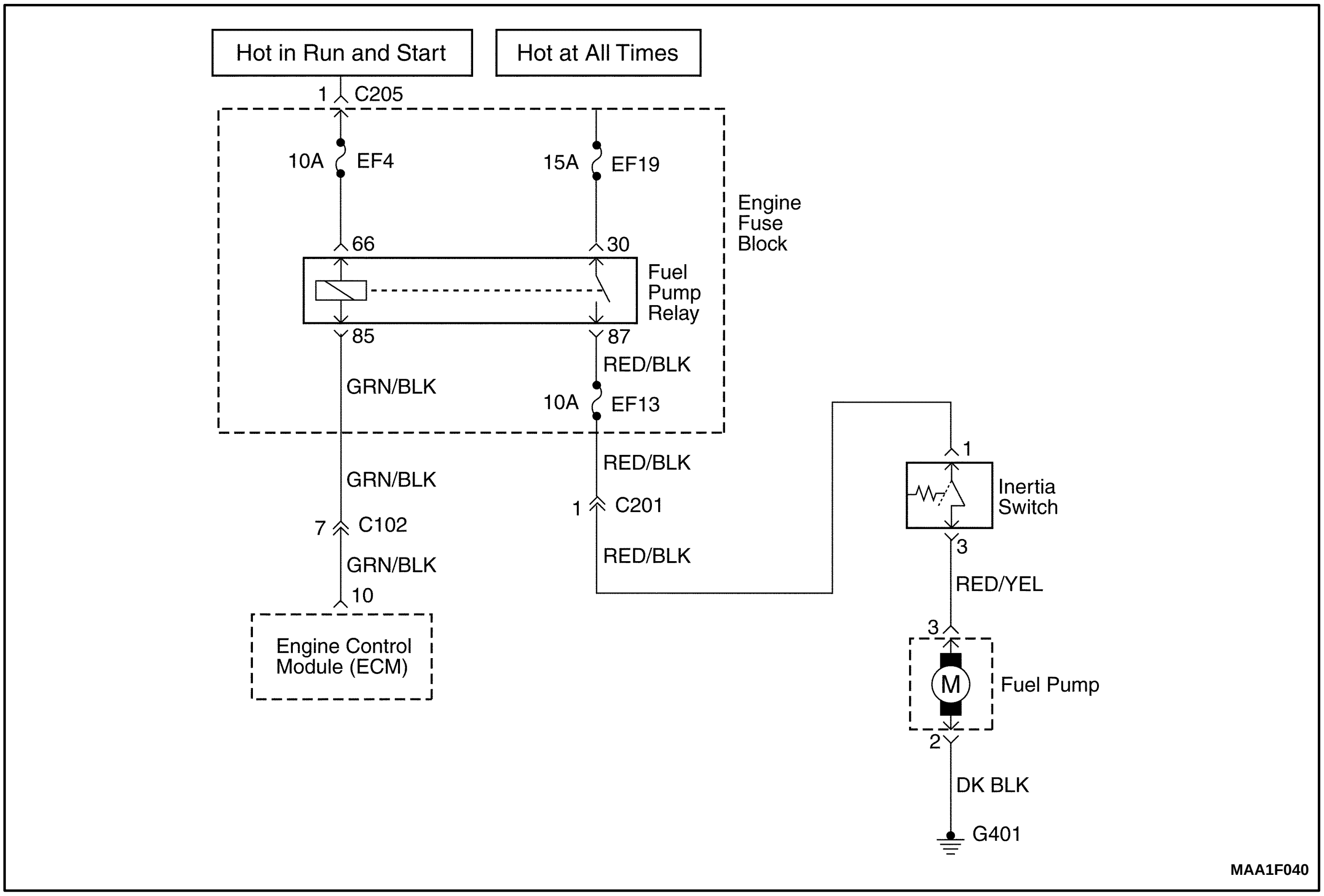
DTC P1230 – Fuel Pump Relay Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the Turn the ignition switch to ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	2.55 seconds	Go to “Diagnostic Aids”	Go to *Step 3*
3	1. Turn the Turn the ignition switch to ON. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 85 and ground. 4. Turn the Turn the ignition switch to ON. Is the test light ON?	–	Go to *Step 4*	Go to *Step 10*
4	1. Turn the Turn the ignition switch to ON. 2. Disconnect the fuel pump relay. 3. Connect a test light between the fuel pump relay connector terminal 66 and B+. 4. Turn the Turn the ignition switch to ON. Is the test light ON?	–	Go to *Step 5*	Go to *Step 9*
5	1. Turn the ignition switch to LOCK. 2. Connect a test light between the fuel pump relay connector terminal 30 and ground. Is the test light ON?	–	Go to *Step 6*	Go to *Step 8*
6	Check for short to ground in the wire between the fuel pump relay connector terminal 87 and fuel pump connector. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire between the fuel pump relay connector terminal 87 and fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the engine OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 14*	–
8	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 14*	Go to *Step 9*
9	Check for a short to ground wire between the fuel pump relay connector terminal 66 and the ignition after key ON 1(IGN 1). Is the problem found?	–	Go to *Step 11*	Go to *Step 10*
10	Check for a short to ground wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 10. Is the problem found?	–	Go to *Step 12*	Go to *Step 13*

DTC P1230 – Fuel Pump Relay Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Repair the wire between the fuel pump relay connector terminal 66 and the ignition key ON (IGN1). 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 13*
12	1. Repair the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 10. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 13*
13	1. Replace the ECM. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 14*
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1231 FUEL PUMP RELAY HIGH VOLTAGE

Circuit Description

When the ignition switch is turned ON, the ECM will activate the fuel pump relay and run the in-tank fuel pump.

The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- A high voltage condition exists.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.
- Coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

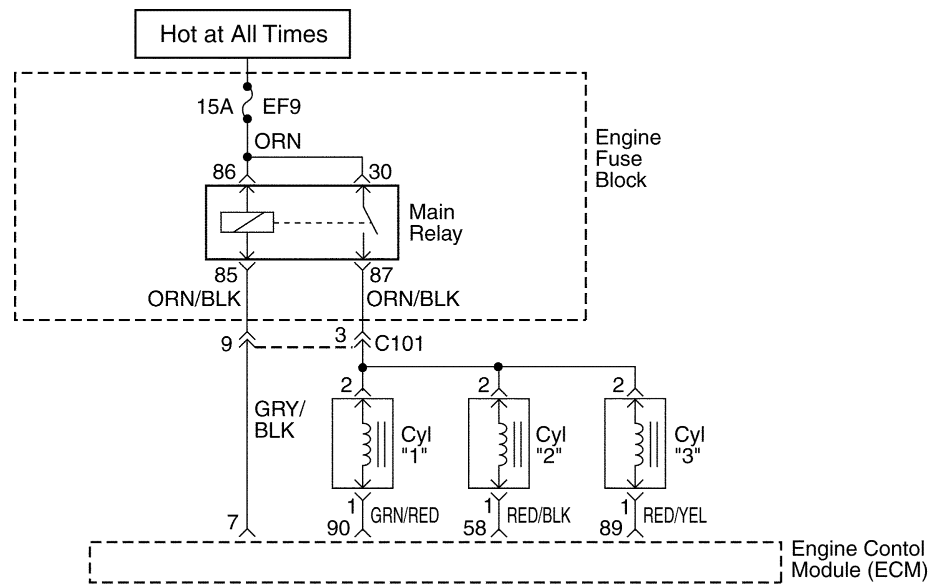
DTC P1231 – Fuel Pump Relay High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK for 10 seconds. 2. Turn the Turn the ignition switch to ON. 3. Listen for in-tank fuel pump operation. Does the fuel pump operate?	2.55 seconds	Go to “Diagnostic Aids”	Go to *Step 3*
3	Check for short to battery voltage or low voltage in the wire between the fuel pump relay connector terminal 87 and fuel pump connector 3. Is the problem found?	–	Go to *Step 7*	Go to *Step 5*
4	1. Repair the wire between the fuel pump relay connector terminal 87 and fuel pump connector terminal 3. 2. Install the fuel pump relay. 3. Turn the engine OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 14*	–
5	1. Replace the fuel pump relay. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	Go to *Step 11*	Go to *Step 6*
6	Check for short to battery voltage wire between the fuel pump relay connector terminal 66 and the ignition after key ON 1(IGN 1). Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Check for an open wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 10. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
8	1. Repair the wire between the fuel pump relay connector terminal 66 and the ignition key ON (IGN1). 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 13*
9	1. Repair the wire between the fuel pump relay connector terminal 85 and the ECM connector terminal 10. 2. Install the fuel pump relay. 3. Turn the ignition OFF for 10 seconds. 4. Clear any DTCs from ECM. 5. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 10*

DTC P1231 – Fuel Pump Relay High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Replace the ECM. 2. Turn the ignition OFF for 10 seconds. 3. Clear any DTCs from ECM. 4. Turn the ignition switch to ON. Does the fuel pump operate?	2.55 seconds	System OK	Go to *Step 11*
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0261 INJECTOR 1 LOW VOLTAGE

Circuit Description

The engine control module (ECM) has three individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- 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 battery voltage is less than 9 volts.
- The above conditions are met for 5seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

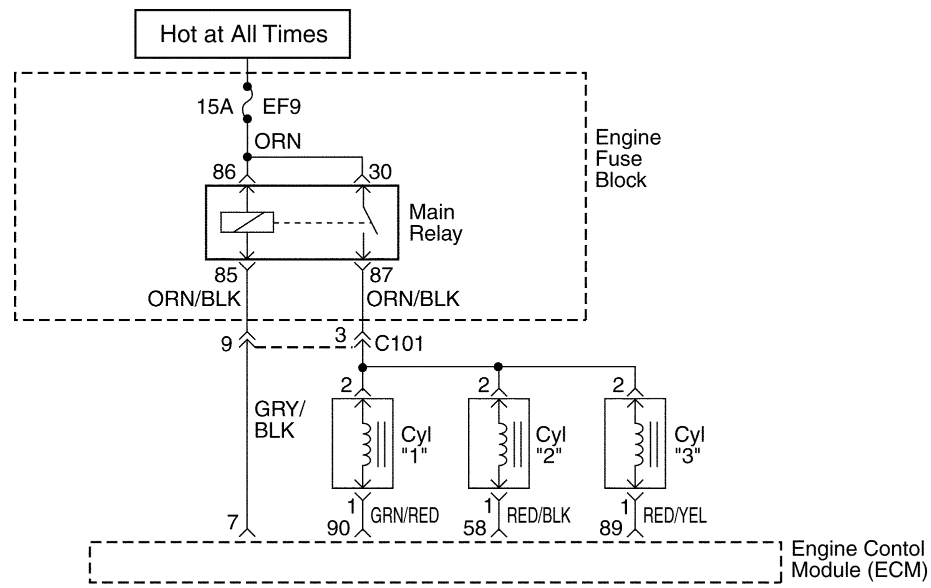
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0261 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 2alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector 2ecause it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0261 – Injector 1 Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0261 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. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0261 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 1 connector terminal 1 and ECM connector terminal 90. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 1 connector terminal 2 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Does DTC P0261 reset?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0262 INJECTOR 1 HIGH VOLTAGE

Circuit Description

The engine control module (ECM) has three individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- 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 battery voltage is more than 16 volts.
- The above conditions are met for 5seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

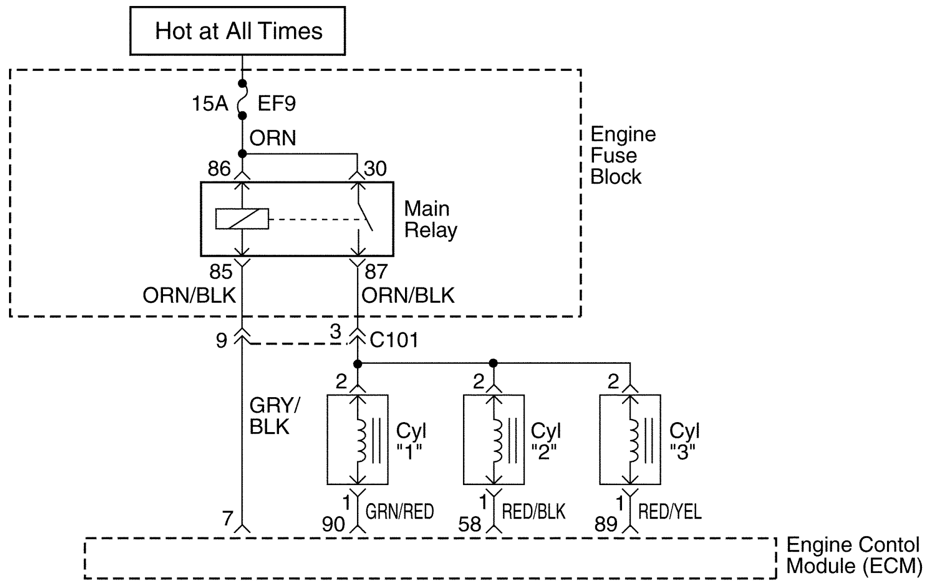
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0262 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 2alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector 2ecause it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0262 – Injector 1 High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0262 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. 2. Operate the vehicle within the Freeze Frame conditions as notes Does DTC P0262 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 1 connector terminal 1 and ECM connector terminal 90. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for short to battery voltage in the wire between the injector 1 connector terminal 2 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0262 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



MAA1F150

DIAGNOSTIC TROUBLE CODE (DTC) – P0264 INJECTOR 2 LOW VOLTAGE

Circuit Description

The engine control module (ECM) has three individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- 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 battery voltage is less than 9 volts.
- The above conditions are met for 5 seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

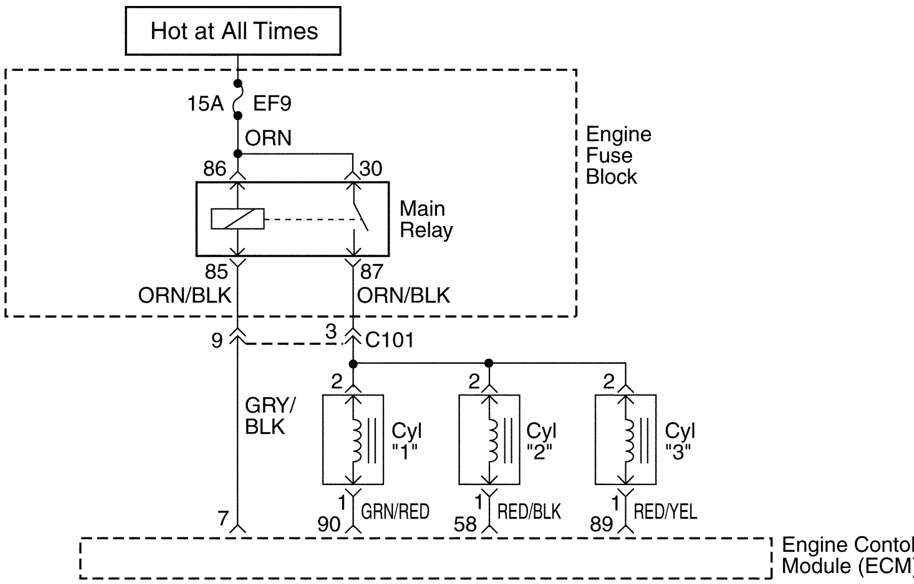
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0264 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 2alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector 2ecause it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0264 – Injector 2 Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	With the engine start?	–	Go to *Step 3*	Go to “Engine Crank but will not Run”
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P2064 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. 2. Operate the vehicle within the Freeze Frame conditions as notes Does DTC P0264 reset?	–	Go to *Step 5*	Go to “Diagnostic Aids”
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 2 connector terminal 1 and ECM connector terminal 58. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 2 connector terminal 2 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0264 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



MAA1F150

DIAGNOSTIC TROUBLE CODE (DTC) – P0265 INJECTOR 2 HIGH VOLTAGE

Circuit Description

The engine control module (ECM) has three individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- 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 battery voltage is more than 16 volts.
- The above conditions are met for 5 seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

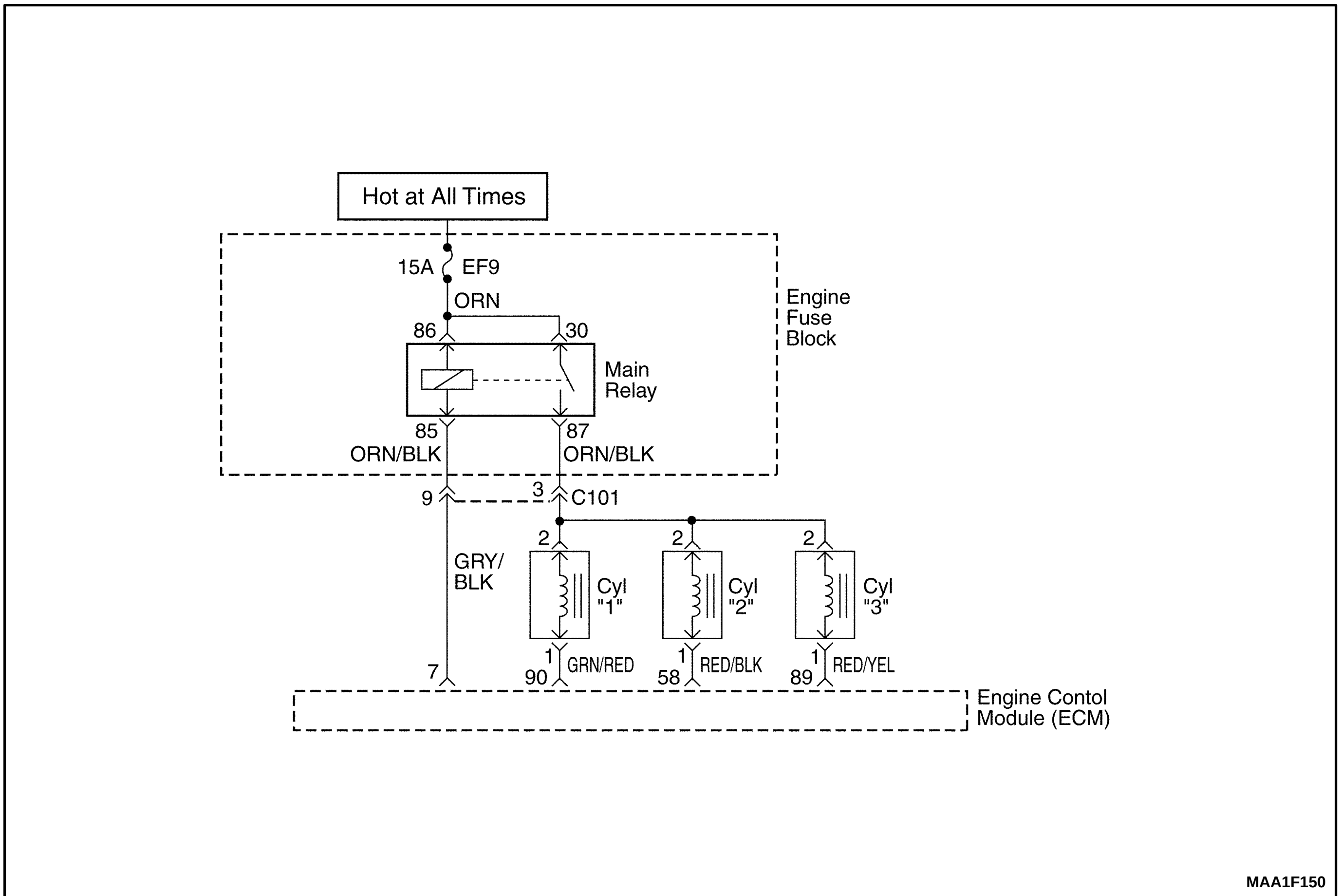
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0265 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 2alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0265 – Injector 2 High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0265 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. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0265 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 2 connector terminal 2 and ECM connector terminal 58. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for short to battery voltage in the wire between the injector 2 connector terminal 2 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0265 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0267 INJECTOR 3 LOW VOLTAGE

Circuit Description

The engine control module (ECM) has three individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- 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 battery voltage is less than 9 volts.
- The above conditions are met for 5 seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 4 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

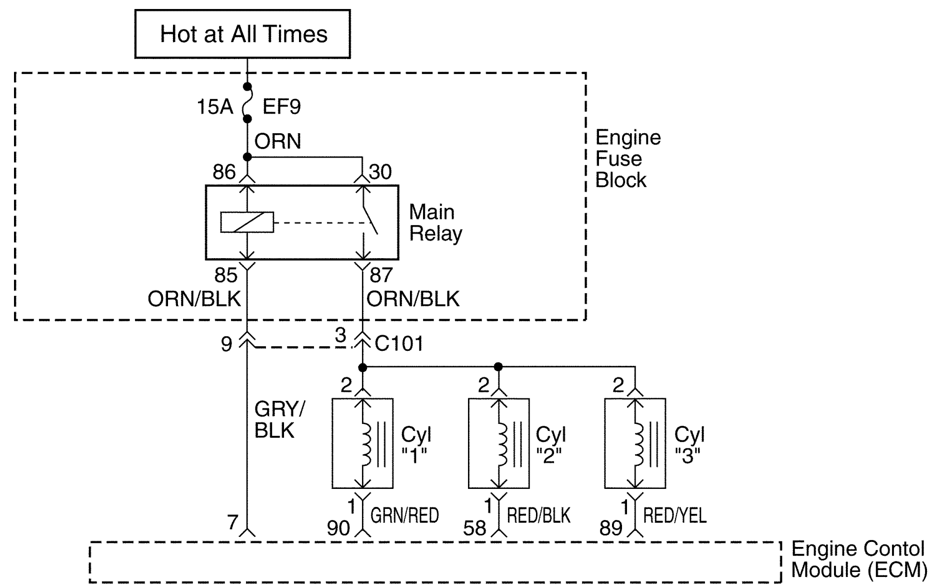
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0267 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 3alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0267 – Injector 3 Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0267 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. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0267 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 3 connector terminal 1 and ECM connector terminal 89. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to LOCK. 2. Check for short to ground in the wire between the injector 3 connector terminal 2 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0267 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0268 INJECTOR 3 HIGH VOLTAGE

Circuit Description

The engine control module (ECM) has three individual injector driver circuits, each of which controls an injector. When a driver circuit is grounded by the ECM, the injector is activated. The ECM monitors the current in each driver circuit. The ECM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the ECM expects to monitor on the circuit, a Diagnostic Trouble Code (DTC) is set. This DTC detects a low voltage and/or an open circuit and high voltage conditions for low-side drive injector outputs.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- 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 battery voltage is more than 16 volts.
- The above conditions are met for 5 seconds.

Action Taken when the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

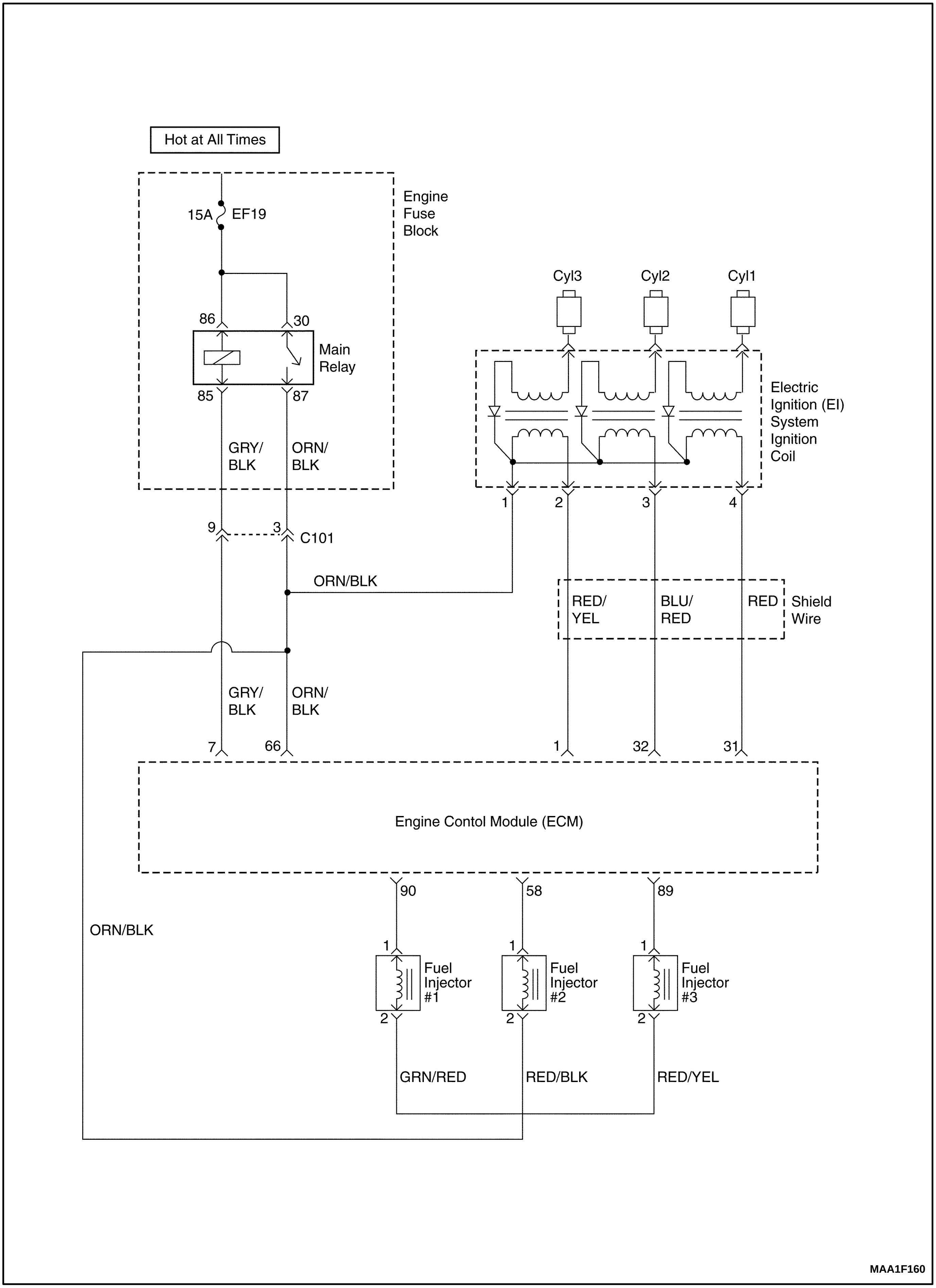
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0268 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

Long-term and short-terms fuel trims that are excessively high or low are a good indication that an injector is malfunctioning. Refer to *“Fuel Injector 3alance Test”* in this Section to check for malfunctioning injectors.

The injector resistance tested at the ECM connection is slightly more than it tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5Ω.

DTC P0268 – Injector 3 High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	With the engine start?	–	Go to *Step 3*	Go to "Engine Crank but will not Run"
3	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Idle the engine for one minuet. Does DTC P0268 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. 2. Operate the vehicle within the Freeze Frame conditions as notes. Does DTC P0268 reset?	–	Go to *Step 5*	Go to "Diagnostic Aids"
5	1. Turn the ignition switch to Lock. 2. Check for an open or short to battery voltage in the wire between the injector 3 connector terminal 1 and ECM connector terminal 89. Is the problem found?	–	Go to *Step 7*	Go to *Step 6*
6	1. Turn the ignition switch to Lock. 2. Check for short to battery voltage in the wire between the injector 3 connector terminal 2 and battery positive. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair the wire or the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	System OK	–
8	1. Replace the injector valve. 2. Clear any DTCs from ECM. 3. Perform the Diagnostic System Check. Does DTC P0268 reset?	–	Go to *Step 9*	System OK
9	1. Turn the ignition switch to LOCK. 2. Replace the ECM. 3. Perform the Diagnostic System Check. Is the repair complete?	–	Go to *Step 10*	–
10	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to applicable DTC table	System OK


Hot at All Times
15A
EF19
Engine
Fuse
Block
86
30
Main
Relay
85
87
GRY/
BLK
ORN/
BLK
Cyl3
Cyl2
Cyl1
Electric
Ignition (EI)
System
Ignition
Coil
1
2
3
4
9
3
C101
ORN/BLK
RED/
YEL
BLU/
RED
RED
Shield
Wire
GRY/
BLK
ORN/
BLK
7
66
1
32
31
Engine Contol Module (ECM)
90
58
89
ORN/BLK
1
Fuel
Injector
#1
2
1
Fuel
Injector
#2
2
1
Fuel
Injector
#3
2
GRN/RED
RED/BLK
RED/YEL
MAA1F160

DIAGNOSTIC TROUBLE CODE (DTC) – P0300 MULTIPLE CYLINDER MISFIRE

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Electric Exhaust Gas Recirculation (EEGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle.
- Fuel is not shutoff at 255 km/h (158 mph).
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 800 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7°C (20°F) and 120°C (248°F).
- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0320, P0337, P0341, P0342 and P0502 are not set.

Action Taken when the DTC Sets

- The malfunction Indicator Lamp (MIL) will blinking.
- The ECM will record operating conditions at the time the diagnostic fails. The information will be stored in the Freeze Frame and failure records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to *“Symptoms Diagnosis”* in this section.

DTC P0300 – Multiple Cylinder Misfire

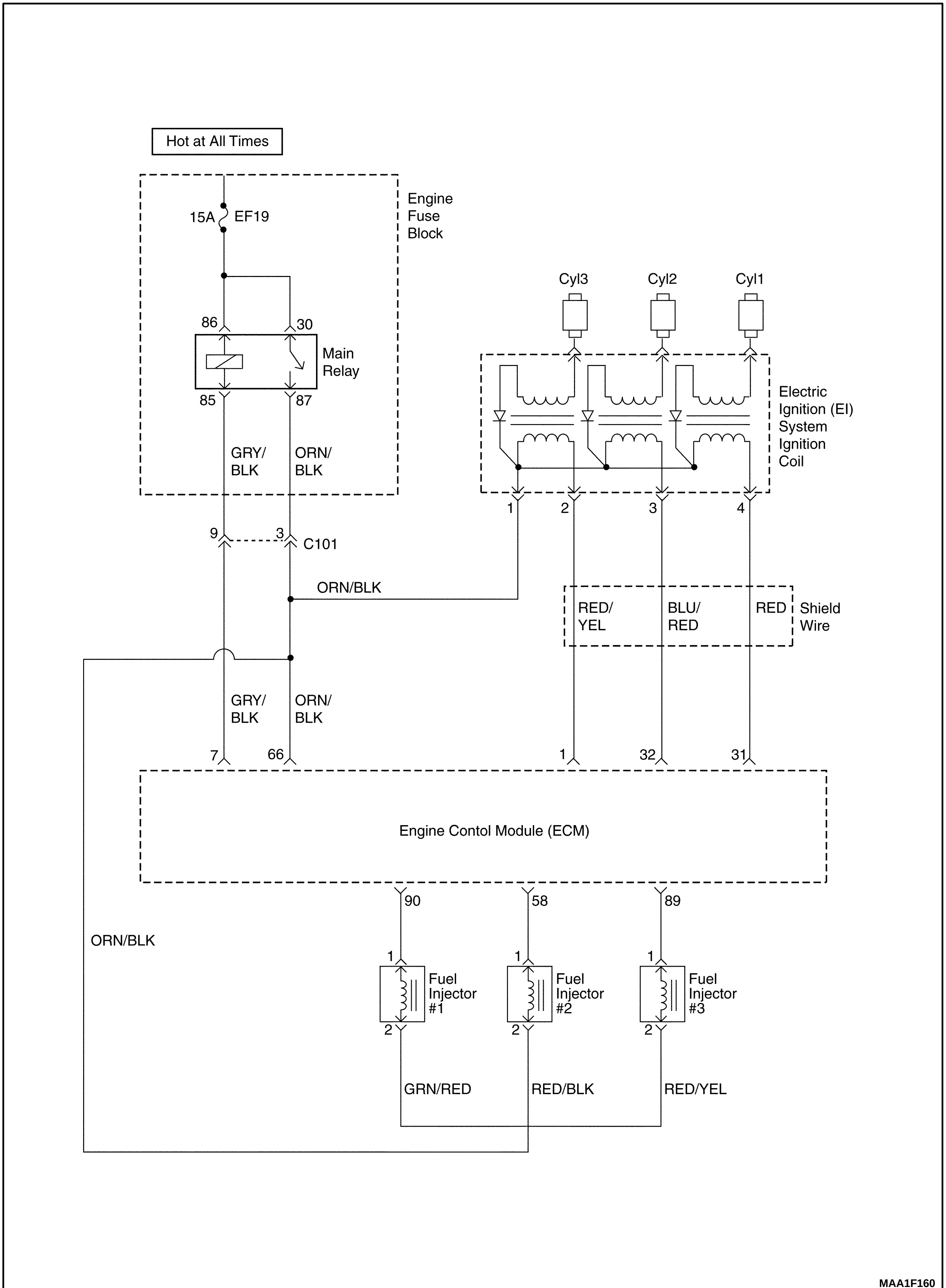
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0201, P0202, P0203, P0204 set?	–	Go to Applicable DTC table	Go to *Step 3*
3	Perform a visual/physical inspection. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*

DTC P0300 – Multiple Cylinder Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to "Diagnostic Aids"
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to "Fuel System Diagnosis"
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinders #2, #3. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace any malfunctioning spark plugs if necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the fuel injector connectors from the injectors. 3. Install an injector test light on the injector harness connector for the cylinders that had misfired. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector for each cylinder that had misfire. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*
16	Replace any malfunctioning fuel injectors. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit at terminals 90, 58 and 89 for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*

DTC P0300 – Multiple Cylinder Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable less than the specified value?	30000Ω	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK


Hot at All Times
15A
EF19
Engine
Fuse
Block
86
30
Main
Relay
85
87
GRY/
BLK
ORN/
BLK
Cyl3
Cyl2
Cyl1
Electric
Ignition (EI)
System
Ignition
Coil
1
2
3
4
9
3
C101
ORN/BLK
RED/
YEL
BLU/
RED
RED
Shield
Wire
GRY/
BLK
ORN/
BLK
7
66
1
32
31
Engine Contol Module (ECM)
90
58
89
ORN/BLK
1
1
1
Fuel
Injector
#1
Fuel
Injector
#2
Fuel
Injector
#3
2
2
2
GRN/RED
RED/BLK
RED/YEL
MAA1F160

DIAGNOSTIC TROUBLE CODE (DTC) – P0300 MULTIPLE CYLINDER MISFIRE

System Description

The Engine Control Module (ECM) monitors the crankshaft and camshaft positions to detect if the engine is misfiring. The ECM looks for a quick drop in crankshaft speed. This test is executed in blocks of 100 engine revolution tests. It may take between one to several tests to store a Diagnostic Trouble Code (DTC) and illuminate the Malfunction Indicator Lamp (MIL). Under light misfire conditions, it may also take more than one trip to set a DTC. Severe misfire will flash the MIL, indicating that catalyst damage is possible.

Conditions for Setting the DTC

- Emission threshold is 3.0% for automatic transaxle and 3.0% for manual transaxle.
- 20 engine cycles have occurred since cranking has started.
- A/C compressor clutch has not just engaged or disengaged.
- Engine load and engine speed are in a detectable region and are at or above zero torque.
- Camshaft Position (CMP) sensor is in synchronization.
- Electric Exhaust Gas Recirculation (EEGR) flow diagnostic is not in progress.
- Fuel level is greater than or equal to 20% of rated tank capacity.
- Decel Fuel Cutoff (DFCO) not active.
- Fuel is not shutoff from high engine speed of 6500 rpm for manual transaxle vehicle or 6500 rpm in drive and 6250 rpm in park for automatic transaxle vehicles.
- Fuel is not shutoff at 255 km/h (158 mph).
- An automatic transmission is not shifting.
- Throttle position change is less than 3% per 125 ms.
- Vehicle has not encountered an abusive engine speed of 7000 rpm.
- Crankshaft speed patters are normal.
- Throttle position is less than 4% when vehicle speed is greater than 10 km/h (6 mph).
- Engine speed is between 600 and 4500 rpm.
- Vehicle voltage is between 11 and 16 volts.
- Engine Coolant Temperature (ECT) is between –7°C (20°F) and 120°C (248°F).
- The engine speed is less than or equal to 1800 rpm or the crank angle sensing error has not been learned.
- There is the correct ratio between Crankshaft Position (CKP) sensor pulses and CMP sensor pulses.
- DTCs P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0320, P0337, P0341, P0342 and P0502 are not set.

Action Taken when the DTC Sets

- Emission related.
- “Armed” after two trip with a fail.
- “Disarmed” after one trip with a pass.
- MIL on if failure is detected in three consecutive trips.
- Stores a History DTC on the third consecutive with a fail (The DTC will be armed after the second fail).
- Stores a Freeze Frame on the third consecutive trip with a fail (if empty).

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for 10 seconds.

Diagnostic Aids

An intermittent can also be the result of a defective reluctor wheel. Remove the CKP sensor and inspect the reluctor wheel through the sensor mount hole. Check for porosity and the condition of wheel. If the DTC is intermittent refer to *“Symptoms Diagnosis”* in this section.

DTC P0300 – Multiple Cylinder Misfire

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble Codes (DTCs) Are DTCs P0201, P0202, P0203, P0204 set?	–	Go to Applicable DTC table	Go to *Step 3*

DTC P0300 – Multiple Cylinder Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
3	Perform a visual/physical inspection. Make any repairs that are necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 4*
4	Start the engine and allow it to idle. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to *Step 6*
5	Are all counters equal (within a percentage of each other)?	–	Go to *Step 7*	Go to *Step 11*
6	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data, and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for setting this DTC as noted. Are any Misfire Current counters incrementing?	–	Go to *Step 5*	Go to "Diagnostic Aids"
7	1. Turn the engine OFF. 2. Install a fuel pressure gauge to the fuel rail. 3. Observe the fuel pressure with the engine running. Is the fuel pressure within the specified value?	284–325 kPa (41–47 psi)	Go to *Step 8*	Go to "Fuel System Diagnosis"
8	Check the fuel for contamination. Is the fuel OK?	–	Go to *Step 9*	Go to *Step 10*
9	Check for a basic engine problem and repair as necessary. Is the repair complete?	–	Go to *Step 27*	–
10	Replace the contaminated fuel. Is the repair complete?	–	Go to *Step 27*	–
11	1. Turn the engine OFF. 2. Disconnect the fuel injector harness connector. 3. Install a spark tester on cylinder #1 spark plug cable. 4. Crank the engine and check for spark. 5. Repeat the above procedure on cylinders #2, #3. Is a spark observed on all four spark plug cables?	–	Go to *Step 12*	Go to *Step 20*
12	Replace any malfunctioning spark plugs if necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 13*
13	1. Turn the engine OFF. 2. Disconnect the fuel injector connectors from the injectors. 3. Install an injector test light on the injector harness connector for the cylinders that had misfired. 4. Crank the engine and note the test light. Does the injector test light blink?	–	Go to *Step 14*	Go to *Step 15*
14	Perform the Fuel Injector Balance Test. Are the fuel injectors OK?	–	Go to *Step 9*	Go to *Step 16*
15	1. Disconnect the injector test light. 2. With a test light connected to ground, probe the ignition feed terminal 1 of the injector harness connector for each cylinder that had misfire. 3. Crank the engine. Does the test light illuminate?	–	Go to *Step 17*	Go to *Step 19*

DTC P0300 – Multiple Cylinder Misfire (Cont'd)

Step	Action	Value(s)	Yes	No
16	Replace any malfunctioning fuel injectors. Is the repair complete?	–	Go to *Step 27*	–
17	Check the affected fuel injector driver circuit at terminals 90, 58, and 89 for an open, short, or short to voltage. Is a problem found?	–	Go to *Step 18*	Go to *Step 24*
18	Repair the open or the shorted fuel injector driver circuit. Is the repair complete?	–	Go to *Step 27*	–
19	Repair the open ignition feed circuit between the fuel injector harness connector and the fuel injector connector. Is the repair complete?	–	Go to *Step 27*	–
20	Measure the resistance of the spark plug cable that the spark plug tester did not spark. Is the resistance of the spark plug cable less than the specified value?	30000Ω	Go to *Step 21*	Go to *Step 25*
21	Inspect the Engine Control Module (ECM) connector and connections. Are the connections OK?	–	Go to *Step 22*	Go to *Step 23*
22	Check the affected cylinders ignition control circuit for an open or short and repair as necessary. Is the repair complete?	–	Go to *Step 27*	Go to *Step 26*
23	Repair the connector or connections. Is the repair complete?	–	Go to *Step 27*	–
24	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 27*	–
25	Replace the spark plug cable. Is the repair complete?	–	Go to *Step 27*	–
26	Replace the faulty ignition coil. Is the repair complete?	–	Go to *Step 27*	Go to *Step 24*
27	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 28*	Go to *Step 2*
28	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P1320 CRANKSHAFT SEGMENT PERIOD SEGMENT ADAPTATION AT LIMIT

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 Engine Control Module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of Camshaft Position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P0320 will set.

Conditions for Setting the DTC

- Engine is running.
- Number of extra or missing teeth is greater than or equal to 2 per revolution.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

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 ECM harness and connectors for 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, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. 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 P1320 – Crankshaft Segment Period Segment Adaptation At Limit

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Turn the ignition ON, with the engine OFF. 4. Review and record Failure Records information. 5. Clear the Diagnostic Trouble Codes (DTCs). 6. Start the engine and idle for 1 minute. Is DTC P1320 set?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Remove the crankshaft. 2. Check for a problem with the crahkshaft's visual defection and tooth. Is a problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the crankshaft. Is the replacement complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P1321 CRANKSHAFT SEGMENT PERIOD TOOTH ERROR

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 Engine Control Module (ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of Camshaft Position (CMP) signal pulses being received. If the ECM receives and incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code (DTC) P0320 will set.

Conditions for Setting the DTC

- Engine is running.
- Number of extra or missing teeth is greater than or equal to 2 per revolution.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

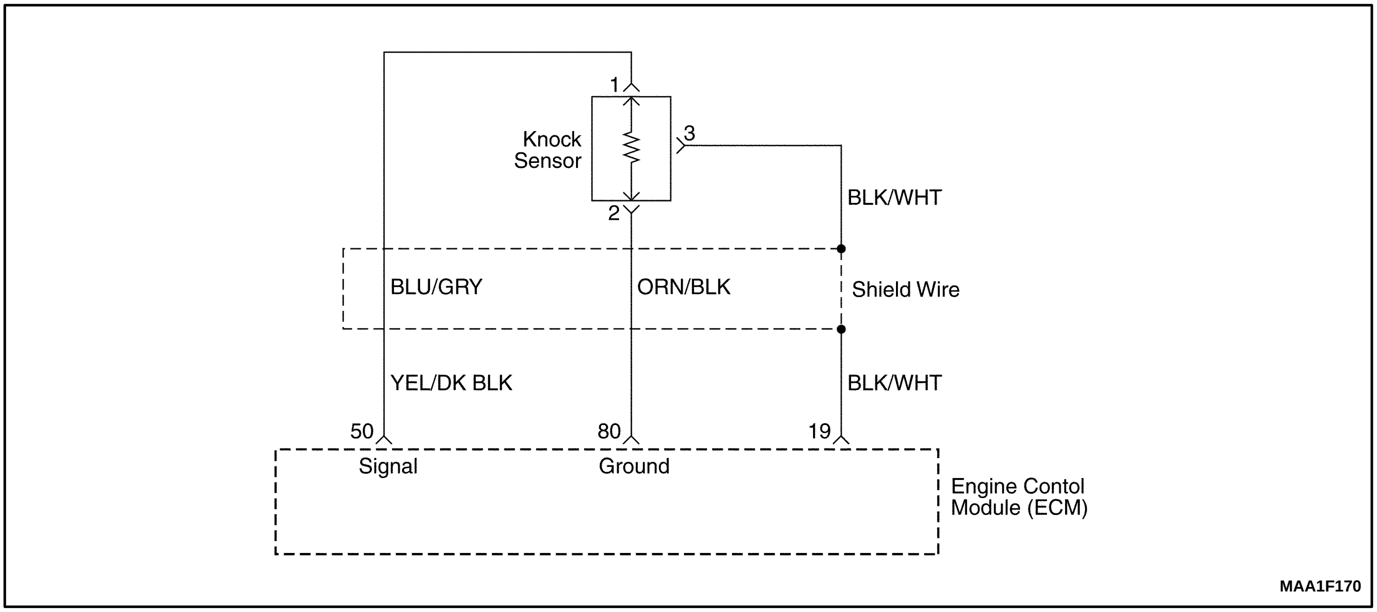
Diagnostic Aids

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 ECM harness and connectors for 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, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harnesses related to the ECM. 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 P1321 – Crankshaft Segment Period Tooth Error

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Turn the ignition OFF. 2. Install a scan tool to the Data Link Connector (DLC) 3. Turn the ignition ON, with the engine OFF. 4. Review and record Failure Records information. 5. Clear the Diagnostic Trouble Codes (DTCs). 6. Start the engine and idle for 1 minute. Is DTC P1321 set?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Remove the crankshaft. 2. Check for a problem with the crahkshaft's visual defection and tooth. Is a problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the crankshaft. Is the replacement complete?	–	System OK	–
6	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as supported in the text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0327 KNOCK SENSOR CIRCUIT FAULT

Circuit Description

The knock sensor(KS) system is used to detect engine detonation, allowing the engine control module(ECM) to retard ignition control spark timing based on the KS signal being received. The KS produces an AC signal so that under a no knock condition the signal on the KS circuit measures about 0.007V AC. The KS signal's amplitude and frequency depend upon the amount of knock being experienced. The ECM contains a non-replaceable knock filter module called a signal-to-noise enhancement filter (SNEF) module. This filter module in the ECM determines whether knock is occurring by comparing the signal level on the KS circuit with the voltage level on the noise channel. The noise channel allows the ECM to reject any false knock signal by knowing the amount of normal engine mechanical noise present. Normal engine noise varies depending on engine speed and load. When the ECM determines that an abnormally low noise channel voltage level is being experienced, a DTC P0327 will set.

Conditions for Setting the DTC

- Knock sensor SPI bus in failure during 7 seconds.
- The knock sensor voltage is below 0.2V.
- Engine Coolant Temperature is higher than 80°C (176°F).
- Engine rpm is more than 2,500rpm.
- Mass air flow is higer than 180mg/tdc.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

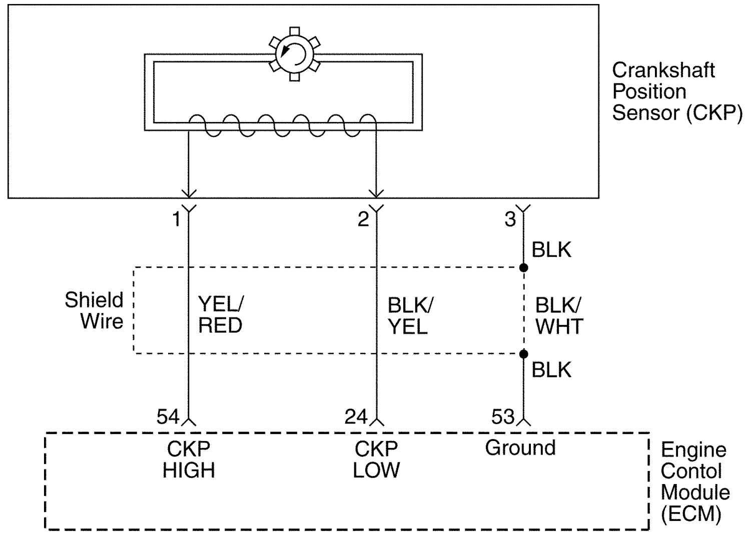
DTC P0327 – Knock Sensor Circuit

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD II) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Start the engine. 2. Install a scan tool. 3. Clear the Diagnostic Trouble Codes (DTCs). 4. Operate the vehicle within the Freeze Frame conditions and conditions for setting the DTC as noted. Does the Malfunction Indicator (MIL) illuminate?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and conditions for Setting The DTC as noted. Does the Malfunction Indicator (MIL) illuminate?	–	Go to *Step 4*	Go to *Step 12*
4	Listen to the engine while raising and lowering the engine speed. Is a knock or audible noise present?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the mechanical engine problem or a loose bracket or component. Is the repair complete?	–	Go to *Step 12*	–
6	1. Turn the ignition switch to lock. 2. Disconnect the engine control module(ECM). 3. With a digital voltmeter (DVM) connected to ground, measure the resistance of the knock sensor through the knock sensor signal circuit, terminal 50. Is the measured value within the specified value?	90–110KΩ	Go to *Step 7*	Go to *Step 9*
7	Check for a poor connection at the ECM connector, knock sensor (KS) signal circuit and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 8*
8	Replace the engine control module(ECM). Is the replacement complete?	–	Go to *Step 12*	Go to *Step 10*
9	Check the KS electrical connector for a poor connection and repair an necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 10*
10	Check the KS signal circuit for an open or a low voltage or voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 11*
11	Replace the KS. Is the replacement complete?	–	Go to *Step 12*	–

DTC P0327 – Knock Sensor Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the DTCs. • Start the engine and idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 13*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0335 MAGNETIC CRANKSHAFT POSITION SENSOR ELECTRICAL ERROR

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 engine control module(ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CKP) signal pulses being received. If the ECM receive and incorrect number of pulses on the 58X reference circuit, DTC P0335 will set.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Extra or missing pulses is detected between consecutive 58X reference pulses.
- The value of Magnetic Crankshaft position sensor is higher than 0.2V.
- The minimum value of Magnetic Crankshaft position sensor is less than 1.5V.
- The Maximum value of Magnetic Crankshaft position sensor is higher than 2.2V.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for :

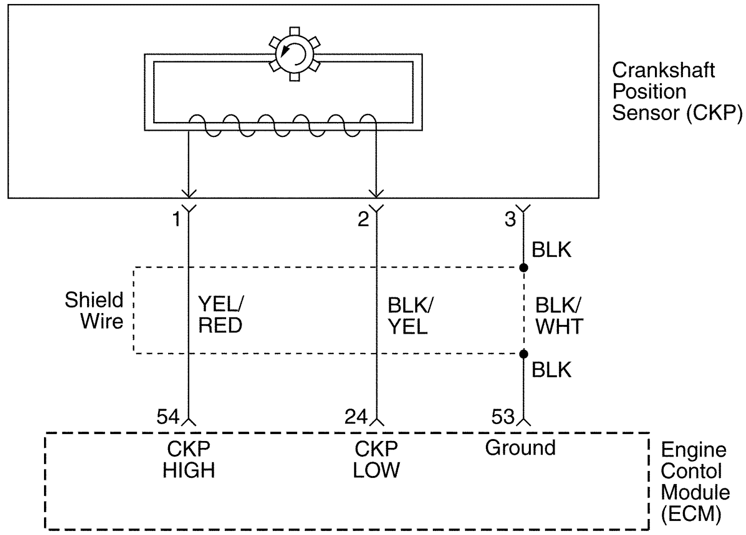
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Damaged harness – inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harness related to the ECM. A change in voltage will indicate the location of the fault.

Review the failure records vehicle mileage since the diagnostic test failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0335 – Magnetic Crankshaft Position Sensor Electrical Error

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to “Engine Cranks But Will Not Run”
3	1. Review and record Failure Records information. 2. Clear the DTC P0335. 3. Start the engine and idle for 1 minute. 4. Observe the diagnostic trouble codes (DTCs). Is the DTC P0335 set?	–	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Disconnect the engine control module(ECM) and the crankshaft position (CKP) sensor. 2. Check for an open or an open or short to ground in the CKP sensor connector and the ECM harness connector. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open or an open or short to ground in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to *Step 11*	–
6	1. Reconnect the ECM and CKP sensor. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal 54 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5V	Go to *Step 9*	Go to *Step 7*
7	Check the connection at the CKP sensor and replace the terminals if necessary. Do any terminals require replacement?	–	Go to *Step 11*	Go to *Step 8*
8	Replace the CKP sensor. Is the replacement complete?	–	Go to *Step 11*	–
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminal require replacement?	–	Go to *Step 11*	Go to *Step 10*
10	Replace the ECM. Is the replacement complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0336 58X CRANKSHAFT POSITION SENSOR NO PLAUSIBLE SIGNAL

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 engine control module(ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CKP) signal pulses being received. If the ECM receive and incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Detected number of teeth is differs by 3 or higher.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for :

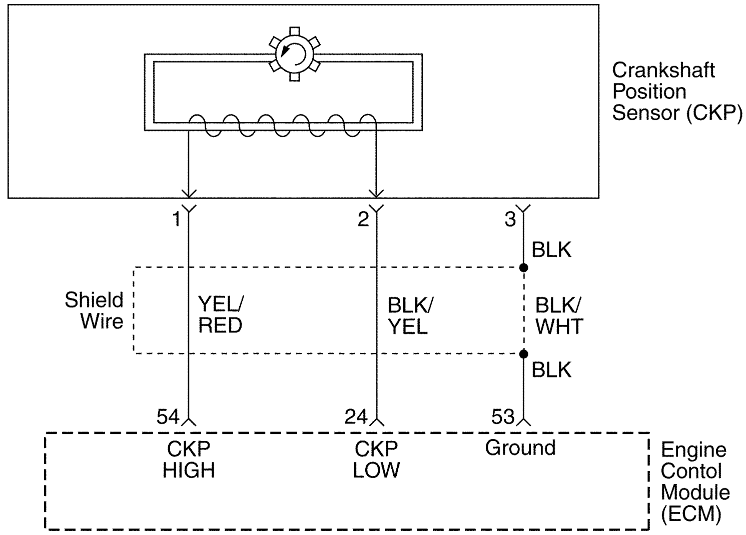
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Damaged harness – inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harness related to the ECM. A change in voltage will indicate the location of the fault.

Review the failure records vehicle mileage since the diagnostic test 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 Crankshaft Position Sensor No Plausible Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to “Engine Cranks But Will Not Run”
3	1. Review and record Failure Records information. 2. Clear the DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe the diagnostic trouble codes (DTCs). Is the DTC P0336 set?	–	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Disconnect the engine control module(ECM) and the crankshaft position (CKP) sensor. 2. Check for an open or a low voltage in the CKP sensor connector and the ECM harness connector. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open or low voltage in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to *Step 11*	–
6	1. Reconnect the ECM and CKP sensor. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal 54 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5V	Go to *Step 9*	Go to *Step 7*
7	Check the connection at the CKP sensor and replace the terminals if necessary. Do any terminals require replacement?	–	Go to *Step 11*	Go to *Step 8*
8	Replace the CKP sensor. Is the replacement complete?	–	Go to *Step 11*	–
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminal require replacement?	–	Go to *Step 11*	Go to *Step 10*
10	Replace the ECM. Is the replacement complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0337 58X CRANKSHAFT POSITION SENSOR NO SIGNAL

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 engine control module(ECM) uses the 58X reference signal to calculate engine rpm and CKP. The ECM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CKP) signal pulses being received. If the ECM receive and incorrect number of pulses on the 58X reference circuit, DTC P0337 will set.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- No crankshaft teeth detected.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for :

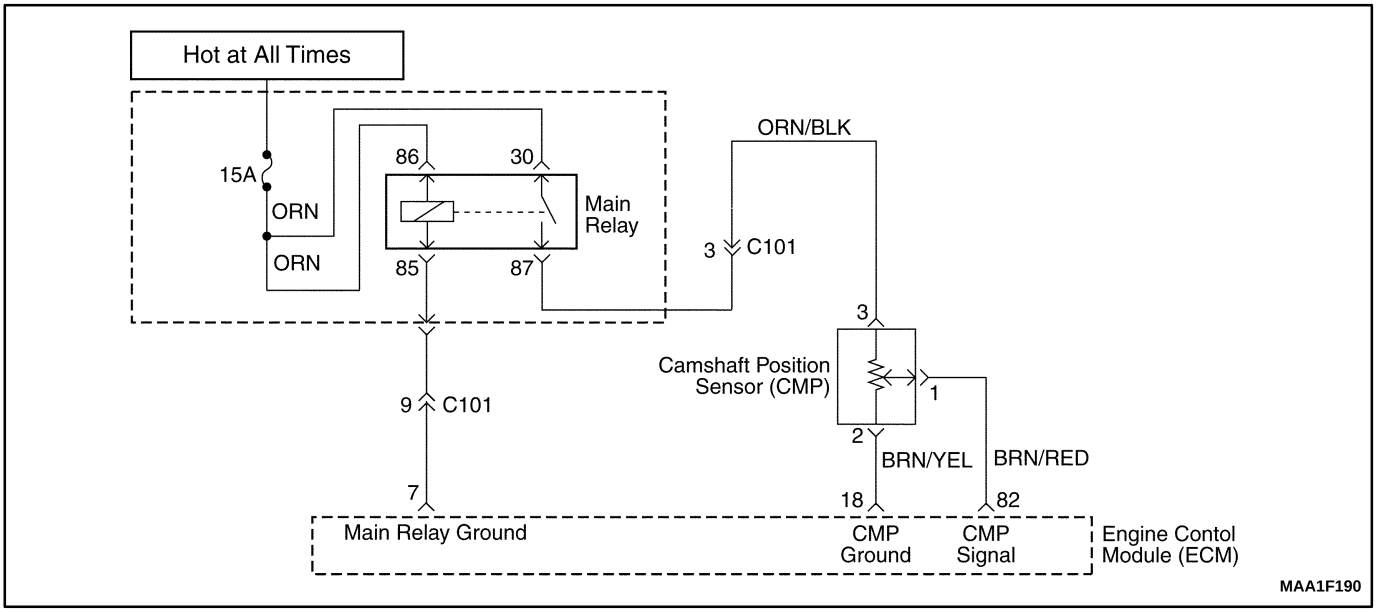
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Damaged harness – inspect the wiring harness for damage. If the harness appears to be OK, disconnect the ECM, turn the ignition ON and observe a voltmeter connected to the 58X reference circuit at the ECM harness connector while moving the connectors and the wiring harness related to the ECM. A change in voltage will indicate the location of the fault.

Review the failure records vehicle mileage since the diagnostic test 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 – 58X Crankshaft Position Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	Attempt to start the engine. Does the engine start?	–	Go to *Step 3*	Refer to "Engine Cranks But Will Not Run"
3	1. Review and record Failure Records information. 2. Clear the DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe the diagnostic trouble codes (DTCs). Is the DTC P0337 set?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Disconnect the engine control module(ECM) and the crankshaft position (CKP) sensor. 2. Check for an open or a low voltage in the CKP sensor connector and the ECM harness connector. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open or low voltage in the 58X reference circuit between the CKP sensor connector and the ECM harness connector. Is the repair complete?	–	Go to *Step 11*	–
6	1. Reconnect the ECM and CKP sensor. 2. Connect a digital voltmeter (DVM) to measure voltage on the 58X reference circuit, terminal 54 at the ECM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5V	Go to *Step 9*	Go to *Step 7*
7	Check the connection at the CKP sensor and replace the terminals if necessary. Do any terminals require replacement?	–	Go to *Step 11*	Go to *Step 8*
8	Replace the CKP sensor. Is the replacement complete?	–	Go to *Step 11*	–
9	Check the connections at the ECM and replace the terminals if necessary. Do any terminal require replacement?	–	Go to *Step 11*	Go to *Step 10*
10	Replace the ECM. Is the replacement complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to *Step 12*	Go to *Step 2*
12	Check if any additional DTCs are set. Are any DTCs displaced that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0341 CAMSHAFT POSITION SENSOR RATIONALITY

Circuit Description

The Camshaft Position Sensor is used to detect Camshaft position and to have correlation with Crankshaft position so that the ECM can determine which cylinder is ready to be fueled by the injector. The polarity of camshaft sensor signal must be changed only once per crankshaft position.

Conditions for Setting the DTC

- Engine is running.
- No traction of CMP signal between teeth 18 and 82 but change in polarity.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

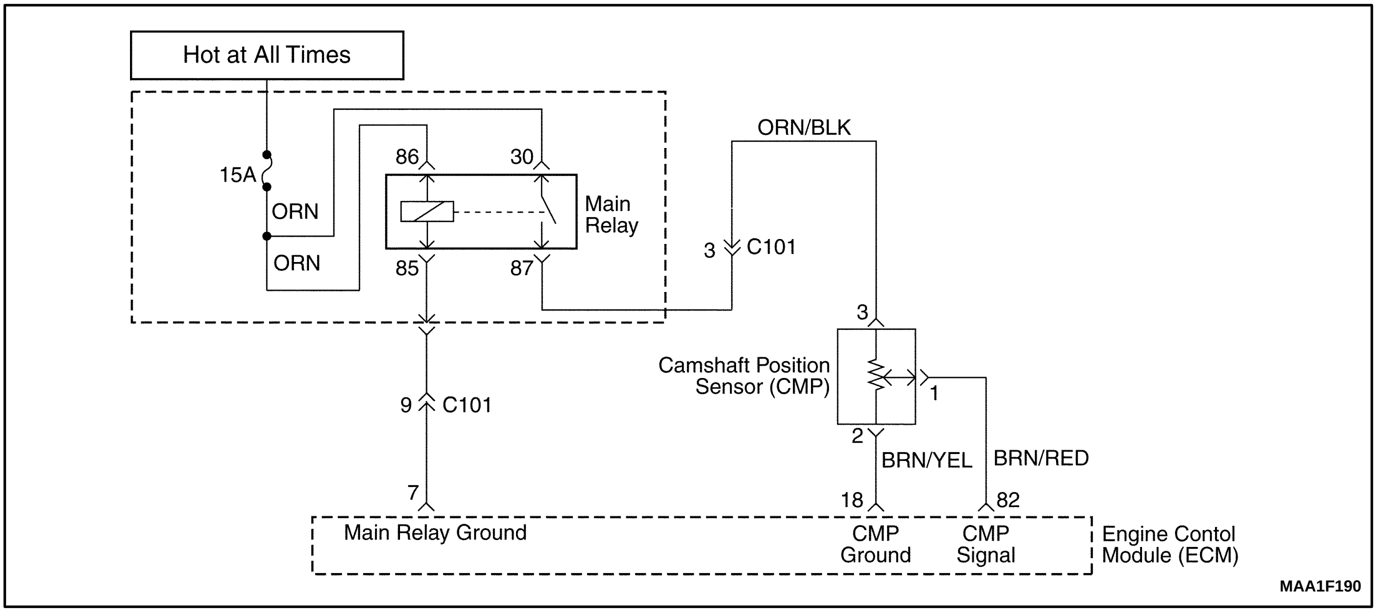
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0341 – Camshaft Position Sensor Rationality

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the CMP sensor connector. 3. Check for a faulty connector or terminals. Is the problem found?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the ignition switch to ON. 2. Disconnect the ECM connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. 4. Check the wire between the CMP sensor terminal 1 and ECM connector 82 for an open or short to ground or short to battery voltage while related connectors and wiring harness. 5. Check the wires between the CMP sensor terminal 2 and ECM connector 18 for an open while moving related connectors and wiring harness. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch to LOCK. 2. Repair or replace the wire or the connector. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the CMP sensor. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Does DTC P0341 reset?	–	System OK	Go to *Step 6*
6	1. Replace the ECM. 2. Run the engine. 3. Perform the Diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to *Step 8*	–
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0342 CAMSHAFT POSITION SENSOR NO SIGNAL

Circuit Description

The Camshaft Position Sensor is used to detect Camshaft position and to have correlation with Crankshaft position so that the ECM can determine which cylinder is ready to be fueled by the injector. The polarity of camshaft sensor signal must be changed only once per crankshaft position.

Conditions for Setting the DTC

- Engine is running.
- No traction of CMP signal between teeth 18 and 82 but change in polarity.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DIAGNOSTIC AIDS

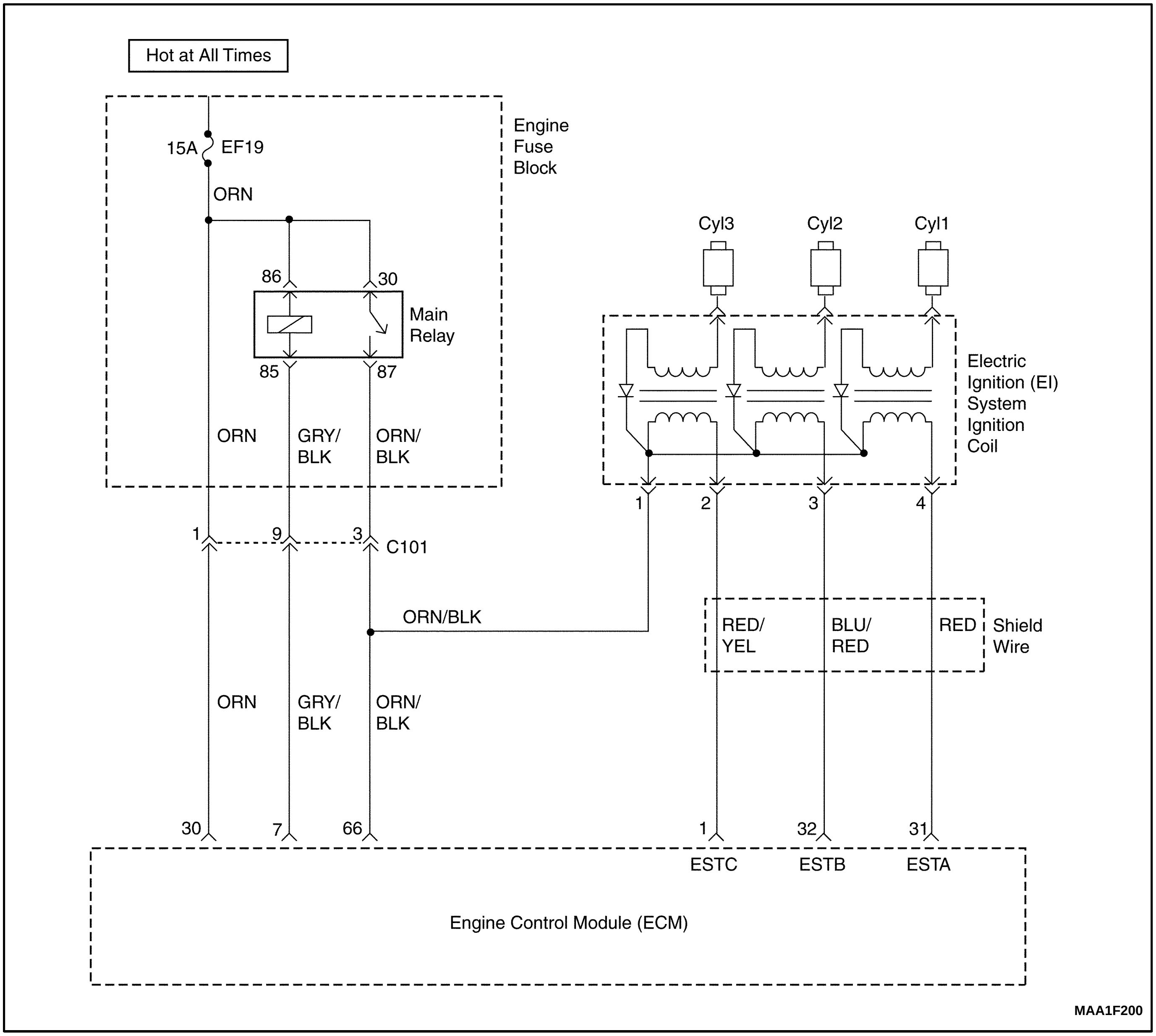
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0342 – Camshaft Position Sensor No Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the CMP sensor connector. 3. Check for a faulty connector or termin1als. Is the problem found?	–	Go to *Step 4*	Go to *Step 3*
3	1. Turn the Turn the ignition switch to ON. 2. Disconnect the ECM connector. 3. Inspect the ECM pins and connector for bent or damaged terminals. 4. Check the wire between the CMP sensor terminal 1 and ECM connector 82 for an open or short to ground or short to battery voltage while related connectors and wiring harness. 5. Check the wires between the CMP sensor terminal 2 and ECM connector 18 for an open while moving related connectors and wiring harness. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch to LOCK. 2. Repair or replace the wire or the connector. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Turn the ignition switch to LOCK. 2. Replace the CMP sensor. 3. Clear any DTCs from the ECM. 4. Run the engine. 5. Perform the diagnostic system check. Does DTC P0342 reset?	–	System OK	Go to *Step 6*
6	1. Replace the ECM. 2. Run the engine. 3. Perform the Diagnostic system check. Is the replacement complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic run and passed?	–	Go to *Step 8*	–
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0351 IGNITION SIGNAL COIL A FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing 1 circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil which fires the spark plug. The circuit between the ECM and the electronic ignition system is monitored for an open circuit, short to voltage, and low voltage. When the ECM detects a problem in the spark timing 1 circuit, it will set DTC P0351.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Time of fault fall occurrence is greater than time of the DIS fall occurrence.
- Must receive more than 40 failure within 80 test cycles.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.

- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

DIAGNOSTIC AIDS

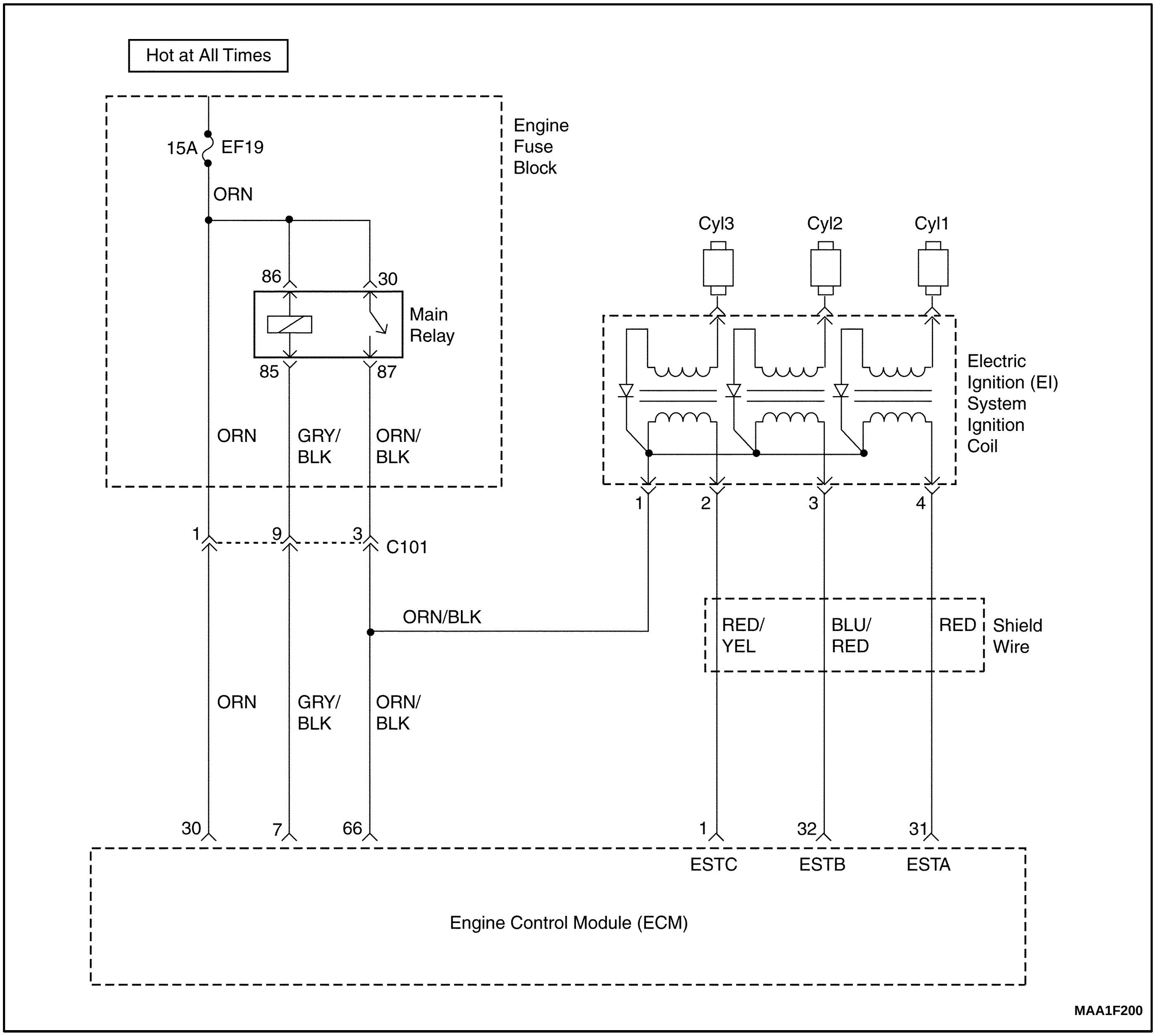
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0351 – Ignition Signal Coil A Fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Check for a faulty connection or a damaged terminal 1 at the ignition coil. Is a problem found?	–	Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or a damaged terminal 31 at the engine control module(ECM) connector. Is the problem found?	–	Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. Check the ignition control circuit for a short to ground. Is the problem found?	–	Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to battery voltage. Is the problem found?	–	Go to *Step 8*	Go to *Step 6*
6	Check for an open in the ignition control. Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). • Start the engine and Idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	–
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0352 IGNITION SIGNAL COIL B FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing 3 circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil, which fires the spark plug. The circuit between the ECM and the electronic ignition system is monitored for an open circuit, short to voltage, and low voltage. When the ECM detects a problem in the spark timing 3 circuit, it will set DTC P0352.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Time of fault fall occurrence is greater than time of the DIS fall occurrence.
- Must receive more than 40 failure within 80 test cycles.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and failure records buffers.
- A history DTC is stored.
- The ECM will default to 6 degree timing.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

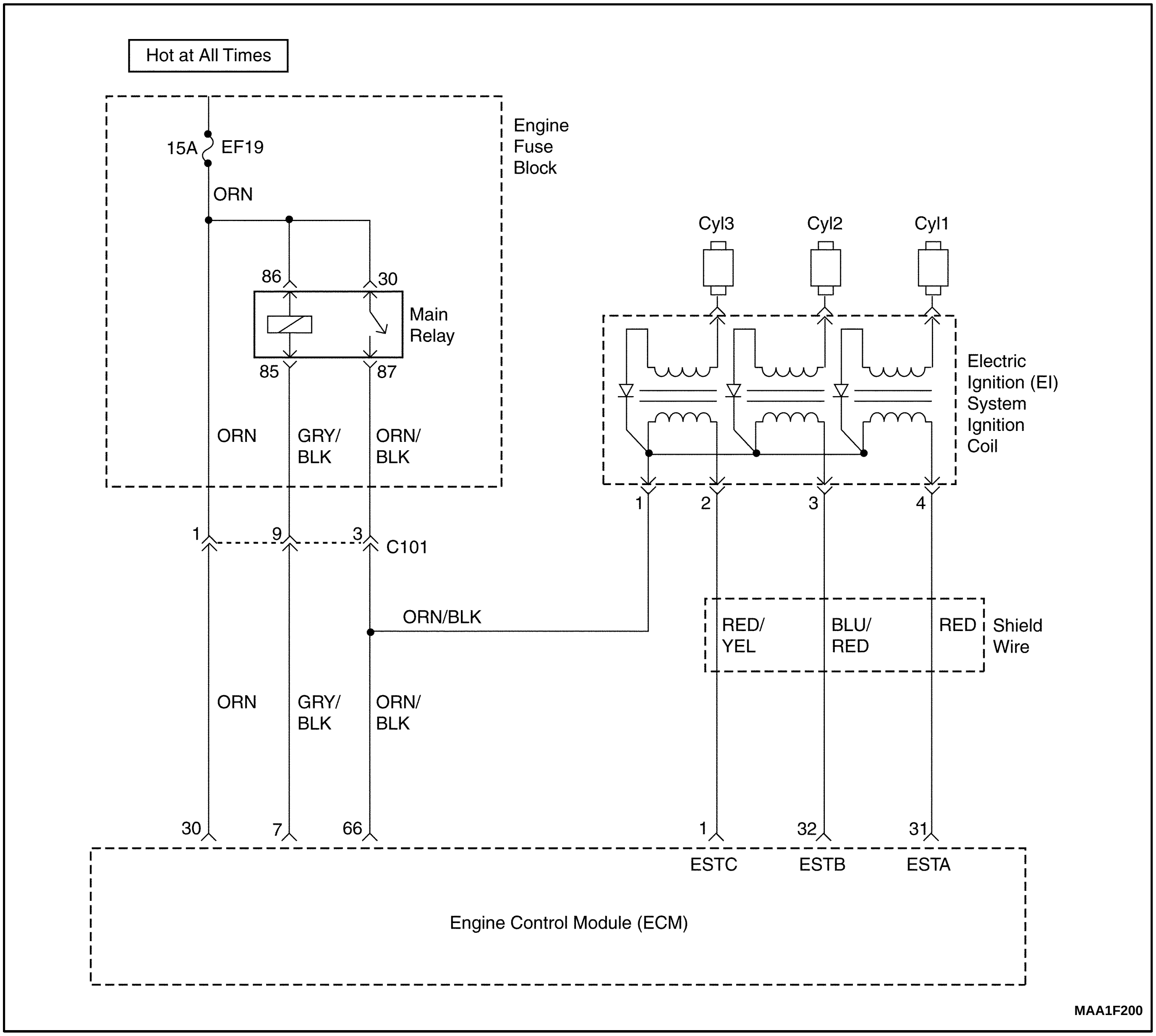
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0352 – Ignition Signal Coil B Fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Check for a faulty connection or a damaged terminal 3 at the ignition coil. Is a problem found?	–	Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or a damaged terminal 32 at the engine control module(ECM) connector. Is the problem found?	–	Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. Check the ignition control circuit for a short to ground Is the problem found?	–	Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to battery voltage. Is the problem found?	–	Go to *Step 8*	Go to *Step 6*
6	Check for an open in the ignition control. Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). • Start the engine and Idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	–
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0353 IGNITION SIGNAL COIL C FAULT

Circuit Description

The engine control module (ECM) provides a ground for the electronic spark timing 3 circuit. When the ECM removes the ground path of the ignition primary coil, the magnetic field produced by the coil collapses. The collapsing magnetic field produces a voltage in the secondary coil, which fires the spark plug. The circuit between the ECM and the electronic ignition system is monitored for an open circuit, short to voltage, and low voltage. When the ECM detects a problem in the spark timing 3 circuit, it will set DTC P0352.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Time of fault fall occurrence is greater than time of the DIS fall occurrence.
- Must receive more than 40 failure within 80 test cycles.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and failure records buffers.
- A history DTC is stored.
- The ECM will default to 6 degree timing.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.

- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

DIAGNOSTIC AIDS

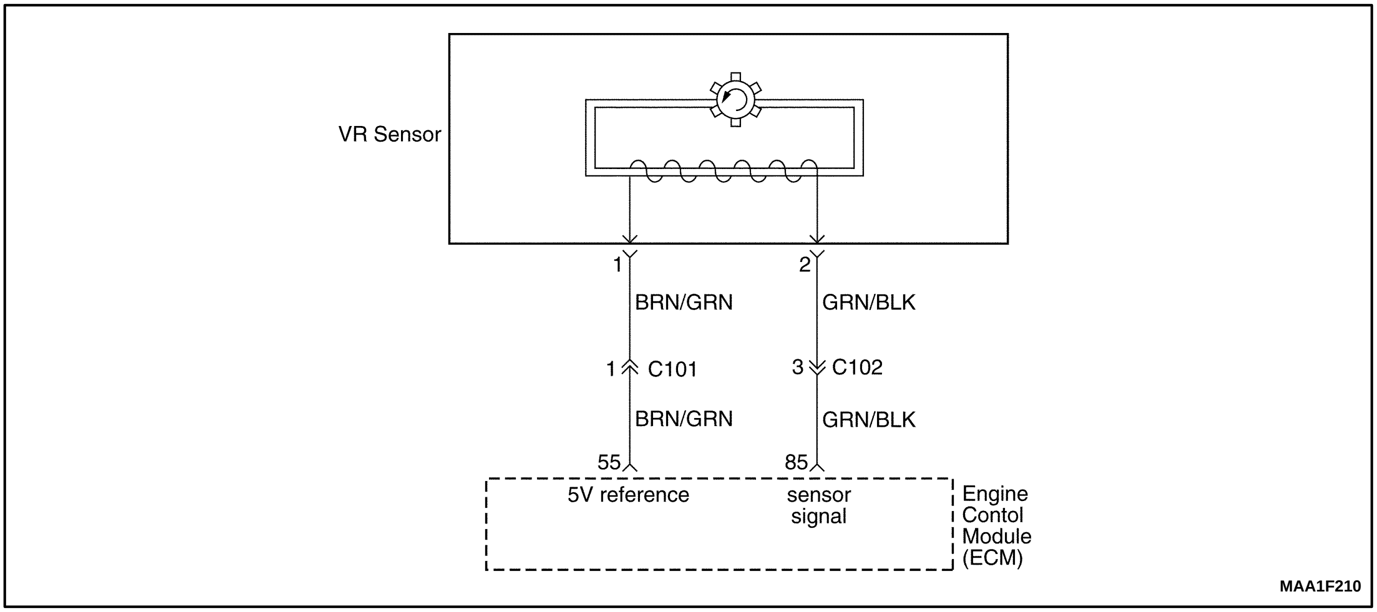
Check and correct any abnormal engine noise before using the diagnostic table.

Any circuitry that is suspected as causing engine noise complaint should be thoroughly checked for the following conditions :

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connections.
- Physical damage to the wiring harness.

DTC P0353 – Ignition Signal Coil C Fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Check for a faulty connection or a damaged terminal 3 at the ignition coil. Is a problem found?	–	Go to *Step 8*	Go to *Step 3*
3	Check for a faulty connection or a damaged terminal 32 at the engine control module(ECM) connector. Is the problem found?	–	Go to *Step 8*	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. Check the ignition control circuit for a short to ground Is the problem found?	–	Go to *Step 8*	Go to *Step 5*
5	Check the ignition control circuit for a short to battery voltage. Is the problem found?	–	Go to *Step 8*	Go to *Step 6*
6	Check for an open in the ignition control. Is the problem found?	–	Go to *Step 8*	Go to *Step 7*
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs). • Start the engine and Idle at normal operating temperature. • Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 9*	–
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1382 ROUGH ROAD DATA INVALID (NON ABS)

Circuit Description

The VR sensor is used to detecting the road situation.

By sensing difference of wheel rotation duration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the VR sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

The VR sensor is located in front–right wheel.

Conditions for Setting the DTC

- Vehicle speed is higher than 10km/h(6.21mph).
- No Vehicle Speed Sensor error not set.
- VR sensor output signal is higher than 0.26.
- VR sensor output signal is not change for 30seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

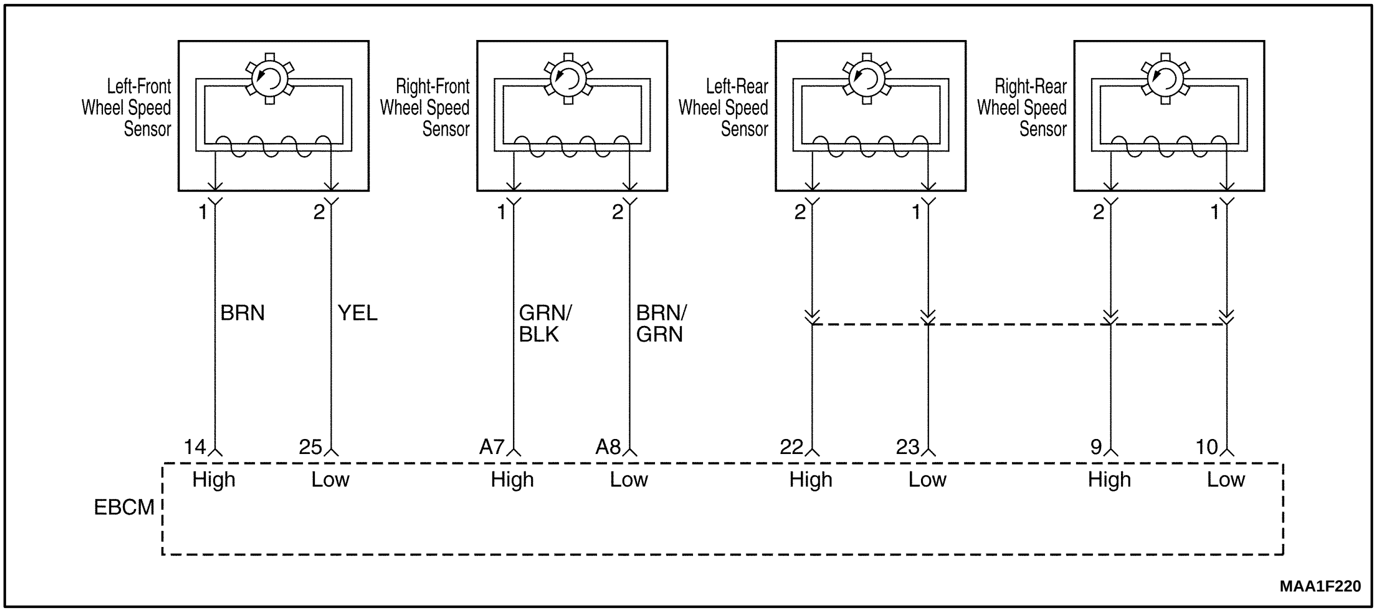
DTC P1382 – Rough Road Data Invalid (NON ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1382. Does the scan tool indicate that DTC P1382 failed?	–	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions and repair as needed: 2. VR sensor seal missing or damaged. 3. VR sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to *Step 14*	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the VR sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	0V	Go to *Step 5*	Go to *Step 12*
5	1. Jumper the 5 volt reference circuit, terminal 1 and the VR sensor signal circuit, terminal 2 together at the VR sensor harness connector. 2. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	4.95V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the wheel speed sensor, or for a poor connection at the terminal 85 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 10*
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the VR sensor, or a poor connection at the terminal 55 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 8*
8	1 Turn the ignition OFF. 2. Disconnect the ECM and check the VR sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 9*

DTC P1382 – Rough Road Data Invalid (NON ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the VR sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
10	Check for a poor connection at terminal 2 of the VR sensor and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 11*
11	Replace the VR sensor. Is the repair complete?	–	Go to *Step 14*	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the VR sensor signal circuit for a short to battery voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1382 ROUGH ROAD DATA INVALID (ABS)

Circuit Description

The wheel speed sensor is used to detecting the road situation.

As the wheel is rotated, the wheel speed sensor produces an AC voltage that increase with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The wheel speed sensor is connected to EBCM by a "twisted pair" of wires. Twisting reduces noise susceptibility than may cause a DTC to se.If the wheel speed sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- Vehicle speed is higher than 10km/h(6.21mph).
- No Vehicle Speed Sensor error not set.
- VR sensor output signal is higher than 0.26.
- VR sensor output signal is not change for 30seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

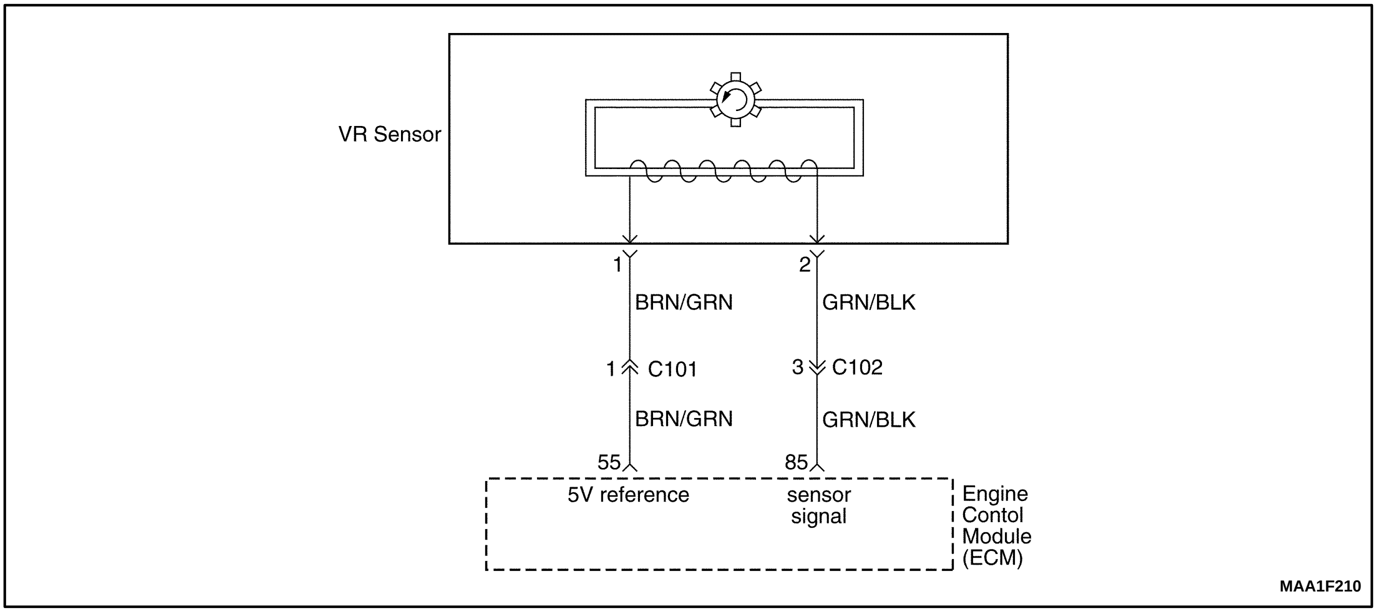
DTC P1382 – Rough Road Data Invalid (ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition On, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1382. Does the scan tool indicate that DTC P1382 failed?	–	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions and repair as needed: 2. Wheel speed sensor seal missing or damaged. 3. Wheel speed sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to *Step 14*	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the defected Wheel speed sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the wheel speed sensor value displayed on the scan tool. Is the Wheel speed sensor value near the specified value?	0V	Go to *Step 5*	Go to *Step 12*
5	1. Jumper the 5 volt reference circuit, the Wheel speed sensor signal circuit, together at the defected wheel speed sensor harness connector. 2. Observe the defected Wheel speed sensor value displayed on the scan tool. Is the wheel speed sensor value near the specified value?	4.95V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the Wheel speed sensor, or for a poor connection of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 10*
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the wheel speed sensor, or a poor connection of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Disconnect the ECM and check the wheel speed sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 9*

DTC P1382 – Rough Road Data Invalid (ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the wheel speed sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
10	Check for a poor connection at terminal 3 of the wheel speed sensor and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 11*
11	Replace the wheel speed sensor. Is the repair complete?	–	Go to *Step 14*	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the wheel speed sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1385 ROUGH ROAD SENSOR CIRCUIT FAULT (NON ABS)

Circuit Description

The VR sensor is used to detecting the road situation.

By sensing difference of wheel rotation duration caused by bumps or potholes in the road, the Engine Control Module (ECM) can determine if the changes in crankshaft speed are due to engine misfire or are driveline induced. If the VR sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- Vehicle speed is higher than 10km/h(6.21mph).
- No Vehicle Speed Sensor error not set.
- VR sensor output signal is higher than 0.26.
- VR sensor output signal is not change for 30 seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

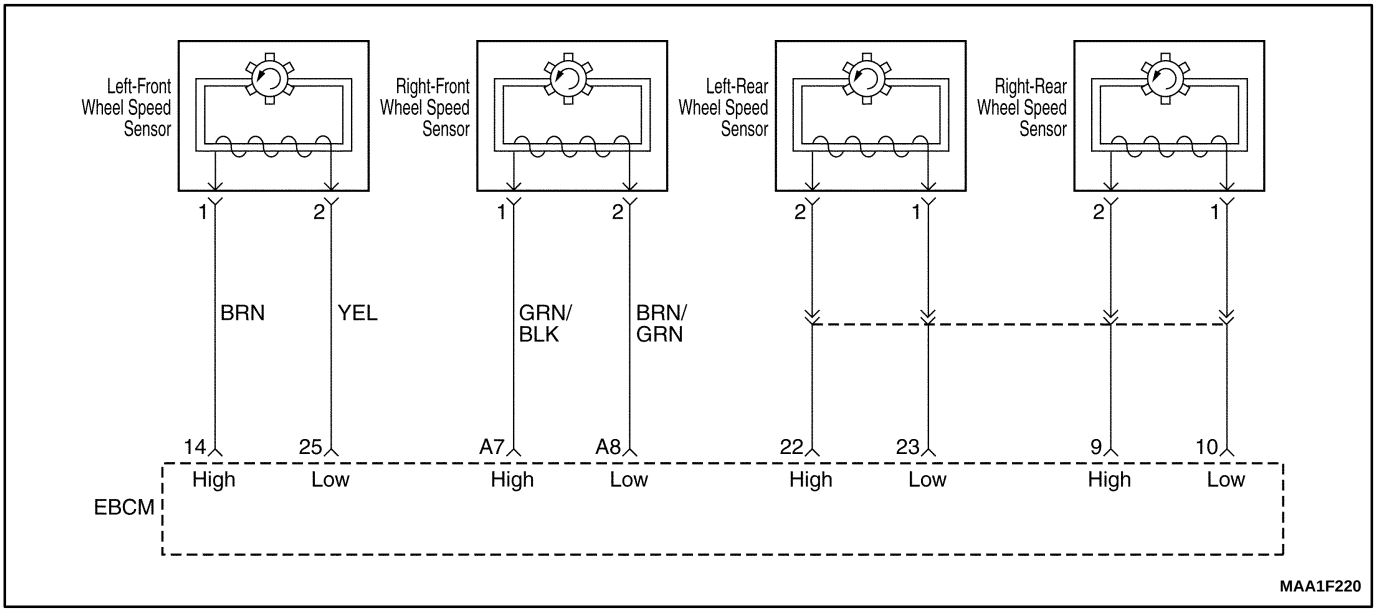
DTC P1385 – Rough Road Sensor Circuit Fault (NON ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1382. Does the scan tool indicate that DTC P1382 failed?	–	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions and repair as needed: 2. VR sensor seal missing or damaged. 3. VR sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to *Step 14*	Go to "Diagnostic Aids"
4	1. Turn the ignition OFF. 2. Disconnect the VR sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	0V	Go to *Step 5*	Go to *Step 12*
5	1. Jumper the 5 volt reference circuit, terminal 1 and the VR sensor signal circuit, terminal 2 together at the VR sensor harness connector. 2. Observe the VR sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	4.95V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the VR sensor, or for a poor connection at the terminal 85 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 10*
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the VR sensor, or a poor connection at the terminal 85 of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 8*
8	1 Turn the ignition OFF. 2. Disconnect the ECM and check the VR sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 9*

DTC P1385 – Rough Road Sensor Circuit Fault (NON ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the VR sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
10	Check for a poor connection at terminal 2 of the VR sensor and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 11*
11	Replace the VR sensor. Is the repair complete?	–	Go to *Step 14*	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the VR sensor signal circuit for a short to battery voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1385 ROUGH ROAD SENSOR CIRCUIT FAULT (ABS)

Circuit Description

The wheel speed sensor is used to detecting the road situation.

As the wheel is rotated, the wheel speed sensor produces an AC voltage that increase with wheel speed. The EBCM uses the frequency of the AC signal to calculate wheel speed. The wheel speed sensor is connected to EBCM by a “twisted pair” of wires. Twisting reduces noise susceptibility than may cause a DTC to se.If the wheel speed sensor detects a rough road condition, the ECM misfire detection diagnostic will be de-activated.

Conditions for Setting the DTC

- Vehicle speed is higher than 10km/h(6.21mph).
- No Vehicle Speed Sensor error not set.
- VR sensor output signal is higher than 0.26.
- VR sensor output signal is not change for 30seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

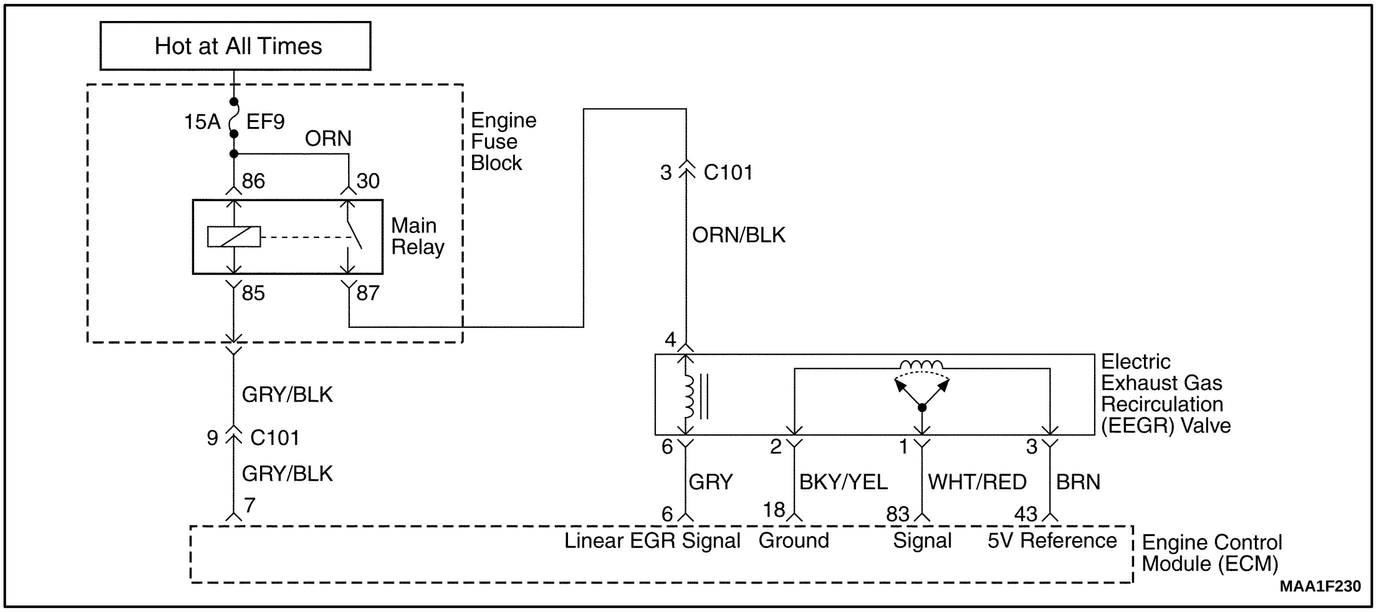
DTC P1385 – Rough Road Sensor Circuit Fault (ABS)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition ON, with engine OFF. 2. Install a scan tool to the Data Link Connector (DLC). 3. Review and record the scan tool Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using the scan tool, monitor specific Diagnostic Trouble Code (DTC) info for DTC P1385. Does the scan tool indicate that DTC P1385 failed?	–	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions and repair as needed: 2. Wheel speed sensor seal missing or damaged. 3. Wheel speed sensor mounting flanges cracked, missing, or incorrectly installed. Is the repair complete?	–	Go to *Step 14*	Go to “Diagnostic Aids”
4	1. Turn the ignition OFF. 2. Disconnect the defected Wheel speed sensor electrical connector. 3. Turn the ignition ON, with the engine OFF. 4. Observe the Wheel speed sensor value displayed on the scan tool. Is the Wheel speed sensor value near the specified value?	0V	Go to *Step 5*	Go to *Step 12*
5	1. Jumper the 5 volt reference circuit, the Wheel speed sensor signal circuit, together at the defected Wheel speed sensor harness connector. 2. Observe the defected Wheel speed sensor value displayed on the scan tool. Is the VR sensor value near the specified value?	4.95V	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition OFF. 2. Disconnect the Engine Control Module (ECM) and check the sensor ground circuit for high resistance, an open between the ECM and the Wheel speed sensor, or for a poor connection of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 10*
7	Check the 5 volt reference circuit for high resistance, an open between the ECM and the Wheel speed sensor, or a poor connection of the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 8*
8	1. Turn the ignition OFF. 2. Disconnect the ECM and check the Wheel speed sensor signal circuit for high resistance, an open, a low voltage, or a short to the sensor ground circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 9*

DTC P1385 – Rough Road Sensor Circuit Fault (ABS) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the Wheel speed sensor signal circuit for a poor connection at the ECM and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
10	Check for a poor connection at terminal 3 of the Wheel speed sensor and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 11*
11	Replace the Wheel speed sensor. Is the repair complete?	–	Go to *Step 14*	–
12	1. Turn the ignition OFF. 2. Disconnect the ECM. 3. Turn the ignition ON. 4. Check the Wheel speed sensor signal circuit for a short to voltage or a short to the 5 volt reference circuit and repair as needed. Is the repair complete?	–	Go to *Step 14*	Go to *Step 13*
13	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0400 ELECTRIC EXHAUST GAS RECIRCULATION OUT OF LIMIT

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

ThisDiagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting the DTC

- Engine Coolant Temperature(ECT) is higher than 80°C(176°F).
- Intake Air Temperature(IAT) is higher than 15°C (59°F).
- Manifold Absolute Pressure is greater than 75kPA.
- The EEGR is higher than 3%.
- Mass Air Flow is between 92 ~157mg/tdc.
- Engine Speed Is Between 2,500~2,900rpm.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0300, P0335, P0336, P0341, P0342, P1671, P1672, P1673 are NOT SET.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

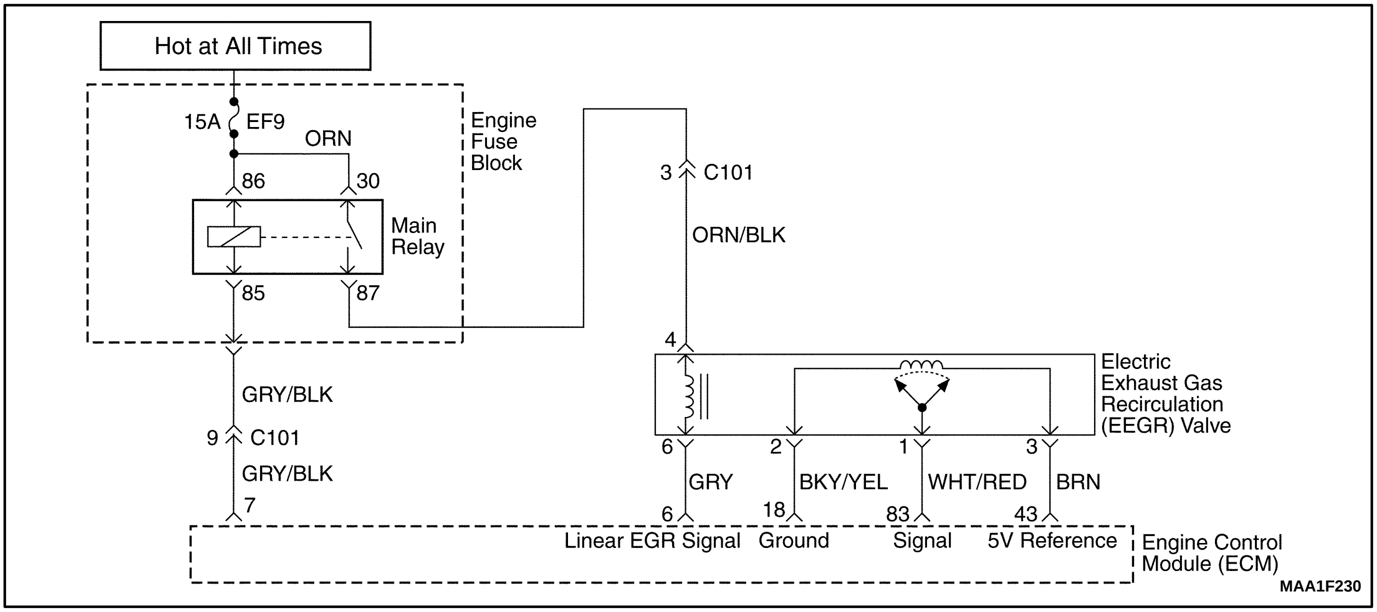
DTC P0400 – Electric Exhaust Gas Recirculation Out of Limit

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the Actual EEGR Position follow the desired EEGR position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch to ON. 2. Disconnect the EEGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EEGR valve. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	1. Connect the test light to ground. 2. Probe the EEGR control circuit at terminal 1 to the EEGR valve. 3. Command the EEGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EEGR ground circuit. Is the repair complete?	–	Go to *Step 19*	–
6	With a test light still connected to ground, probe the signal circuit at terminal 1. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
7	With a test light still connected to ground, again probe the signal circuit without commanding the EEGR valve with the scan tool. Does the test light illuminate?	–	Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
9	With a digital voltmeter (DVM) connected to ground, probe the 5V reference circuit at terminal 3. Is the voltage measured near the specified value?	5V	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to battery voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
11	Connect the test light to B+ and again probe the control circuit at terminal 4. Does the test light illuminate?	–	Go to *Step 15*	Go to *Step 16*
12	Replace the engine control module (ECM). Is the replacement complete?	–	Go to *Step 19*	–
13	Check the EEGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 17*

DTC P0400 – Electric Exhaust Gas Recirculation Out of Limit (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check the 5V reference circuit for a shortage to vattery voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
15	Check the control circuit for a shortage to ground and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
16	Check the control circuit for an open or poor connection at the EEGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 18*
17	Replace the EEGR valve. Is the replacement complete?	–	Go to *Step 19*	–
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1402 ELECTRIC EXHAUST GAS RECIRCULATION BLOCKED

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/ fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.
A EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

ThisDiagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting the DTC

- Engine Coolant Temperature(ECT) is greater than 80°C(176°F).
- Intake Air Temperature(IAT) is greater than 15°C (59°F).
- Manifold Absolute Pressure is greater than 75kPA.
- The EEGR differential rate is less than 3%.
- Mass Air Flow is between 92 ~157mg/tdc.
- Engine Speed Is Between 2,500~2,900rpm.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0300, P0335, P0336, P0341, P0342, P1671, P1672, P1673 are NOT SET.
- EEGR is disabled.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

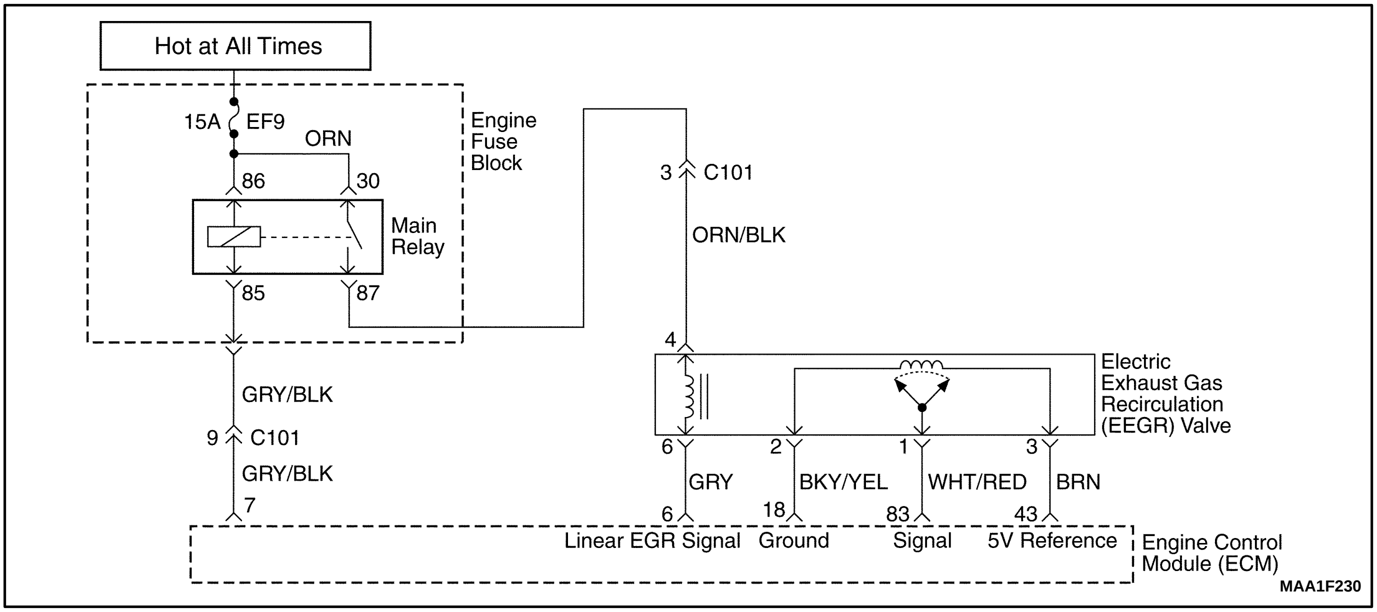
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EEGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EEGR and desired EEGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P1402 – Electric Exhaust Gas Recirculation Blocked

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Start the engine and allow the engine to idle. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the engine stall or attempt to stall?	50%	Go to *Step 5*	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. Remove the EEGR valve assembly. 3. Inspect the EEGR valve, passages and pipe for a restriction or damage and repair as necessary. Is a repair necessary?	–	Go to *Step 5*	Go to *Step 4*
4	Replace the EEGR valve. Is the replacement complete?	–	Go to *Step 5*	–
5	1. Start the engine. 2. Disconnect the battery for the specified time. 3. Drive the vehicle to the specified value. 4. Release the throttle and allow the vehicle to decelerate to the specified value. Is the EEGR Decel Filter Values less than the specified value?	10 secnds 60mph (97km/h) 20mph (32km/h) 0mph	Go to *Step 3*	Go to *Step 6*
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 7*	Go to *Step 2*



DIAGNOSTIC TROUBLE CODE (DTC) – P1403 ELECTRIC EXHAUST GAS RECIRCULATION VALVE FAILURE

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

ThisDiagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- Engine Coolant Temperature(ECT) is greater than 80°C(176°F).
- Intake Air Temperature(IAT) is greater than 15°C (59°F).
- Manifold Absolute Pressure is greater than 75kPA.
- The open EEGR value is higher than 3%.
- Mass Air Flow is between 92 ~157mg/tdc.
- Engine Speed Is Between 2,500~2,900rpm.
- EEGR potentiometer voltage is less than 0.4V.
- EEGR potentiometer voltage is higher than 1.75V or integral term of EEGR controller blocked in high or low limit.
- DTCs P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0300, P0335, P0336, P0341, P0342, P1671, P1672, P1673 are NOT SET.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EEGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EEGR and desired EEGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

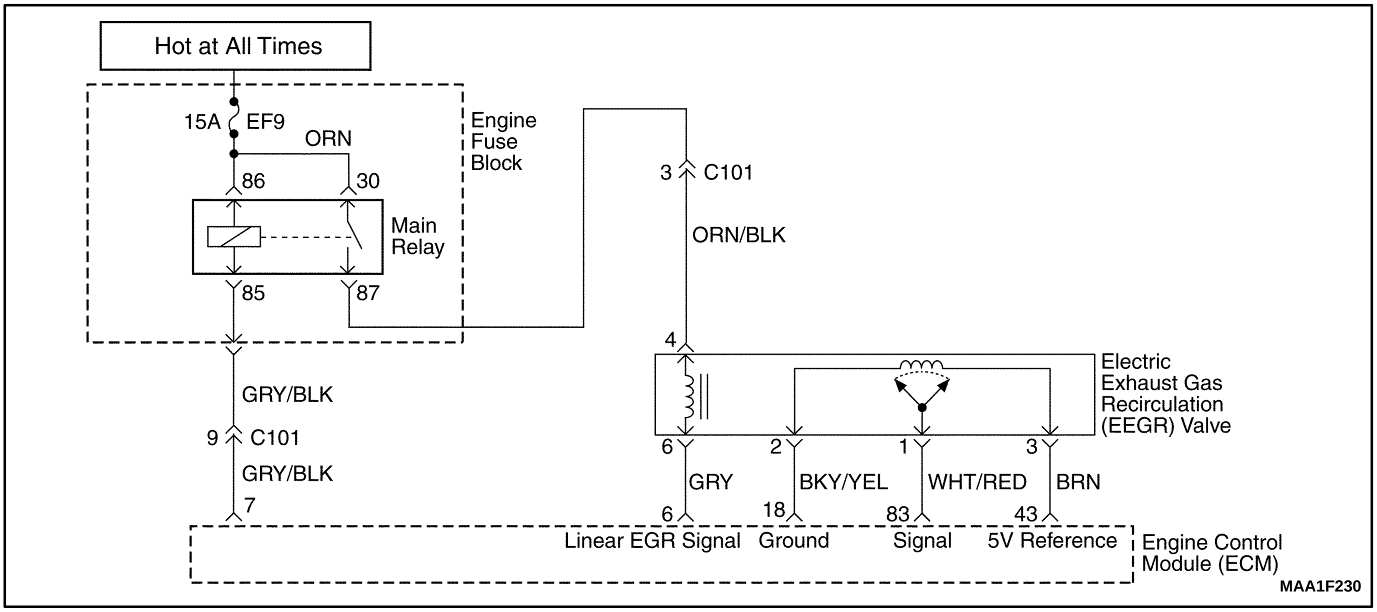
DTC P1403 – Electric Exhaust Gas Recirculation Valve Failure

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the Actual EEGR Position follow the desired EEGR position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch to ON. 2. Disconnect the EEGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EEGR valve. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	1. Connect the test light to ground. 2. Probe the EEGR control circuit at terminal 1 to the EEGR valve. 3. Command the EEGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EEGR ground circuit. Is the repair complete?	–	Go to *Step 19*	–
6	With a test light still connected to ground, probe the signal circuit at terminal 1. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
7	With a test light still connected to ground, again probe the signal circuit without commanding the EEGR valve with the scan tool. Does the test light illuminate?	–	Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
9	With a digital voltmeter (DVM) connected to ground, probe the 5V reference circuit at terminal 3. Is the voltage measured near the specified value?	5V	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to battery voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
11	Connect the test light to B+ and again probe the control circuit at terminal 4. Does the test light illuminate?	–	Go to *Step 15*	Go to *Step 16*
12	Replace the engine control module (ECM). Is the replacement complete?	–	Go to *Step 19*	–

DTC P1403 – Electric Exhaust Gas Recirculation Valve Failure (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check the EEGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 17*
14	Check the 5V reference circuit for a shortage to battery voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
15	Check the control circuit for a shortage to ground and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
16	Check the control circuit for an open or poor connection at the EEGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 18*
17	Replace the EEGR valve. Is the replacement complete?	–	Go to *Step 19*	–
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0404 ELECTRIC EXHAUST GAS RECIRCULATION OPENED

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

ThisDiagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EEGR circuit low voltage.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- EEGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EEGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EEGR and desired EEGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

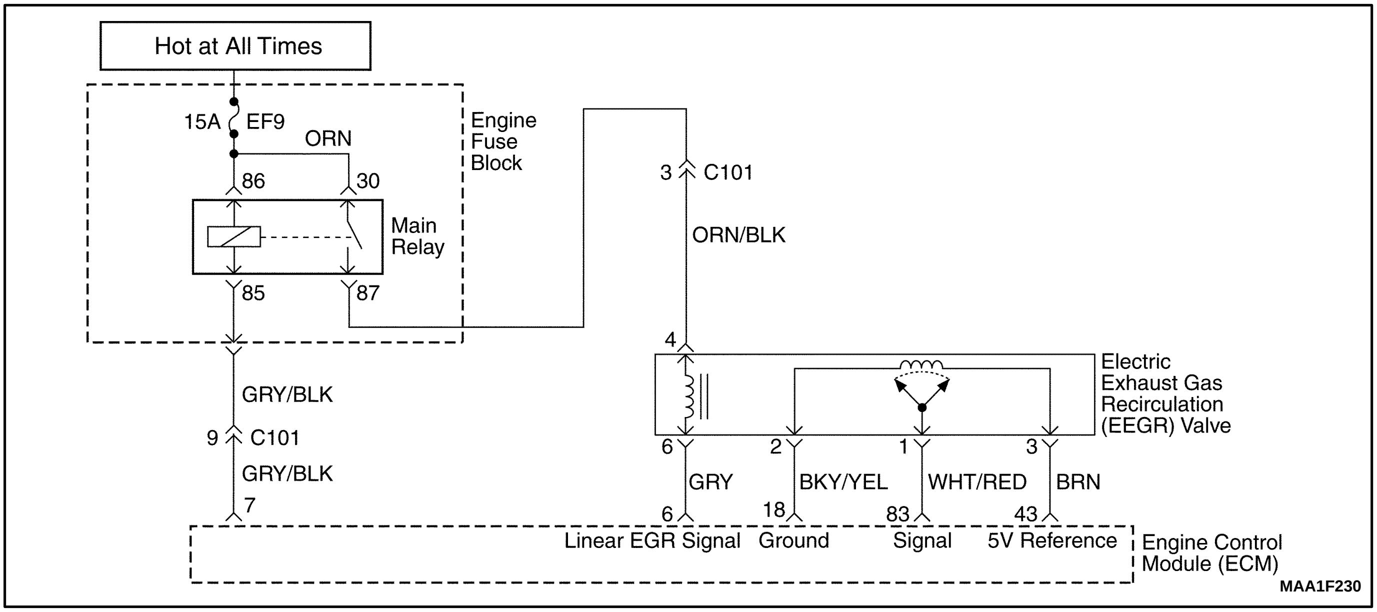
DTC P0404 – Electric Exhaust Gas Recirculation Opened

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the Actual EEGR Position follow the desired EEGR position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch to ON. 2. Disconnect the EEGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EEGR valve. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	1. Connect the test light to ground. 2. Probe the EEGR control circuit at terminal 1 to the EEGR valve. 3. Command the EEGR valve to the specified values using a scan tool. After the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to *Step 6*	Go to *Step 7*
5	Repair the open or poor connection in the EEGR ground circuit. Is the repair complete?	–	Go to *Step 19*	–
6	With a test light still connected to ground, probe the signal circuit at terminal 1. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
7	With a test light still connected to ground, again probe the signal circuit without commanding the EEGR valve with the scan tool. Does the test light illuminate?	–	Go to *Step 10*	Go to *Step 11*
8	Check the signal circuit for a short to voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
9	With a digital voltmeter (DVM) connected to ground, probe the 5V reference circuit at terminal 3. Is the voltage measured near the specified value?	5V	Go to *Step 13*	Go to *Step 14*
10	Check the control circuit for a short to battery voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
11	Connect the test light to B+ and again probe the control circuit at terminal 4. Does the test light illuminate?	–	Go to *Step 15*	Go to *Step 16*
12	Replace the engine control module (ECM). Is the replacement complete?	–	Go to *Step 19*	–
13	Check the EEGR ground circuit for a poor connection or proper terminal tension at the ECM and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 17*

DTC P0404 – Electric Exhaust Gas Recirculation Opened (Cont'd)

Step	Action	Value(s)	Yes	No
14	Check the 5V reference circuit for a shortage to battery voltage and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
15	Check the control circuit for a shortage to ground and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
16	Check the control circuit for an open or poor connection at the EEGR valve electrical connector and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 18*
17	Replace the EEGR valve. Is the replacement complete?	–	Go to *Step 19*	–
18	Check the ECM electrical connector for a poor connection and repair as necessary. Is a repair necessary?	–	Go to *Step 19*	Go to *Step 12*
19	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 20*	Go to *Step 2*
20	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1404 ELECTRIC EXHAUST GAS RECIRCULATION CLOSED

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

ThisDiagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EEGR circuit high voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- EEGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EEGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EEGR and desired EEGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

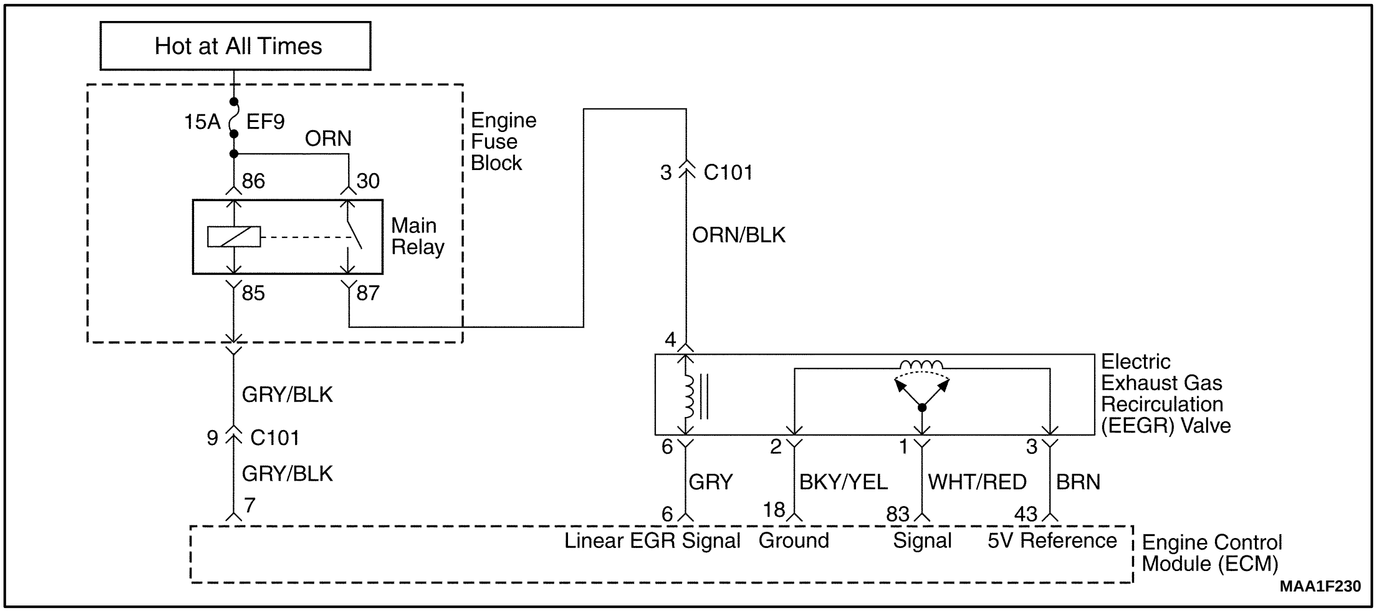
DTC P1404 – Electric Exhaust Gas Recirculation Opend

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the Actual EEGR Position follow the desired EEGR position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch to ON with the engine OFF. 2. Disconnect the EEGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5volt reference circuit at terminal 2 to the EEGR valve. Does the DVM read near the specified value?	5V	Go to *Step 4*	Go to *Step 5*
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 2 and 3. Does the actual EEGR position display the specified value ?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EEGR valve. Does the test light illuminate?	–	Go to *Step 6*	Go to *Step 7*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 7*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 1 to the EEGR valve. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Check for a high voltage in the EEGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 9*
9	Replace the EEGR valve. Is a replacement complete?	–	Go to *Step 12*	–
10	Check for a high voltage in the EEGR valve signal circuit and repair as necessary Is a repair necessary?	–	Go to *Step 12*	Go to *Step 11*
11	Replace the engine control module(ECM). Is a replacement complete?	–	Go to *Step 12*	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P1404 – Electric Exhaust Gas Recirculation Opend (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0405 EEGR PINTLE POSITION SENSOR LOW VOLTAGE

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

ThisDiagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EEGR voltage is less than 0.01V.
- EEGR potentiometer circuit low voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- EEGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EEGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EEGR and desired EEGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

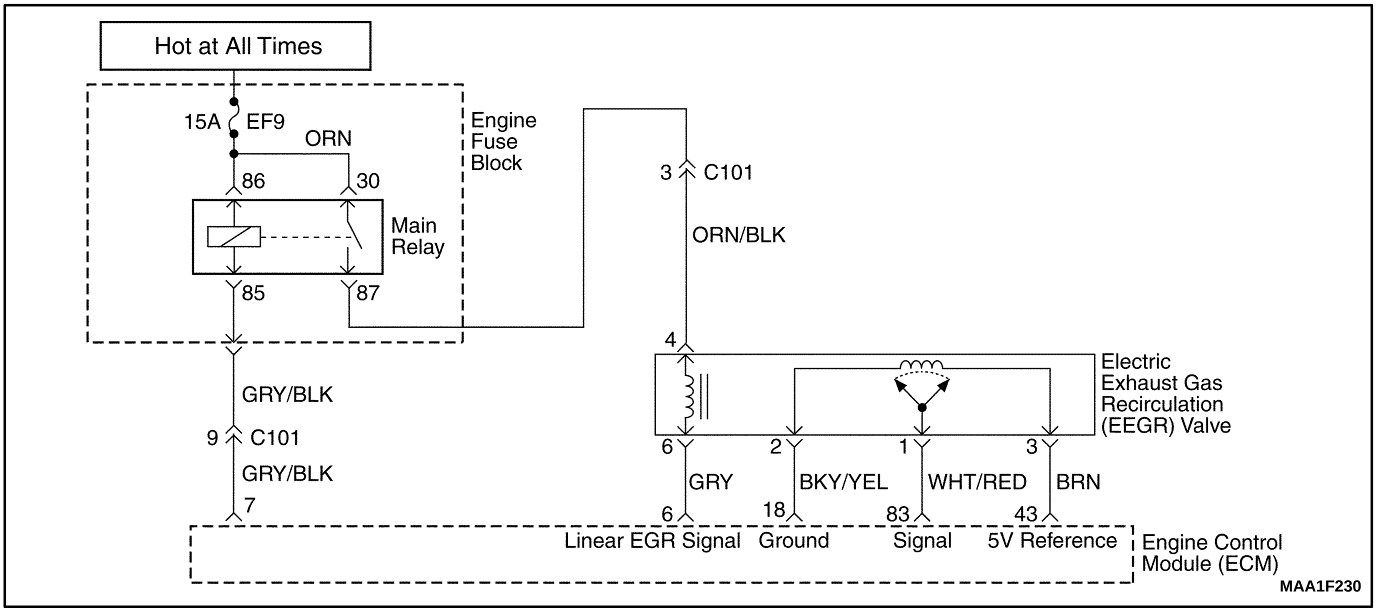
DTC P0405 – EEGR Pintle Position Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the Actual EEGR Position follow the desired EEGR position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch to ON with the engine OFF. 2. Disconnect the EEGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5volt reference circuit at terminal 3 to the EEGR valve. Does the DVM read near the specified value?	–0.01V	Go to *Step 4*	Go to *Step 5*
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 2 and 3. Does the actual EEGR position display the specified value ?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EEGR valve. Does the test light illuminate?	–	Go to *Step 6*	Go to *Step 7*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 7*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 2 to the EEGR valve. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Check for a low voltage in the EEGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 9*
9	Replace the EEGR valve Is a replacement complete?	–	Go to *Step 12*	–
10	Check for a low voltage in the EEGR valve signal circuit and repair as necessary Is a repair necessary?	–	Go to *Step 12*	Go to *Step 11*
11	Replace the engine control module(ECM). Is a replacement complete?	–	Go to *Step 12*	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P0405 – EEGR Pintle Position Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0406 EEGR PINTLE POSITION SENSOR HIGH VOLTAGE

Circuit Description

An Electric Exhaust Gas Re-circulation (EEGR) system is used to lower oxides of nitrogen (NOX) emission levels caused by high combustion temperatures. It a accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EEGR valve is used on this system. The linear EEGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold fhrough an orifice with a engine control module(ECM) controlled pintle. The ECM controls the pintle position using inputs from the Throttle Position (TP) and the Manifold Absolute Pressure (MAP) sensor. The ECM then commands the EEGR valve to operate when necessary by controlling an ignition signal through the ECM. This can be monitored on a scan tool as the Desired EEGR position.

The ECM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EEGR valve, a voltage signal representing the EEGR valve pintle position is sent to the ECM. This feedback signal can also be monitored on a scan tool and is the actual position of the EEGR pintle. The actual EEGR position should always be near the commanded or Desired EEGR position.

This Diagnostic Trouble Code(DTC) will detect an open or short circuit.

Conditions for Setting THE DTC

- EEGR voltage is higher than 4.99V.
- EEGR potentiometer circuit high voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- EEGR is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Due to moisture associated with exhaust systems, the EEGR valve may freeze and stick in cold weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EEGR and desired EEGR positions on a cold vehicle with a scan tool, the fault can be easily verified. Check the Freeze Frame data to determine if the DTC set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

DTC P0406 – EEGR Pintle Position Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to with the engine OFF. 2. Install the scan tool. 3. Command the electric exhaust gas recirculation (EEGR) valve to the specified values. Does the Actual EEGR Position follow the desired EEGR position?	25%, 50%, 75%, 100%	Go to *Step 19*	Go to *Step 3*
3	1. Turn the ignition switch to ON with the engine OFF. 2. Disconnect the EEGR valve electrical connector. 3. With a digital voltmeter (DVM) connected to ground, probe the 5volt reference circuit at terminal 3 to the EEGR valve. Does the DVM read near the specified value?	More than 5V	Go to *Step 4*	Go to *Step 5*
4	Jumper the 5 volt reference circuit to the signal circuit at terminals 2 and 3. Does the actual EEGR position display the specified value ?	100%	Go to *Step 6*	Go to *Step 7*
5	1. Connect the test light to B+. 2. Probe the 5 volt reference circuit to the EEGR valve. Does the test light illuminate?	–	Go to *Step 6*	Go to *Step 7*
6	Check the 5 volt reference and signal circuit for a poor connection or proper terminal tension and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 7*
7	1. Connect the test light to B+. 2. Probe the signal circuit at terminal 2 to the EEGR valve. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 9*
8	Check for a high voltage in the EEGR valve 5 volt reference circuit and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 9*
9	Replace the EEGR valve Is a replacement complete?	–	Go to *Step 12*	–
10	Check for a high voltage in the EEGR valve signal circuit and repair as necessary Is a repair necessary?	–	Go to *Step 12*	Go to *Step 11*
11	Replace the engine control module(ECM). Is a replacement complete?	–	Go to *Step 12*	–
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 13*	Go to *Step 2*

DTC P0406 – EEGR Pintle Position Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK

DIAGNOSTIC TROUBLE CODE (DTC) – P0420 CATALYST LOW EFFICIENCY

Circuit Description

In order to control exhaust emissions of Hydrocarbons (HC), Carbon Monoxide (CO) and Nitrogen Oxide (NOx), a Three-Way Catalytic Converter (TWC) 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, it also reduces NOx, converting it into nitrogen. The catalytic converter also has the ability to store oxygen. The Engine Control Module (ECM) has the capability to monitor this process using a Heated

Oxygen Sensor (HO2S) located in the exhaust stream past the TWC. The HO2S produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust emissions effectively. The ECM monitors the catalyst efficiency by first allowing the catalyst to heat up, waiting for a stabilization period while the engine is idling, and then adding and removing fuel while monitoring the reaction of the HO2S. When the catalyst is functioning properly, the HO2S response to the extra fuel is slow compared to the Oxygen Sensor (O2S). When the HO2S response is close to that of the O2S, the Oxygen storage capability or efficiency of the catalyst is considered to be bad, and the Malfunction Indicator Lamp (MIL) will illuminate.

Conditions for Setting the DTC

- Oxygen Sensor Capacity test condition:
- Closed loop stoichiometry.
- Engine is running more than 300 seconds.
- Airflow is between 25~50kg/h.
- Engine Coolant Temperature (ECT) is more than 70°C(176°F) .
- Engine speed between 2,400rpm and 3,000rpm.
- Vehicle speed is between 64km/h(28.6mph) and 80km/h(49.7mph).

Note: Test is aborted for this idle if:

- Change in engine speed is greater than 80 rpm.
- A/C status changed.
- Cooling fan status changed.
- Insufficient air/fuel shift.
- DTC(s) P0106, P0107, P0108, P0117, P0118, P0122, P0123, P0125, P0131, P0132, P0133, P1133, P0134, P1134, P0137, P0138, P0140, P0141, P1167, P1171, P0171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P0405, P0406, P0506, P0507, and P0562 are NOT SET.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

The catalyst test may abort due to a change in the engine load. Do not change the engine load (i.e. A/C, coolant fan, heater motor) while a catalyst test is in progress.

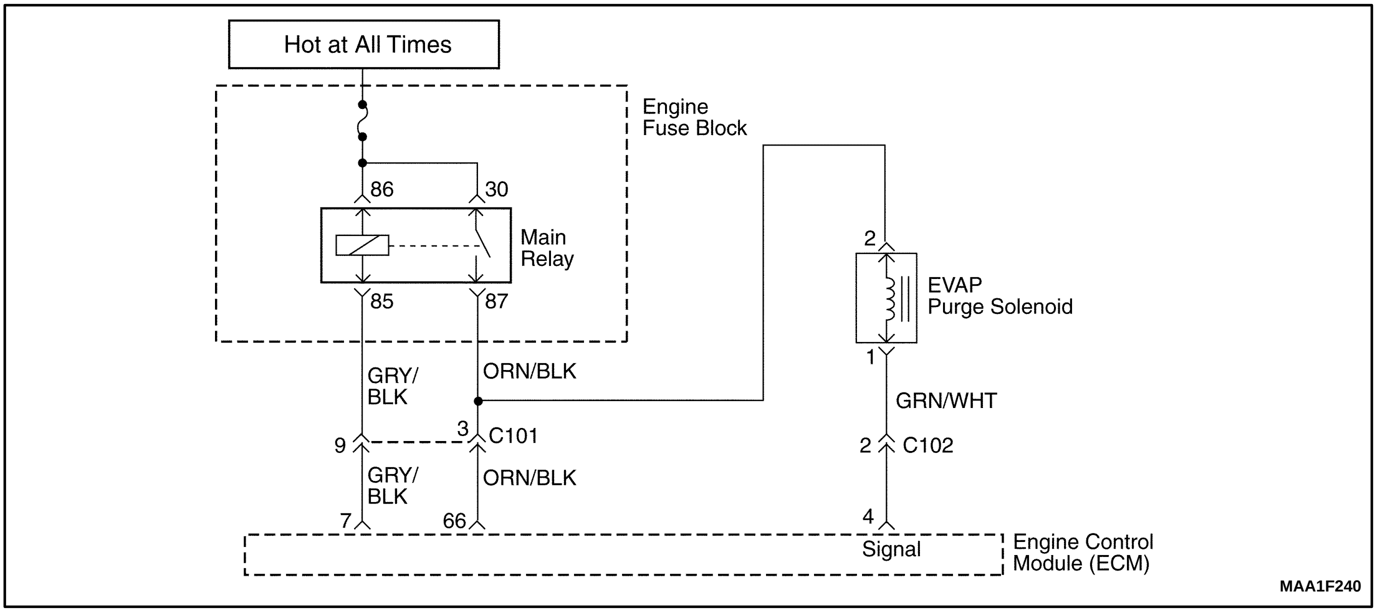
An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the intermittent complaint, should be thoroughly checked for the following conditions:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminal-to-wire connection.

DTC P0420 – Catalyst Low Efficiency

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data link Connector (DLC). 2. Turn the ignition ON. Are any component Diagnostic Trouble Codes (DTCs) set?	–	Go to Applicable DTC table	Go to *Step 3*
3	1. Visually/physically check the following: 2. Exhaust system for a leak. 3. Heated Oxygen Sensor (HO2S). Is a problem found?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the exhaust system as needed. Is the repair complete?	–	Go to *Step 6*	–
5	Replace the Three Way Catalytic Converter (TWC). Is the repair complete?	–	Go to *Step 6*	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0444 EVAP PURGE CONTROL CIRCUIT NO SIGNAL

Circuit Description

The evaporative emission (EVAP) system includes the following components :

- Fuel tank.
- EVAP vent solenoid.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The engine control module(ECM) monitors the vacuum level through the fuel tank pressure sensor signal. At the appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned on, allowing the engine to draw a small vacuum on the entire EVAP system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. If a sufficient vacuum level cannot be achieved, a large leak is indicated. This can be caused by the following conditions :

Missing or faulty fuel cap.

Disconnected or faulty fuel tank pressure sensor.

Disconnected, damaged, pinched, or blocked EVAP purge line.

Disconnected or faulty EVAP canister purge valve.

Disconnected or faulty EVAP vent solenoid.

Open ignition feed circuit to the EVAP vent or purge solenoid.

Damaged EVAP canister.

Leaking fuel sensor assembly O-ring.

Leaking fuel tank or fuel filler beck.

Any of the above conditions can set DTC P0444.

The test is failed if the tank vacuum is less than 10 in H20 for 15 seconds and the manifold vacuum integral is greater than 49512 (proportional to purge mass from the tank).

Conditions for Setting the DTC

- Intake Air Temperature(IAT) is between 4°C and 34°C(39°F and 93°F).at engine start up.
- Engine Coolant Temperature(ECT) is between 4°C and 34°C(39°F and 93°F).at engine start up.
- Barometric pressure (BARO) is greater than 68kPA.
- IAT is not more than 8°C(46°F) greater than the ECT at start up.
- Fuel level is between 10% and 90%.
- The throttle position (TP) sensor is less than or equal to 100%.
- No fuel slosh, and the change in fuel level percent is 21 counts on 0.125 sec.
- Manifold vacuum is greater than or equal to 10kPA.
- Fuel level or change in tank pressure is less than or equal to 24.9 in H2O.
- System voltage is between 11V and 16V.

- The EVAP system in unable to achieve or maintain vacuum during the diagnostic test. The amount of decay will vary within the fuel level.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Although this DTC is considered a type. A diagnostic, it acts like a type B diagnostic under certain conditions. Whenever this diagnostic reports the system has passed, or if the battery is disconnected, the diagnostic must fail twice before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

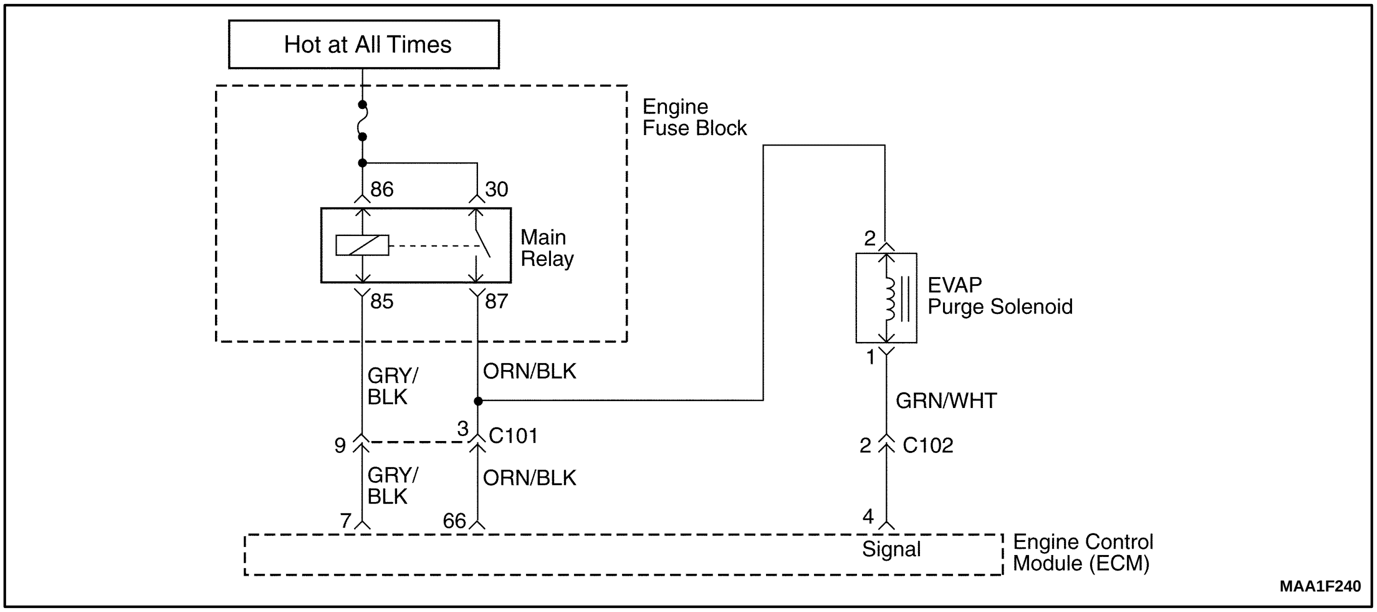
Check for the following conditions :

- Missing or damaged fuel cap.
- Missing or damaged O-rings at fuel vapor and EVAP purge line canister fittings.
- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.
- Poor connection at the ECM. Inspect the harness connectors for the following conditions.
- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness to the EVAP vent solenoid, EVAP canister purge valve, 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.

DTC P0444 – EVAP Purge Control Circuit No Signal

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Disconnect the evaporative emission (EVAP) canister purge valve connector. 2. Connect a test light between the EVAP canister purge valve connector terminal 2 and battery positive. Is the test light ON?	–	Go to *Step 3*	Go to *Step 5*
3	1. Disconnect the ECM connector. 2. Connect a test light between the ECM connector terminal 66 and ground. Is the test light ON?	–	Go to *Step 4*	Go to *Step 6*
4	1. Repair the line break in the wire between the EVAP canister purge valve connector 1 and the ECM connector terminal 66. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
5	1. Repair the line break in the wire between the EVAP canister purge valve connector 2 and the main relay connector terminal 87. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
6	1. Replace the ECM. 2. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 7*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0445 EVAP PURGE CONTROL CIRCUIT FAULT

Circuit Description

The evaporative emission (EVAP) system includes the following components :

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The engine control module(ECM) monitors the vacuum level through the fuel tank pressure sensor signal. At the appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned on, allowing the engine to draw a small vacuum on the entire EVAP system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. If a sufficient vacuum level cannot be achieved, a large leak is indicated. This can be caused by the following conditions :

Missing or faulty fuel cap.

Disconnected or faulty fuel tank pressure sensor.

Disconnected, damaged, pinched, or blocked EVAP purge line.

Disconnected or faulty EVAP canister purge valve.

Disconnected or faulty EVAP vent solenoid.

Open ignition feed circuit to the EVAP vent or purge solenoid.

Damaged EVAP canister.

Leaking fuel sensor assembly O-ring.

Leaking fuel tank or fuel filler beck.

Any of the above conditions can set DTC P0445.

The test is failed if the tank vacuum is less than 10 in H20 for 15 seconds and the manifold vacuum integral is greater than 49512 (proportional to purge mass from the tank).

Conditions for Setting the DTC

- Intake Air Temperature(IAT) is between 4°C and 34°C(39°F and 93°F).at engine start up.
- Engine Coolant Temperature(ECT) is between 4°C and 34°C(39°F and 93°F).at engine start up.
- Barometric pressure (BARO) is greater than 68kPA.
- IAT is not more than 8°C(46°F) greater than the ECT at start up.
- Fuel level is between 10% and 90%.
- The throttle position (TP) sensor is less than or equal to 100%.
- No fuel slosh, and the change in fuel level percent is 21 counts on 0.125 sec.
- Manifold vacuum is greater than or equal to 10kPA.
- Fuel level or change in tank pressure is less than or equal to 24.9 in H2O.
- System voltage is between 11V and 16V.

- The EVAP system in unable to achieve or maintain vacuum during the diagnostic test. The amount of decay will vary within the fuel level.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns ON.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Although this DTC is considered a type. A diagnostic, it acts like a type B diagnostic under certain conditions. Whenever this diagnostic reports the system has passed, or if the battery is disconnected, the diagnostic must fail twice before setting a DTC. The initial failure is not reported to the diagnostic executive or displayed on a scan tool. A passing system always reports to the diagnostic executive immediately.

Check for the following conditions :

Missing or damaged fuel cap.

Missing or damaged O-rings at fuel vapor and EVAP purge line canister fittings.

Cracked or punctured EVAP canister.

Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.

Poor connection at the ECM. Inspect the harness connectors for the following conditions.

- Backed-out terminals.
- Improper mating.
- Broken locks.
- Improperly formed.
- Damaged terminals.
- Poor terminal-to-wire connection.
- Damaged harness. Inspect the wiring harness to the EVAP vent solenoid, EVAP canister purge valve, 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.

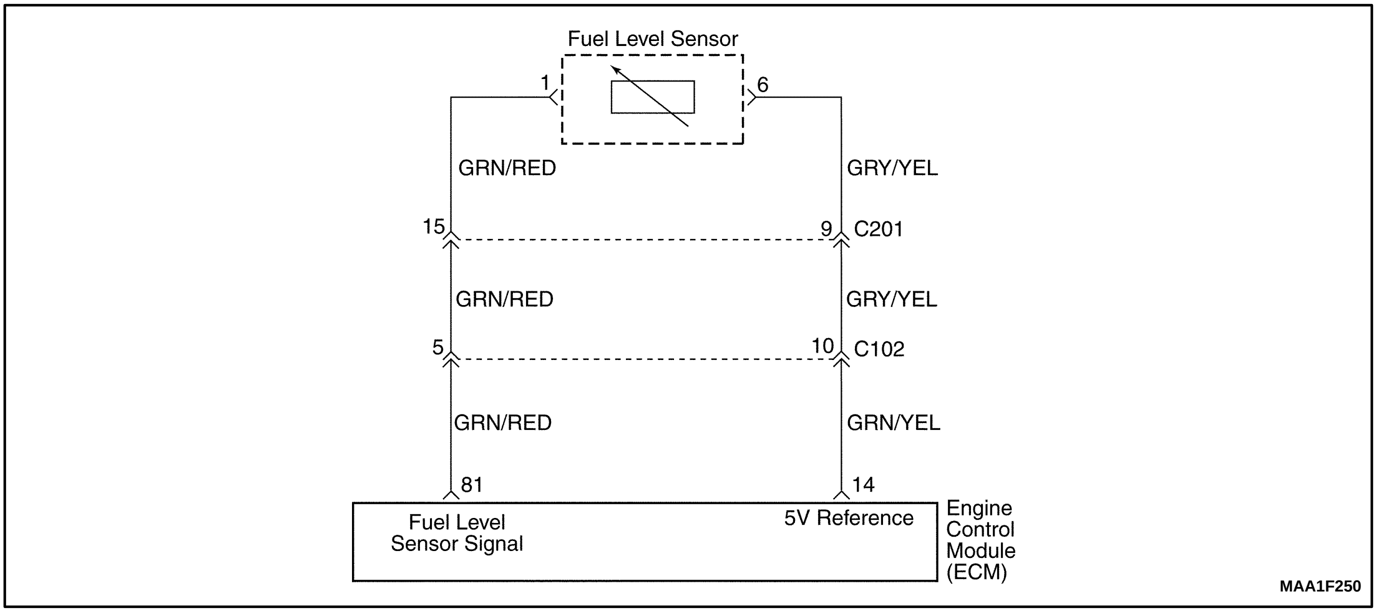
DTC P0445 – EVAP Purge Control Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Disconnect the evaporative emission (EVAP) canister purge valve connector. 2. Measure the resistance of the EVAP canister purge valve connector. Does the resistance measure near within the value specified?	30Ω	Go to *Step 3*	Go to *Step 9*
3	Connect a test light between EVAP canister purge valve connector terminal 2 and ground. Is the test light ON?	–	Go to *Step 4*	Go to *Step 6*
4	1. Disconnect the ECM connector. 2. Connect a test light between the ECM connector terminal 66 and ground. Is the test light ON?	–	Go to *Step 5*	Go to *Step 7*

DTC P0445 – EVAP Purge Control Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Repair the high voltage or ground in the wire between the EVAP canister purge valve connector terminal 1 and the ECM connector terminal 66. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
6	1. Disconnect the EVAP canister purge valve connector. 2. Connect a test light between the EVAP canister purge valve connector terminal 2 and battery. Is the test light ON?	–	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the ECM connector. 2. Connect a test light between the ECM connector terminal 65 and ground. Is the test light ON?	–	Go to *Step 8*	Go to *Step 10*
8	1. Repair the low voltage in the wire between the EVAP canister purge valve connector terminal 1 and the ECM connector terminal 66. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
9	1. Replace the EVAP canister purge valve. 2. Clear any Diagnostic Trouble Codes (DTCs) from the ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	Go to *Step 10*	–
10	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 11*	Go to *Step 2*
11	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0462 FUEL LEVEL SENSOR LOW VOLTAGE

Circuit Description

The engine control module(ECM) uses the fuel level input from the Fuel Level Sensor to calculate expected vapor pressures within the fuel system. Vapor pressure vary as the fuel level changes. Vapor pressure is critical in determining if the evaporative emission (EVAP) system is operating properly. Fuel Level is also used to determine if the Fuel level is too high or too low to be able to accurately detect EVAP system faults. This Diagnostic Trouble Code(DTC) detects a stuck fuel level sender.

Conditions for Setting the DTC

- Fuel Level Sensor voltage is less than 0.05V.
- Fuel Level Sensor circuit low voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Inspect harness connectors for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect the wiring harness for damage.

A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0463 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance check for the Fuel Level Sensor.

Empty = 100 ohms or over.

Half full = about 32.5 ohms.

Full = 10 ohms or less.

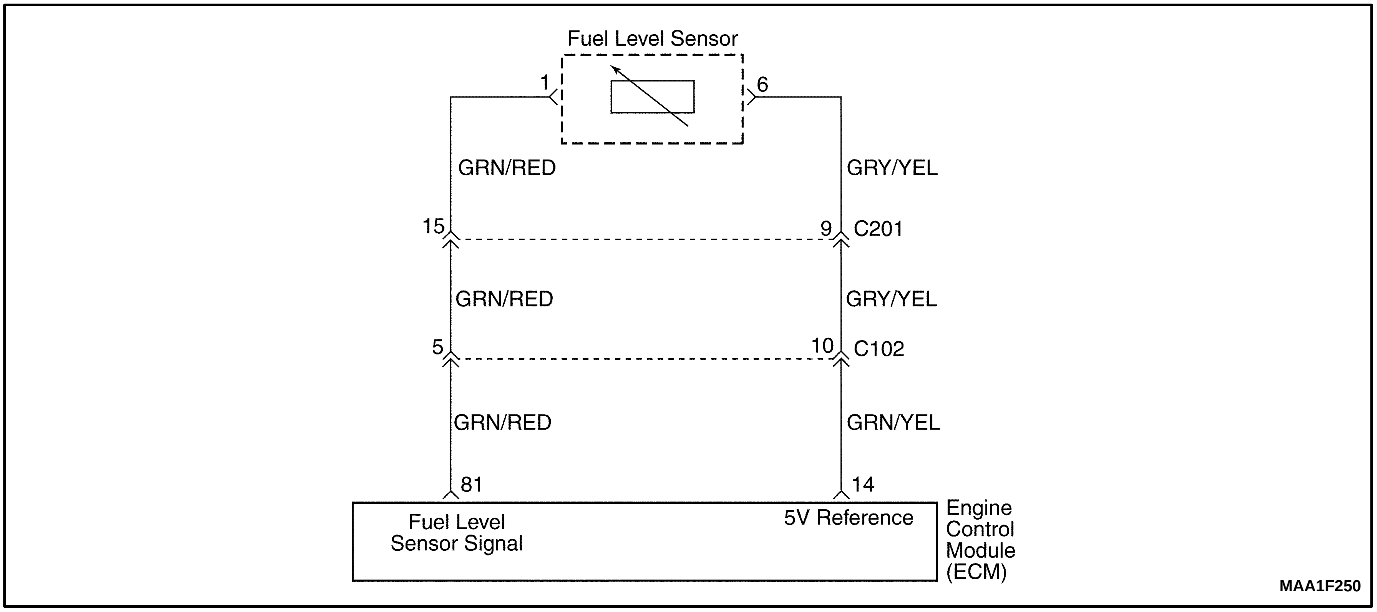
DTC P0462 – Fuel Level Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON. 2. Install a scan tool. 3. Operate the vehicle within Freeze Frame conditions as noted. Is the Diagnostic Trouble Code (DTC) P0462 set?	–	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Disconnect the fuel sender electircal connector from the fuel pump. 2. Using a digital voltmeter (DVM), measure the voltage in the signal circuit at terminal 1. Is the voltage within the specified value?	0.2–4.8V	Go to *Step 4*	Go to *Step 6*
4	Check for a proper ground connection at the fuel tank and repair as necessary. Is a repair necessary?	–	Go to *Step 11*	Go to *Step 5*
5	1. Remove the fuel sender from the fuel tank. 2. Reconnect the fuel sender electrical connector. 3. Monitor the Fuel Level Sensor parameter on the scan tool while moving the Fuel Level Sensor float from the empty position to the full position. 4. Repeat the procedure several times. Does the Fuel Level Sensor value on the scan tool increase and then decrease steadily when the float is moved?	–	Go to "Diagnostic Aids"	Go to *Step 8*
6	Check for an open or short to ground in the Fuel Level Sensor circuit and repair as necessary. Is the repair necessary?	–	Go to *Step 11*	Go to *Step 9*
7	Repair the open or short to ground in the Fuel Level Sensor circuit between the Fuel Level Sensor harness connector and the Fuel Level Sensor. Is the repair complete?	–	Go to *Step 11*	–
8	Replace the fuel sender assembly. Is the replacement complete?	–	Go to *Step 11*	–
9	1. Connect the fuel sender electrical connector. 2. Disconnect the engine control module(ECM) connector. 3. Using a digital voltmeter (DVM) measure the voltage in the signal circuit, at terminal 81. Does the DVM read within the specified value?	0.2–4.8V	Go to *Step 10*	Go to section *9E, Instrumenta-tion/Driver Information*
10	Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 12*	Go to *Step 2*

DTC P0462 – Fuel Level Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0463 FUEL LEVEL SENSOR HIGH VOLTAGE

Circuit Description

The engine control module(ECM) uses the fuel level input from the Fuel Level Sensor to calculate expected vapor pressures within the fuel system. Vapor pressure vary as the fuel level changes. Vapor pressure is critical in determining if the evaporative emission (EVAP) system is operating properly. Fuel Level is also used to determine if the Fuel level is too high or too low to be able to accurately detect EVAP system faults. This Diagnostic Trouble Code(DTC) detects a stuck fuel level sender.

Conditions for Setting the DTC

- Fuel Level Sensor voltage is higher than 4.9V.
- Fuel Level Sensor circuit high voltage.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Inspect harness connectors for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect the wiring harness for damage.

A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0463 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance check for the Fuel Level Sensor.

Empty = 100 ohms or over.

Half full = about 32.5 ohms.

Full = 10 ohms or less.

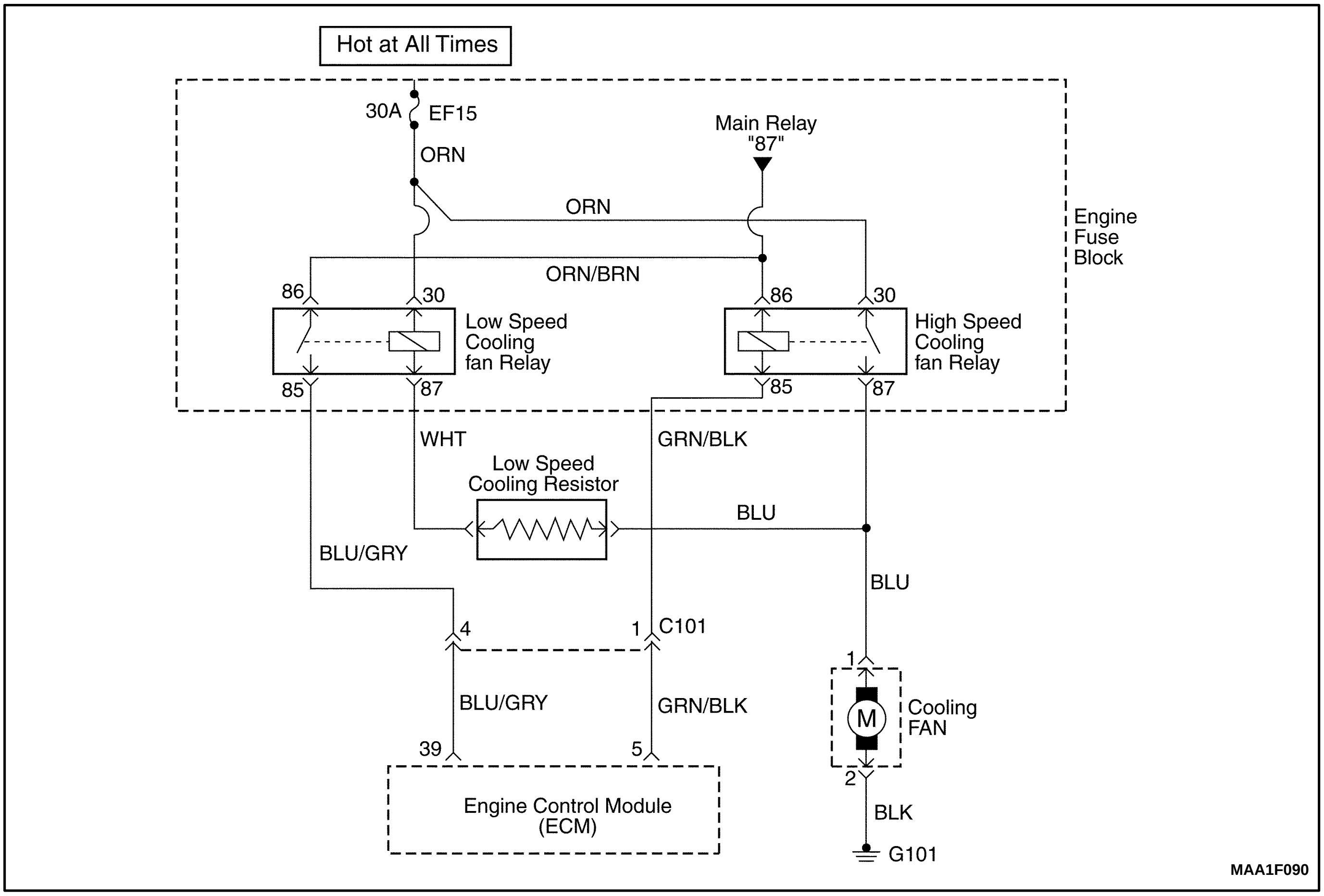
DTC P0463 – Fuel Level Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON. 2. Install a scan tool. 3. Operate the vehicle within Freeze Frame conditions as noted. Is the Diagnostic Trouble Code (DTC) P0463 set?	–	Go to *Step 3*	Go to "Diagnostic Aids"
3	1. Disconnect the fuel sender electrical connector from the fuel pump. 2. Using a digital voltmeter (DVM), measure the voltage in the signal circuit at terminal 1. Is the voltage within the specified value?	0.2–4.9V	Go to *Step 4*	Go to *Step 6*
4	Check for a proper ground connection at the fuel tank and repair as necessary. Is a repair necessary?	–	Go to *Step 11*	Go to *Step 5*
5	1. Remove the fuel sender from the fuel tank. 2. Reconnect the fuel pump electrical connector. 3. Monitor the Fuel Level Sensor parameter on the scan tool while moving the Fuel Level Sensor float from the empty position to the full position. 4. Repeat the procedure several times. Does the Fuel Level Sensor value on the scan tool increase and then decrease steadily when the float is moved?	–	Go to "Diagnostic Aids"	Go to *Step 8*
6	Check for an open or short to battery voltage in the Fuel Level Sensor circuit and repair as necessary. Is the repair necessary?	–	Go to *Step 11*	Go to *Step 9*
7	Repair the open or short to battery voltage in the Fuel Level Sensor circuit between the Fuel Level Sensor harness connector and the Fuel Level Sensor. Is the repair complete?	–	Go to *Step 11*	–
8	Replace the fuel sender assembly. Is the replacement complete?	–	Go to *Step 11*	–
9	1. Connect the fuel pump electrical connector. 2. Disconnect the engine control module(ECM) connector. 3. Using a digital voltmeter (DVM) measure the voltage in the signal circuit, at terminal 81. Does the DVM read within the specified value?	0.2–4.9V	Go to *Step 10*	Go to section *9E, Instrumenta-tion/Driver Information*
10	Replace the ECM. Is the repair complete?	–	Go to *Step 11*	–
11	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 12*	Go to *Step 2*

DTC P0463 – Fuel Level Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0480 LOW SPEED COOLING FAN RELAY CIRCUIT FAULT (WITHOUT A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- Diagnostic Trouble Codes (DTCs) P0117, P0118 not set.
- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 5 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported

a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

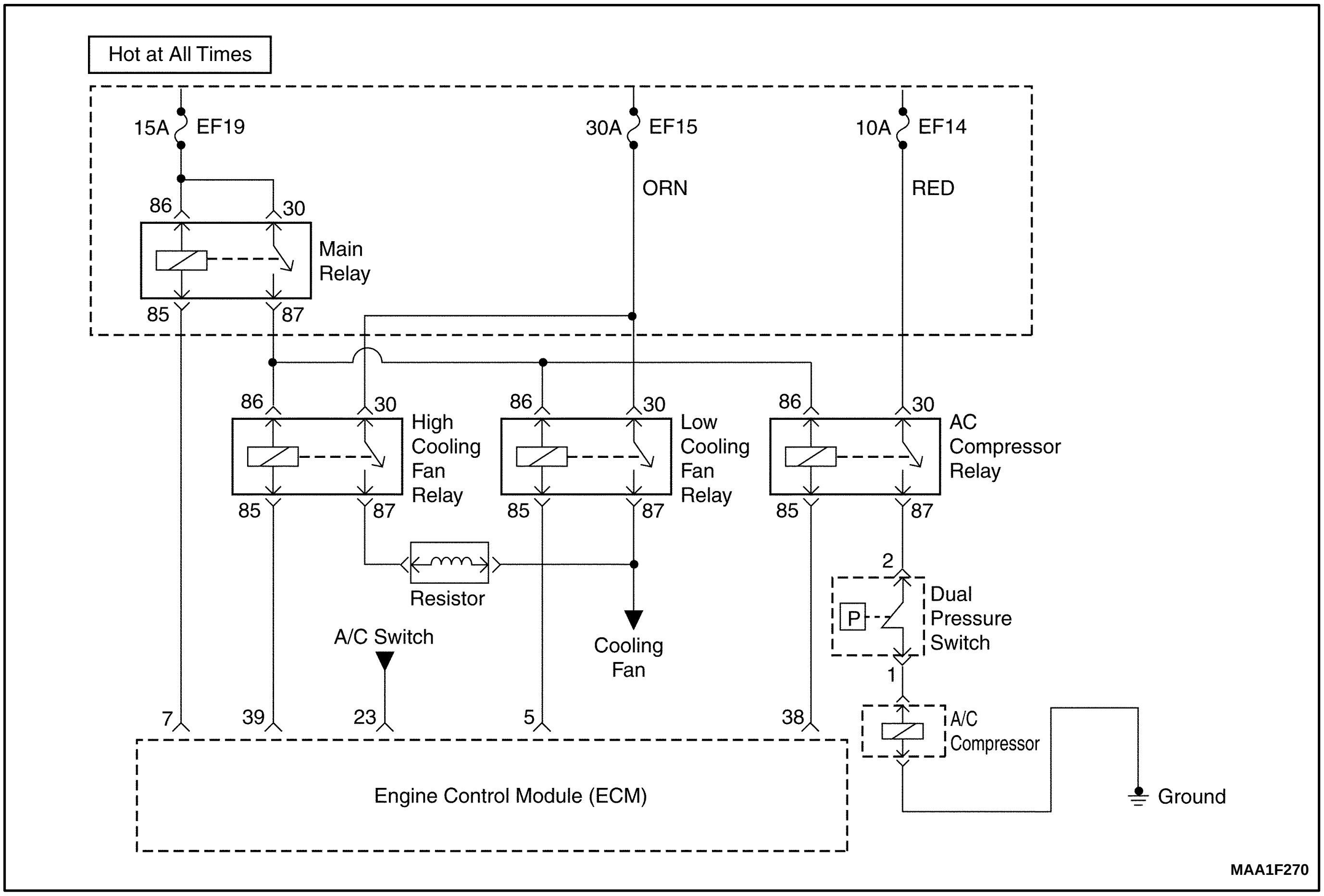
DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (WITHOUT A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in low speed relay control circuit, at terminal 39 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to “Diagnostic Aids”	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 87 and 39 in the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to *Step 12*	Go to *Step 10*
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 30 and 87 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to *Step 8*	Go to *Step 6*
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 39 in the ECM harness connector. Does the relay operate?	–	Go to *Step 9*	Go to *Step 10*
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to *Step 14*	Go to *Step 12*

DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (WITHOUT A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to *Step 11*	Go to *Step 13*
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to *Step 14*	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to *Step 14*	–
12	Replace the relay. Is the replacement complete?	–	Go to *Step 14*	–
13	Replace the ECM. Is the replacement complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0480 LOW SPEED COOLING FAN RELAY CIRCUIT FAULT (WITH A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- Diagnostic Trouble Codes (DTCs) P0117, P0118 not set.
- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 5 seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported

a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

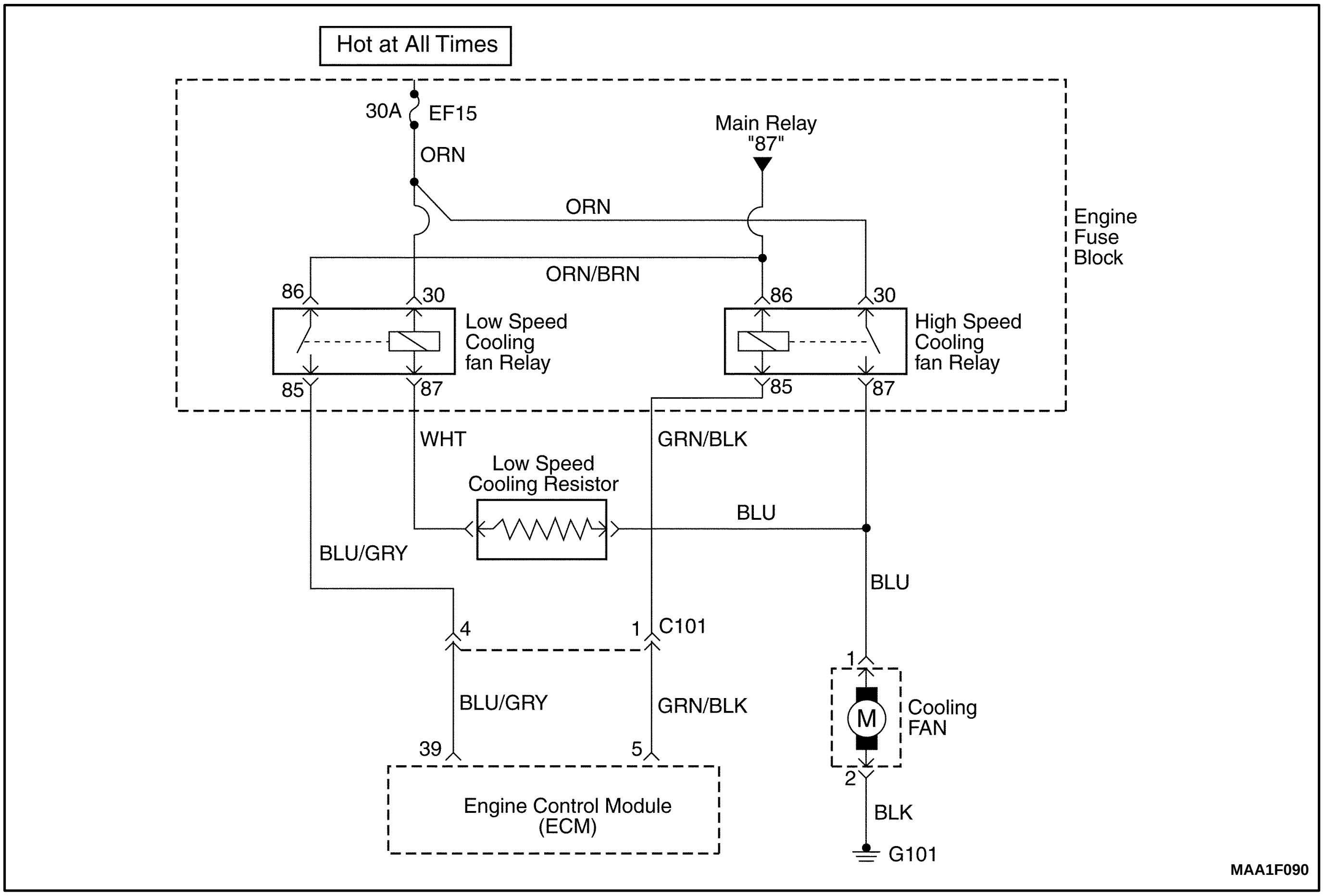
DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (with A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in low speed relay control circuit, at terminal 10 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to “Diagnostic Aids”	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 5 in the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to *Step 12*	Go to *Step 10*
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to *Step 8*	Go to *Step 6*
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 5 in the ECM harness connector. Does the relay operate?	–	Go to *Step 9*	Go to *Step 10*
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to *Step 14*	Go to *Step 12*

DTC P0480 – Low Speed Cooling Fan Relay Circuit Fault (with A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to *Step 11*	Go to *Step 13*
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to *Step 14*	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to *Step 14*	–
12	Replace the relay. Is the replacement complete?	–	Go to *Step 14*	–
13	Replace the ECM. Is the replacement complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0481 HIGH SPEED COOLING FAN RELAY CIRCUIT FAULT (WITHOUT A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- Diagnostic Trouble Codes (DTCs) P0117, P0118 not set.
- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 5 seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported

a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

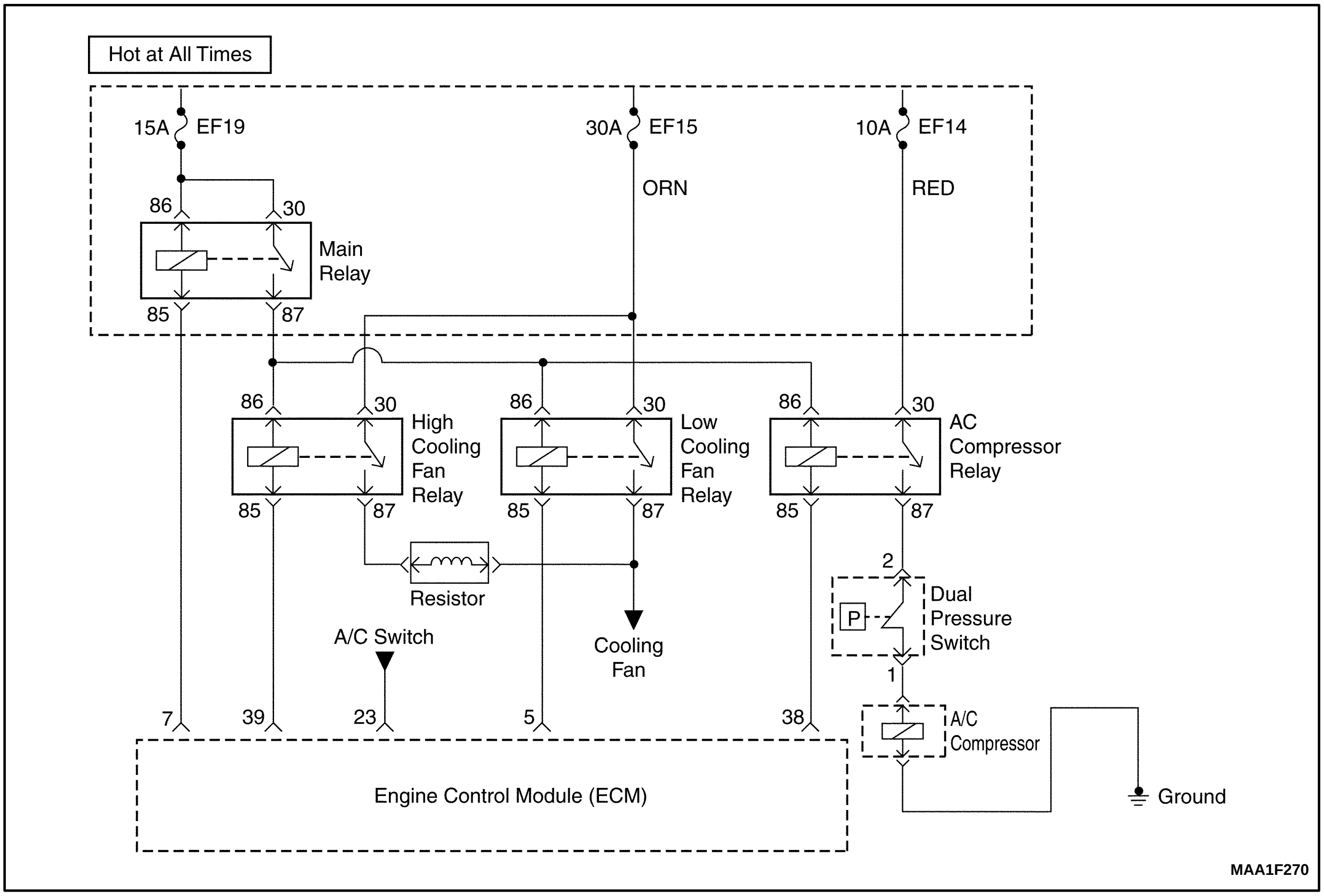
DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (without A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in high speed relay control circuit, at terminal 5 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to “Diagnostic Aids”	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 5 in the relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to *Step 12*	Go to *Step 10*
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to *Step 8*	Go to *Step 6*
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 5 in the ECM harness connector. Does the relay operate?	–	Go to *Step 9*	Go to *Step 10*
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to *Step 14*	Go to *Step 12*

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (without A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to *Step 11*	Go to *Step 13*
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to *Step 14*	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to *Step 14*	–
12	Replace the relay. Is the replacement complete?	–	Go to *Step 14*	–
13	Replace the ECM. Is the replacement complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0481 HIGH SPEED COOLING FAN RELAY CIRCUIT FAULT (WITH A/C)

Circuit Description

Ignition voltage is supplied directly to the cooling fan relay coil. The engine control module(ECM) controls the relay by grounding the control circuit via an internal switch called a driver. The primary function of the driver is supply the ground for the component being controlled. Each driver has a fault line which is monitored by the ECM. When the ECM is commanding a component ON, the voltage of the control circuit should be low (near 0volts). When the ECM is commanding the control circuit to a component OFF, the voltage potential of the circuit should be high(near battery voltage). If the fault detection circuit senses a voltage other than what is expected, the fault line status will change causing the DTC to set.

The relay is used to control the high current flow to the cooling fan motors. This allows the ECM driver to only have to handle the relatively low current used by the relay.

Conditions for Setting the DTC

- Diagnostic Trouble Codes (DTCs) P0117, P0118 not set.
- Ignition ON.
- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 5 seconds.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Using Freeze Frame and/or failure records data may aid in locating an intermittent condition. If the DTC cannot be duplicated, the information included in the Freeze Frame and/or failure records data can be useful in determining how many miles since the DTC set. The fail counter and Pass Counter can also be used to determine how many ignition cycles the diagnostics reported

a Freeze Frame conditions (rpm, load, vehicle speed, temperature, etc.) that .are noted. This will isolate when the DTC failed.

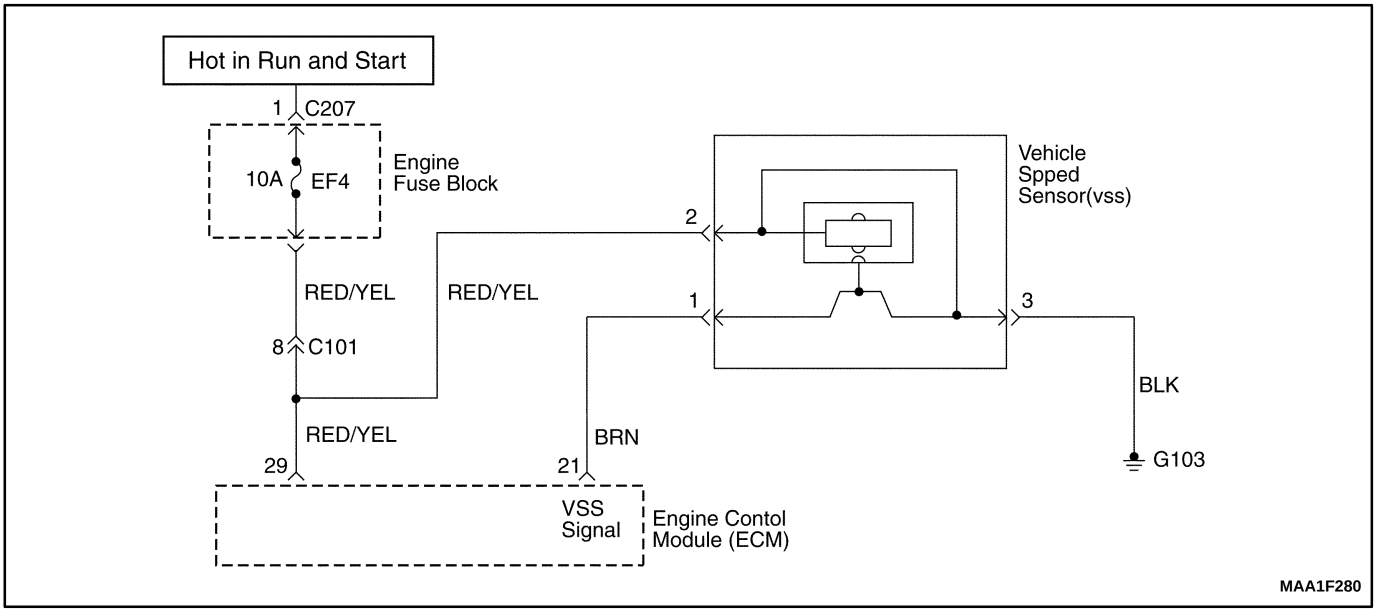
DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (with A/C)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to ON with the engine OFF. 2. Install a scan tool. 3. Command the relay ON and OFF. Does the relay turn ON and OFF when commanded?	–	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module (ECM) connector. 3. Turn the ignition switch to ON. 4. Using a digital voltmeter(DVM), measure the current in high speed relay control circuit, at terminal 39 to ground for 2 minutes. Does the amperage measure less than the specified value?	0.75 amps	Go to "Diagnostic Aids"	Go to *Step 4*
4	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Using a DVM, measure the resistance between terminals 85 and 39 in the high speed cooling fan relay control circuit in the ECM harness connector to ground. Does the DVM display infinite resistance?	–	Go to *Step 12*	Go to *Step 10*
5	1. Turn the ignition switch to LOCK. 2. Disconnect the relay. 3. Connect a test light between the relay coil terminals 86 and 85 in the relay harness connector. 4. Turn the Turn the ignition switch to ON. 5. Using the scan tool, command the relay ON and OFF. Does the test light turn ON and OFF with each commanded?	–	Go to *Step 8*	Go to *Step 6*
6	With the test light connected to ground, probe the ignition feed circuit in the relay harness connector. Does the test light illuminate?	–	Go to *Step 7*	Go to *Step 11*
7	1. Turn the ignition switch to LOCK. 2. Reconnect the relay. 3. Disconnect the ECM connector containing the relay control circuit. 4. Turn the Turn the ignition switch to ON. 5. With a fused jumper wire connected to ground, probe the relay control circuit at terminal 10 in the ECM harness connector. Does the relay operate?	–	Go to *Step 9*	Go to *Step 10*

DTC P0481 – High Speed Cooling Fan Relay Circuit Fault (with A/C) (Cont'd)

Step	Action	Value(s)	Yes	No
8	Check the connections at the relay. Is a problem found and corrected?	–	Go to *Step 14*	Go to *Step 12*
9	Check the connection at the ECM. Is a problem found and corrected?	–	Go to *Step 11*	Go to *Step 13*
10	Repair the faulty relay control circuit. Is the repair complete?	–	Go to *Step 14*	–
11	Repair the faulty relay ignition feed circuit. Is the repair complete?	–	Go to *Step 14*	–
12	Replace the relay. Is the replacement complete?	–	Go to *Step 14*	–
13	Replace the ECM. Is the replacement complete?	–	Go to *Step 14*	–
14	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
15	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P0501 VEHICLE SPEED NO SIGNAL (M/T ONLY)

Circuit Description

Vehicle speed information is provided to the engine control module (ECM) by the voltage speed sensor (VSS) is a permanent magnet generator that is mounted in the transaxle and produces a pulsing voltage whenever vehicle speed is over 3 mph (5km/h). The A/C voltage level and the number of pulses increase with vehicle speed. The ECM converts the pulsing voltage into mph (km/h) and than supplies the necessary signal to the instrument panel for speedometer / odometer operation and to the cruise control module and multi-function alarm module operation. The Diagnostic Trouble Code (DTC) will detect if vehicle speed is reasonable according to engine rpm and load.

Conditions for Setting the DTC

- Vehicle speed is not change at least 10 seconds.
- Engine speed is greater than 2,100rpm.
- MAF is greater than 152mg/tdc.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and failure records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

VSS signal circuit should be thoroughly checked for the following conditions

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

Ensure the VSS is correctly torqued to the trnasaxle housing.

Refer to *"intermittents"* in this Section.

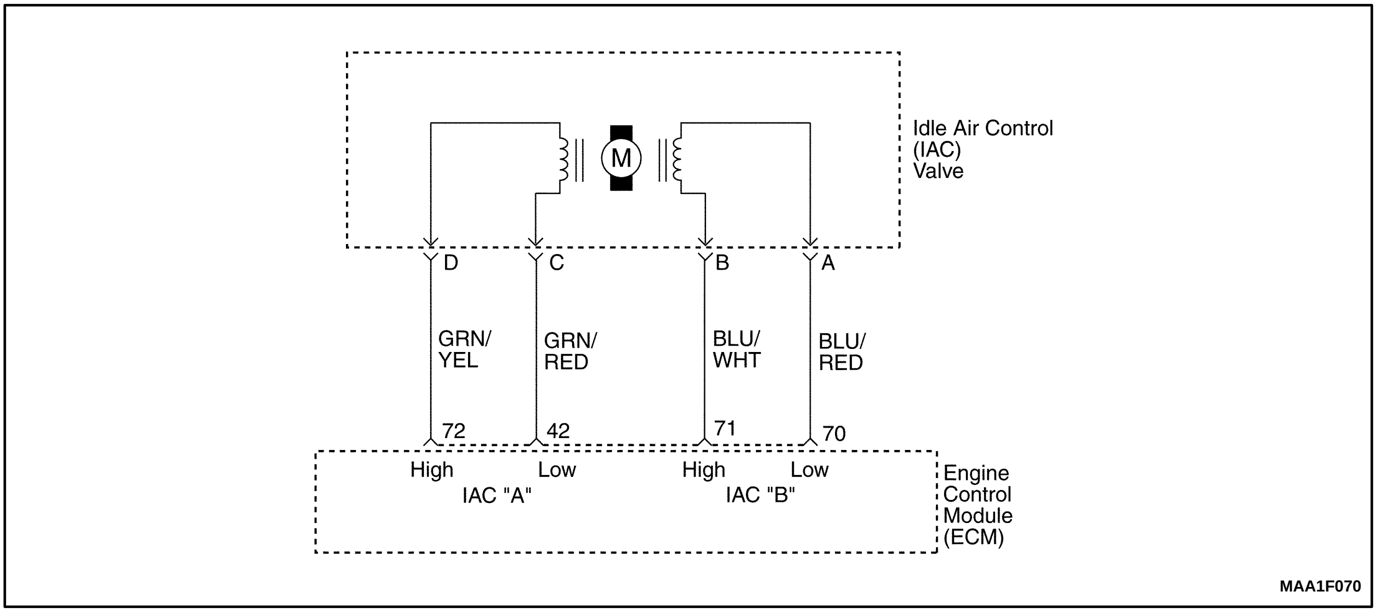
DTC P0501 – Vehicle Speed No Signal(M/T Only)

Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	**Notice:** Running the vehicle in gear with the wheels hanging down at full travel will damage the drive axles. 1. Turn the ignition ON, with the engine OFF. 2. Install a scan tool. 3. Raise the drive wheels. 4. Support the lower control arms so that the drive axles are in a horizontal (straight) position. 5. Allow the engine to idle in gear. Does the scan tool display vehicle speed above the specified value?	0 mph	Go to *Step 3*	Go to *Step 4*
3	1. Turn the ignition ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Freeze Frame conditions and Conditions for Setting this DTC. Does the scan tool display the vehicle speed above the specified value?	0 mph	Go to *Step 12*	Go to *Step 4*
4	1. Turn the ignition OFF. 2. Disconnect the engine control module(ECM) connector. 4. using a digital voltmeter(DVM) connected to ground, measure the voltage in the Vehicle Speed Sensor (VSS) signal circuit, at terminal 1 while rotating the wheels. Is the voltage greater than or eqaul to specified value?	0.5 v	Go to *Step 12*	Go to *Step 5*
5	Measure the resistant in the VSS signal circuit while rotating the wheels. Is the resistance greater than the specified value?	1950 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the VSS signal circuit for an open and repair as necessary. Is the repair complete?	–	Go to *Step 12*	Go to *Step 9*
7	Is the resistance value within or equal to the specified value?	1300–1950 Ω	Go to *Step 8*	Go to *Step 9*
8	Check the VSS signal circuit for a short to ground or for being shorted together and repair as necessary. Is a repair necessary?	–	Go to *Step 12*	Go to *Step 12*
9	1. Remove the VSS. 2. Measure the resistance between terminals 2 and 3. Is the resistance value within the specified value?	1300–1950 Ω	Go to *Step 11*	Go to *Step 10*
10	Replace the VSS. Is the action complete?	–	Go to *Step 12*	–
11	Replace the ECM. Is the action complete?	–	Go to *Step 12*	–

DTC P0501 – Vehicle Speed No Signal(M/T Only) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting the DTC as specifiec in the supporting text. Does the scan tool indicate that this diagnostic ran and passed?	–	Go to *Step 15*	Go to *Step 2*
13	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) 0505
IDLE AIR CONTROL VALVE (IACV) CIRCUIT FAULT

Circuit Description

The Engine Control Module (ECM) controls the air entering into the engine with an Idle Air Control (IAC) Valve. To increase the idle rpm, the ECM commands the pintle inside the IAC valve away from the throttle body seat. This allows more air to bypass through the throttle blade. To decrease the rpm the ECM commands the pintle towards the throttle body seat. This reduces the amount of air bypassing the throttle blade. A scan tool will read the IAC valve pintle position in counts. The higher the counts, the more air that is allowed to bypass the throttle blade. This Diagnostic Trouble Code (DTC) determines if a low idle condition exists as defined as 100 rpm below the desired idle rpm.

Conditions for Setting the DTC

- No intrusive tests are active.
- DTC(s) P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0122, P0123, P0131, P0132, P0133, P1133, P1134, P0171, P1171, P0172, P0201, P0202, P0203, P0204, P0300, P0336, P0337, P0341, P0342, P0351, P0352, P0402, P0404, P1404, P0405, P0406, P0443, and P0502 are not set.
- Engine is running more than 60 seconds.
- Barometric Pressure (BARO) is greater than 72 kPa (10.4 psi).
- Engine Coolant Temperature (ECT) is greater than 60°C (140°F).
- Ignition voltage is between 11 and 16 volts.
- The Intake Air Temperature (IAT) is greater than –20°C (–4°F).
- Manifold Absolute Pressure is less than 60 kPa (8.7 psi).
- IAC valve is controlled fully opened.
- All of the above must be met for greater than 5 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

Inspect the IAC valve electrical connection for proper mating.

Inspect the wiring harness for damage.

Inspect the throttle stop screw for signs of tampering.

Inspect the throttle linkage for signs of binding or excessive wear.

A slow or unstable idle may be caused by one of the following conditions:

- Fuel system too rich or too lean.
- Foreign material in the throttle body bore or in the air induction system.
- A leaking or restricted intake manifold.

- Excessive engine overloading. Check for seized pulleys, pumps, or motors on the accessory drive,
- Overweight engine oil.

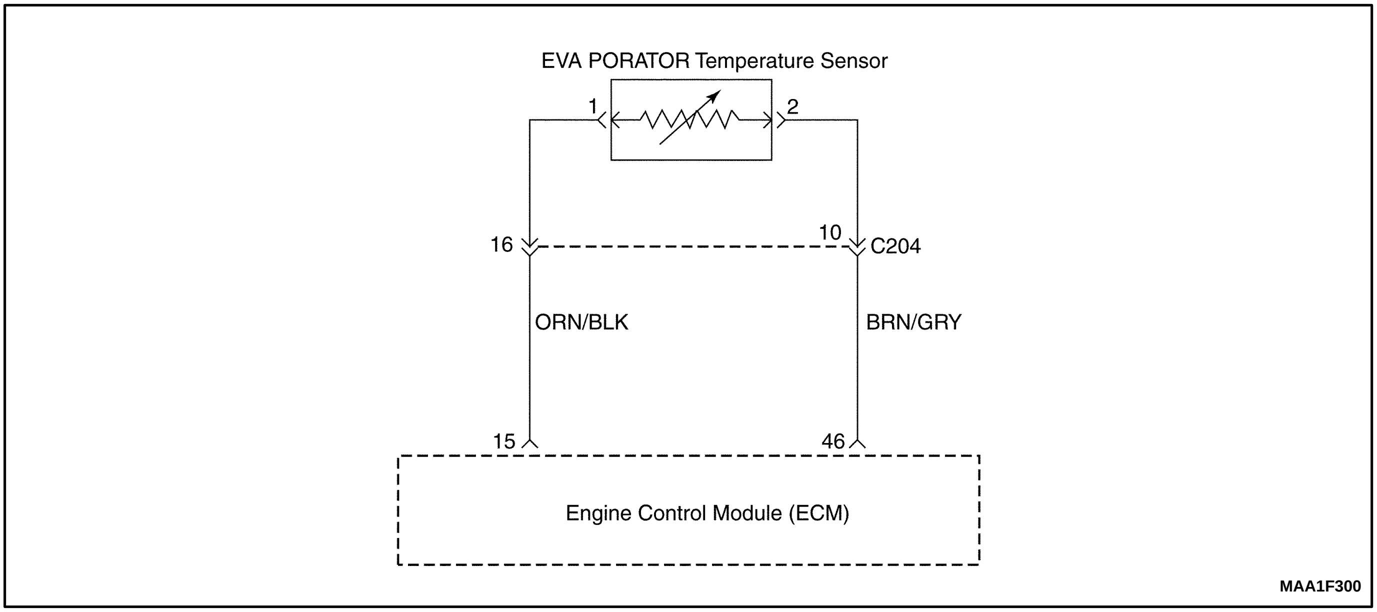
DTC P0505 Idle Air Control Valve (IACV) Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Operate the engine to idle speed. 3. Transmission in park or neutral and the parking brake set. 4. A/C is off. 5. Using scan tool, command the Idle Air Control (IAC) valve up and down between the specified value. Does the rpm change smoothly when he commanded by the scan tool?	900–1200 rpm	Go to *Step 3*	Go to *Step 5*
3	1. Turn the ignition OFF. 2. Disconnect the IAC valve connector. 3. Measure the resistance between terminal C and D of the IAC valve. 4. Measure the resistance between terminal B and A of the IAC valve. Is the resistance within the specified value?	40–80 Ω	Go to *Step 4*	Go to *Step 13*
4	1. Measure the resistance between terminal D and B of the IAC valve. 2. Measure the resistance between terminal C and A of the IAC valve. Is the resistance equal to the specified value?	∞	Go to *Step 15*	Go to *Step 13*
5	1. Turn the ignition OFF. 2. Disconnect the IAC valve connector. 3. Turn the ignition ON. 4. With test light connected to ground, probe the IAC connector terminals. Does the test light illuminate on D terminals?	–	Go to *Step 6*	Go to *Step 7*
6	With test light connected to B+, probe the IAC connector terminals. Does the test light illuminate on D terminals?	–	Go to *Step 8*	Go to *Step 9*
7	Check for an open or short to ground in the IAC high and low circuits and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
8	1. Idle the engine. 2. Connect a test light to ground, probe the IAC connector terminals. Does the test light flash On and OFF for all terminals?	–	Go to *Step 11*	Go to *Step 12*
9	Check for an open or a short to voltage in the IAC valve high and low circuits and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 10*
10	Check the Engine control Module (ECM) connector for poor connections and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 14*

DTC P0505 Idle Air Control Valve (IACV) Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
11	Inspect the IAC valve passages and repair as needed. Is the repair complete?	–	Go to *Step 15*	Go to *Step 13*
12	Check the test light. Does the test light remain on constantly for the terminals that did not blink?	–	Go to *Step 9*	Go to *Step 7*
13	1. Turn the ignition OFF. 2. Replace the IAC valve. Is the repair complete?	–	Go to *Step 15*	–
14	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 15*	–
15	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 16*	Go to *Step 2*
16	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1535 EVAPORATOR TEMPERATURE SENSOR HIGH VOLTAGE

Circuit Description

A semiconductor which resistance is noticeably changed as the change of temperature. When the refrigerant temperature of the evaporator drops to 0°C (0°F) and below, the evaporator cores get stuck with frost or ice, reducing the airflow, lowering the cooling capacity. The thermistor is a sensor which is used to prevent from frosting or icing. The thermistor is installed on the evaporator.

Conditions for Setting the DTC

- A short to battery voltage condition exists and is present for more the 2 seconds.

Action Taken When the DTC Sets

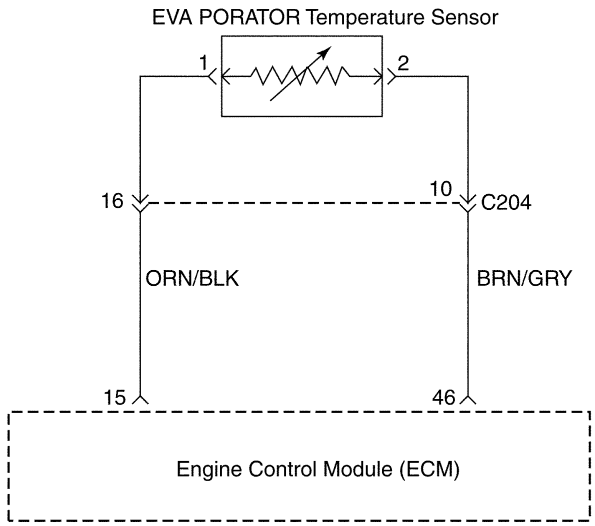
- The ECM will not illuminate the Malfunction Indicator Lamp (MIL).
- A history DTCs is stored.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored Failure Records buffers.
- The A/C compressor operation will be disabled while the low voltage indication exists.
- Update the fail record each time the diagnostic test fail.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- Usisng the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

DTC P1535 – Evaporator Temperature Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD II) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1.. Turn the ignition switch to LOCK. 2. Disconnect the evaporator temperature sensor. 3. Measure the resistance between evaporator temperature sensor terminals 1 and 2. Does the resistance within the specified value?	0Ω	Go to *Step 7*	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 2 in the sensor harness connector. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	Repair a short to battery between the terminal 46 of ECM and A/C compressor relay terminal 2. Is the repair complete?	–	Go to *Step 9*	–
5	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 2 in the sensor harness connector. Does the test light illuminate?	–	Go to *Step 6*	Go to *Step 8*
6	Repair a short to battery between the ECM wiring connector terminal 46 and evaporator temperature sensor terminal 2. Is the repair complete?	–	Go to *Step 9*	–
7	Replace the evaporator temperature sensor. Is the replacement complete?	–	Go to *Step 9*	–
8	1. Turn the ignition switch to LOCK. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1536 EVAPORATOR TEMPERATURE SENSOR LOW VOLTAGE

Circuit Description

A semiconductor which resistance is noticeably changed as the change of temperature. When the refrigerant temperature of the evaporator drops to 0°C (0°F) and below, the evaporator cores get stuck with frost or ice, reducing the airflow, lowering the cooling capacity. The thermistor is a sensor which is used to prevent from frosting or icing. The thermistor is installed on the evaporator.

Conditions for Setting the DTC

- A short to battery voltage condition exists and is present for more the 2 seconds.

Action Taken When the DTC Sets

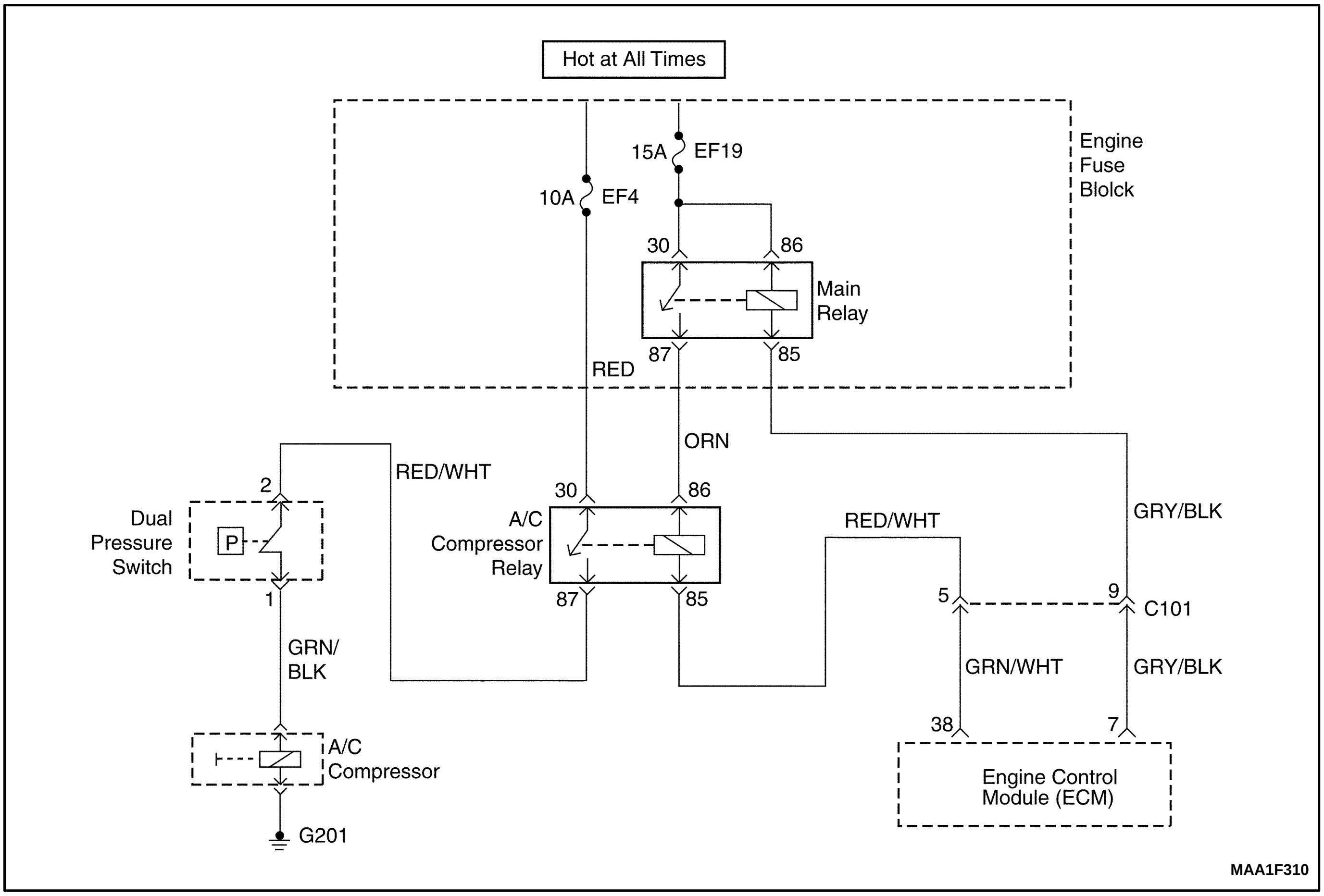
- The ECM will not illuminate the Malfunction Indicator Lamp (MIL).
- A history DTCs is stored.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored Failure Records buffers.
- The A/C compressor operation will be disabled while the low voltage indication exists.
- Update the fail record each time the diagnostic test fail.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- Usisng the scan tool can clear DTC(s).
- Disconnecting the ECM battery feed for 10 seconds.

DTC P1536 – Evaporator Temperature Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD II) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	2.. Turn the ignition switch to LOCK. 2. Disconnect the evaporator temperature sensor. 3. Measure the resistance between evaporator temperature sensor terminals 1 and 2. Does the resistance within the specified value?	0Ω	Go to *Step 7*	Go to *Step 3*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 2 in the sensor harness connector. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	Repair a short to battery between the terminal 46 of ECM and A/C compressor relay terminal 2. Is the repair complete?	–	Go to *Step 9*	–
5	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 2 in the sensor harness connector. Does the test light illuminate?	–	Go to *Step 6*	Go to *Step 8*
6	Repair a short to battery between the ECM wiring connector terminal 46 and evaporator temperature sensor terminal 2. Is the repair complete?	–	Go to *Step 9*	–
7	Replace the evaporator temperature sensor. Is the replacement complete?	–	Go to *Step 9*	–
8	1. Turn the ignition switch to LOCK. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1537 A/C COMPRESSOR RELAY HIGH VOLTAGE

Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The engine control module (ECM) uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low.

Conditions for Setting the DTC

- A/C compressor relay circuit short to battery.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

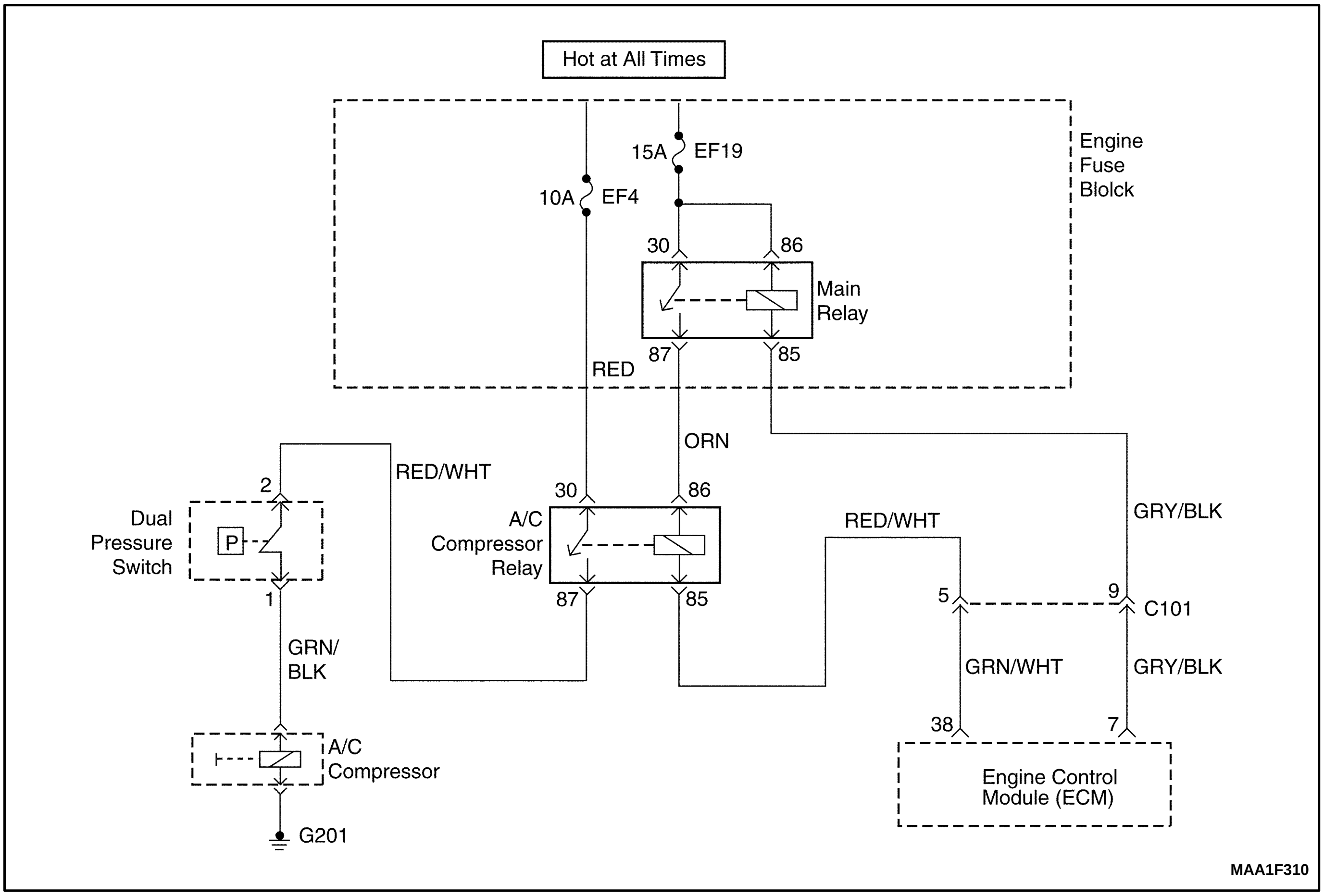
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1537 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1537 – A/C Compressor Relay High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	3.. Turn the ignition switch to LOCK. 2. Disconnect the A/C compressor relay. 3. Measure the resistance between A/C compressor relay terminals 85 and 86. Does the resistance within the specified value?	0Ω	Go to *Step 3*	Go to *Step 7*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 5*	Go to *Step 4*
4	Repair a short to battery voltage between the ignition switch terminal and A/C compressor relay terminal 86. Is the repair complete?	–	Go to *Step 9*	–
5	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 6*
6	Repair a short to battery voltage between the ECM wiring connector terminal 38 and A/C compressor relay terminal 85. Is the repair complete?	–	Go to *Step 9*	–
7	Replace the A/C compressor relay. Is the replacement complete?	–	Go to *Step 9*	–
8	1. Turn the ignition switch to LOCK. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1538 A/C COMPRESSOR RELAY LOW VOLTAGE

Circuit Description

The A/C system uses an A/C refrigerant pressure sensor mounted in the high pressure side of the A/C refrigerant system to monitor A/C refrigerant pressure. The engine control module (ECM) uses this information to turn ON the engine coolant fans when the A/C refrigerant pressure is high and to keep the compressor disengaged when A/C refrigerant pressure is excessively high or low.

Conditions for Setting the DTC

- A/C compressor relay circuit short to ground or open.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

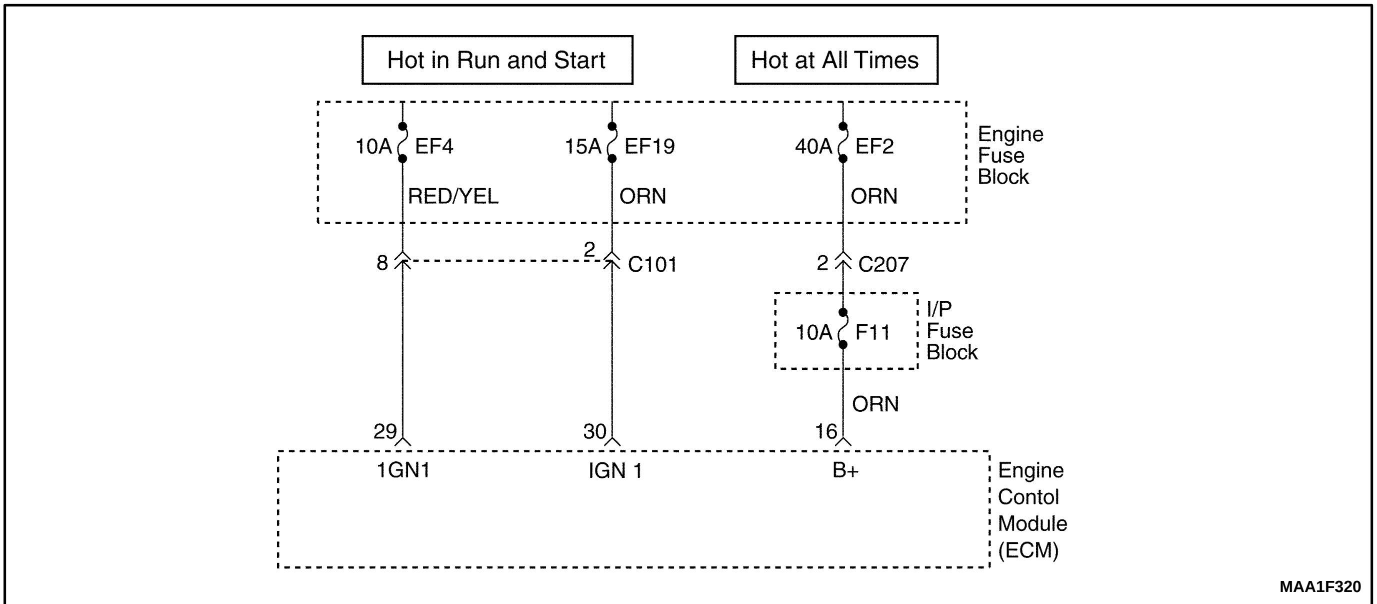
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1538 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1538 – A/C Compressor Relay Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the A/C compressor relay. 3. Measure the resistance between A/C compressor relay terminals 85 and 86. Does the resistance within the specified value?	0Ω	Go to *Step 3*	Go to *Step 7*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 5*	Go to *Step 4*
4	Repair a short to ground between the ignition switch terminal 4 and A/C compressor relay terminal 86. Is the repair complete?	–	Go to *Step 9*	–
5	1. 1. Turn the ignition switch to LOCK. 2. Disconnect the ECM. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 86 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 8*	Go to *Step 6*
6	Repair a short to ground between the ECM wiring connector terminal 38 and A/C compressor relay terminal 85. Is the repair complete?	–	Go to *Step 9*	–
7	Replace the A/C compressor relay. Is the replacement complete?	–	Go to *Step 9*	–
8	1. Turn the ignition switch to LOCK. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0562 SYSTEM VOLTAGE(ENGINE SIDE) TOO LOW

Circuit Description

The engine control module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal 7 at the ECM. A system voltage Diagnostic Trouble Code (DTC) sill set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition ON.
- Main relay is ON.
- The ignition voltage is less than 11.5 volt.
- The main relay voltage is less than 5.0V or higher than 26V during 7.6 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

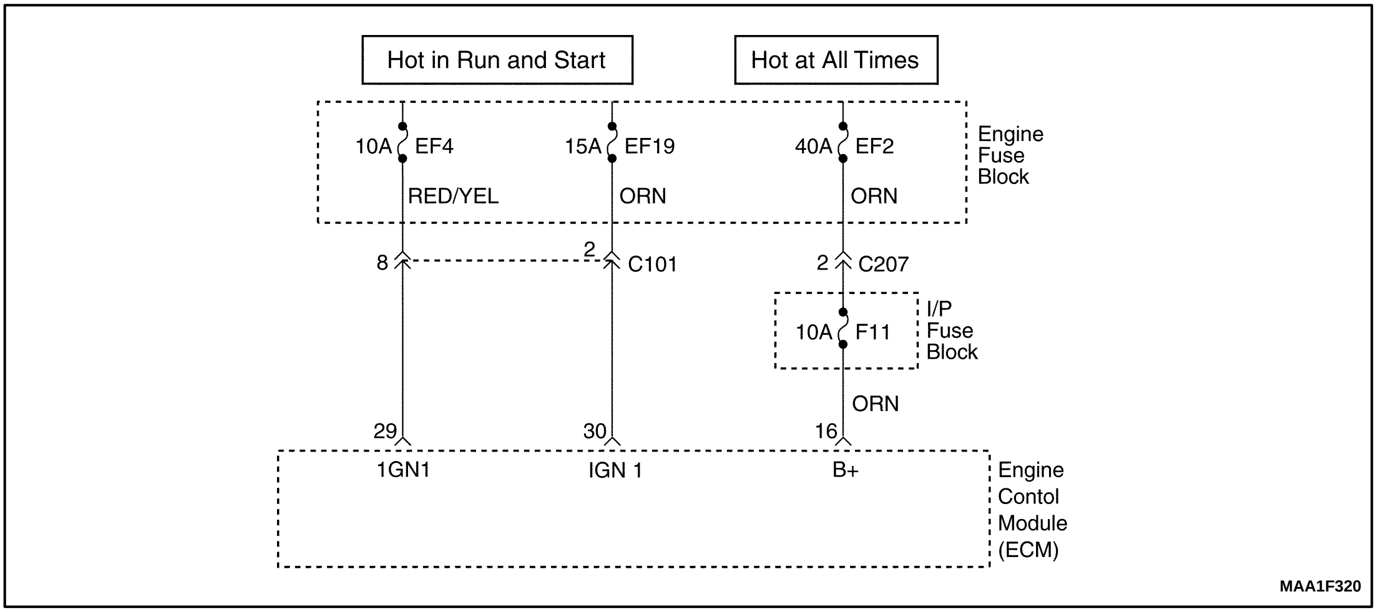
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0562 – System Voltage (Engine Side) Too Low

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed to the specified value. 3. Load the electrical system by turning on the headlights, high blower motor, etc. Is the ignition voltage less than the specified value?	1,400rpm 10V	Go to *Step 3*	Go to *Step 8*
3	1. With the engine still running at the specified value. 2. Using a digital voltmeter(DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	1,400rpm 12V	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module(ECM) connector at the ECM. 3. Turn the Turn the ignition switch to ON with the engine OFF. 4 Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal 29. Is the ignition voltage greater than the specified value?	10V	Go to *Step 5*	Go to *Step 6*
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. Is a repair necessary?	–	Go to *Step 8*	Go to *Step 7*
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the repair complete?	–	Go to *Step 8*	–
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1 Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0563 SYSTEM VOLTAGE (ENGINE SIDE) TOO HIGH

Circuit Description

The engine control module (ECM) monitors the ignition voltage on the ignition feed circuit to terminal 7 at the ECM. A system voltage Diagnostic Trouble Code (DTC) sill set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition ON.
- The ignition voltage is greater than 16 volt.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.
- Disconnecting the ECM battery feed for more than 10 seconds.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P0563 – System Voltage (Engine Side) Too High

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Install a scan tool and clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and raise the engine speed to the specified value. 3. Load the electrical system by turning on the headlights, high blower motor, etc. Is the ignition voltage less than the specified value?	1,400rpm 10V	Go to *Step 3*	Go to *Step 8*
3	1. With the engine still running at the specified value. 2. Using a digital voltmeter(DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	1,400rpm 12V	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the engine control module(ECM) connector at the ECM. 3. Turn the Turn the ignition switch to ON with the engine OFF. 4. Using a DVM, measure the ignition voltage at the ignition feed circuit, terminal 29. Is the ignition voltage greater than the specified value?	10V	Go to *Step 5*	Go to *Step 6*
5	Check for a malfunctioning connection at the ECM harness terminals and repair as necessary. Is a repair necessary?	–	Go to *Step 8*	Go to *Step 7*
6	Repair the poor connection (high resistance) in the ignition feed circuit. Is the repair complete?	–	Go to *Step 8*	–
7	Replace the ECM. Is the replacement complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0601 ENGINE CONTROL MODULE CHECKSUM ERROR

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that after vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An electrically erasable programmable read only memory (EEPROM) is used to house the program information and the calibrations required for engine, transaxle, transaxle diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects more than 3 incorrect checksum.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DTC P0601– Engine Control Module Checksum Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Replace the engine control module(ECM). Is the replacement complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0604 ENGINE CONTROL MODULE INTERNAL/EXTERNAL RAM ERROR

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that after vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An electrically erasable programmable read only memory (EEPROM) is used to house the program information and the calibrations required for engine, transaxle, transaxle diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects more than 3 incorrect checksum.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DTC P0604 – Engine Control Module RAM Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Replace the engine control module(ECM). Is the replacement complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to Step 4	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) – P0605 ENGINE CONTROL MODULE NMVY WRITE ERROR

Circuit Description

The engine control module (ECM) is the control center of the fuel injection system. It constantly looks at the information from various sensors, and controls the systems that after vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Malfunction Indicator Lamp (MIL), and store a Diagnostic Trouble Code (DTC) or DTCs which identify the problem areas to aid the technician in making repairs. An electrically erasable programmable read only memory (EEPROM) is used to house the program information and the calibrations required for engine, transaxle, transaxle diagnostics operation. The ECM uses a value called a checksum for error detection of the software. The checksum is a value that is equal to all the numbers in the software added together. The ECM adds all the values in the software and if that value does not equal the checksum value, a checksum error is indicated.

Conditions for Setting the DTC

- The ECM detects more than 3 incorrect checksum.

Action taken when The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.
- Coolant fan turns on.

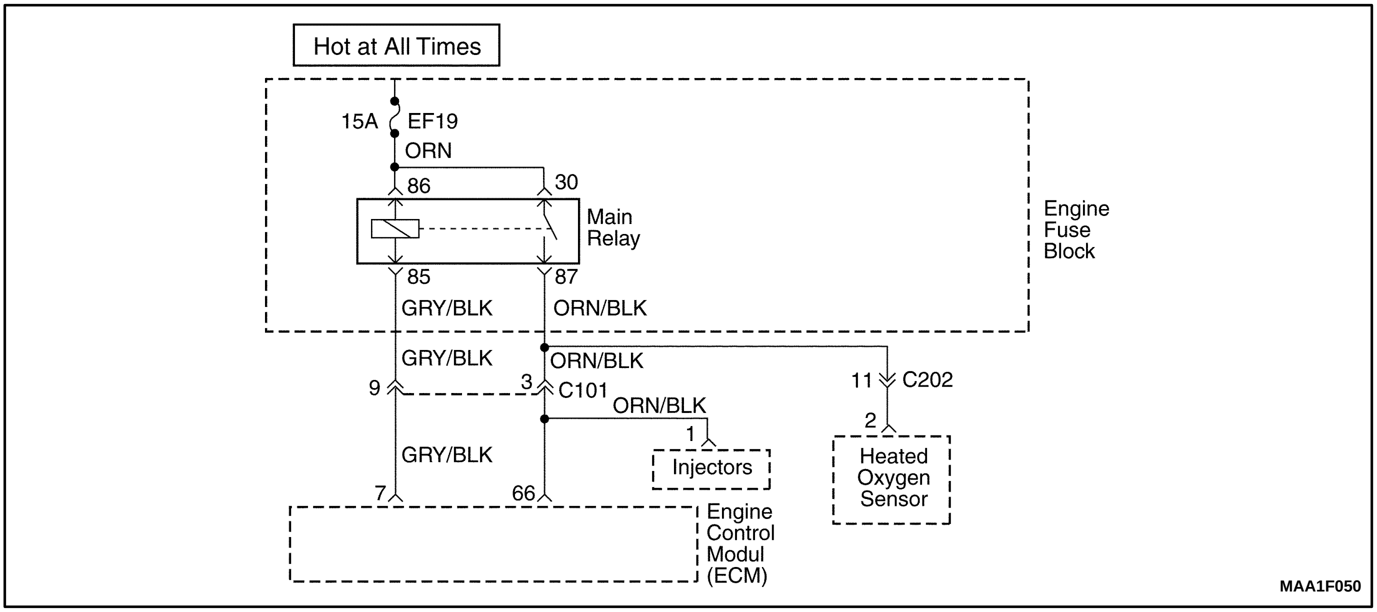
Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DTC P0605 Engine Control Module NMVY Write Error

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	Replace the engine control module(ECM). Is the replacement complete?	–	Go to *Step 3*	–
3	1. Using the scan tool, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC ad specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 4*	Go to *Step 2*
4	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to applicable DTC table	System OK

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) – P1610 MAIN RELAY HIGH VOLTAGE

Circuit Description

When the ignition switch to ON, main relay will grounded to ECM internal ground by ECM controlling.

A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Main relay wiring harness high voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and failure records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).

Diagnostic Aids

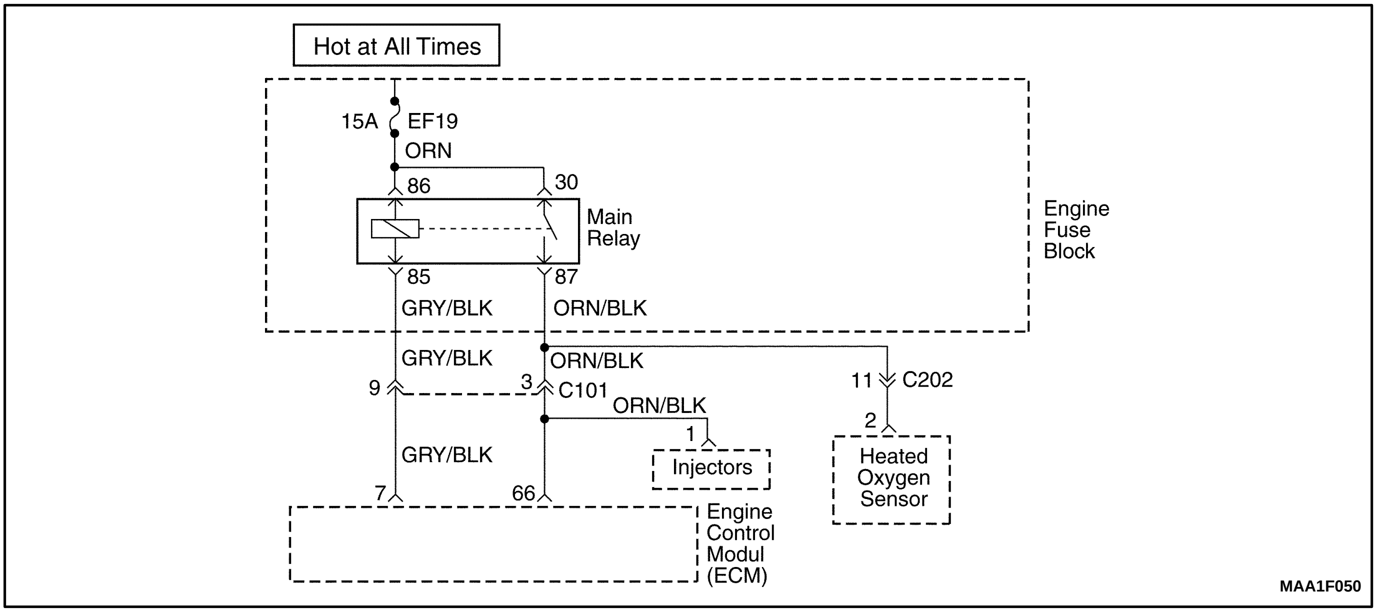
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1610 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1610 – Main Relay High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Disconnect the main relay. 2. Measure the resistance between main relay terminals 85 and 86. Does the resistance within the specified value?	75~85Ω	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 4*	Go to “Diagnostic Aids”
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring harness connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 5*	Go to *Step 7*
5	Repair a high voltage between the ECM wiring connector terminal 7 and main relay terminal 85. Is the repair complete?	–	Go to *Step 7*	–
6	Replace the main relay. Is the replacement complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1611 MAIN RELAY LOW VOLTAGE

Circuit Description

When the ignition switch to ON, main relay will grounded to ECM internal ground by ECM controlling.

A system voltage Diagnostic Trouble Code (DTC) will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- This DTC can be stored in “key-on” status.
- Main relay wiring harness high voltage.

Action Taken When The DTCs Sets

- The ECM will illuminate the Malfunction Indicator Lamp (MIL).
- A history DTC is stored.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored Failure Records buffers.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- Using the scan tool can clear DTC(s).

Diagnostic Aids

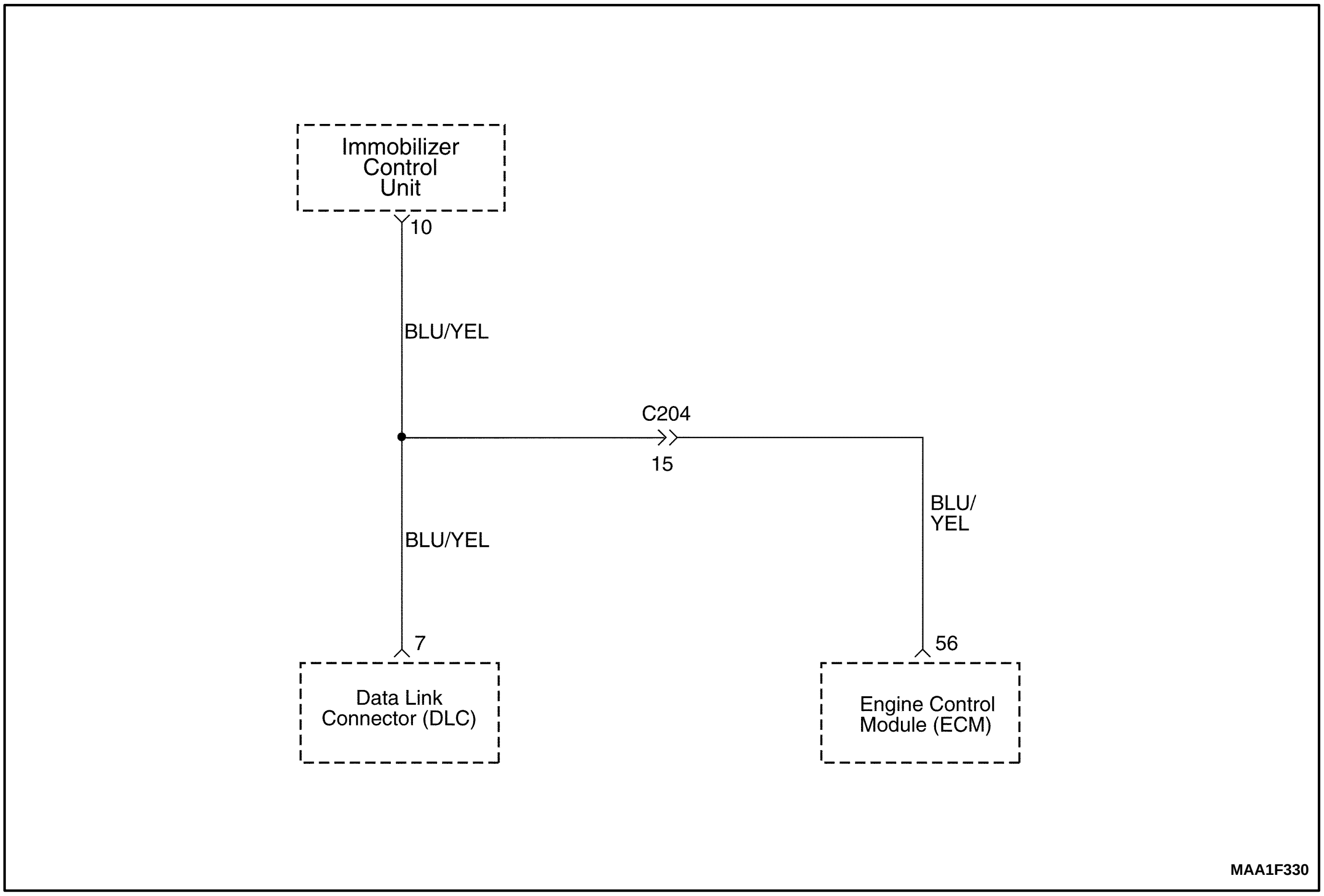
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

Inspect the wiring harness for damage. If the harness appears to be OK, observe the A/C pressure display on the scan tool while moving the connectors and wiring harnesses related to the ACP sensor. A change in the A/C pressure display will indicate the location of the fault.

If DTC P1611 cannot be duplicated, reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to set occurs. This may assist in diagnosing the condition.

DTC P1611 – Main Relay Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Disconnect the main relay. 2. Measure the resistance between main relay terminals 85 and 86. Does the resistance within the specified value?	75~85Ω	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 4*	Go to "Diagnostic Aids"
4	1. Turn the ignition switch to LOCK. 2. Disconnect the ECM wiring harness connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal 85 in the relay harness connector. Does the test light illuminate?	–	Go to *Step 5*	Go to *Step 7*
5	Repair a high voltage between the ECM wiring connector terminal 7 and main relay terminal 85. Is the repair complete?	–	Go to *Step 7*	–
6	Replace the main relay. Is the replacement complete?	–	Go to *Step 7*	–
7	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 8*	Go to *Step 2*
8	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1628 IMMOBILIZER NO SUCCESSFUL COMMUNICATION

Circuit Description

When the ignition switch is turned to ON, the key tested by immobilizer anti-theft system. While the key code is being read by immobilizer control unit or integrated anti-theft control unit, the engine can start run with any key that will turn the lock cylinder. the key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the Engine Control Module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM have been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following action:

- Disable the fuel injector circuit.
- Disable the fuel pump circuit.
- Disable the ignition coil.
- A Diagnostic Trouble Code (DTC) will stored if detect communication link failure between the ECM and immobilizer control unit.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Immobilizer option auto detected.
- ECM release time window(1.5 or 2 seconds) expired.
- Vehicle Speed Sensor (VSS) signal is less than 512 km/h.

Action Taken When the DTC Sets

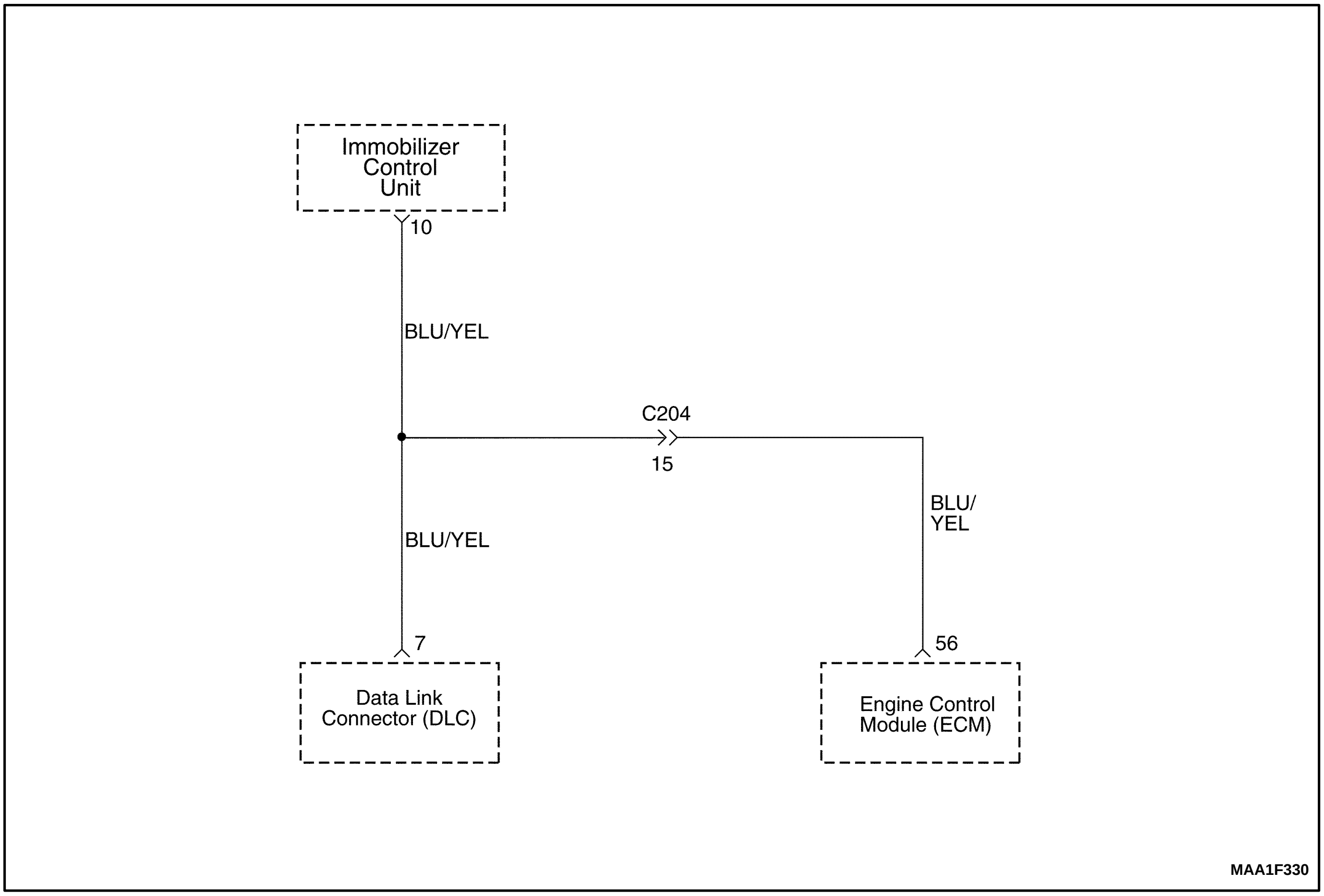
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DTC P1628 – Immobilizer No Successful Communication

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition OFF. 2. Install a scan too to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Select IMMOBILIZER DIAGNOSIS STATUS from the scan tool menu. Is the communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 3*	Go to *Section 9T, Immobilizer Anti-Theft System*
3	1. Turn the ignition OFF. 2. Disconnect the Immobilizer Control Unit and Engine Control Module (ECM) connectors. 3. Measure the resistance between terminal 7 of immoblizer control unit and terminal 56 of the ECM. Is the resistance within the specified value?	0 Ω	Go to *Step 5*	Go to *Step 4*
4	Repair an open circuit between terminal 7 of immobilizer control unit and terminal 56 of the ECM. Is the repair complete?	–	Go to *Step 8*	–
5	Check the terminals in immobilizer control unit and the ECM for damages and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 6*
6	Replace the immobilizer control unit. Is the repair complete?	–	Go to *Step 8*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1629 IMMOBILIZER WRONG COMPUTATION

Circuit Description

When the ignition switch is turned to ON, the key tested by immobilizer anti-theft system. While the key code is being read by immobilizer control unit or integrated anti-theft control unit, the engine can start run with any key that will turn the lock cylinder. the key code is read and compared with key codes that have been stored in the memory of the immobilizer control unit. If a valid key is detected, the immobilizer control unit sends a serial data release message to the Engine Control Module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM have been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following action:

- Disable the fuel injector circuit.
- Disable the fuel pump circuit.
- Disable the ignition coil.

A Diagnostic Trouble Code (DTC) will stored if detect communication link failure between the ECM and immobilizer control unit.

Conditions for Setting the DTC

- Ignition switch is turned to ON.
- Immobilizer option auto detected.
- ECM release time window(1.5 or 2 seconds) expired.
- Vehicle Speed Sensor (VSS) signal is less than 512 km/h.

Action Taken When the DTC Sets

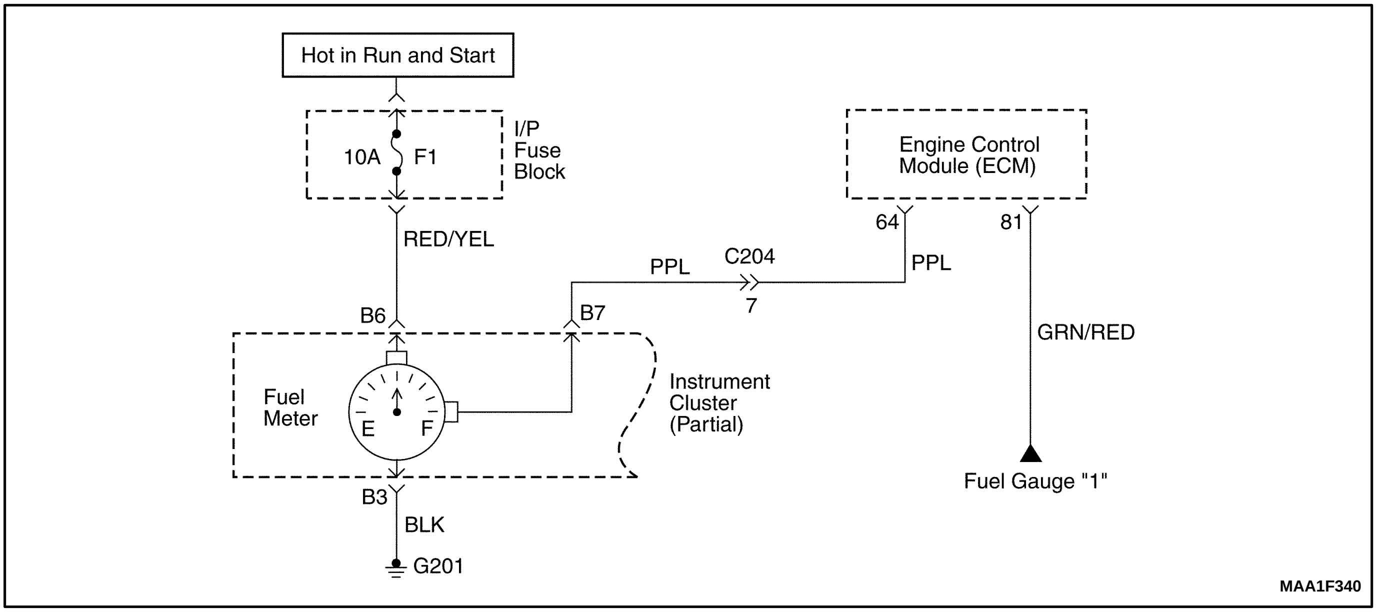
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

DTC P1629 – Immobilizer Wrong Computation

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition OFF. 2. Install a scan too to the Data Link Connector (DLC). 3. Turn the ignition ON. 4. Select IMMOBILIZER DIAGNOSIS STATUS from the scan tool menu. Is the communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 3*	Go to *Section 9T, Immobilizer Anti-Theft System*
3	1. Turn the ignition OFF. 2. Disconnect the Immobilizer Control Unit and Engine Control Module (ECM) connectors. 3. Measure the resistance between terminal 7 of immoblizer control unit and terminal 56 of the ECM. Is the resistance within the specified value?	0 Ω	Go to *Step 5*	Go to *Step 4*
4	Repair an open circuit between terminal 7 of immobilizer control unit and terminal 56 of the ECM. Is the repair complete?	–	Go to *Step 8*	–
5	Check the terminals in immobilizer control unit and the ECM for damages and repair as needed. Is the repair complete?	–	Go to *Step 8*	Go to *Step 6*
6	Replace the immobilizer control unit. Is the repair complete?	–	Go to *Step 8*	Go to *Step 7*
7	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	Go to *Step 8*	–
8	1. Using the scan tool, clear the Diagnostic Trouble Codes (DTCs). 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the Conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 9*	Go to *Step 2*
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	–	Go to Applicable DTC Table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P0656 FUEL LEVEL GAUGE CIRCUIT FAULT

Circuit Description

The engine control module(ECM) uses the fuel level input from the Fuel Level Sensor to calculate expected vapor pressures within the fuel system. Vapor pressure vary as the fuel level changes. Vapor pressure is critical in determining if the evaporative emission (EVAP) system is operating properly. Fuel Level is also used to determine if the Fuel level is too high or too low to be able to accurately detect EVAP system faults. This Diagnostic Trouble Code(DTC) detects a stuck fuel level sender.

Conditions for Setting the DTC

- Fuel Level Sensor voltage is higher than 4.8V.
- Fuel Level Sensor circuit high voltage.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

Inspect harness connectors for backed-out terminal, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

Inspect the wiring harness for damage.

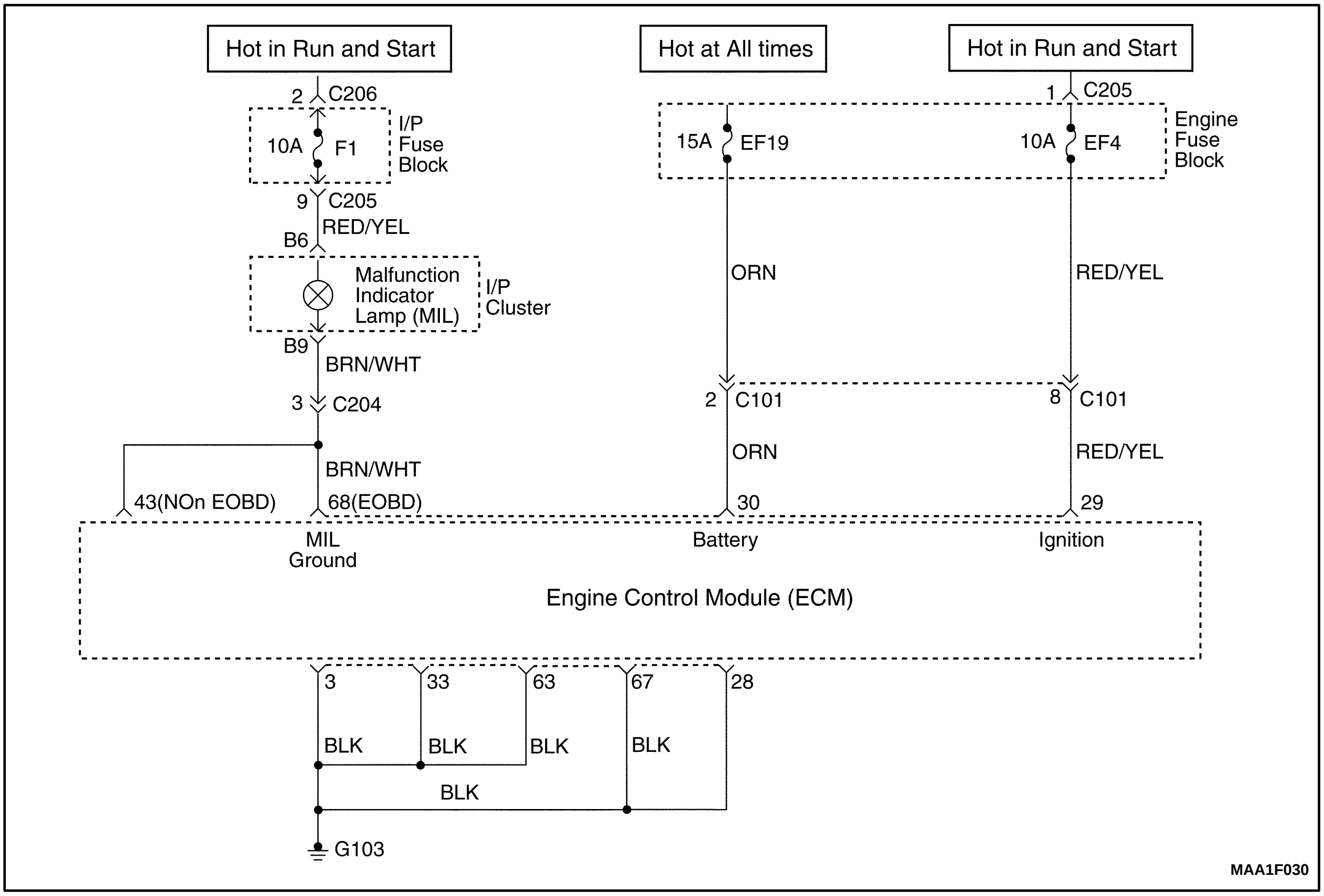
A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0656 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

Resistance check for the Fuel Level Sensor.

- Empty = 100 ohms or over.
- Half full = about 32.5 ohms.
- Full = 10 ohms or less.

DTC P0656 – Fuel Level Gauge Circuit Fault

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. connect the scan tool to the DLC. 3. Turn the Turn the ignition switch to ON. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to *Step 3*	Try with another scan tool
3	Refer to the applicable DTC table. Start with the DTC with the lowest numerical value and move up. Is the DTC identified as valid trouble code P0656?	–	Go to *Step 4*	Go to applicable DTC table
4	1. Disconnect the cluster connector 2. Turn the ignition switch to LOCK. 3. Check for an open or short to ground in the wire between the cluster connector terminal C14 and ground. Is the problem found?	–	Go to *Step 6*	Go to *Step 5*
5	1. Turn the ignition switch to LOCK. 2. Check for short to battery in the wire between the the cluster connector terminal C14 and ground. Is the problem found?	–	Go to *Step 6*	Go to *Step 7*
6	1. Change the between cluster and ECM or repair the connector terminal as needed. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Is the repair complete?	–	System OK	–
7	1. Replace the cluster. 2. Clear any DTCs from ECM. 3. Perform the diagnostic system check. Are any Diagnostic Trouble Codes (DTCs) displayed?	–	Go to *Step 8*	System OK
8	Replace the ECM. Is the replcement complete?	–	Go to *Step 9*	–
9	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 10*	Go to *Step 2*
10	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1660 MALFUNCTION INDICATOR LAMP (MIL) HIGH VOLTAGE

Circuit Description

When the ignition switch to ON, the Malfunction Indicator Lamp (MIL) is ON steady.

When the engine cranking, the Malfunction Indicator Lamp (MIL) is OFF after one flashing time.

If a system have some difficulties, the Malfunction Indicator Lamp (MIL) is ON.

Conditions for Setting the DTC

- The Malfunction Indicator Lamp (MIL) wiring harness high voltage.

Action Taken When The DTCs Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

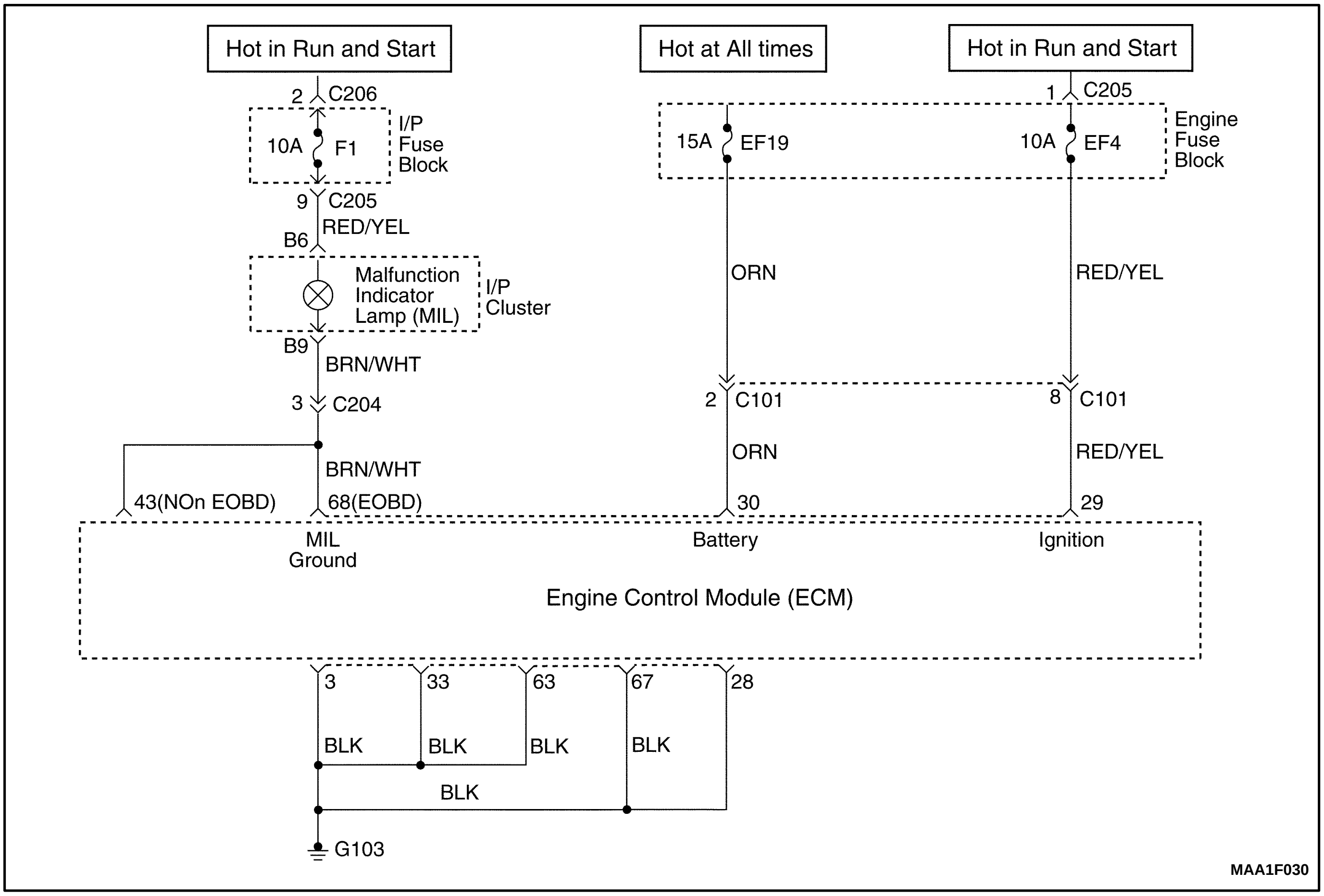
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1660 – Malfunction Indicator Lamp (MIL) High Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to “On-Board Diagnostic System Check”
2	1. Turn the ignition switch to LOCK. 2. Disconnect the cluster wiring connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal A7 in the harness connector. Does the resistance within the specified value?	0 Ω	Go to *Step 3*	Go to *Step 6*
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at ECM wiring connector terminal 68. Does the test light illuminate?	–	Go to *Step 4*	Go to Step 5
4	1. Turn the ignition switch to LOCK. 2. Replace the cluster. Is the replacement complete?	–	Go to *Step 6*	–
5	Repair a short to battery between the ECM wiring connector terminal 68 and cluster wiring connector terminal B9. Is the repair complete?	–	Go to *Step 6*	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK



DIAGNOSTIC TROUBLE CODE (DTC) – P1661 MALFUNCTION INDICATOR LAMP (MIL) LOW VOLTAGE

Circuit Description

When the ignition switch to ON, the Malfunction Indicator Lamp (MIL) is ON steady.

When the engine cranking, the Malfunction Indicator Lamp (MIL) is OFF after one flashing time.

If a system have some difficulties, the Malfunction Indicator Lamp (MIL) is ON.

Conditions for Setting the DTC

- The Malfunction Indicator Lamp (MIL) wiring harness low voltage.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm-up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

Diagnostic Aids

An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for the following conditions.

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed
- Damaged terminals
- Poor terminals to wire connection
- Physical damage to the wiring harness

DTC P1661 – Malfunction Indicator Lamp (MIL) Low Voltage

Step	Action	Value(s)	Yes	No
1	Perform an On-Board Diagnostic (EOBD) System Check. Is the system check complete?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Turn the ignition switch to LOCK. 2. Disconnect the cluster wiring connector. 3. With the test light, connected to ground, probe the ignition feed circuit, at terminal A7 in the harness connector. Does the resistance within the specified value?	–	Go to Step 3	Go to Step 6
3	1. Turn the ignition switch to LOCK. 2. With the test light, connected to ground, probe the ignition feed circuit, at ECM wiring connector terminal 39. Does the test light illuminate?	–	Go to *Step 4*	Go to *Step 5*
4	1. Turn the ignition switch to LOCK. 2. Replace the cluster. Is the replacement complete?	–	Go to *Step 6*	–
5	Repair a short to ground or open between the ECM wiring connector terminal 39 and cluster wiring connector terminal A7. Is the repair complete?	–	Go to *Step 6*	–
6	1. Using the scan tool, clear the Diagnostic Trouble Codes(DTCs) 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the scan tool indicate that this diagnostic has run and passed?	–	Go to *Step 7*	Go to *Step 2*
7	Check if any additional DTCs are set. Are any DTCs displayed that that have not been diagnosed?	–	Go to applicable DTC table	System OK

SYMPTOM DIAGNOSIS

IMPORTANT PRELIMINARY CHECKS

Important: Several symptom procedures call for a careful visual/physical inspection. Always perform the visual/physical test first. Visual inspections may lead to correcting a problem without further checks and can save valuable time.

Step	Action	Value(s)	Yes	No
1	Perform the On-Board Diagnostic (EOBD) System Check. Are any Diagnostic Trouble Code(s) (DTCs) stored in the Engine Control Module (ECM) memory?	–	Go to Appropriate DTC Table	Go to *Step 2*
2	1. Inspect all of the ECM ground connections. 2. Inspect all of the vacuum hoses for splits, kinks, and proper connections. 3. Check for air leaks at all of the mounting areas of the intake manifold sealing surfaces. 4. Inspect the ignition wires for cracking, hardness, proper routing, and carbon tracking. 5. Inspect the wiring for proper connections, pinches, and cuts. Are all checks complete?	–	Go to Appropriate Symptom Table	–

INTERMITTENT

Definition: The problem may or may not illuminate the Malfunction Indicator Lamp (MIL) or store a Diagnostic Trouble Code (DTC).

Important: Do not use the Diagnostic Trouble Code (DTC) tables for intermittent problems. A fault must be present in order to locate the problem. If a fault is intermittent, use of Diagnostic Trouble Code tables may result in the replacement of good parts.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Perform a careful inspection of any suspect circuits. 2. Inspect for poor mating of the connector halves, or terminals not fully seated into the connector body. 3. Inspect for improperly formed or damaged terminals. 4. Inspect for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it. Are any problems present?	–	Go to *Step 3*	Go to *Step 4*
3	Repair the electrical connections as needed. Is the repair complete?	–	System OK	–
4	Road test the vehicle with a voltmeter connected to a suspected circuit or a scan tool connected to the Data Link Connector (DLC). Did the voltmeter or the scan tool indicate an abnormal voltage or scan reading?	–	Go to *Step 5*	Go to *Step 6*
5	Replace the sensor in the affected circuit, if a Diagnostic Trouble Code (DTC) was stored for this circuit (except for the DTCs P0171 and P0172). Is the repair complete?	–	System OK	–
6	Does an intermittent Malfunction Indicator Lamp (MIL) or DTC occur?	–	Go to *Step 7*	Go to *Step 8*
7	1. Check for a faulty relay, Engine Control Module (ECM) driven solenoid, or switch. 2. Check for improper installation of electrical devices, such as lights, two-way radios, electric motors, etc. 3. Inspect the ignition control wires for proper routing (away from ignition wires, ignition system components, and the generator). 4. Check for a short-to-ground in the MIL circuit or the DLC "test" terminal. 5. Inspect the ECM ground connections. 6. Correct or repair the affected circuits as needed. Is the repair complete?	–	System OK	–
8	1. Check for a loss of DTC memory. 2. Disconnect the throttle position (TP) sensor. 3. Run the engine at idle until the MIL comes on. 4. Turn the ignition OFF. Is DTC P0122 stored in memory?	–	Go to *Step 10*	Go to *Step 9*

Intermittent (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	System OK	–
10	Does the vehicle stall while driving?	–	Go to *Step 11*	Go to *Step 12*
11	Monitor the oxygen sensor and the injector base pulse width with the scan tool. Does the scan tool display a steady low voltage (about 0 millivolts) for the oxygen sensor with the control module commanding an injector base pulse width of the value specified?	8 ms	Go to *Step 9*	Go to *Step 12*
12	1. Check for an open diode across the A/C clutch and for other open diodes. 2. Repair or replace any components as needed. Is the repair complete?	–	System OK	–

HARD START

Definition: The engine cranks OK, but does not start for a long time. The engine eventually runs or may start and immediately die.

Important: Ensure that the driver is using the correct starting procedure. Before diagnosing, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Connect the scan tool to the Data Link Connector (DLC). 2. Check the Engine Coolant Temperature (ECT) sensor and the Intake Air Temperature (IAT) sensor using the scan tool. 3. Compare the coolant temperature and the IAT with the ambient temperature when the engine is cold. Do the ECT and the IAT readings differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to *Step 3*	Go to *Step 4*
3	1. Measure the resistance of the ECT sensor and the IAT sensor. 2. Compare the resistance value to specifications using the Temperature Vs. Resistance tables for DTCs P0118 and P0113. 3. If the resistance is not the same, replace the faulty sensor. Is the repair complete?	–	System OK	–
4	1. Check for a sticking throttle shaft or a binding linkage that may cause a high Throttle Position (TP) sensor voltage. Repair or replace as needed. 2. Check the TP sensor voltage reading with the throttle closed. Does the voltage measure within the value specified?	0.4–0.8 V	Go to *Step 5*	Go to *Step 26*
5	1. Check the Manifold Absolute Pressure (MAP) sensor response and accuracy. 2. Replace the MAP sensor as needed. Is the repair complete?	–	System OK	Go to *Step 6*
6	Check the fuel pump operation. Does the fuel pump operate for the specified time when the ignition switch is turned ON?	2 sec	Go to *Step 7*	Go to "Fuel Pump Relay Circuit Check"
7	Check the fuel system pressure. Is the fuel pressure within the specifications?	380 kPa (55 psi)	Go to *Step 8*	Go to *Step 27*
8	Check for water contamination in the fuel. Is fuel contaminated?	–	Go to *Step 9*	Go to *Step 10*
9	Replace the contaminated fuel. Is the repair complete?	–	System OK	–

Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the fuel injector driver circuit. 2. Disconnect all of the fuel injector harness connectors at the fuel injectors. 3. Connect an injector test light between the harness terminals of each fuel injector connector. 4. Note the test light while cranking the engine. Does the test light blink at all connectors?	–	Go to *Step 13*	Go to *Step 11*
11	Check the fuel injector driver wiring harness, the connectors, and the connector terminals for the proper connections. Is the problem found?	–	Go to *Step 12*	Go to *Step 28*
12	Repair the wiring harness, the connector, or the connector terminal as needed. Is the repair complete?	–	System OK	–
13	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified at 20°C (68°F) **Note:** The resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 15*	Go to *Step 14*
14	Replace any fuel injector with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
15	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 16*	Go to *Step 17*
16	Replace any restricted or leaking fuel injectors as needed. Is the repair complete?	–	System OK	–
17	1. Check for the proper ignition voltage output for each cylinder with a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Inspect the ignition wires for short conditions. 4. Inspect all of the ignition grounds for loose connections. 5. Inspect the Engine Control Module (ECM) for the proper operation. Is the problem found?	–	Go to *Step 18*	Go to *Step 19*
18	Correct or replace any faulty ignition components. Is the repair complete?	–	System OK	–
19	Does the engine misfire or cut out under load or at idle?	–	Go to "Ignition System Check"	Go to *Step 20*
20	Does the engine start, but then immediately stall?	–	Go to *Step 21*	Go to *Step 23*
21	1. Remove the Crankshaft Position (CKP) sensor. 2. Inspect for faulty connections and repair as needed. Is the problem found?	–	Go to *Step 22*	Go to *Step 25*
22	Repair the faulty connections as needed. Is the repair complete?	–	System OK	–

Hard Start (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Check for the proper valve timing. 2. Check the cylinder compression. 3. Inspect the pushrods, the rocker arms, the valve springs, and the camshaft lobes for excessive wear. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	–	Go to *Step 24*	Go to *Step 25*
24	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
25	Check the idle air control valve operation. Repair or replace components as needed. Is the repair complete?	–	System OK	–
26	Check the throttle position sensor circuit for proper operation. Repair or replace components as needed. Is the repair complete?	–	System OK	–
27	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
28	1. Turn the ignition OFF. 2. Replace the ECM. Is the repair complete?	–	System OK	–

SURGES OR CHUGGLES

Definition: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal position.

Important: Make sure the driver understands A/C compressor operation as described in the owner's manual.

The speedometer reading and the speed reading on the scan tool should be equal.

Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	Connect the scan tool to the Data Link Connector (DLC). Does the oxygen sensor (O2S) respond quickly to different throttle positions?	–	Go to *Step 4*	Go to *Step 3*
3	1. Check the O2S for silicone or other contaminants from fuel or use of improper Room Temperature Vulcanizing (RTV) sealant. 2. Replace the contaminated O2S. Is the repair complete?	–	System OK	–
4	1. Drive the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	–20–25%	Go to *Step 7*	Go to *Step 5*
5	Is the long term fuel trim reading below the value specified?	–20%	Go to "Diagnostic Aids for DTC P0172"	Go to *Step 6*
6	Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	–
7	Check the fuel system pressure while the condition exists. Is the fuel system pressure within specifications?	380 kPa (55 psi)	Go to *Step 8*	Go to *Step 17*
8	Check the in-line fuel filter. Is the filter dirty or plugged?	–	Go to *Step 18*	Go to *Step 9*
9	Perform an injector diagnosis. Did the injector diagnosis pinpoint the problem?	–	Go to *Step 19*	Go to *Step 10*
10	1. Check for proper ignition voltage output using a spark tester. 2. Inspect the spark plugs for cracks, wear, improper gap, burned electrodes, or heavy deposits. Is the problem found?	–	Go to *Step 11*	Go to *Step 12*
11	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
12	1. Inspect the ECM grounds for being clean, tight, and in their proper locations. 2. Inspect the vacuum lines for kinks or leaks. Is the problem found?	–	Go to *Step 13*	Go to *Step 14*

Surges or Chuggles (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the electrical connections or the vacuum lines as needed. Is the repair complete?	–	System OK	–
14	Check the generator output voltage. Is the generator voltage within the value specified?	12–16 V	Go to *Step 16*	Go to *Step 15*
15	Repair the generator. Is the repair complete?	–	System OK	–
16	1. Check for intermittent Electric Exhaust Gas Recirculation (EEGR) valve operation. 2. Repair or replace any components as needed. Is the repair complete?	–	System OK	–
17	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
18	Replace the fuel filter. Is the repair complete?	–	System OK	–
19	Replace the leaking or restricted fuel injectors. Is the repair complete?	–	System OK	–

LACK OF POWER, SLUGGISHNESS, OR SPONGINESS

Definition: The engine delivers less than expected power. There is little or no increase in speed when the accelerator pedal is partially applied.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Verify the customer's complaint. 2. Compare the performance of the customer's vehicle with a similar unit. Does the problem exist?	–	Go to *Step 3*	System OK
3	1. Inspect the air filter for excessive contamination. 2. Replace the air filter as needed. 3. Check the transaxle shift pattern and down shift operation. Does the transaxle operate properly?	–	Go to *Step 4*	Go to *Step 5*
4	Check the fuel system pressure. Is the fuel system pressure within specifications?	380 kPa (55 psi)	Go to *Step 7*	Go to *Step 6*
5	Repair the transaxle as needed. Is the repair complete?	–	System OK	–
6	Repair the fuel system as needed. Is the repair complete?	–	System OK	–
7	Check for a restricted fuel filter or contaminated fuel. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
9	1. Check the ignition system output for all of the cylinders using a spark tester. 2. Check for proper ignition control operation. Is the ignition system operating properly?	–	Go to *Step 10*	Go to *Step 11*
10	1. With the engine at normal operating temperature, connect a vacuum gauge to a vacuum port on the intake manifold. 2. Operate the engine at 1000 rpm. 3. Record the vacuum reading. 4. Increase the engine speed to 2500 rpm. 5. Note the vacuum reading at a steady 2500 rpm. Does the vacuum decrease more than the value specified?	10 kPa (3 in Hg)	Go to *Step 12*	Go to *Step 15*
11	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
12	Inspect the exhaust system for restrictions and damaged or collapsed pipes. Is the problem found?	–	Go to *Step 13*	Go to *Step 14*
13	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
14	1. Check the cylinder compression and valve timing. 2. Inspect the camshaft for excessive wear. Is the problem found?	–	Go to *Step 15*	Go to *Step 16*

Lack of Power, Sluggishness, or Sponginess (Cont'd)

Step	Action	Value(s)	Yes	No
15	Repair or replace any engine components as needed. Is the repair complete?	–	System OK	–
16	1. Check the Engine Control Module (ECM) grounds for being clean, tight, and in their proper location. 2. Check the exhaust recirculation valve for being open or partially open all the time. 3. Check the torque converter clutch operation. 4. Check the A/C system operation. 5. Check the generator output. 6. Repair the generator if the output is not within the specified range. Are all checks and repairs complete?	12–16 V	System OK	–

DETONATION/SPARK KNOCK

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Fill the fuel tank with a known good grade of gasoline that has the octane rating of the value specified. 2. Reevaluate the vehicle's performance. Does the detonation problem still exist?	91 octane	Go to *Step 3*	System OK
3	1. Inspect for low engine coolant level. 2. Check for restricted airflow to the radiator or restricted coolant flow. 3. Check for a faulty thermostat. 4. Check for an incorrect coolant solution. Is the problem found?	–	Go to *Step 4*	Go to *Step 5*
4	Repair or replace any cooling system components as needed. Is the repair complete?	–	System OK	–
5	1. Check the engine coolant temperature using the scan tool. 2. Replace the Engine Coolant Temperature (ECT) sensor if the resistance is not within specifications as listed in the Diagnostic Aids for diagnostic trouble code P0118. Is the problem found?	–	Go to *Step 6*	Go to *Step 7*
6	Replace the ECT sensor or repair the circuit as needed. Is the repair complete?	–	System OK	–
7	1. Check the ignition system output with a spark tester. 2. Inspect the spark plugs for the proper heat range and gap. 3. Check for the proper operation of the ignition controls. Is the ignition system operating properly?	–	Go to *Step 9*	Go to *Step 8*
8	Repair or replace the ignition system components as needed. Is the repair complete?	–	System Ok	–
9	1. Connect the scan tool to the Data Link Connector (DLC). 2. Road test the vehicle at the speed of the complaint. 3. Monitor the long term fuel trim reading from the scanner data stream. Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	Go to *Step 10*
10	Check the fuel system pressure. Is the problem found?	380 kPa (55 psi)	Go to *Step 11*	Go to *Step 12*
11	Repair or replace the fuel system components as needed. Is the repair complete?	–	System OK	–

Detonation/Spark Knock (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Inspect for carbon buildup inside the engine. 2. Remove the carbon with a top engine cleaner. Follow the instructions supplied with the product. 3. Check the basic engine parts such as the camshaft, the cylinder head, the pistons, etc. for excessive wear. 4. Replace any excessively worn parts. Is the procedure complete?	–	Go to *Step 13*	–
13	1. Check the exhaust gas recirculation valve for proper operation. 2. Check the air intake system for proper operation. 3. Check the torque converter clutch operation and transaxle shift points. 4. Check the service bulletins for Programmable Read Only Memory (PROM) updates. 5. Check the cylinder compression. 6. Repair or replace any faulty components. Are all checks and repairs complete?	–	System OK	–

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. This can occur at any vehicle speed. It is usually the most severe when first trying to make the vehicle move, as from a stop. Hesitation, sag, or stumble may cause the engine to stall if severe enough.

Important: Before diagnosing this condition, check service bulletins for PROM updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to “Important Preliminary Checks”
2	1. Check the fuel system pressure. If the pressure is not within the value specified, service the fuel system as needed. 2. Inspect the Throttle Position (TP) sensor for binding or sticking. The TP sensor voltage should increase at a steady rate as the throttle is moved toward Wide Open Throttle (WOT). Is the problem found?	380 kPa (55 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
4	1. Check the Manifold Absolute Pressure (MAP) sensor response and accuracy. 2. Inspect the fuel for water contamination. 3. Check the Evaporative Emission (EVAP) Canister Purge System for proper operation. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
6	1. Disconnect all of the fuel injector harness connectors. 2. Connect an injector test light between the harness terminals of each fuel injector. 3. Note the test light while cranking the engine. Does the test light blink on all connectors?	–	Go to *Step 8*	Go to *Step 7*
7	1. Repair or replace the faulty fuel injector drive harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
8	Measure the resistance of each fuel injector. Is the fuel injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 10*	Go to *Step 9*
9	Replace any of the fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
10	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 11*	Go to *Step 12*
11	Replace any restricted or leaking fuel injectors. Is the repair complete?	–	System OK	–
12	Check the fuel system pressure after a cold start or during moderate or full throttle acceleration. Is the fuel pressure within specifications?	380 kPa (55 psi)	Go to *Step 14*	Go to *Step 13*

Hesitation, Sag, Stumble (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the restriction in the fuel system or replace the faulty fuel pump. Is the repair complete?	–	System OK	–
14	1. Check for faulty ignition wires. 2. Inspect for fouled spark plugs. 3. Check the ignition system output on each cylinder with a spark tester. Is the problem found?	–	Go to *Step 15*	Go to *Step 16*
15	Repair or replace any ignition components as needed. Is the repair complete?	–	System OK	–
16	1. Check the generator output voltage. 2. Repair or replace the generator if the generator output is less than the value specified. 3. Check the Electric Exhaust Gas Recirculation (EEGR) valve operation. Are all checks and needed repairs complete?	–	System OK	–

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	Check the ignition system voltage output for all of the cylinders using a spark tester. Is spark present on all of the cylinders?	–	Go to *Step 3*	Go to "Ignition System Check"
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Check the resistance of the ignition wires. Replace any ignition wires that have a resistance greater than the value specified. Is the problem found?	30000 Ω	Go to *Step 4*	Go to *Step 5*
4	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
5	With the engine running, spray the ignition wires with a fine water mist to check for arcing and shorting to ground. Is the problem found?	–	Go to *Step 6*	Go to *Step 7*
6	Replace the ignition wires. Is the repair complete?	–	System OK	–
7	1. Perform a cylinder compression test. 2. If the compression is low, repair the engine as needed. 3. Inspect for proper valve timing, bent pushrods, worn rocker arms, broken or weak valve springs, and worn camshaft lobes. 4. Inspect the intake manifold and the exhaust manifold passages for casting flash. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
9	1. Check the fuel system for a plugged in-line fuel filter. 2. Check the fuel system for low fuel pressure. If the fuel pressure is below the value specified, service the fuel system as needed. 3. Inspect for contaminated fuel. Is the problem found?	380 kPa (55 psi)	Go to *Step 10*	Go to *Step 11*
10	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
11	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light to the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine for each fuel injector. Does the test light blink for all of the fuel injectors?	–	Go to *Step 13*	Go to *Step 12*

Cuts Out, Misses (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminal. 2. If the connections and the harnesses are good, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
13	Measure the resistance of each fuel injector. Is the injector resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 15*	Go to *Step 14*
14	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
15	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 16*	Go to *Step 17*
16	Replace any restricted or leaking fuel injectors. Is the repair complete?	–	System OK	–
17	1. Check for electromagnetic interference. 2. Monitor the engine rpm with a scan tool. Does the scan tool rpm change greatly with little change in actual engine rpm?	–	Go to *Step 18*	–
18	1. Inspect the routing of the ignition wires. 2. Inspect all of the ignition system grounds. 3. Correct the routing or repair the ground connections as needed. Are all checks and needed repairs complete?	–	System OK	–

POOR FUEL ECONOMY

Definition: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Important: Driving habits affect fuel economy. Check the owner's driving habits by asking the following questions:

1. Is the A/C system (i.e. defroster mode) turned on all the time?
2. Are the tires at the correct air pressure?
3. Have excessively heavy loads been carried?
4. Does the driver accelerate too much and too often? Suggest the driver read the section in the owner's manual about fuel economy.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Inspect the air filter for excessive contamination. 2. Inspect for fuel system leaks. Are all needed checks complete?	–	Go to *Step 3*	–
3	1. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 2. Replace any faulty spark plugs. 3. Inspect the ignition wires for cracking, hardness, and proper connections. Are all needed checks and repairs complete?	–	Go to *Step 4*	–
4	1. Inspect the engine coolant level. 2. Check the thermostat for being always open or for an incorrect heat range. 3. Replace the thermostat as needed. Are all needed checks and repairs complete?	–	Go to *Step 4*	–
5	1. Check the transaxle shift pattern. Ensure all transaxle gears are functioning. 2. Check for proper calibration of the speedometer. 3. Check the brakes for dragging. 4. Check the cylinder compression. 5. Repair, replace, or adjust any components as needed. Are all checks and needed repairs complete?	–	System OK	–

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: The engine runs unevenly at idle. If the condition is bad enough, the vehicle may shake. Also, the idle varies in rpm (called “hunting”). Either condition may be severe enough to cause stalling. The engine idles at incorrect idle speed.

Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to Step 2	Go to “Important Preliminary Checks”
2	1. Connect the scan tool to the Data Link Connector (DLC). 2. Monitor the oxygen sensor (O2S) reading at different throttle positions. Does the O2S change quickly from rich to lean at the different throttle positions?	–	Go to *Step 5*	Go to *Step 3*
3	Check the O2S for contamination from fuel or improper use of room temperature vulcanizing sealant. Is the O2S contaminated?	–	Go to *Step 4*	Go to *Step 5*
4	Replace the contaminated O2S as needed. Is the repair complete?	–	System OK	–
5	1. Check for a sticking throttle shaft or binding throttle linkage that may cause incorrect Throttle Position (TP) sensor voltage. 2. Check the TP sensor voltage reading with the throttle closed. Is the TP sensor voltage within the value specified?	0.4–0.8 V	Go to *Step 6*	Go to “Diagnostic Aids for DTC P0123”
6	1. Check the Engine Coolant Temperature (ECT) sensor voltage reading using the scan tool. 2. Compare the ECT sensor reading with the ambient temperature when the engine is cold. Does the ECT sensor temperature reading differ from the ambient temperature by more than the value specified?	3°C (5°F)	Go to *Step 7*	Go to *Step 9*
7	Check for high resistance in the ECT sensor circuit or the sensor itself. Is the problem found?	–	Go to *Step 8*	Go to *Step 9*
8	Replace the ECT sensor or repair the circuit as needed. Is the repair complete?	–	System OK	–
9	Check the Manifold Absolute Pressure (MAP) sensor for response and accuracy. Is the problem found?	–	Go to *Step 10*	Go to *Step 11*
10	Replace the MAP sensor or repair the MAP sensor circuit as needed. Is the repair complete?	–	System OK	–
11	1. Road test the vehicle at the speed of the complaint. 2. Monitor the long term fuel trim reading using the scan tool. Is the long term fuel trim reading within the value specified?	–20–25%	Go to *Step 14*	Go to *Step 12*

Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
12	Is the long term fuel trim reading below the value specified?	–20%	Go to "Diagnostic Aids for DTC P0172"	Go to *Step 13*
13	Is the long term fuel trim reading above the value specified?	25%	Go to "Diagnostic Aids for DTC P0171"	–
14	1. Disconnect all of the fuel injector harness connectors at the fuel injectors. 2. Connect an injector test light between the harness terminals of each fuel injector connector. 3. Note the test light while cranking the engine. Does the test light blink for all of the fuel injectors?	–	Go to *Step 16*	Go to *Step 15*
15	1. Repair or replace the faulty injector drive circuit harness, the connector, or the connector terminals as needed. 2. If the harness, the connectors, and the terminals are OK, replace the Engine Control Module (ECM). Is the repair complete?	–	System OK	–
16	Measure the resistance of each of the fuel injectors. Is the resistance within the value specified (the resistance will increase slightly at higher temperatures)?	11.6–12.4 Ω	Go to *Step 18*	Go to *Step 17*
17	Replace any fuel injectors with a resistance that is out of specifications. Is the repair complete?	–	System OK	–
18	Perform an injector diagnosis. Is the problem found?	–	Go to *Step 19*	Go to *Step 20*
19	Replace any leaking or restricted fuel injectors. Is the repair complete?	–	System OK	–
20	1. With the engine OFF, disconnect the fuel pressure regulator vacuum hose. 2. Thoroughly inspect the fuel pressure regulator vacuum port and the fuel pressure regulator vacuum hose for the presence of fuel. Is the problem found?	–	Go to *Step 21*	Go to *Step 22*
21	Replace the fuel pressure regulator as needed. Is the repair complete?	–	System OK	–
22	1. Check the ignition system output voltage for all of the cylinders using a spark tester. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Inspect the ignition wires for cracking, hardness, or improper connections. 4. Replace any ignition wires with a resistance over the value specified. Is the problem found?	30000 Ω	Go to *Step 23*	Go to *Step 24*
23	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–

Rough, Unstable, or Incorrect Idle, Stalling (Cont'd)

Step	Action	Value(s)	Yes	No
24	1. Inspect for vacuum leaks. 2. Check for proper Positive Crankcase Ventilation (PCV) operation. 3. Check the Idle Air Control (IAC) valve operation. 4. Inspect the ECM ground connections. Is the problem found?	–	Go to *Step 25*	Go to *Step 26*
25	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
26	1. Check the Electric Exhaust Gas Recirculation (EEGR) valve for proper operation. 2. Inspect the battery cables and the ground straps for proper connections. 3. Check the generator voltage output. Repair or replace the generator if the voltage output is not within the value specified. Is the problem found?	12–16 V	Go to *Step 27*	Go to *Step 28*
27	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
28	1. Inspect for broken engine mounts. 2. Check for proper valve timing. 3. Perform a cylinder compression test. 4. Inspect for bent pushrods, worn rocker arms, broken or weak valve springs, and a worn camshaft. 5. Perform repairs as needed. Are all of the checks and needed repairs complete?	–	System OK	–

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: A vehicle fails an emission test. The vehicle has an excessive rotten egg smell. Excessive odors do not necessarily indicate excessive emissions.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Run the engine until it reaches operating temperature. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	Go to *Step 3*
3	1. Connect the scan tool to the Data Link Connector (DLC). 2. Road test the vehicle. 3. Monitor the long term fuel trim memory. Is the long term fuel trim memory within the value specified?	–20 – 25 %	Go to *Step 6*	Go to *Step 4*
4	Is the long term fuel trim memory below the value specified?	–20 %	Go to "Diagnostic Aids for DTC P0172"	Go to *Step 5*
5	Is the long term fuel trim memory above the value specified?	25 %	Go to "Diagnostic Aids for DTC P0171"	–
6	1. Check for a properly installed fuel cap. 2. Check the fuel system pressure. 3. Perform an injector diagnosis. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	1. Repair or replace any fuel system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	–
8	1. Check the ignition system for proper operation. 2. Inspect the spark plugs for excessive wear, insulation cracks, improper gap, or heavy deposits. 3. Check the ignition wires for cracking, hardness, or improper connections. Is the problem found?	–	Go to *Step 9*	Go to *Step 10*
9	1. Repair or replace any ignition system components as needed. 2. Perform an emission test. Did the vehicle pass the emission test?	–	System OK	–

Excessive Exhaust Emissions or Odors (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Inspect for vacuum leaks. 2. Inspect the catalytic converter for contamination. 3. Inspect for carbon buildup on the throttle body and the throttle plate and inside the engine. Remove with a top engine cleaner. 4. Check the Electric Exhaust Gas Recirculation (EEGR) valve for not opening. 5. Check for proper Positive Crankcase Ventilation (PCV) operation. Are all checks and needed repairs complete?	–	System OK	–

DIESELING, RUN-ON

Definition: An engine continues to run after the ignition switch is turned OFF.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	Does the engine run smoothly after the ignition switch is turned OFF?	–	Go to *Step 3*	Go to *Step 4*
3	1. Check the ignition switch and the ignition switch adjustment. 2. Replace the ignition switch if needed. Is the repair complete?	–	System OK	–
4	1. Check the evaporative emission system. 2. Check for leaking fuel injectors. 3. Check the Idle Air Control (IAC) valve operation. 4. Inspect for vacuum leaks. 5. Check for the proper base idle setting. Are all checks and repairs complete?	–	System OK	–

BACKFIRE

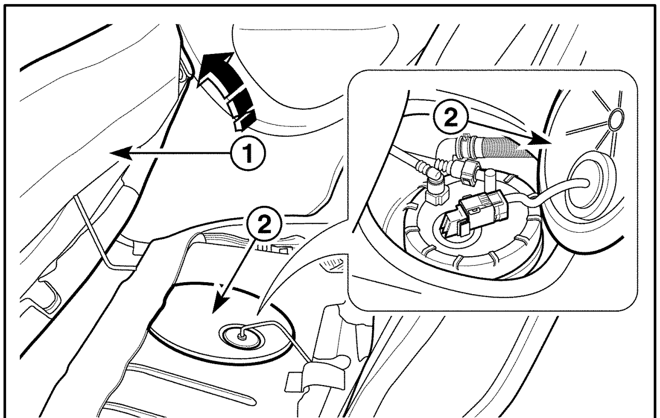
Definition: Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

Important: Before diagnosing the symptom, check service bulletins for updates.

Step	Action	Value(s)	Yes	No
1	Were the Important Preliminary Checks performed?	–	Go to *Step 2*	Go to "Important Preliminary Checks"
2	1. Inspect for crossed or crossfiring ignition wires. 2. Check the ignition system output voltage for all cylinders using a spark tester. 3. Inspect the spark plugs for excessive wear, burned electrodes, improper gap, or heavy deposits. Is the problem found?	–	Go to *Step 3*	Go to *Step 4*
3	Repair or replace any ignition system components as needed. Is the repair complete?	–	System OK	–
4	1. Check the fuel system operation. 2. Check the fuel injectors by performing an injector diagnosis. Is the problem found?	–	Go to *Step 5*	Go to *Step 6*
5	Repair or replace any fuel system components as needed. Is the repair complete?	–	System OK	–
6	1. Inspect the Electric Exhaust Gas Recirculation (EEGR) gasket for a leak or a loose fit. 2. Check the EEGR valve for proper operation. 3. Inspect the intake manifold and the exhaust manifold for a casting flash. Is the problem found?	–	Go to *Step 7*	Go to *Step 8*
7	Repair or replace any components as needed. Is the repair complete?	–	System OK	–
8	1. Inspect the timing belt for proper installation and tension. 2. Check the engine compression. 3. Inspect the intake manifold gasket and the exhaust manifold gasket for leaks. 4. Check for sticking or leaking valves. 5. Repair or replace any components as needed. Are all checks and corrections complete?	–	System OK	–

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE



D102F501

FUEL PUMP

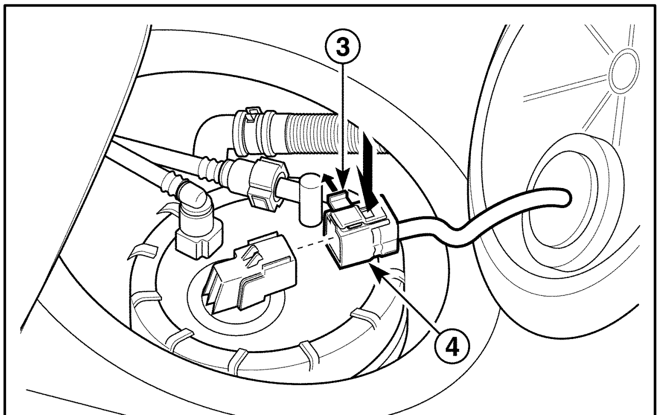
Tools Required

DW 140–010A Fuel Pump Lock Ring Remover/Installer.

Removal Procedure

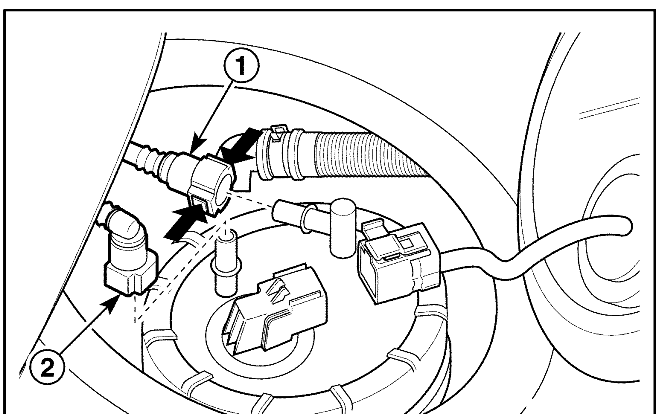
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure.
   - Start the engine and remove the rear seat cushon (1).
   - Remove the fuel pump access cover (2).
   - Disconnect the fuel pump assembly electrical connector lock pin (3).
   - Disconnect the fuel pump assembly electrical connector (4).
   - Crank the engine for an additional 10 seconds.

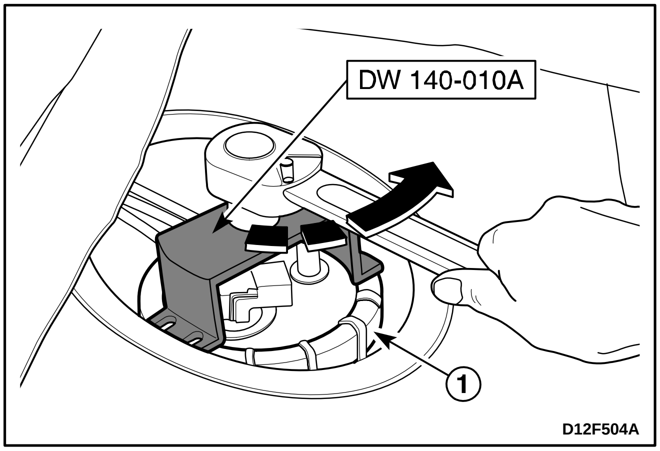


D102F502

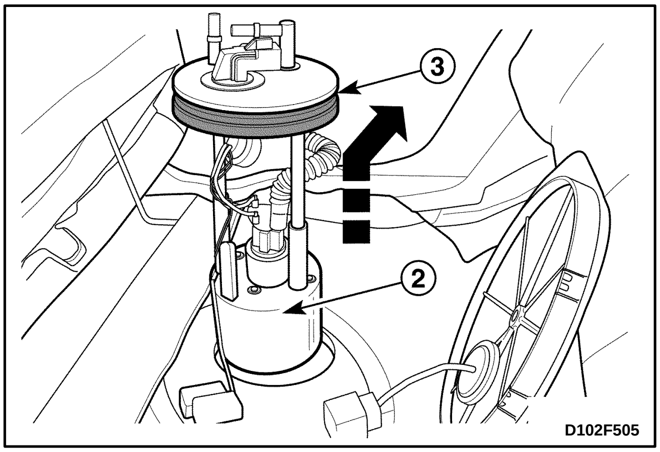
2. Disconnect the fuel lines from the fuel pump.
   - Disconnect the fuel outlet line (1).
   - Disconnect the fuel tank return line (2).



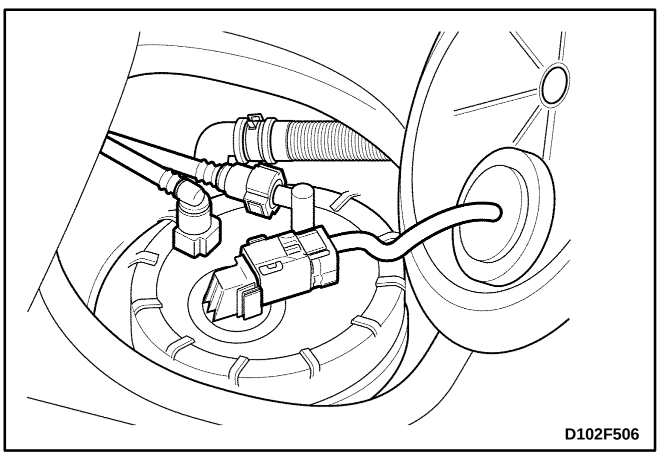
D102F503



3. Remove the fuel pump assembly from the tank.
   - Install the fuel pump lock ring remover/installer DW 140– 010A.
   - Turn the fuel tank lock ring counterclockwise (1).

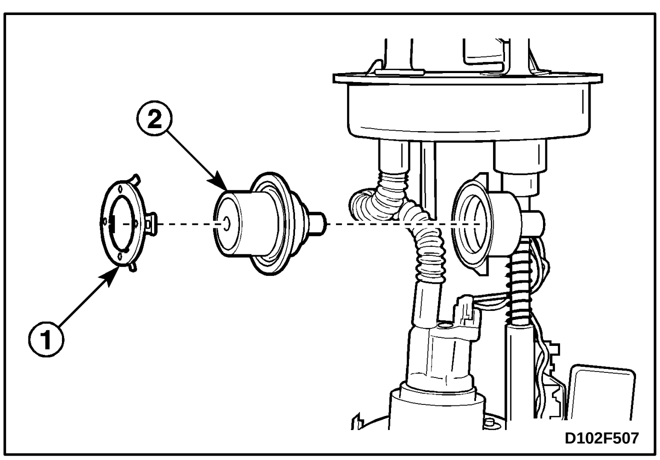


   - Remove the fuel pump assembly (2).
   - Remove the fuel pump gasket (3).



Installation Procedure

1. Install in the reverse order of removal.
2. Perform an operational check of the fuel pump.
   - Perform an operational check of the ignition switch ON the 2 seconds fuel pump operation.

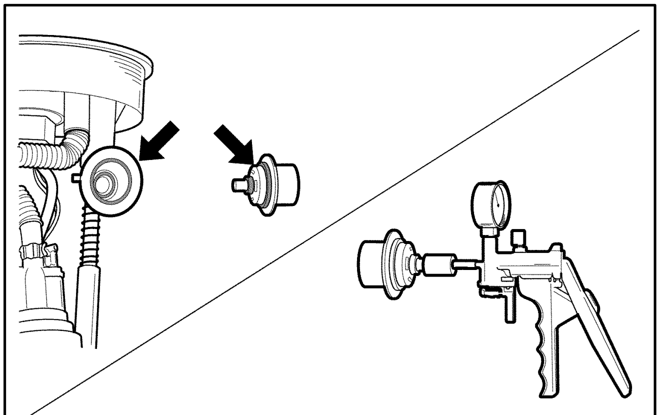


FUEL PRESSURE REGULATOR

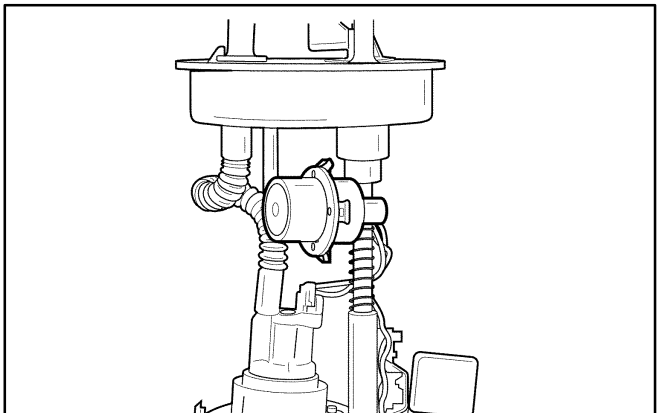
Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure after remove the fuel pump assembly. Refer to “Fuel Pump” in this section.

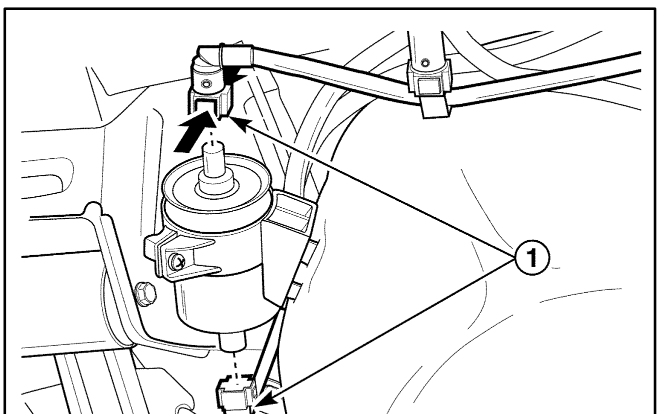

D102F508

2. Remove the fuel pressure regulator from the fuel pump.
   - Remove the retainer from the fuel pump assembly (1).
   - Remove the fuel pressure regulator (2).
   - Check the O–ring seals for the damage or the rip.
   - Use a vacuum gauge to check the diaphram for damage and the spring for operation.


D102F509

Installation Procedure

1. Install in the reverse order of removal.
   - Do not reuse the removed O–ring seals. Replace the removed O–ring seals with the new ones.



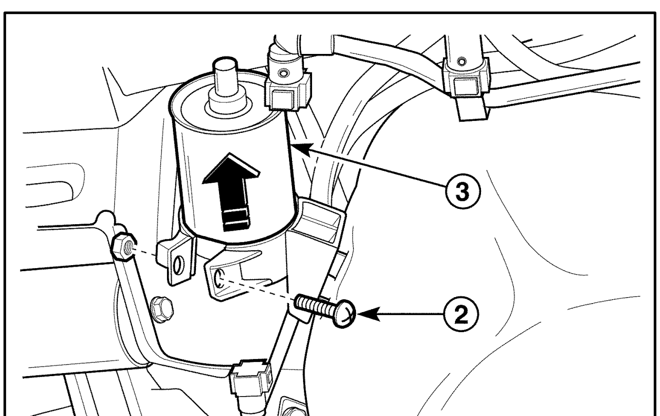
D102F510

FUEL FILTER

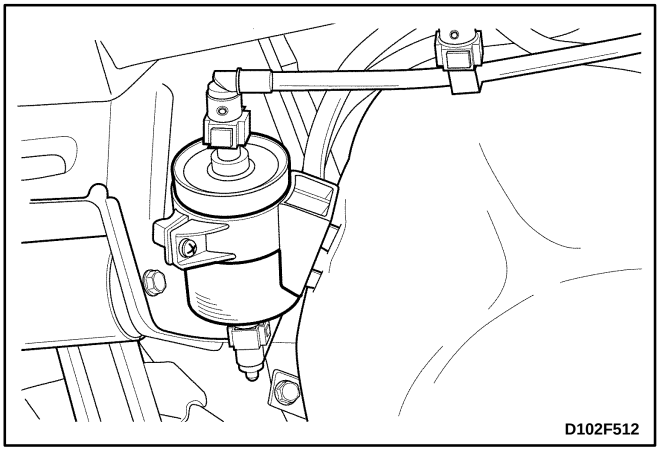
Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

1. Relieve the fuel system pressure.
   Refer to “Fuel Pump” in this section.
2. Remove the fuel filter from the fuel tank.
   - Disconnect the inlet/outlet fuel lines by pushing the line connector lock and pulling off the hose of the fuel filter tube (1).
   - Remove the screw from the retaining clamp (2).
   - Remove the fuel filter (3).

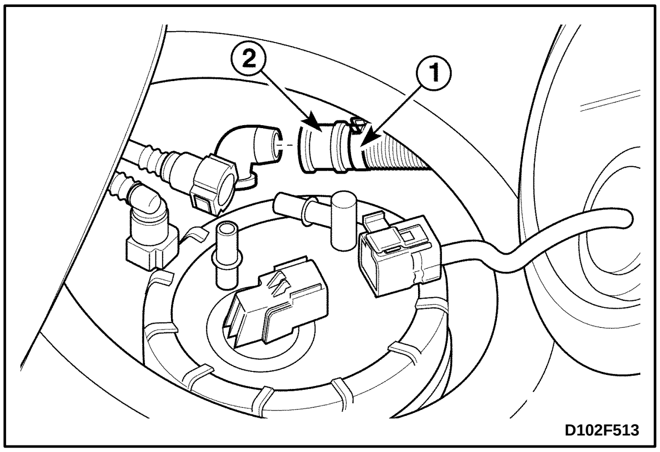


D102F511



Installation Procedure

1. Install in the reverse order of removal.
   - Install the new fuel filter into the retaining clamp. Note the flow direction.
   - Connect the inlet/outlet lines. Secure the lines with the connector lock.
   - Perform a leak test of the fuel filter.

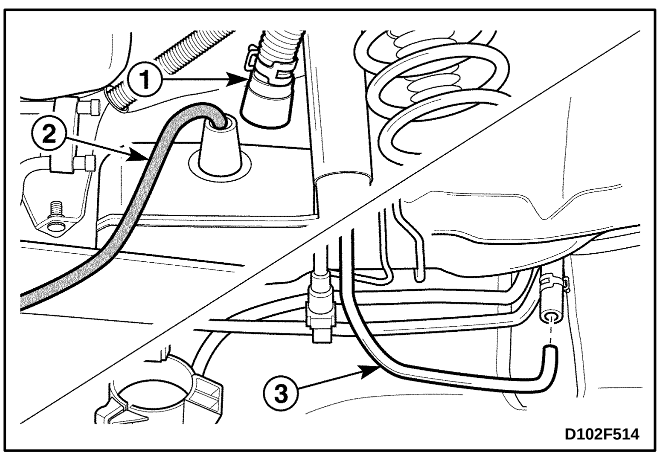


FUEL TANK

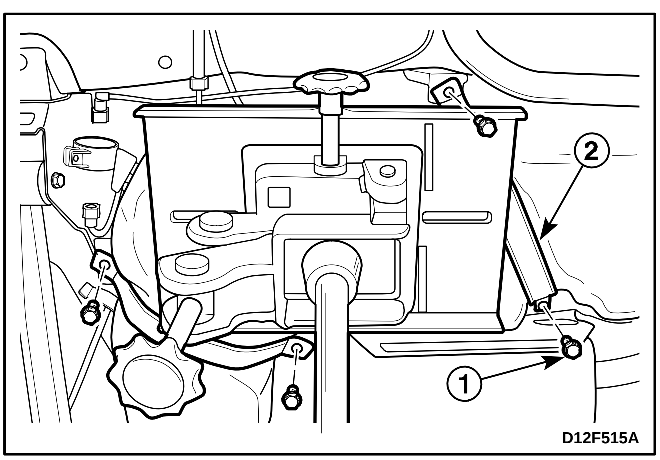
Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

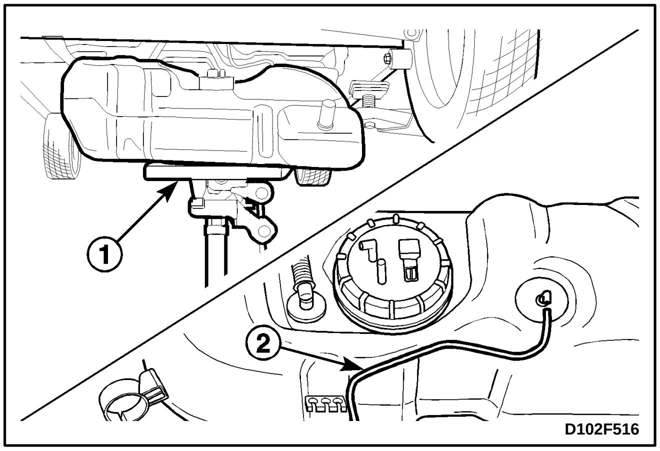
1. Relieve the fuel system pressure.
   Refer to “Fuel Pump” in this section.
2. Disconnect the fuel tank ventilation tube.
   - Disconnect the clamp (1).
   - Disconnect the ventilation tube (2).



3. Drain the fuel tank.
   - Place a pan below the fuel tank to catch the draining fuel.
   - Disconnect the fuel tank filter tube (1).
   - Drain the fuel from the fuel tank using the ventilation tube joint port (2).
   - Disconnect the evaporative emission canister line (3).

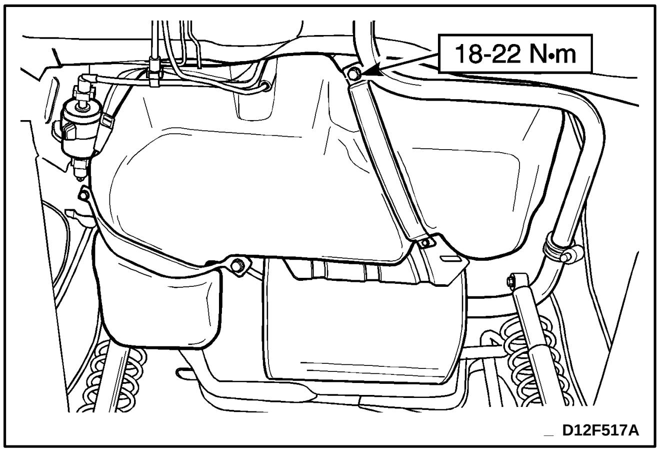


4. Remove the fuel filter. Refer to “Fuel Filter” in this section.
5. Install the jack to remove the fuel tank.
   - Install the jack on the center of the fuel tank.
   - Remove the strap bolts (1).
   - Remove the straps (2).



D102F516

6. Remove the fuel tank.
   - Lower slowly the jack to remove the fuel tank easily (1).
   - Disconnect the canister hose which is connected to the roll over valve from the fuel tank removed (2).
   - Inspect the fuel tank for clacks, damages, and contaminations.
   - Inspect the fuel lines for cracks and damages.



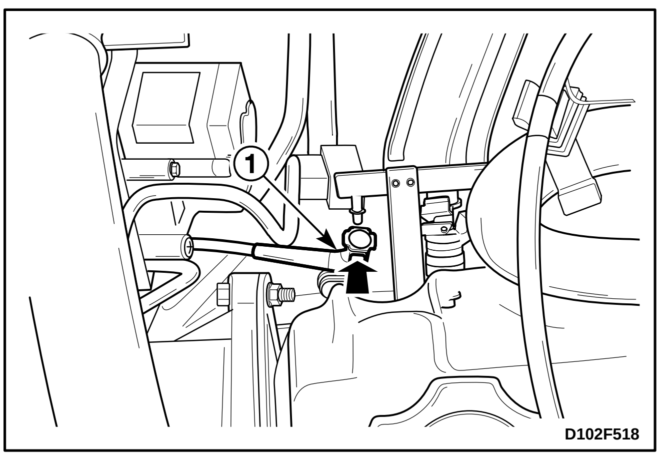
D12F517A

Installation Procedure

1. Install in the reverse order of removal.
   - After the installation is complete, start the engine to prevent the vapor lock and check the hoses for leaks.
2. Install the fuel tank strap bolts.

Tighten

Tighten the fuel tank strap bolts to 18–22 N•m (13–16 lb-ft).



D102F518

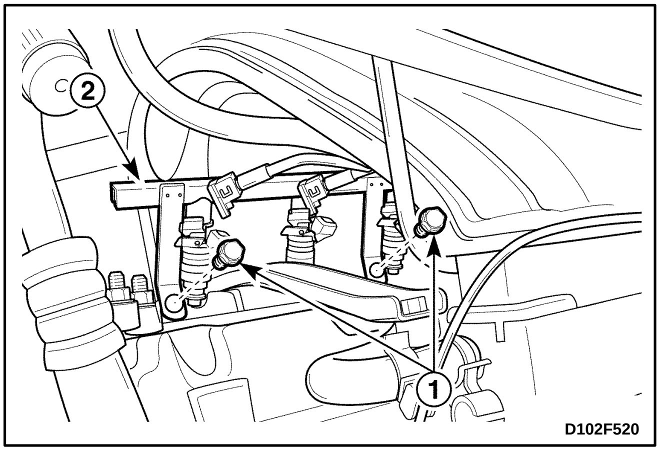
FUEL RAIL AND INJECTORS

Removal Procedure

Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

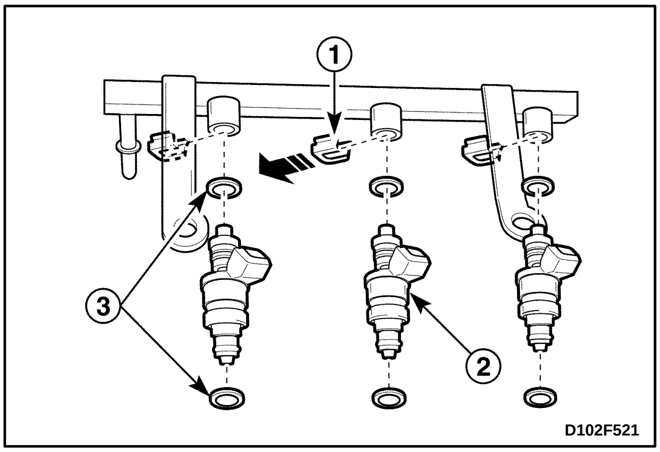
1. Relieve the fuel system pressure.
   Refer to “Fuel Pump” in this section.
2. Remove the canister from the engine room. Refer to “Evaporative Emission Canister” in this section.
3. Disconnect the fuel inlet line (1).
4. Disconnect the fuel injector harness connectors (2).

D102F519



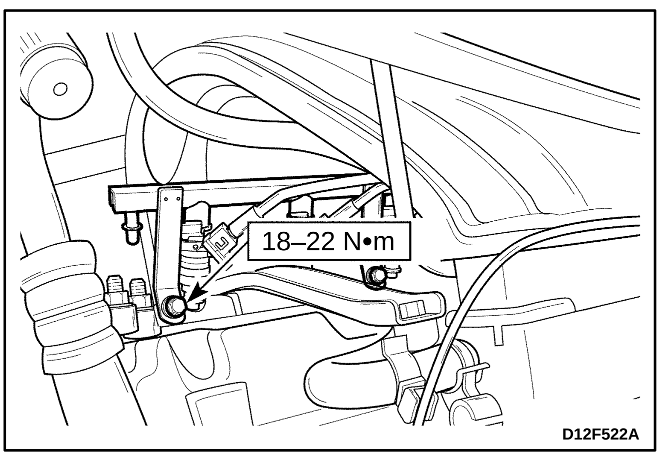
5. Remove the fuel rail with the fuel injectors attached.
   - Remove the bolts (1).
   - Remove the fuel rail with the fuel injectors attached (2).

Notice: Before removal, the fuel rail assembly may be cleaned with a spray–type cleaner, following package instructions. Do not immerse the fuel rails in liquid cleaning solvent. Use care in removing the fuel rail assembly to prevent damage to the electrical connectors and the injector spray tips. Prevent dirt and other contaminants from entering open lines and passages. Fittings should be capped and holes plugged during service.



6. Remove the injectors from the fuel rail.
   - Remove the fuel injector retainer clips (1).
   - Remove the fuel injectors by pulling them down and out (2).
   - Discard the fuel injector O–rings (3).

Important: Different fuel injectors are calibrated for different flow rates. When ordering new fuel injectors, be certain to order the identical part number that is inscribed on the old fuel injector.



Installation Procedure

1. Install in the reverse order of removal.

Important: If a fuel injector becomes separated from the fuel rail and remains in the cylinder head, replace the fuel injector O–ring seals and the retaining clip.

- Lubricate the new fuel injector O–rings with engine oil. Install the new O–rings on the fuel injectors.

2. Install the fuel rail retaining bolts.

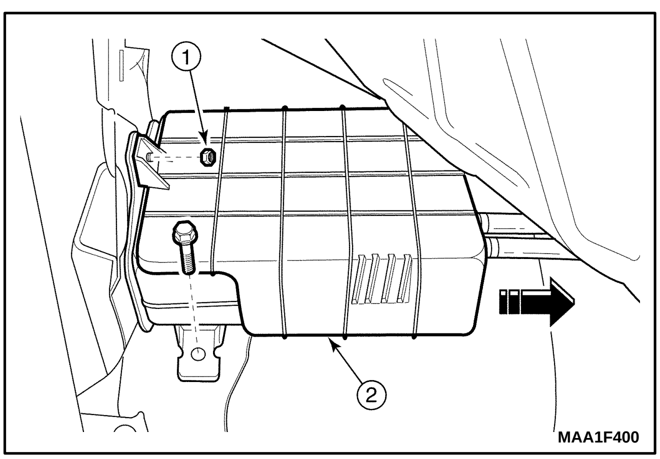
   Tighten

   Tighten the fuel rail retaining bolts to 18–22 N•m (13–16 lb-ft).

3. Perform a leak check of the fuel rail and the fuel injectors.

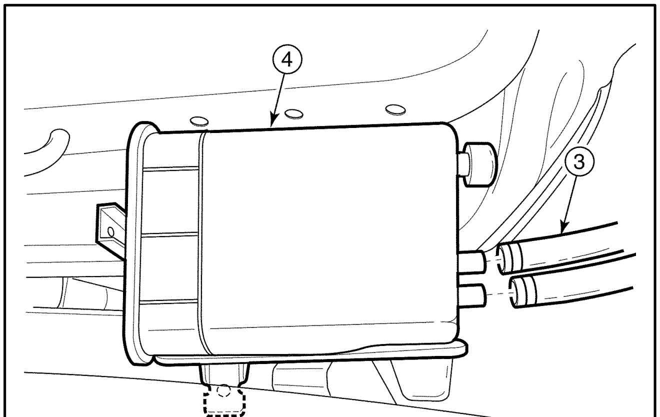
EVAPORATIVE EMISSION CANISTER

Removal Procedure



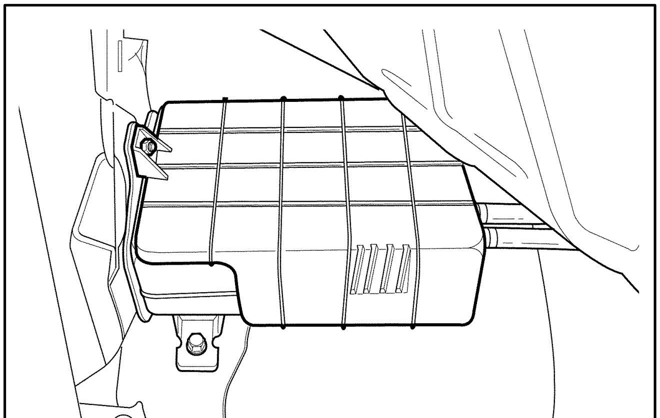
Caution: Canister and vacuum hoses contain fuel vapors. Do not smoke in the area or permit an open flame.

1. Disconnect the negative battery cable.
2. Remove the canister.
   - Remove the bolt (1).
   - Remove the nut, then remove the cover (2).



MAA1F410

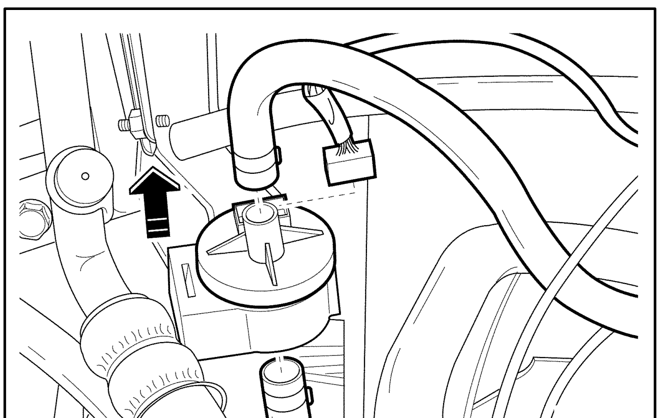
- Disconnect the canister hoses (3).
- Remove the evaporative emission casnister (4).



MAA1F420

Installation Procedure

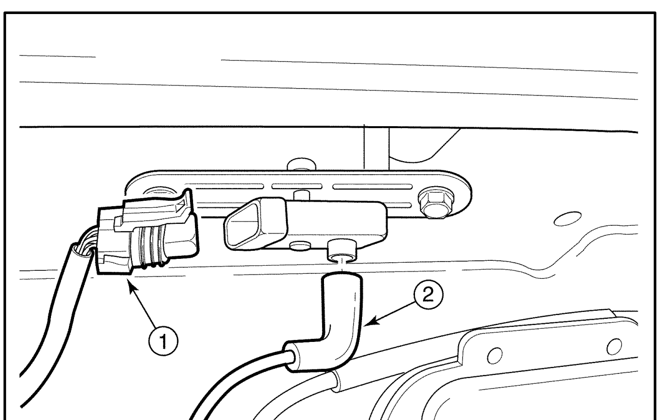
1. Install in the reverse order of removal.



MAA1F430

EVAPORATIVE EMISSION CANISTER PURGE SOLENOID

1. Disconnect the negative battery cable.
2. Disconnectthe evaporative (EVAP) emission canister purge solenoid connector.
3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.
4. Unclip the EVAP emission canister purge solenoid from the mounting bracket.
5. Installation should follow the removal procedure in the reverse order.

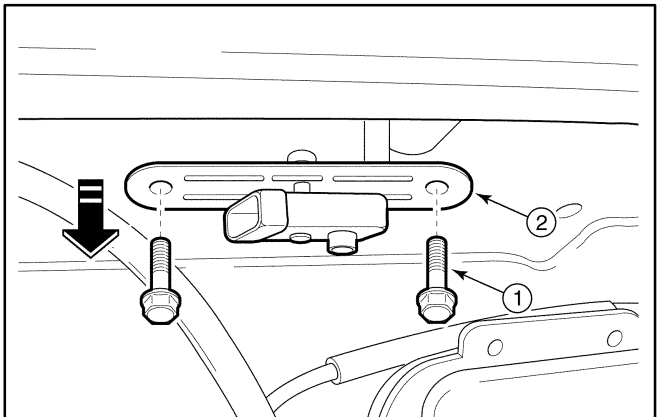


MAA1F440

MANIFOLD ABSOLUTE PRESSURE SENSOR

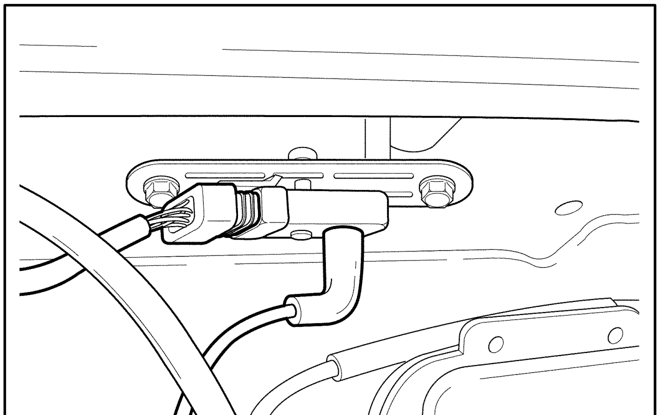
Removal Procedure

1. Disconnect the manifold absolute pressure (MAP) sensor connector and vacuum hose.
   - Disconnect the MAP connector (1).
   - Disconnect the vacuum hose from the MAP sensor (2).



MAA1F450

2. Remove the MAP sensor.
   - Remove the bolts (1).
   - Remove the MAP sensor with bracket (2).



MAA1F460

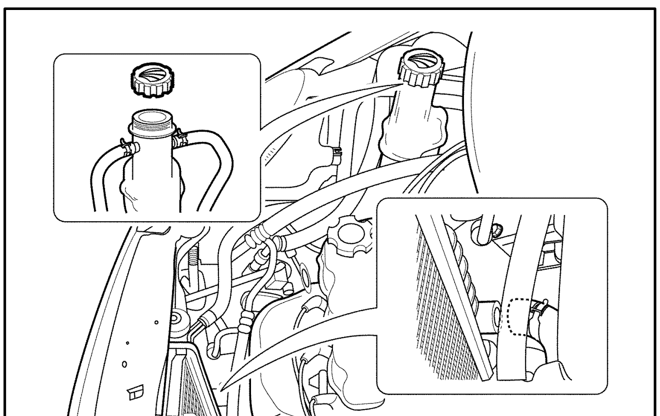
Installatin Procedure

1. Install in the reverse order of removal.
   - Inspect the MAP sensor vacuum hose for the tear and damages.
2. Install the MAP sensor with the bolts and nuts.

Tighten

Tighten the MAP sensor bolts/nuts to 8–12 N•m (71–106 lb-in).

Tighten the MAP sensor bracket bolt to 8–12 N•m (71–106 lb-in).

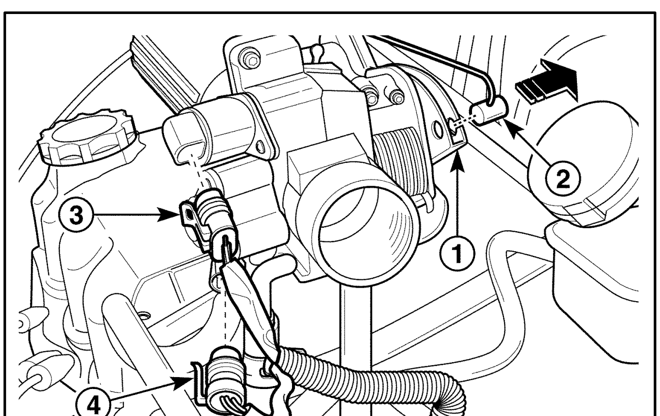


D102F537

THROTTLE BODY

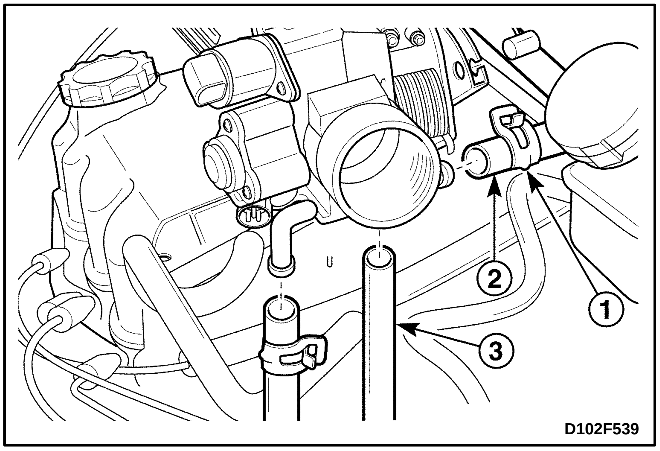
Removal Procedure

1. Remove the air cleaner/resonator assembly and air intake tube. Refer to *Section 1B, SOHC Engine Mechanical*.
2. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*

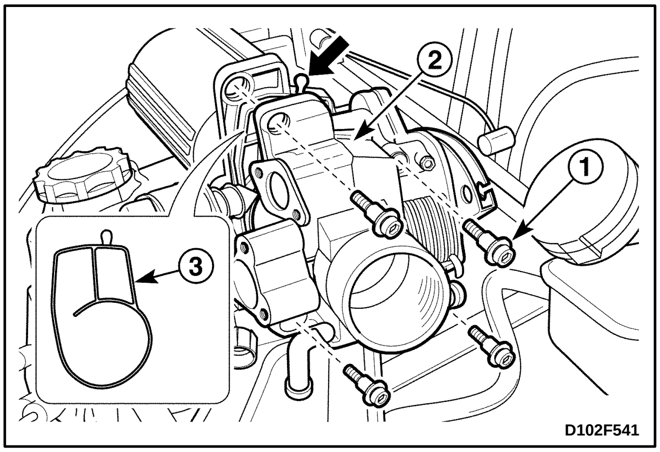


D102F538

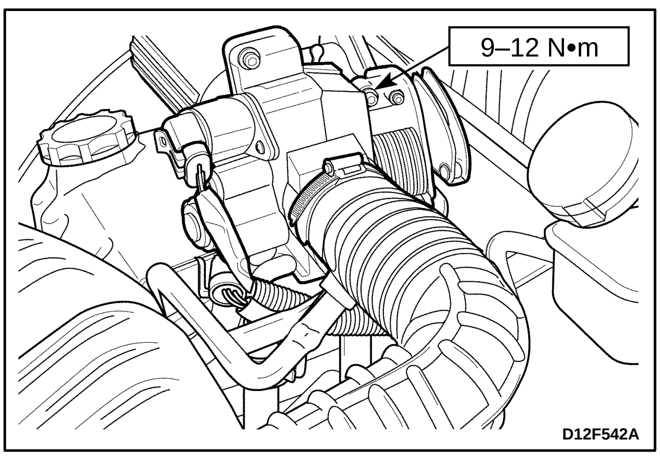
3. Disconnect the throttle cable, the throttle position sensor and the idle air control valve connectors.
   - Open the throttle valve (1).
   - Disconnect the throttle cable (2).
   - Disconnect the idle air control valve connector (3).
   - Disconnect the throttle position sensor connector (4).



4. Disconnect the coolant hoses and vacuum hoses from the throttle body.
   - Loosen the clamps from the coolant hoses (1).
   - Disconnect the coolant hoses from the throttle body (2).
   - Disconnect the vacuum hoses (3).



5. Remove the throttle body from the intake manifold.
   - Remove the throttle body bolts (1).
   - Remove the throttle body (2).
   - Discard the throttle body gasket (3).
   - Inspect the throttle body gasket for the deformation and the damages.



Installation Procedure

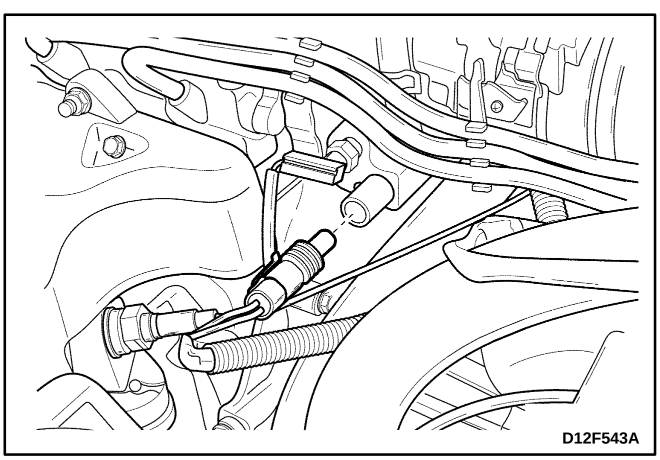
1. Install in the reverse order of removal.

Important: Make sure the throttle control cable do not hold the throttle open. With the engine OFF, check to see that the accelerator pedal is free.

2. Install the throttle body with the bolts.

Tighten

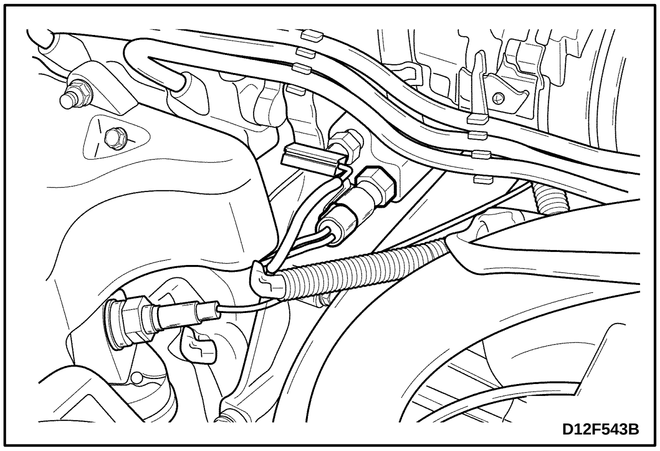
Tighten the throttle body bolts to 9–12 N•m (80–106 lb-in).



ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal Procedure

1. Remove the engine coolant temperature (ECT) sensor. Refer to *Section 1D, Engine Coolings*.

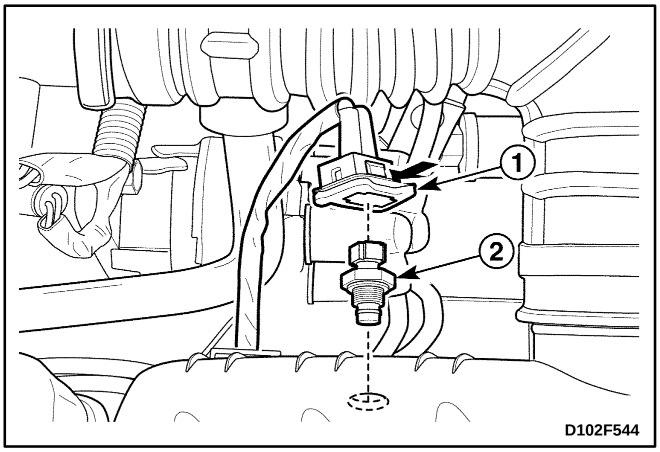


Installation Procedure

1. Install the engine coolant temperature sensor.

Tighten

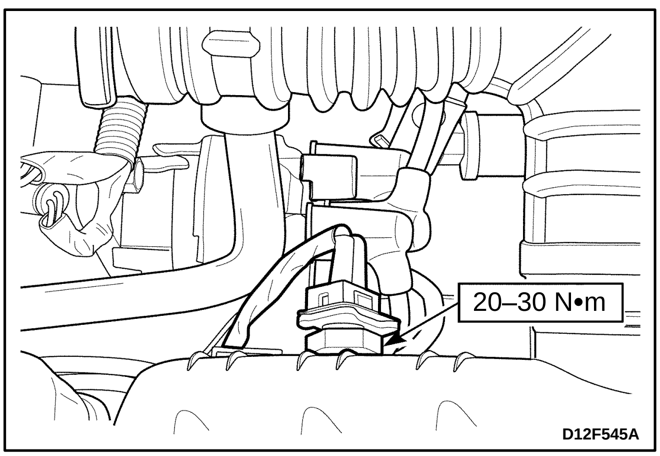
Tighten the engine coolant temperature sensor to 8–12 N•m (71–106 lb-ft).



INTAKE AIR TEMPERATURE (IAT) SENSOR

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the intake air temperature (IAT) sensor.
   - Disconnect the IAT sensor connector (1)
   - Disconnect the IAT sensor.

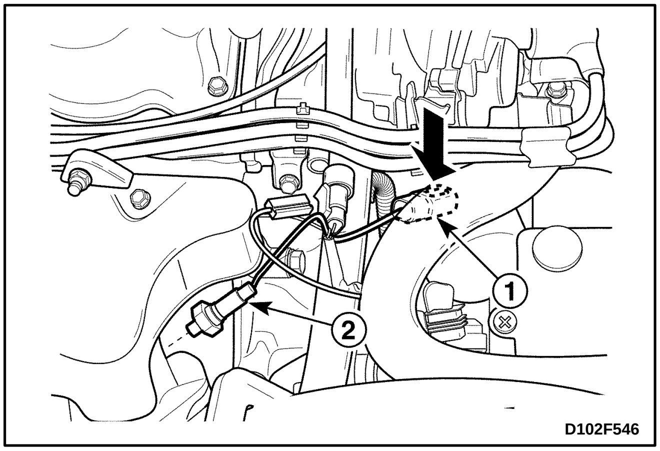


Installation Procedure

1. Install in the reverse order of removal.
2. Install the IAT sensor.

Tighten

Tighten the IAT sensor to 20–30 N•m (15–22 lb-ft).

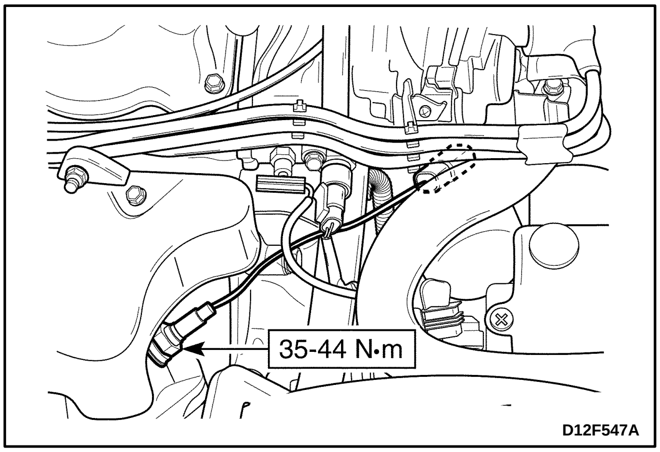


OXYGEN SENSOR (O2S1)

Removal Procedure

1. Remove the air cleaner/resonator assembly. Refer to *Section 1B, SOHC Engine Mechanical*.
2. Remove the oxygen sensor.
   - Disconnect the oxygen sensor connector (1).
   - Remove the oxygen sensor (2).

Notice: The oxygen sensor uses a permanently attached pigtail and connector. This pigtail should not be removed from the oxygen sensor. Damage or removal of the pigtail or the connector could affect proper operation of the oxygen sensor. Take care when handling the oxygen sensor. Do not drop the oxygen sensor.



Installation Procedure

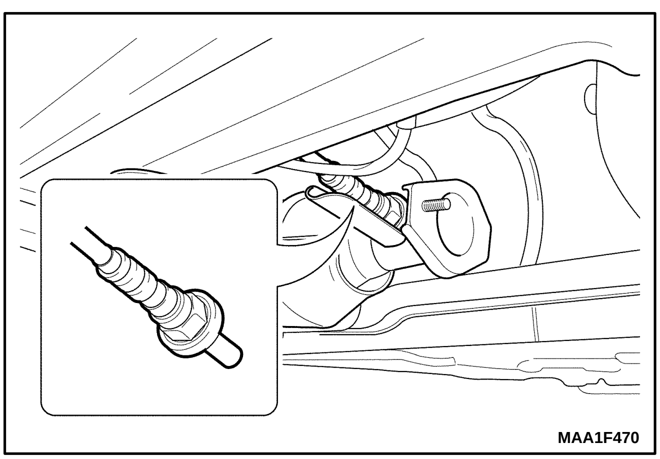
1. Install in the reverse order of removal.

Important: A special anti–seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, 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 from any engine and if for any reason it is to be reinstalled, the threads must have anti–seize compound applied before reinstallation.

2. Install the oxygen sensor.

Tighten

Tighten the oxygen sensor to 35~44 N•m (26~33 lb-ft).



HEATED OXYGEN SENSOR (HO2S2)

Removal and Installation Procedure

1. Disconnect the negative battery cable.
2. Remove the front center console.
3. Disconnect the HO2S2 connector.
4. Remove the front exhaust pipe. Refer to *Section 1G, Engine Exhaust.*
5. Remove the HO2S2 from the front exhaust pipe.

Installation Procedure

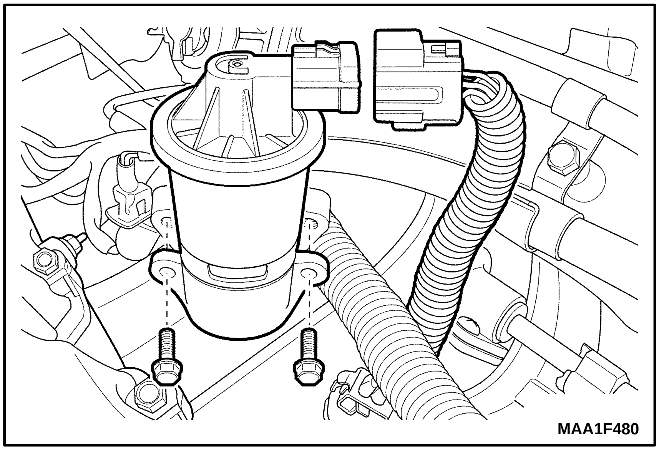
1. Install in the reverse order of removal.

Important: A special anti–seize compound is used on the oxygen sensor threads. This compound consists of a liquid graphite and glass beads. The graphite will burn away, 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 from any engine and if for any reason it is to be reinstalled, the threads must have anti–seize compound applied before reinstallation.

2. Install the oxygen sensor.

Tighten

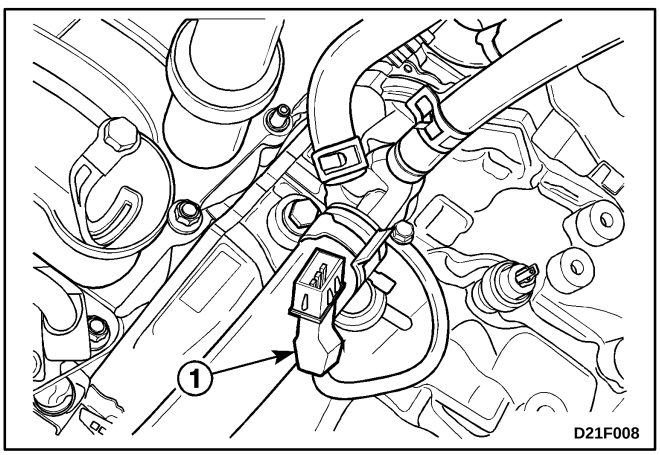
Tighten the oxygen sensor to 35~44 N•m (26~33 lb-ft).



EXHAUST GAS RECIRCULATION VALVE

Removal Procedure

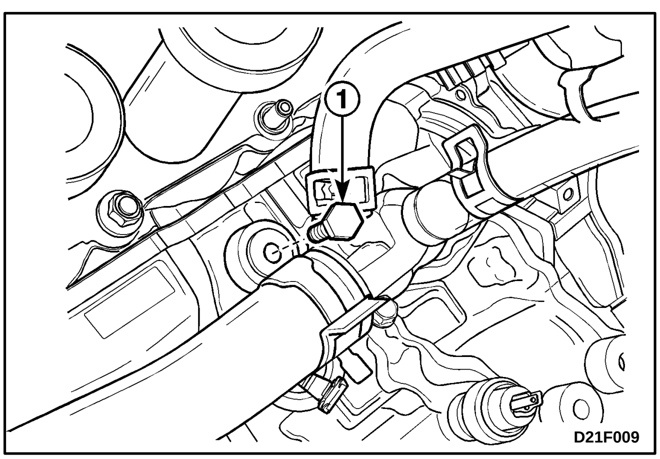
1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly.
3. Disconnect the electric exhaust gas recirculation (EEGR) valve connector.



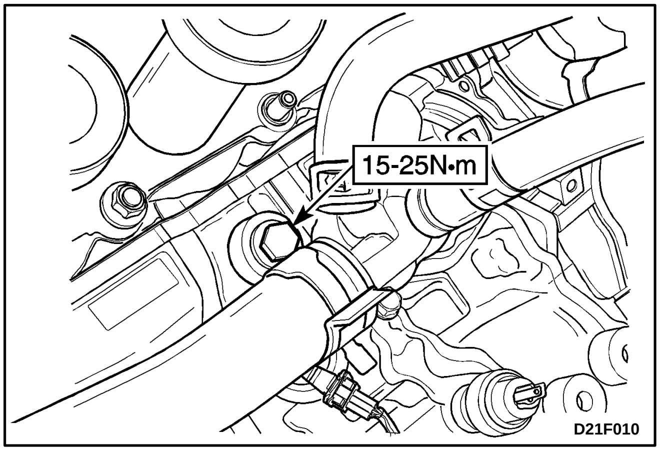
KNOCK SENSOR

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the starter. Refer to *Section 1E, Engine Electrical*.
3. Disconnect the electrical connector at the knock sensor (1).



4. Remove the knock sensor.
   - Remove the knock sensor retaining bolt (1).
   - Remove the knock sensor.

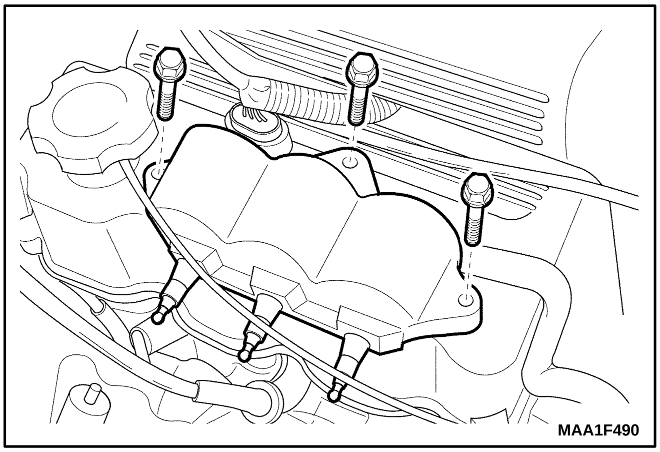


Installation Procedure

1. Install the knock sensor with the bolt.

   Tighten

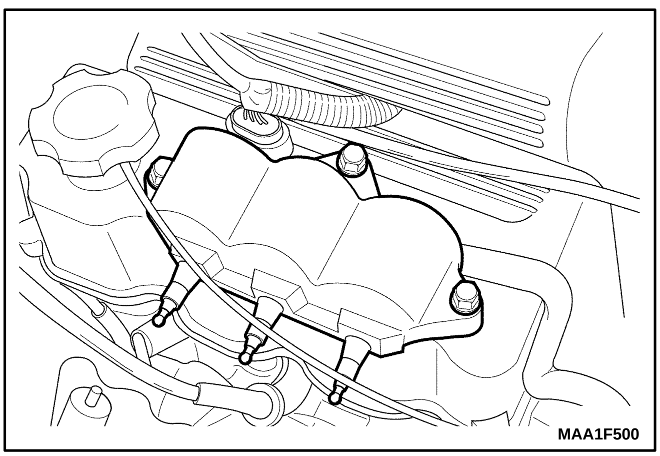
   Tighten the knock sensor retaining bolt to 15–25 N•m (11–18 lb-ft).
2. Connect the electrical connector to the knock sensor.
3. Install the starter. Refer to *Section 1E, Engine Electrical*.
4. Connect the negative battery cable.



ELECTRONIC IGNITION (EI) SYSTEM IGNITION COIL

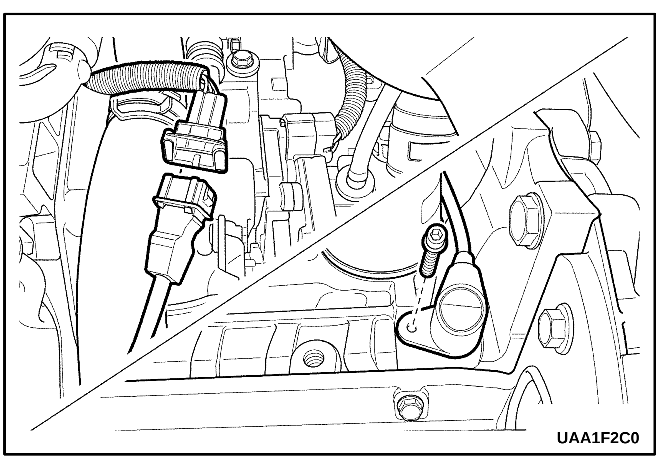
Removal Procedure

1. Disconnect the negative battery cable.
2. Note the ignition wire location and disconnect the ignition wires from the EI system ignition coil.
3. Disconnect the EI system ignition coil connector.
4. Remove the EI system ignition coil retaining bolts.
5. Remove the EI system ignition coil.



Installation Procedure

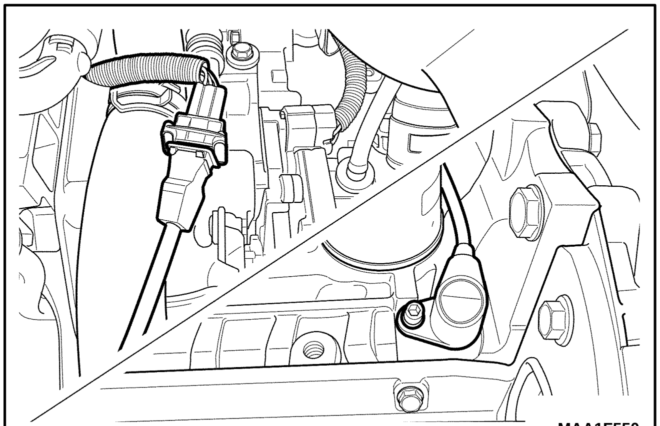
1. Install the EI system ignition coil.
2. Tighten the EI system ignition coil to 8–12 N•m (71–106 lb-in).



CRANKSHAFT POSITION (CKP) SENSOR

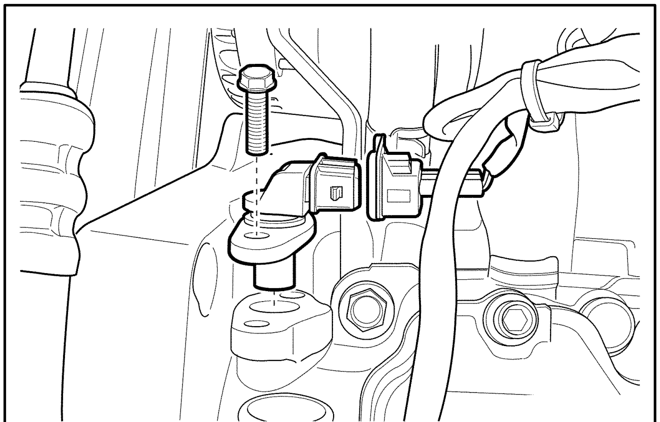
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly.
3. Disconnect the crankshaft position (CKP) sensor connector.
4. Remove the CKP sensor retaining bolt.


MAA1F550

Installation Procedure

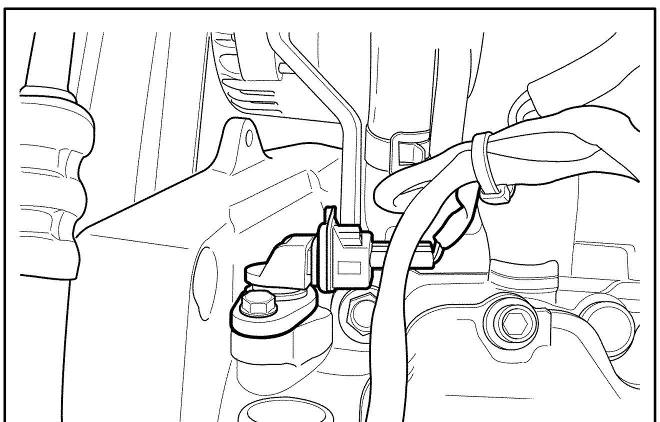
1. Install the CKP sensor.
2. Tighten the CKP sensor retaining bolt to 5–8 N•m (44–71 lb-in).


UAA1F2E0

CAMSHAFT POSITION (CMP) SENSOR

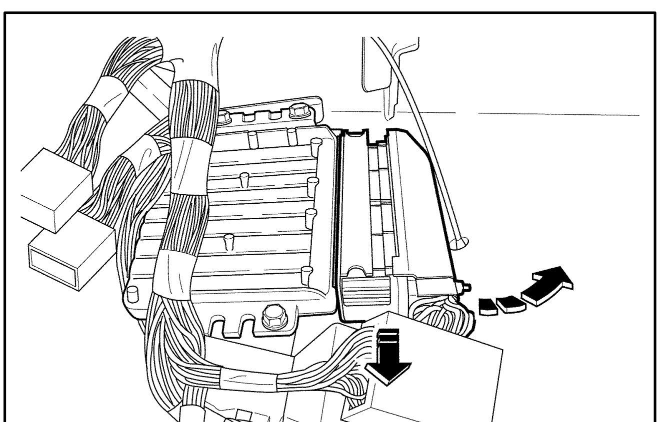
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the camshaft position (CMP) sensor connector.
3. Remove the CMP sensor retaining bolt.
4. Remove the CMP sensor.


MAA1F540

Installation Procedure

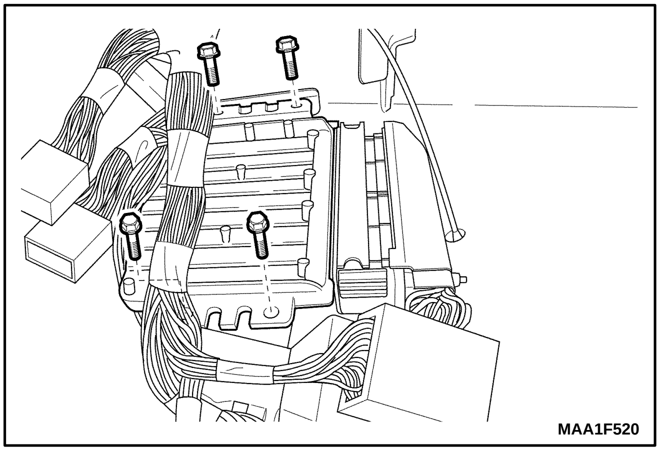
1. Install the CMP sensor.
2. Tighten the CMP sensor retaining bolt to 10–14 N•m (89–124 lb-in).


MAA1F510

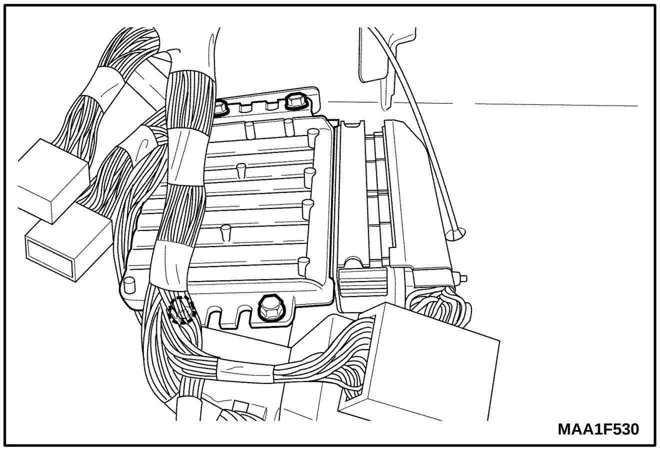
ENGINE CONTROL MODULE (ECM)

Removal Procedure

1. Disconnect the ECM connector.


MAA1F520

2. Remove the ECM.
- Remove the bolts.
- Remove the ECM.


MAA1F530

Installation Procedure

1. Install in the reverse order of removal.

Notice: If disconnecting the battery cable to the ECM, the IAC valve resetting should be proceeded.

2. install the ECM with the bolts.

Tighten

Tighten the ECM mounting bolts to 6–8 N•m (53–71 lb-in).

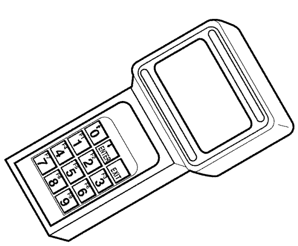
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Camshaft Position Sensor Bolts	10–14	–	89–124
Engine Coolant Temperature (ECT) Sensor	8–12	–	71–106
Crankshaft Position (CKP) Sensor Retaining Bolt	5–8	–	44–71
Electronic Ignition (EI) System Ignition Coil Retaining Bolts	8–12	–	71–106
Evaporative Emission Canister Protective Cover	8	–	71
Electric Exhaust Gas Recirculation (EEGR) Valve Retaining Bolts	20–30	15–22	–
Fuel Rail Retaining Bolts	18–22	13–16	–
Fuel Tank Strap Retaining Nuts	18–22	13–16	–
Knock Sensor Bolt	15–25	11–18	–
Intake Air Temperature (IAT) Sensor	20–30	15–22	–
Manifold Absolute Pressure (MAP) Sensor Retaining Bolt	8–12	–	71–106
Oxygen Sensor	35–44	26–33	–
Heated Oxygen Sensor	35–44	26–33	–
Throttle Body Retaining Bolt	9–12	–	80–106
ECM Mounting Bolts	6–8	–	53–71

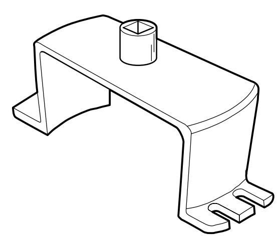
SPECIAL TOOLS

SPECIAL TOOLS TABLE



D102F101

Scan Tool

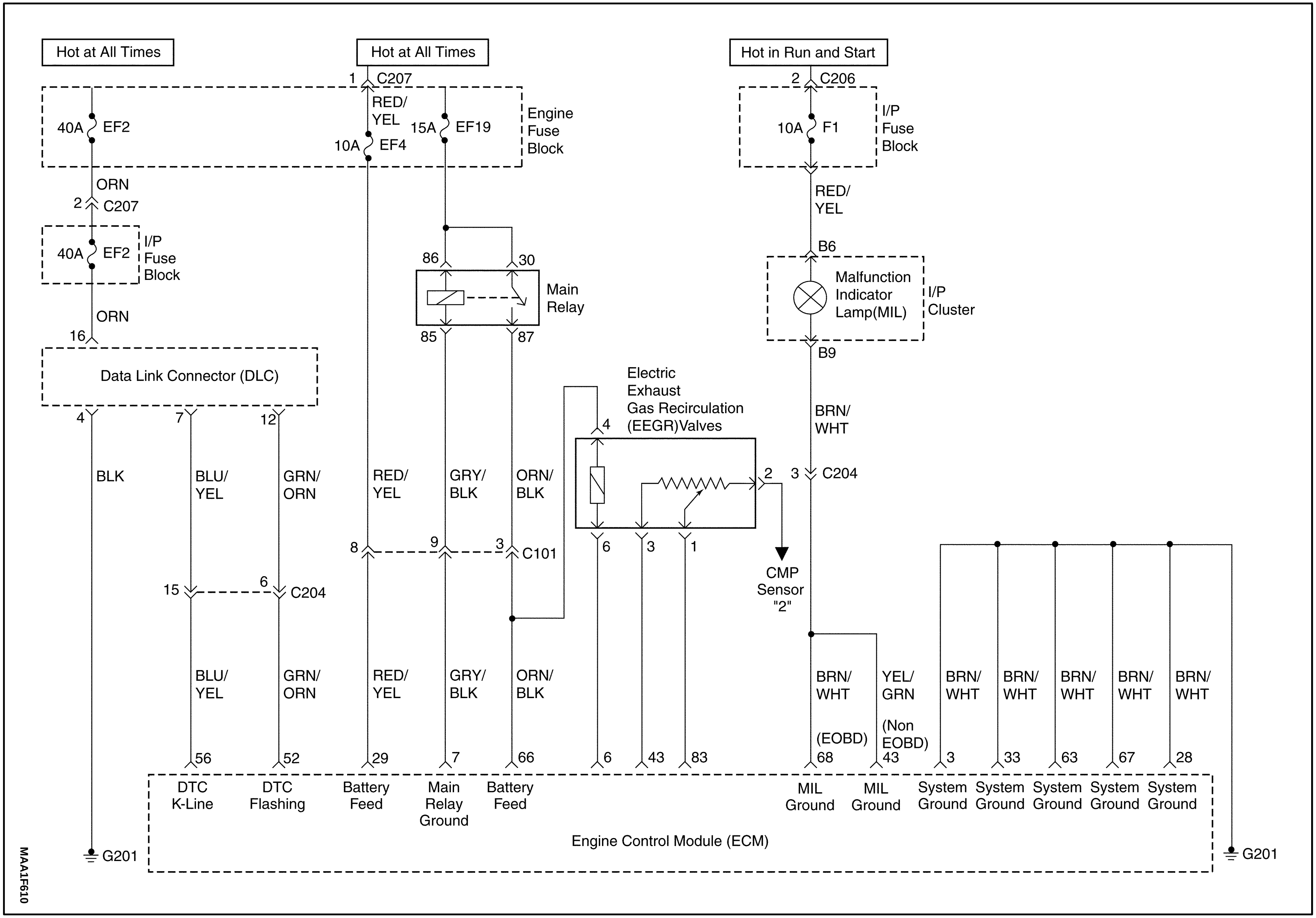


D12F102A

DW–140–010A

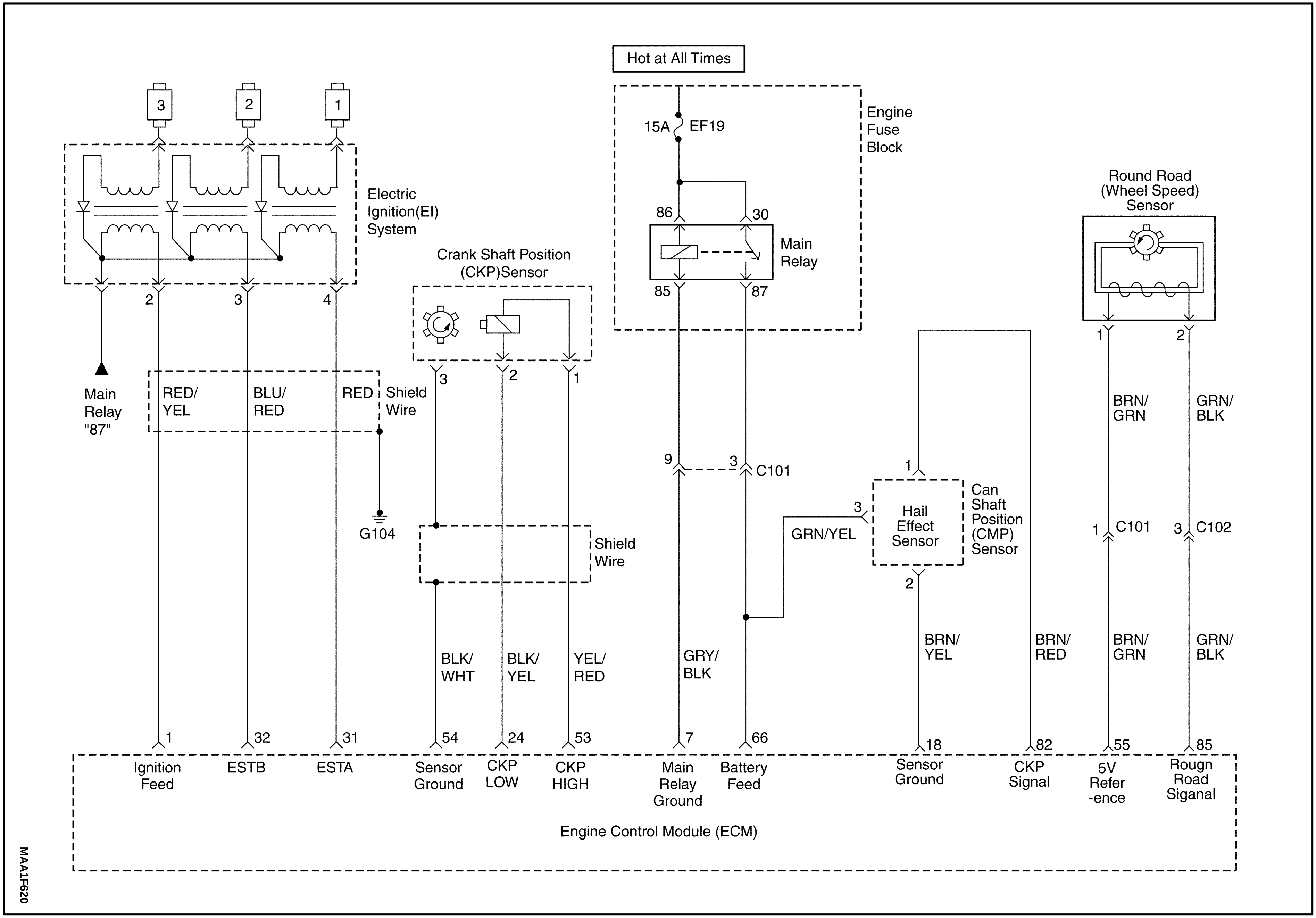
Fuel Pump Lock Ring Remover/Installer

ECM WIRING DIAGRAM (SIRIUS D3 – 1 OF 5)

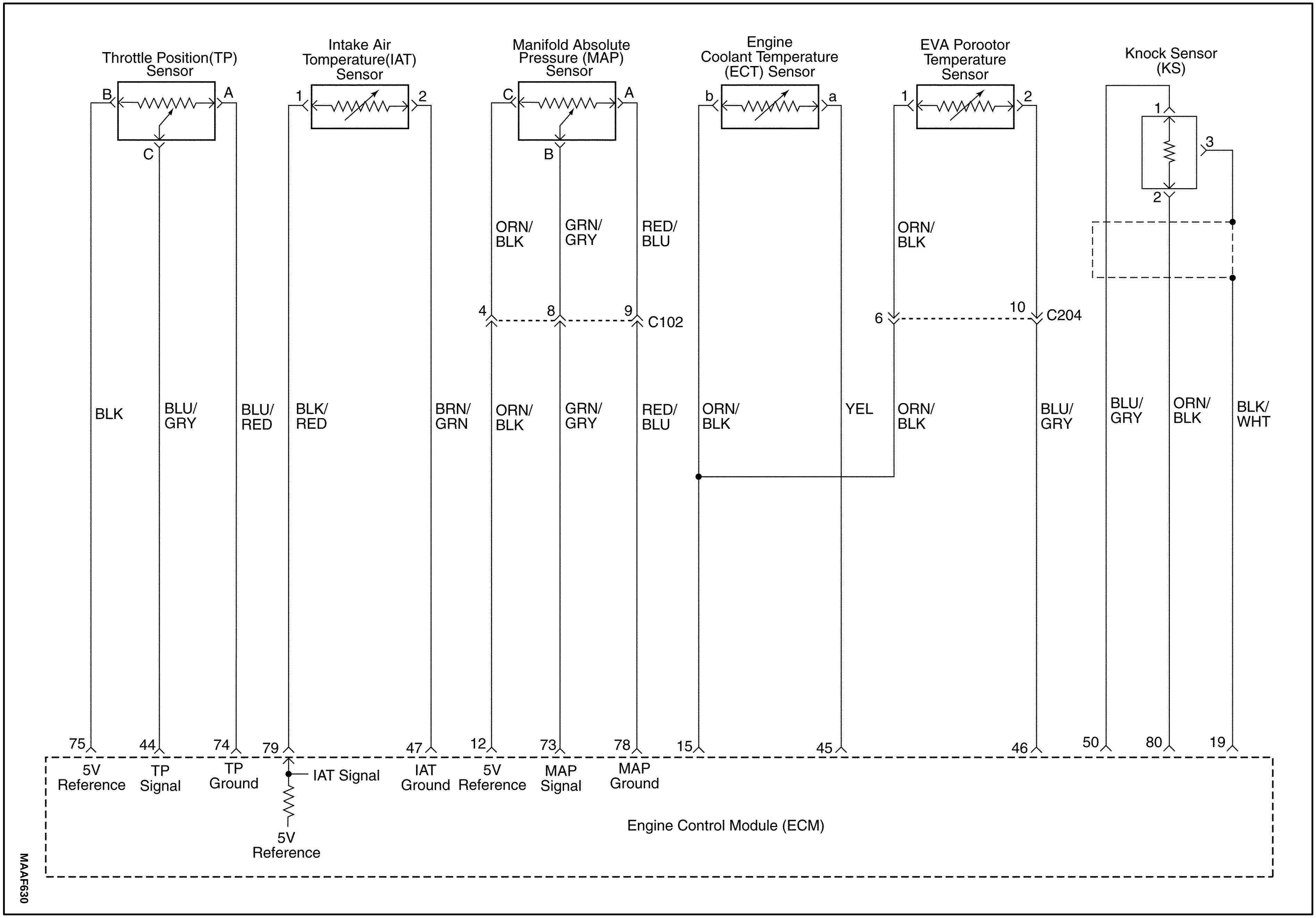


MAA1F610

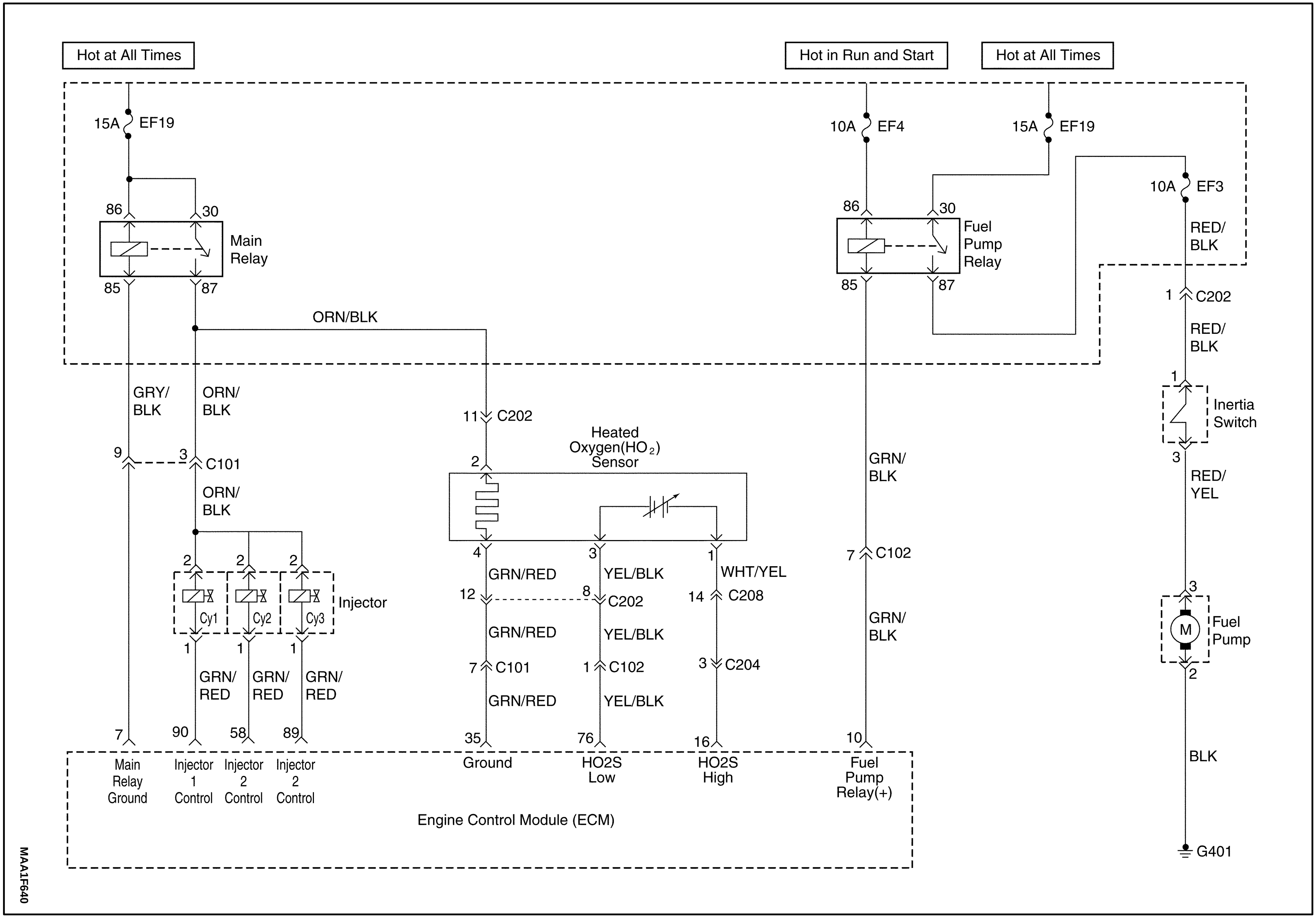
ECM WIRING DIAGRAM (SIRIUS D3 – 2 OF 5)



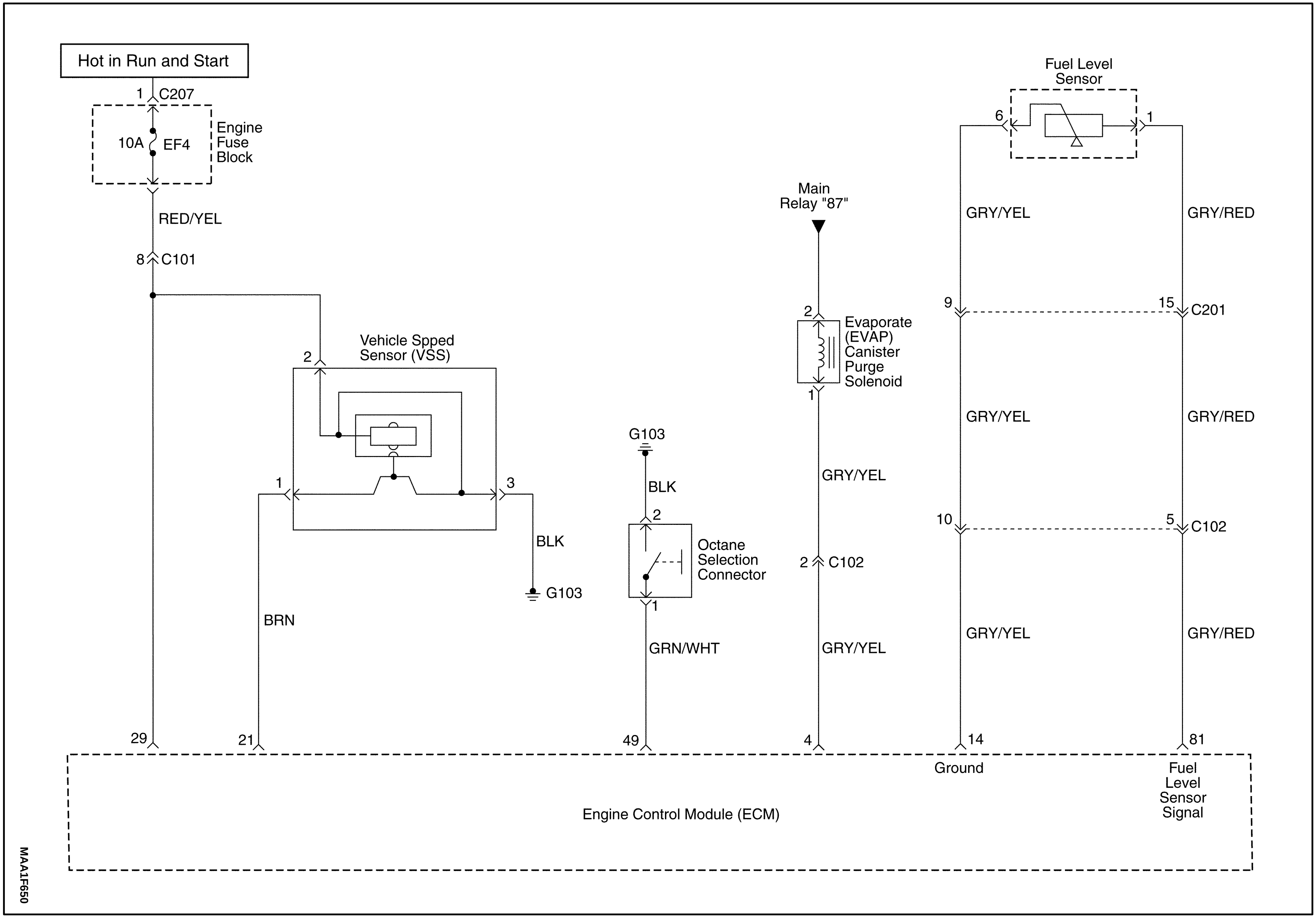
ECM WIRING DIAGRAM (SIRIUS D3 – 3 OF 5)



ECM WIRING DIAGRAM (SIRIUS D3 – 4 OF 5)



ECM WIRING DIAGRAM (SIRIUS D3 – 5 OF 5)



SECTION 1G

ENGINE EXHAUST

TABLE OF CONTENTS

DESCRIPTION AND OPERATION

EXHAUST SYSTEM

Notice: When you are inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to avoid possible overheating of the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check the complete exhaust system and the nearby body areas and tailgate for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the luggage or passenger compartment. Dust or water in the luggage may be an indication of a problem in one of these areas. Any defects should be corrected immediately.

MUFFLER

The muffler reduces the temperature, pressure, and noise of the exhaust gas.

Aside from the exhaust manifold connection, the exhaust system uses a flange and seal joint design opposed to a slip joint coupling design with clamp. If holes, open seams or any deterioration is discovered upon inspection of the front muffler and pipe assembly, the complete assembly should be replaced. The same procedure is applicable to the rear muffler assembly.

Heat shields in the front and rear muffler assembly positions, as well as for the catalytic converter and front exhaust pipe, protect the vehicle and the environment from high temperatures the exhaust system develops.

CATALYTIC CONVERTER

Notice: When jacking or lifting the vehicle from the body side rails, be certain that the lift pads do not contact the catalytic converter as this could damage the catalytic converter.

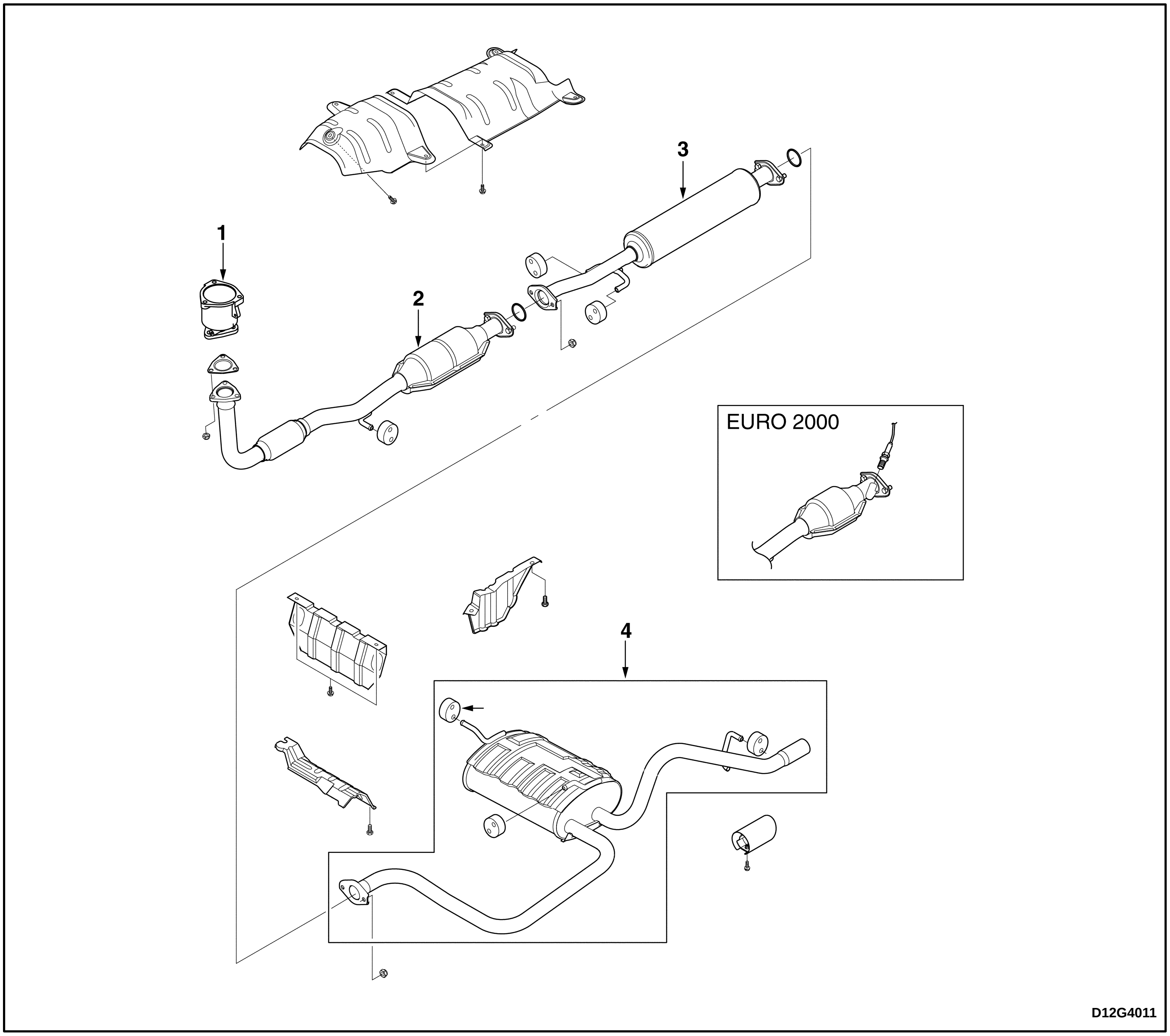
Notice: The catalytic converter requires the use of unleaded fuel only, or damage to the catalyst will result.

The catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust pipes.

The oxidation catalyst is coated with a catalytic material containing platinum and palladium, which reduces levels of hydrocarbon (HC) and carbon monoxide (CO) from the exhaust gas. The three-way catalyst has coatings which contain platinum and rhodium, which additionally lower the levels of oxides of nitrogen (NOx).

COMPONENT LOCATOR

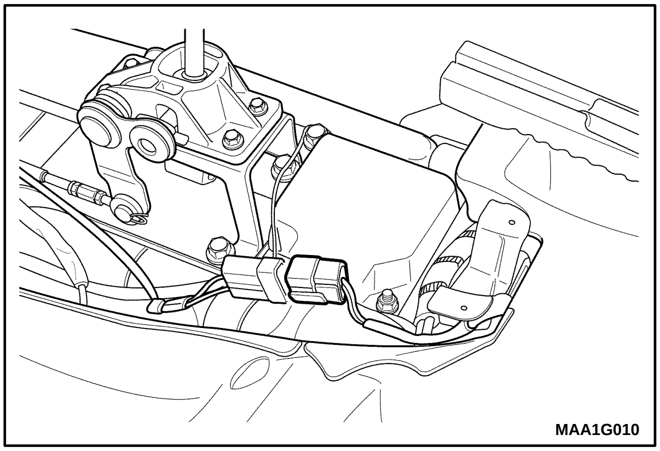
EXHAUST SYSTEM



1 Pup-up Catalytic Converter
2 Front Exhaust Pipe/Catalytic Converter Assembly
3 Front Muffler Pipe
4 Rear Muffler Pipe

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

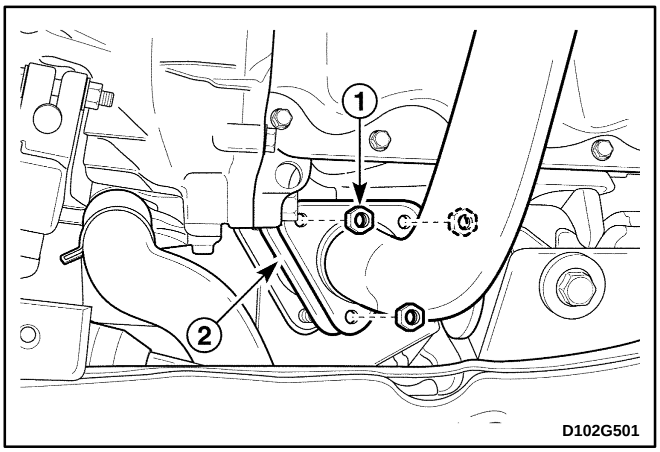


EXHAUST PIPE/CATALYTIC CONVERTER

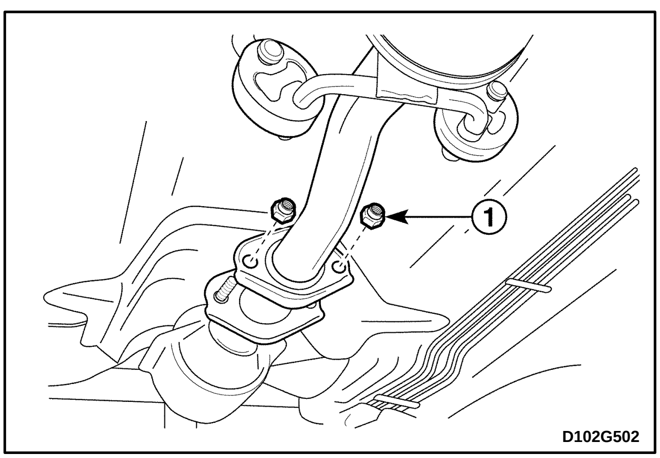
Caution : Make sure to confirm that the components is cool. And do work.

Removal Procedure

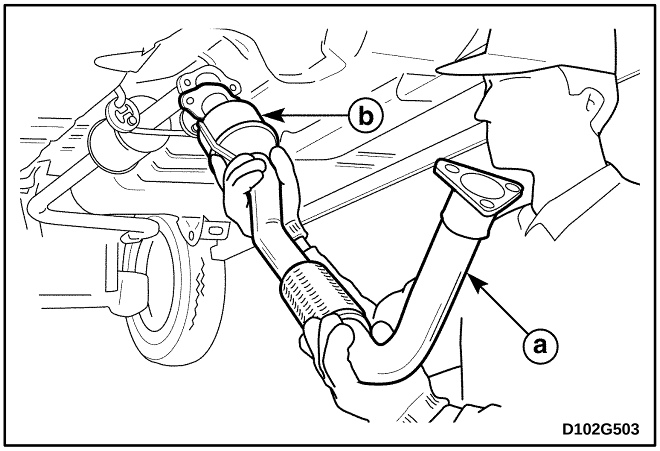
1. Remove the floor console. Refer to *Section 9G, Interior Trim*, if equipped Heated Oxygen Sensor (HO2S).
2. Disconnect HO2S connector.



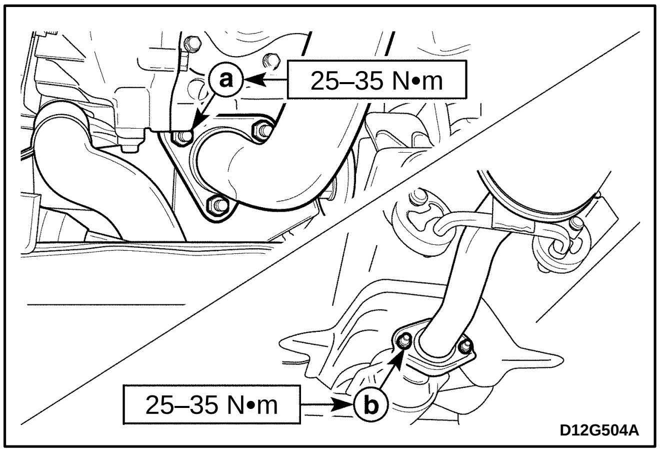
3. Remove the front exhaust pipe from the exhaust manifold or pup-up catalytic converter.
   - Remove the nuts (1).
   - Remove the gasket (2).
4. Check the gasket for damage or crack.



5. Remove the front exhaust pipe from the front muffler pipe.
   - Remove the nuts (1).



6. Remove the front exhaust pipe and the catalytic converter assembly.
   a. Front exhaust pipe.
   b. Catalytic converter.
7. Clean the sealing surfaces on the front exhaust pipe flange and the exhaust manifold.
8. Check the exhaust pipe and the catalytic coverter for holes, damage, open seams, or other deterioration which could permit exhaust fumes to seep into the passenger compartment.



Installation Procedure

1. Using the nuts and the gasket, secure the front exhaust pipe and the catalytic converter assembly to the exhaust manifold.

   Tighten

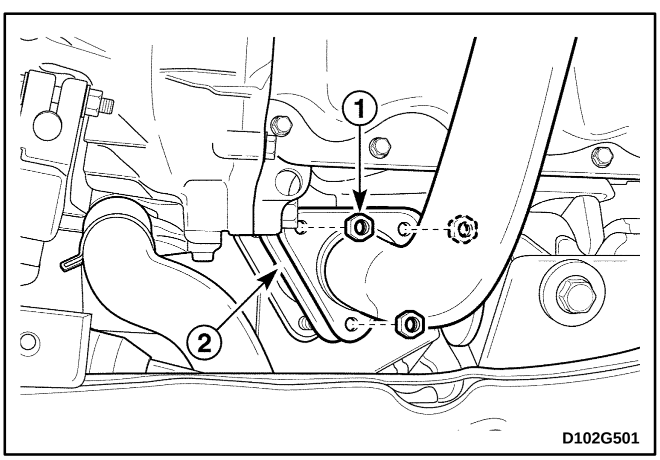
   Tighten the nuts to 25–35 N•m (18–25 lb-ft).
   a. Front exhaust pipe nut.
2. Install the front exhaust pipe and the catalytic converter assembly to the front muffler pipe flange. Use the nuts to secure the front exhaust pipe and the catalytic converter assembly.

   Tighten

   Tighten the nuts to 25–35 N•m (18–25 lb-ft).
   b. Front muffler pipe nut.

Notice : Make sure not to contact the components with the underbody.

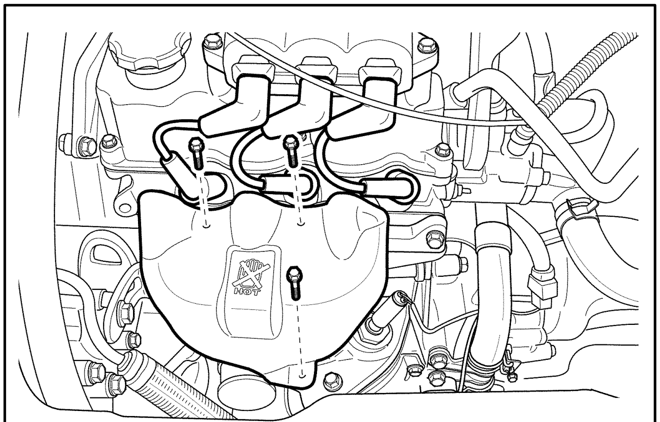
3. Connect the Heated Oxygen Sensor (HO2S) connector.
4. Install the floor console. Refer to *Section 9G, Interior Trim.*



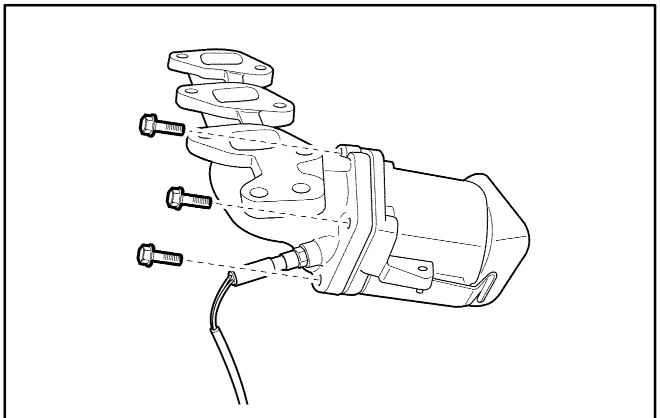
PUP-UP CATALITIC CONVERTER

Removal Procedure

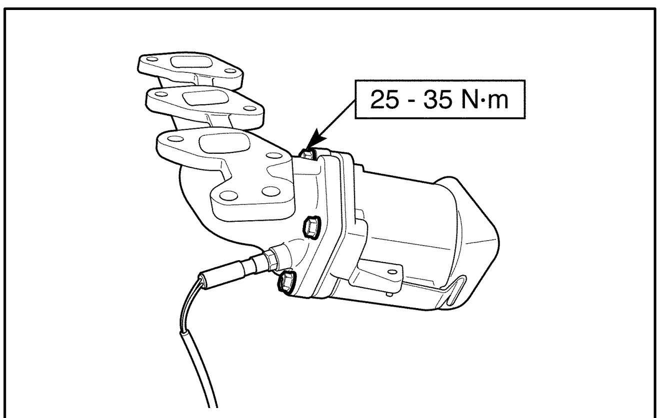
1. Remove the front exhaust pipe from the pup-up catalitic converter.
   - Remove the nuts (1).
   - Remove the gasket (2).
2. Check the gasket for damage or leak.


MAA1B010

3. Remove the air cleaner assembly. Refer to *Section 1B, SOHC Engine Mechanical.*
4. Disconnect Oxygen Sensor (O2S) connector.
5. Remove the exhaust manifold heat shield.
6. Remove the exhaust manifold. Refer to *Section 1B, SOHC Engine Mechanical.*


MAA1B040

7. Remove pup-up catalytic convertor.
   - Remove the bolts.



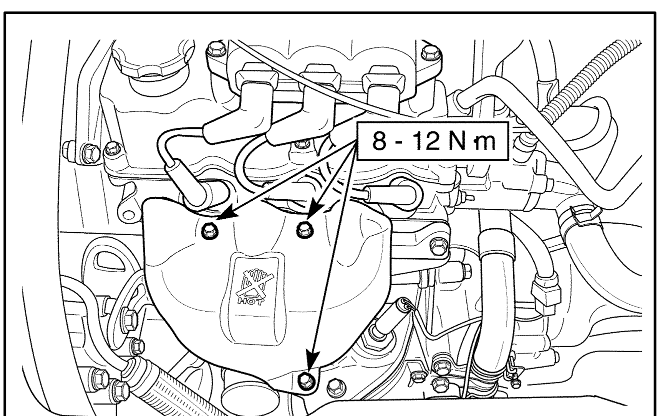
MAA1B041

Installation Procedure

1. Install pup-up catalytic convertor to exhaust pipe.

Tighten

Tighten the bolts to 25–35 N•m (18–25 lb-ft).



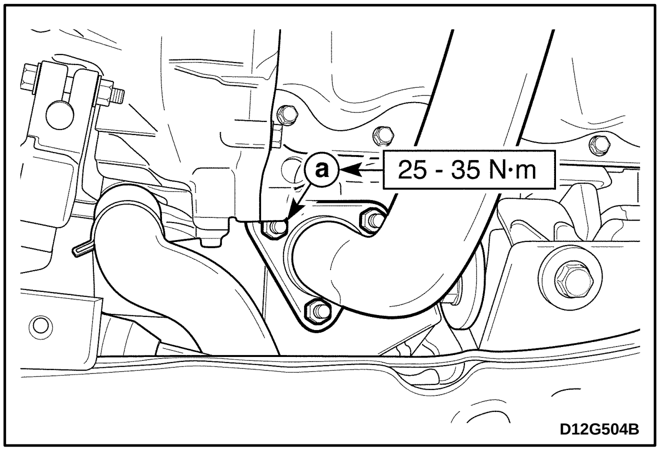
MAA1B011

2. Install exhaust manifold. Refer to *Section 1B, SOHC Engine Mechanical.*

Tighten

Tighten the bolts and nuts to 17–27 N•m (13–20 lb-ft).

Tighten the exhaust manifold heat shield bolts to 8–12 N•m (71–106 lb-in).

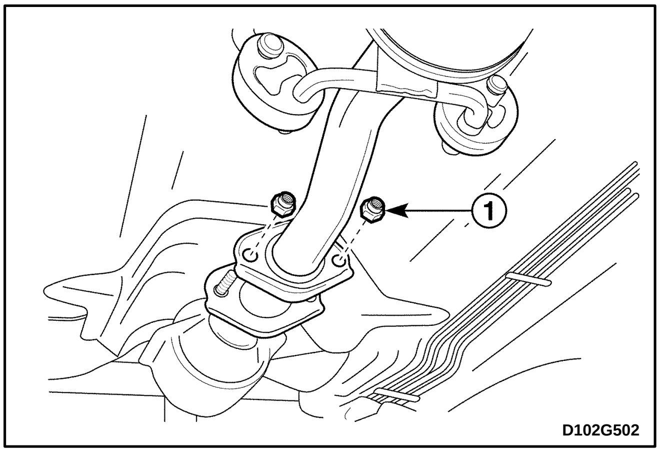


D12G504B

3. Install the front exhaust pipe to pup-up catalytic convertor.

Tighten

Tighten the bolts to 25–35 N•m (18–25 lb-ft).

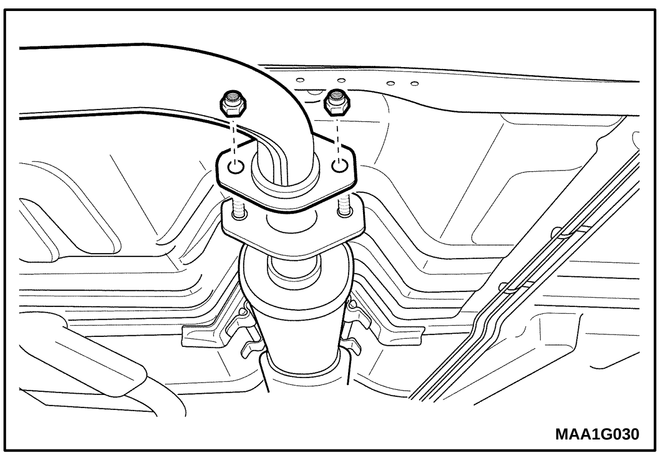


D102G502

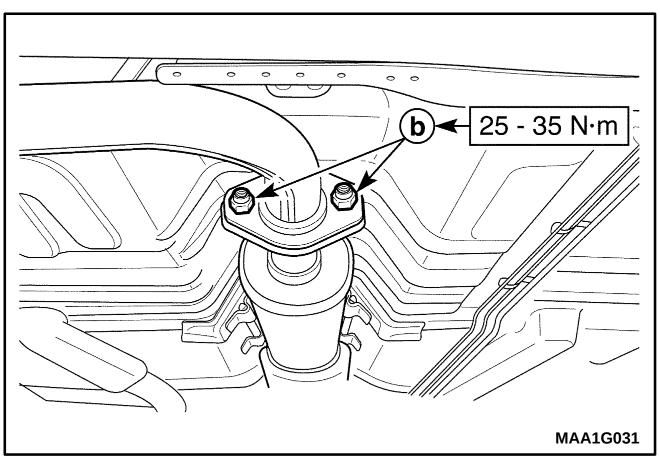
FRONT MUFFLER

Removal Procedure

1. Remove the front exhaust pipe-to-front muffler nuts.
   - Remove the nuts (1).


MAA1G030

2. Remove the front muffler-to-rear muffler nuts.
3. Detach the front muffler from rubber hanger and remove the front muffler.



MAA1G031

Installation Procedure

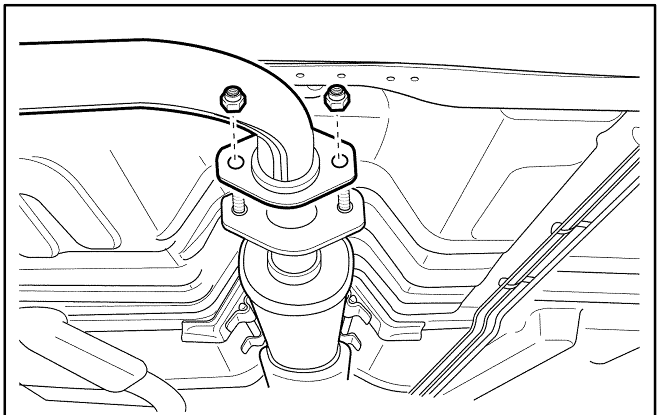
1. Hang the front muffler to rubber hanger.
2. Install the front muffler-to-rear muffler nuts.

   Tighten

   Tighten the nuts to 25–35 N•m (18–25 lb-ft).
3. Install the exhaust pipe-to-front muffler nuts.

   Tighten

   Tighten the nuts to 25–35 N•m (18–25 lb-ft) (a).



MAA1G030

REAR MFFLER

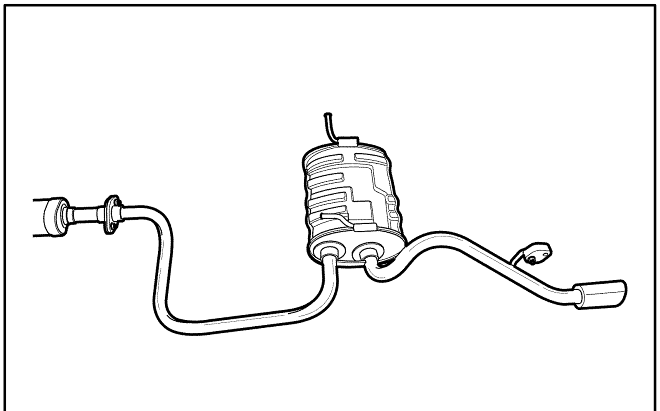
Removal Procedure

1. Remove the front muffler-to rear muffler nuts.

Tighten

Tighten the nuts to 25–35 N•m (18–25 lb-ft).

2. Detach the rear muffler from the rubber hangers.



MAA1G040

3. Remove the rear muffler.
4. Installation should flow the removal procedure in reverse order.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Front Exhaust Pipe-to-Front Muffler Pipe Nuts	25 – 35	18 – 25	–
Front Exhaust Pipe-to-Exhaust Manifold Nuts	25 – 35	18 – 25	–
Front Exhaust Pipe-to-Pup-up Catalytic Converter	25 – 35	18 – 25	–
Front Muffler-to-Rear Muffler nuts	25 – 35	18 – 25	–
Pup-up Catalytic Convertor-to-Exhaust Manifold Bolt	25 – 35	18 – 25	–
Muffler Clamp Nut	24 – 28	18 – 21	–
Catalytic Converter Heat Shield	8 – 12	–	71 – 106
Rear Muffler Heat Shield	8 – 12	–	71 – 106