SERVICE MANUAL

MATIZ (MY2003)

FOREWORD

This manual includes procedure for maintenance, adjustment, service operation and removal and installation of components.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of manual approval.

The right is reserved to make changes at any time without notice.

DAEWOO MOTOR CO., LTD.

INCHON, KOREA

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GENERAL ENGINE INFORMATION

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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

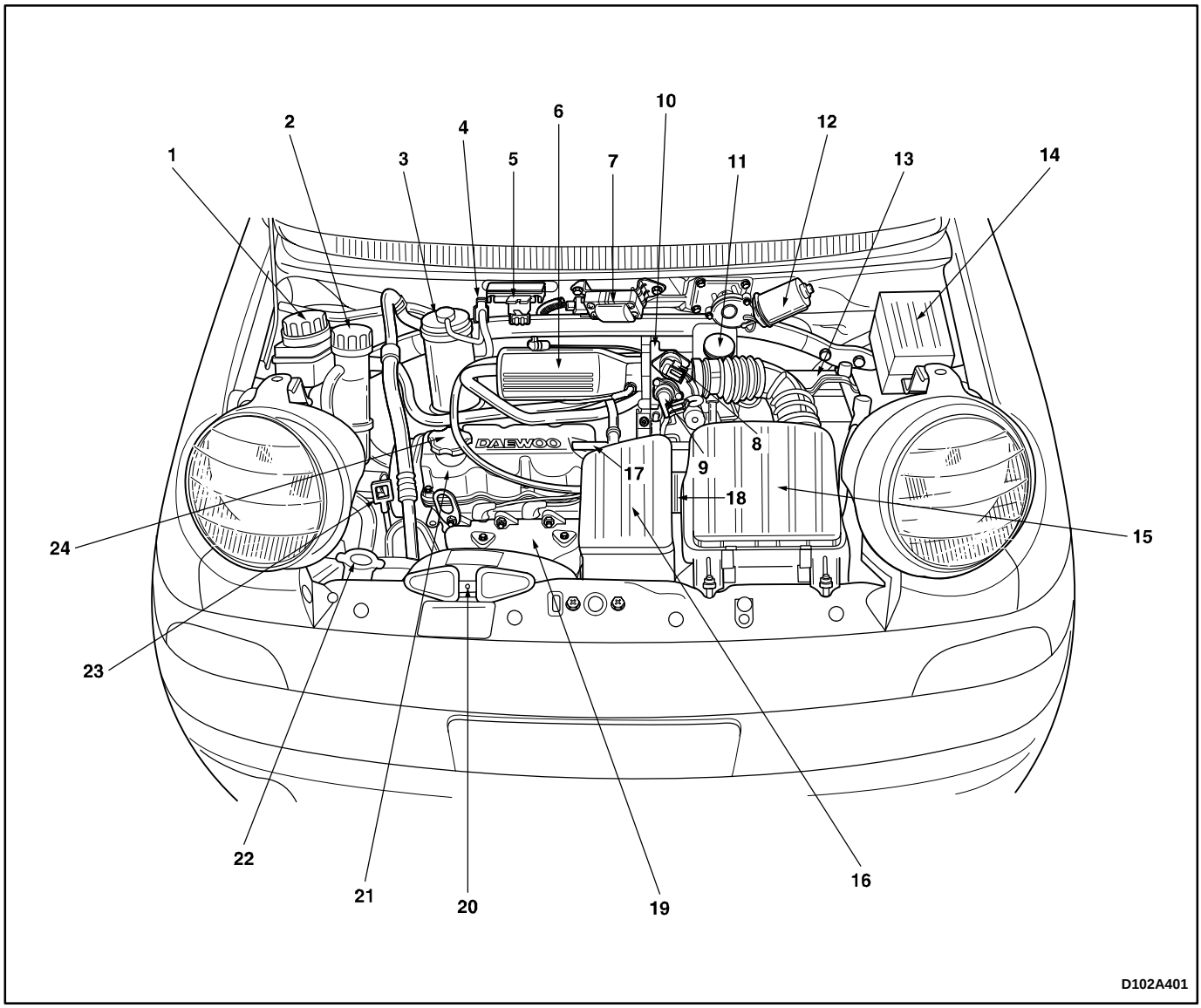
Caution: Disconnect the negative battery cable before removing or installing any electrical unit, or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be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

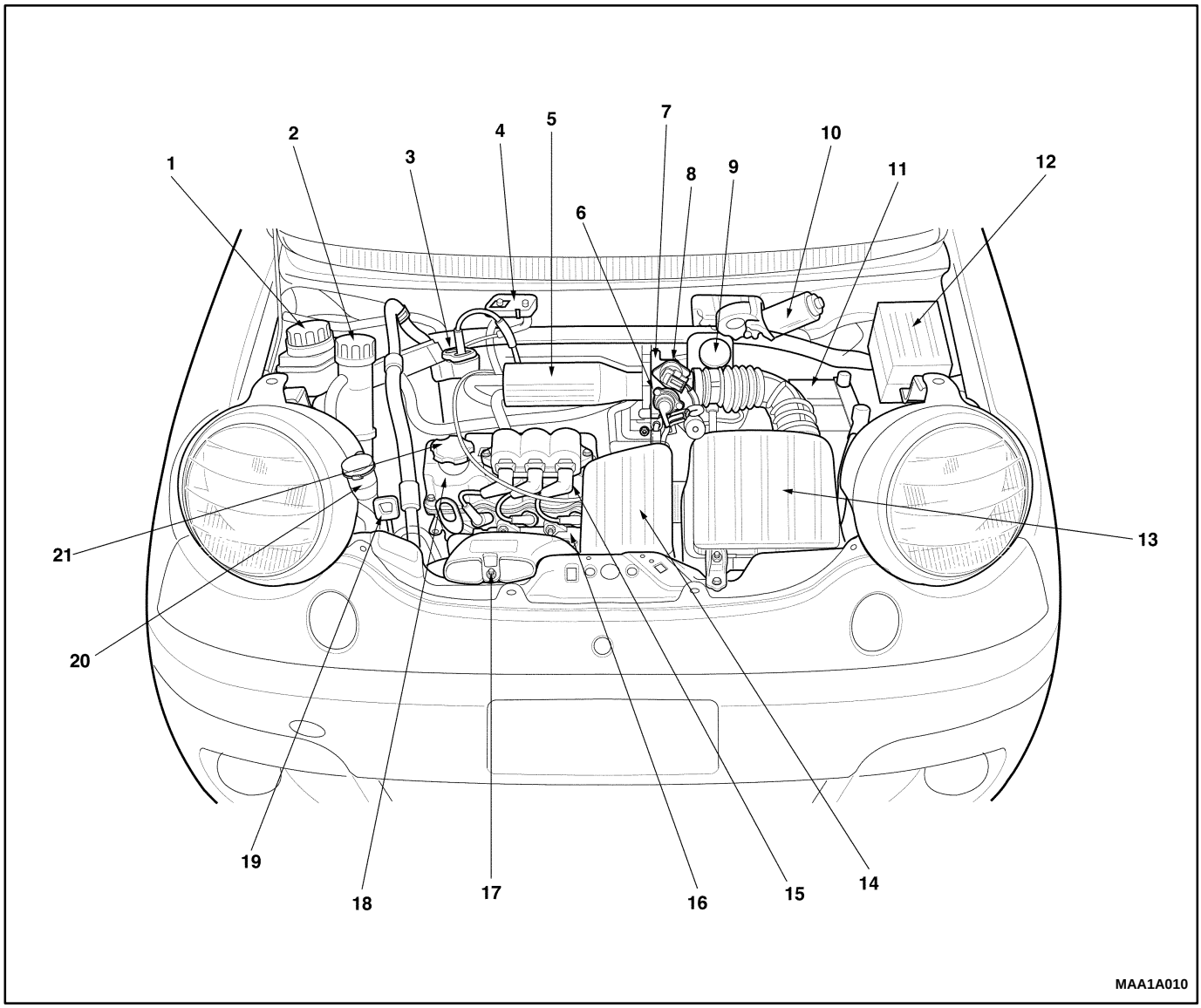
(Left–Hand Drive Shown, Right–Hand Drive Similar)



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.

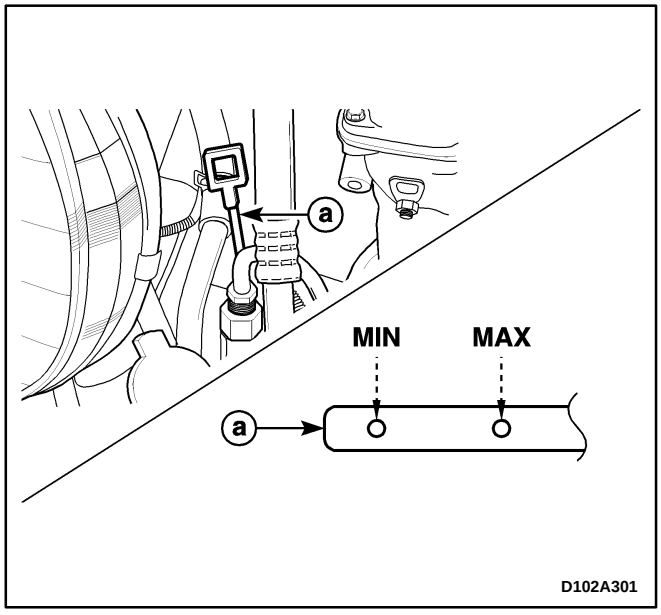
Check the engine oil level within engine normal operating temperature as follows ;

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.



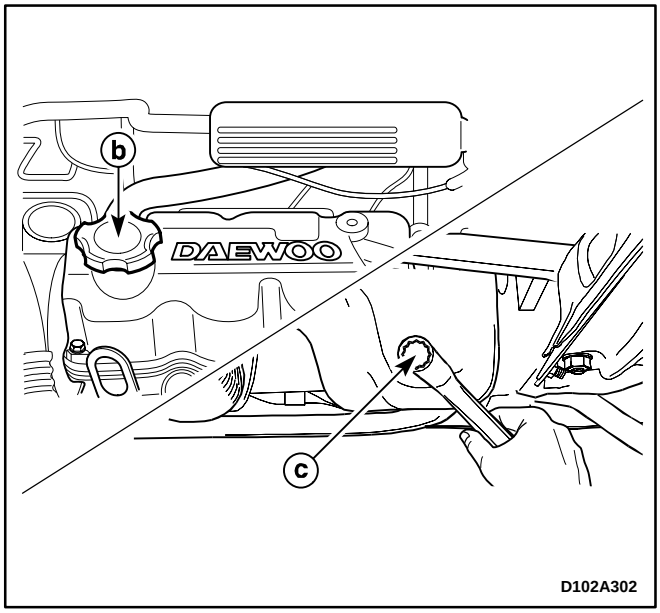
CHANGING ENGINE OIL OR OIL FILTER

Tools Required

09915–47341 Oil Filter Wrench.

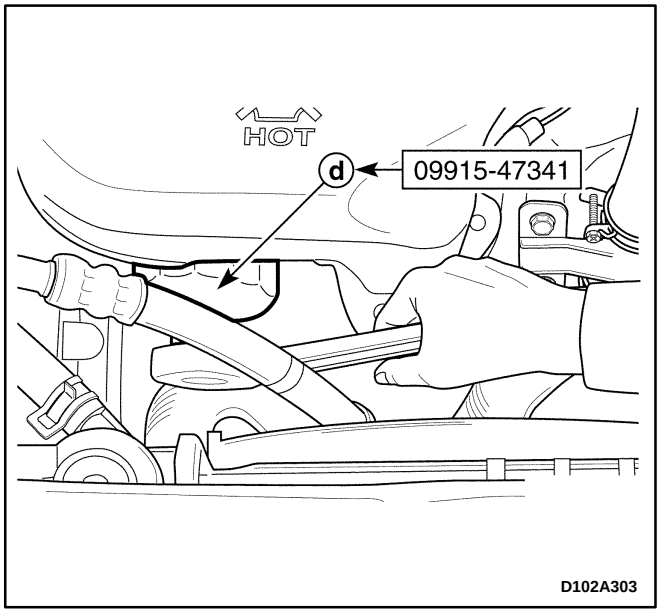
When checking engine oil level or condition, if needed, change engine oil (including the filter) as follows ;

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.



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.

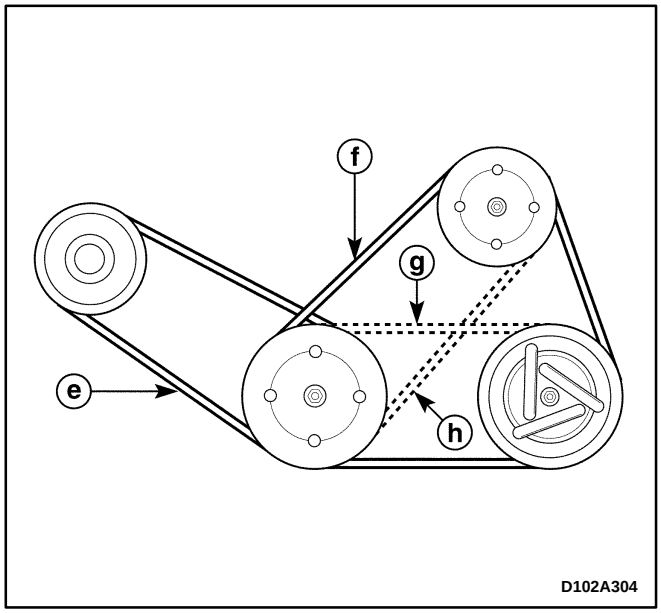


CHECKING ENGINE TIMING BELT

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.

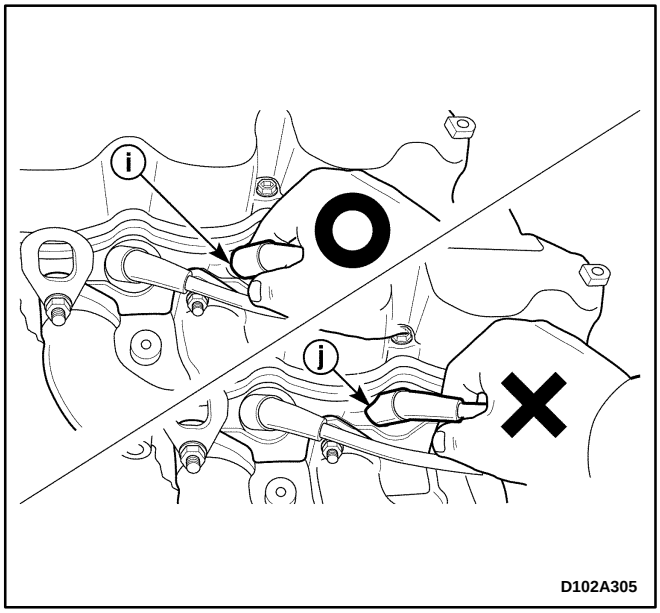


CHECKING SPARK PLUG

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

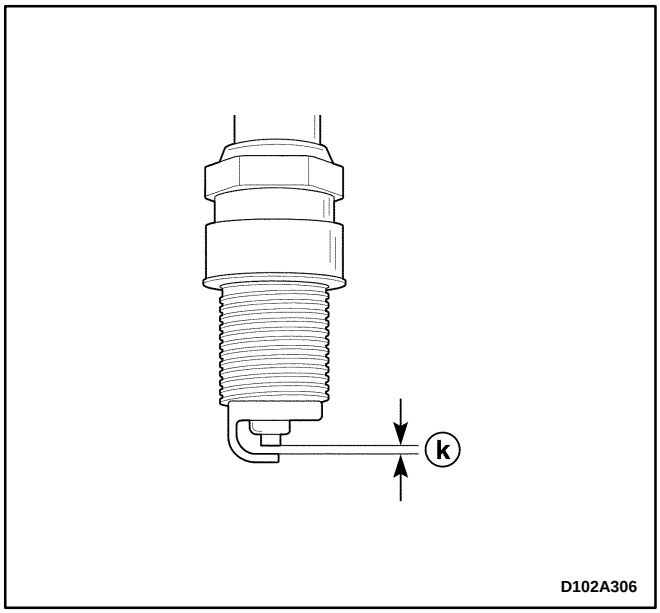
Remove and check the spark plug as follows ;

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.



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.



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

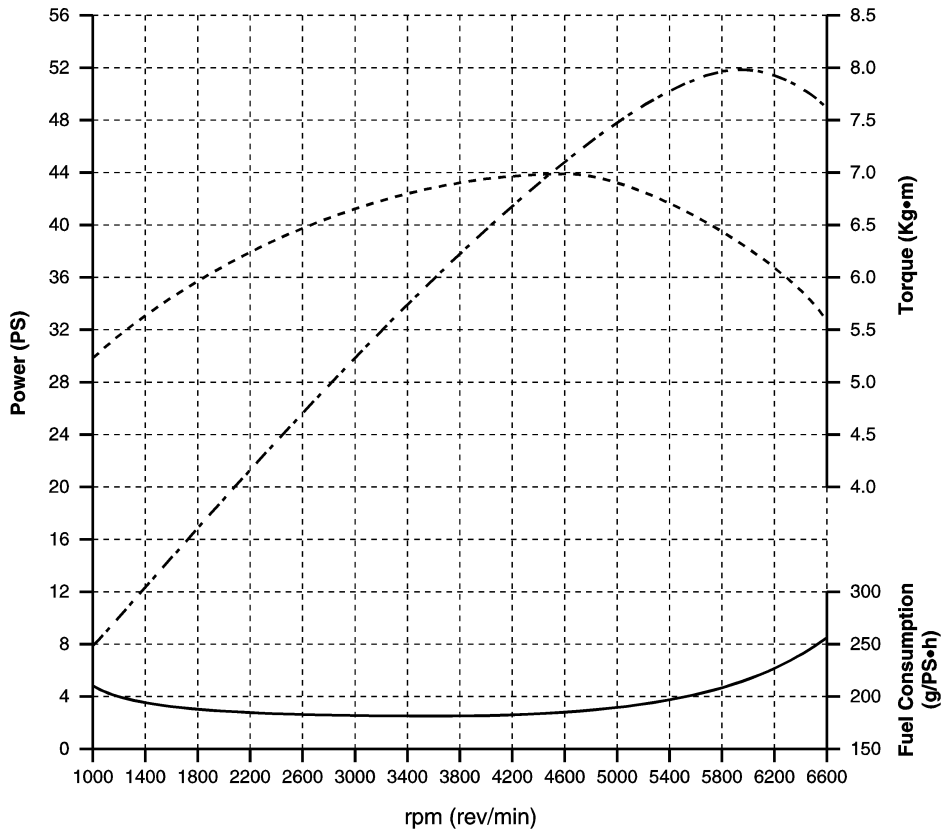
GENERAL SPECIFICATIONS

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.

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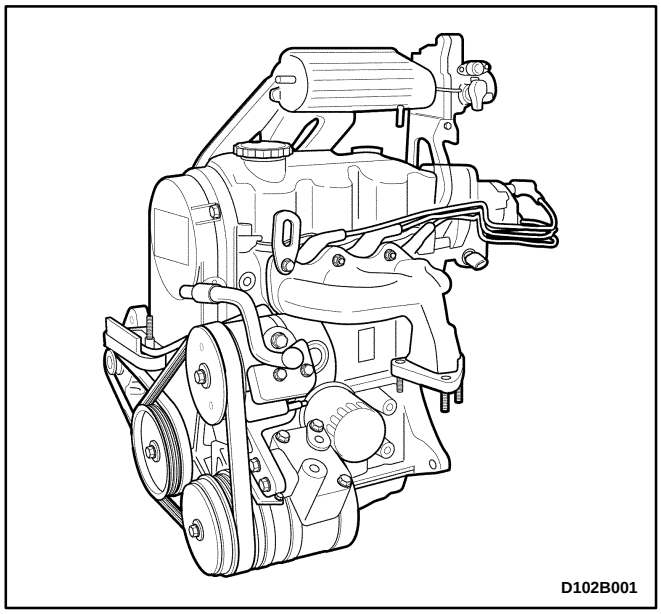
DESCRIPTION AND OPERATION

ENGINE TYPE

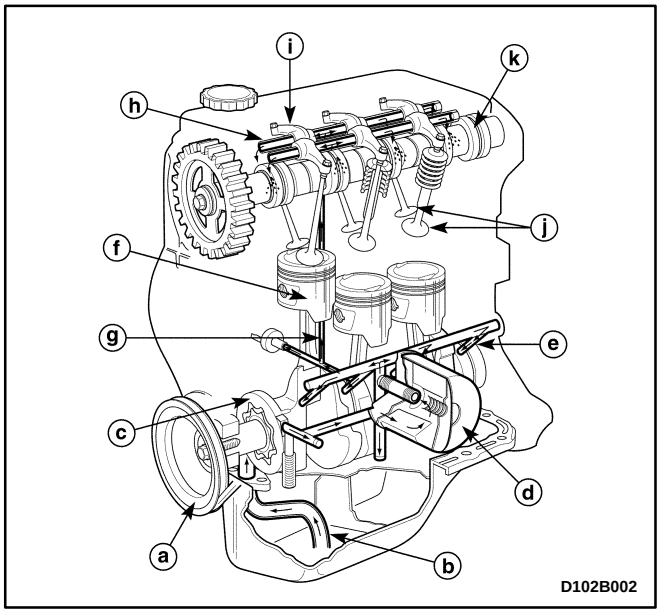
The engine is 4-cycle, water-cooled, in-line 3 cylinders with displacement of 796cc (68.5×72.0mm) (2.70× 2.83 in.).

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



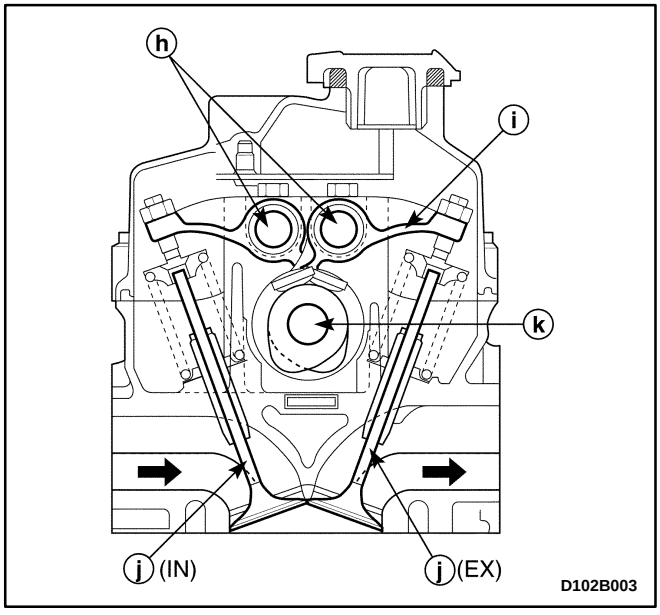
ENGINE LUBRICATION

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).



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.



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.

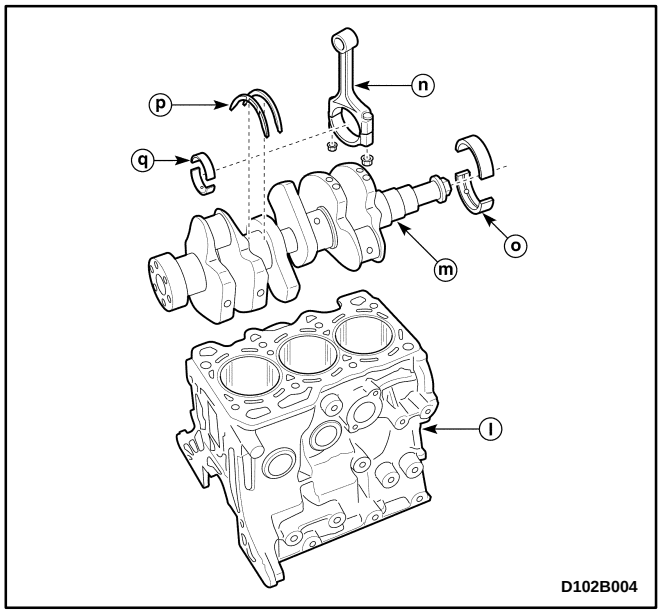
On the inside surface of block, there are bore surfaces by horning, which are cylinders, and on the periphery of the cylinders, there are the passages to prevent the over-heated and to lubricate the engine block.

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).



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

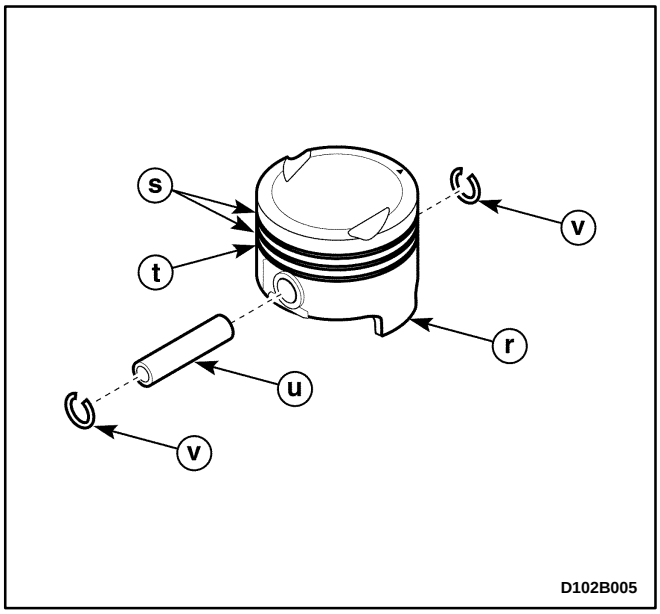
The piston (r) is of the open skirt type and its crown is exposed in the combustion chamber to generate power. Its land and skirt parts are made of coat aluminum alloy which is light and has excellent heat conductivity in order to meet its continuous and high speed reciprocation movement.

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.

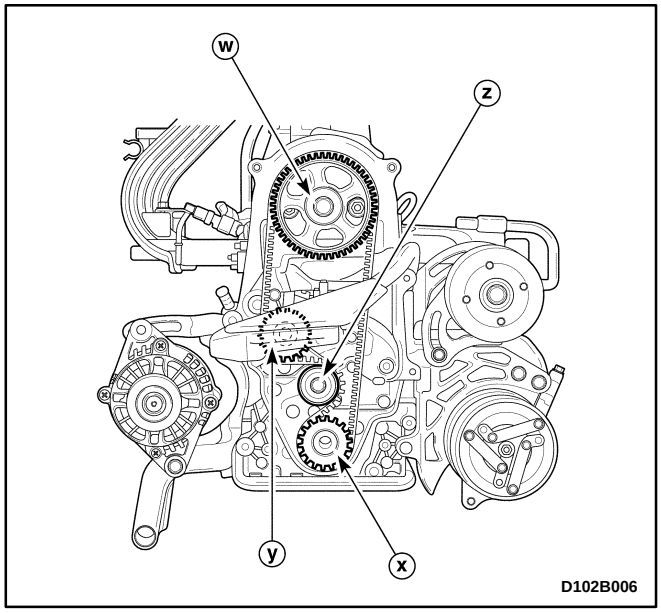
Piston Pin

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.



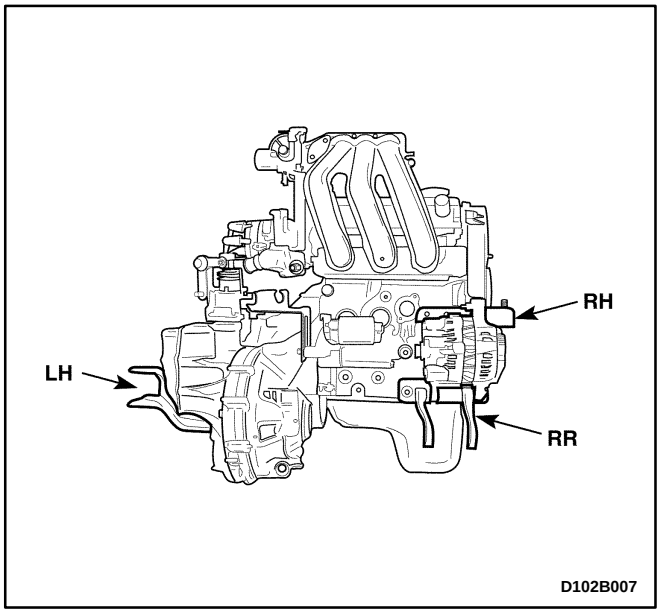
TIMING BELT AND PULLEY

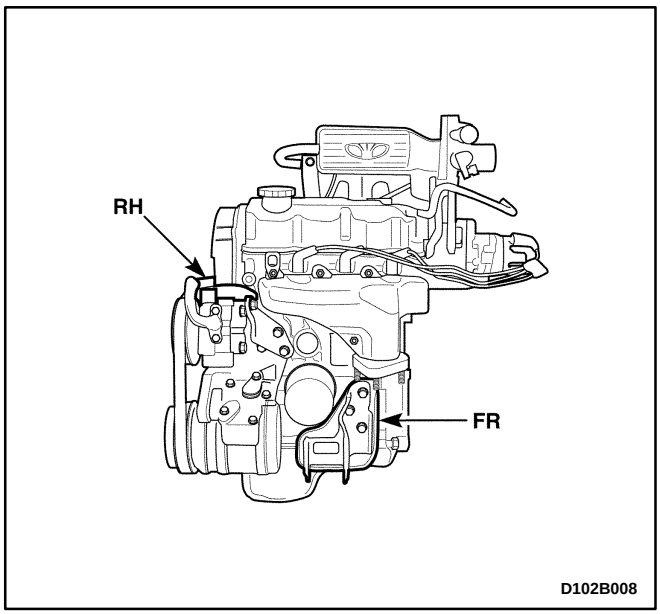
The timing belt connects the camshaft timing pulley (w) and the crankshaft timing pulley (x). The timing belt coordinates the crankshaft and the camshaft and keeps them synchronized. The timing belt also turns the coolant pump (y). The timing belt and the pulleys are toothed so that there is no slippage 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.



ENGINE MOUNT

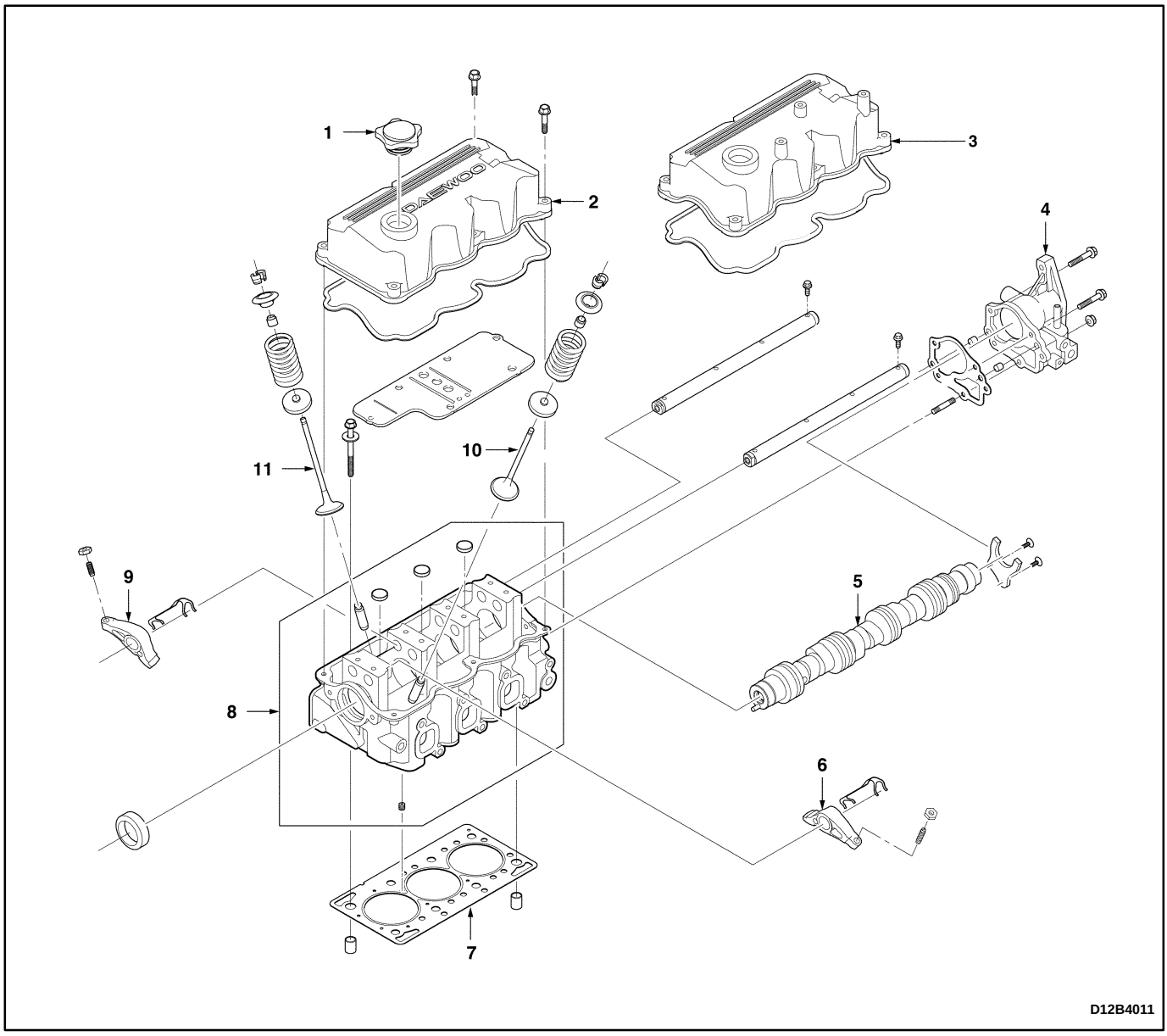
This is to absorb or reduce the engine vibration and impact from the wheeled road. Engine mount is attached to the engine–front side, the engine-right side and the engine-rear side and one transaxle mount is attached to the transaxle side.





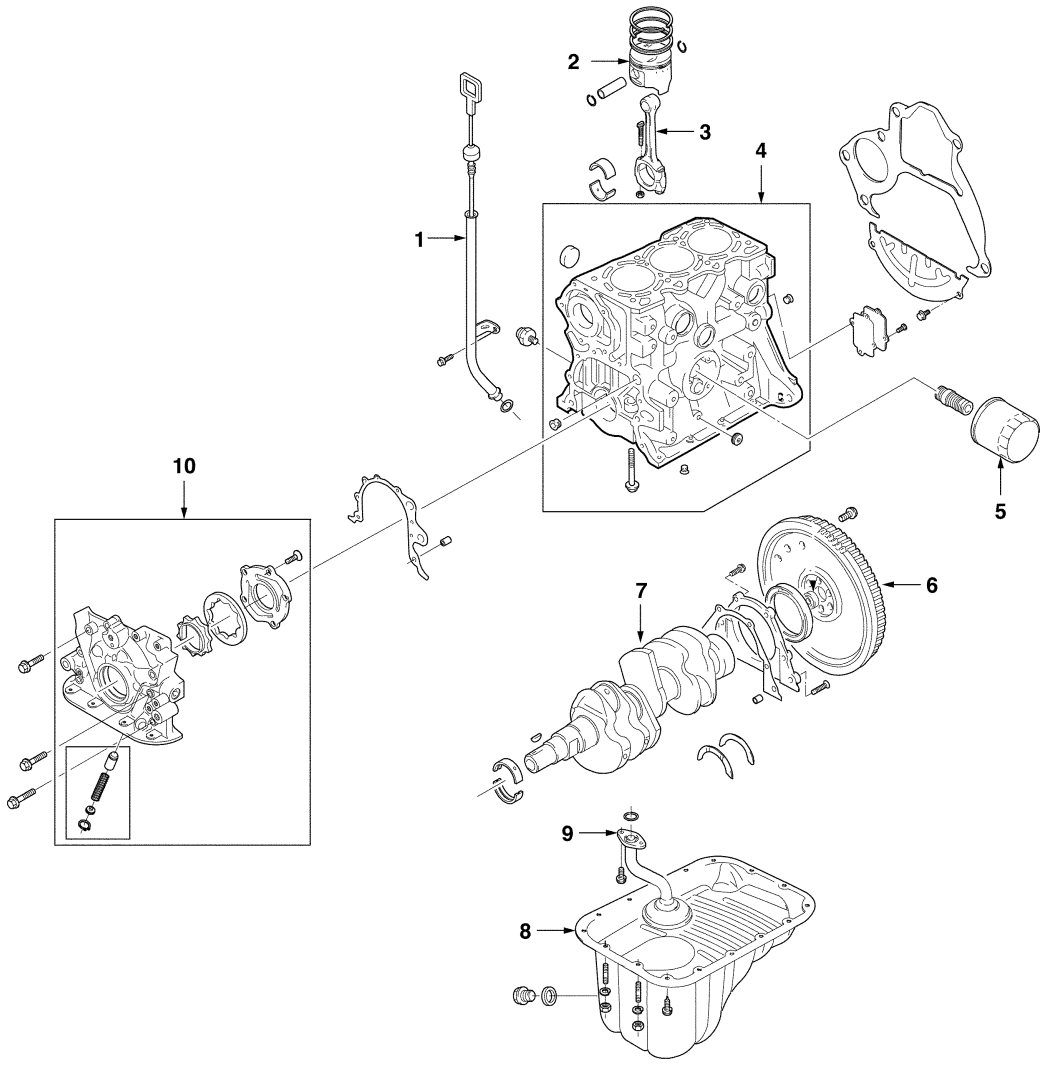
COMPONENT LOCATOR

CYLINDER HEAD



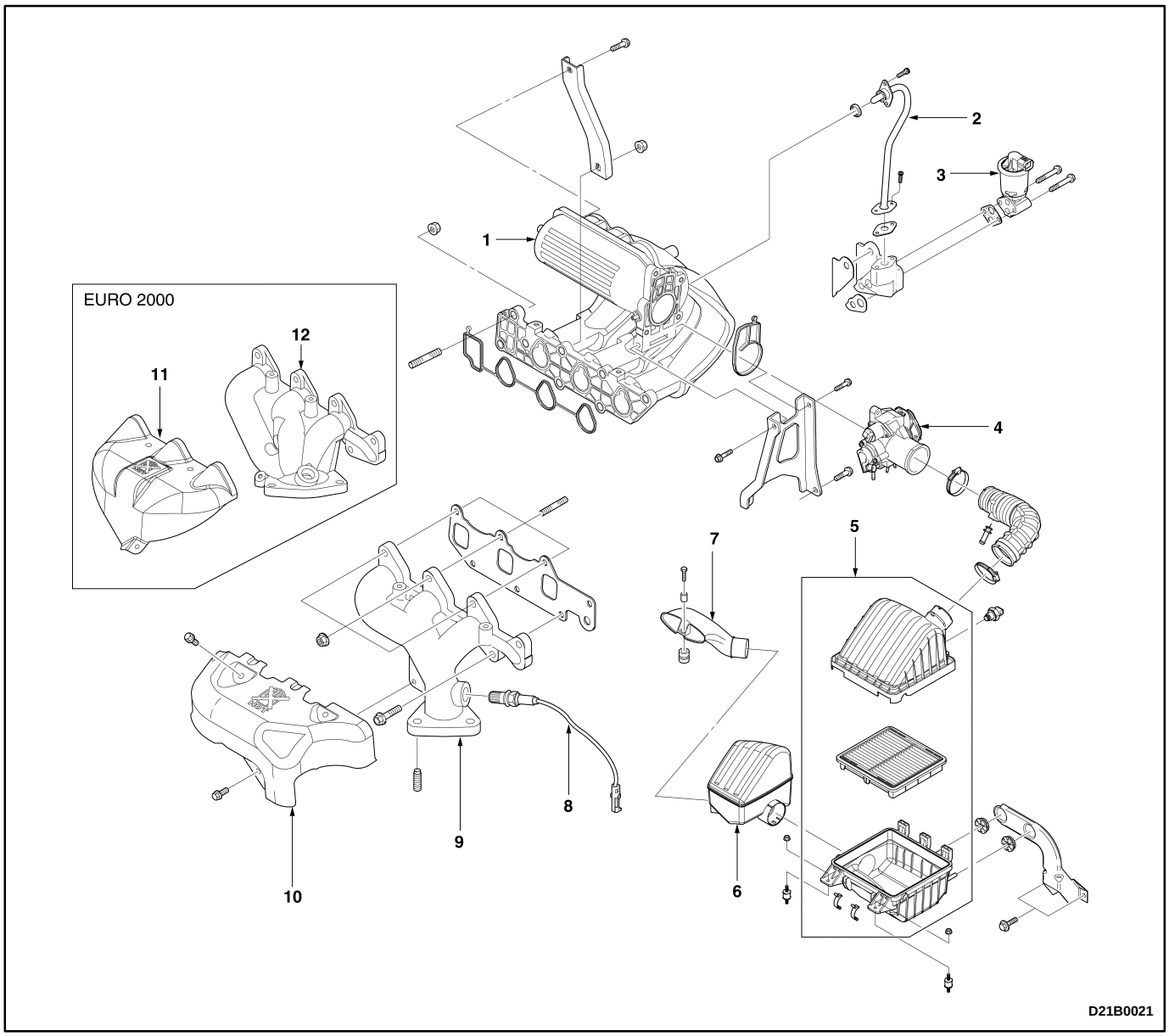
1 Oil Filler Cap
2 Cylinder Head Cover
3 Cylinder Head Cover (Euro III)
4 Distributor Case
5 Camshaft
6 Exhaust Rocker Arm
7 Cylinder Head Gasket
8 Cylinder Head
9 Intake Rocker Arm
10 Exhaust Valve
11 Intake Valve

ENGINE BLOCK



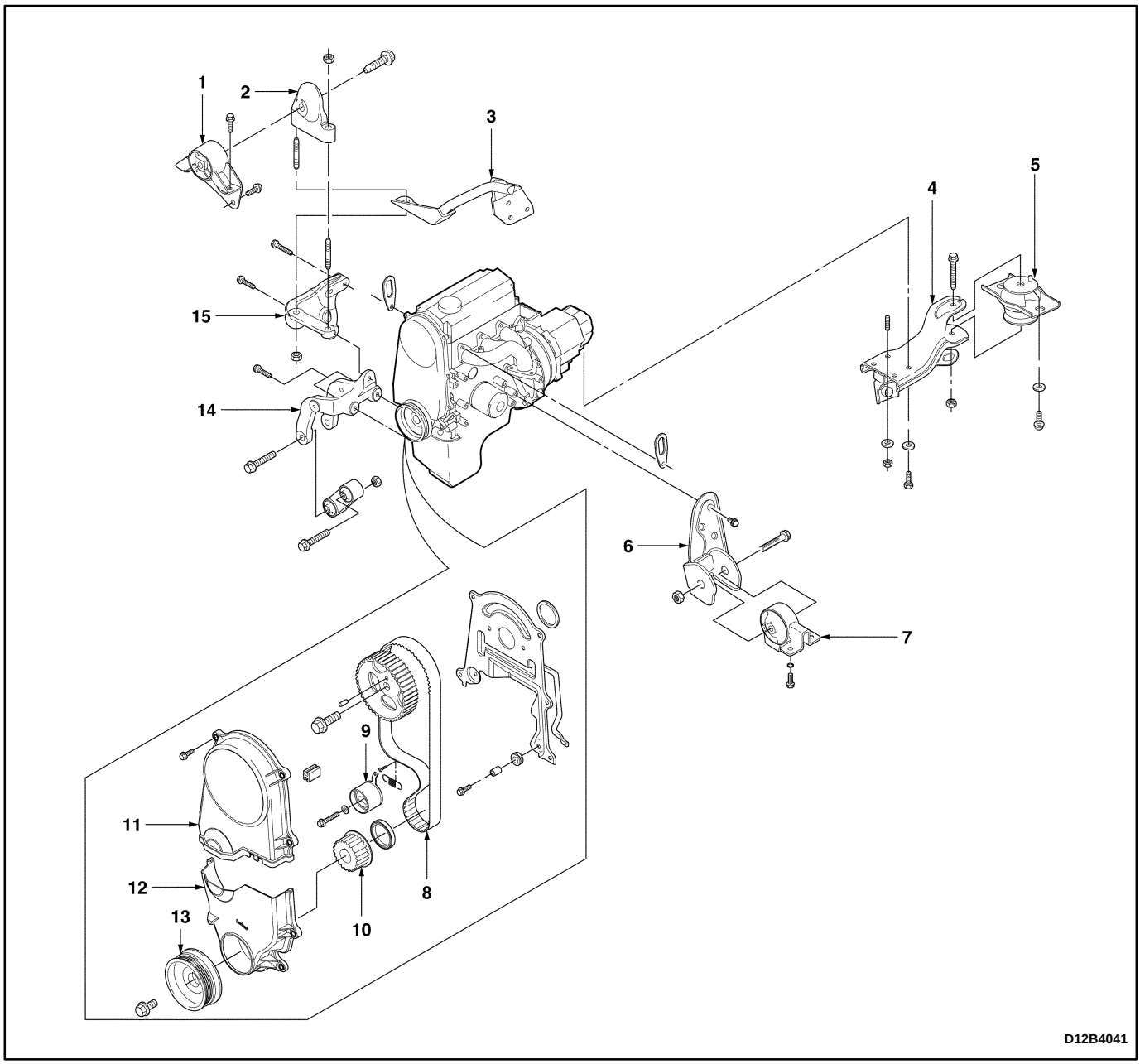
1 Oil Level Gauge Stick
2 Piston
3 Connecting Rod
4 Engine Block
5 Oil Filter
6 Flywheel
7 Crankshaft
8 Oil Pan
9 Oil Pump Strainer
10 Oil Pump Assembly

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

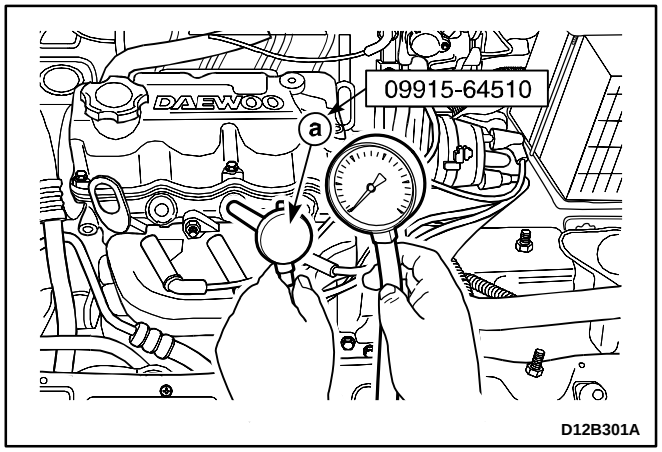
COMPRESSION PRESSURE CHECK

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.



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

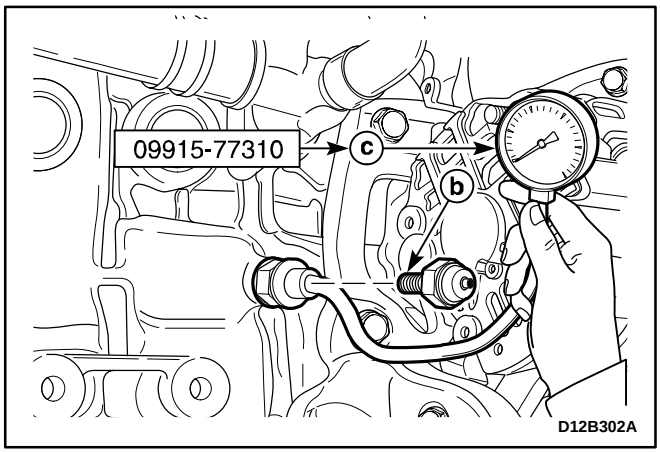
09915–77310 Oil Pressure Gauge

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.



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.

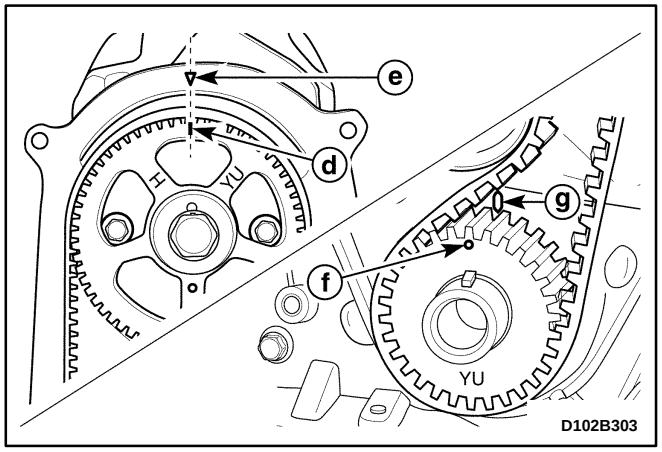
Item	Unit	Standard
Oil Pressure – 2000rpm	kPa (psi)	245.15–294.18 (35.55–42.66)

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.)

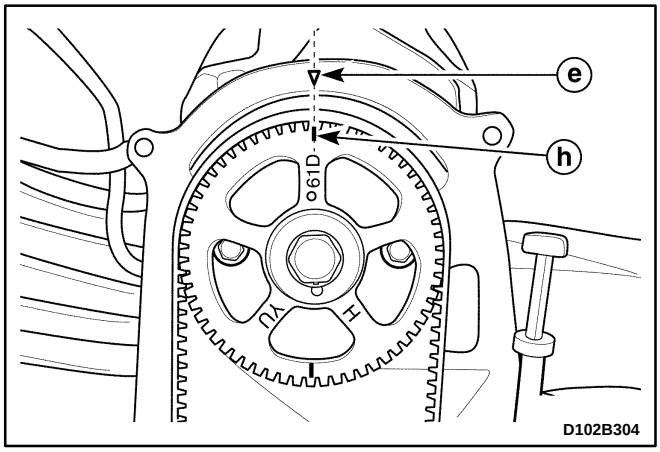


4. Check the valve clearance for No. 1 cylinder compression top dead center.

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.)

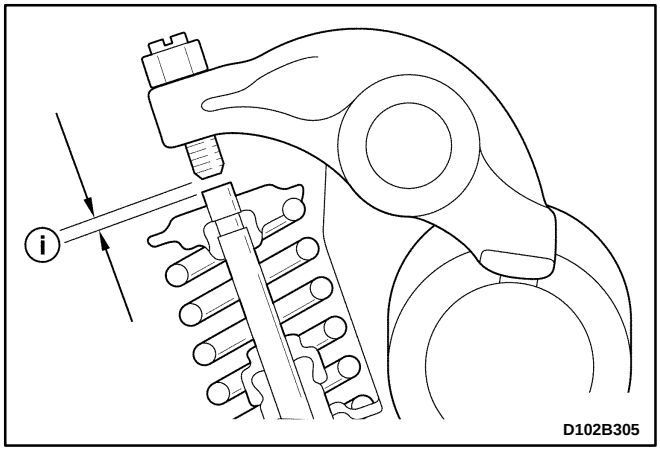


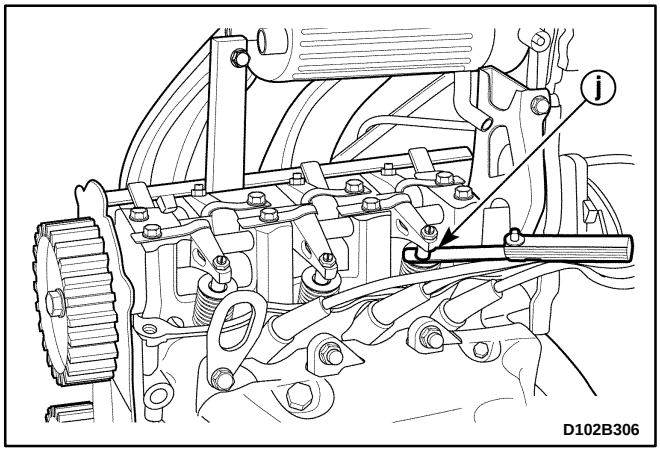
6. Check the valve clearance for the No. 1 cylinder exhaust top dead center.

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).





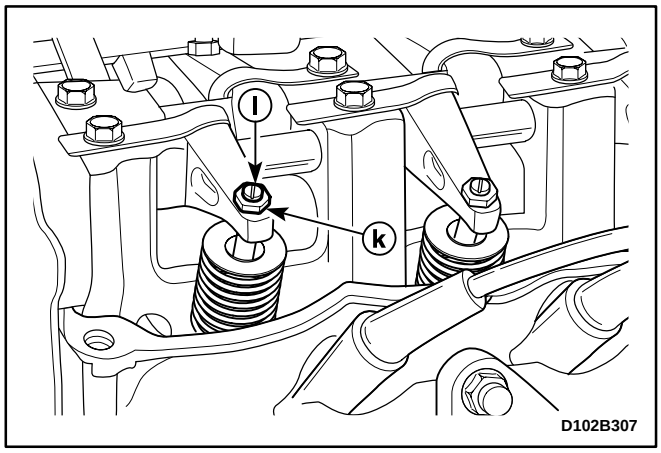
The measured value of valve clearance should meet the specified value. If not, adjust the valve clearance.

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.

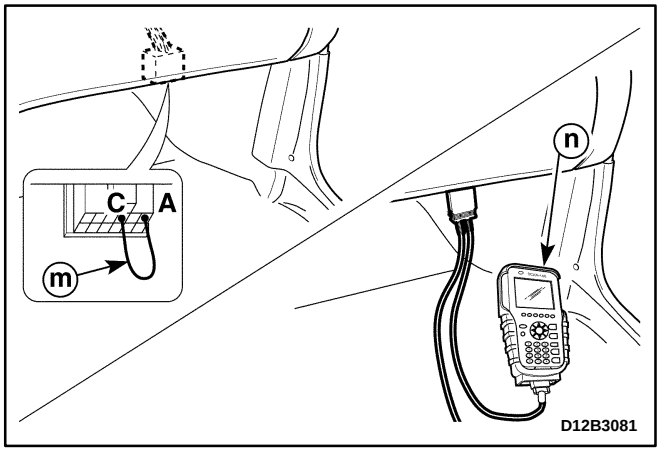


IGNITION TIMING CHECK AND ADJUSTMENT (TYPICAL)

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

Check and adjust the ignition timing in the following procedures:

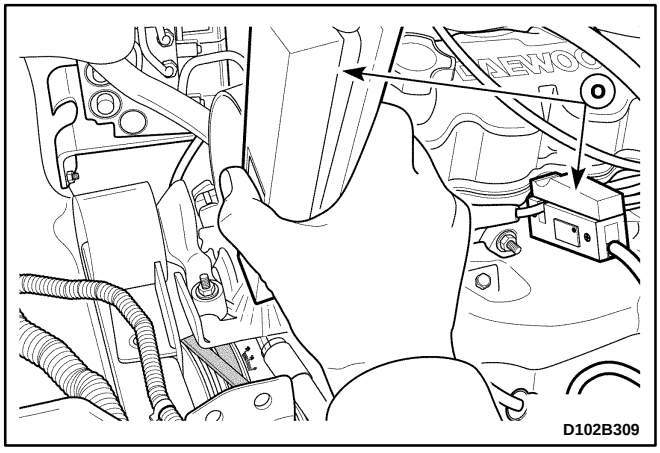
1. Warm up the engine to the normal operating temperature.
2. Turn off the lamp and audio system and shift the shift gear lever in Neutral.

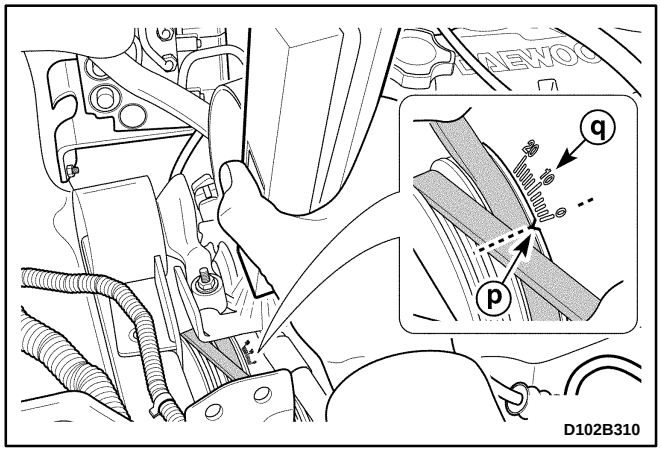


3. Connect terminal A and terminal C of ALDL connector using the wire (m) or connect the scan tool (n) with ALDL connector.
4. Connect the timing light (o) with No. 1 cylinder high tension cable and check the specified value for the ignition timing, flashing notch on the crankshaft pulley.

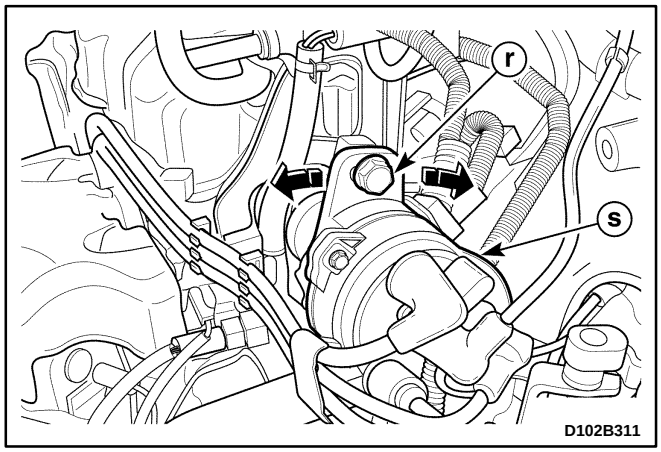
Item	Specified Value
Ignition timing – 950rpm	10° BTDC

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.





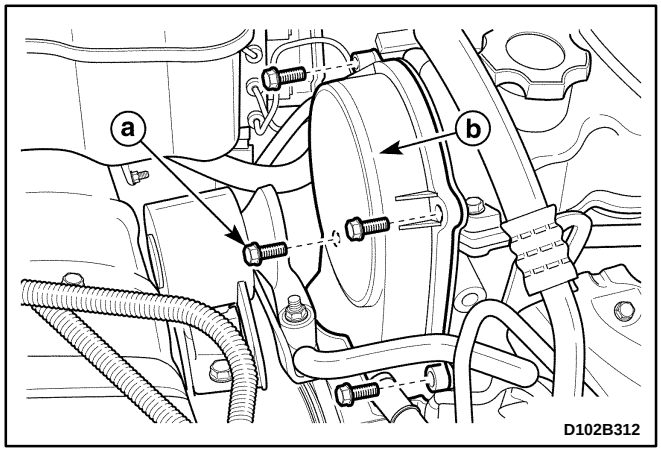
5. If the ignition timing exceeds the specified value, loosen the distributor bolts and adjust it to the specified ignition timing by turning the distributor body (s).



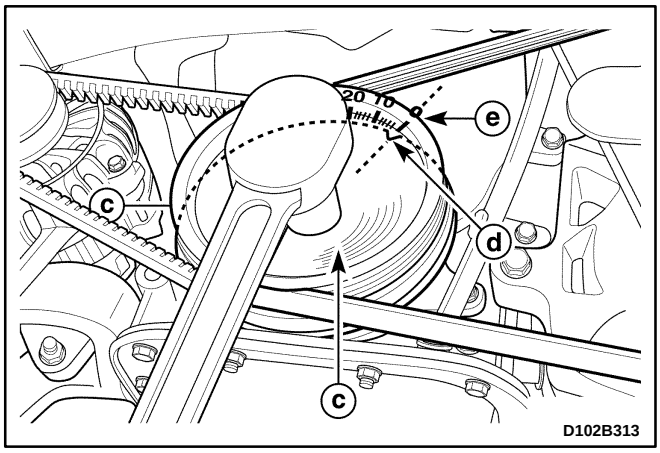
VALVE TIMING CHECK AND ADJUSTMENT

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).

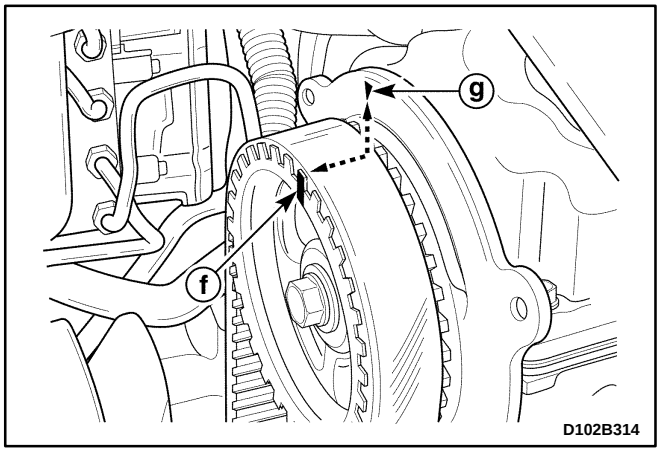


2. Turning the crankshaft clockwise twice, align the notch (d) on the crankshaft pulley (c) with the mark 0 (e) for the timing check on the timing belt front lower cover.



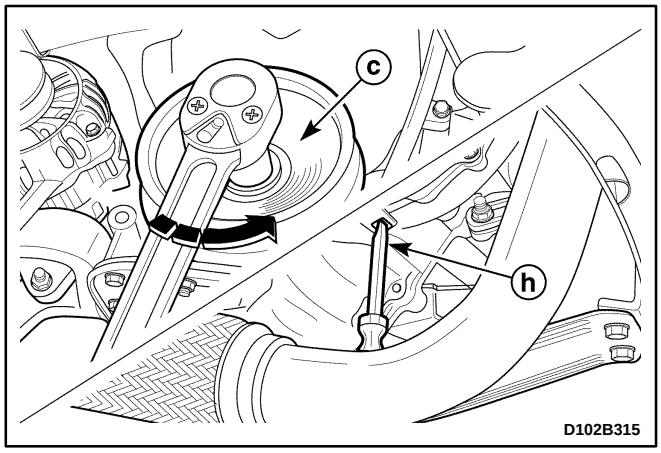
3. Check if the notch (f) on the camshaft sprocket is aligned with the triangle pointer (g) on the timing belt rear cover.

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

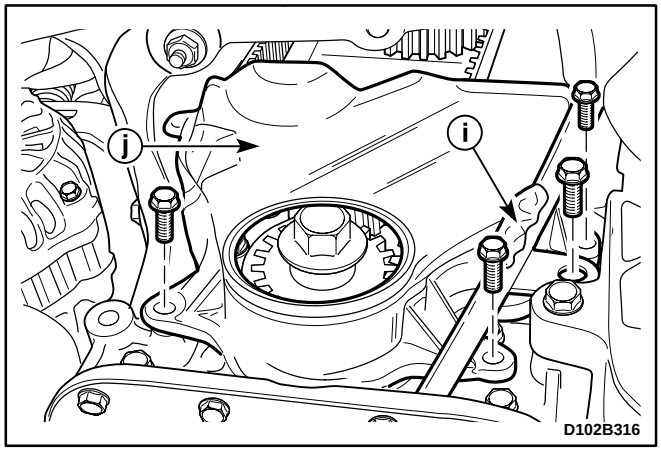


Adjust the valve timing in the following procedures:

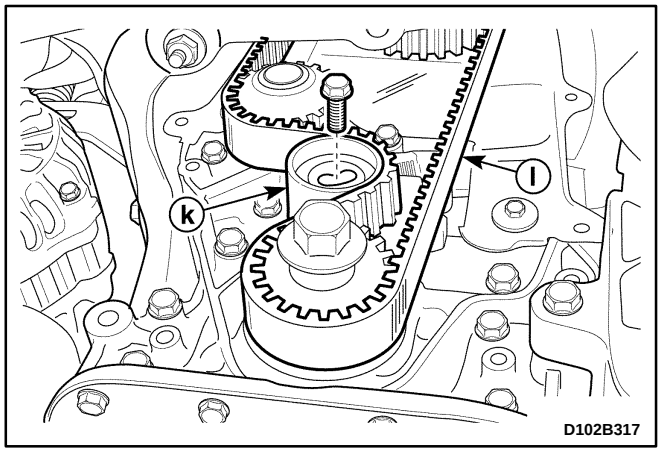
1. Loosen the bolt and remove the timing belt pulley (c). In loosening the bolt, use the driver (h) in the picture shown.



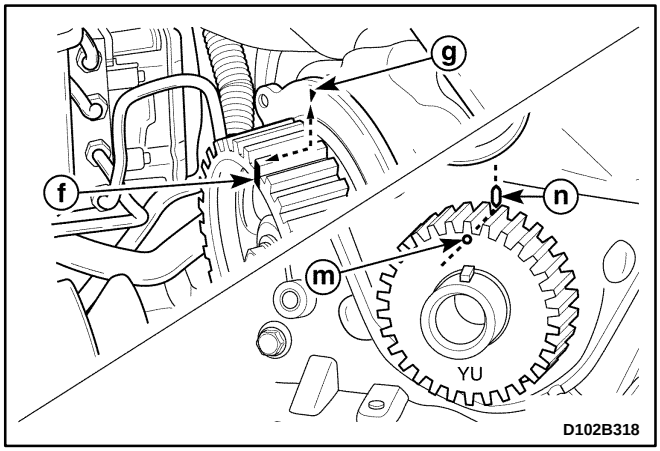
2. Remove the oil level gauge guide tube (i) and the timing belt front lower cover (j).



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

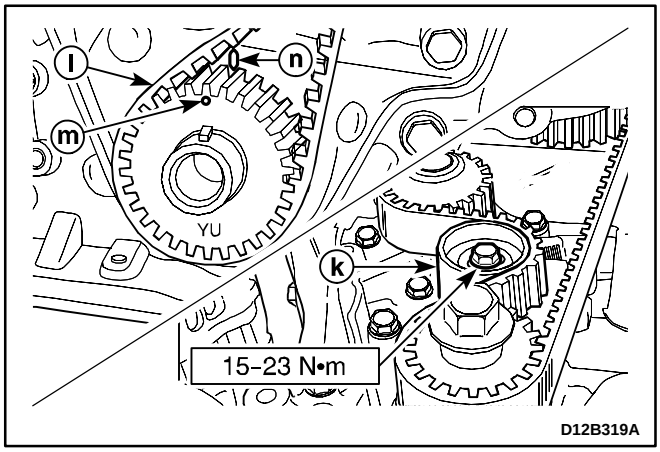


4. Using the bolt, turn the crankshaft clockwise to align the mark (m) on the crankshaft sprocket with the pointer (n) on the oil pump housing. Then, turn the camshaft to align the notch (f) with the pointer (g).



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).



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.

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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.

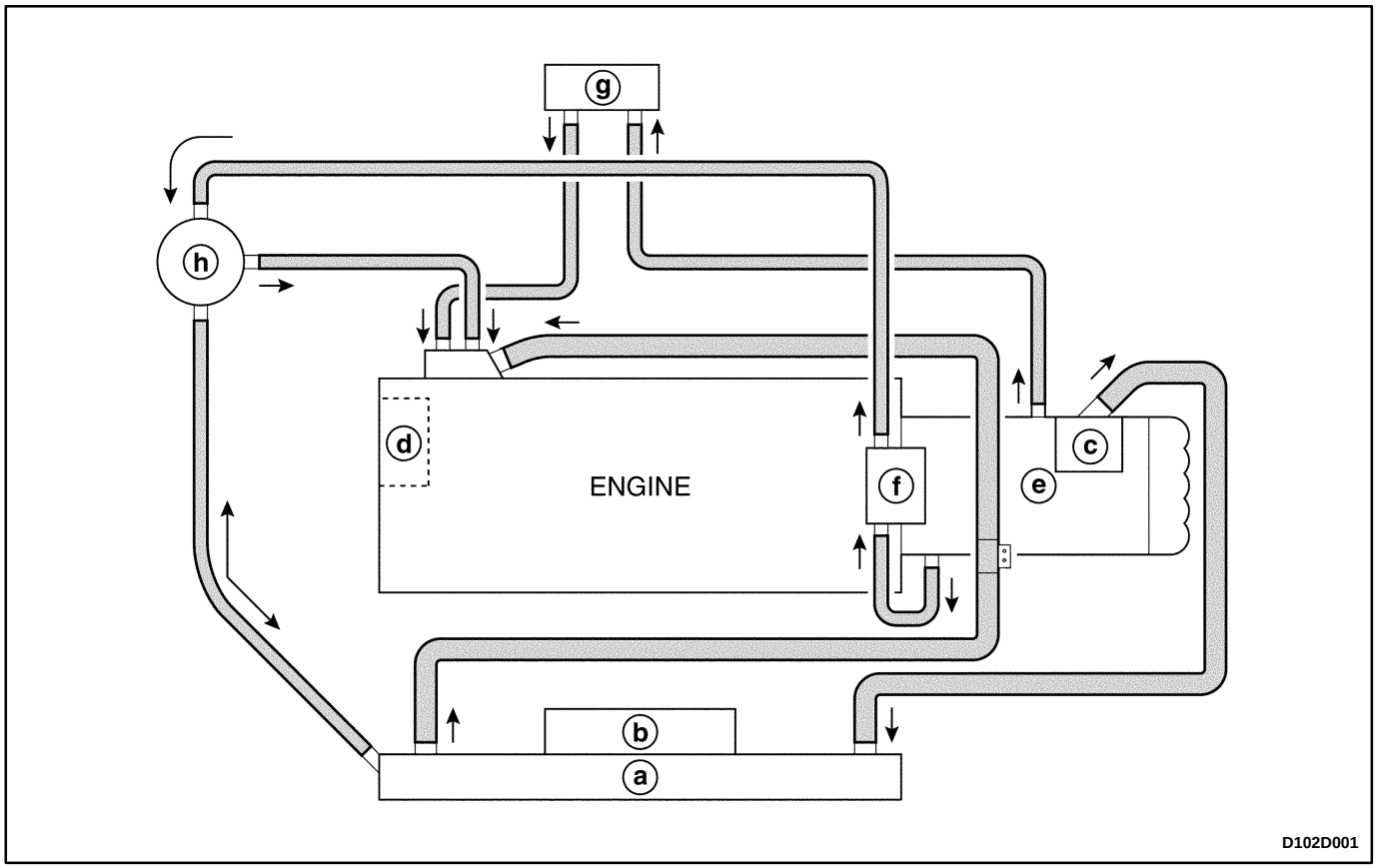
SURGE TANK

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.

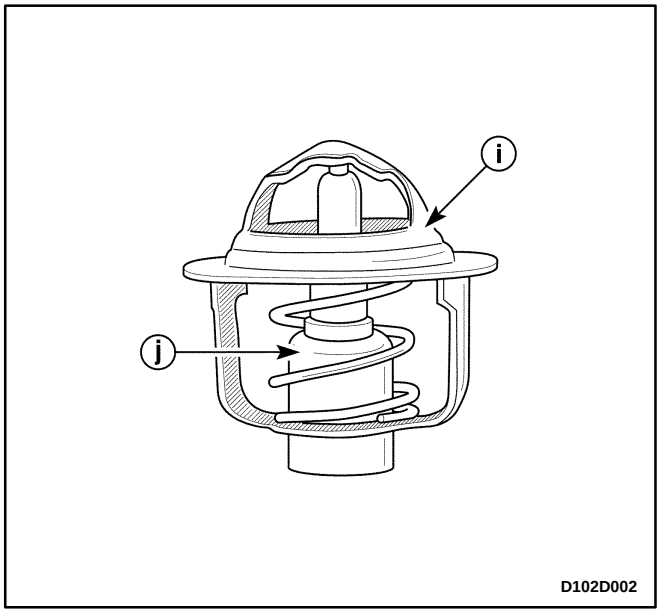
As the engine warms, the thermostat opens. This allows the engine coolant to flow through the radiator, where the heat is dissipated through the radiator. This opening and closing of the thermostat permits enough engine coolant to enter the radiator to keep the engine within proper engine temperature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



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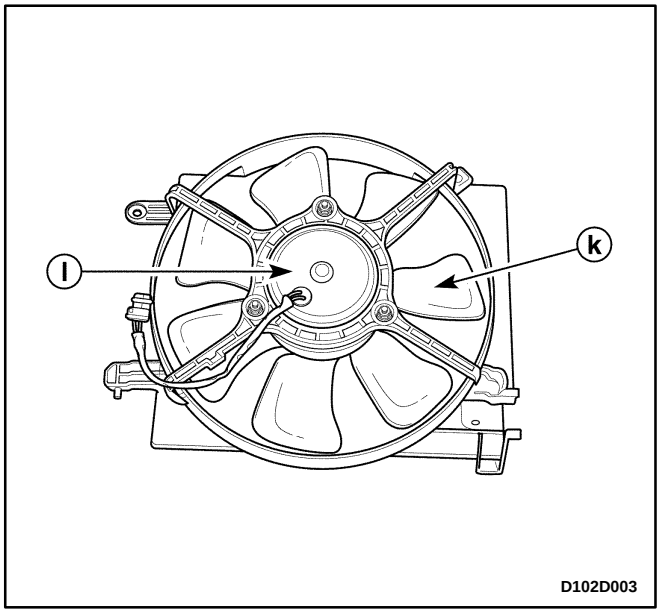
ELECTRIC COOLING FAN

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.



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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

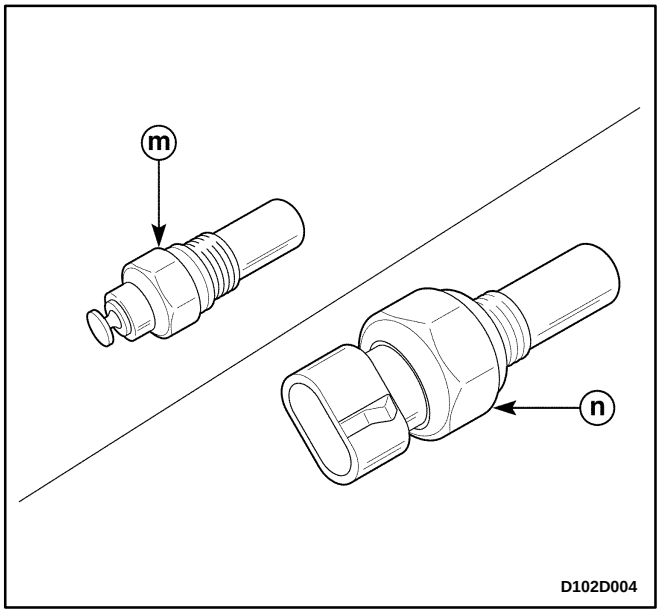
- The cooling fan is actuated by the electronic control module (ECM) using a low speed cooling fan relay and a high speed cooling fan relay. On A/C equipped vehicles, a series/parallel cooling fan relay is also used.
- The ECM will turn the cooling fan on at low speed when the coolant temperature reaches 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).

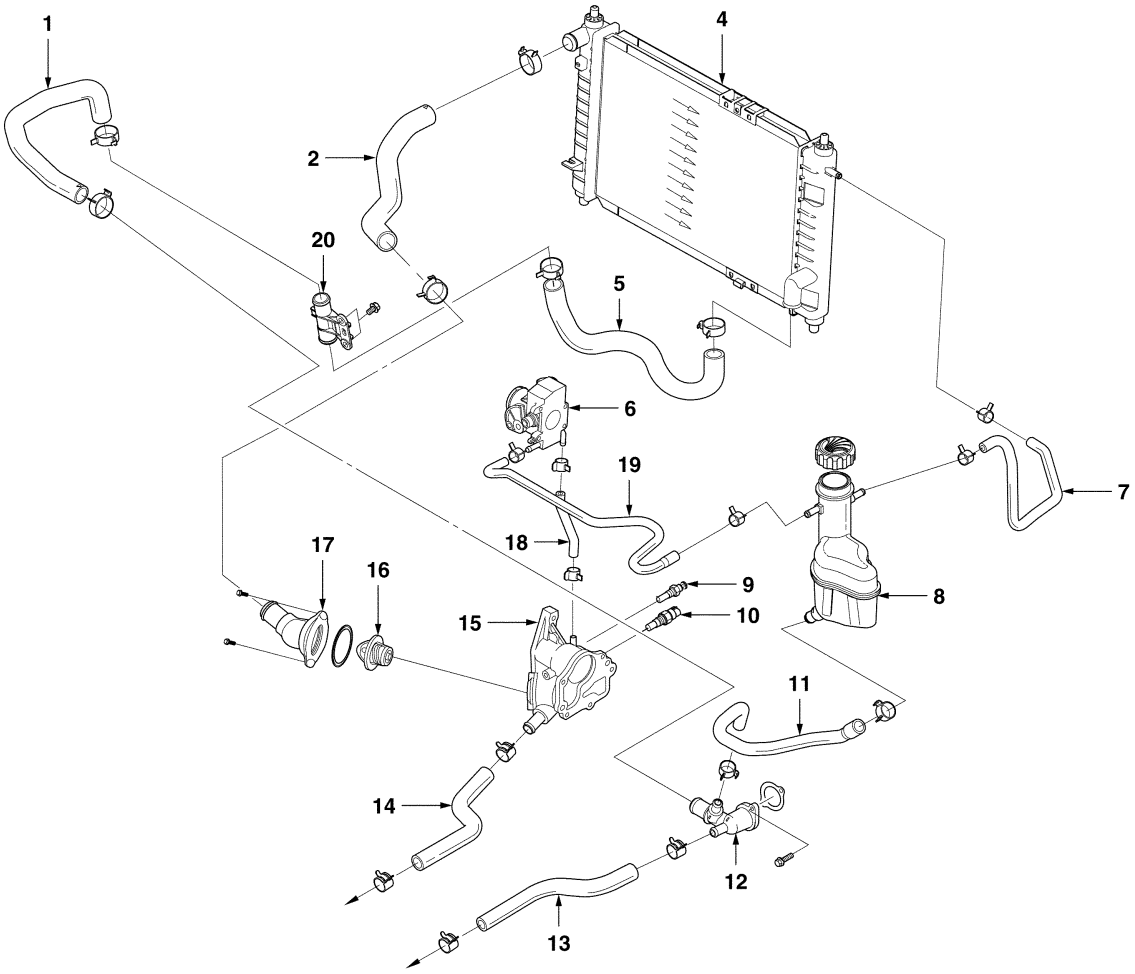


COOLANT TEMPERATURE SENSOR

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.

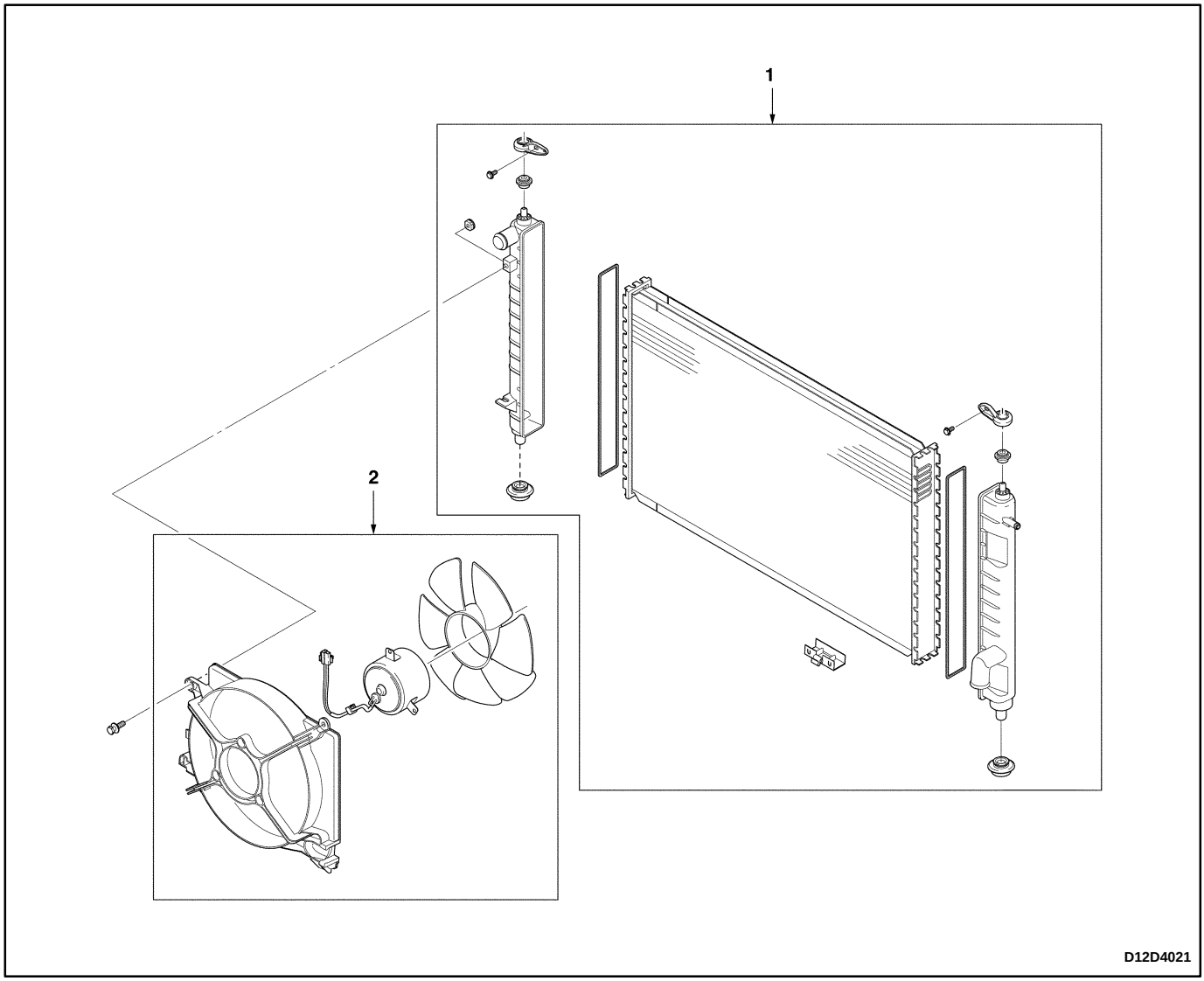
COMPONENT LOCATOR

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



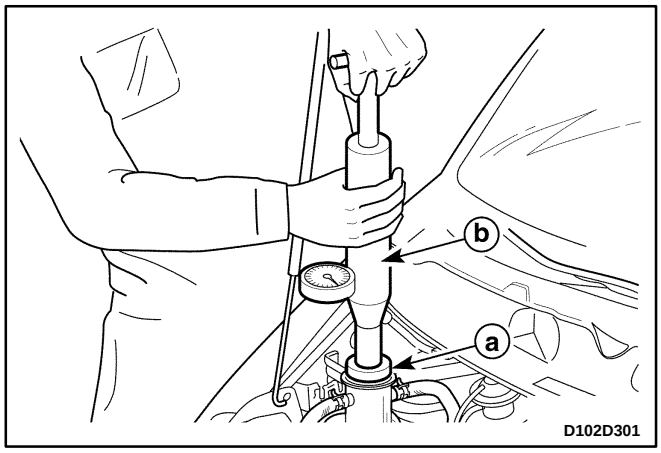
1 Radiator Assembly

2 Electric Cooling Fan Assembly

DIAGNOSTIC INFORMATION AND PROCEDURE

COOLANT LEAKS TEST

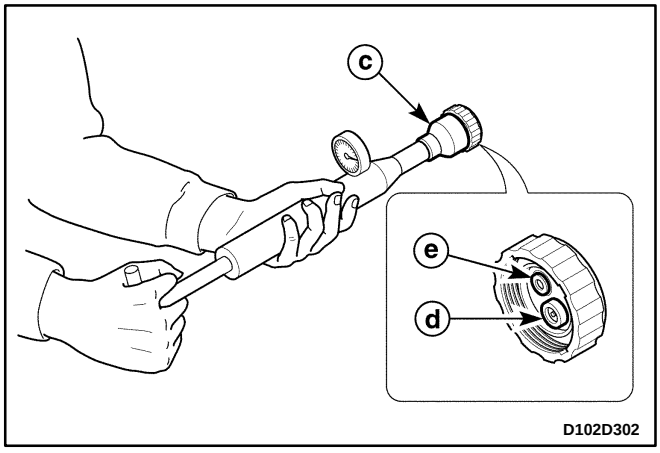
1. Remove the surge tank cap after the engine cools.
2. Check the coolant level.
3. Install a suitable cooling system pressure tester(b) to the surge tank filler neck using the adapter(a) and pressurize (110–120 kPa (16.0–17.4 psi)).
4. Check the coolant leaks on the hoses and connections during 2 minutes.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



SURGE TANK CAP TEST

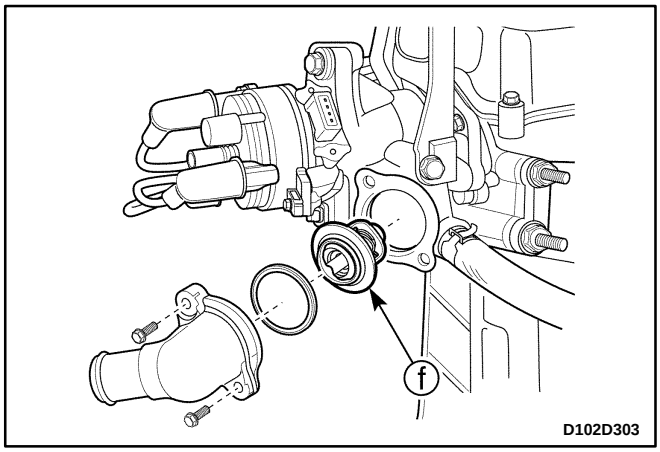
The surge tank cap(c) is equipped with the pressure valve(d) and the vacuum valve(e). Therefore, the surge tank cap maintains proper pressure. And The surge tank cap protects the system from high-pressure by opening a pressure valve, and protects the coolant hoses from collapsing because of a vacuum.

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.).

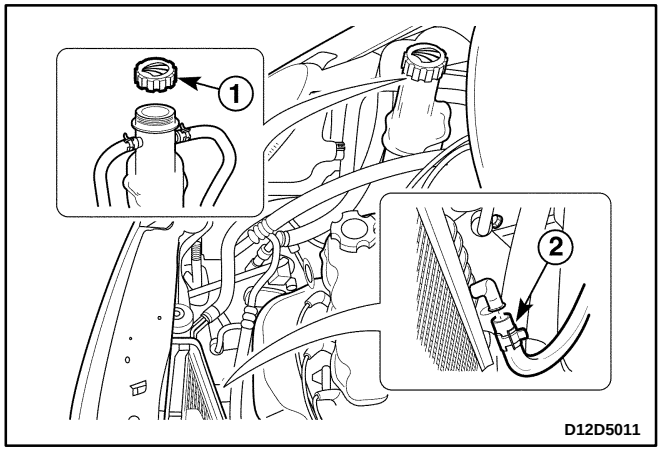


COOLING SYSTEM DIAGNOSIS

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

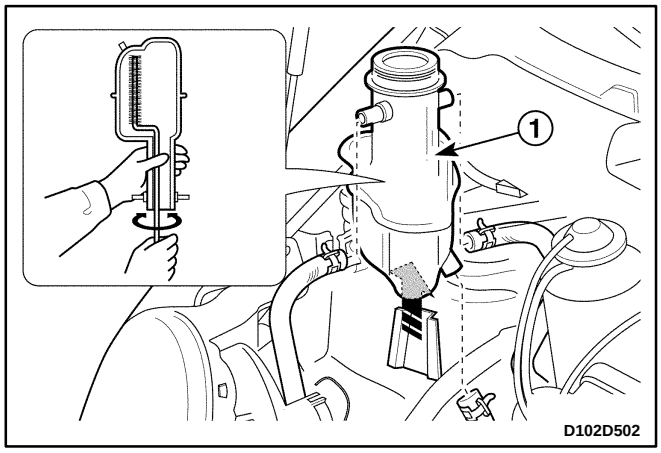


DRAINING AND REFILLING THE COOLING SYSTEM

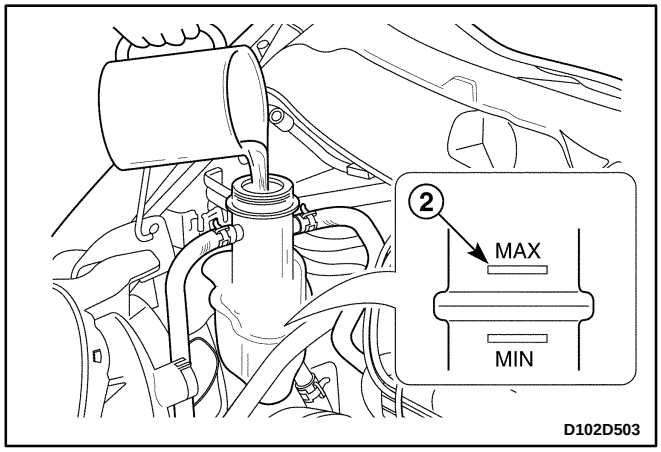
Caution: Do not remove the surge tank cap while the engine and the radiator are hot. Scalding fluid and steam may be blown out under pressure.

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).

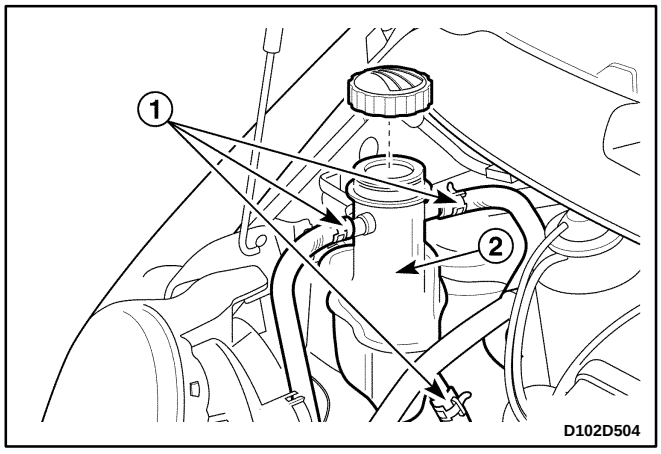


- Add the clean water to the surge tank (2).

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.

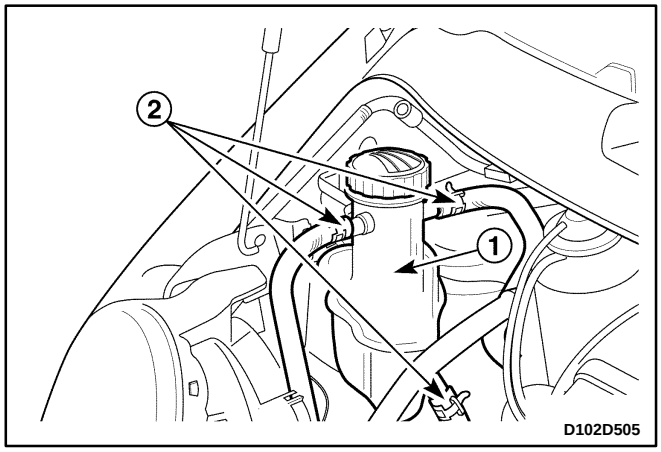


SURGE TANK

Removal Procedure

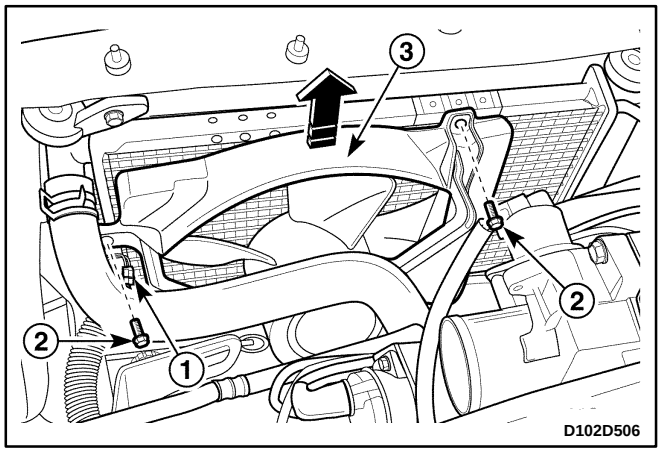
Caution: To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot, because the heat causes the system to remain under pressure scalding fluid and steam may be blown out under pressure.

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

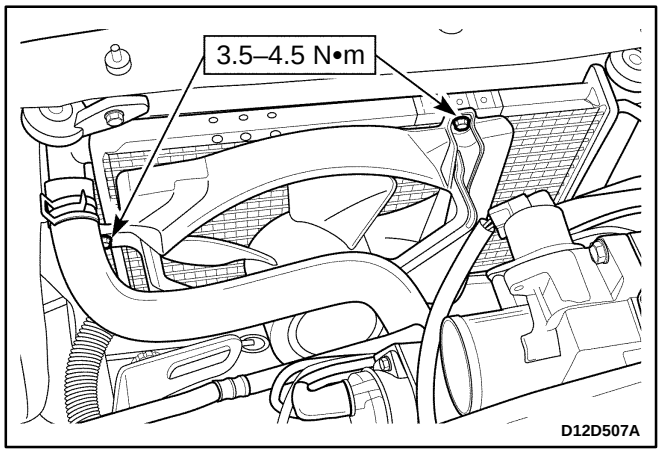
1. Install the surge tank to the vehicle.
   - Install the surge tank with pressing down (1).
   - Connect the overflow hoses to the surge tank (2).
2. Secure the overflow hoses to the surge tank with the hose clamps.
3. Fill the surge tank with coolant to the MAX mark.



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).

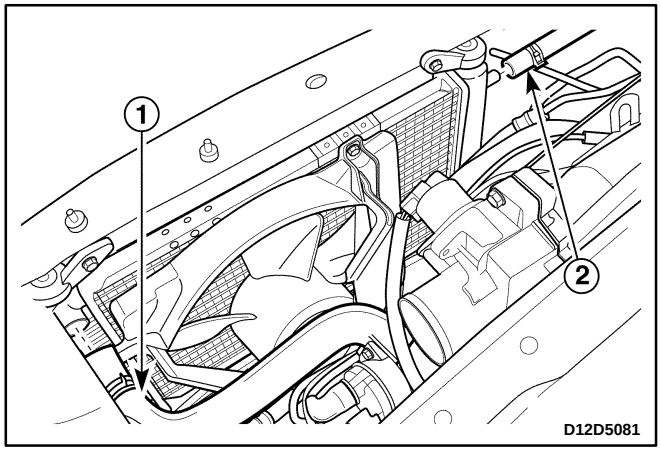


Installation Procedure

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

   Tighten

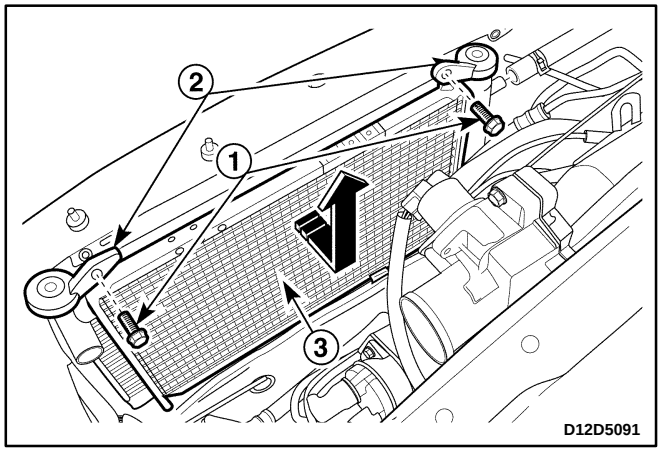
   Tighten the bolts to 3.5–4.5 N•m (31–40 lb-in).
2. Connect the cooling fan electrical connector.
3. Connect the negative battery cable.



RADIATOR

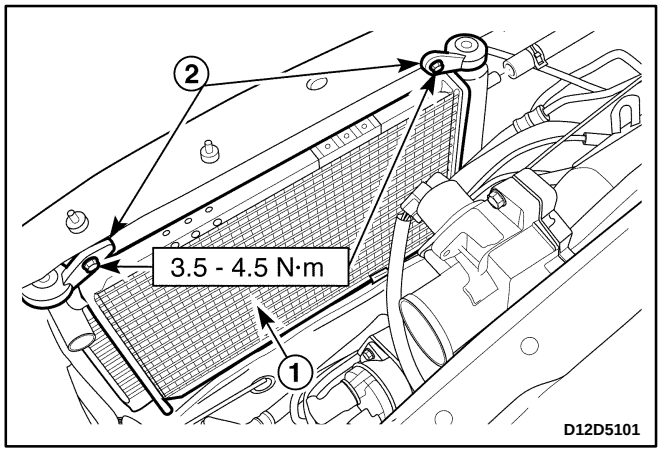
Removal Procedure

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).



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.

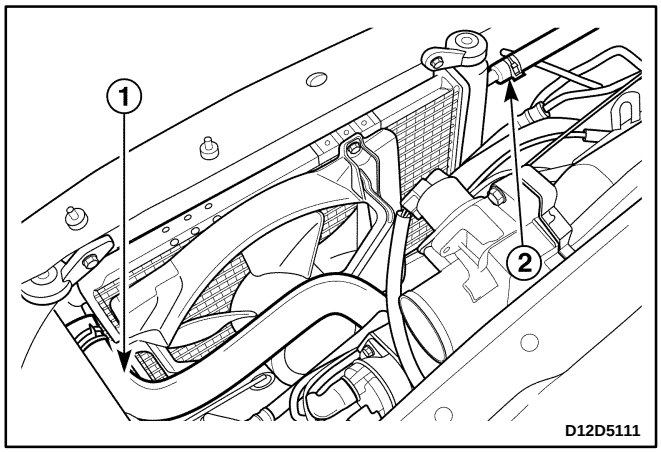


Installation Procedure

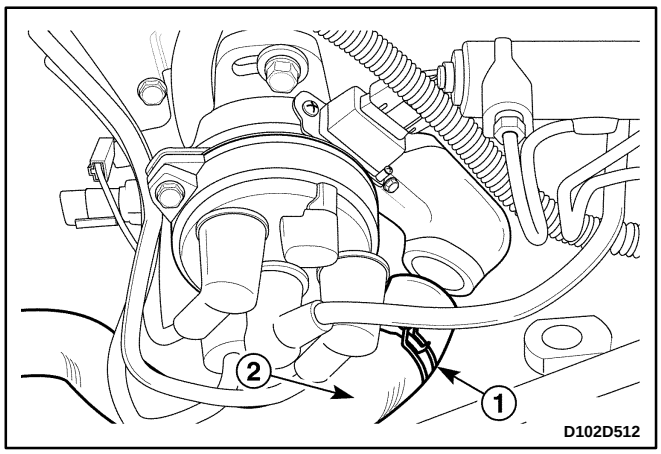
1. Install the radiator with the mounting bolts (1) and the support brackets (2).

   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.



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.



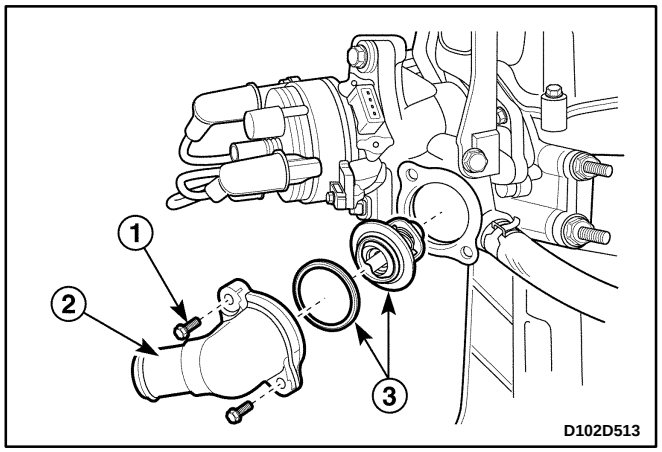
THERMOSTAT (TYPICAL)

Removal Procedure

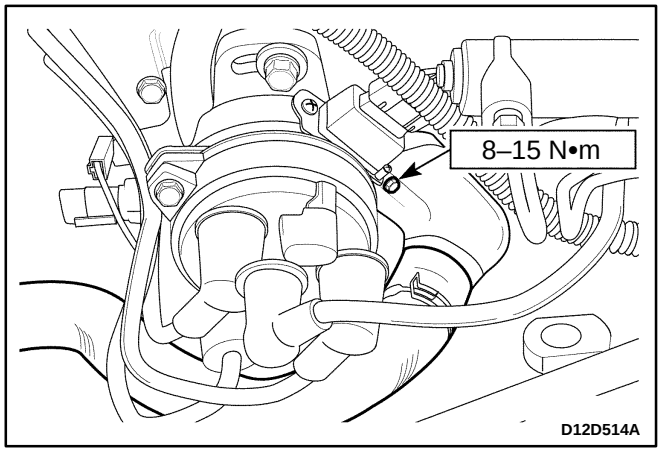
Caution: To prevent personal injury, do not remove the surge tank cap while the engine and the radiator are hot because the heat causes the system to remain under pressure. Scalding fluid and steam may be blown out under pressure.

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.

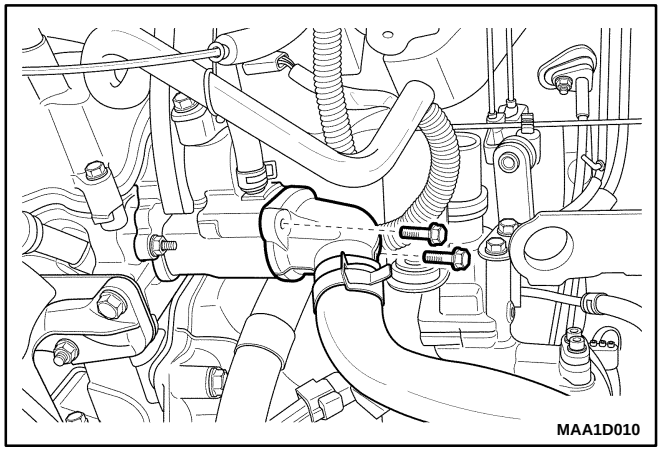


Installation Procedure

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.

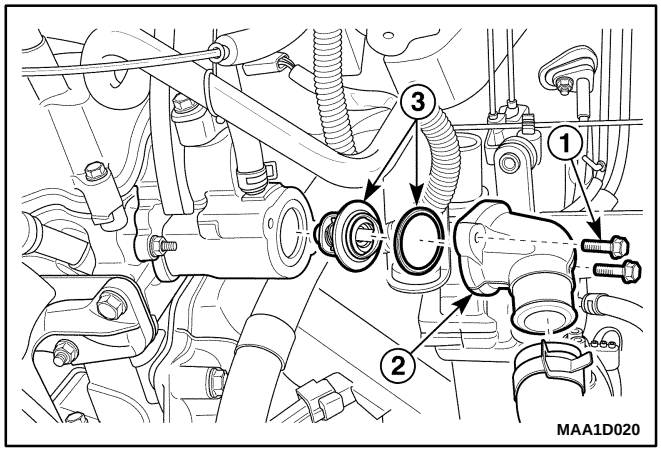


THERMOSTAT (EURO III)

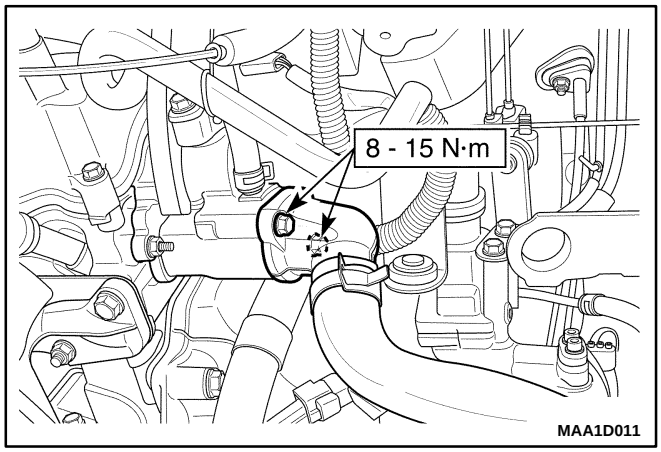
Removal Procedure

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.

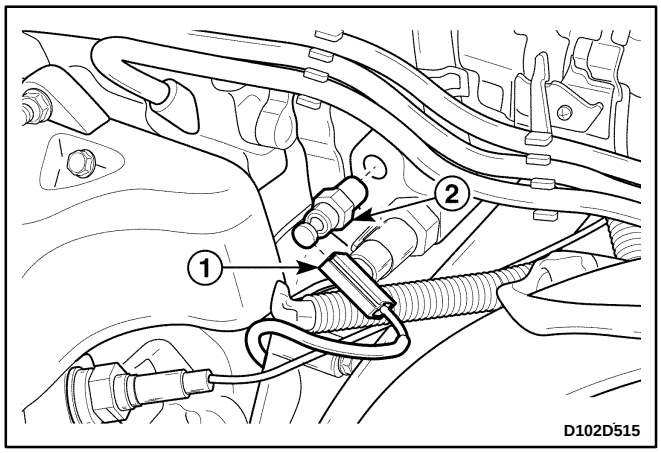
   Tighten

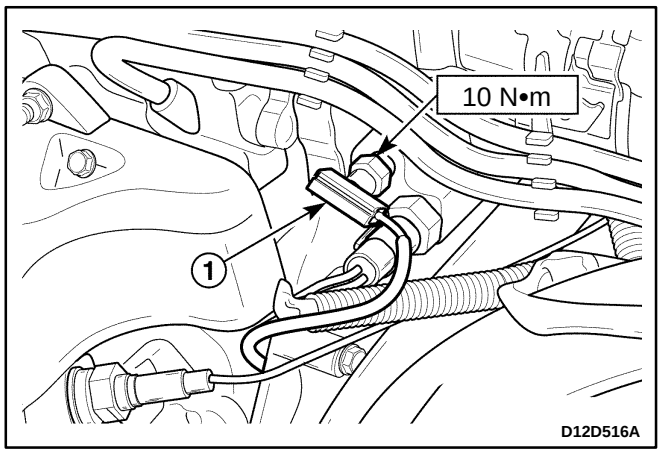
   Tighten the mounting bolts to 8–15 N•m (71–130 lb-in).
2. Secure the upper radiator hose to the thermostat housing with a hose clamp.
3. Refill the engine cooling system. Refer to “Draining and Refilling the Cooling System” in this section.
4. Install the air filter assembly. Refer to *Section 1B, SOHC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



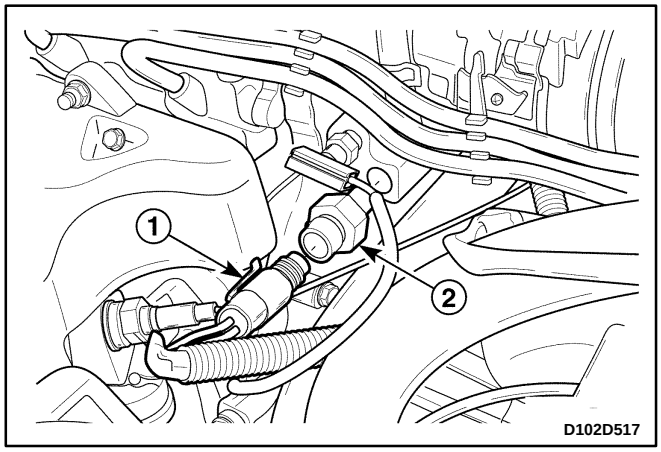


Installation Procedure

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

   Tighten

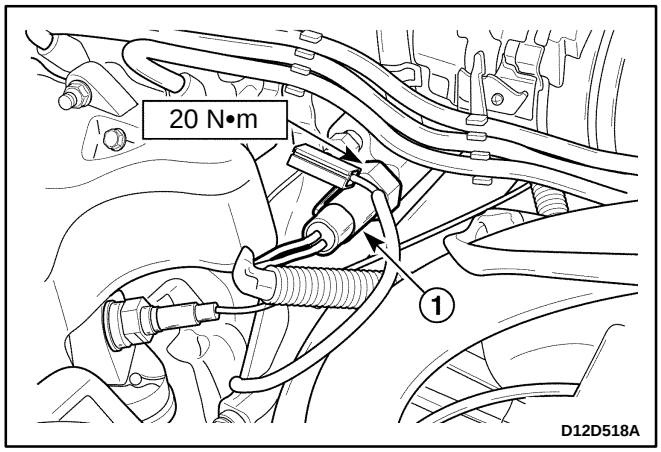
   Tighten the coolant temperature sensor to 10 N•m (89 lb-in).
   - Connect the electrical connector to the coolant temperature sensor (1).
2. Connect the lower radiator hose and refill the coolant. Refer to “Draining and refilling the cooling system” in this section.
3. Connect the negative battery cable.



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).

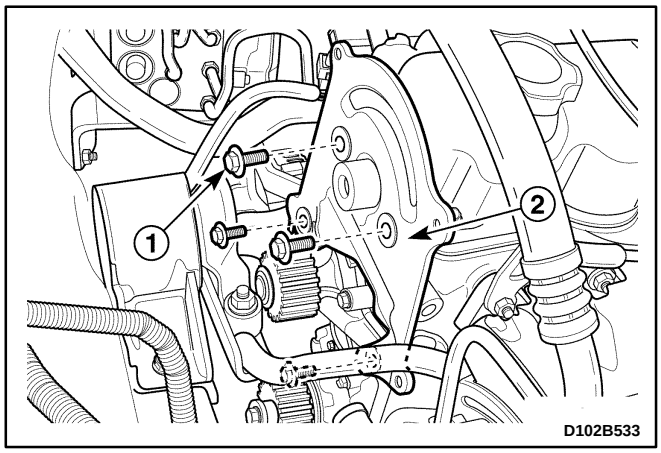


Installation Procedure

1. Install the ECT sensor.

   Tighten

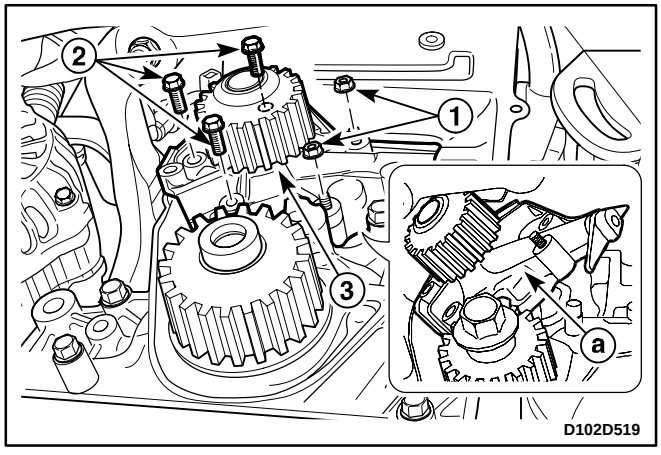
   Tighten the ECT sensor to 20 N•m (15 lb-ft).
   - Connect the electrical connector to the ECT sensor (1).
2. Connect the lower radiator hose and refill the coolant. Refer to “Draining and Refilling the Cooling System” in this section.
3. Connect the negative battery cable.



COOLANT PUMP

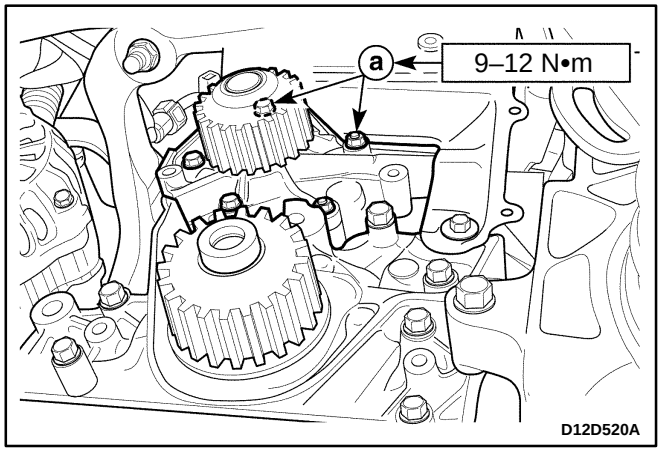
Removal Procedure

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).

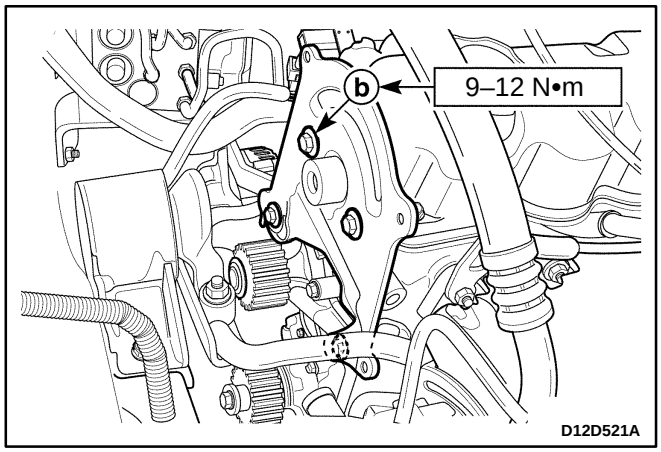


Installation Procedure

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).



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.

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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.

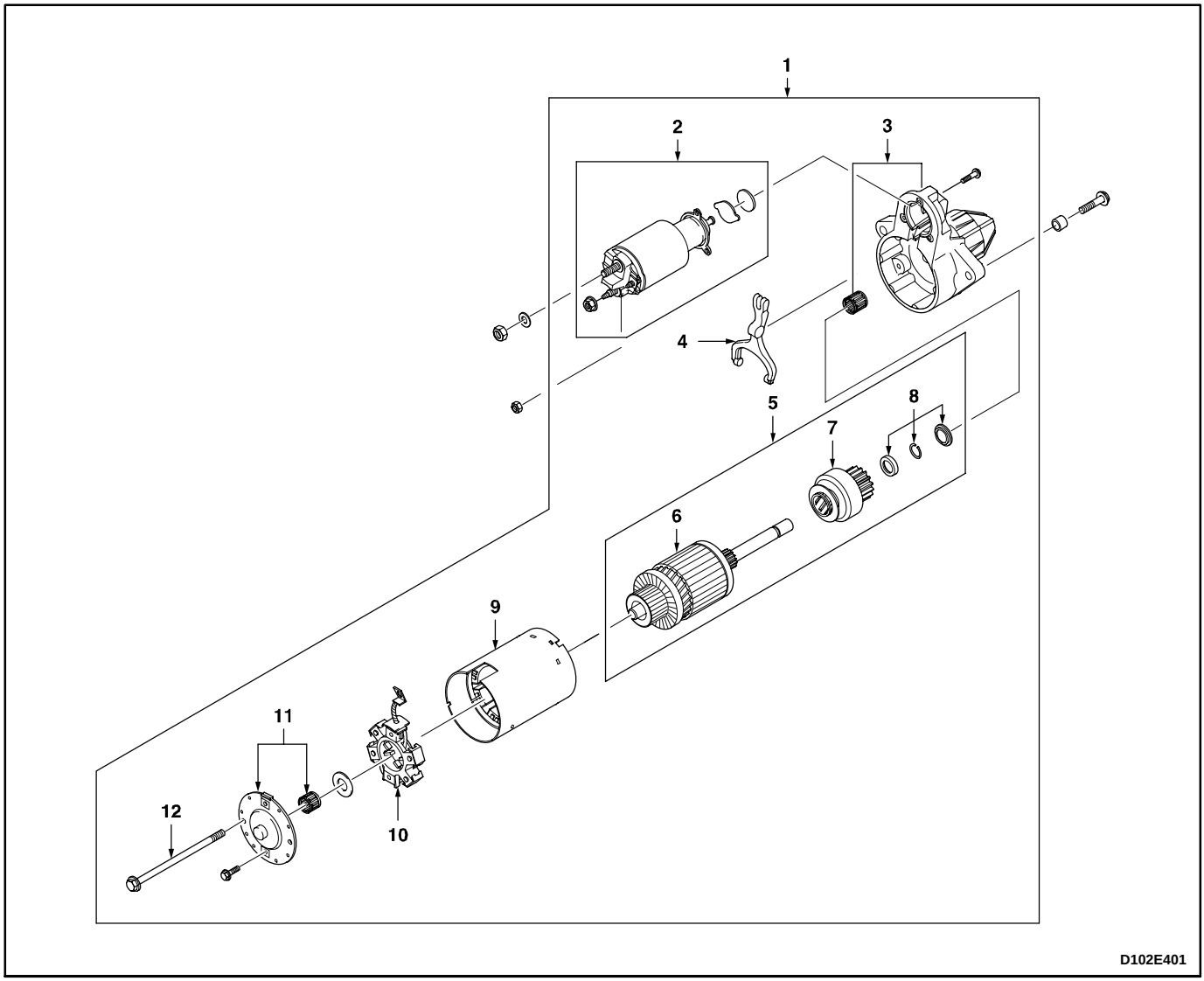
The closed magnetic typed ignition coil is used for the High Energy Ignition (H.E.I) system. Comparing with the iron cored open magnetic type, the closed type almost has no loss of magnetic flux, and smaller in size, so it produces the high voltage of secondary voltage.

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.

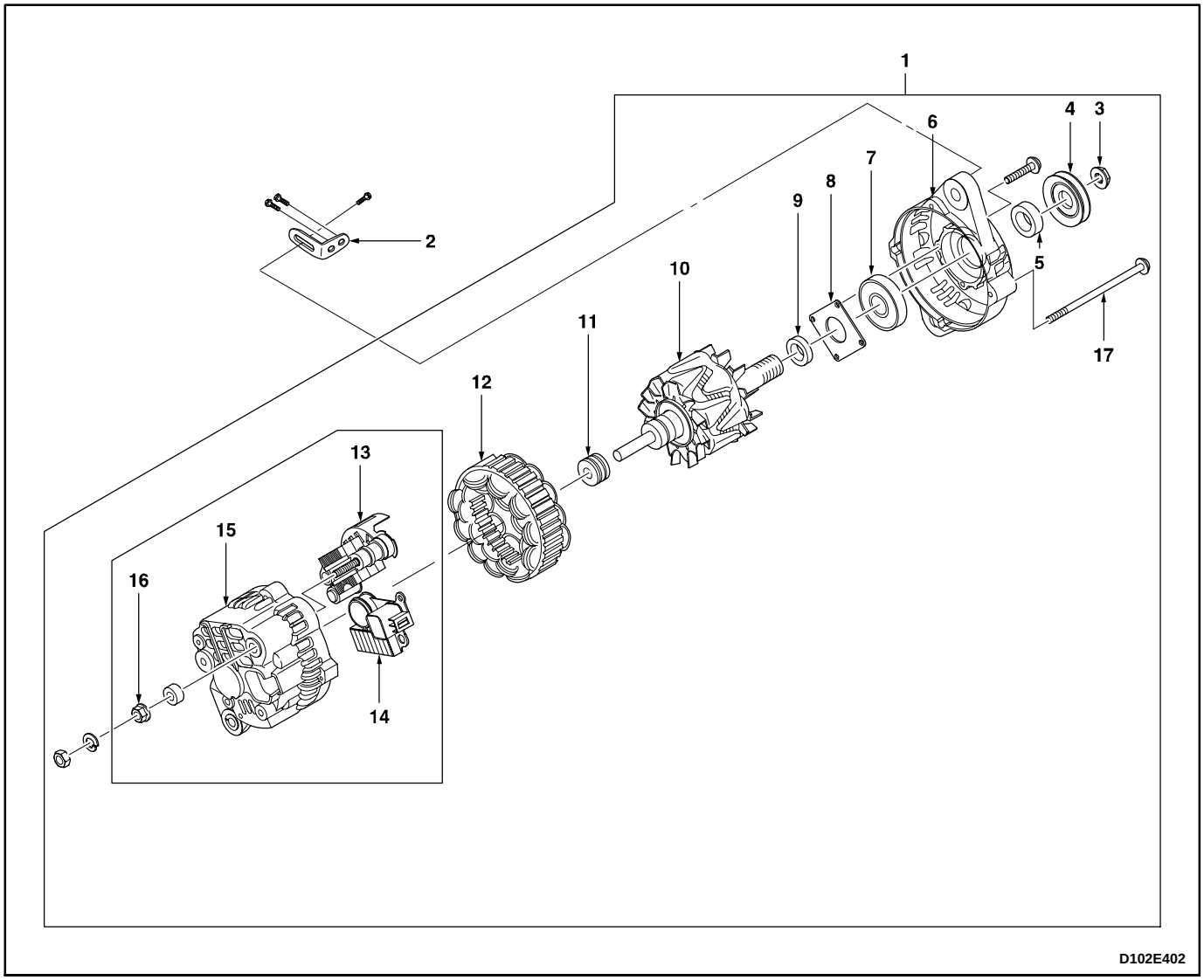
COMPONENT LOCATOR

STARTING SYSTEM



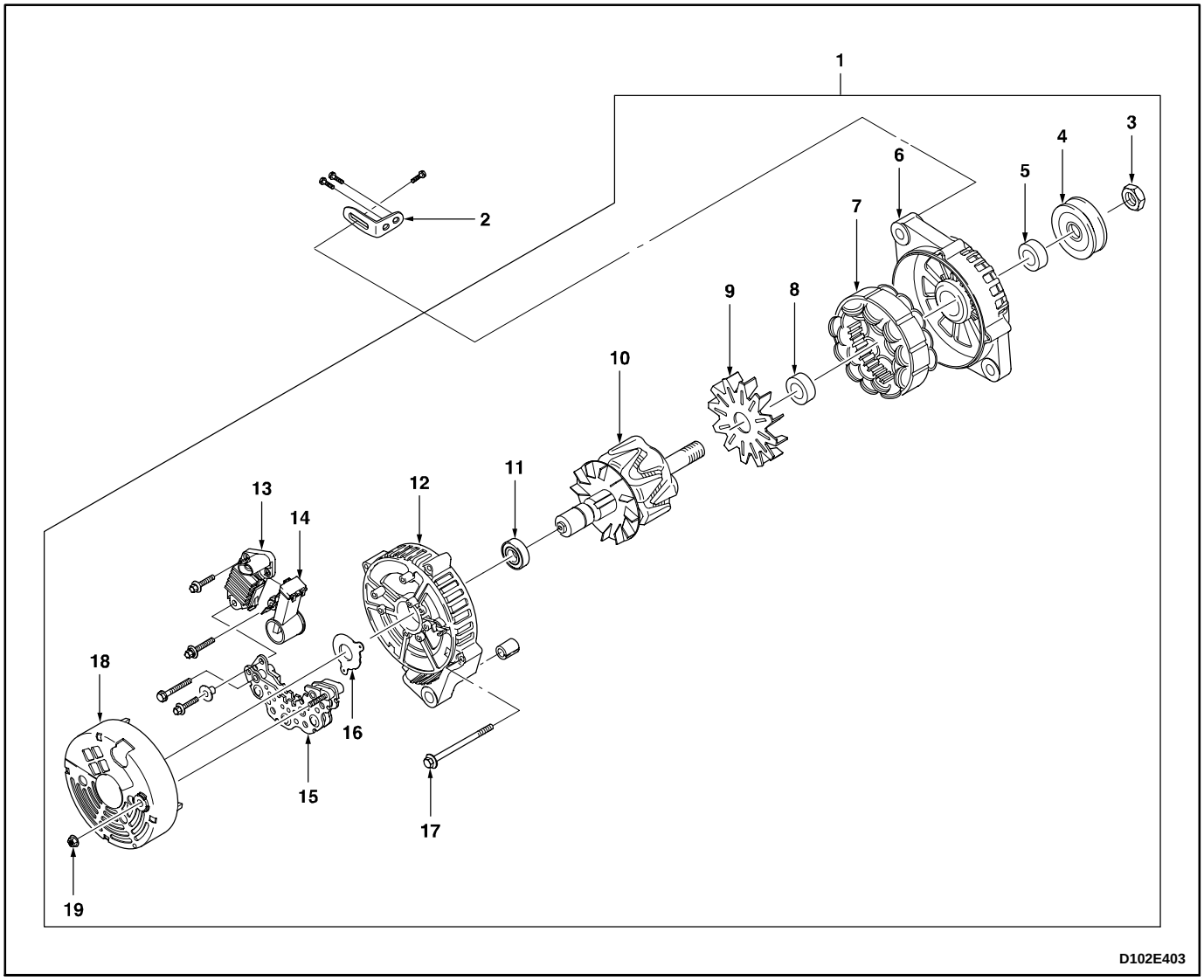
1 Starter Motor Assembly
2 Starter Solenoid Assembly
3 Starter Housing
4 Shift Lever
5 Armature Set
6 Armature
7 Pinion Gear Assembly
8 Ring Set
9 Field Frame Assembly
10 Brush Holder Assembly
11 Contact End Frame Assembly
12 Starter Through - Bolts

CHARGING SYSTEM (A-TYPE : MANDO)



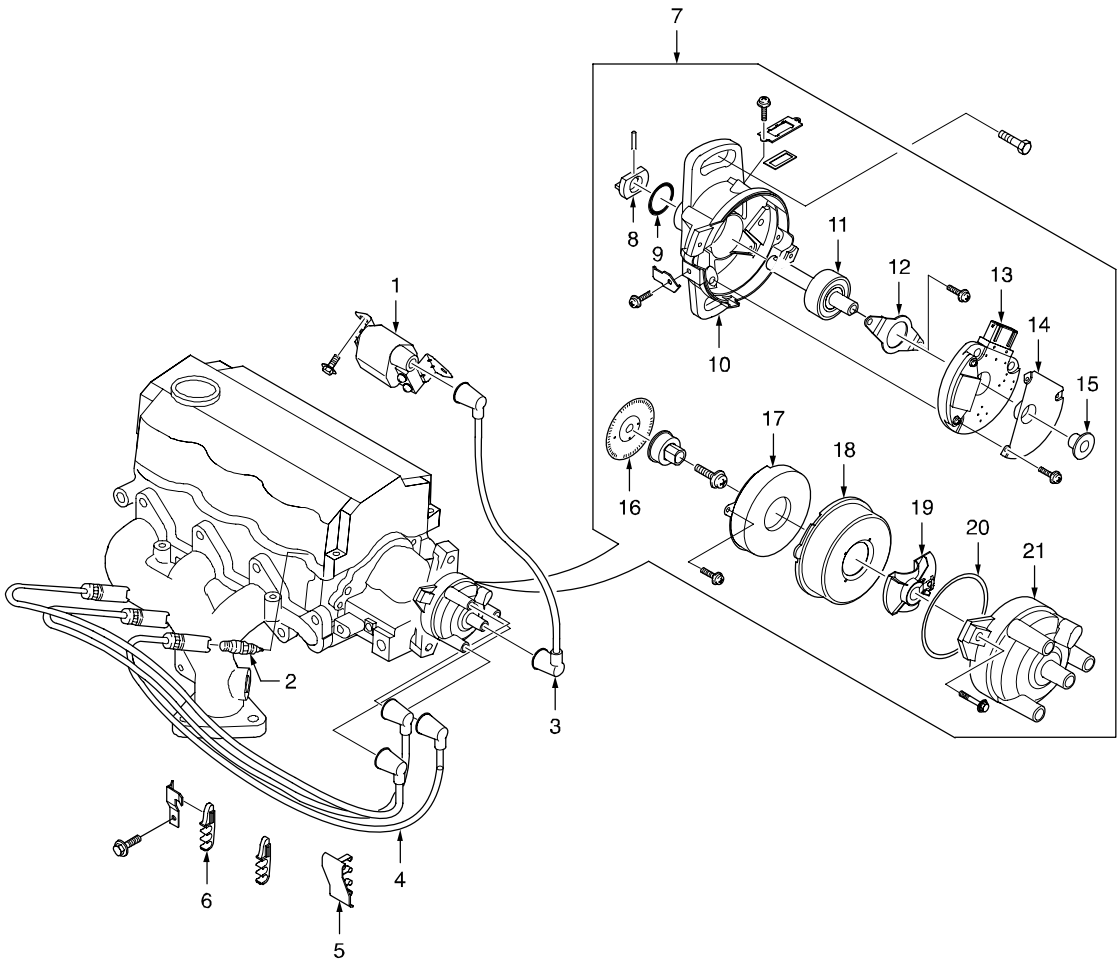
1 Generator Assembly
2 Generator Shackle
3 Generator Drive End Nut
4 Generator Pully
5 Generator Collar (Large)
6 Generator Front Bracket
7 Front Bearing
8 Bearing Spot Plate
9 Generator Collar (Small)
10 Generator Rotor Assembly
11 Rear Bearing
12 Generator Stator Assembly
13 Rectifier Assembly
14 Voltage 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.

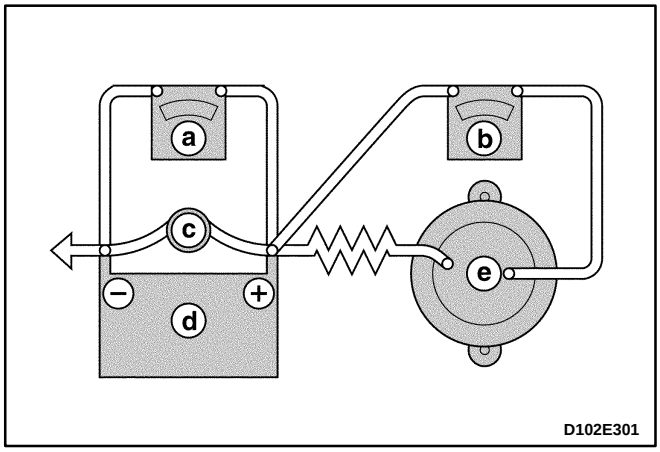
7. If the voltage does not drop below the minimum listed, the battery is good and should be reinstalled. If the voltage is less than the minimum listed, replace the battery. Refer to “Battery Specifications” in this section.

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.

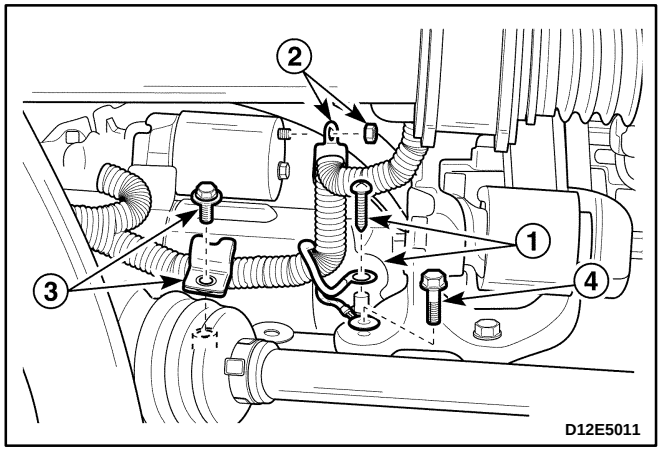
Diagnose the generator with the following procedure:

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

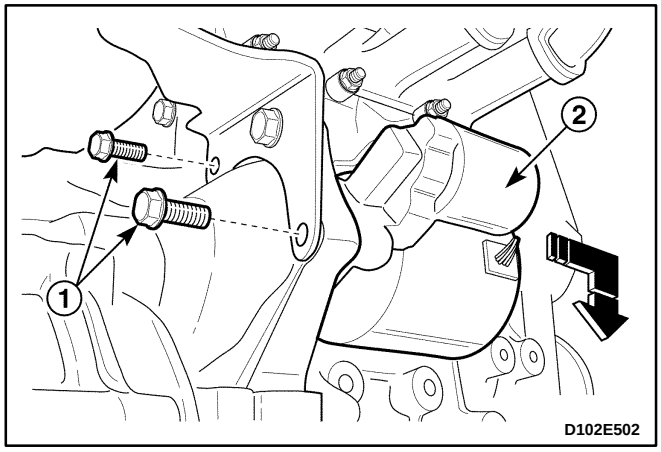
ON–VEHICLE SERVICE

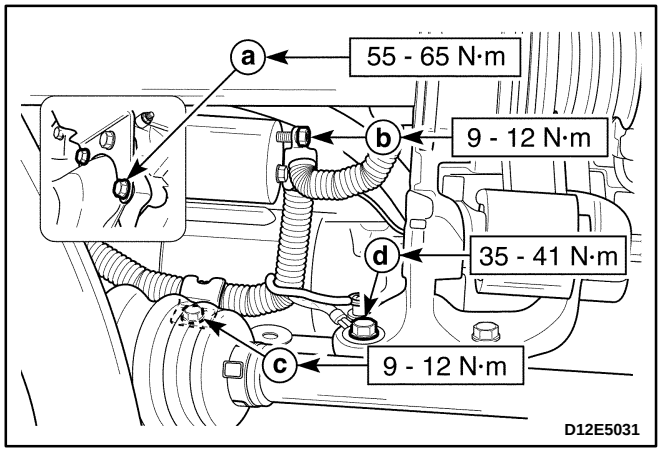


STARTER

Removal Procedure

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



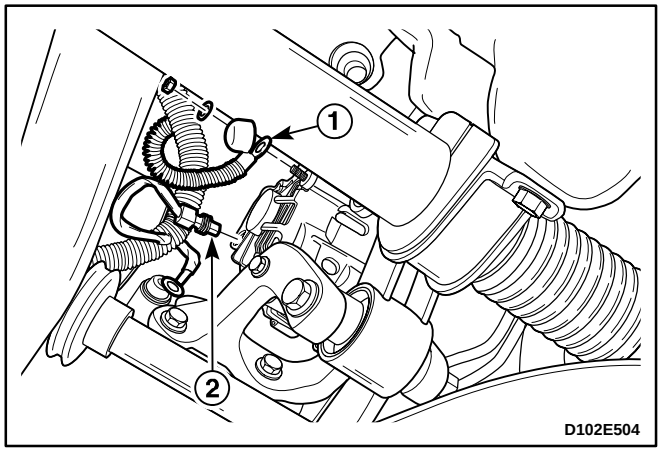


Installation procedure

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

Tighten

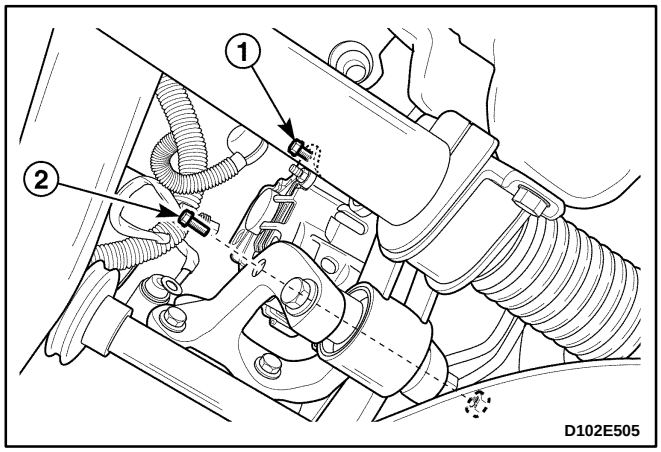
- Tighten the starter mounting bolts to 55–65 N•m (41–48 lb-ft) (a).
- Tighten the starter solenoid nut to 9–12 N•m (80–106 lb-in) (b).
- Tighten the harness clip bolt to 9–12 N•m (80–106 lb-in) (c).
- Tighten the ground bolt to 35–41 N•m (26–30 lb-ft) (d).



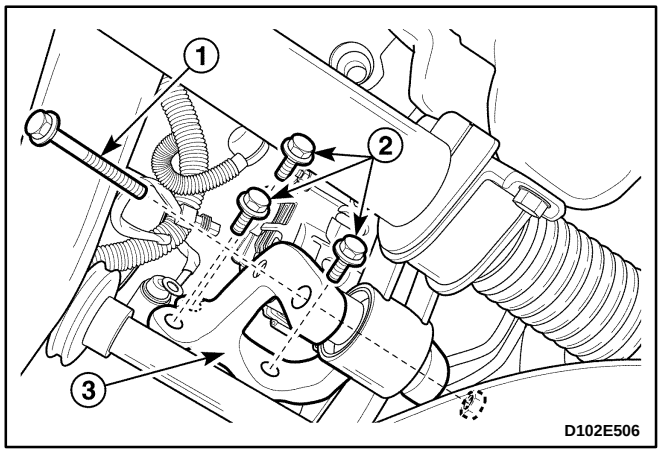
GENERATOR

Removal Procedure

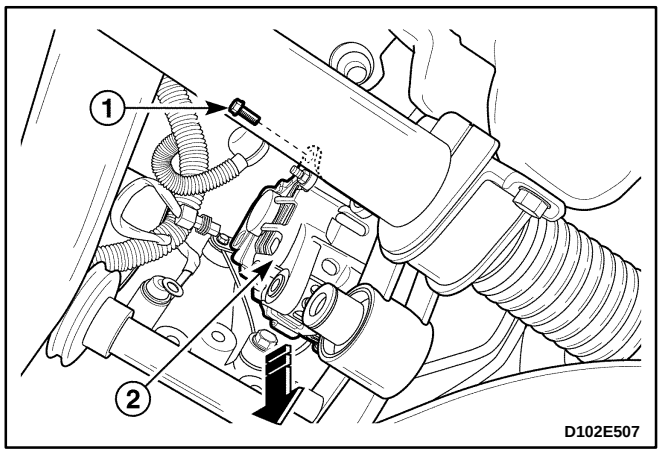
1. Disconnect the negative battery cable.
2. Disconnect the harness connector.
   - Remove the battery harness connector nut to disconnect the battery positive connector (1).
   - Disconnect the generator harness connector (2).



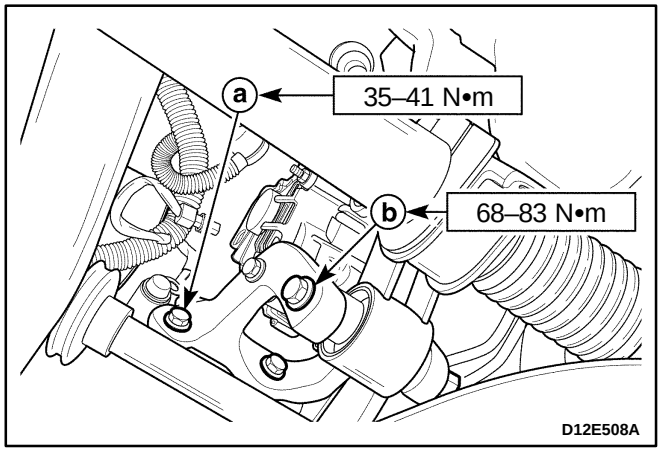
3. Remove the generator drive belt.
   - Loosen the generator adjusting bolt (1).
   - Remove the lower bracket-to-generator bolt and nut (2).
   - Separate the generator drive belt from the generator.



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).

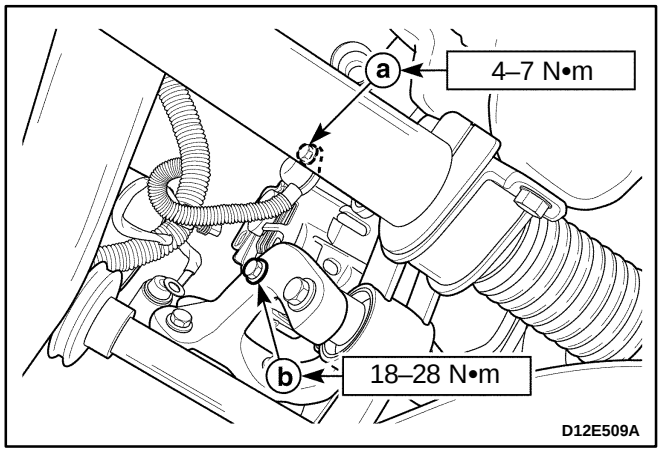


Installation Procedure

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

Tighten

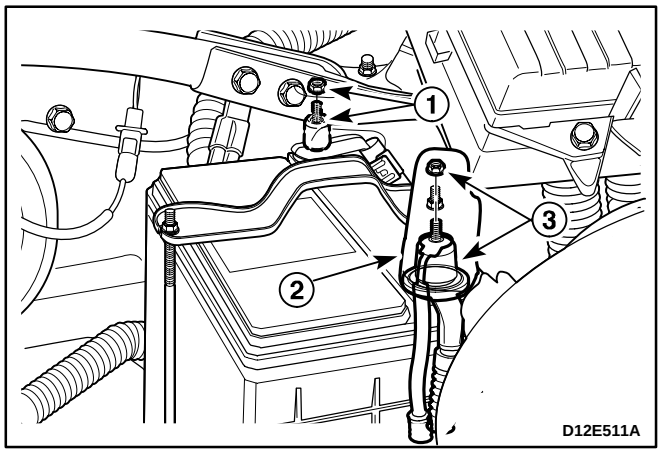
- Tighten the engine mounting lower bracket bolts to 35–41 N•m (25–30 lb-ft) (a).
- Tighten the engine mounting lower bracket, attaching reaction rod bolt and nut to 68–83 N•m (50–61 lb-ft) (b).



3. Install the bolts and nut.

Tighten

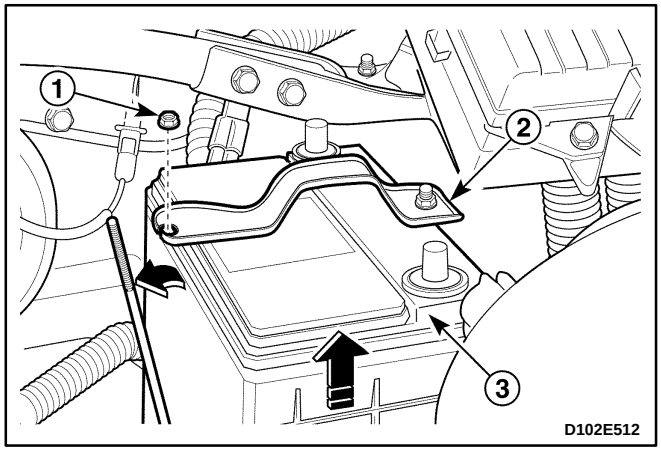
- Tighten the generator adjusting bolt to 4–7 N•m (35–62 lb-in) (a).
- Tighten the generator lower bracket bolt and nut to 18–28 N•m (13–21 lb-ft) (b).
- Inspect the generator drive belt tension.



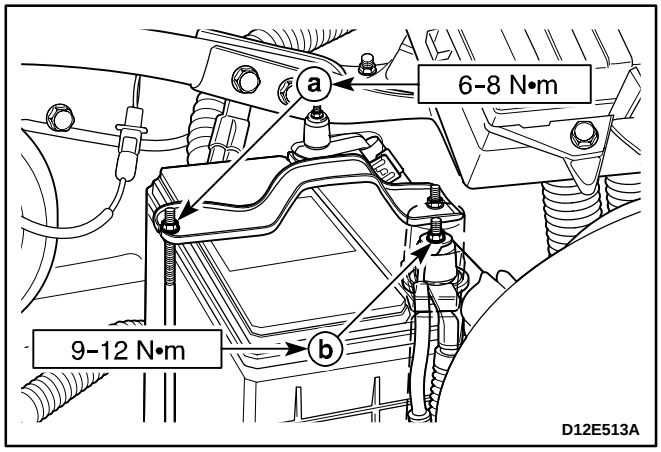
BATTERY

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).

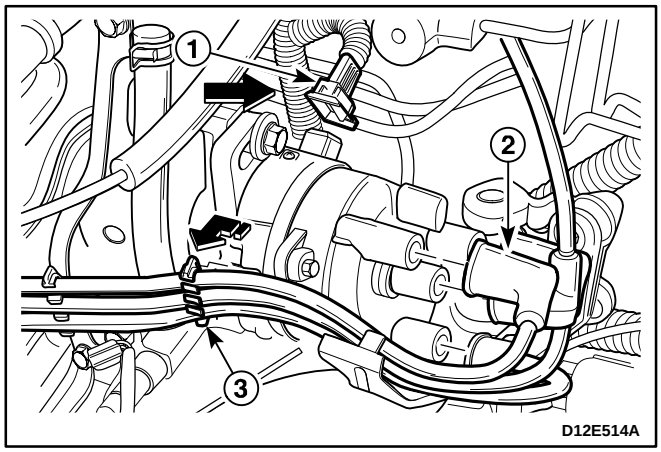


Installation Procedure

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

Tighten

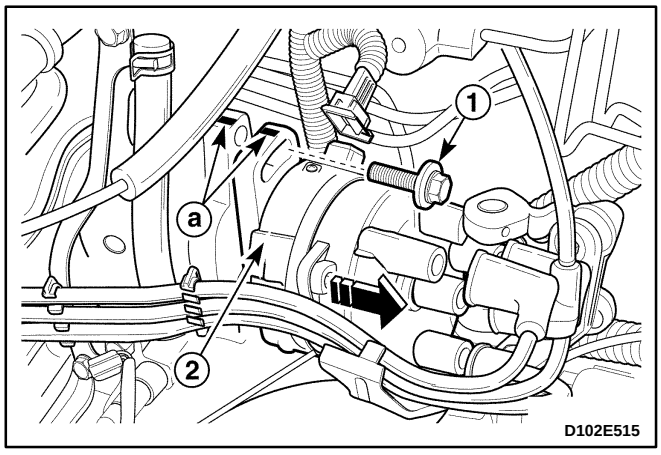
- Tighten the battery rod nut to 6–8 N•m (53–71 lb-in) (a).
- Tighten the battery cable nut to 9-12 N•m (80–106 lb-in) (b).



DISTRIBUTOR

Removal Procedure

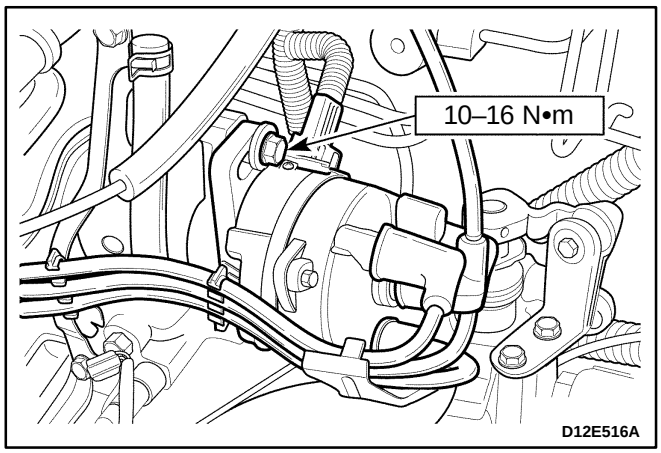
1. Disconnect the negative battery cable.
2. Remove the air filter, resonator with snorkel assembly. Refer to *Section 1B, SOHC Engine Mechanical.*
3. Disconnect the ignition wires and electrical connector.
   - Disconnect the optical sensor connector (1).
   - Disconnect the ignition wires (2).
   -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



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).

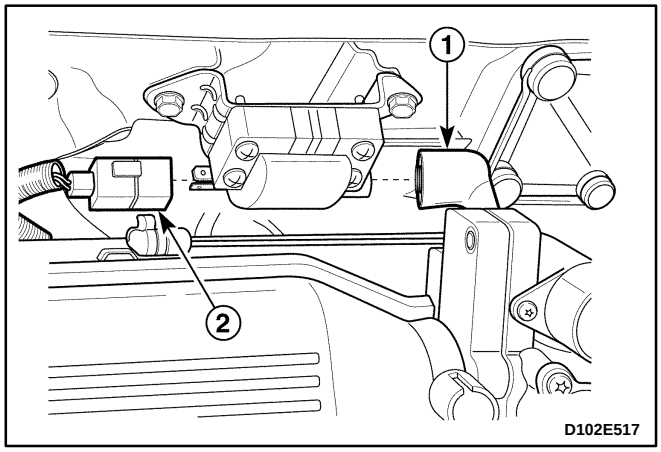


Installation Procedure

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

Tighten

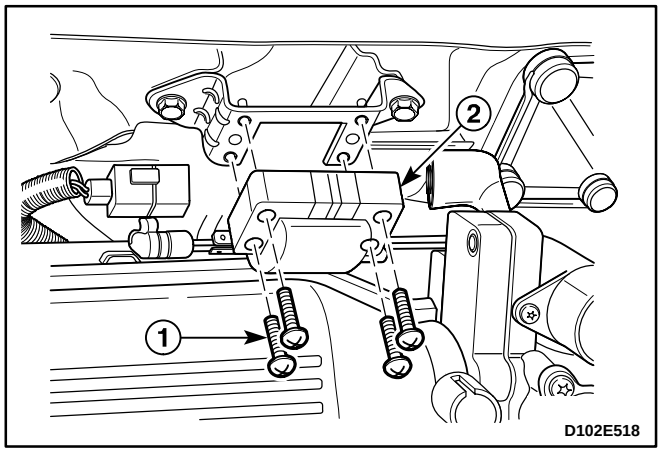
Tighten the distributor bolts to 10–16 N•m (89–142 lb-in).



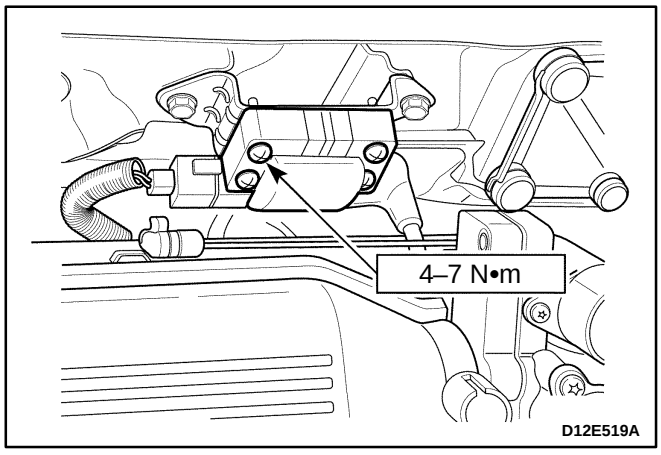
IGNITION COIL

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).



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



Installation Procedure

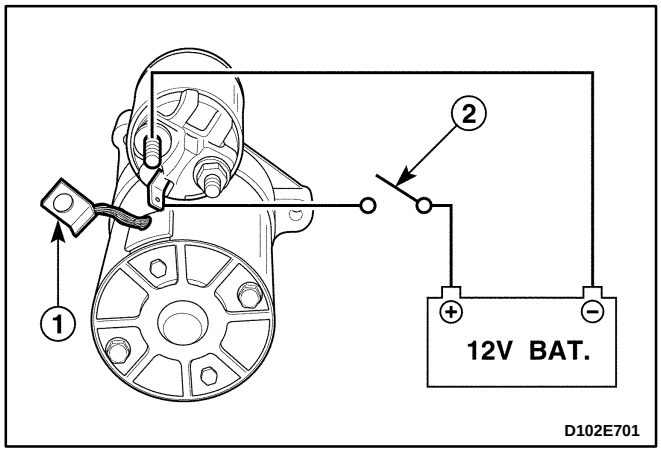
1. Install in the reverse order of removal.
2. Install the ignition coil screws.

Tighten

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

REPAIR INSTRUCTIONS

UNIT REPAIR

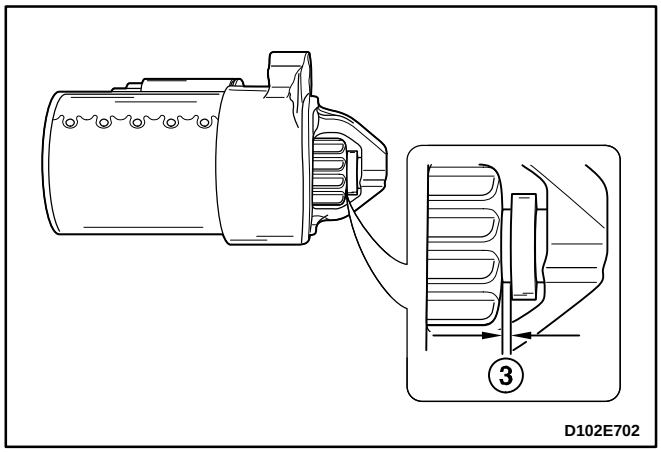


STARTER MOTOR

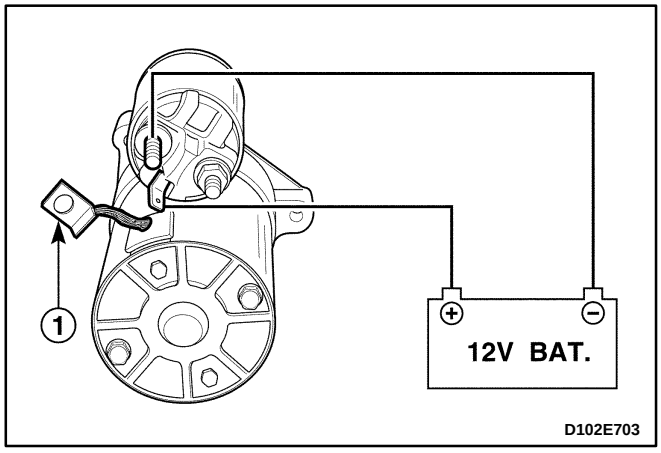
Inspection / Measurement (Before the Overhaul)

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)

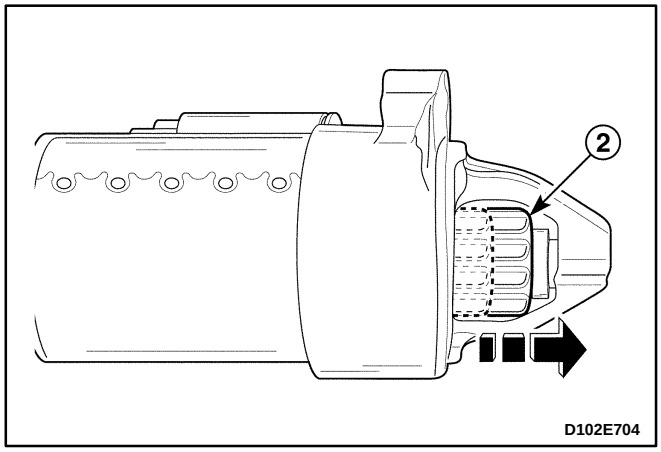


- Switch on to move the pinion gear (2).
- Now check the clearance between the pinion and the stopper with the filler gauge (3).
- If the clearance does not fall within the limits, check for improper installation and replace all worn parts.

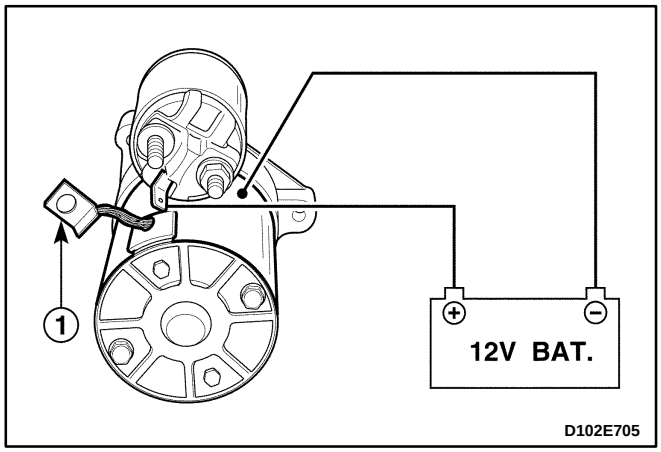


3. Magnetic switch pull-in test.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminals M and S.

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

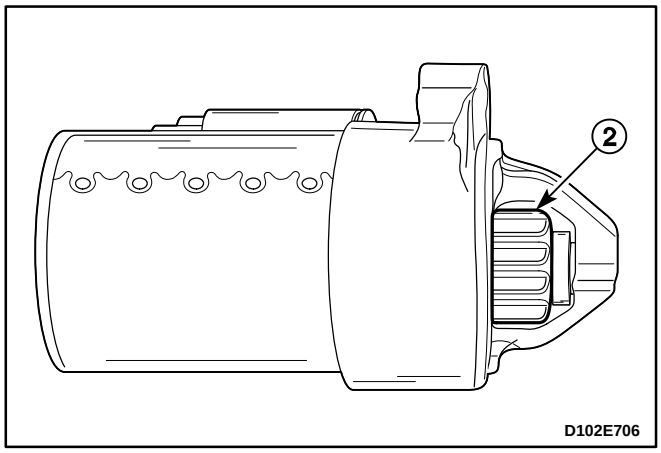


- Inspect the pinion gear's moving to the outside (2).
- If the pinion gear does not move outside, replace the magnetic switch.

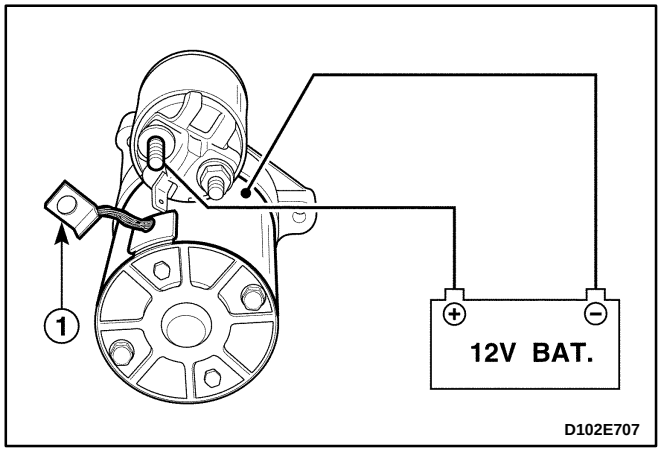


4. Solenoid hold-in test.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminal S and body.

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

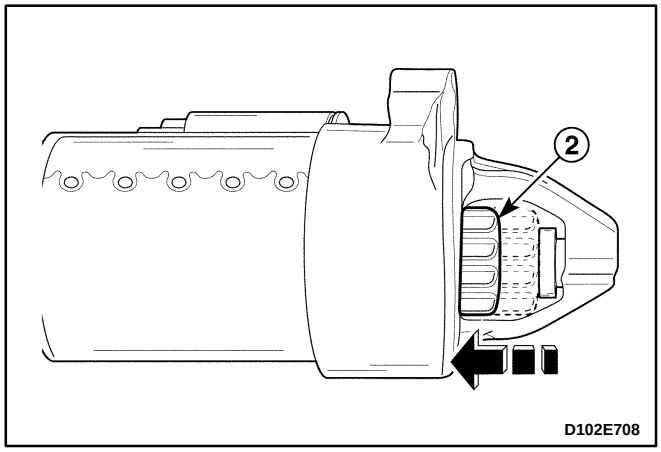


- Check the pinion gear's moving to the outside (2).
- If the pinion gear move to the inside, the circuit is open. Replace the magnetic switch.

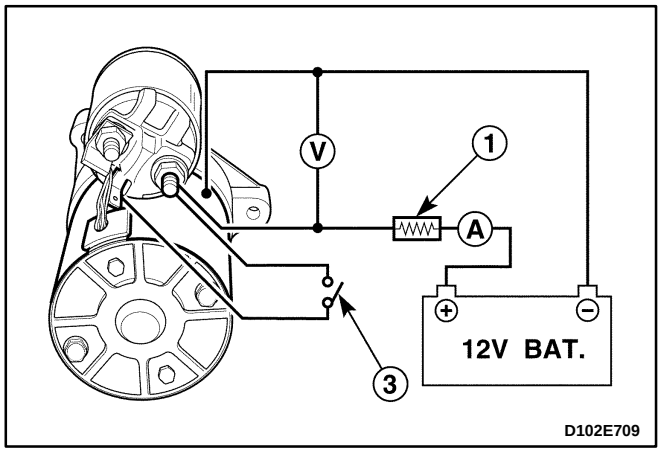


5. Solenoid return test.
   - Disconnect the starter motor terminal M (1).
   - Connect the 12-volt battery lead to the starter motor terminal S and body.

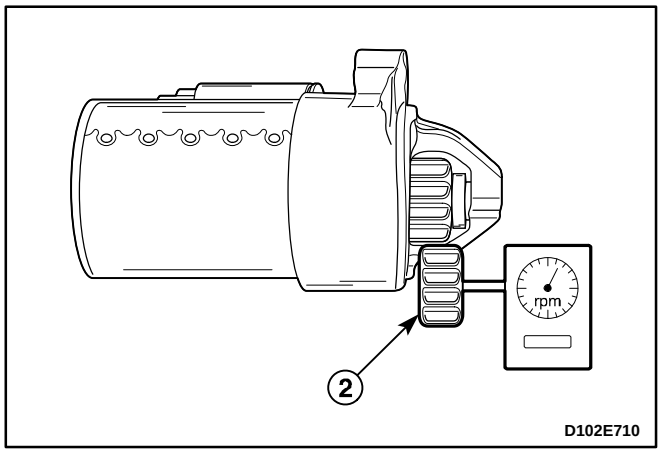
Notice: Complete the testing in a minimum amount of time to prevent overheating and damaging the solenoid.



- 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.

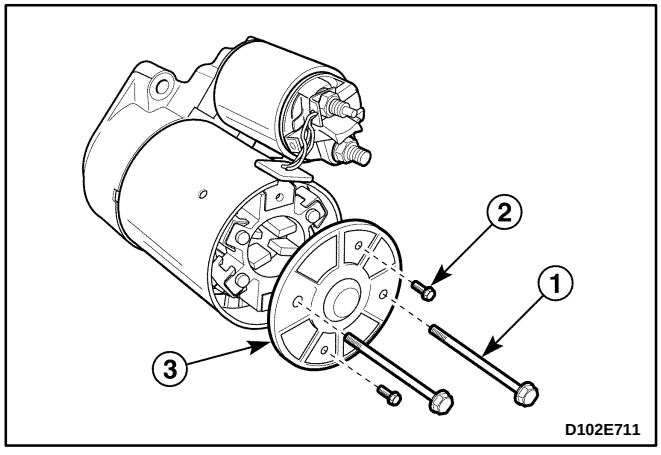


5. No-road test.
   - Connect the 12-volt battery lead to the starter circuit.
   - Connect the current and the voltage (1).
   - Install the starter motor rpm gage (2).
   - Start the starter motor with the switch on (3).
   - Measure the speed of pinion gear and the current.
   - If the measurement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



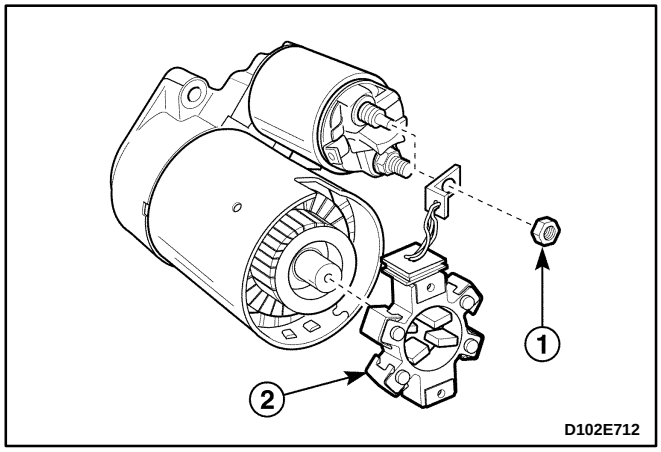
Desciption	Limit
The speed of pinion gear	Minimum: 2,000 rpm
Condition: Voltage/Current	Maximum: 9V / 150A

- Replace the starter motor if necessary.

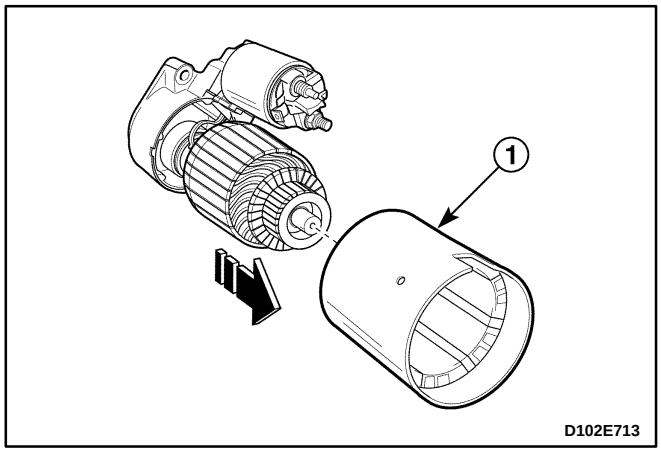


Disassembly Procedure

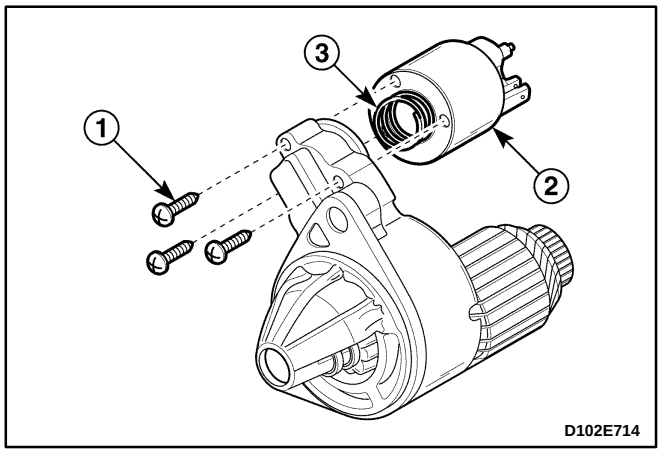
1. Remove the starter contact end frame.
   - Remove the through-bolts (1).
   - Remove the contact end frame bolts (2).
   - Remove the frame with the spacer (3).



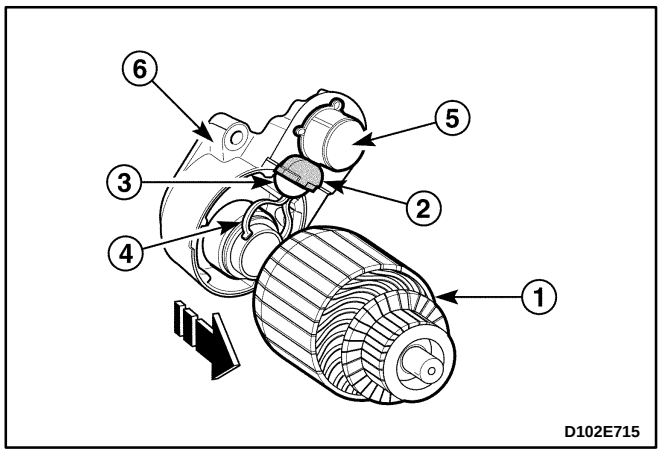
2. Remove the brush holder assembly.
   - Remove the starter motor terminal M nut (1).
   - Remove the brush holder assembly (2).



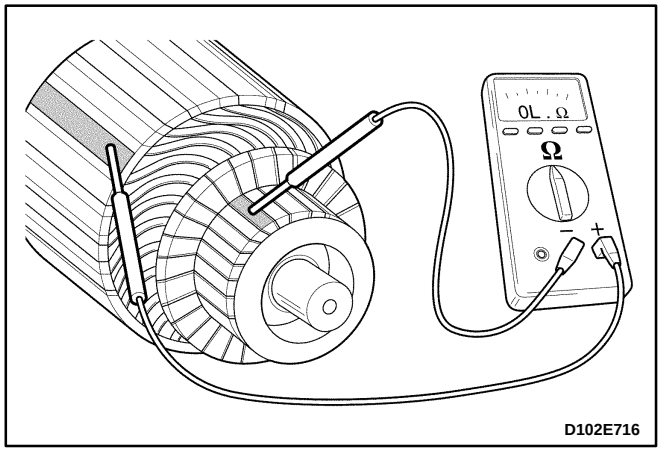
3. Remove the field frame assembly from the armature set (1).



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



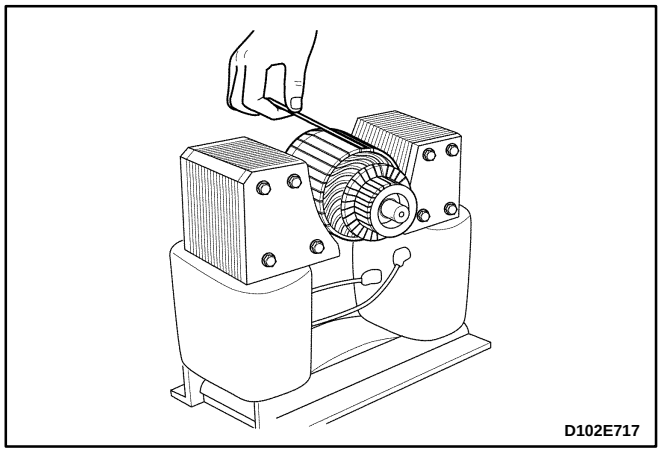
5. Remove the armature set and solenoid from the starter housing.
   - Remove the armature set (1).
   - Remove the rubber sealer (2).
   - Remove the shift lever plate (3).
   - Remove the shift lever (4).
   - Remove the solenoid (5).
   - Remove the gasket (6).



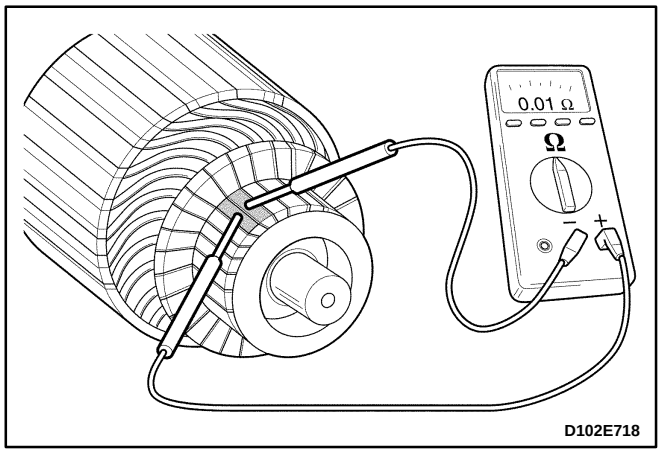
D102E716

Inspection / Measurement (After the Overhaul)

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

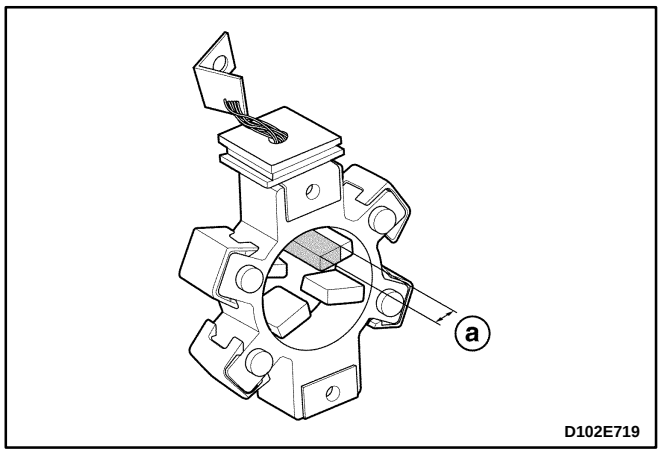

D102E717

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.

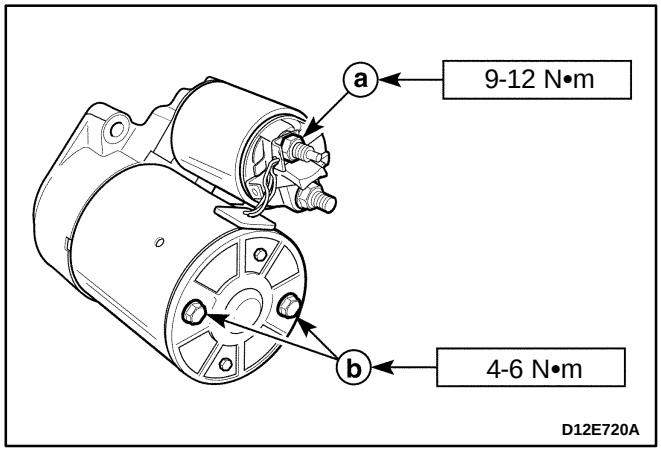


D102E719

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

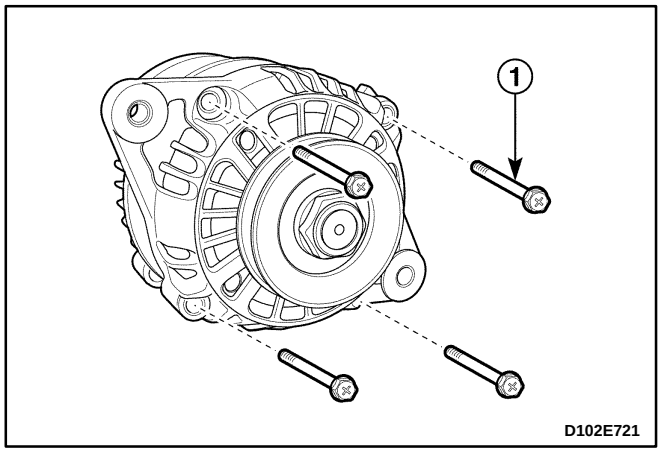
Tighten the starter motor terminal M nut to 9–12 N•m (80–106 lb-in) (a).

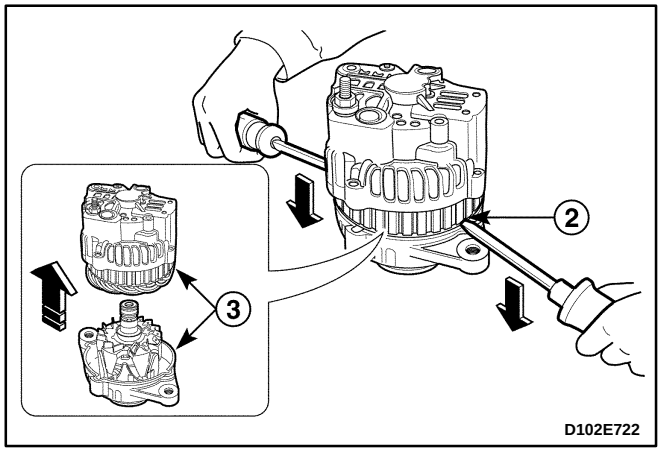
Tighten the through-bolts to 4–6 N•m (35–53 lb-in) (b).

GENERATOR (A-TYPE : MANDO)

Disassembly Procedure

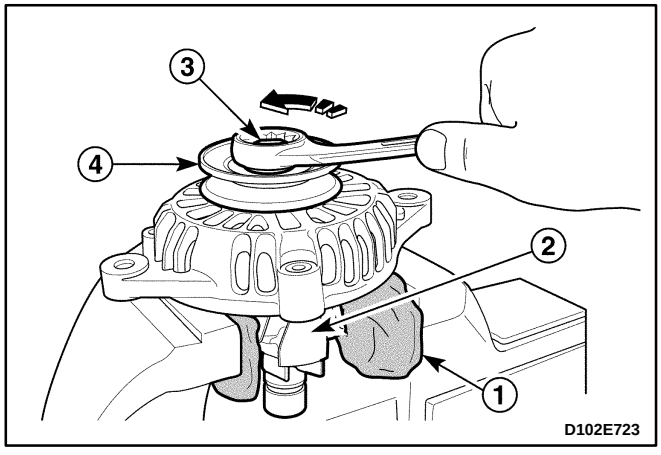
1. Remove the generator. Refer to “Generator” in this section.
2. Remove the front bracket and rear bracket.
   - Remove the through-bolts (1).

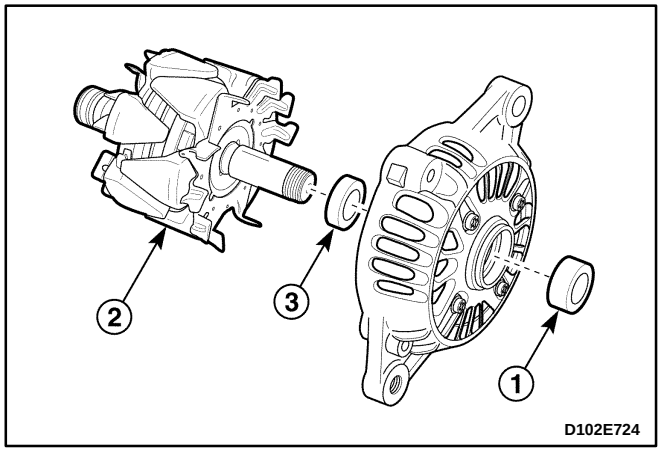




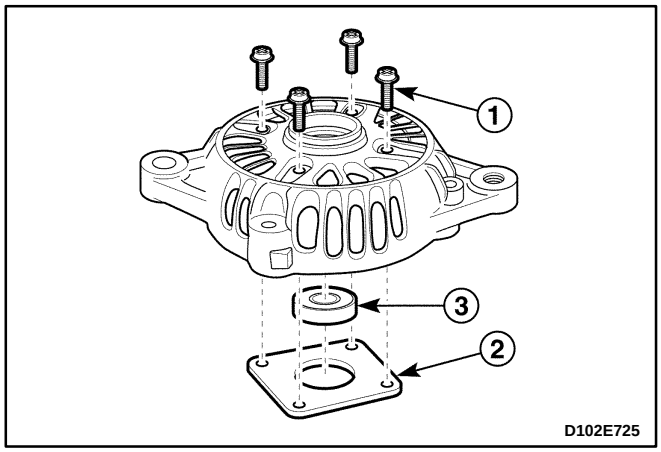
   - Pry front bracket downwards using a screwdriver (2).
   - Separate the front bracket and rear bracket (3).

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).

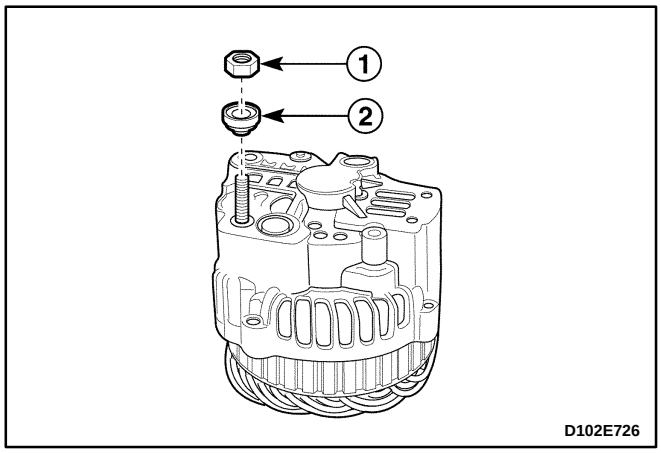




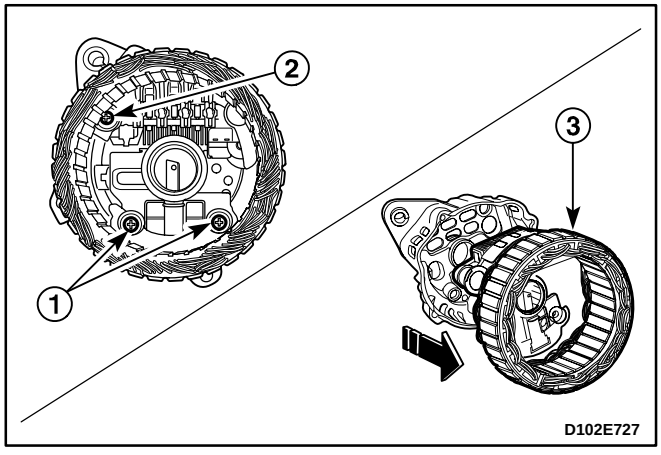
4. Remove the front bracket, rotor and collar.
   - Remove the collar (large) (1).
   - Remove the rotor from the front bracket (2).
   - Remove the collar (small) from the rotor shaft (3).



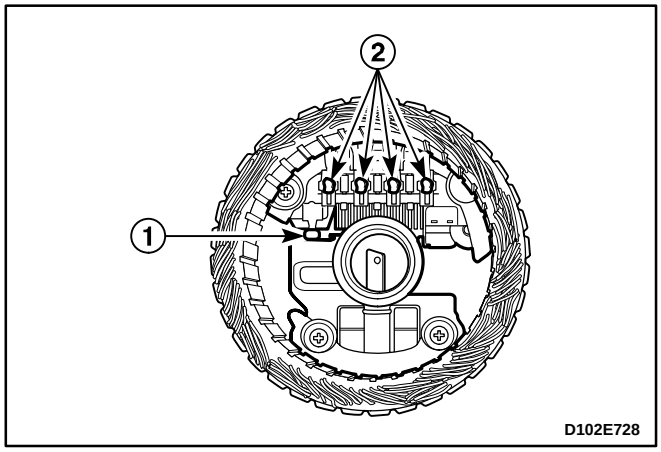
5. Remove the front bearing.
   - Remove the support plate screws (1).
   - Remove the plate (2).
   - Remove the front bearing using the press (3).



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

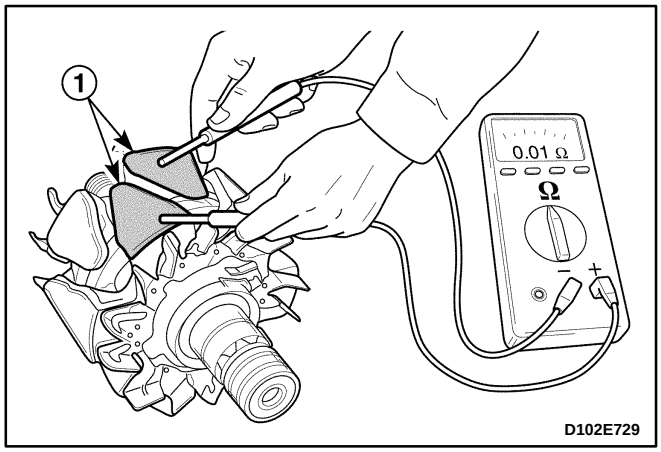


7. Remove the stator assembly from the rear bracket.
   - Remove the rectifier screw (1).
   - Remove the brush holder and regulator assembly screws (2).
   - Remove the stator assembly with the rectifier / brush holder / regulator (3).



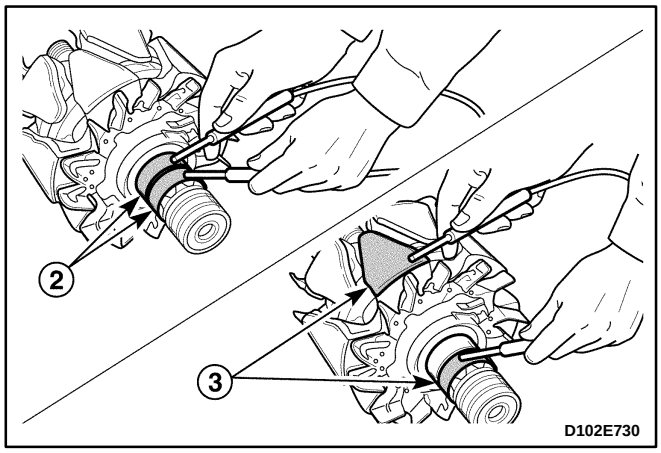
8. Remove the rectifier / brush holder / regulator from the stator.
   - Remove the rectifier / brush holder / regulator connections (1).
   - Remove the stator and rectifier connections (2).

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



Inspection / Measurement

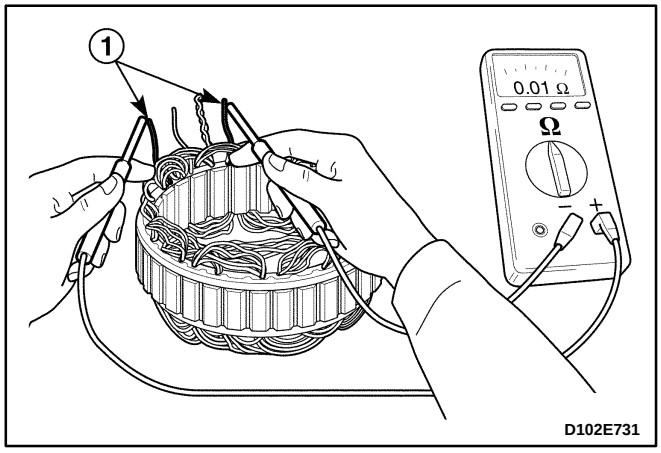
1. Inspect the rotor assembly.
   - Test the rotor for an open circuit by using the ohmmeter (1). Replace the rotor if necessary.



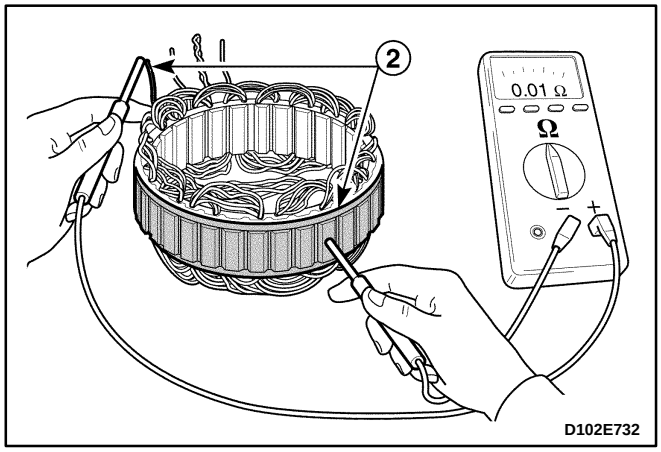
   - Test the rotor for open or short circuit (2).

Desciption	Limit
The measured resistance	2.9Ω

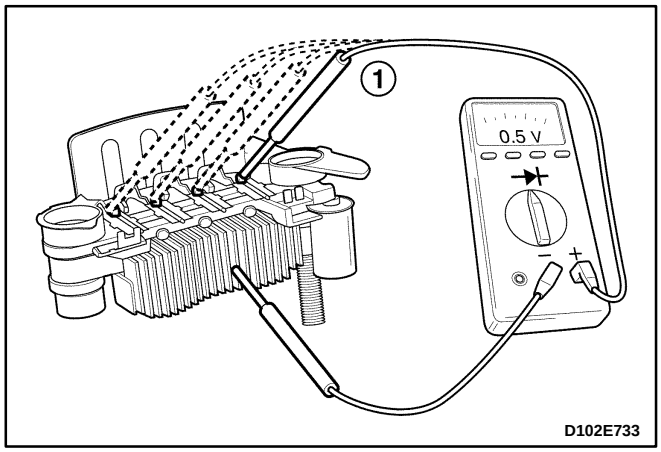
   - Replace the rotor if necessary.
   - Test the rotor for open or ground circuit by using the ohmmeter (3). Replace the rotor if necessary.



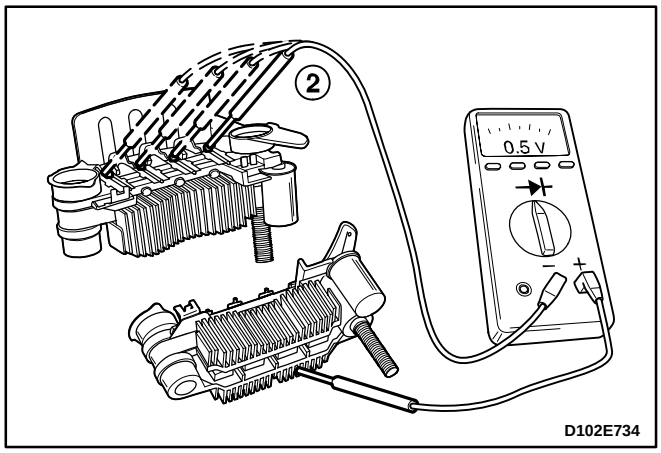
2. Inspect the stator.
   - Test the stator for an open circuit by using the ohmmeter (1). Replace the stator if necessary.



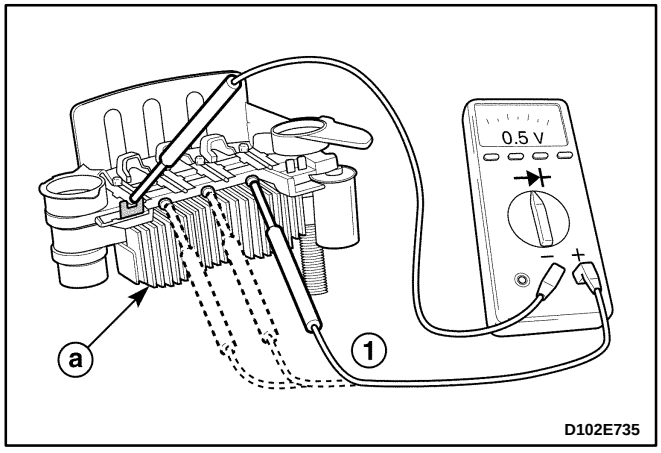
- Test the stator for open or ground circuit by using the ohmmeter (2). Replace the starter if necessary.



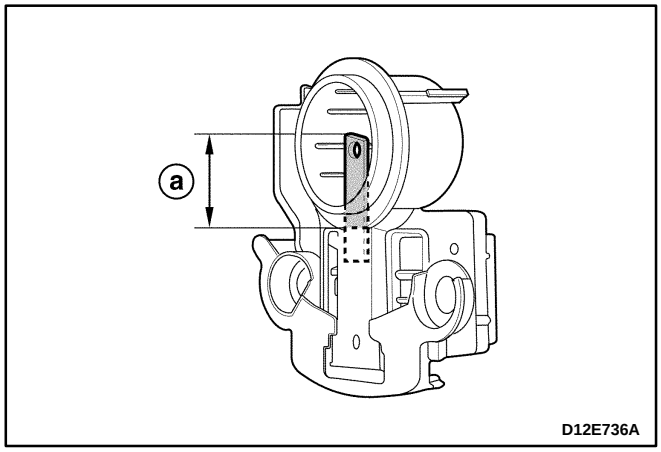
3. Inspect the rectifier.
   - Positive rectifier test:
     Inspect the open circuit for stator coil lead terminals using the ohmmeter (1).
     Replace the rectifier if necessary.



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

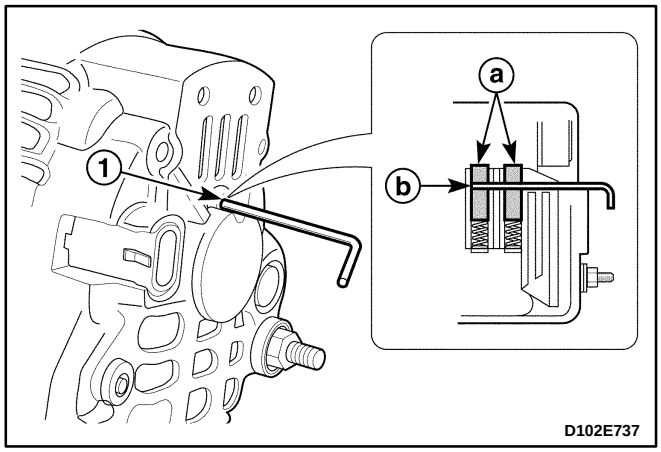


4. Inspect trio diodes.
   - Inspect the open circuit for trio diodes using the ohmmeter (1).
   - Replace the heat sink if necessary (a).



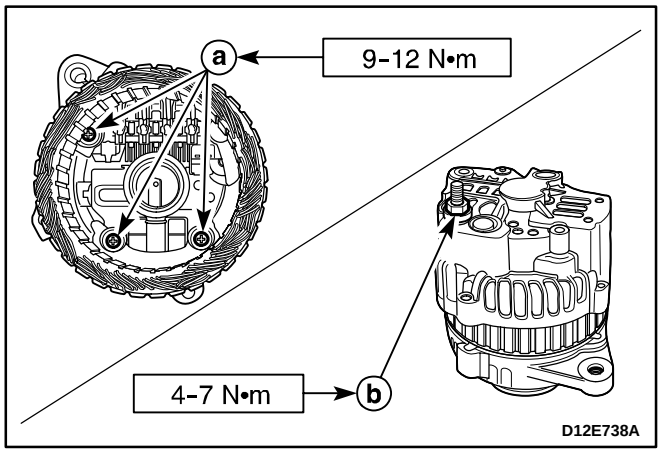
5. Inspect the brush wear.
   - If the brush wear exceeds the specified valve (a), replace the brush.

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



Assembly Procedure

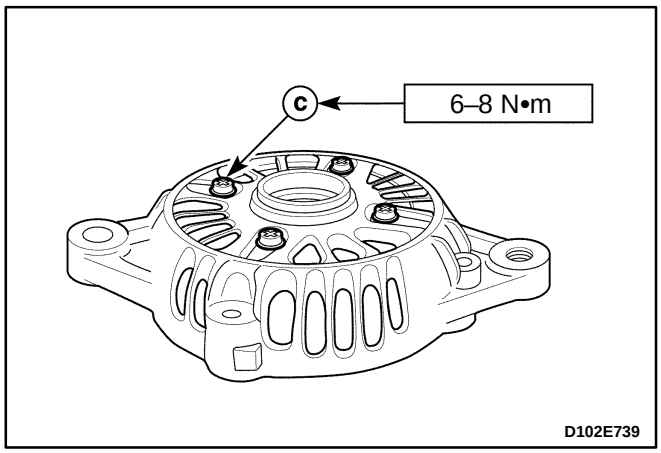
1. Install in the reverse order of removal.
   - Assemble the stator assembly into the rear bracket and rotor assembly.
   a. Brushes.
   b. Hole.



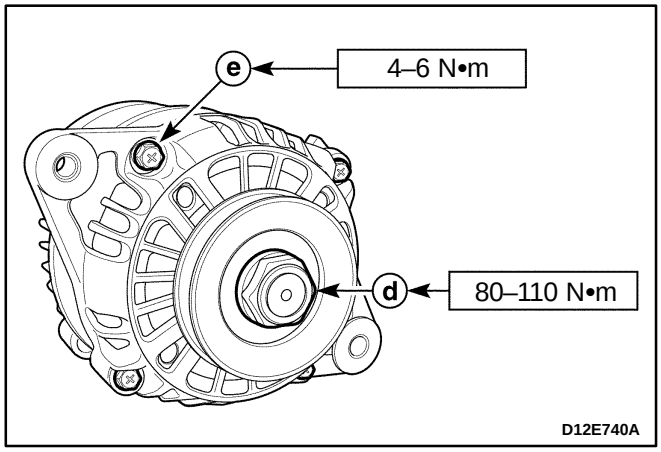
2. Install the bolts / nuts / screws.

Tighten

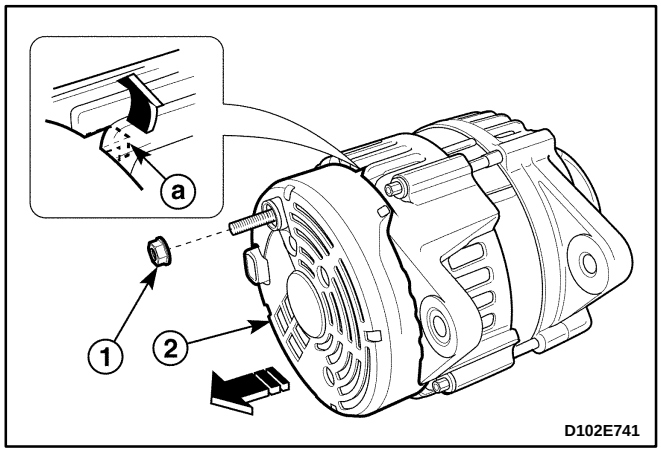
- Tighten the brush holder / regulator / rectifier screws to 9–12 N•m (80–106 lb-in) (a).
- Tighten the battery positive terminal nut to 4–7 N•m (35–62 lb-in) (b).



- 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).

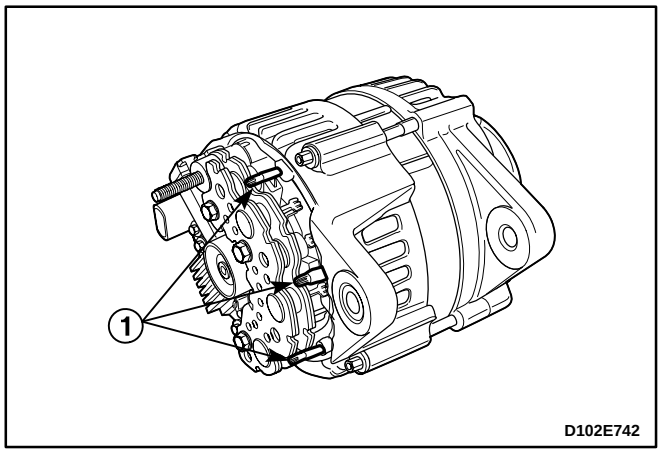


GENERATOR (B-TYPE: DAC)

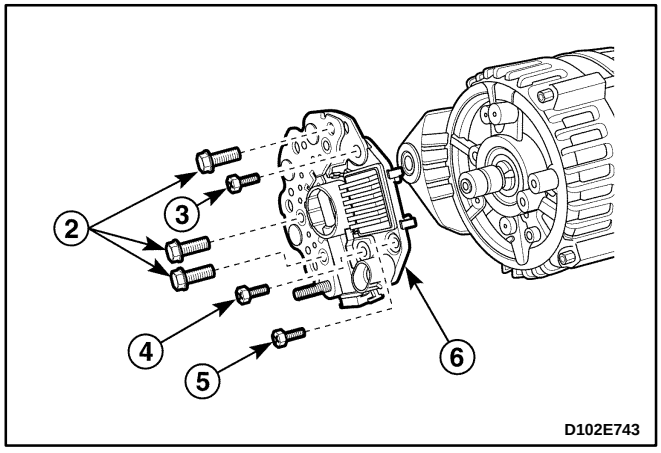
Disassembly Procedure

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).

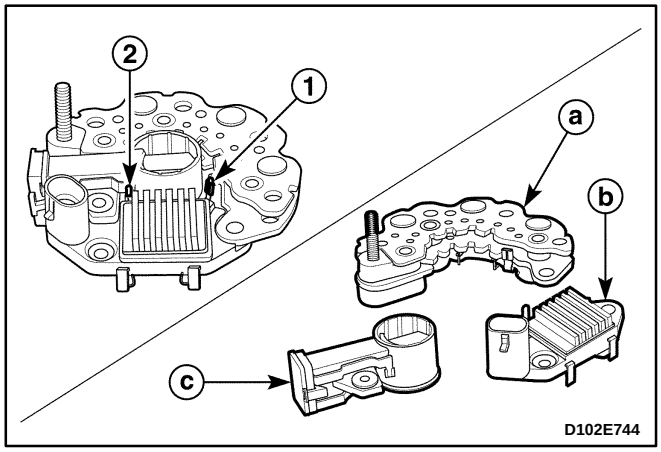
   a. Cover.



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

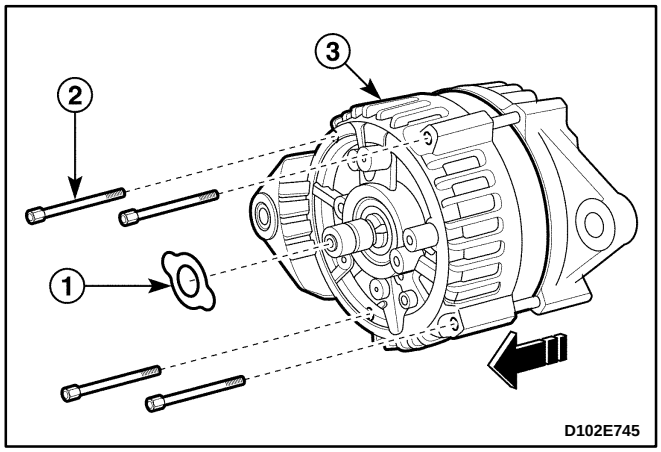


- Remove the rectifier bolts (2).
- Remove the rectifier / regulator screw (3).
- Remove the brush holder / regulator screw (4).
- Remove the regulator screw (5).
- Remove the regulator / brush holder / rectifier assembly (6).

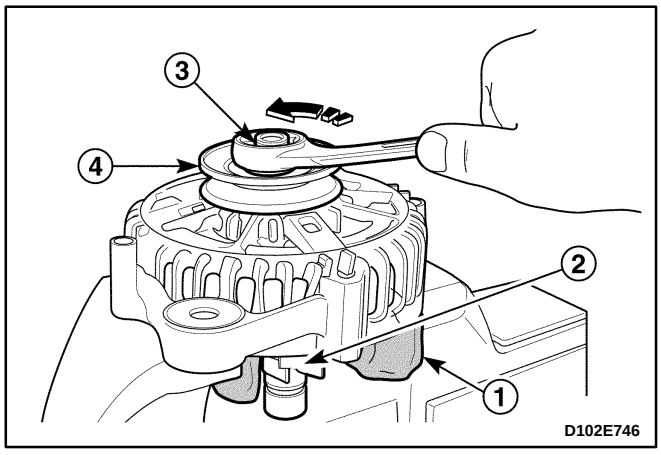


4. Remove the regulator / brush holder / rectifier.
   - Remove the rectifier and regulator connection (1).
   - Remove the regulator and brush holder connection (2).
   - Visibly inspect the rectifier / regulator / brush holder for damage or broken.

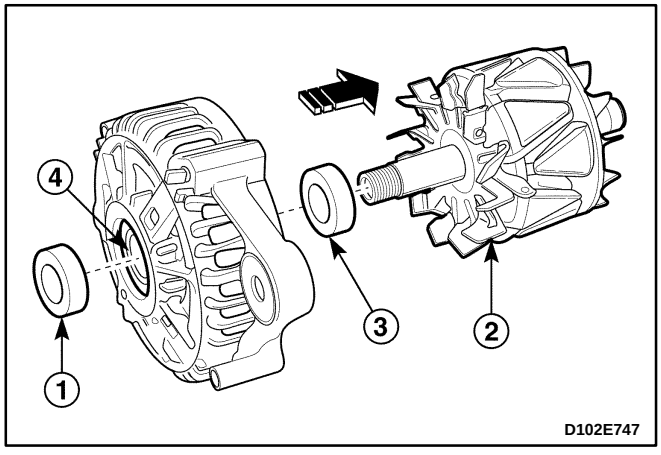
   a. Rectifier.
   b. Regulator.
   c. Brush holder.



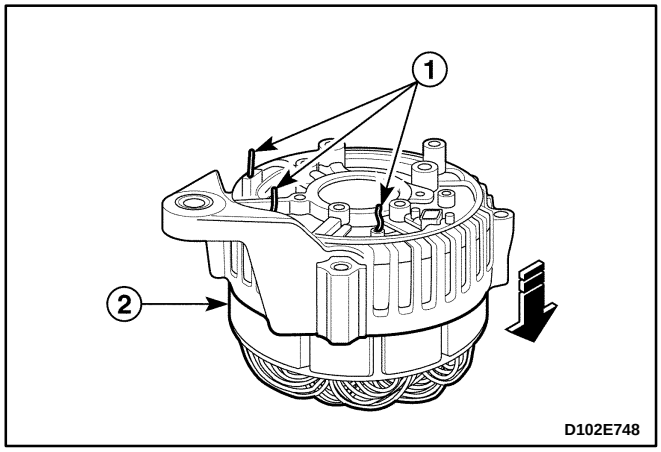
5. Remove the shield before the drive end bracket and the frame.
   - Remove the shield (1).
   - Remove the through-bolts (2).
   - Remove the frame from the drive end bracket (3).



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).

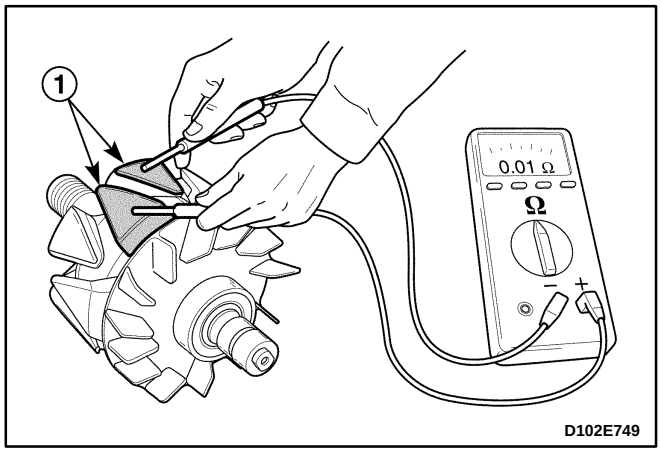


7. Remove the drive end bracket, rotor and space.
   - Remove the collar (1).
   - Remove the rotor from the driver end bracket (2).
   - Remove the collar from the rotor shaft (3).
   - Inspect the front bearing for corrosion, wear, noisy and other damage (4).

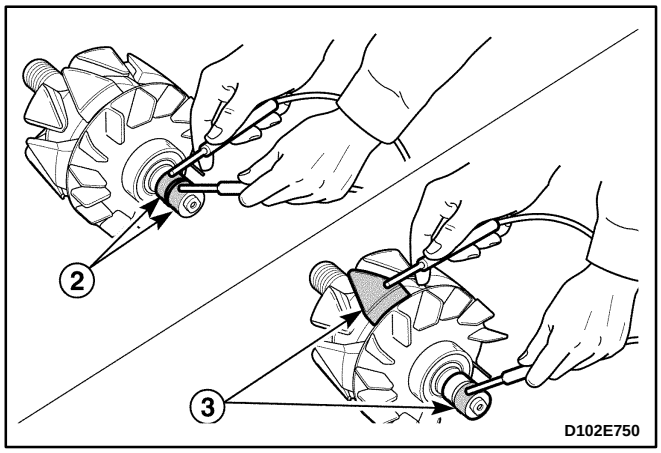


8. Remove the stator assembly from the frame.
   - Remove the remains after the welding.
   - Remove the stator assembly (2).

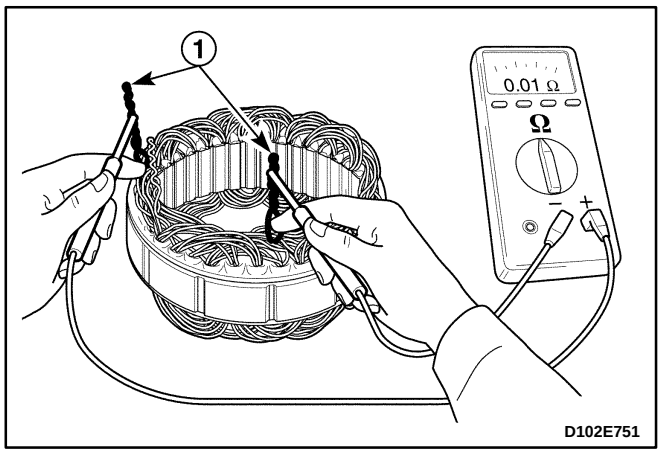
Inspection / Measurement



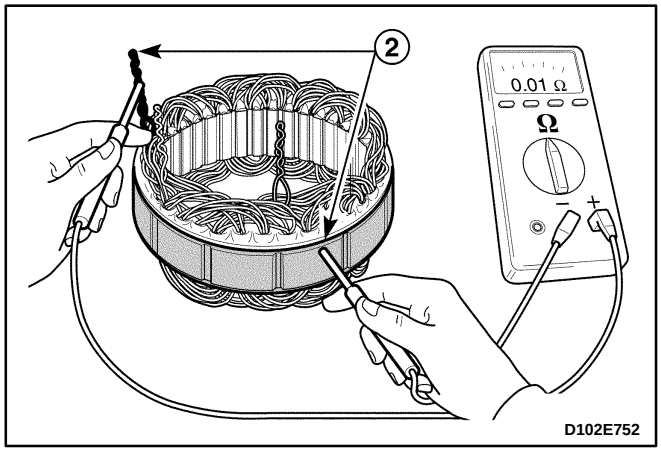
1. Inspect the rotor assembly.
   - Test the rotor coil for an open circuit by using the ohmmeter. The reading should be sufficiently low, or the rotor must be replaced (1).



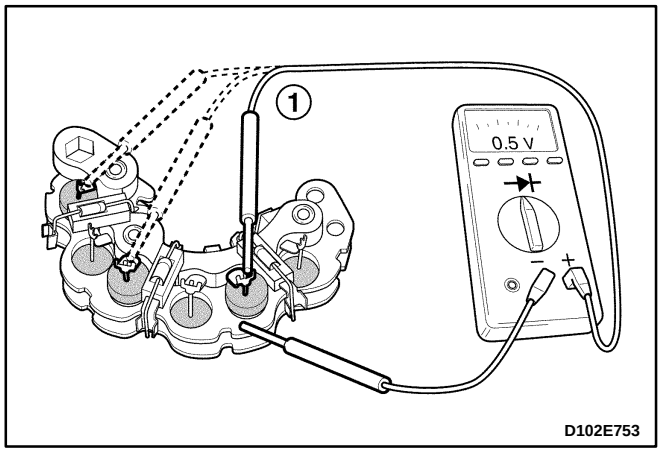
   - Test the rotor for open or short circuits. The reading should be 2.6 to 2.8 ohms, or the rotor should be replaced (2).
   - Test the rotor for open or ground circuits by using the ohmmeter. The reading should be sufficiently high, or the rotor must be replaced (3).
   - Inspect the fan blade for damage.



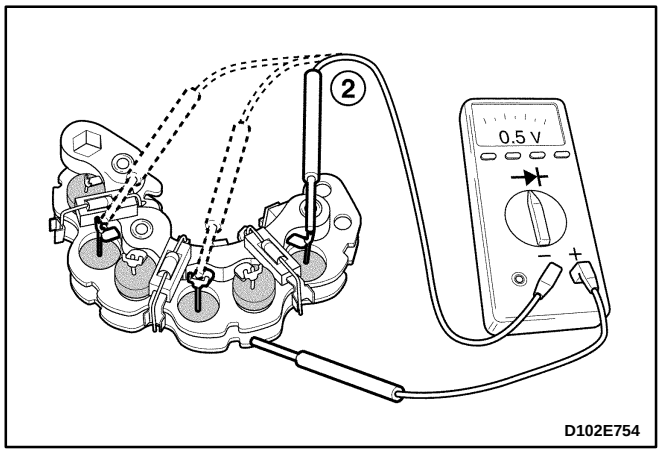
2. Inspect the stator.
   - Test the rotor for an open circuit by using the ohmmeter. The reading should be sufficiently low, or the stator must be replaced (1).



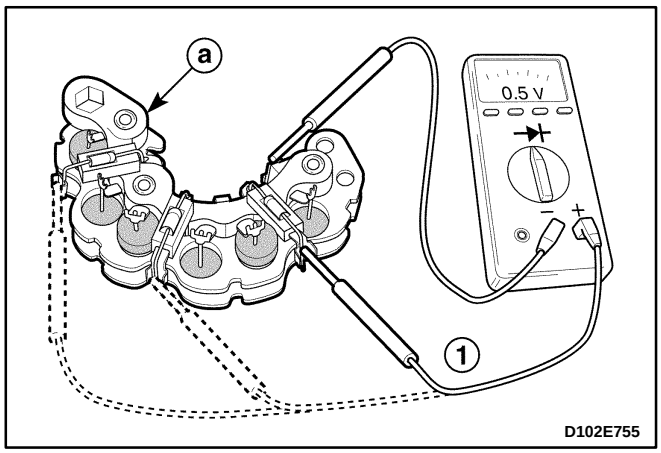
- Test the stator for open or ground circuits by using the ohmmeter. The reading should be sufficiently high, or the stator must be replaced (2).



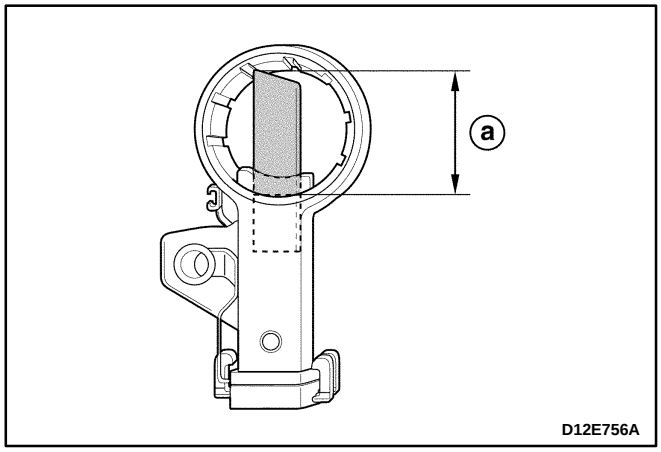
3. Inspect the rectifier.
   - Positive rectifier test:
     Inspect the open circuit for stator coil lead terminals using the ohmmeter (1).
     Replace the rectifier if necessary.



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

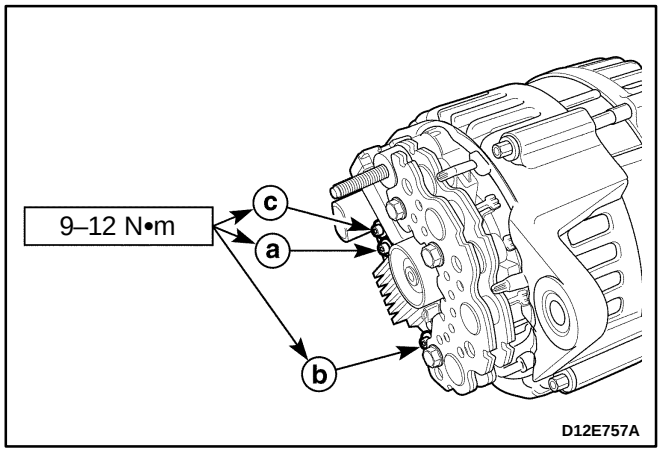


4. Inspect trio diodes.
   - Inspect the open circuit for trio diodes using the ohmmeter (1).
     Replace the heat sink if necessary (a).



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)

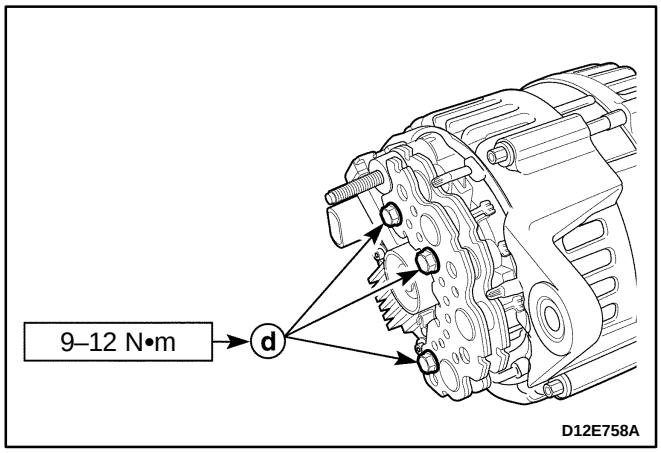


Assembly Procedure

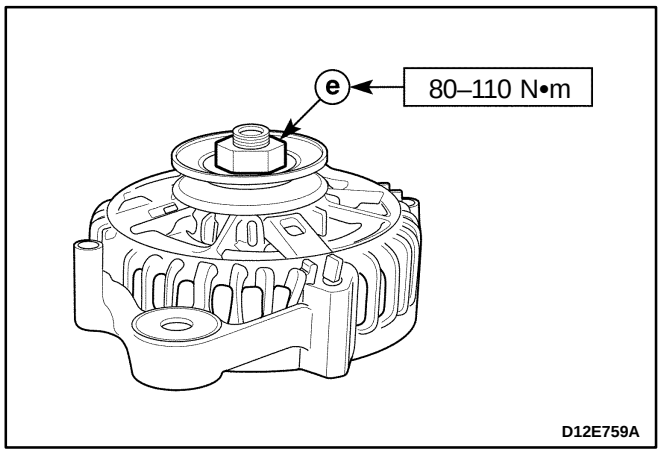
1. Install in the reverse order of removal.
2. Install the screws / nuts / bolts.

Tighten

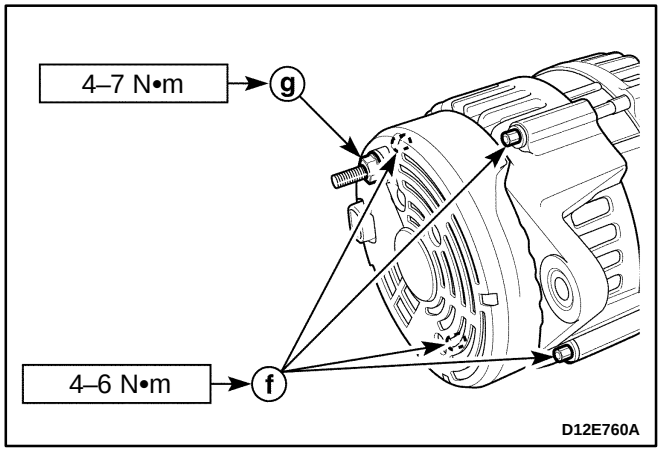
- Tighten the regulator screw to 9–12 N•m (80–106 lb-in) (a).
- Tighten the rectifier / regulator screw to 9–12 N•m (80–106 lb-in) (b).
- Tighten the brush holder / regulator screw to 9–12 N•m (80–106 lb-in) (c).



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



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

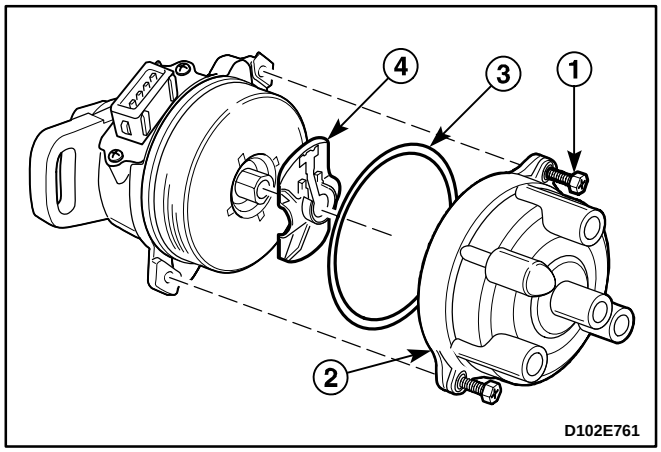


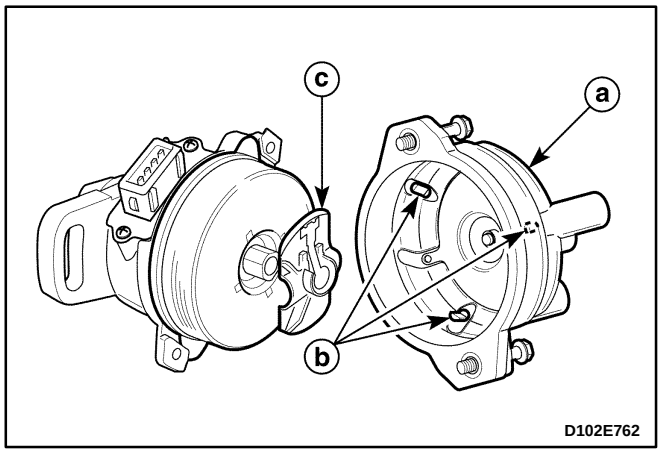
- Tighten the through-bolts to 4–6 N•m (35–53 lb-in) (f).
- Tighten the battery positive terminal nut to 4–7 N•m (35–62 lb-in) (g).

DISTRIBUTOR ASSEMBLY

Disassembly Procedure

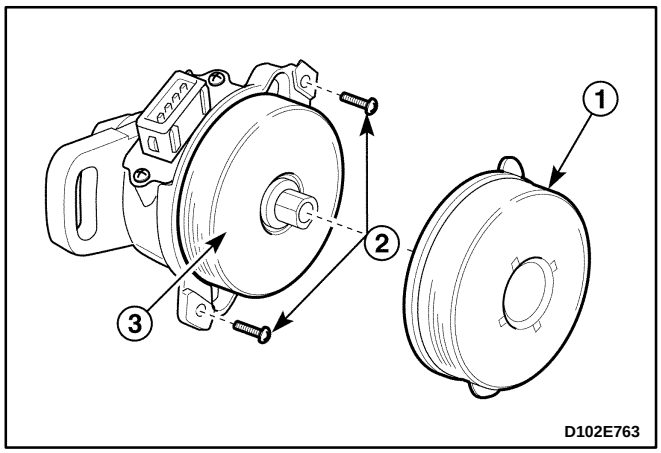
1. Remove the distributor. Refer to “Distributor” in this section.
2. Remove the cap, seal and rotor from the distributor housing.
   - Remove the bolts (1).
   - Remove the distributor cap (2).
   - Remove the seal (3).
   - Remove the rotor (4).

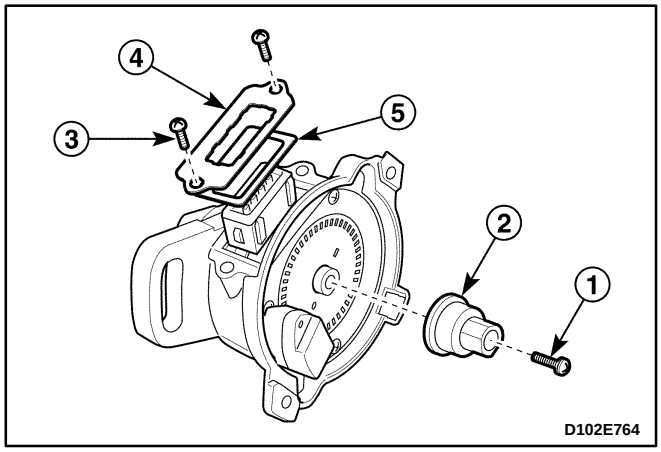




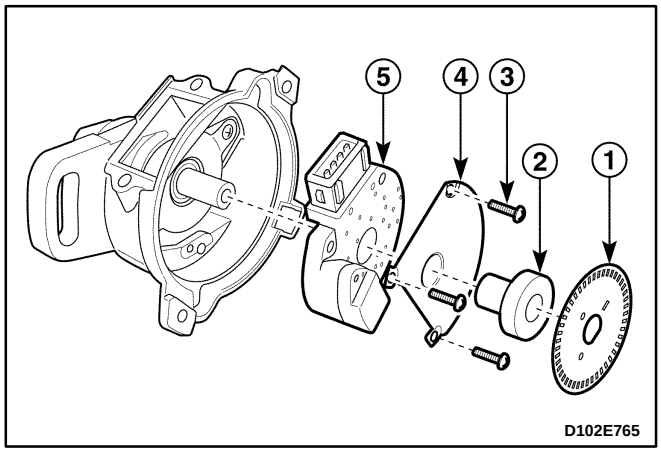
- Inspect the cap for cracks or damage (a).
- Inspect the cap electrode for damage / wear or carbon traces (b).
- Inspect the rotor for damage or carbon traces (c).

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

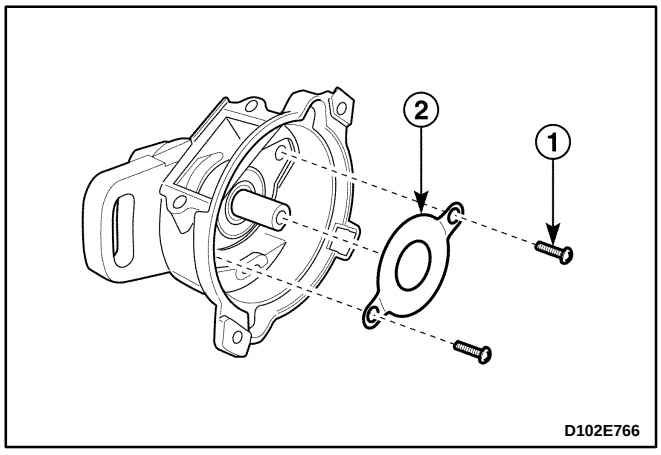




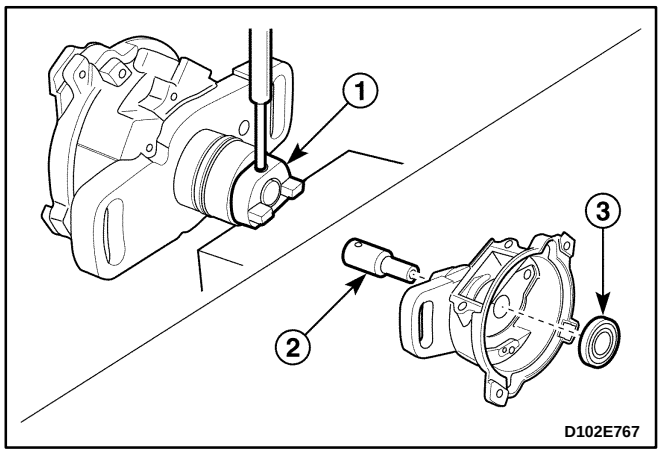
4. Remove the optical sensor cover and adaptor from the distributor housing.
   - Remove the screw (1).
   - Remove the adaptor (2).
   - Remove the screws (3).
   - Remove the cover (4).
   - Remove the gasket (5).



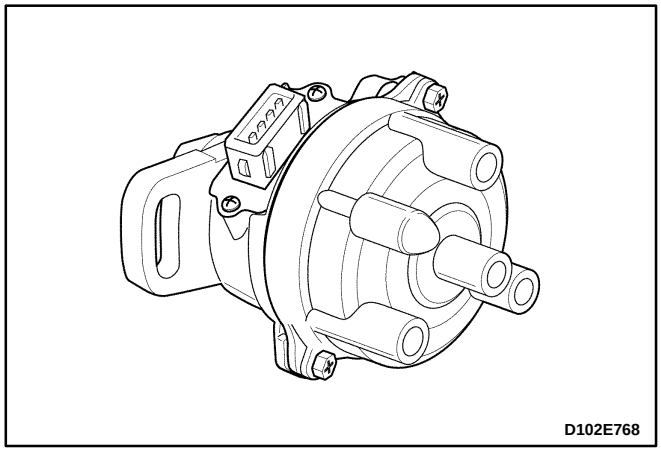
5. Remove the optical sensor unit from the distributor housing.
   - Carefully remove the disc wheel (1).
   - Remove the bushing (2).
   - Remove the screws (3).
   - Remove the optical sensor unit plate (4).
   - Remove the optical sensor unit (5).



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).

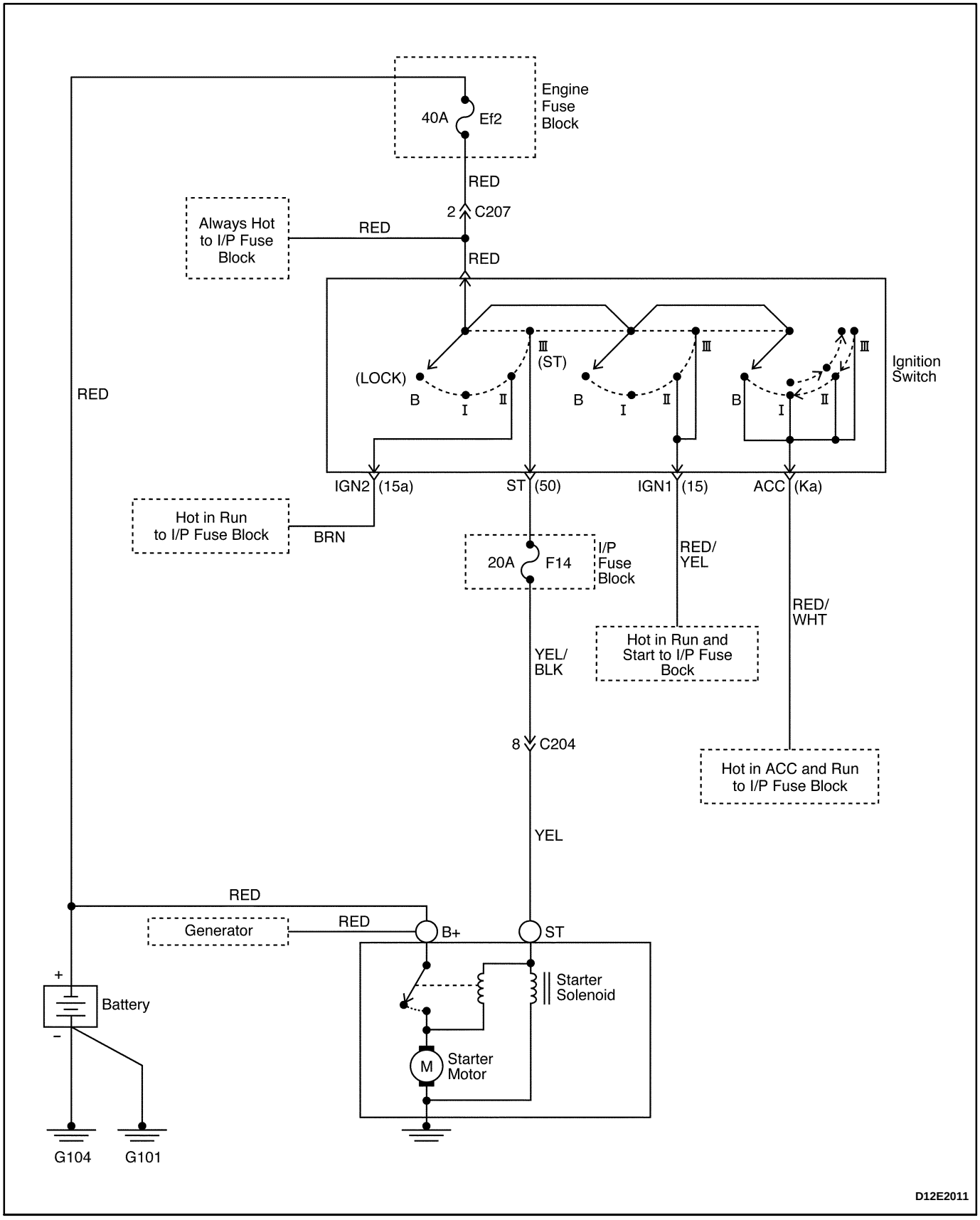


Assembly Procedure

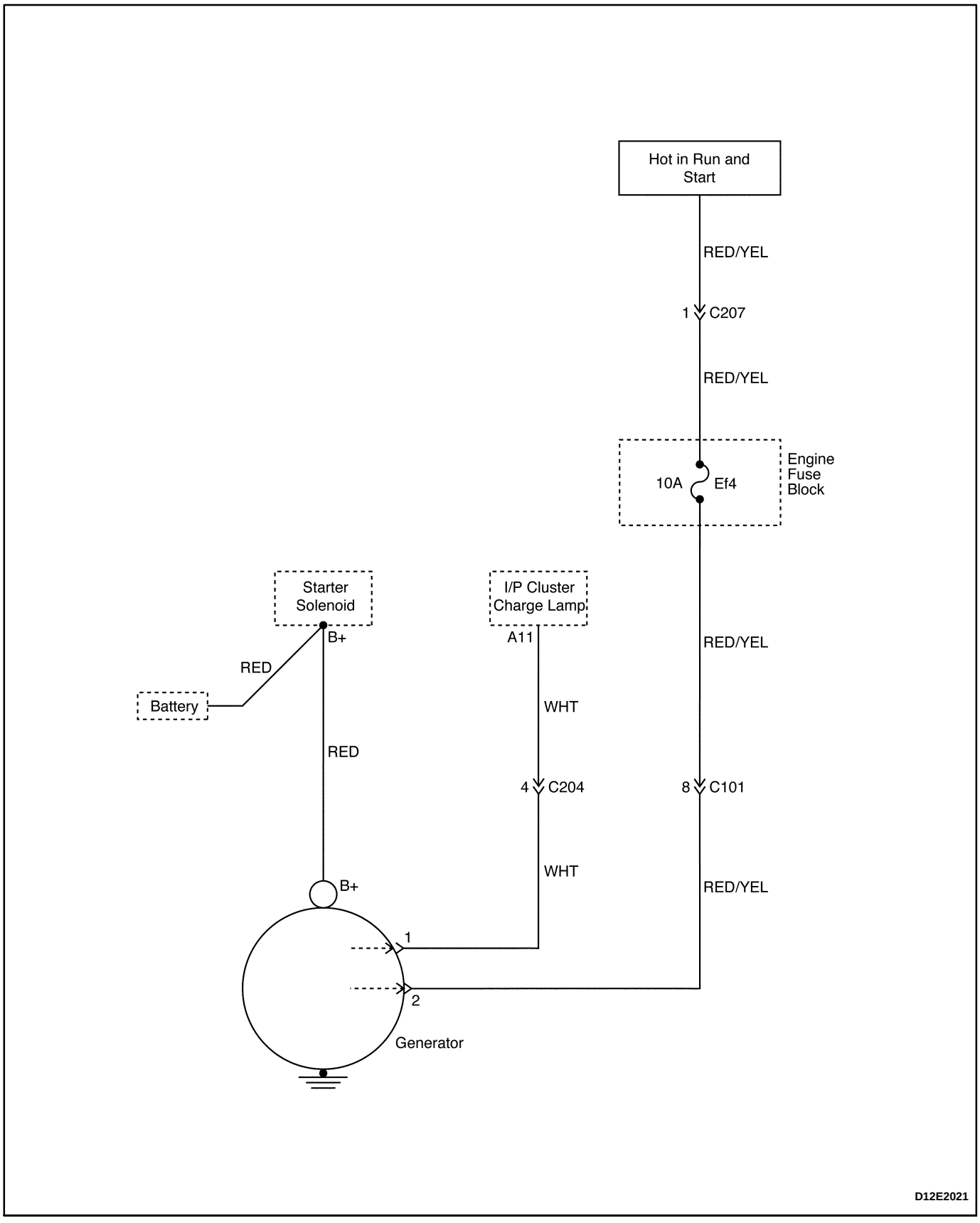
1. Install in the reverse order of removal.
   - Lubricate the shaft with clean engine oil.

SCHEMATIC AND ROUTING DIAGRAMS

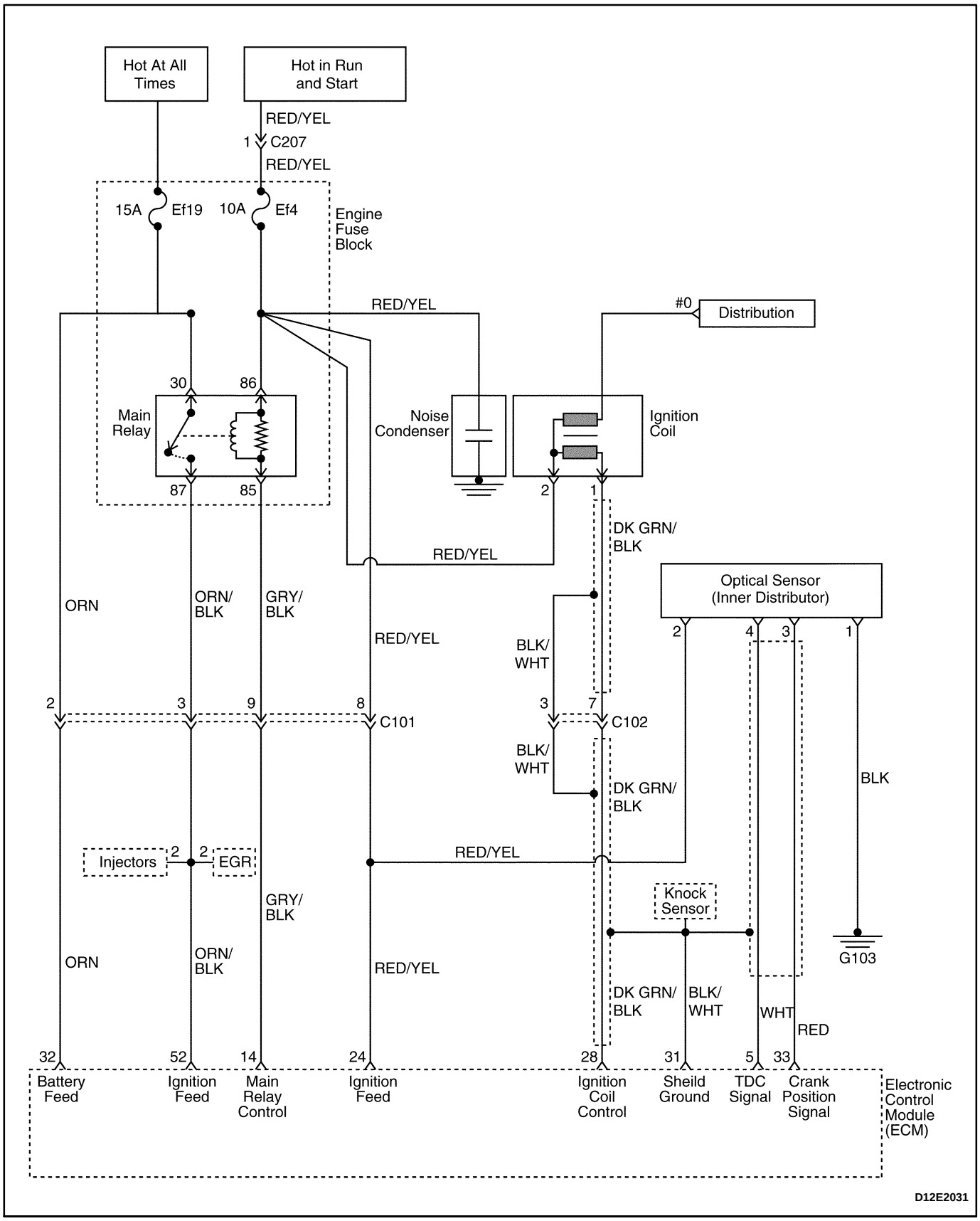
STARTING SYSTEM



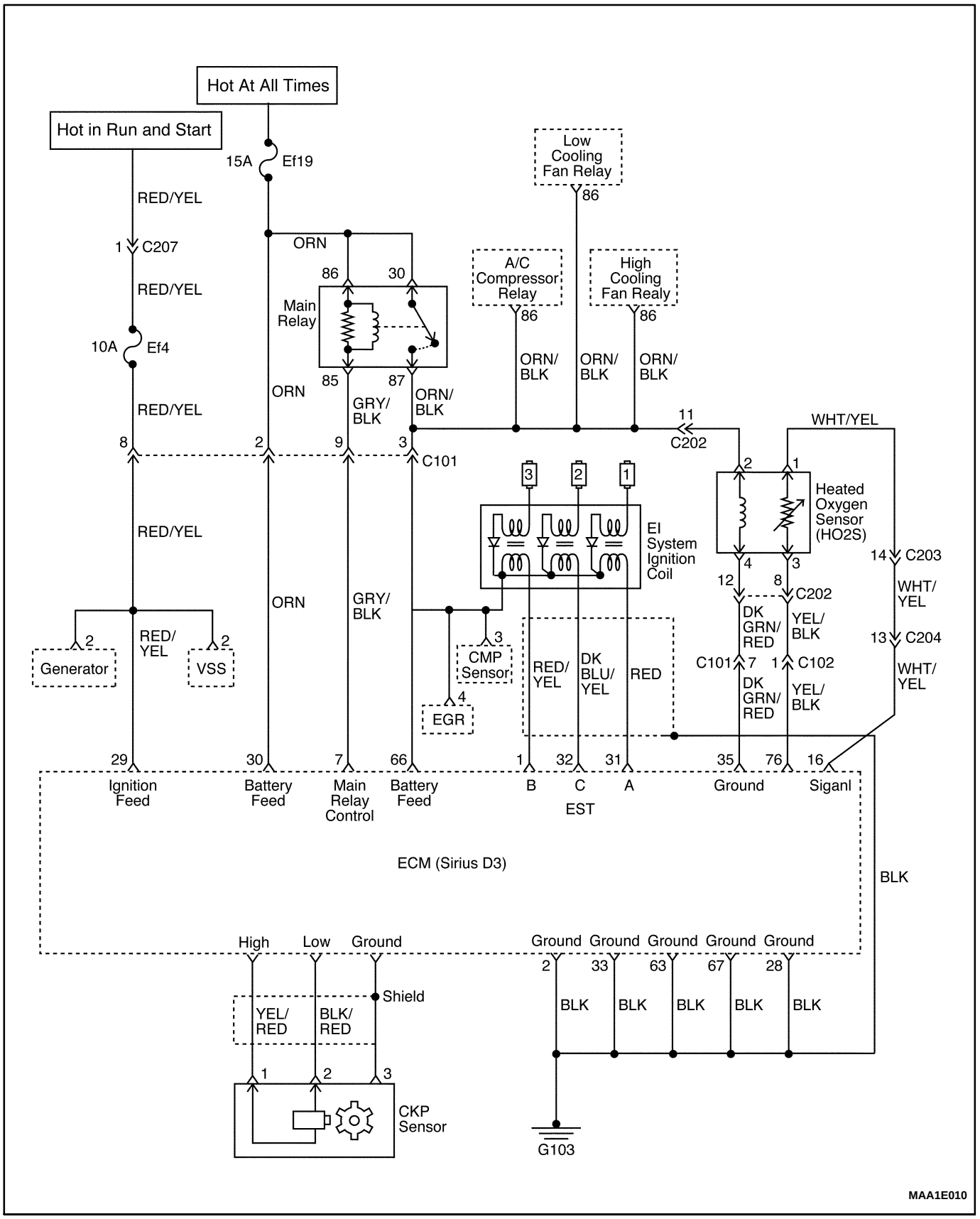
CHARGING SYSTEM



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.

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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 va-

pors. 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 calcula-

tions. 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 in-

termittent 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

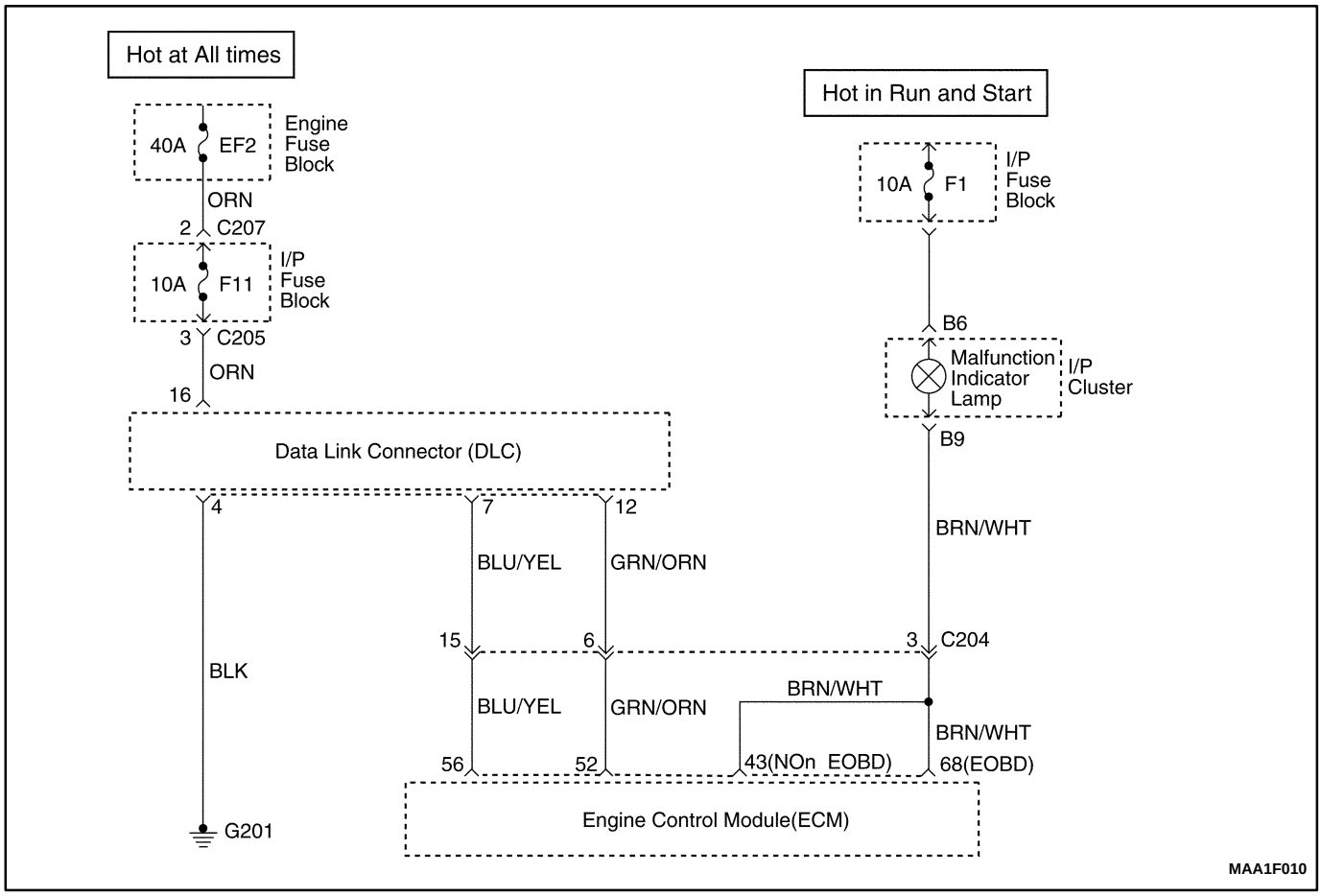
Some intermittent driveability problems can be attributed to poor fuel quality. If a vehicle is occasionally running rough, stalling, or otherwise performing badly, ask the customer about the following fuel buying habits:

- 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.

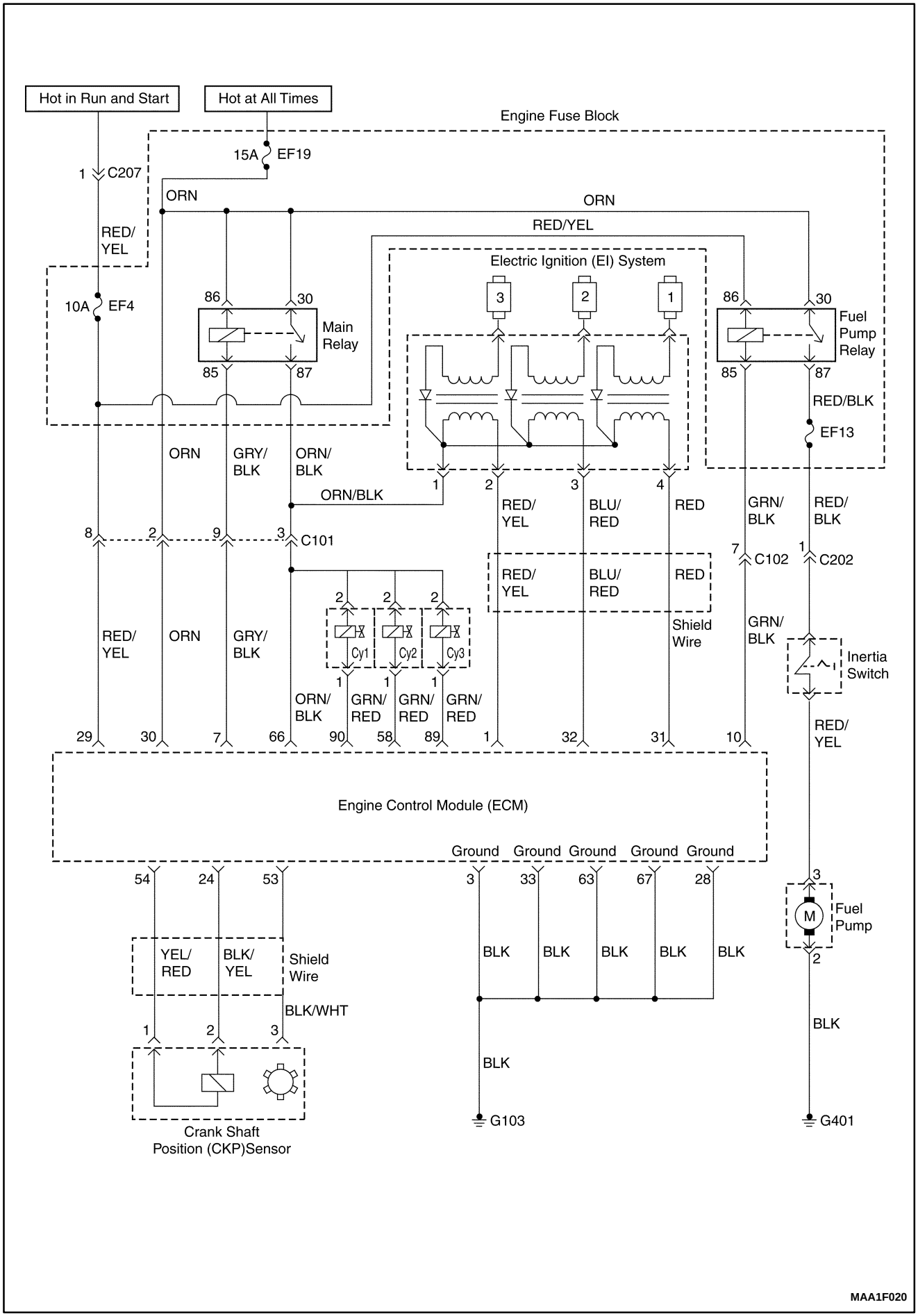
Multiple ECM Information Sensor DTCs Set

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)

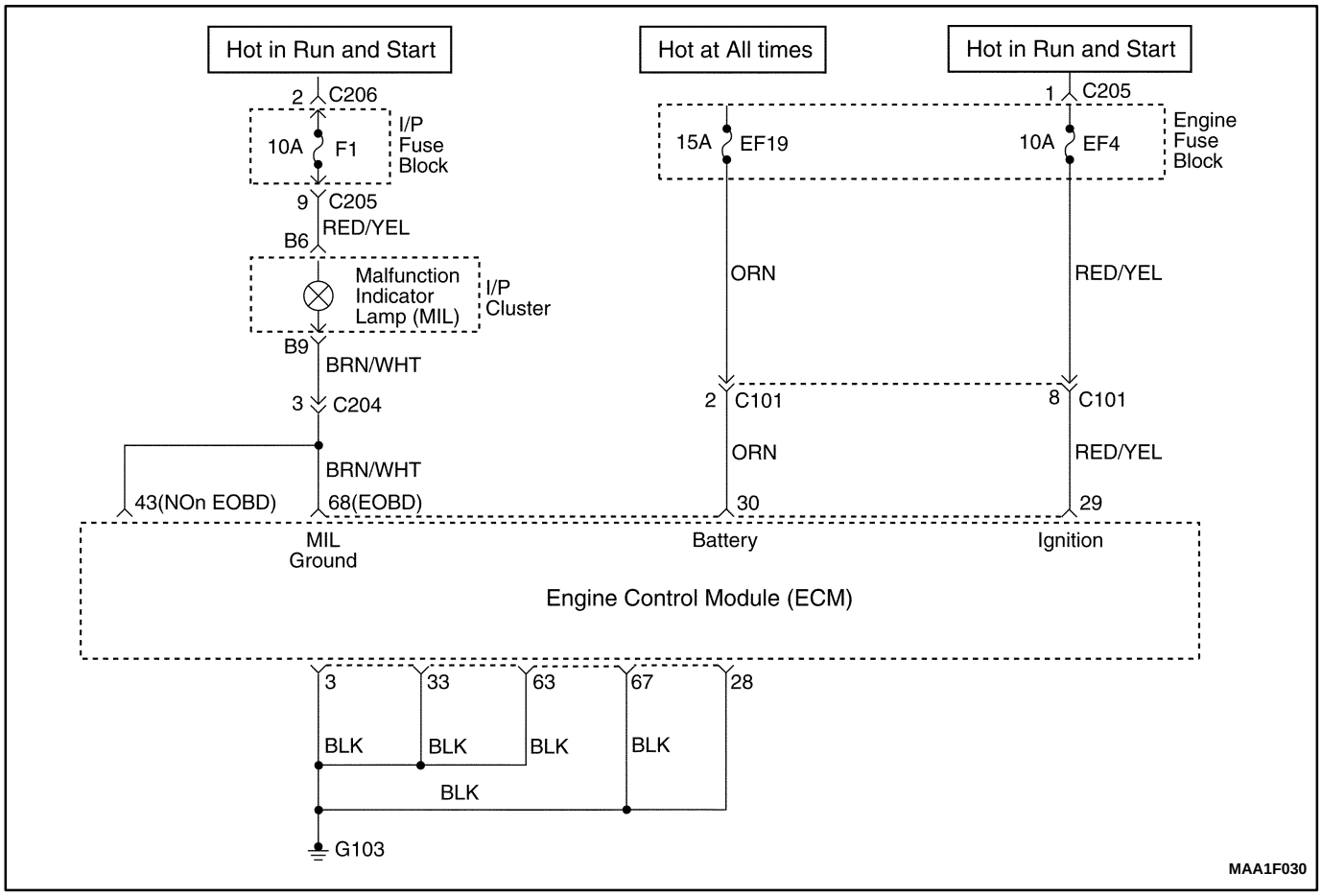
Step	Action	Value(s)	Yes	No
21	1. Check for any damages or poor connection in ignition wires and repair as needed. 2. Connect the Ei system ignition coil connector and ECM connector. 3. Check for the presence of spark from all of the ignition wires. Is the spark present from all of the ignition wires?	–	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

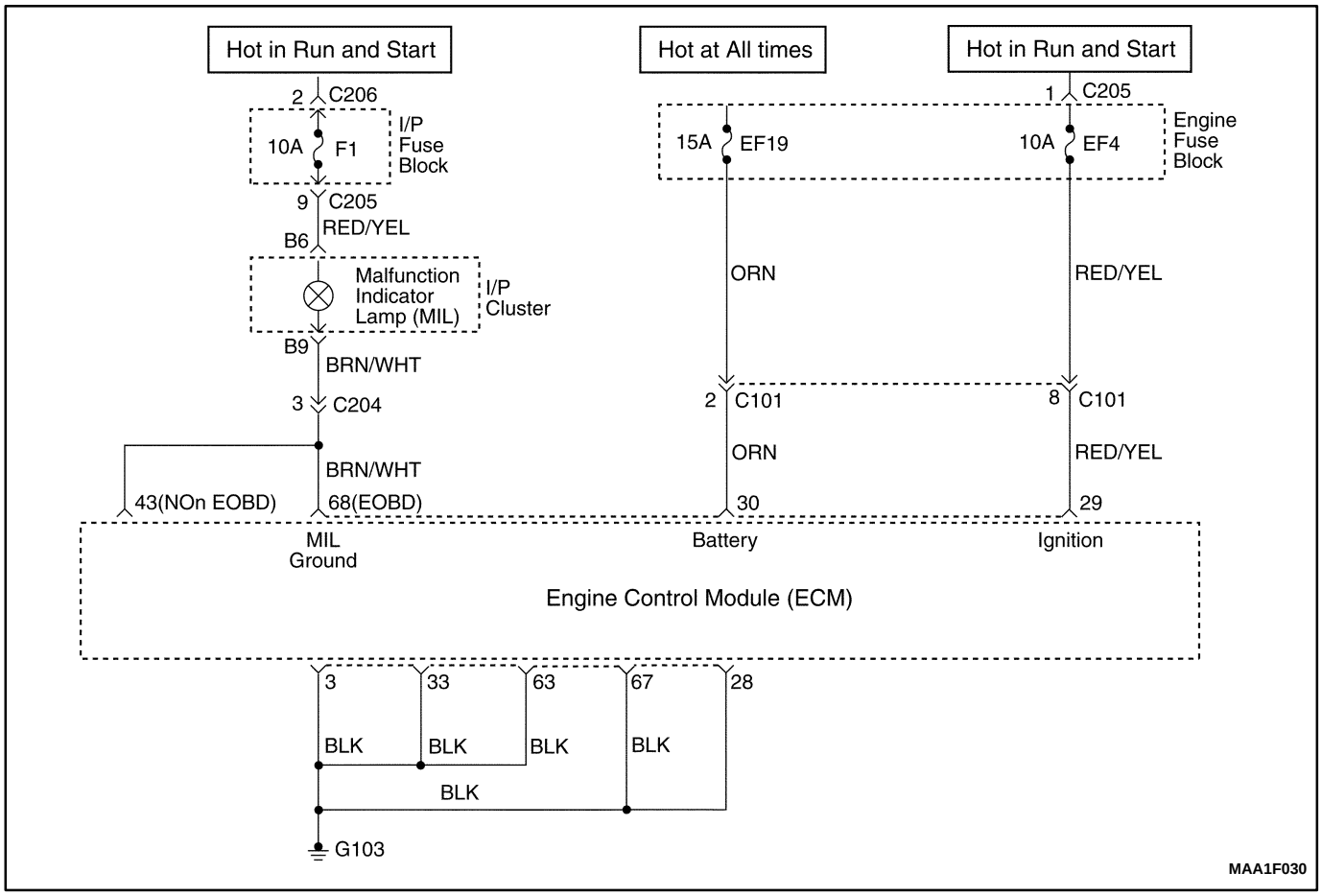
An open ignition F16 fuse will cause the entire cluster to be inoperative.

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

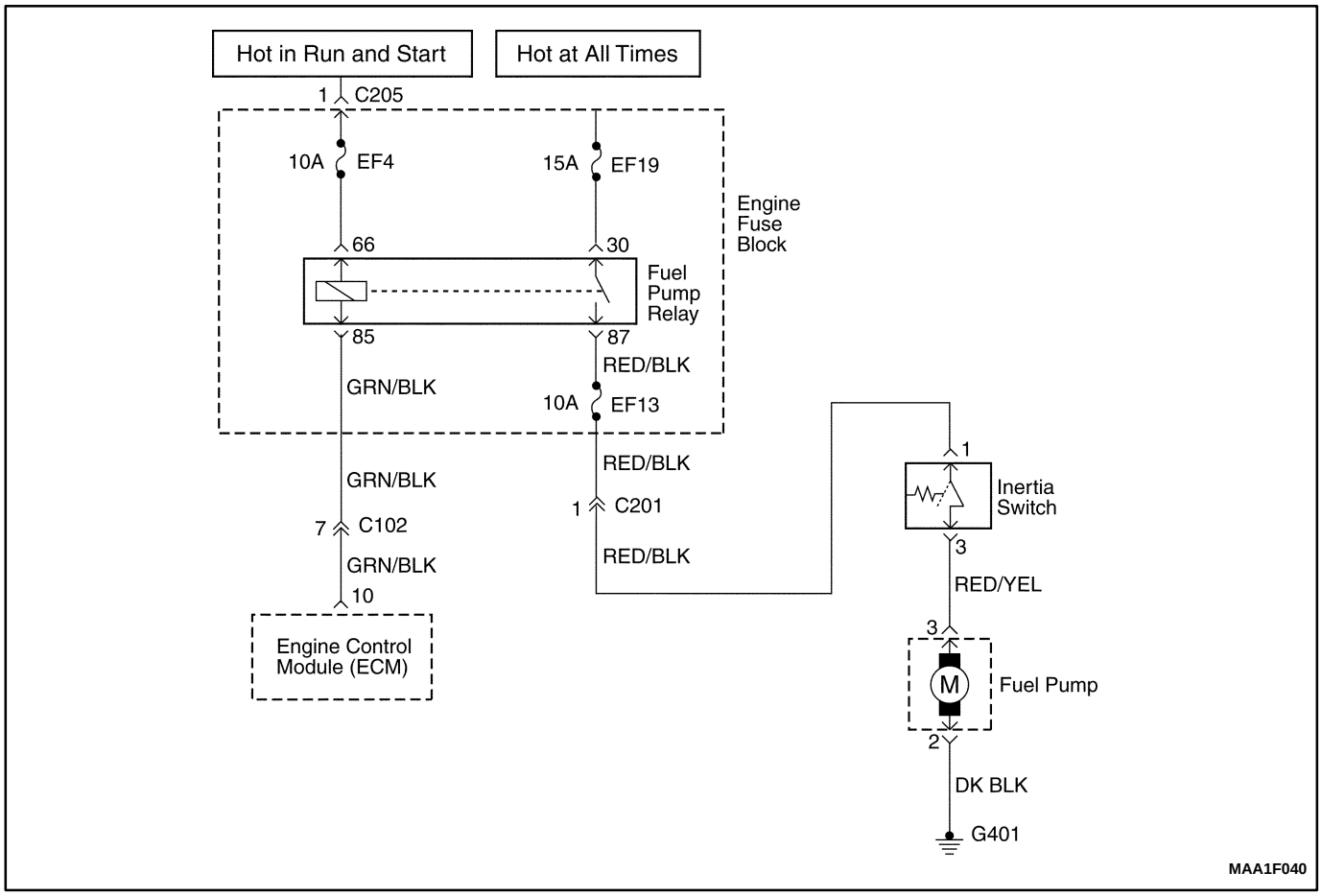
1. Remove the fuel cap.
2. Remove the fuel pump fuse EF23 from the engine fuse block.
3. Start the engine and allow the engine to stall.
4. Crank the engine for an additional 10 seconds.

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

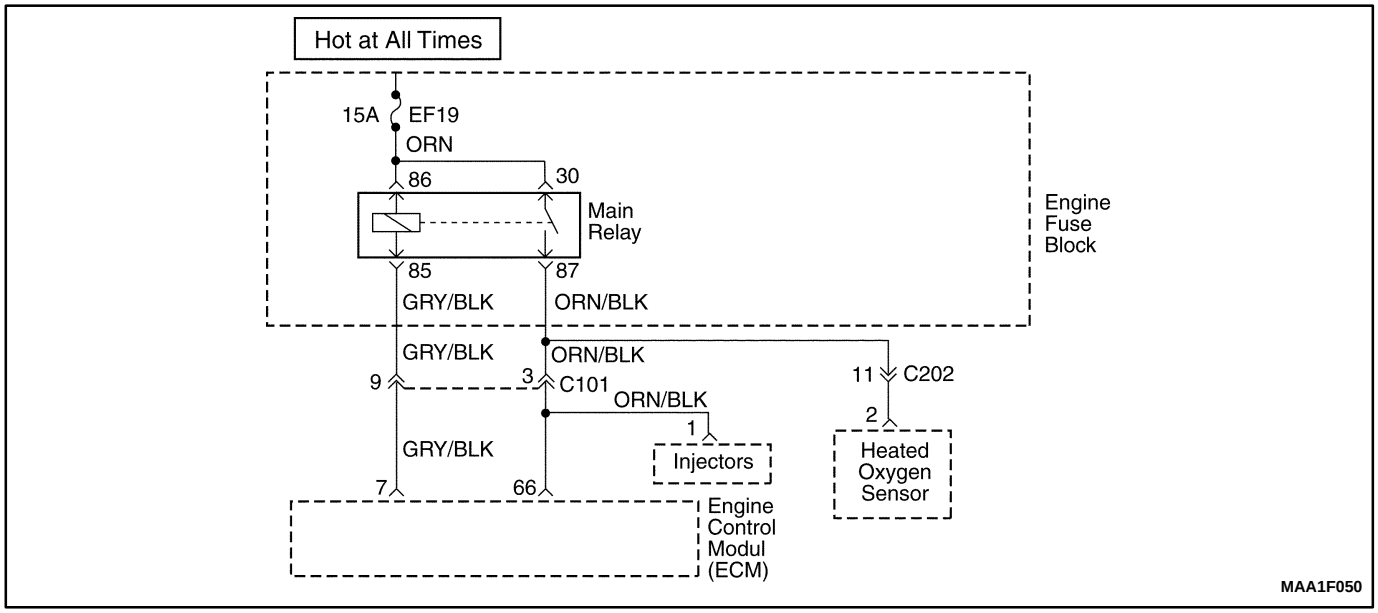
An intermittent problem may be caused by a poor connection, rubbed through wire insulation, or a broken wire inside the insulation.

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

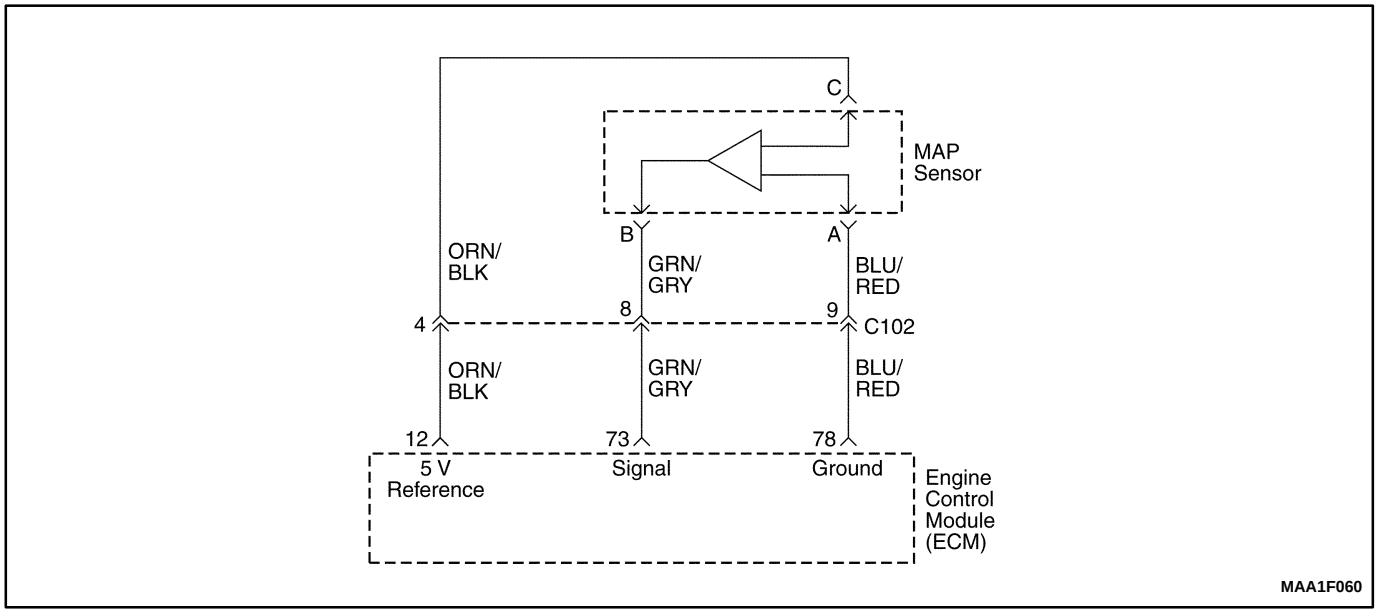
When the ignition is turned On or to the START position, the main relay is energized. The main relay then supply voltage to the engine fuse block fuse EF25 and EF26. The Electronic Ignition (EI) system ignition coil is supplied voltage through the engine fuse block fuse EF26. The fuel injectors are supplied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



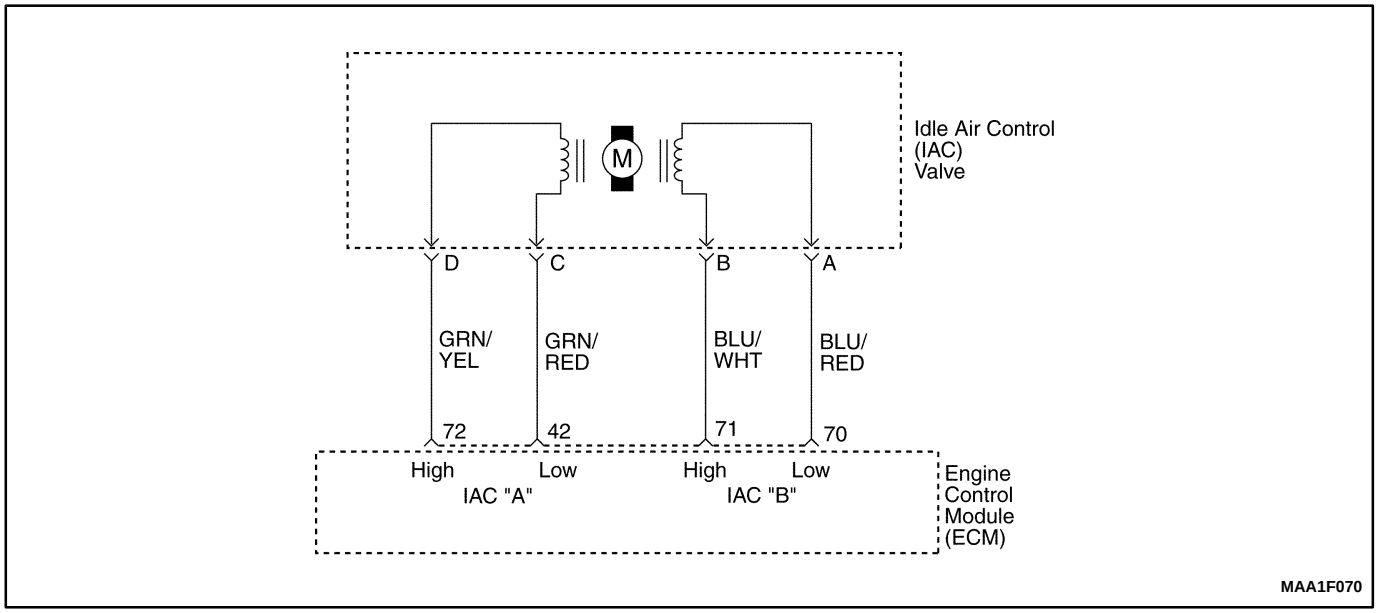
MANIFOLD ABSOLUTE PRESSURE CHECK

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

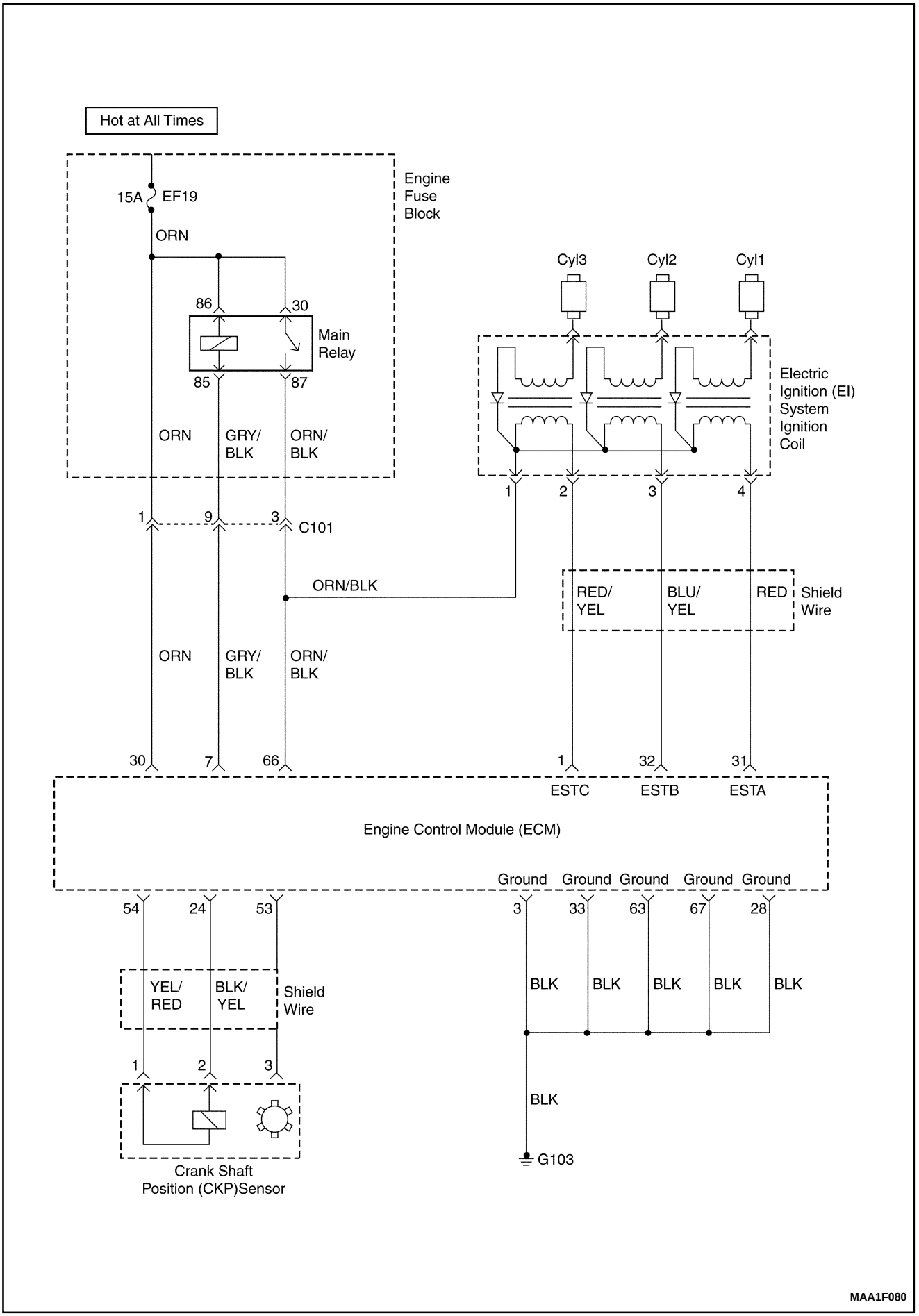
Whenever the battery cable or the Engine Control Module (ECM) connector or the ECM fuse EF6 is disconnected or replaced, the following idle learn procedure must be performed:

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.

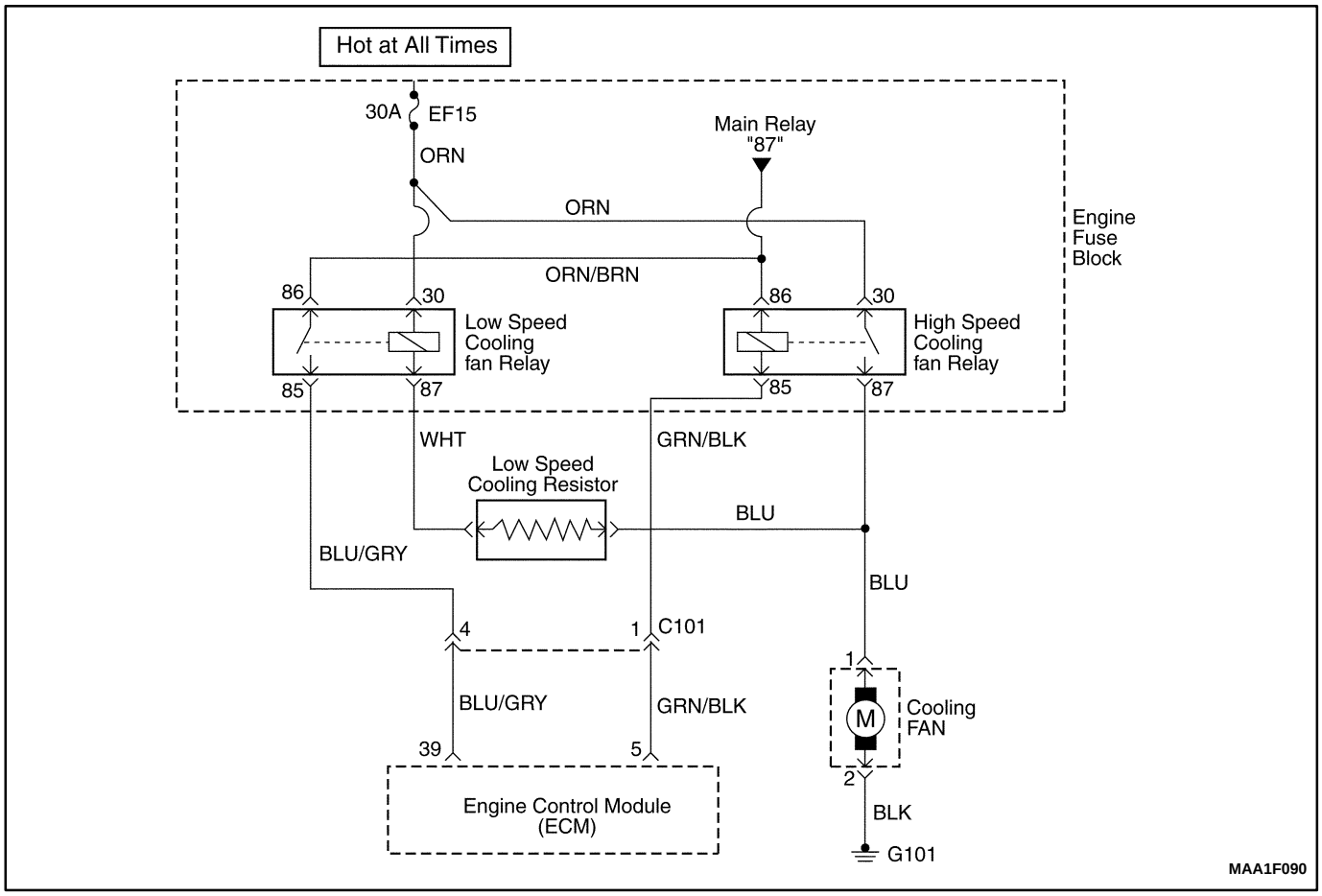
Step	Action	Value(s)	Yes	No
1	1. Remove the spark plugs. 2. Inspect for wet spark plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. 3. Replace the spark plugs as needed. Is the repair complete?	–	System OK	Go to *Step 2*
2	Check for the presence of spark from all of the ignition 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	–

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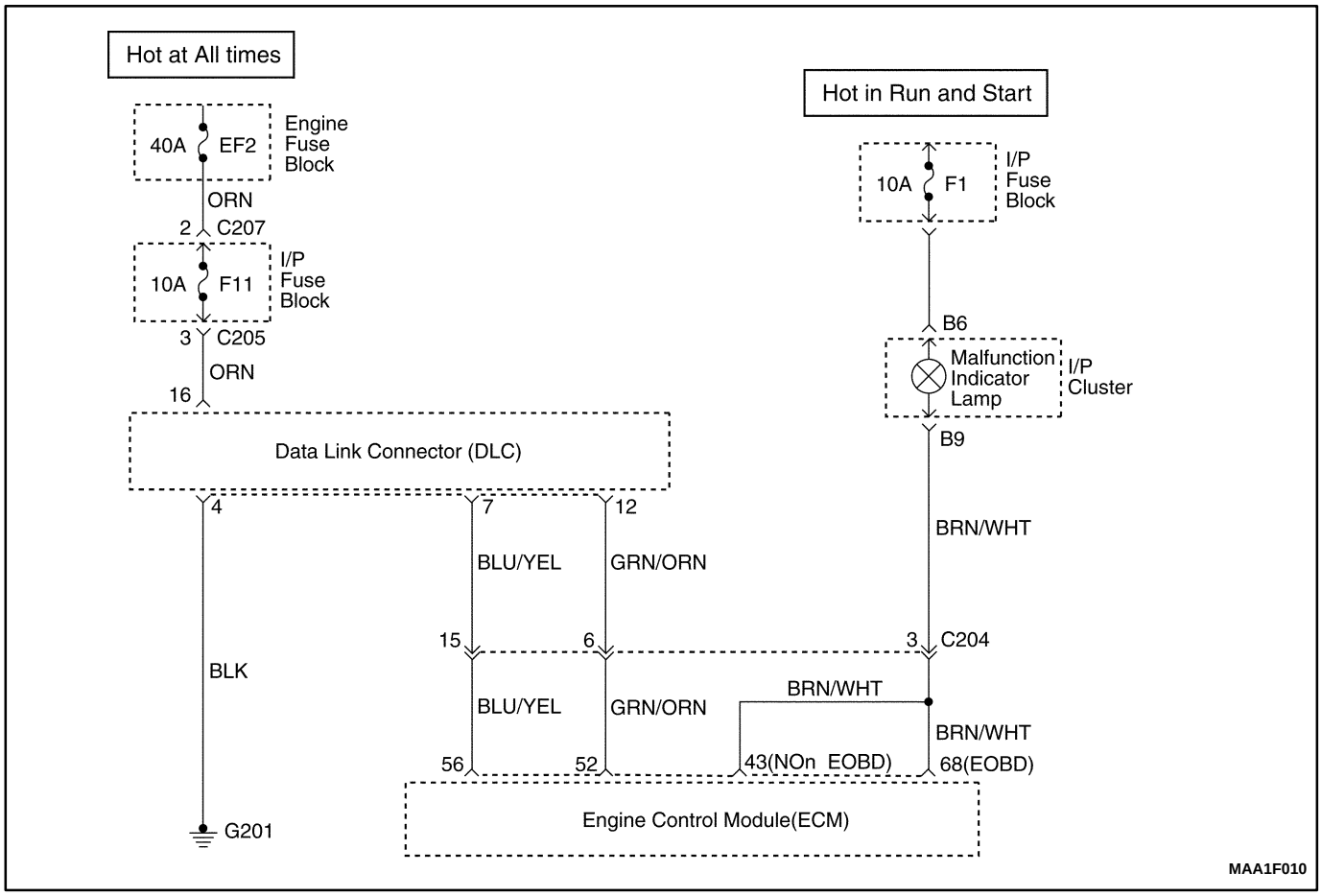


DATA LINK CONNECTOR DIAGNOSIS

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

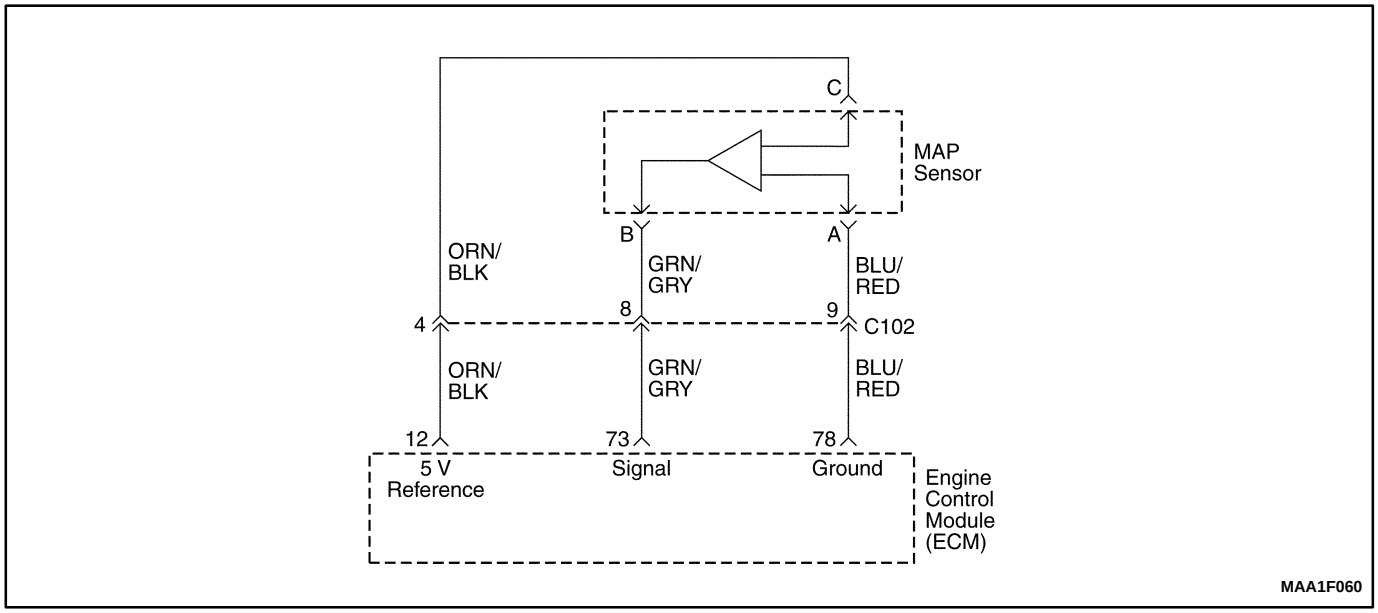
DTC	Function	Error Type	Illuminate MIL
P0107	Manifold Absolute Pressure Sensor Low Voltage	A	YES
P0108	Manifold Absolute Pressure Sensor High voltage	A	YES
P0112	Intake Air Temperature Sensor Low Voltage	E	YES
P0113	Intake Air Temperature Sensor High voltage	E	YES
P0117	Engine Coolant Temperature Sensor 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

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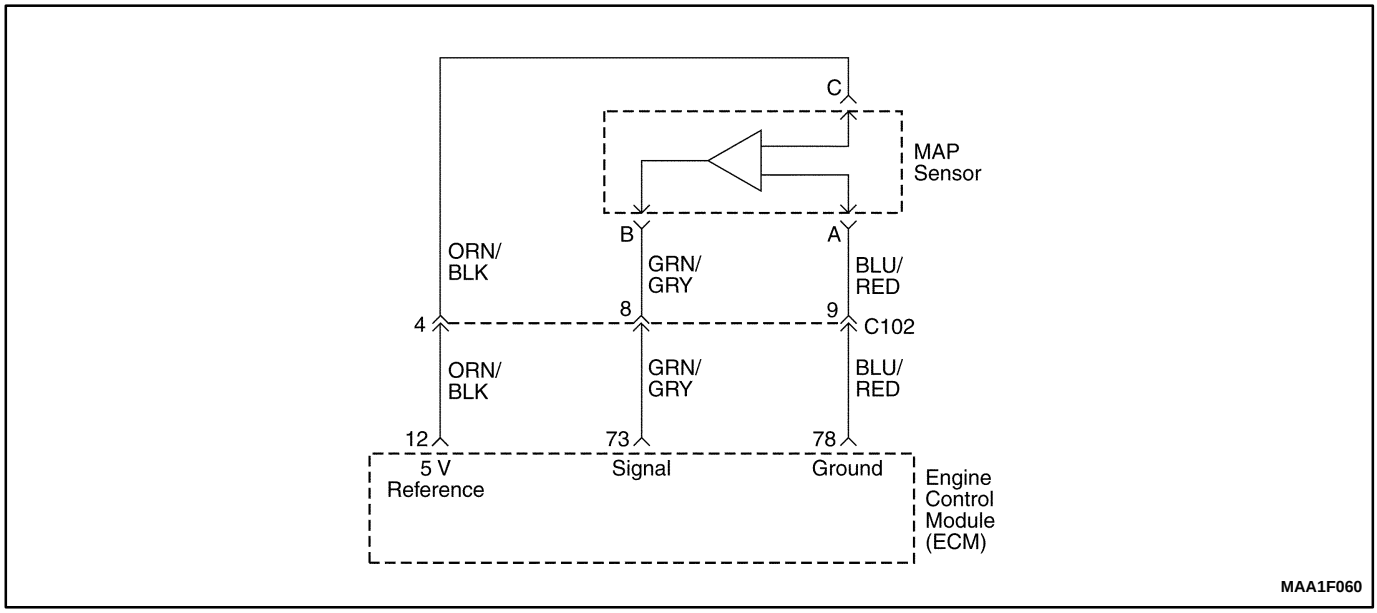

DIAGNOSTIC TROUBLE CODE (DTC) – P0108 MANIFOLD ABSOLUTE PRESSURE SENSOR HIGH VOLTAGE

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

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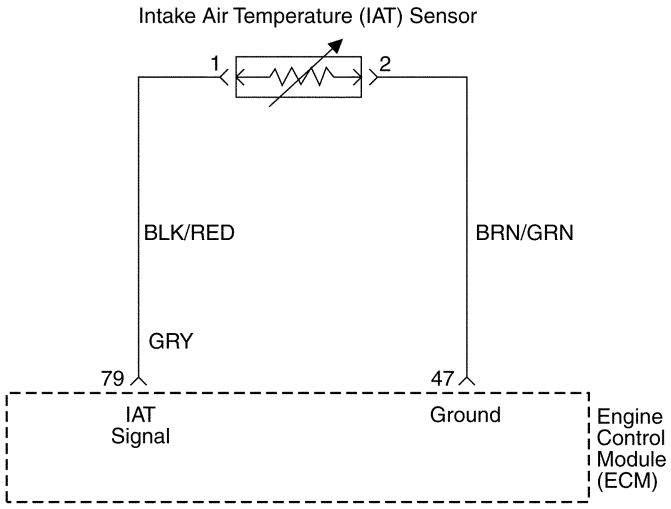


MAA1F100

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

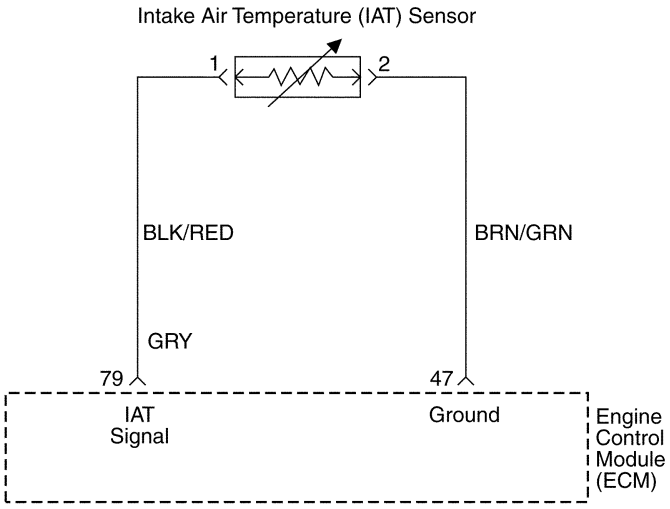
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

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



MAA1F100

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

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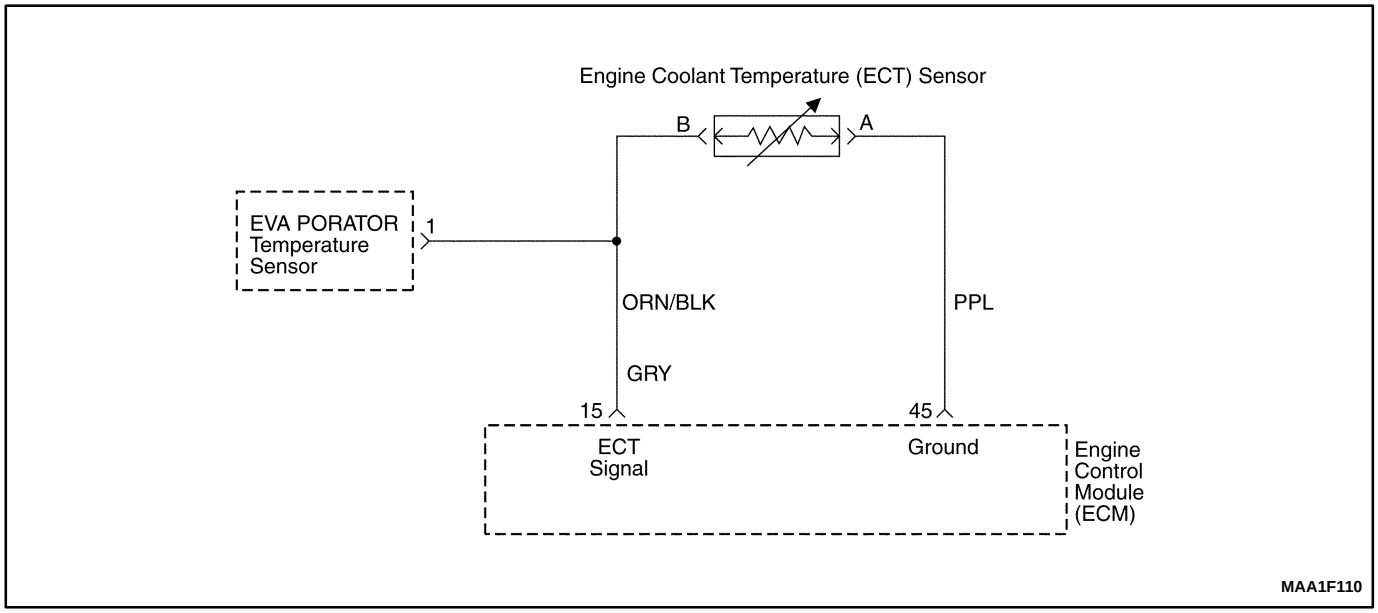


DIAGNOSTIC TROUBLE CODE (DTC) – P0117 ENGINE COOLANT TEMPERATURE SENSOR LOW VOLTAGE

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.

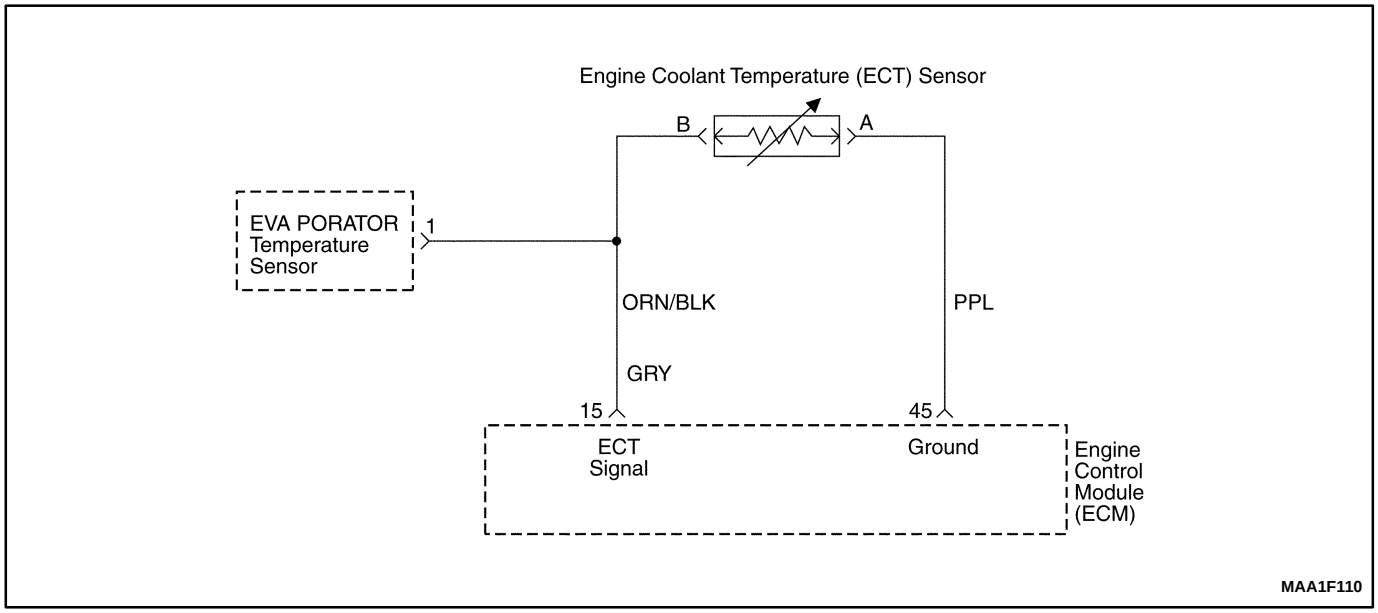
Diagnostic Aids

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.

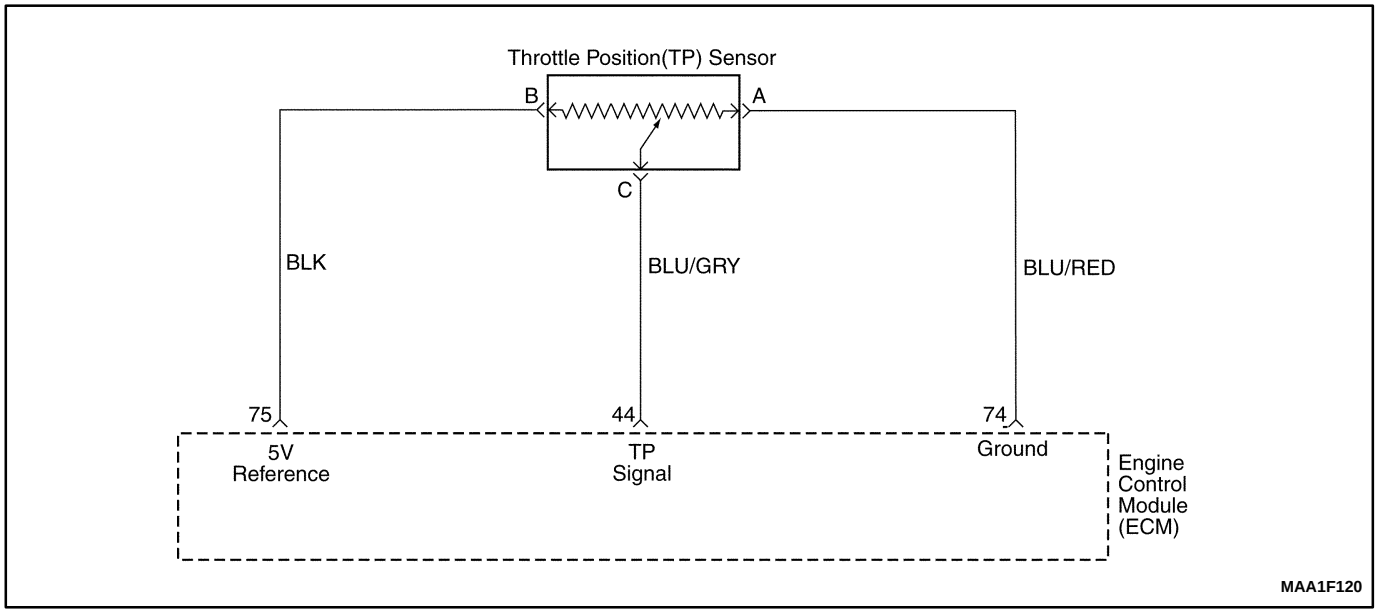
Diagnostic Aids

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

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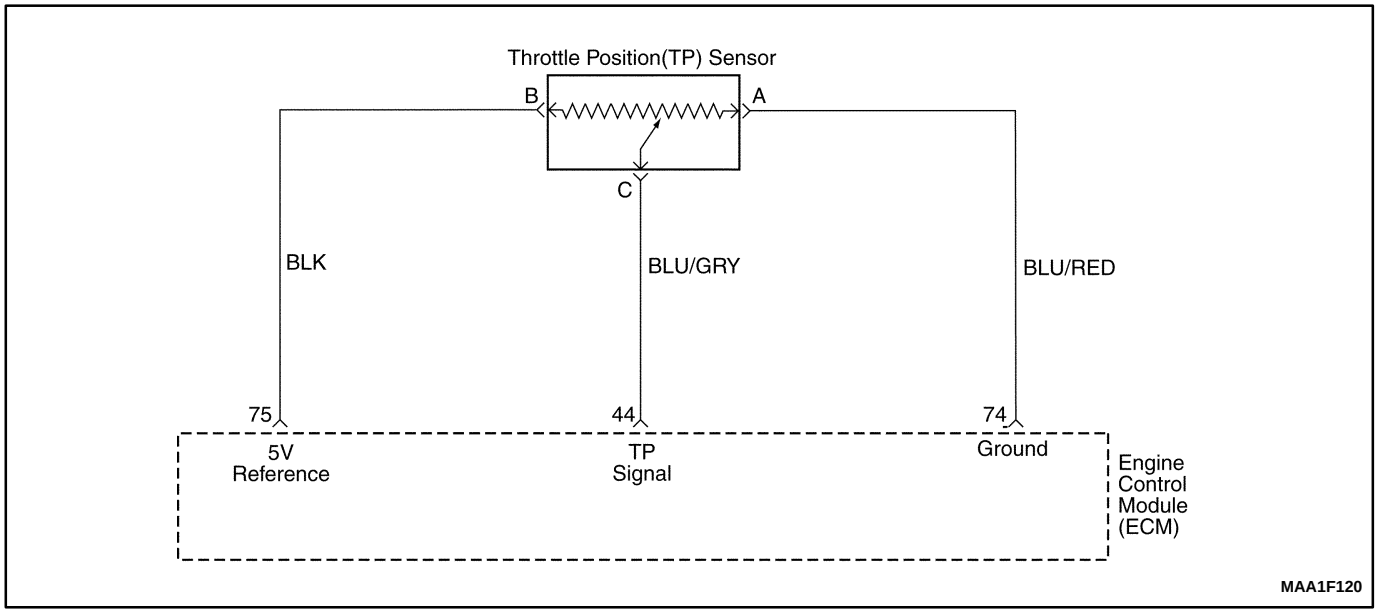

DIAGNOSTIC TROUBLE CODE (DTC) P0123
THROTTLE POSITION SENSOR HIGH VOLTAGE

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

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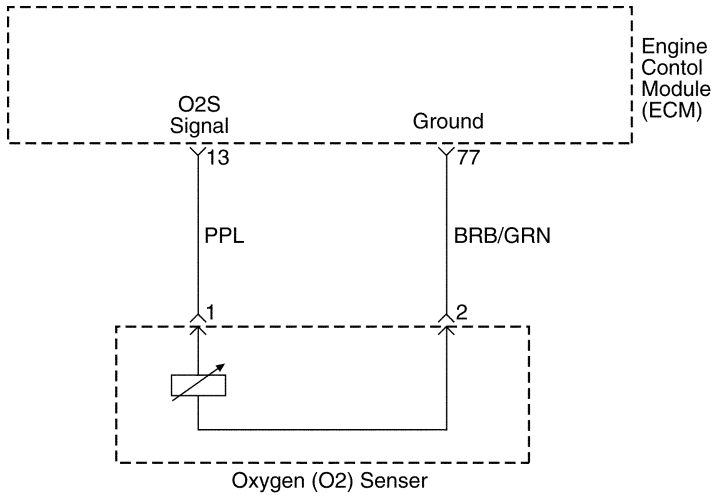

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DIAGNOSTIC TROUBLE CODE (DTC) – P0131 OXYGEN SENSOR LOW VOLTAGE

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

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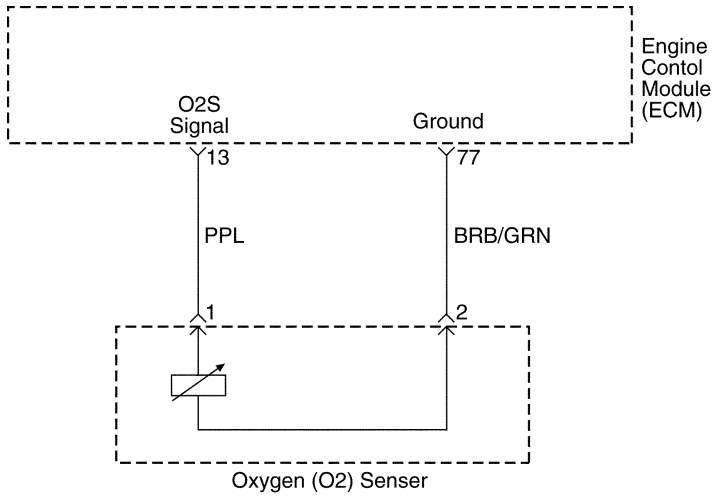

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DIAGNOSTIC TROUBLE CODE (DTC) – P0132 OXYGEN SENSOR HIGH VOLTAGE

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.

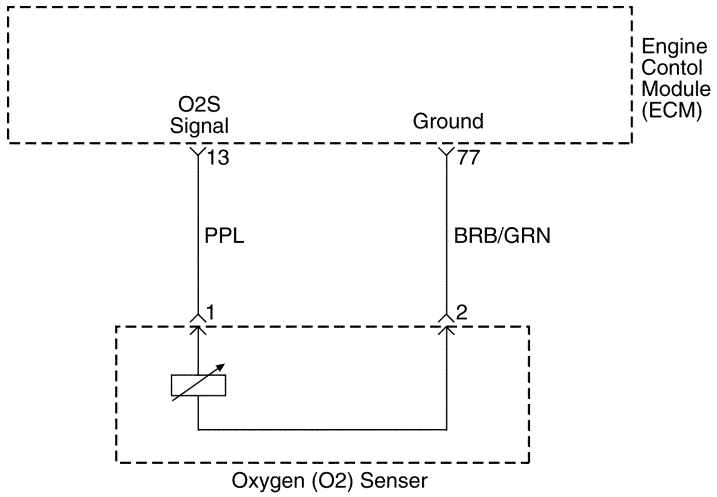
Perform an injector 2alance test to determine if a restricted fuel injector may be causing the lean condition.

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



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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

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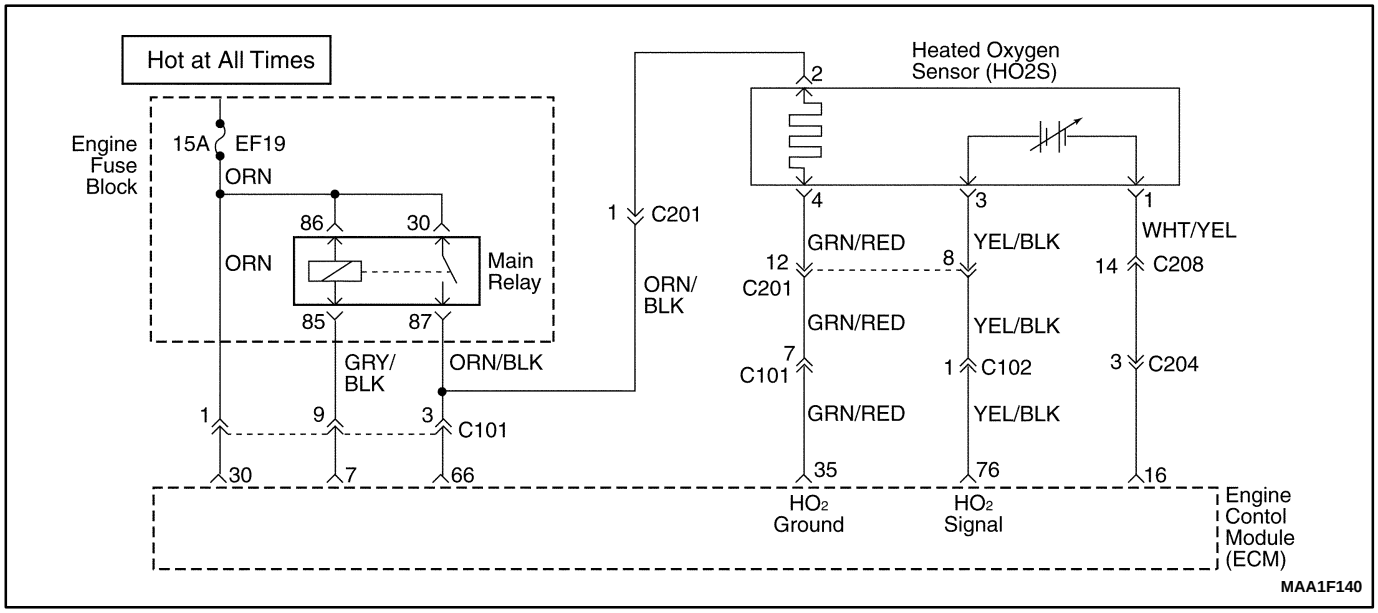

DIAGNOSTIC TROUBLE CODE (DTC) – P0137 HEATED OXYGEN SENSOR LOW VOLTAGE

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

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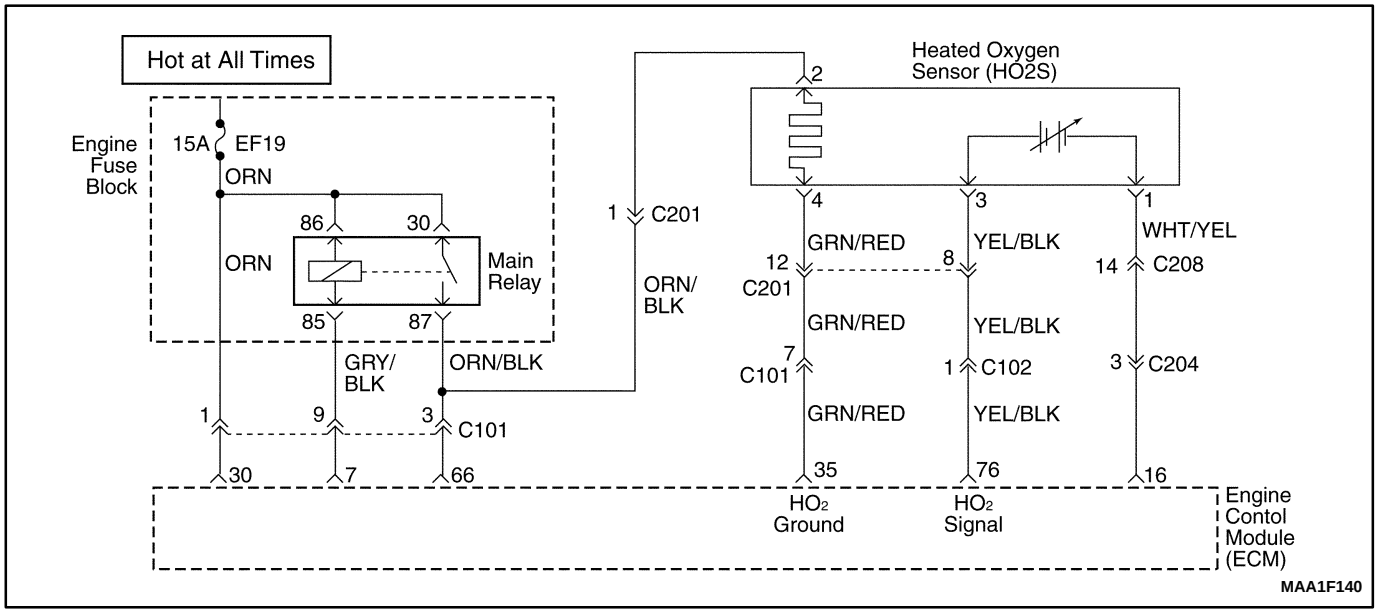


DIAGNOSTIC TROUBLE CODE (DTC) – P0138 HEATED OXYGEN SENSOR HIGH VOLTAGE

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

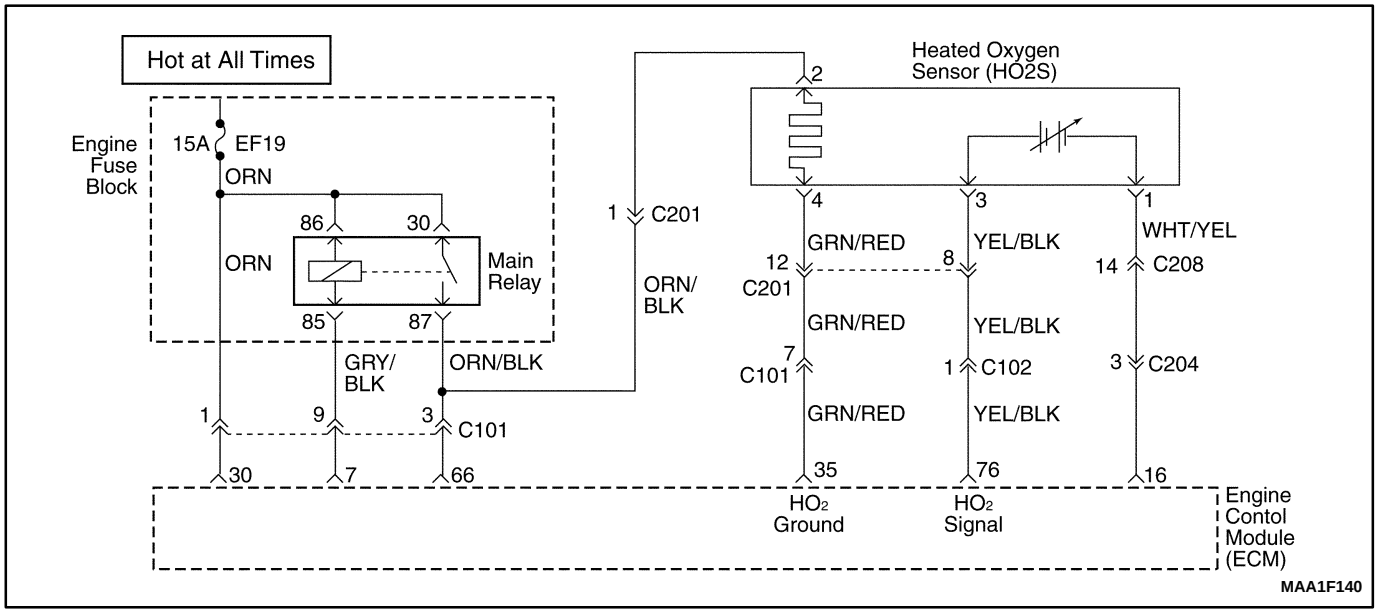
- The MIL will turn off after four consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the scan tool.

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

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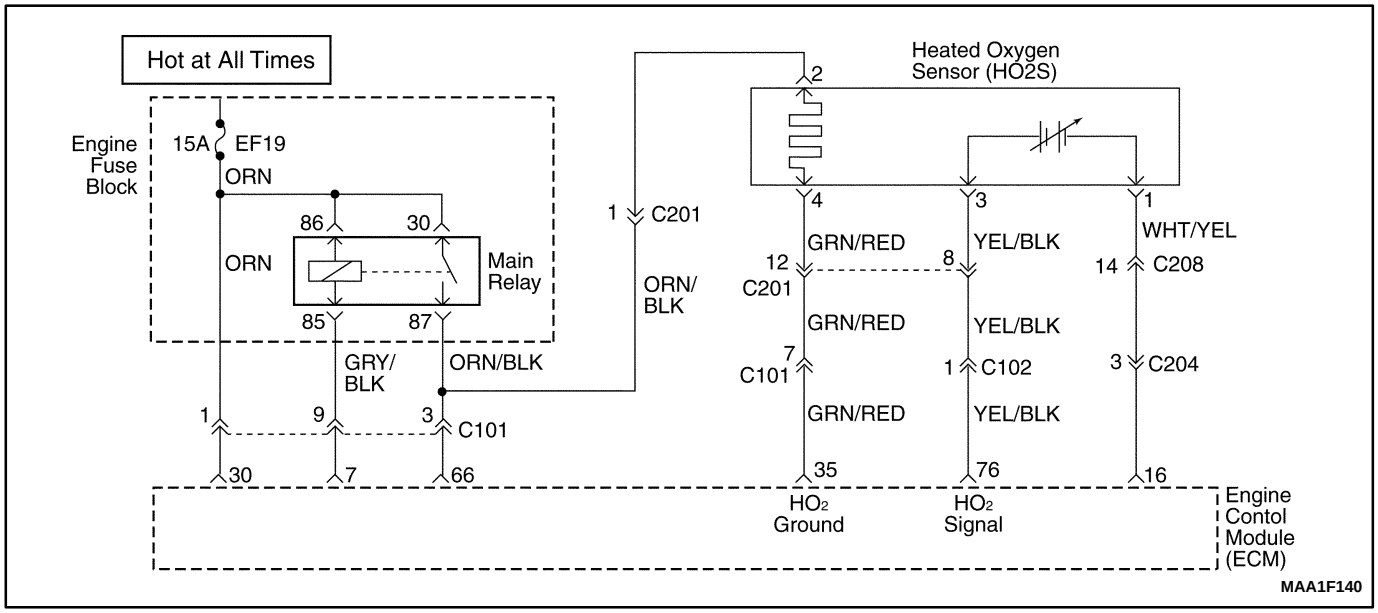

DIAGNOSTIC TROUBLE CODE (DTC) – P0141 HEATED OXYGEN SENSOR HEATER MALFUNCTION

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

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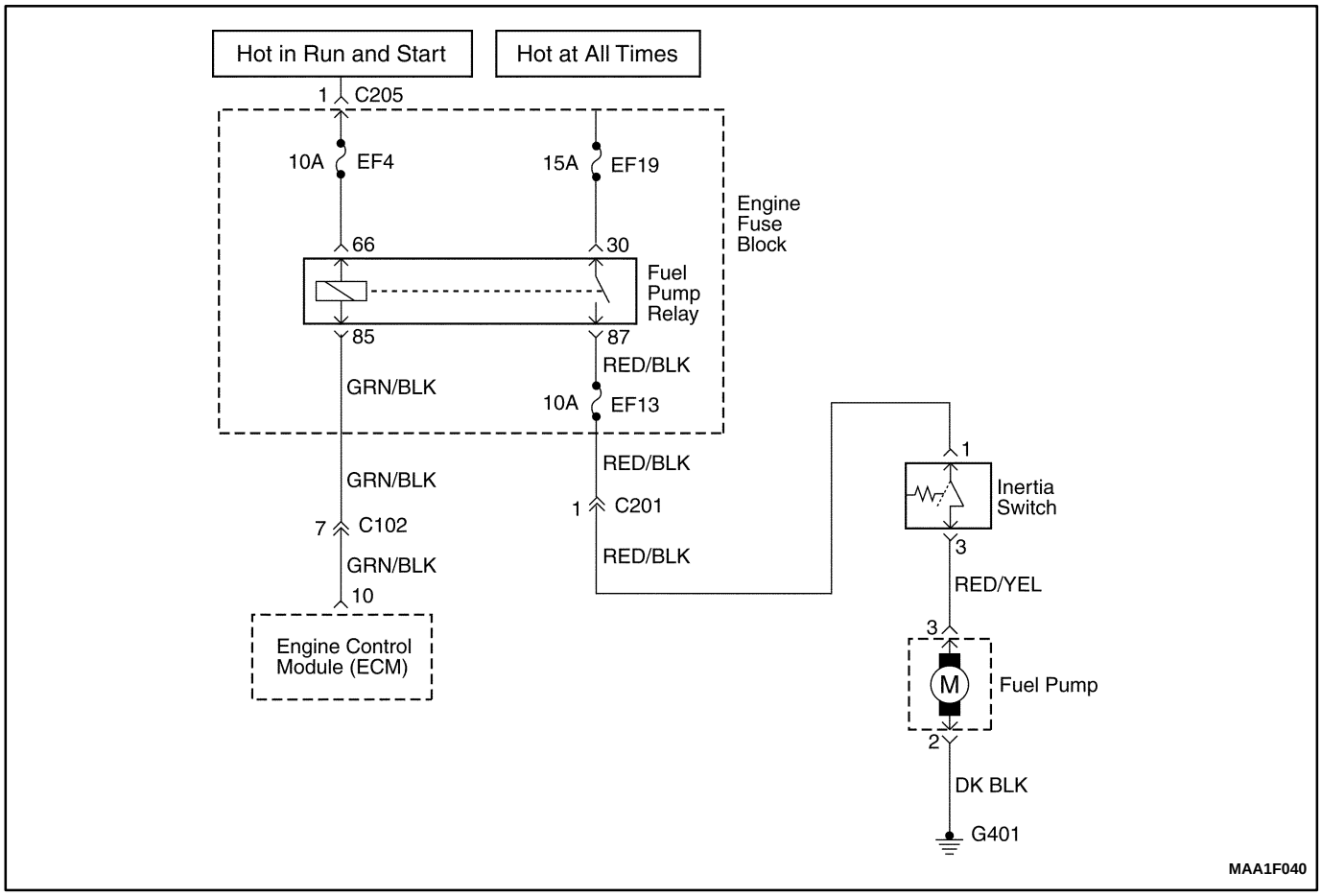

DIAGNOSTIC TROUBLE CODE (DTC) – P1230 FUEL PUMP RELAY LOW VOLTAGE

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

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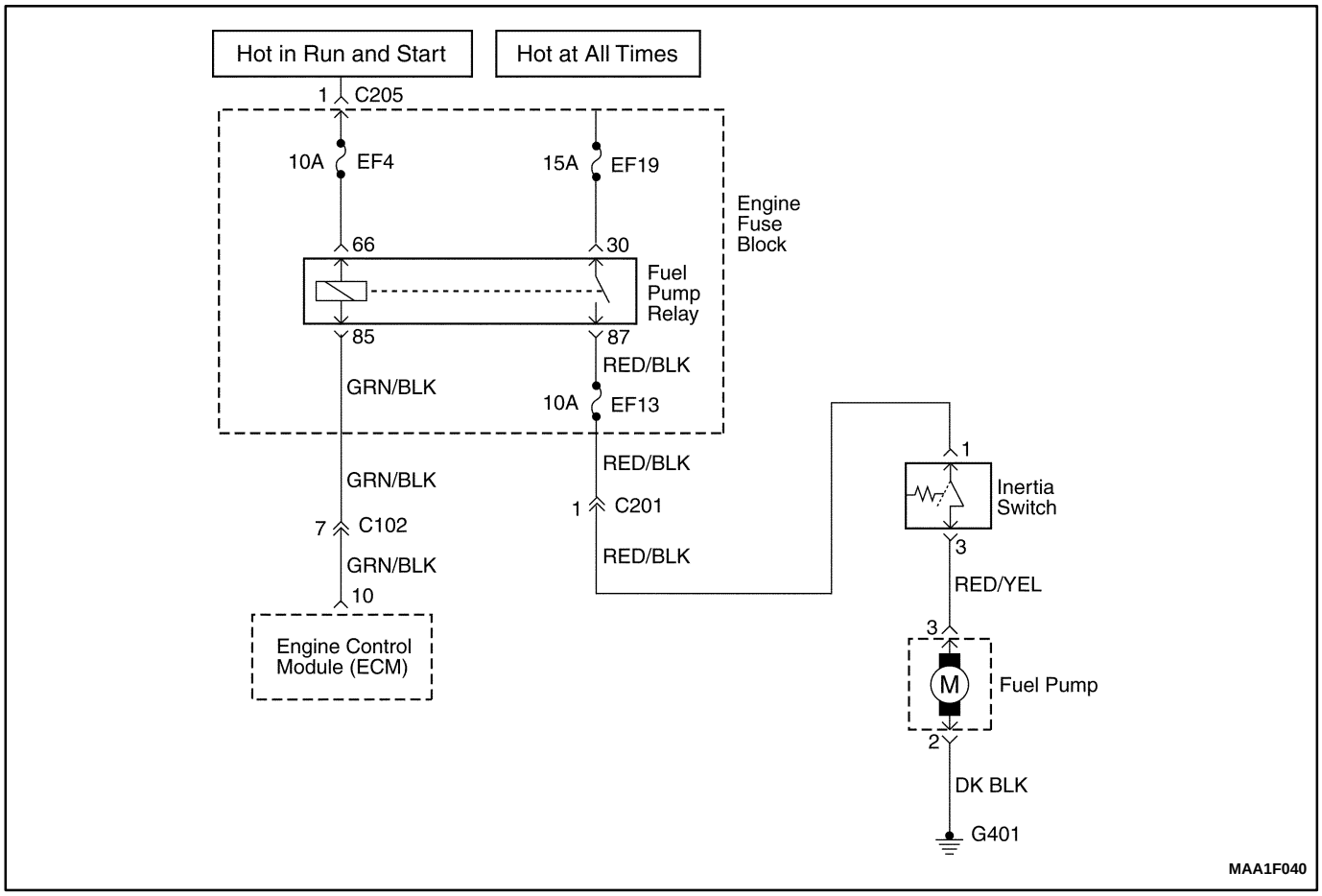

DIAGNOSTIC TROUBLE CODE (DTC) – P1231 FUEL PUMP RELAY HIGH VOLTAGE

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

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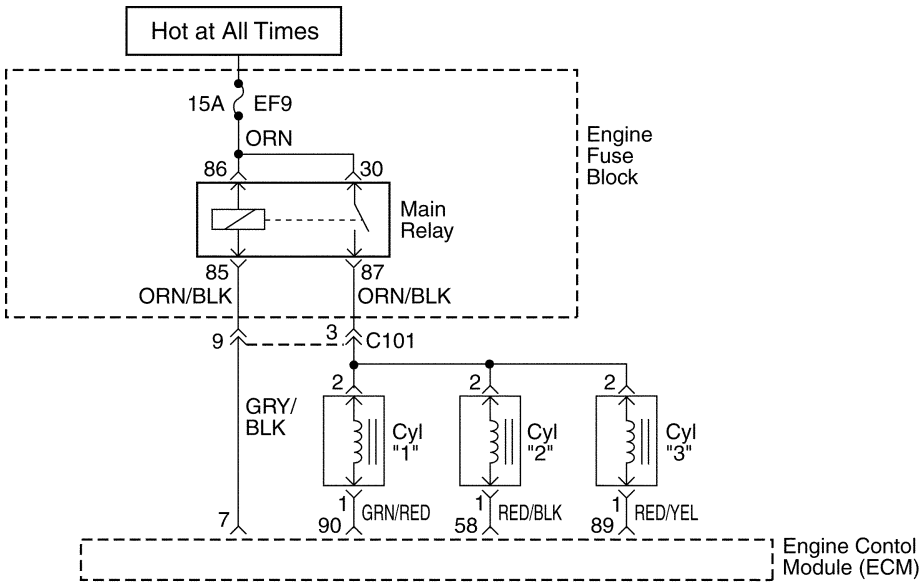


MAA1F150

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

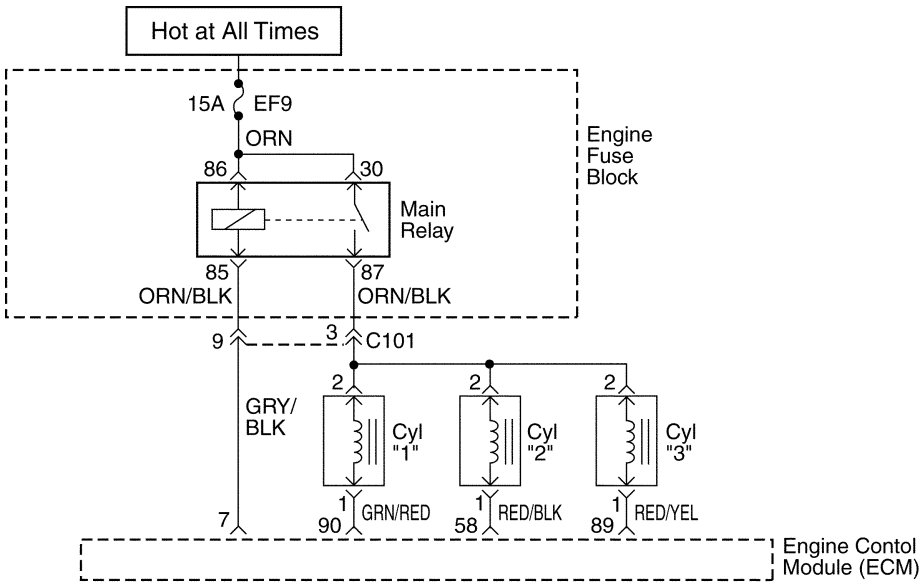
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0261 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

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



MAA1F150

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

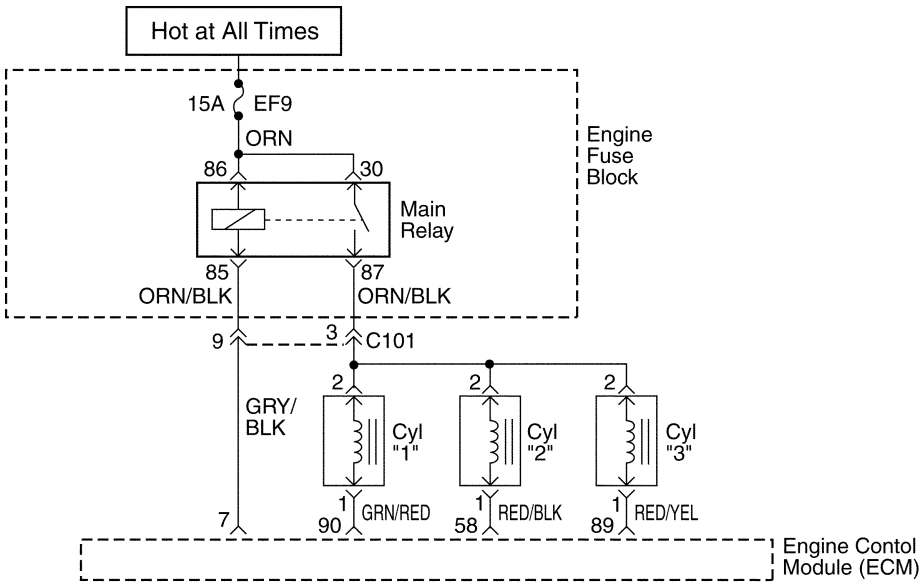
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0262 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

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

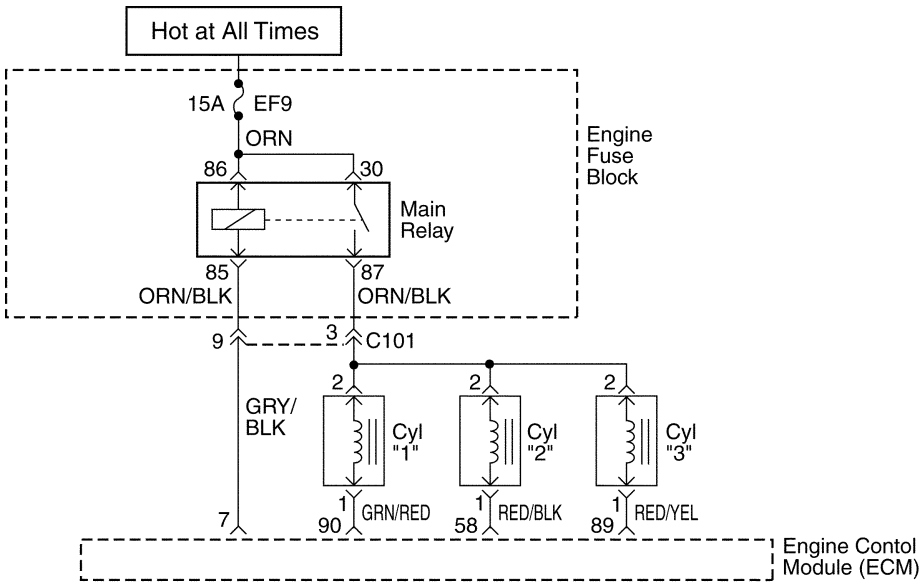
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0264 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

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

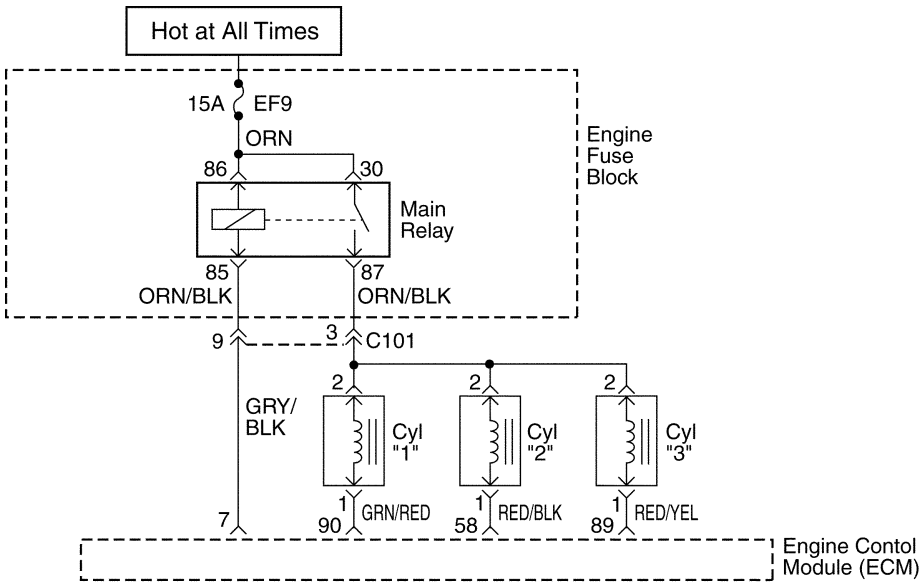
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0265 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

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



MAA1F150

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

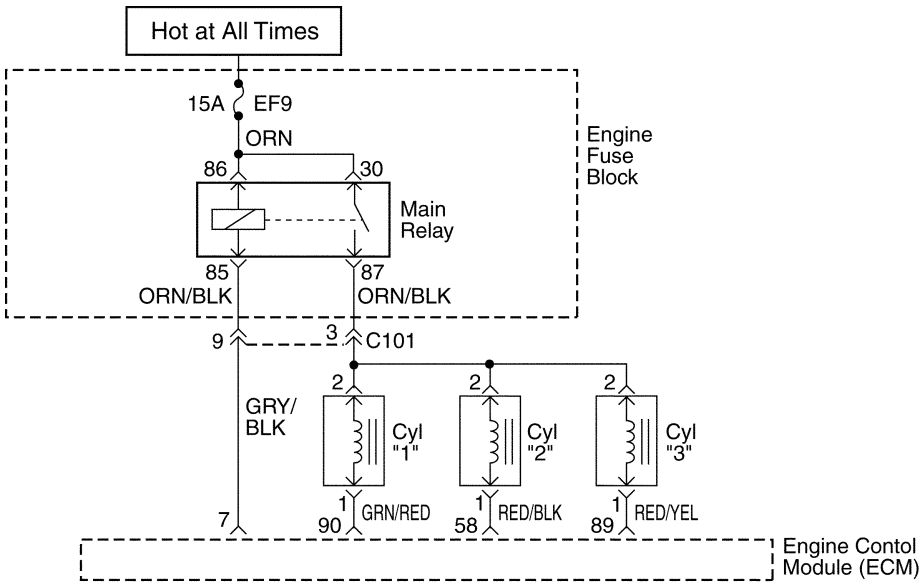
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0267 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

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



MAA1F150

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

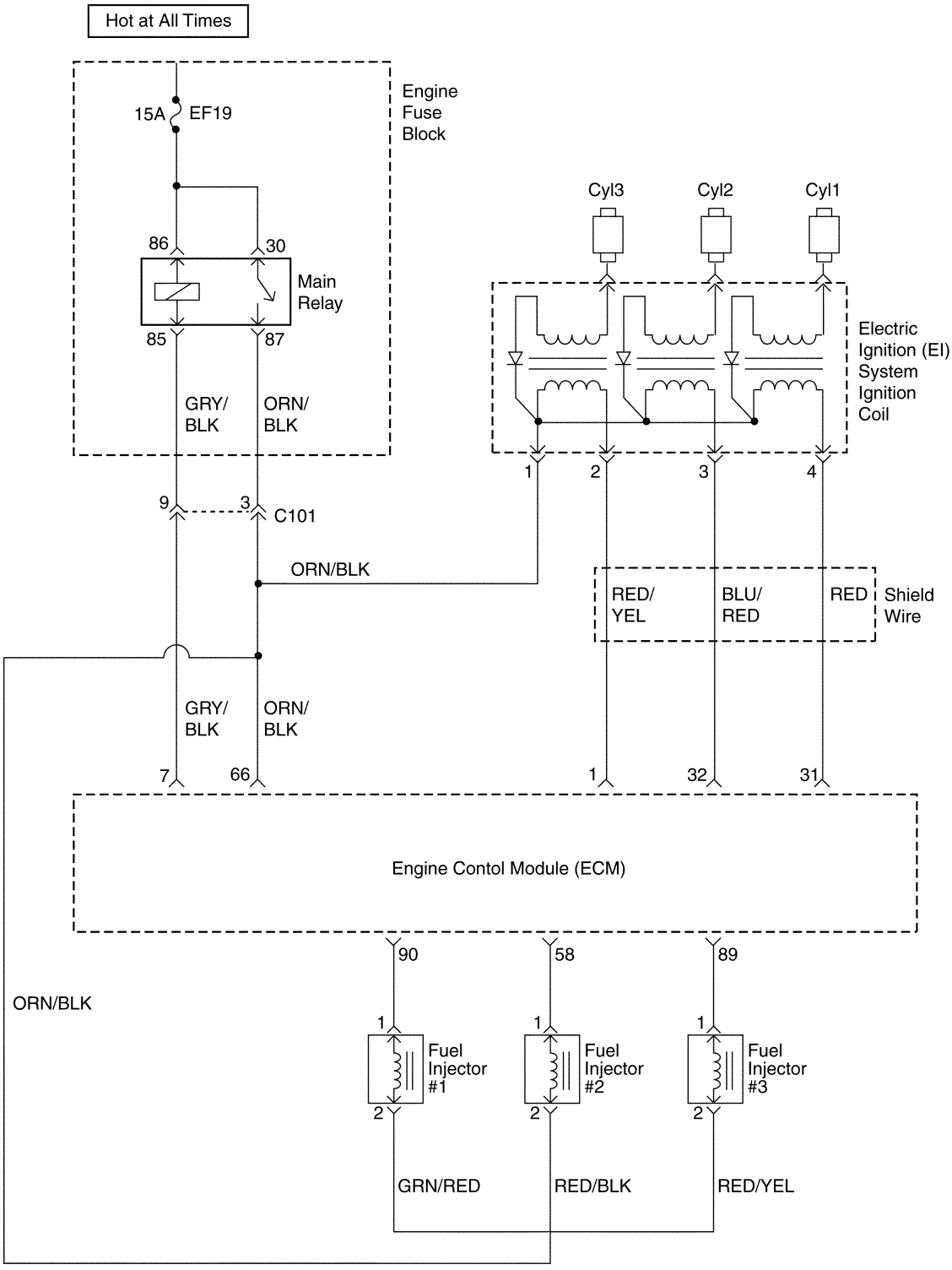
An injector 4river circuit that is open or shorted to voltage will causes a DTC P0268 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC should also be set indicating which injector is inoperative.

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
9
3
C101
ORN/BLK
Cyl3
Cyl2
Cyl1
Electric
Ignition (EI)
System
Ignition
Coil
1
2
3
4
RED/
YEL
BLU/
RED
RED
Shield
Wire
GRY/
BLK
ORN/
BLK
7
66
1
32
31
Engine Contol Module (ECM)
ORN/BLK
90
58
89
1
Fuel
Injector
#1
2
Fuel
Injector
#2
Fuel
Injector
#3
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

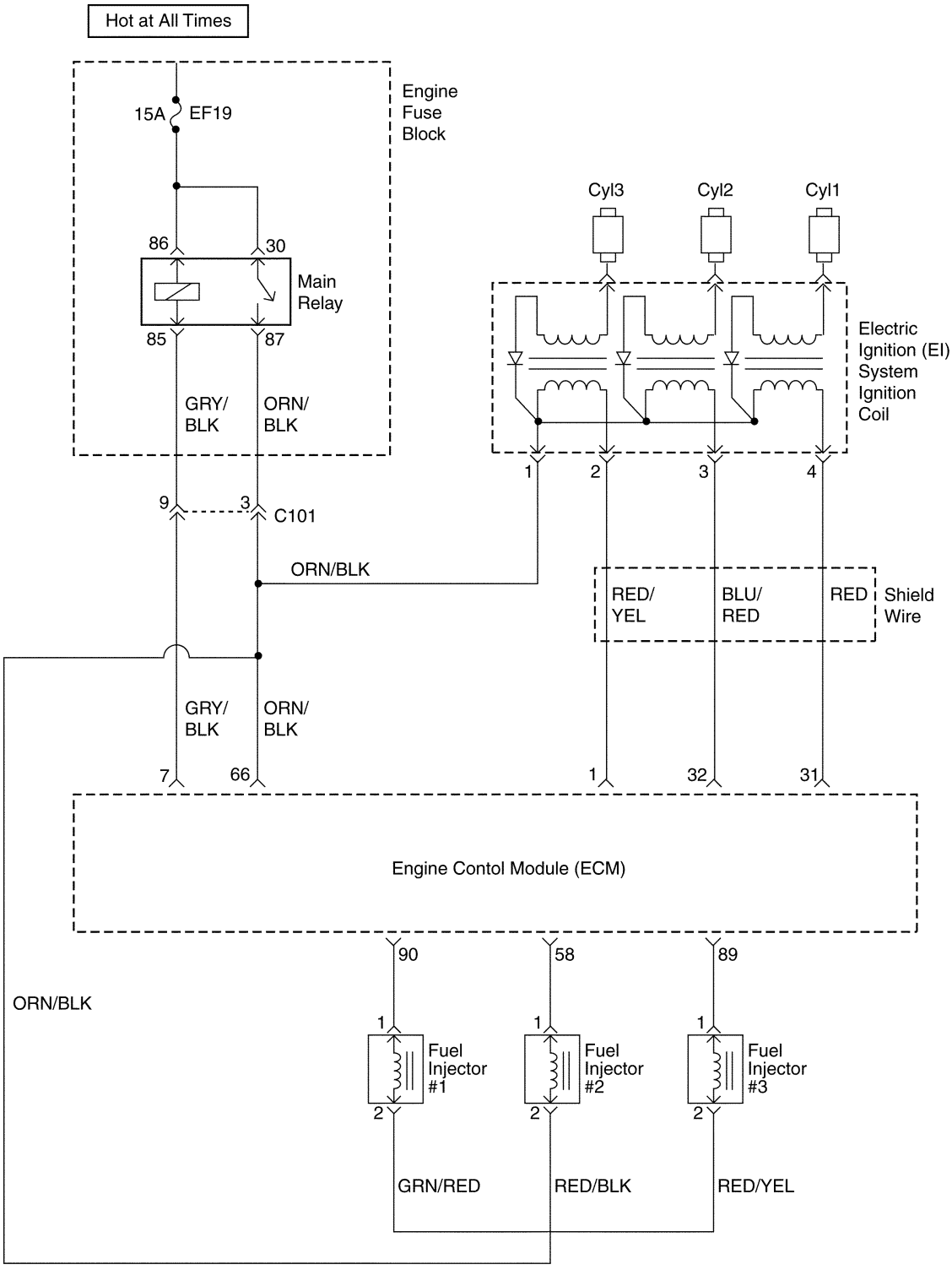
Step	Action	Value(s)	Yes	No
1	Perform an Euro On-Board Diagnostic (EOBD) System Check. Was the check performed?	–	Go to *Step 2*	Go to "On-Board Diagnostic System Check"
2	1. Install a scan tool to the Data Link Connector (DLC). 2. Turn the ignition ON, with the engine OFF. 3. Request Diagnostic Trouble 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
9
3
C101
ORN/BLK
Cyl3
Cyl2
Cyl1
Electric
Ignition (EI)
System
Ignition
Coil
1
2
3
4
RED/
YEL
BLU/
RED
RED
Shield
Wire
GRY/
BLK
ORN/
BLK
7
66
1
32
31
Engine Contol Module (ECM)
ORN/BLK
90
58
89
1
Fuel
Injector
#1
2
Fuel
Injector
#2
Fuel
Injector
#3
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.

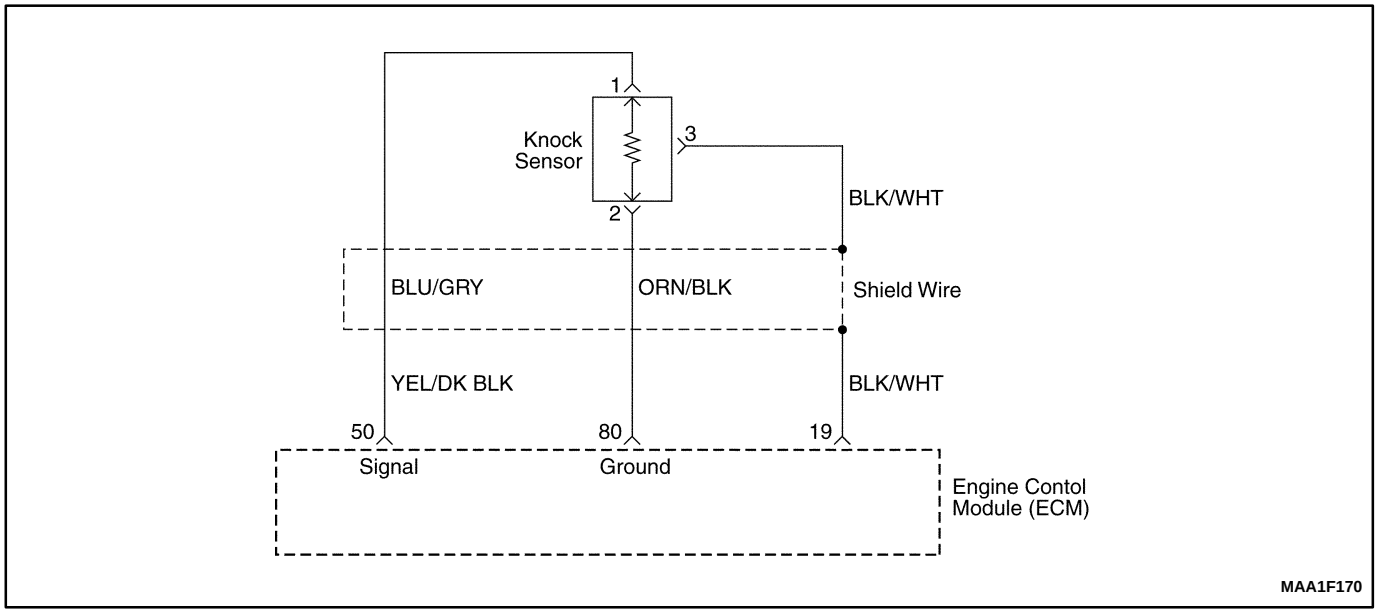
Diagnostic Aids

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.

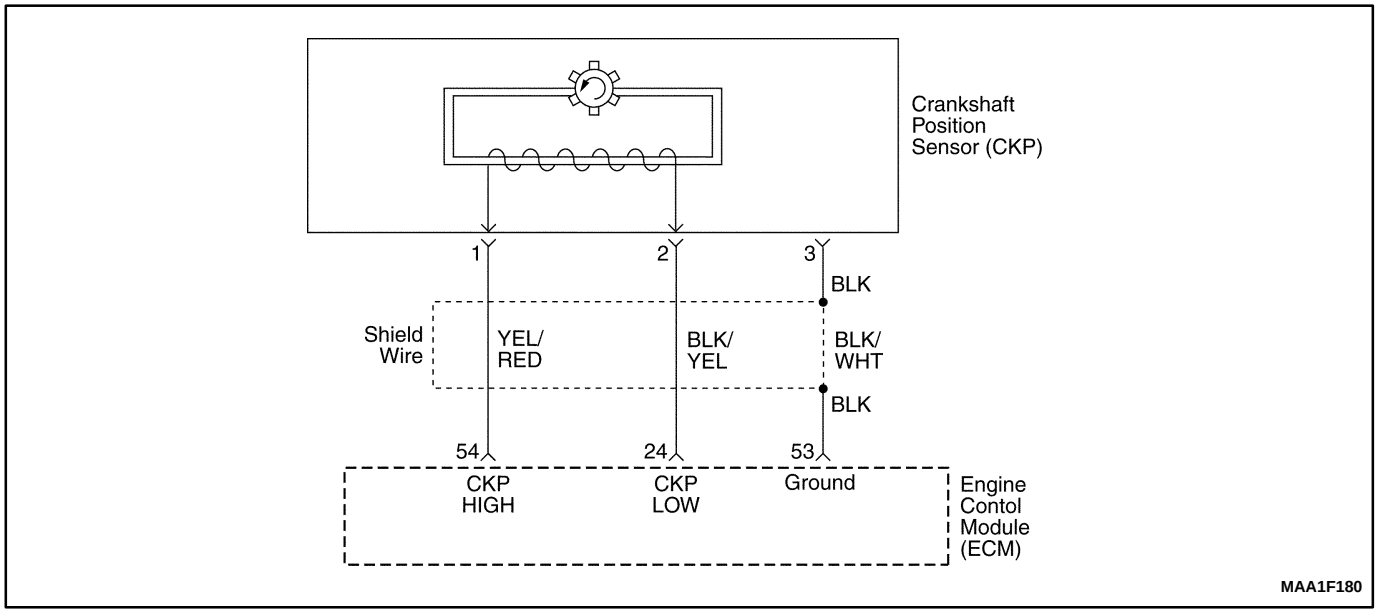
DTC P0327 – Knock Sensor Circuit

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 :

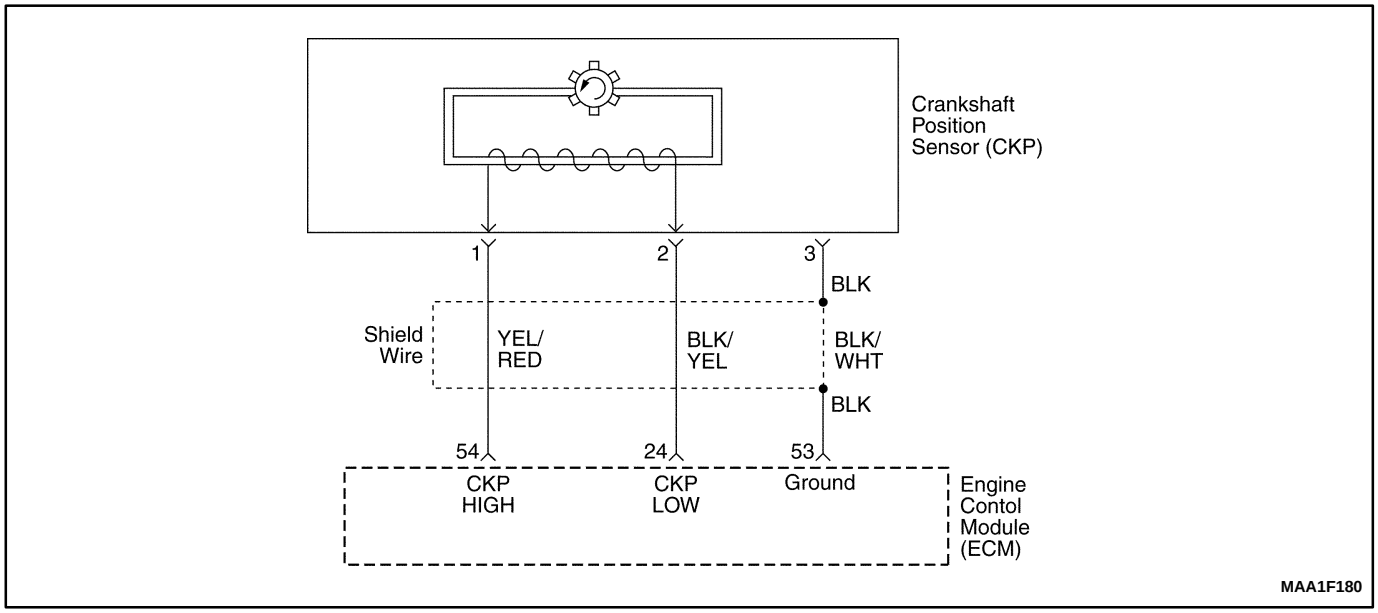
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

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 :

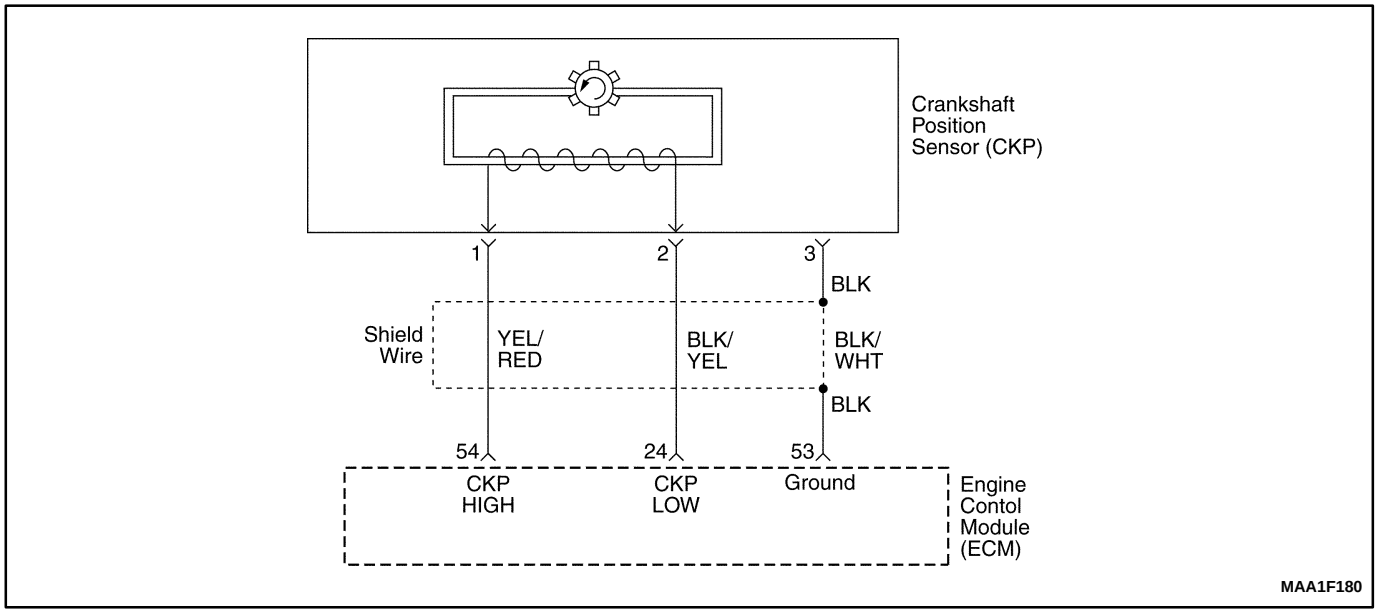
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

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 :

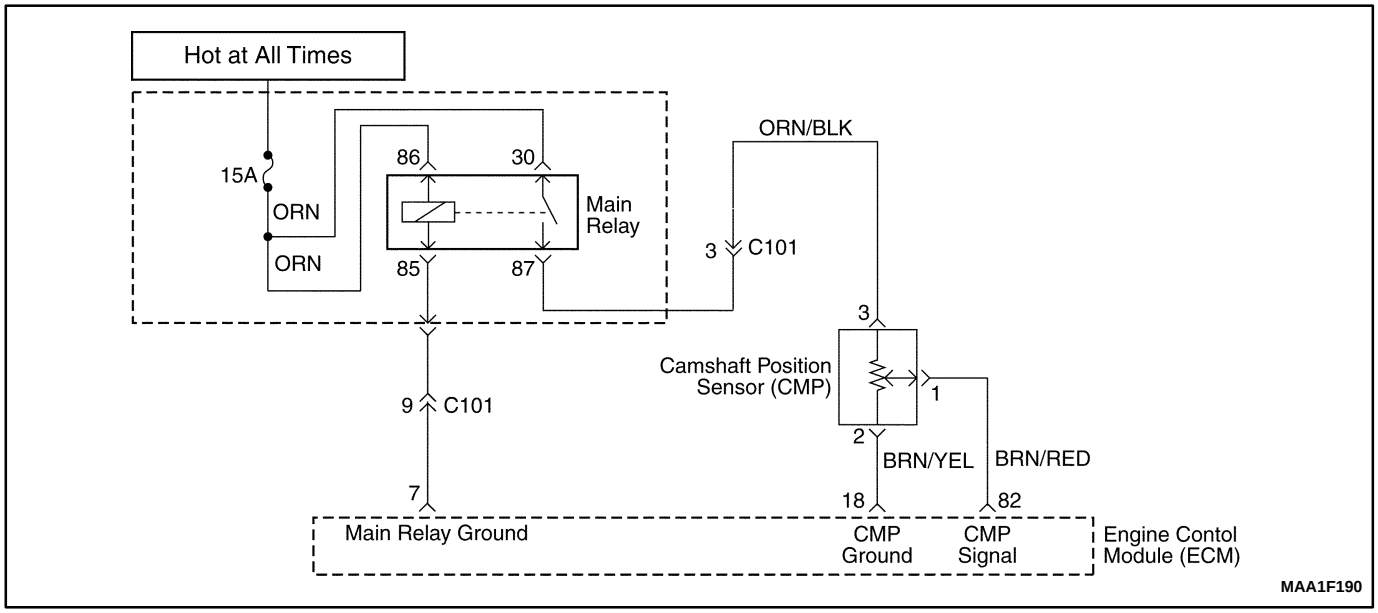
Poor connection – inspect the ECM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

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

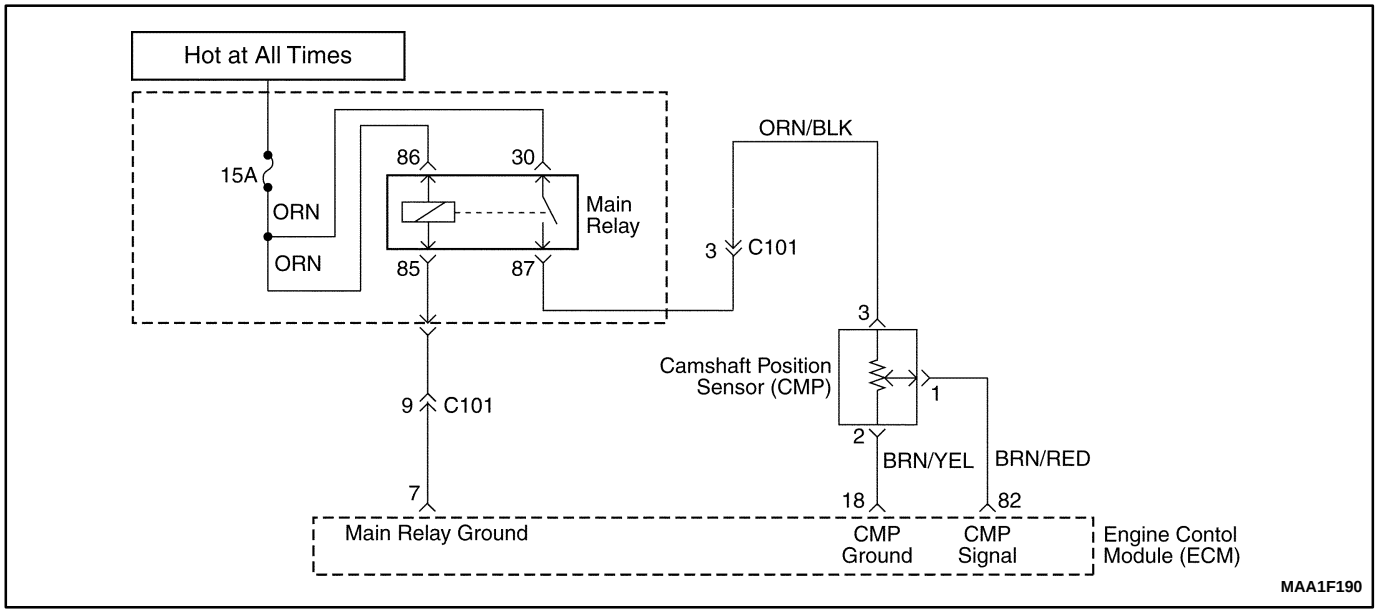
Check and correct any abnormal engine noise before using the diagnostic table.

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

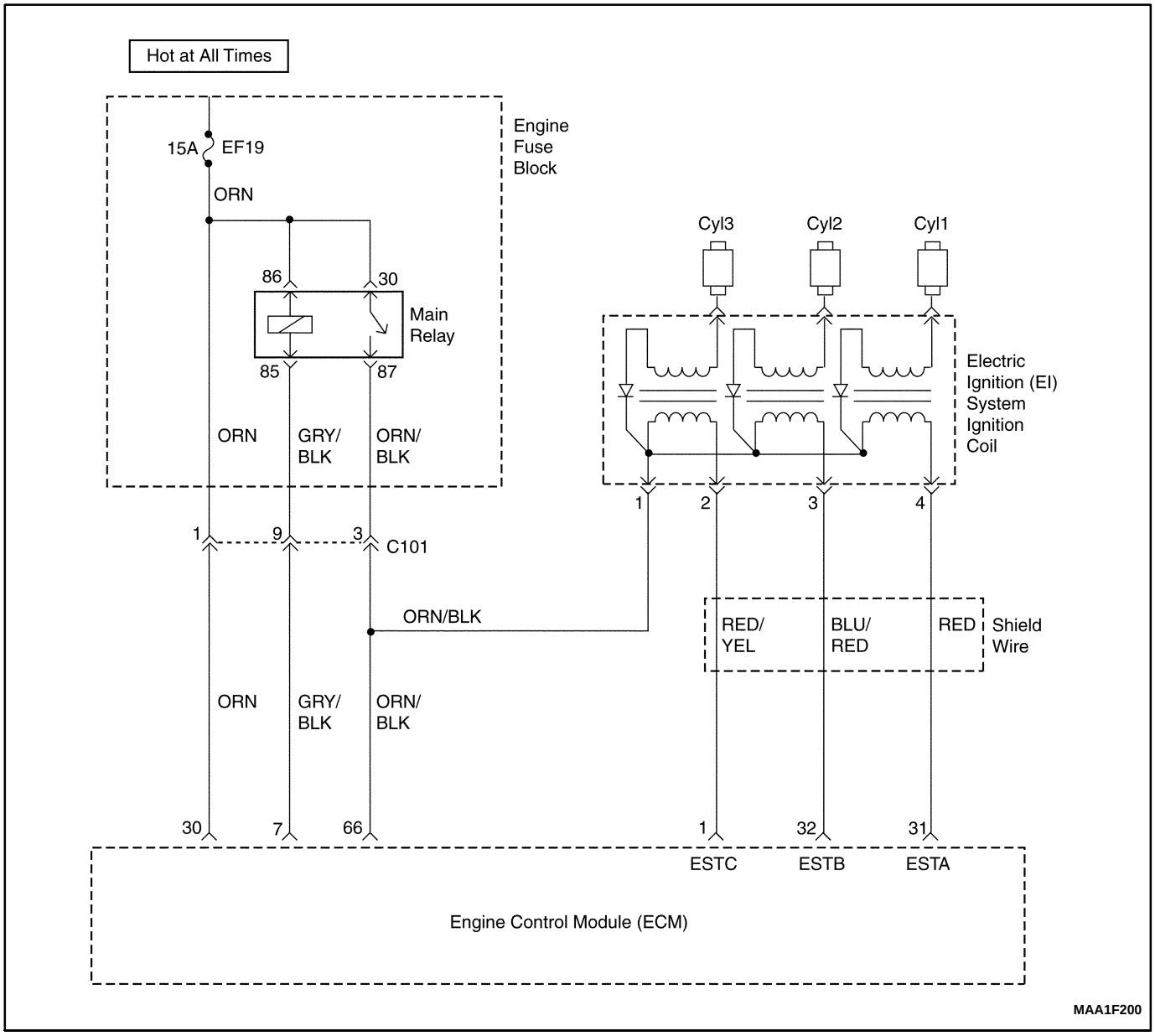
Check and correct any abnormal engine noise before using the diagnostic table.

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

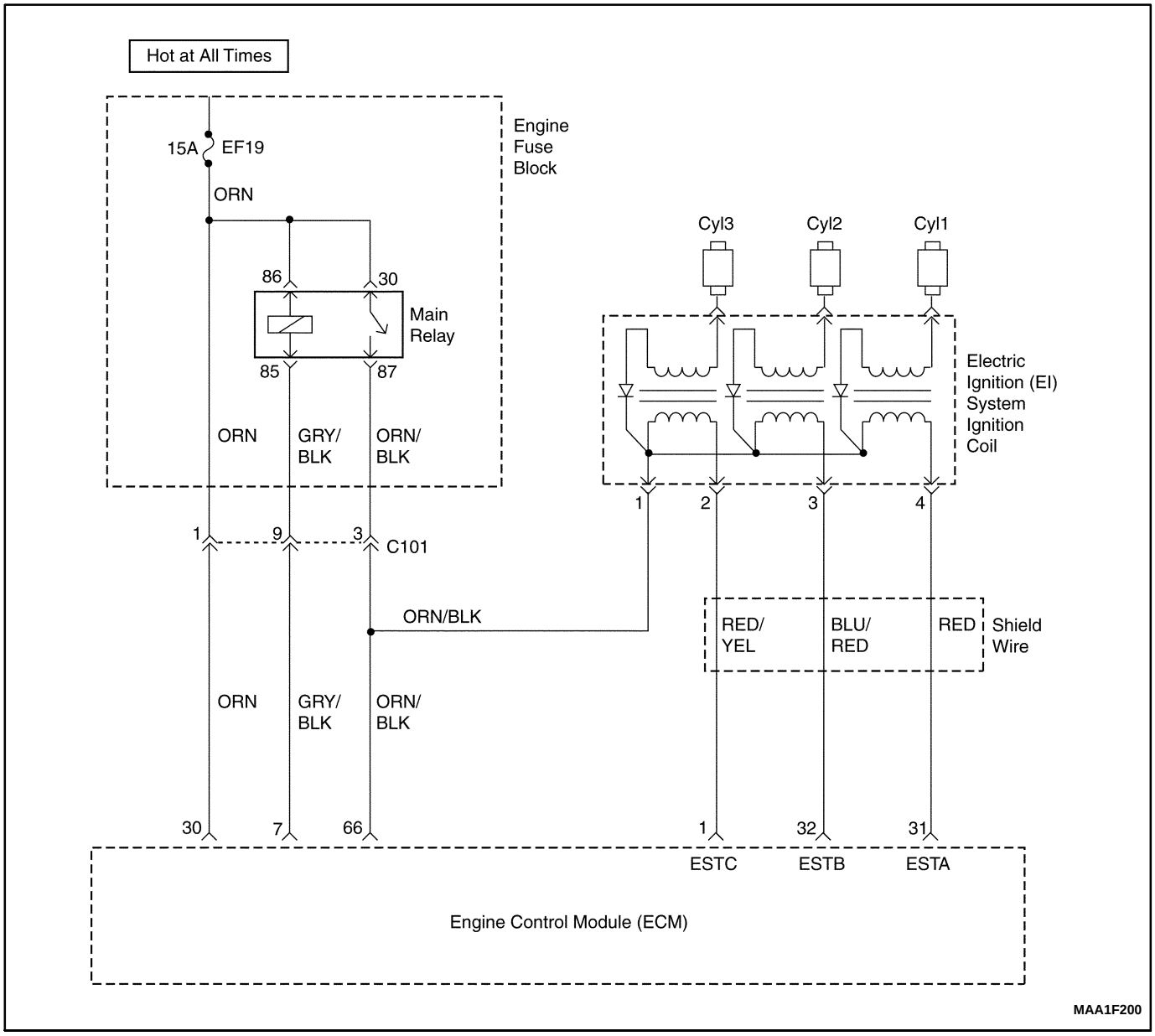
Check and correct any abnormal engine noise before using the diagnostic table.

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

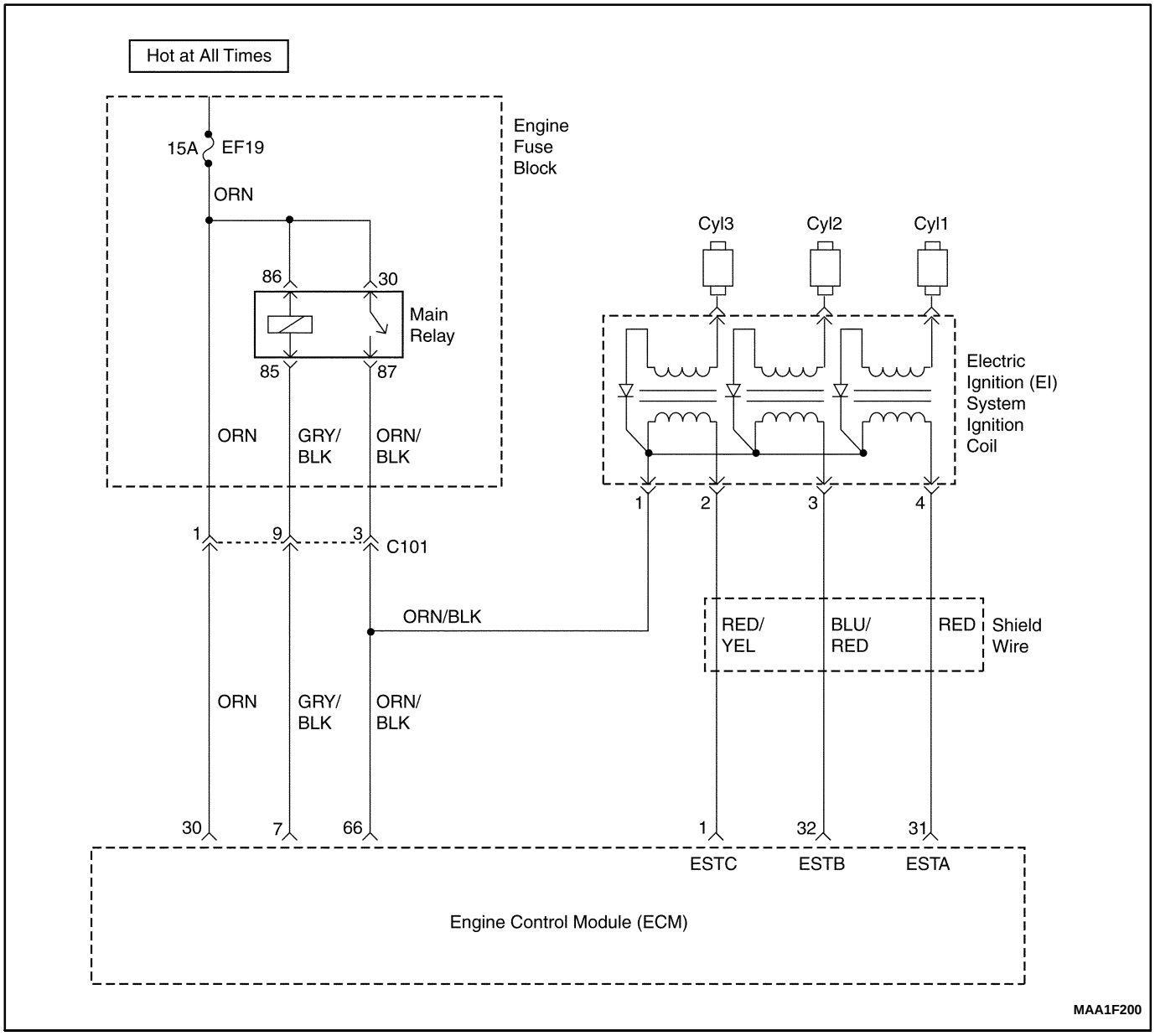
Check and correct any abnormal engine noise before using the diagnostic table.

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

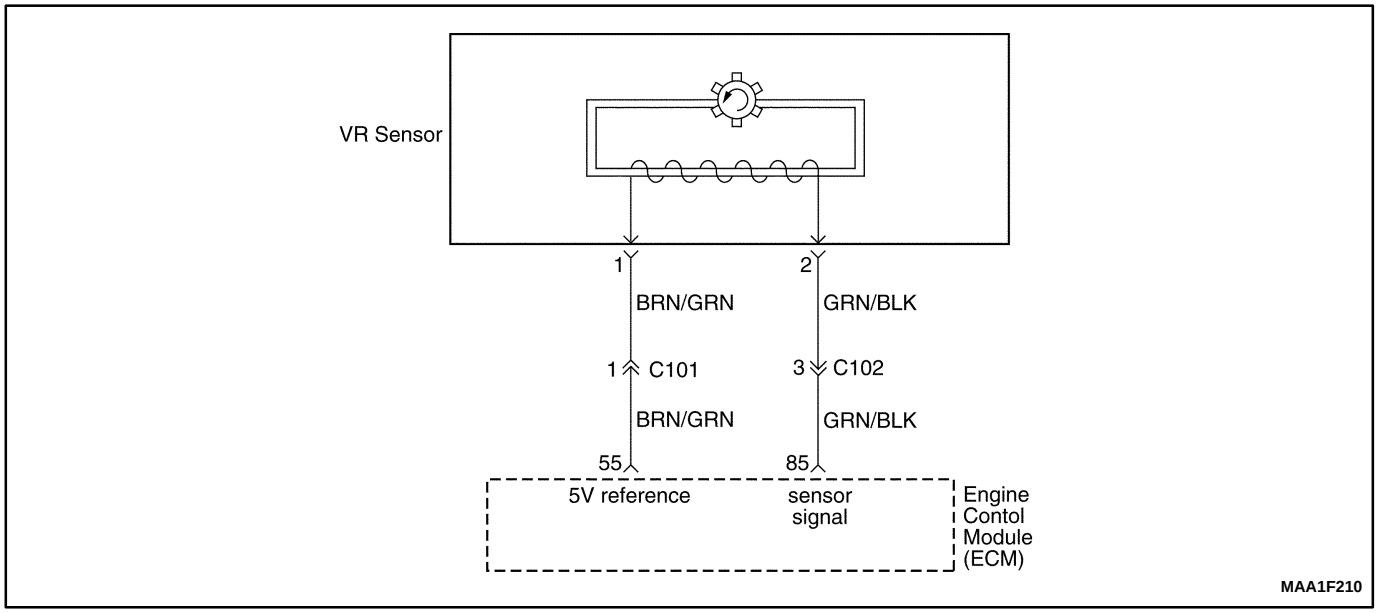
Check and correct any abnormal engine noise before using the diagnostic table.

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

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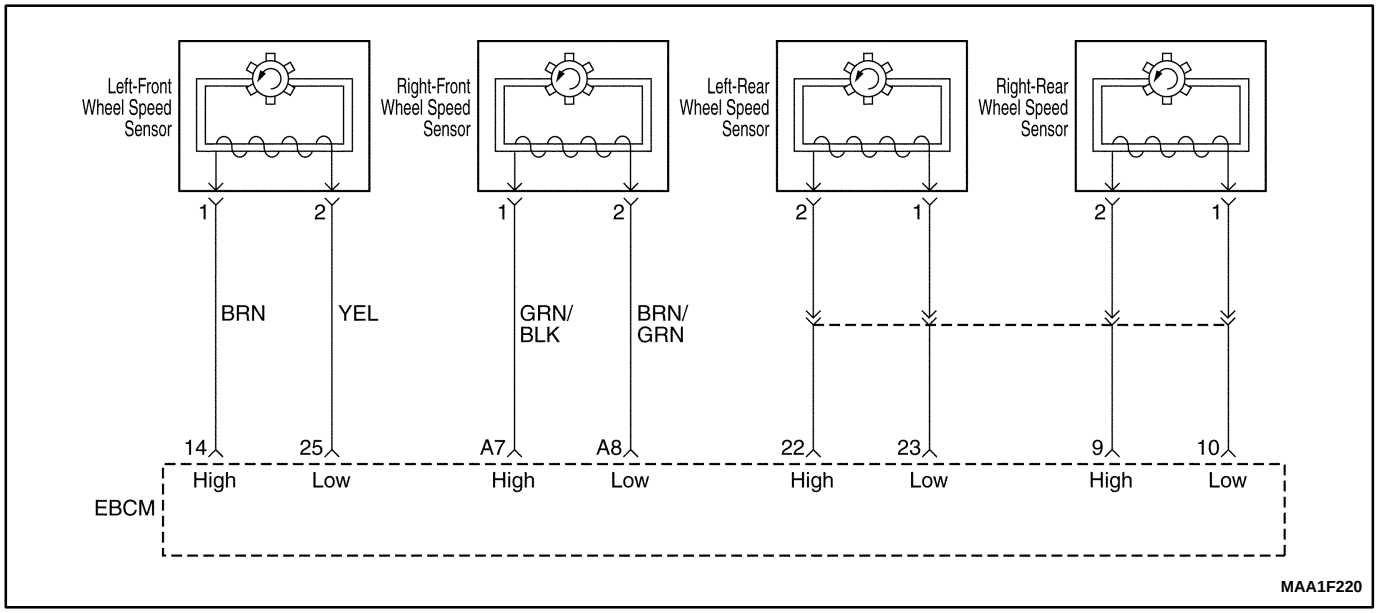

DIAGNOSTIC TROUBLE CODE (DTC) – P1382 ROUGH ROAD DATA INVALID (ABS)

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

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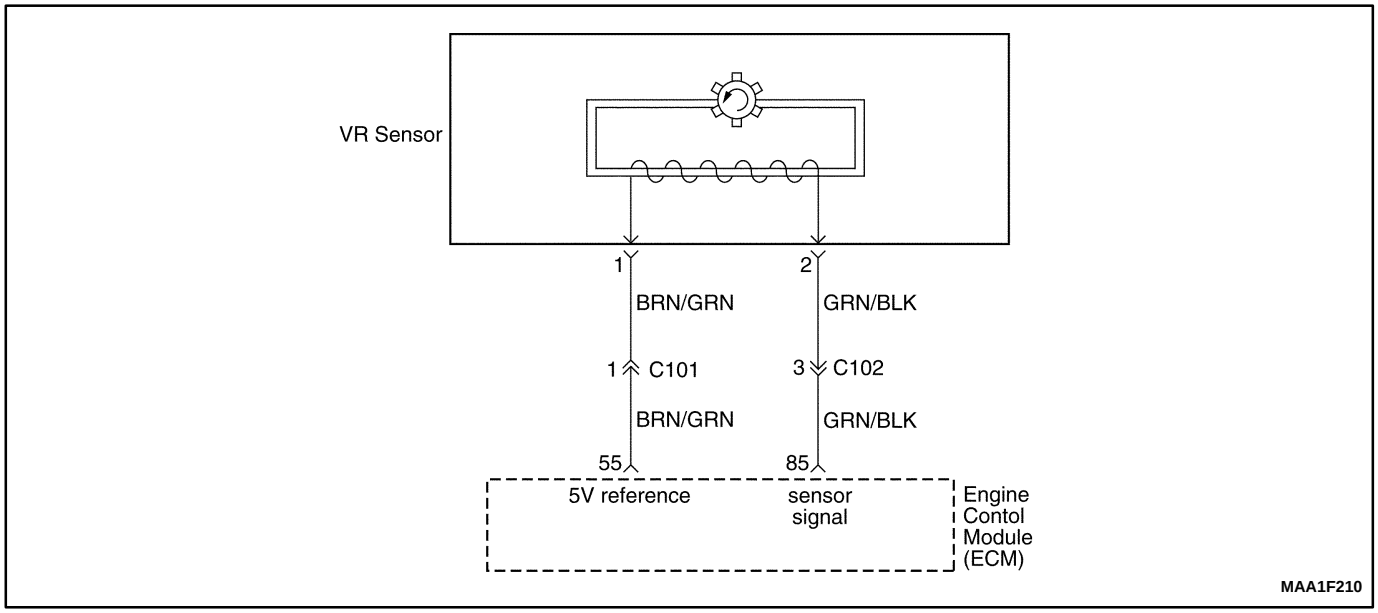

DIAGNOSTIC TROUBLE CODE (DTC) – P1385 ROUGH ROAD SENSOR CIRCUIT FAULT (NON ABS)

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

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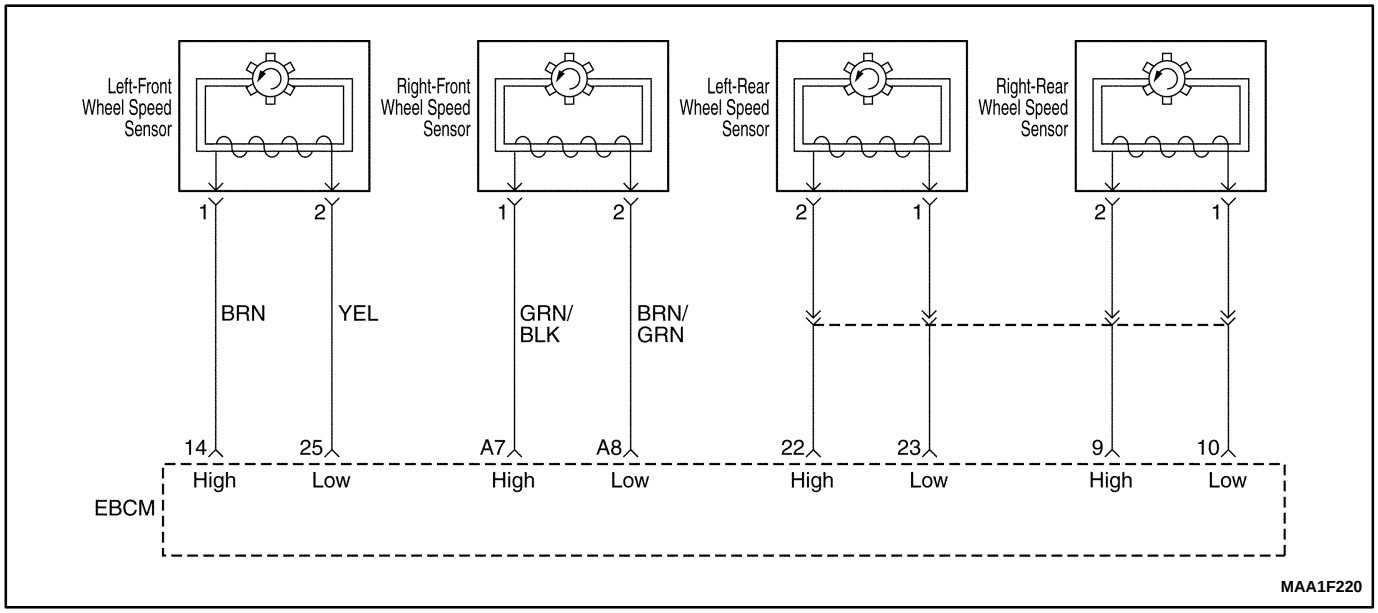

DIAGNOSTIC TROUBLE CODE (DTC) – P1385 ROUGH ROAD SENSOR CIRCUIT FAULT (ABS)

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

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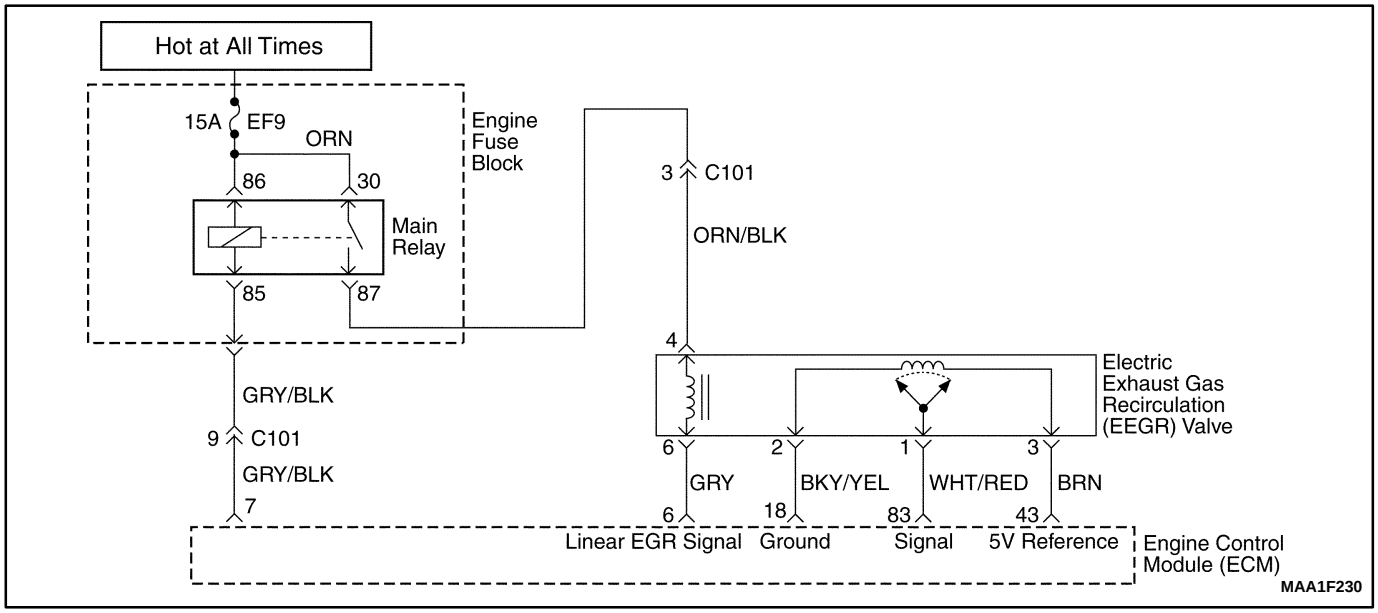

DIAGNOSTIC TROUBLE CODE (DTC) – P0400 ELECTRIC EXHAUST GAS RECIRCULATION OUT OF LIMIT

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

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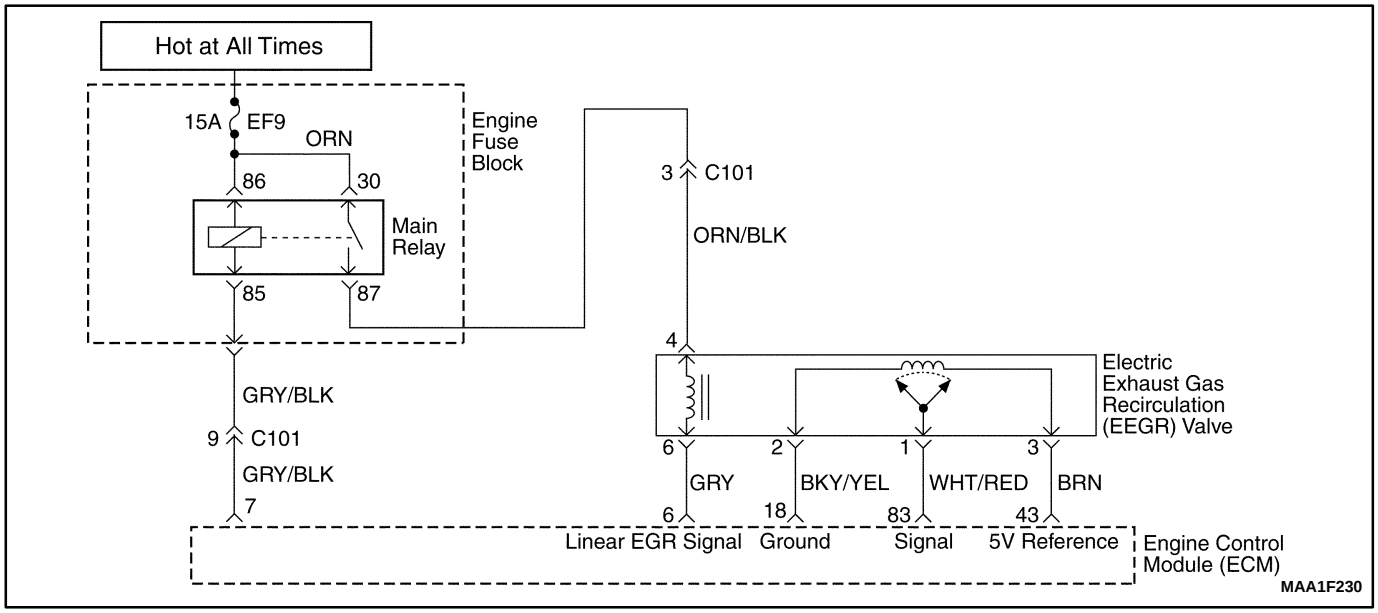


DIAGNOSTIC TROUBLE CODE (DTC) – P1402 ELECTRIC EXHAUST GAS RECIRCULATION BLOCKED

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.

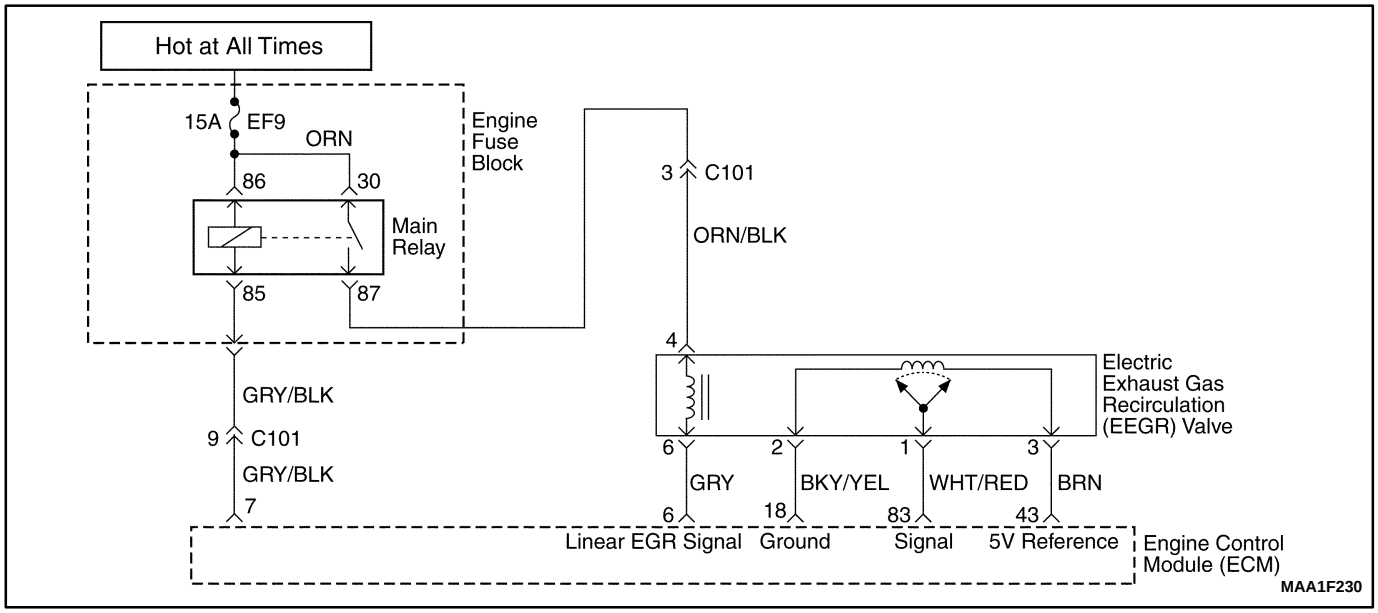
Diagnostic Aids

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

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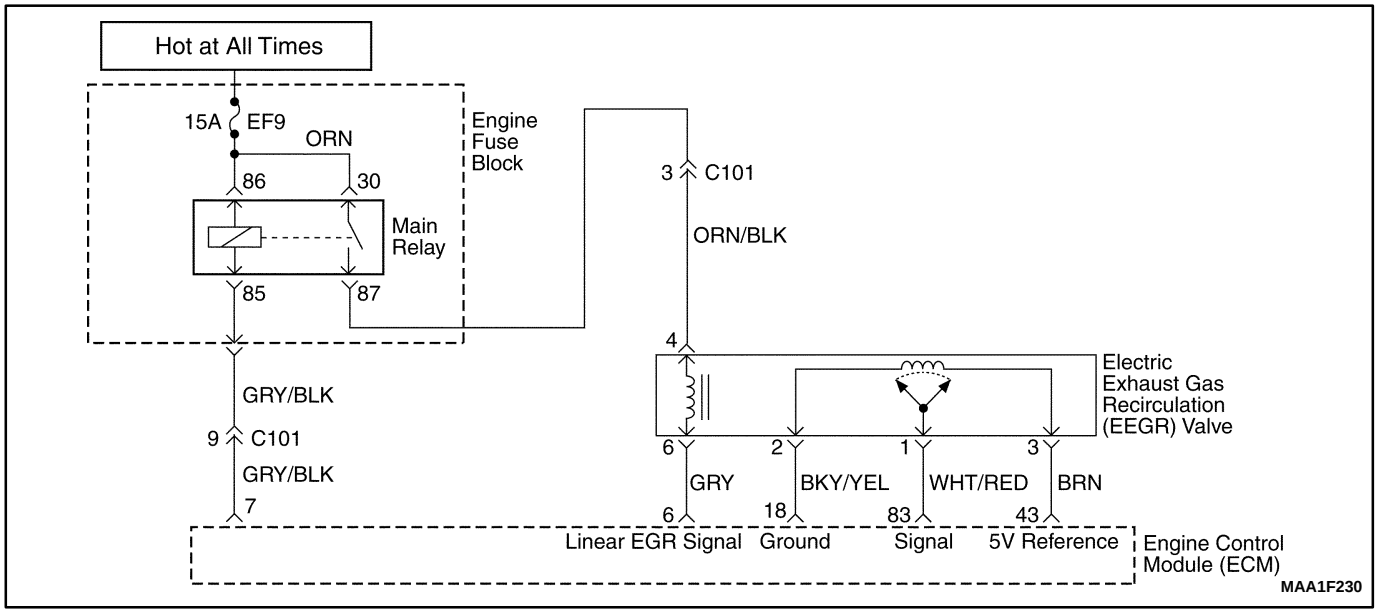

DIAGNOSTIC TROUBLE CODE (DTC) – P0404 ELECTRIC EXHAUST GAS RECIRCULATION OPENED

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 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

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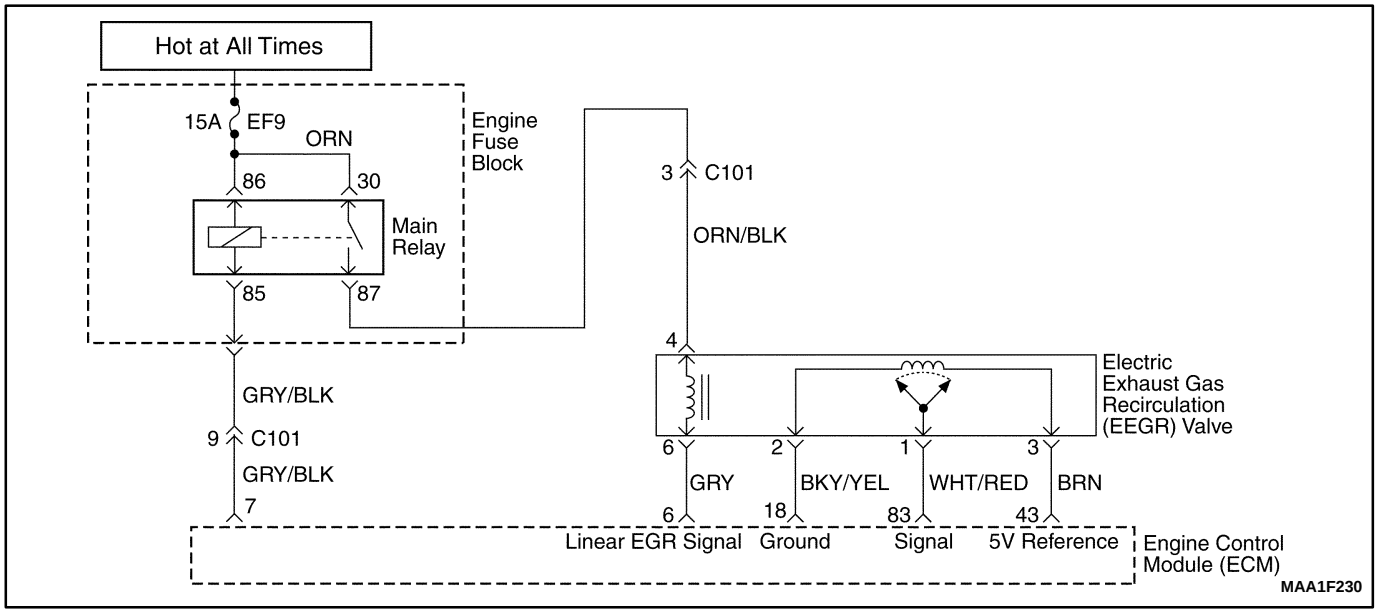

DIAGNOSTIC TROUBLE CODE (DTC) – P1404 ELECTRIC EXHAUST GAS RECIRCULATION CLOSED

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 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

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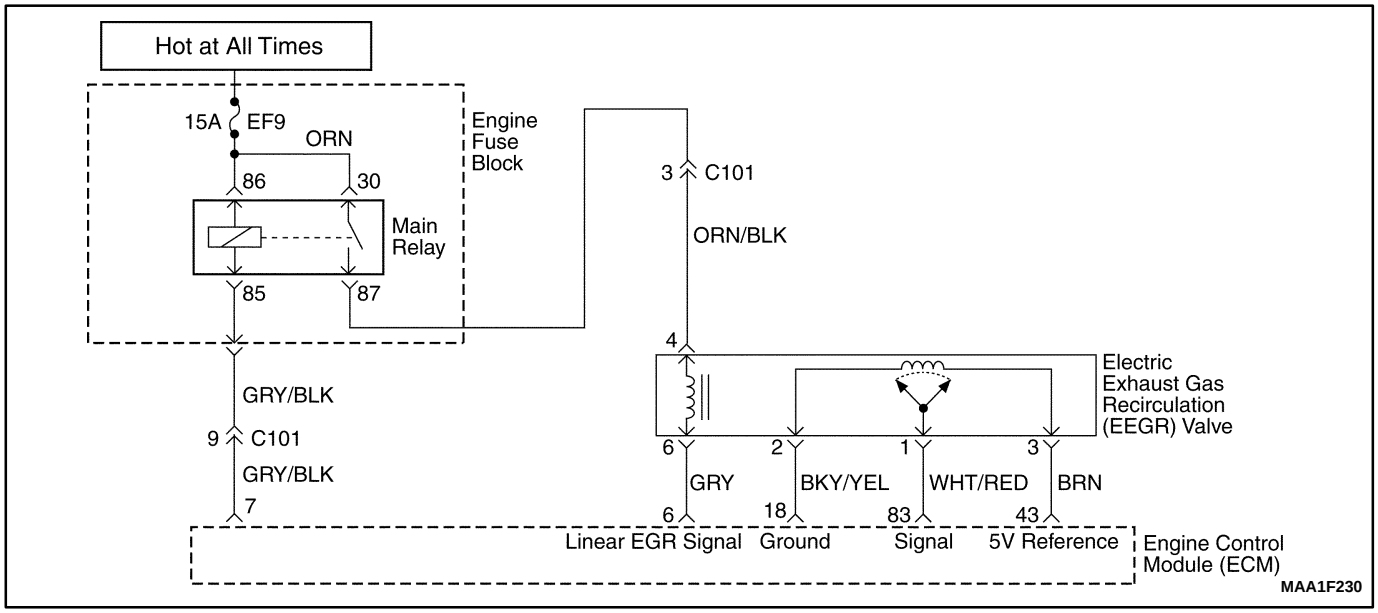

DIAGNOSTIC TROUBLE CODE (DTC) – P0405 EEGR PINTLE POSITION SENSOR LOW VOLTAGE

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 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

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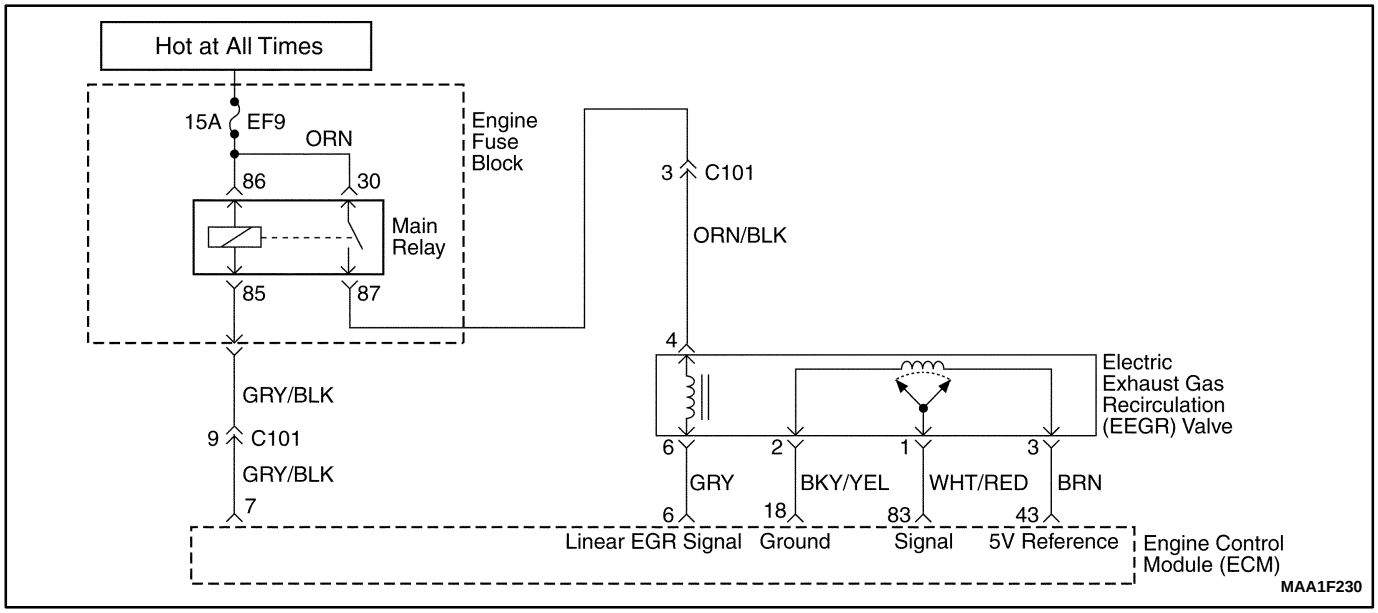

DIAGNOSTIC TROUBLE CODE (DTC) – P0406 EEGR PINTLE POSITION SENSOR HIGH VOLTAGE

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 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

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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.

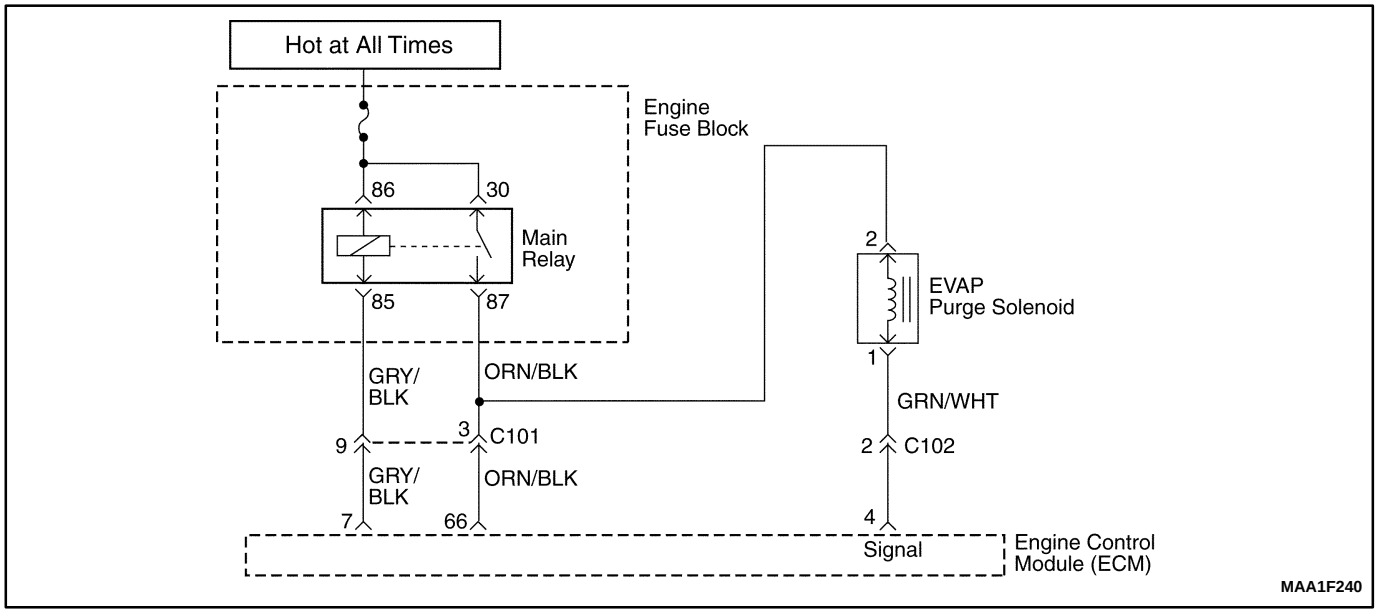
An intermittent problem may be caused by a poor connection, rubbed-through wire insulation, or a wire that is broken inside the insulation.

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

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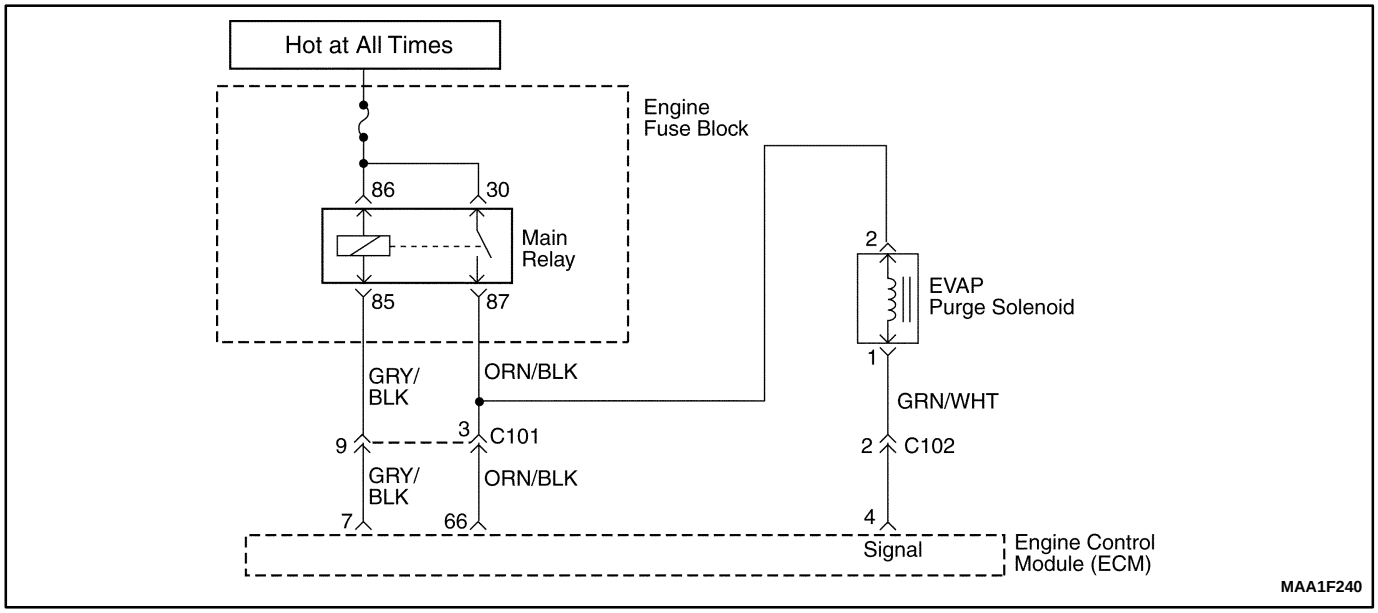

DIAGNOSTIC TROUBLE CODE (DTC) – P0445 EVAP PURGE CONTROL CIRCUIT FAULT

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

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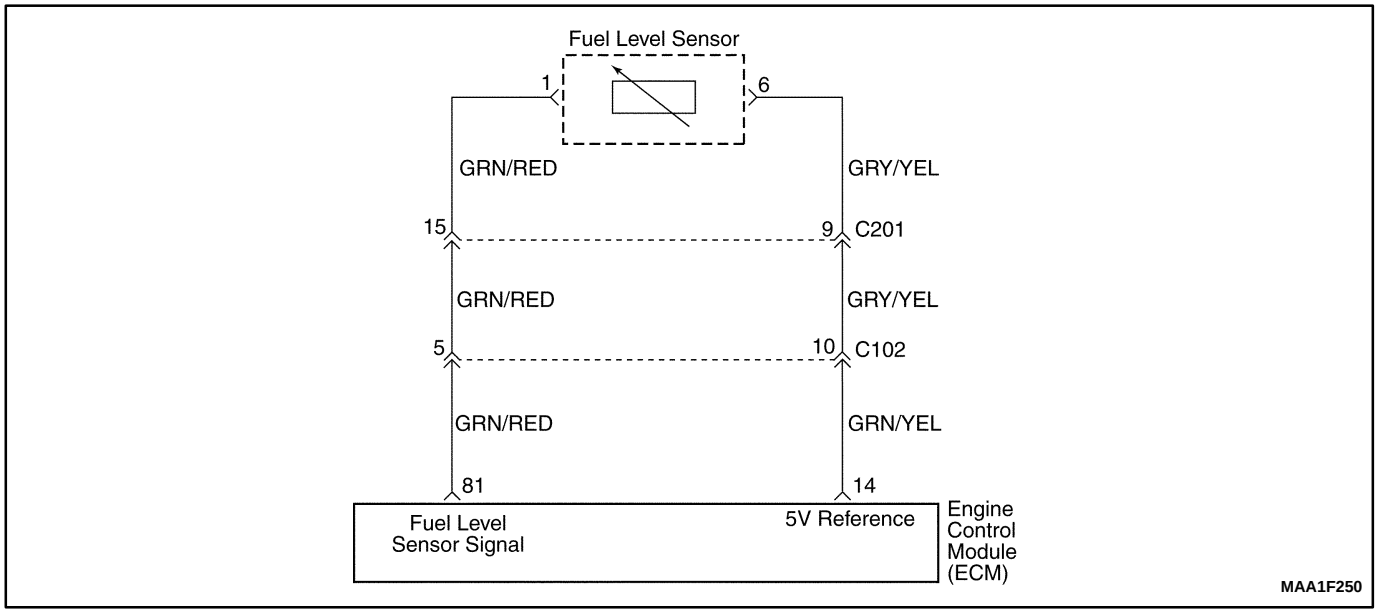

DIAGNOSTIC TROUBLE CODE (DTC) – P0462 FUEL LEVEL SENSOR LOW VOLTAGE

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, Instrumentation/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

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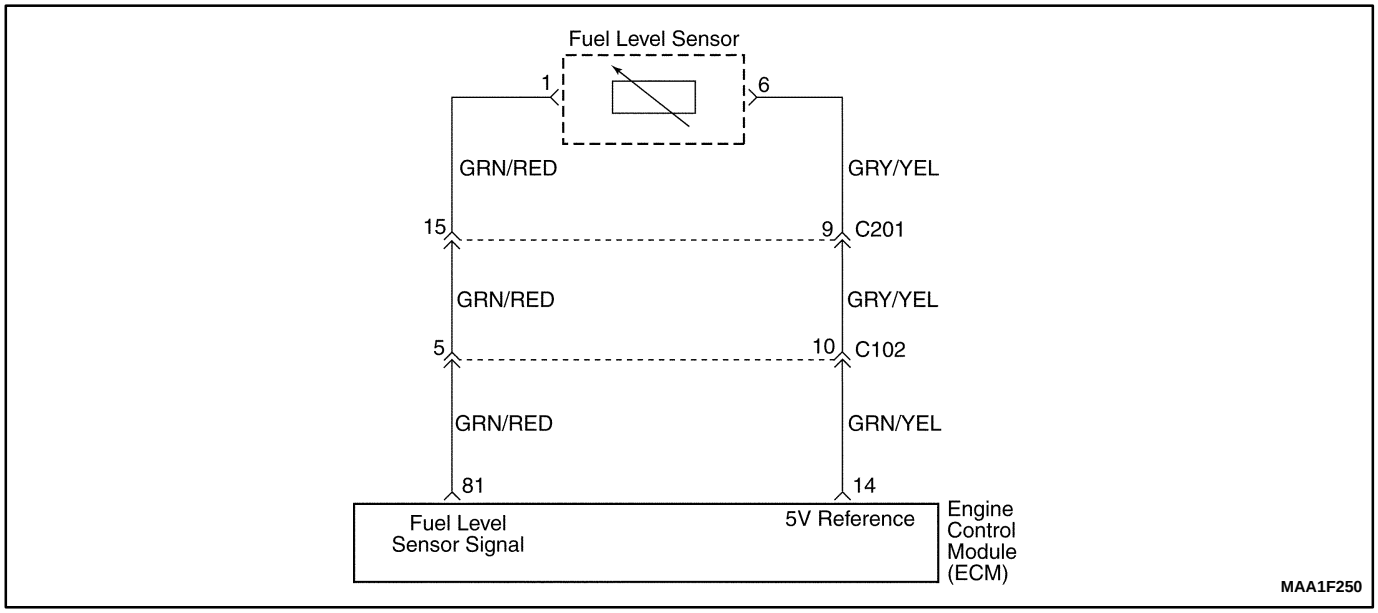

DIAGNOSTIC TROUBLE CODE (DTC) – P0463 FUEL LEVEL SENSOR HIGH VOLTAGE

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, Instrumentation/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

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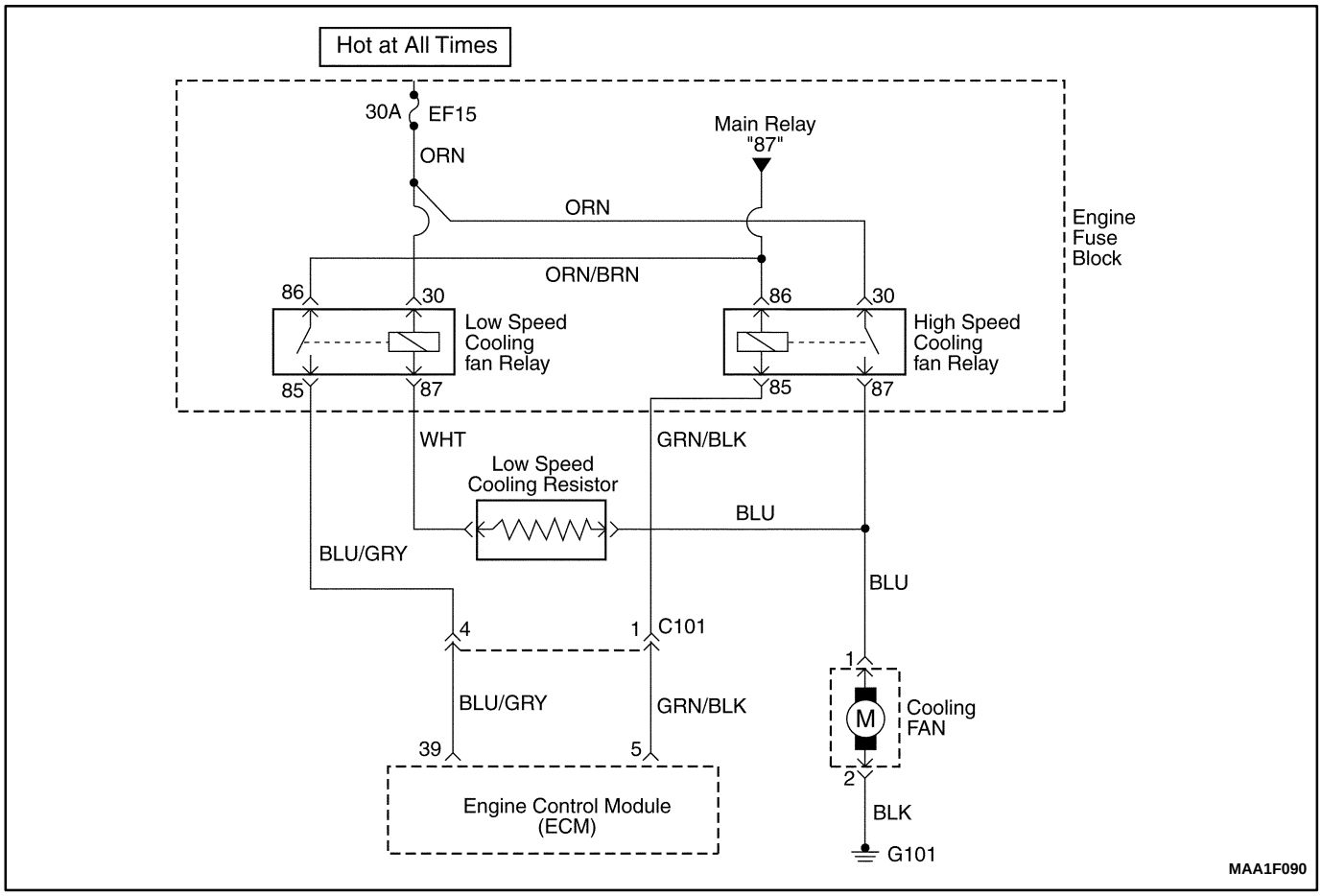

DIAGNOSTIC TROUBLE CODE (DTC) – P0480 LOW SPEED COOLING FAN RELAY CIRCUIT FAULT (WITHOUT A/C)

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

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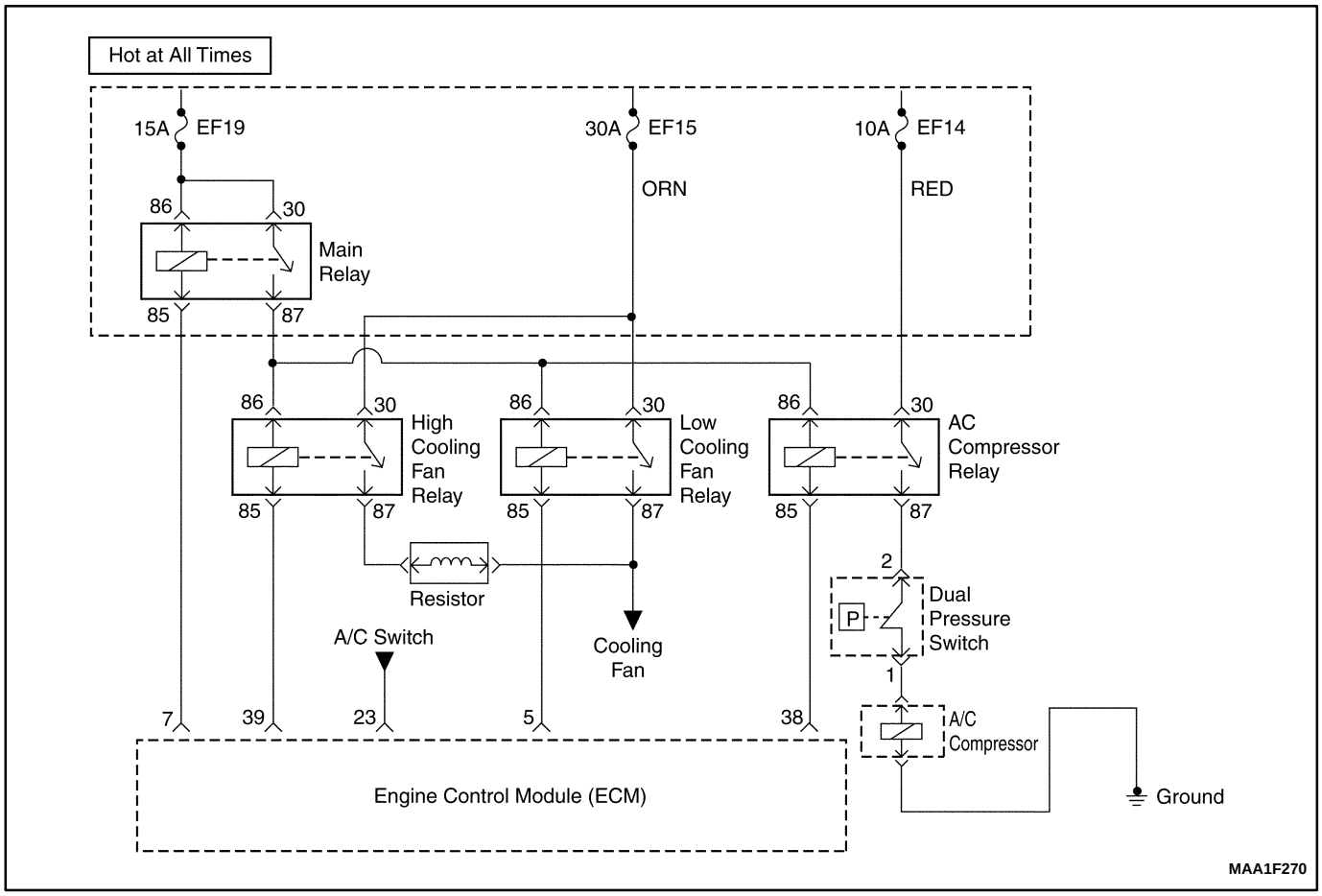

DIAGNOSTIC TROUBLE CODE (DTC) – P0480 LOW SPEED COOLING FAN RELAY CIRCUIT FAULT (WITH A/C)

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

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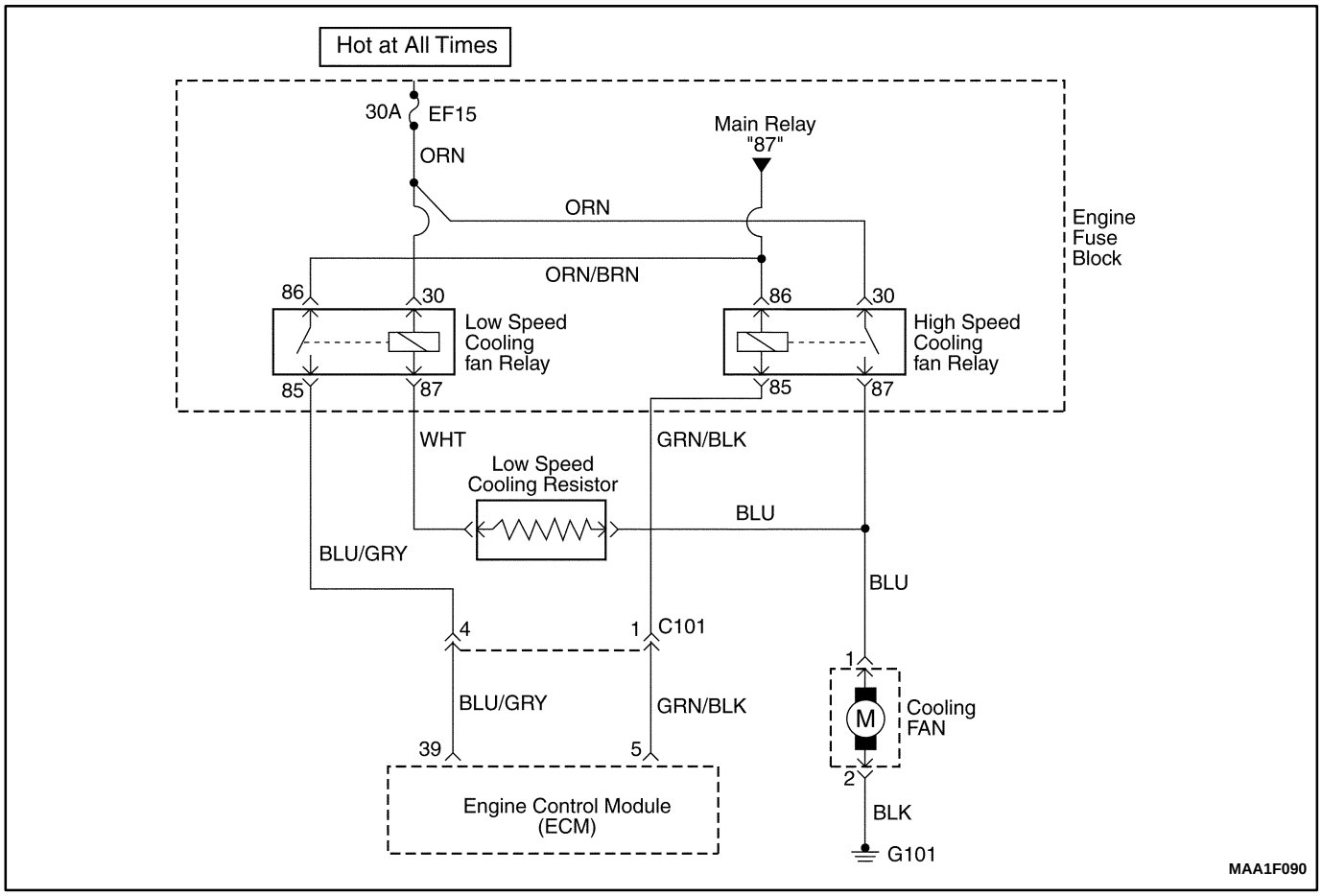

DIAGNOSTIC TROUBLE CODE (DTC) – P0481 HIGH SPEED COOLING FAN RELAY CIRCUIT FAULT (WITHOUT A/C)

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

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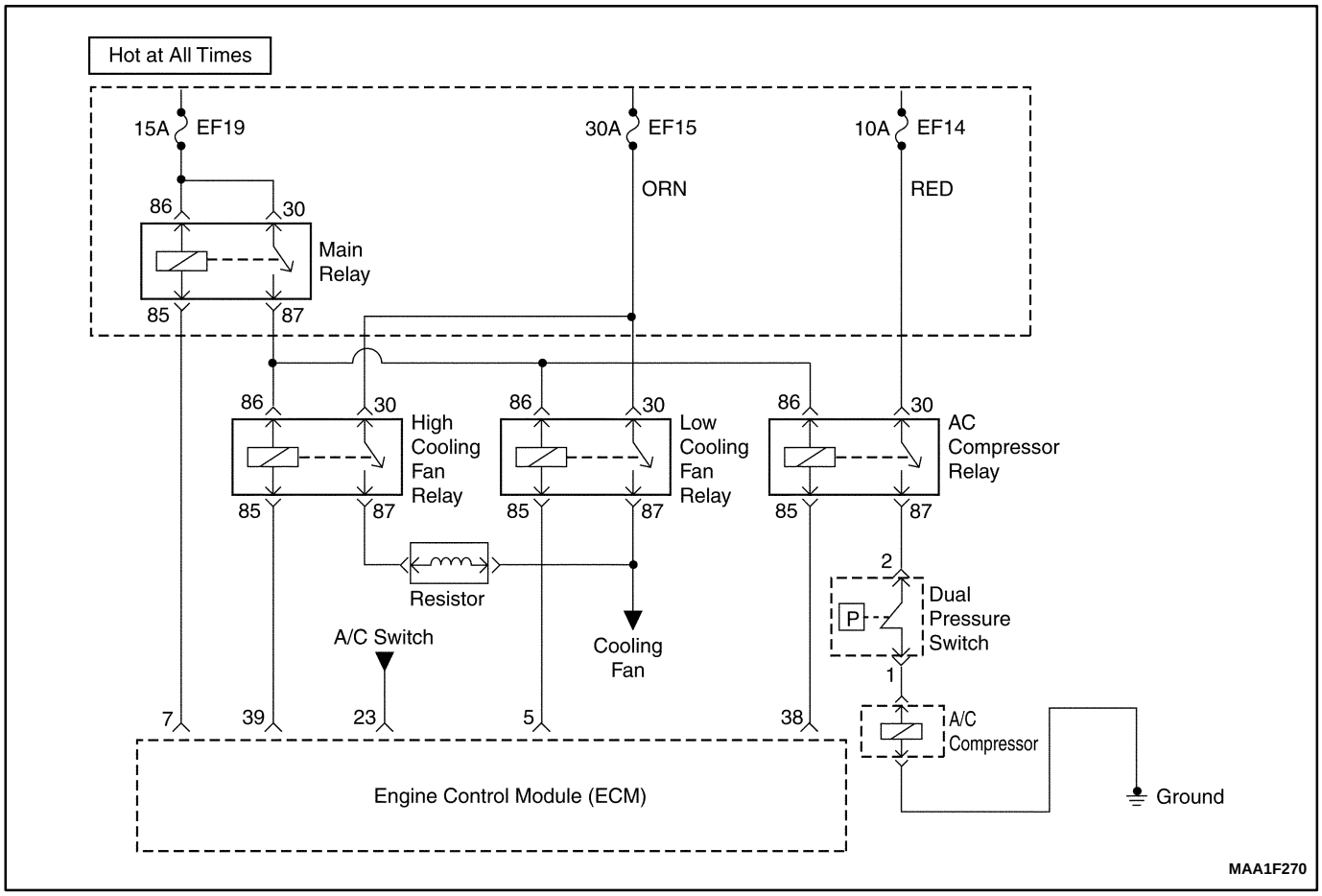

DIAGNOSTIC TROUBLE CODE (DTC) – P0481 HIGH SPEED COOLING FAN RELAY CIRCUIT FAULT (WITH A/C)

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

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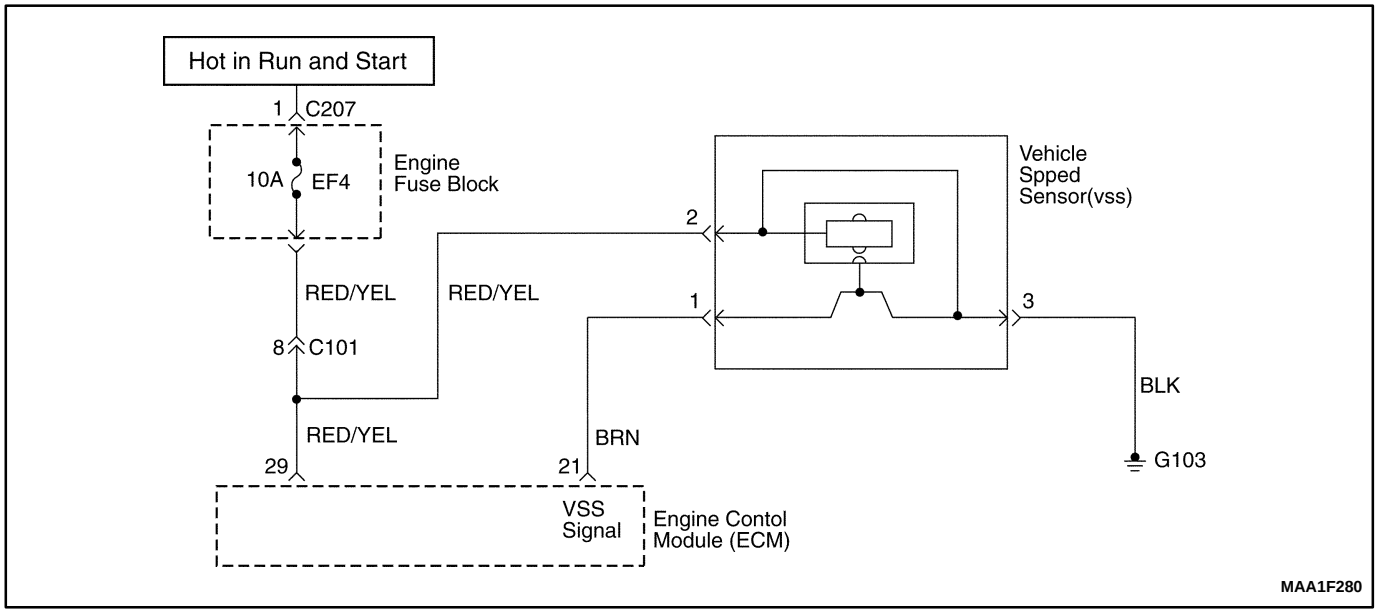

DIAGNOSTIC TROUBLE CODE (DTC) – P0501 VEHICLE SPEED NO SIGNAL (M/T ONLY)

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

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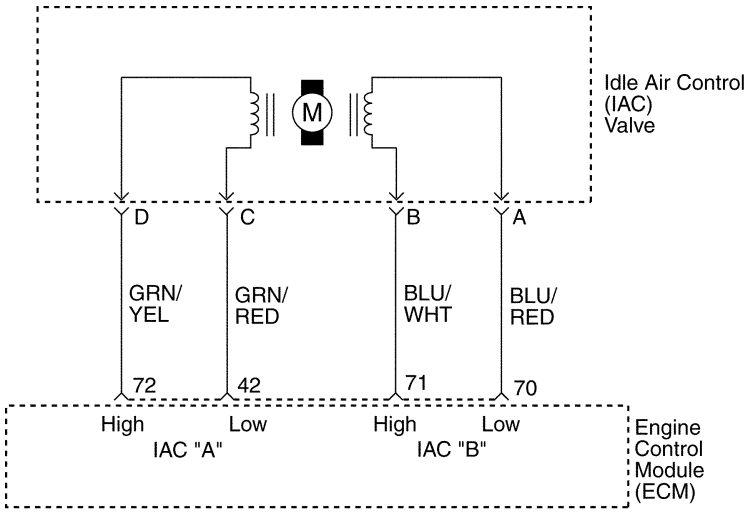

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DIAGNOSTIC TROUBLE CODE (DTC) 0505
IDLE AIR CONTROL VALVE (IACV) CIRCUIT FAULT

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

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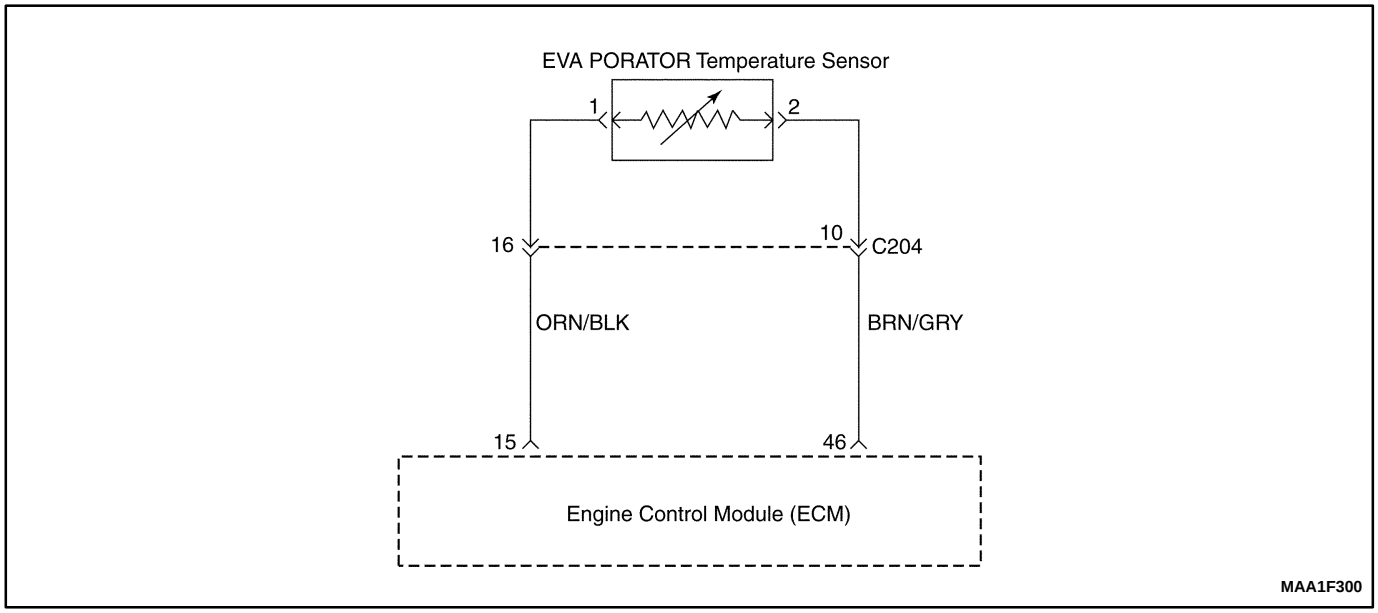


DIAGNOSTIC TROUBLE CODE (DTC) – P1535 EVAPORATOR TEMPERATURE SENSOR HIGH VOLTAGE

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

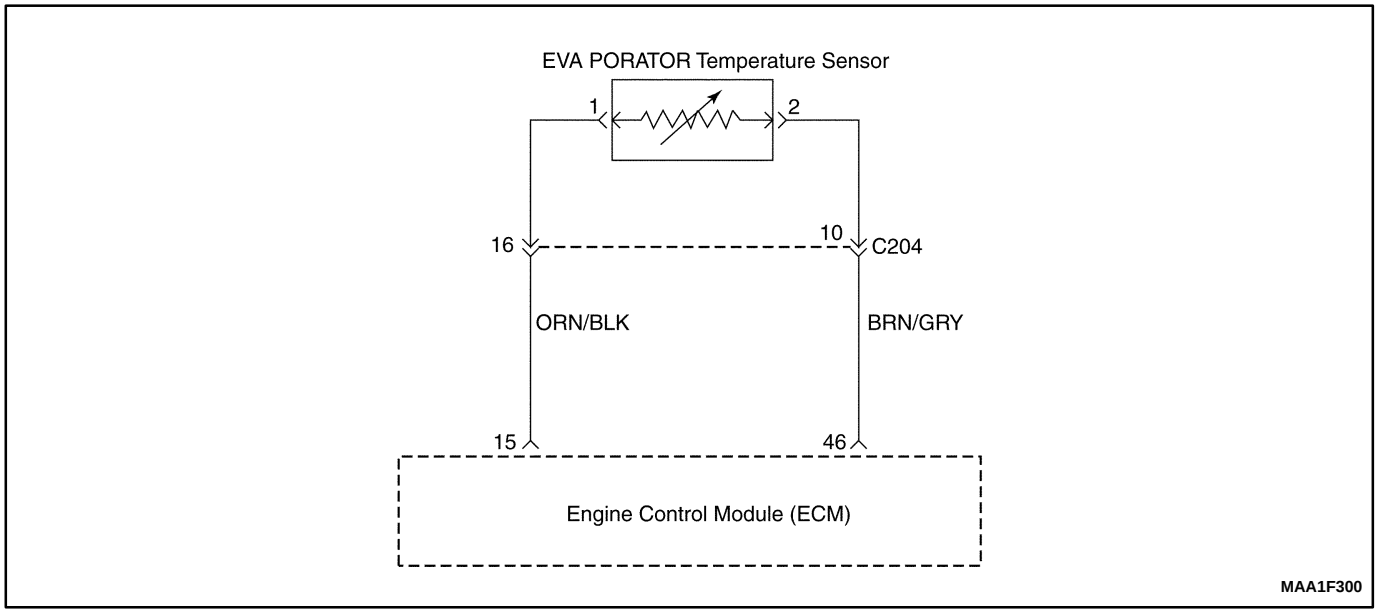
- The ECM will not illuminate the Malfunction Indicator Lamp (MIL).
- A history DTCs is stored.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored Failure Records buffers.
- The A/C compressor operation will be disabled while the low voltage indication 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

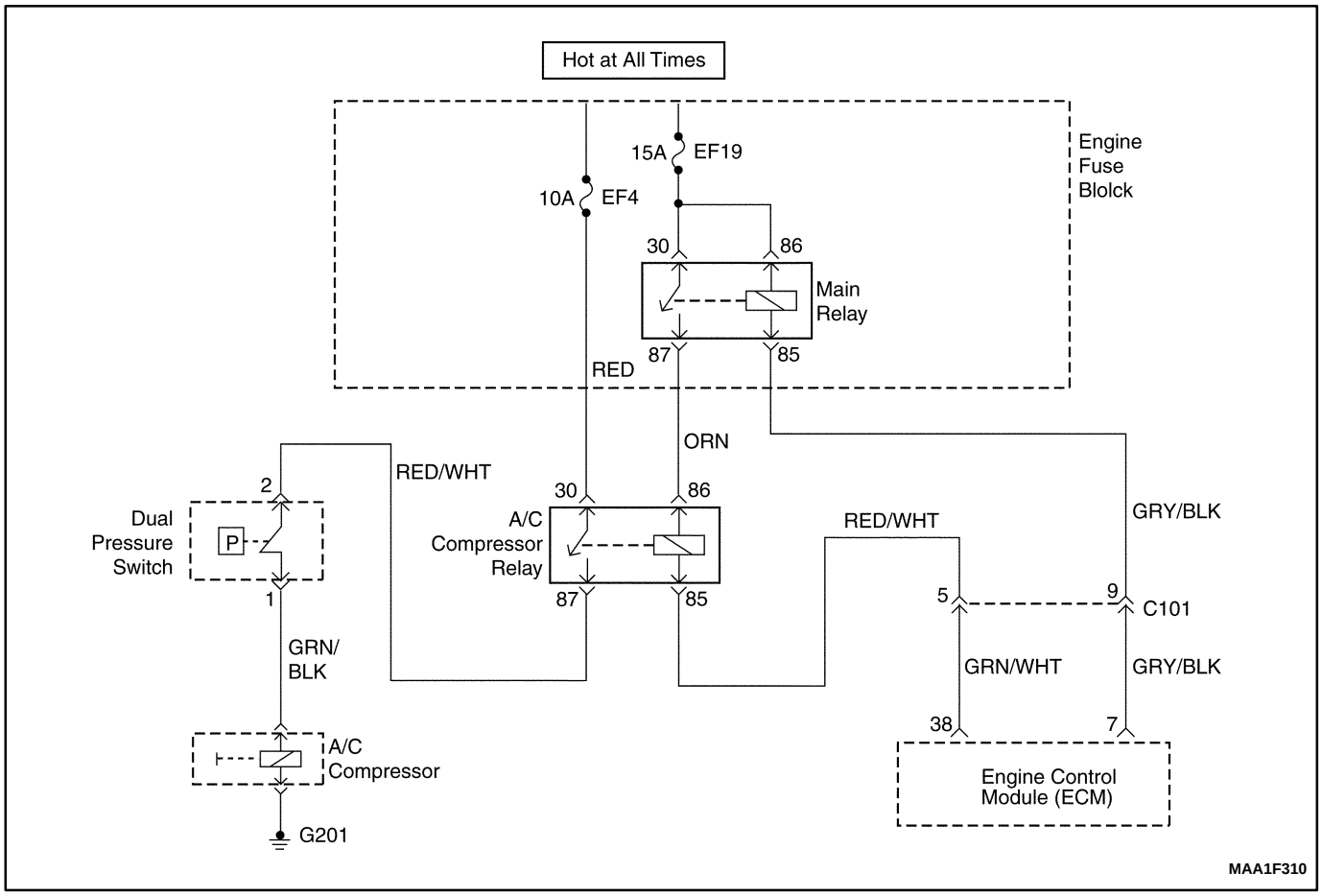
- The ECM will not illuminate the Malfunction Indicator Lamp (MIL).
- A history DTCs is stored.
- The ECM will record operating conditions at the time the diagnostic fails. This information will be stored Failure Records buffers.
- The A/C compressor operation will be disabled while the low voltage indication 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

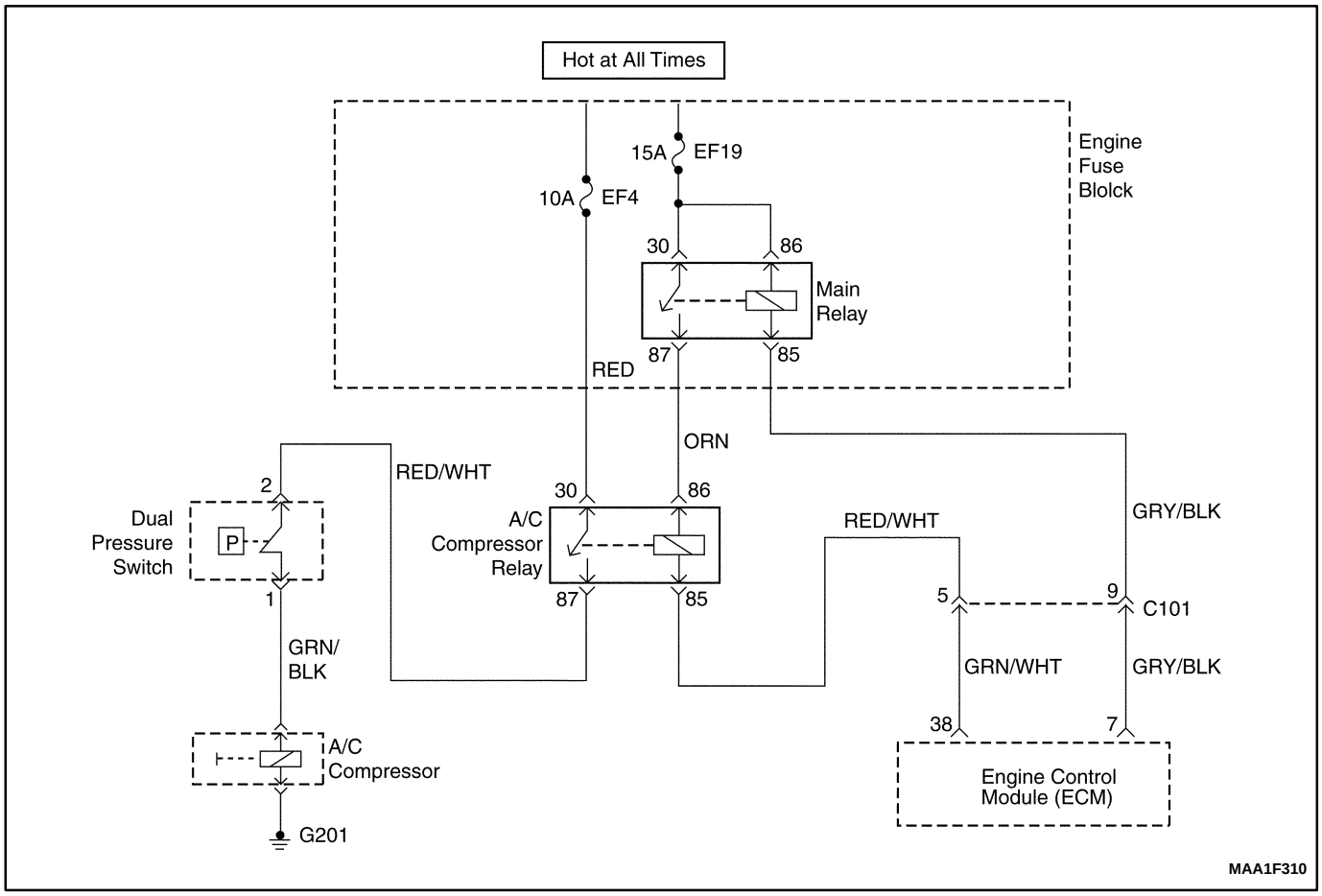
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

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

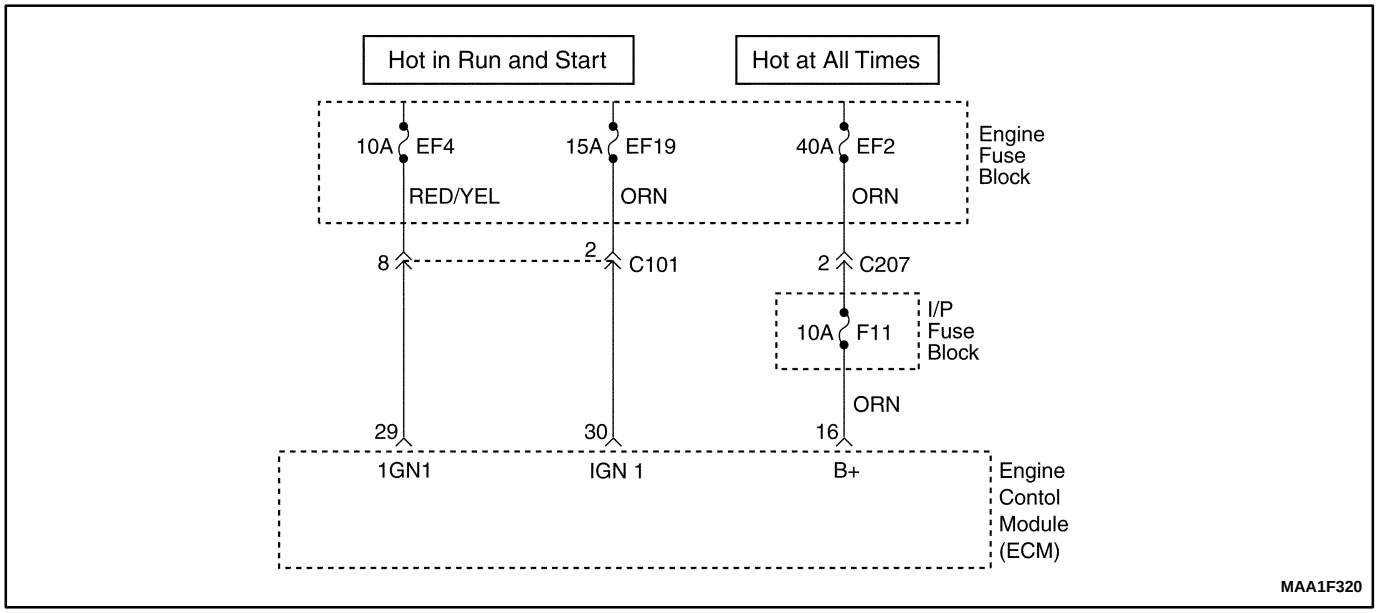
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

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

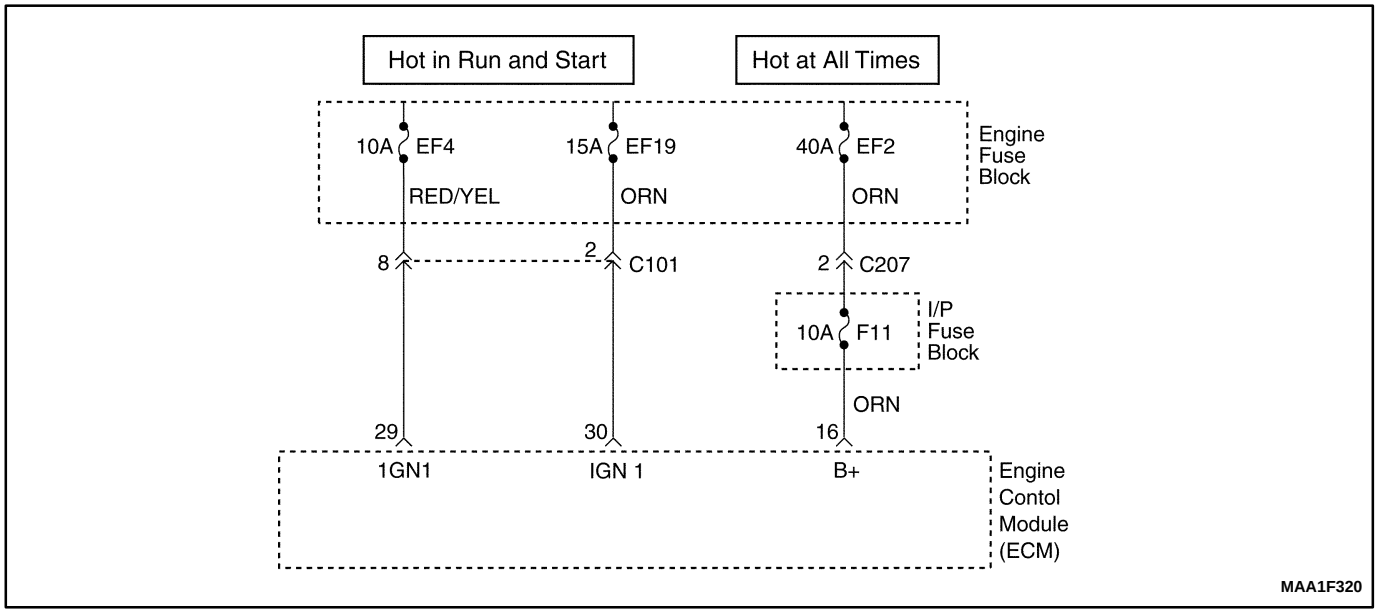
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

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

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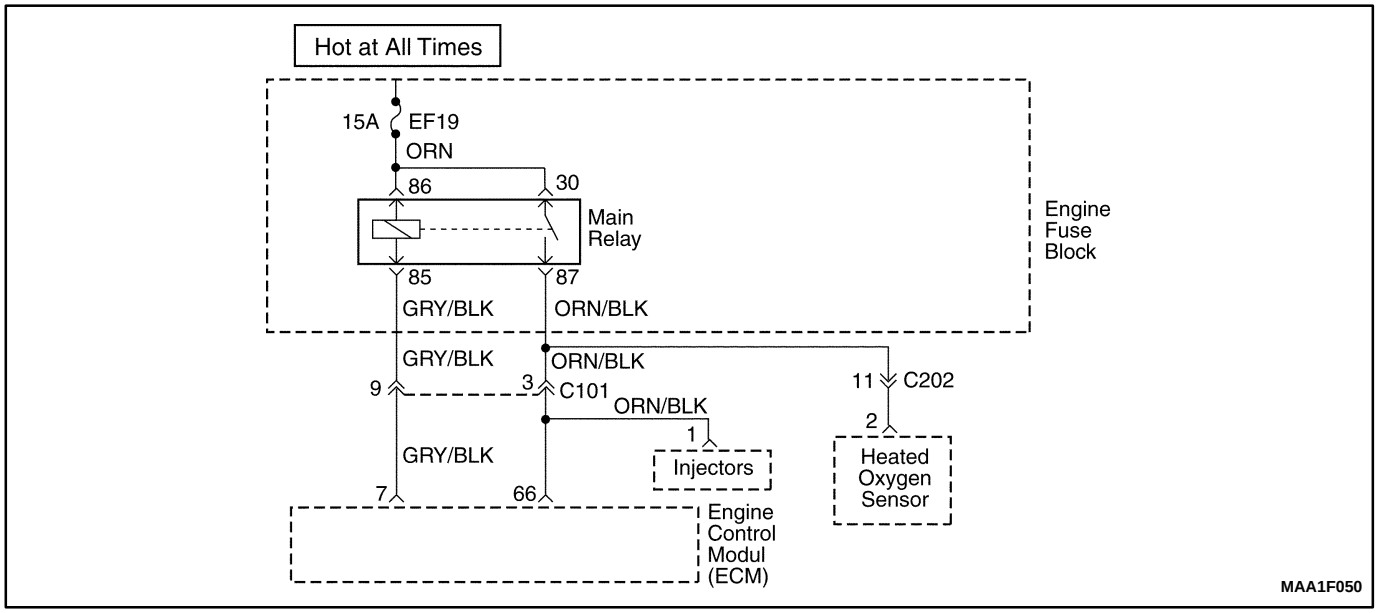


DIAGNOSTIC TROUBLE CODE (DTC) – P1610 MAIN RELAY HIGH VOLTAGE

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

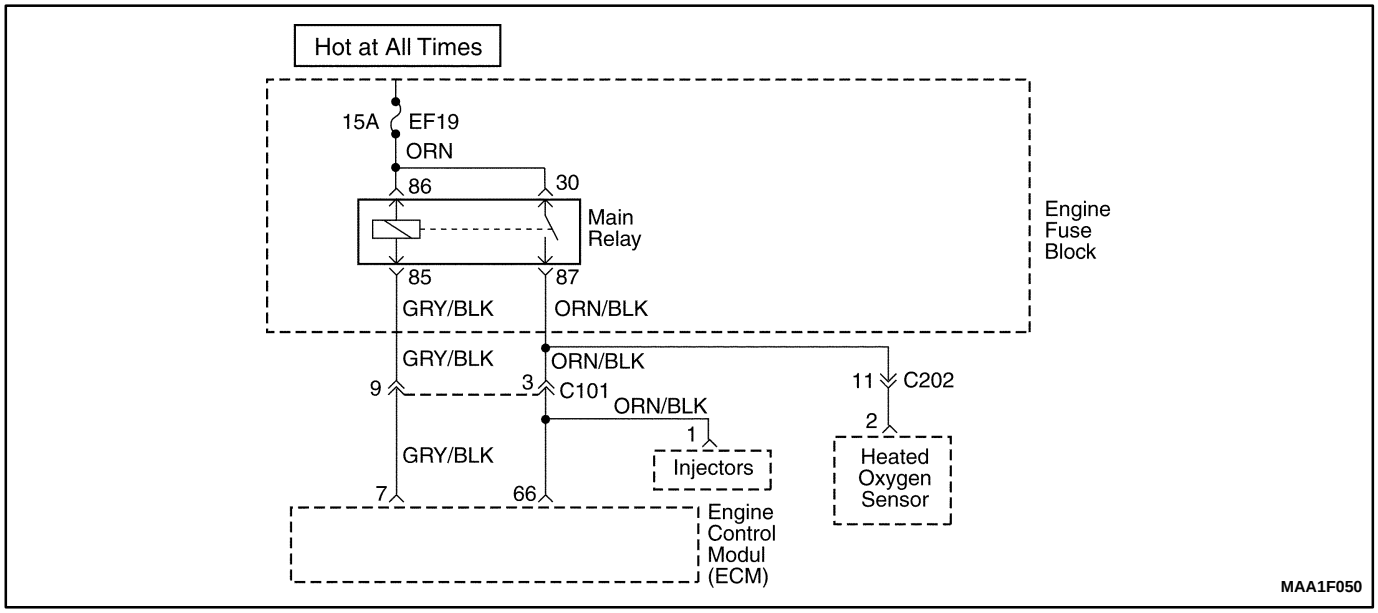
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

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

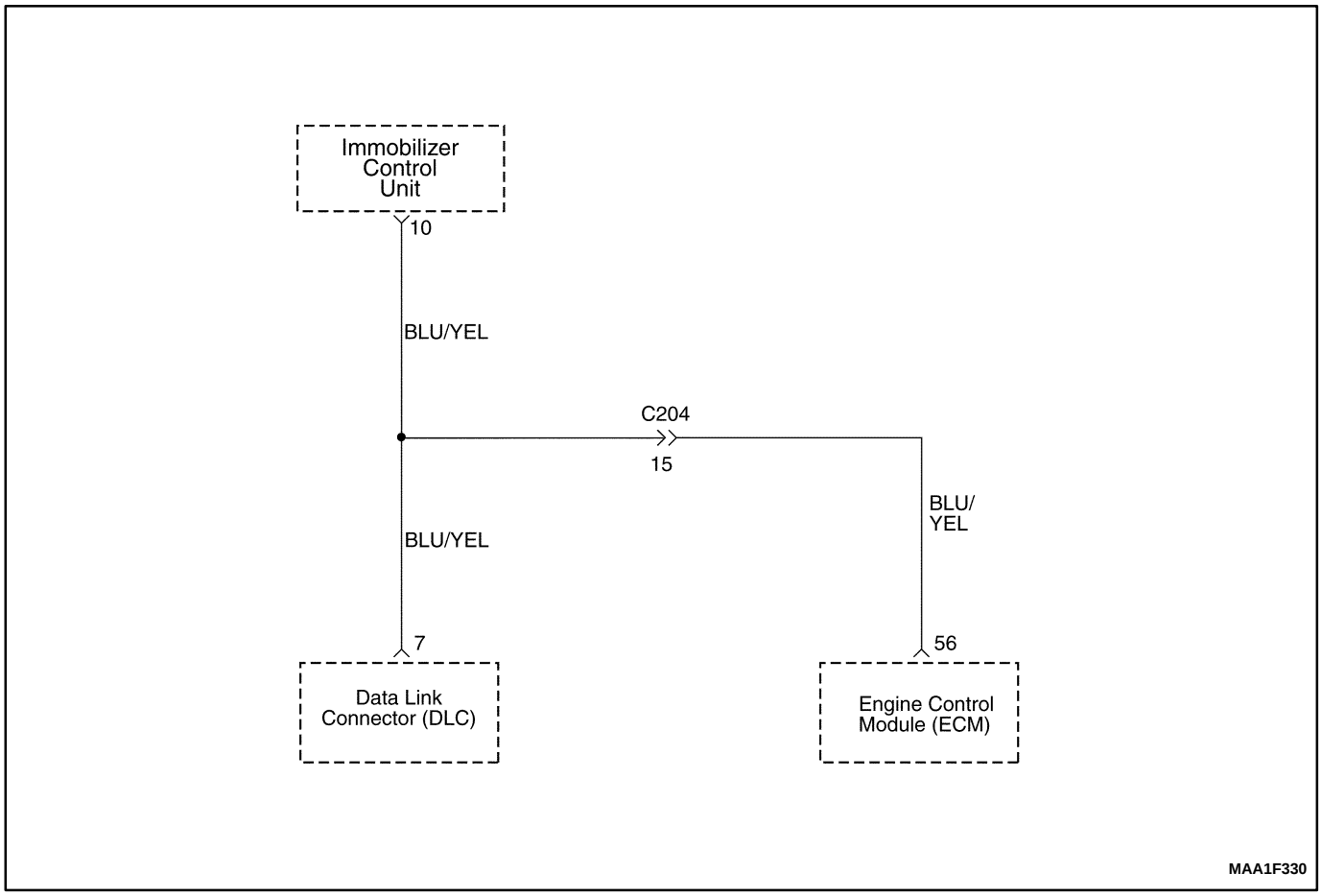
Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection at the ECM.

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

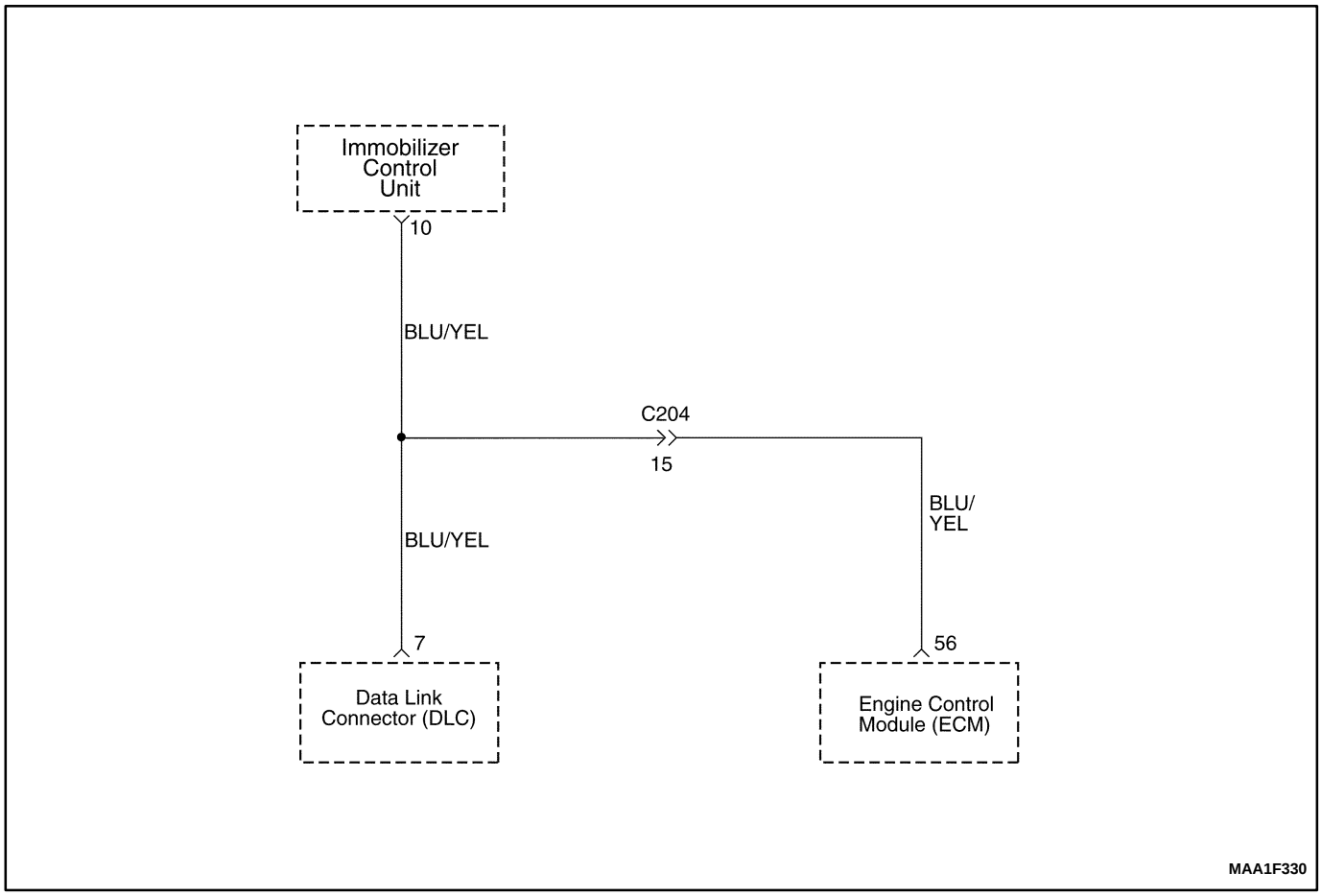
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

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

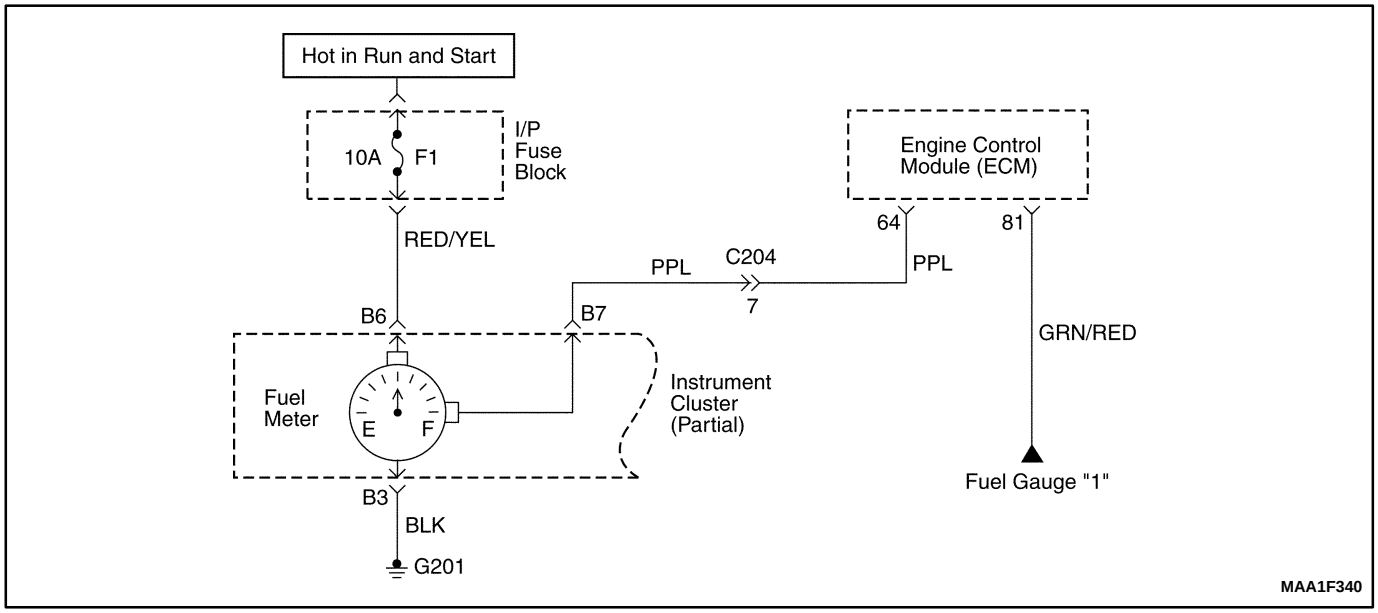
- The Malfunction Indicator Lamp (MIL) will not illuminate.
- The ECM will store conditions which were present when the DTC was set as Failure Records data only.
- This information will not be stored in the Freeze Frame data.

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.

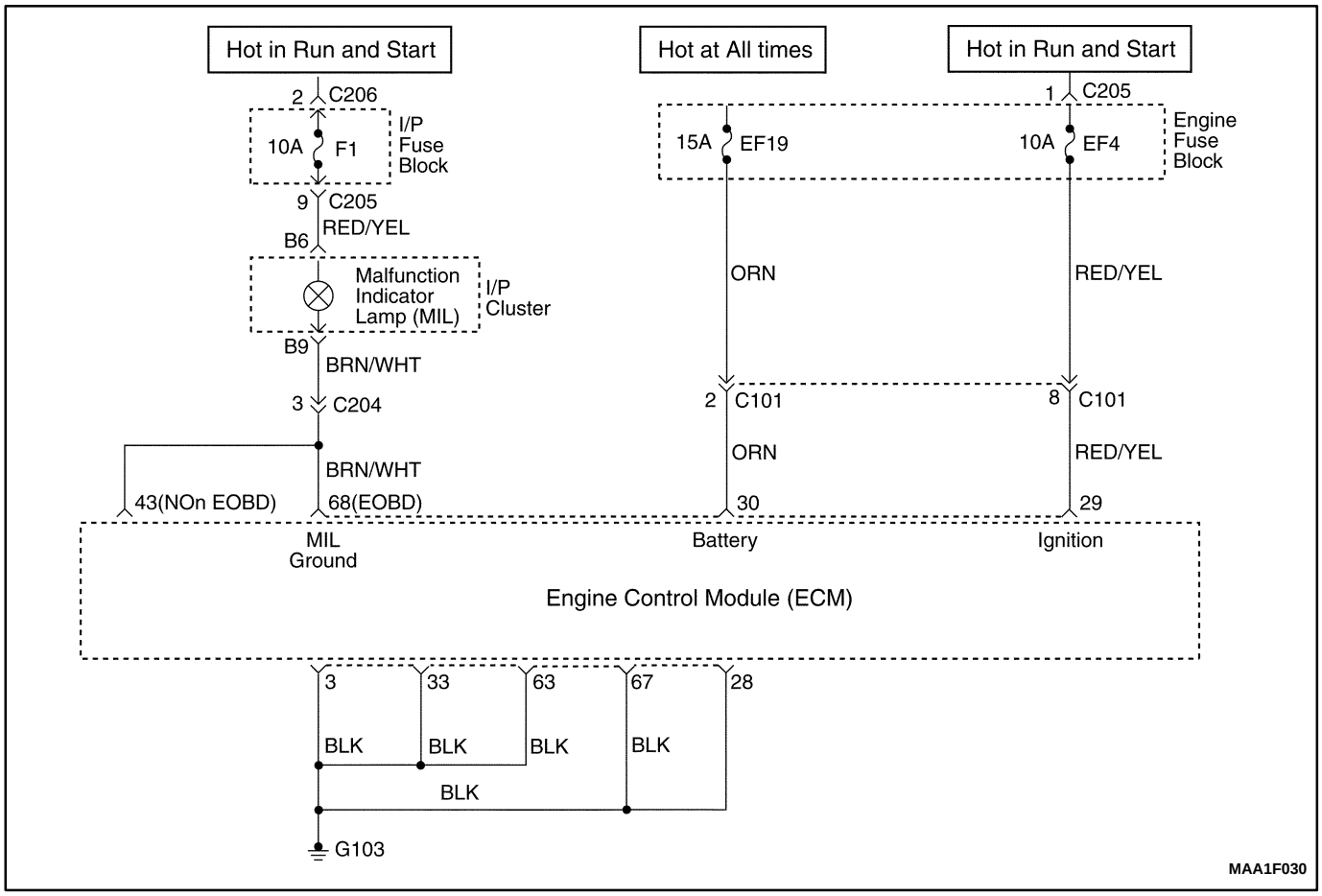
A stuck Fuel Level Sensor may cause the DTC to set. If DTC P0656 cannot be duplicated, the information included in the Freeze Frame data can be useful in determining vehicle operating conditions when the DTC was first set.

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

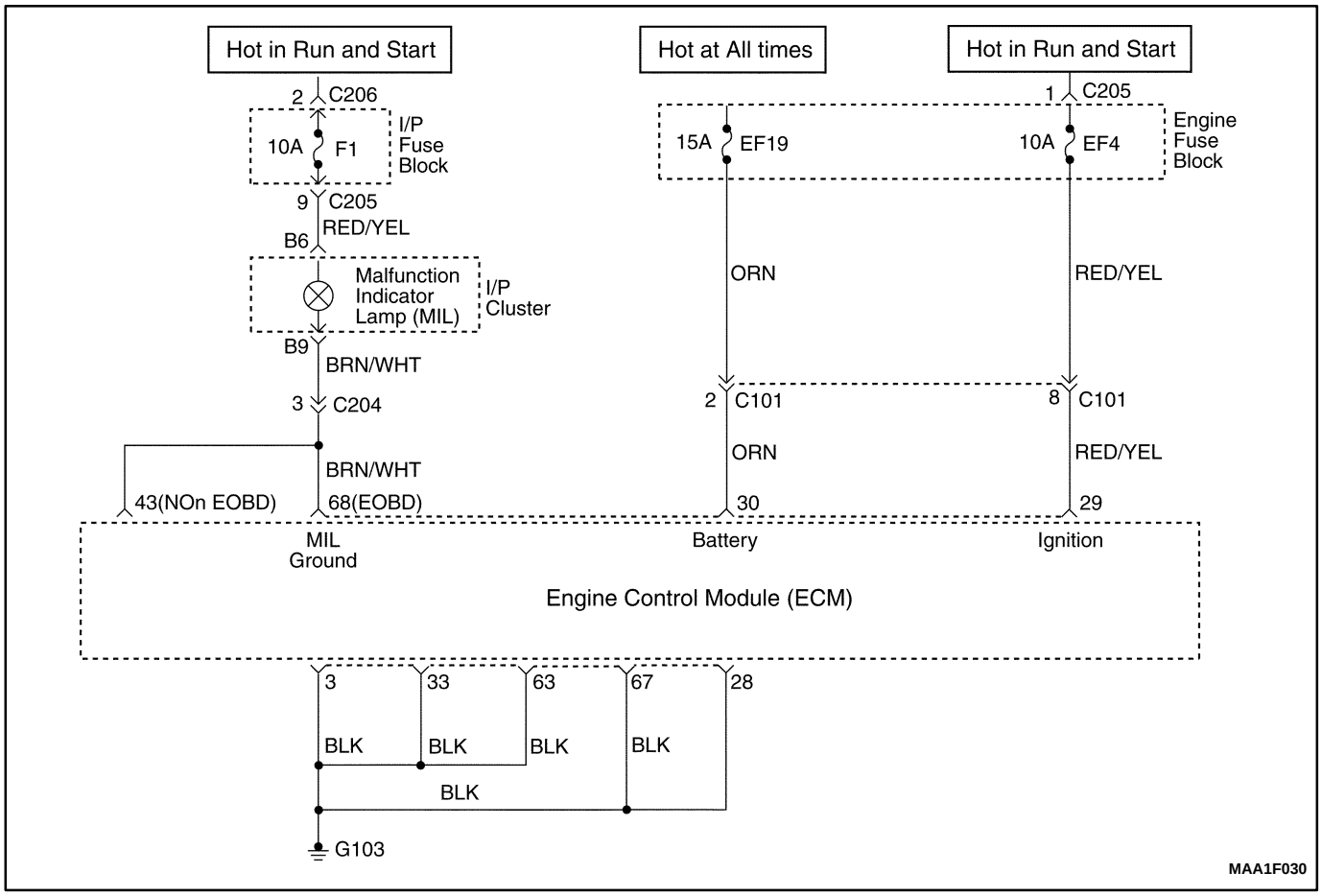
An Intermittent problem may be caused by a poor connection, rubbed through wire insulation, or wire that is broken inside the insulation.

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

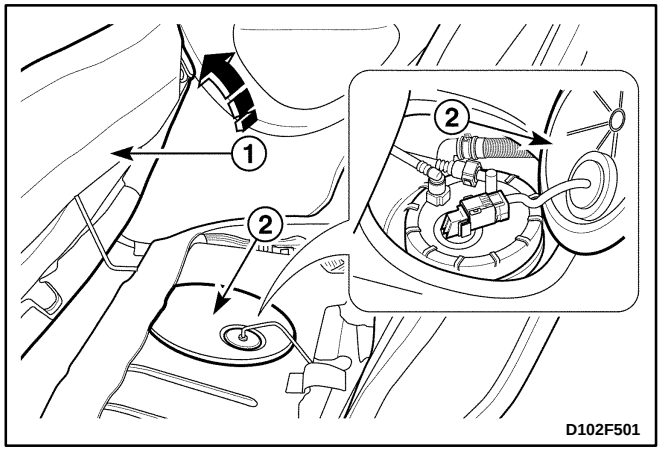
Definition: Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

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



FUEL PUMP

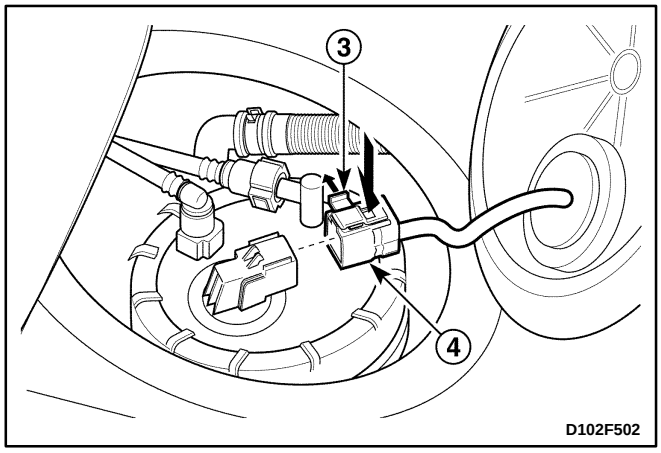
Tools Required

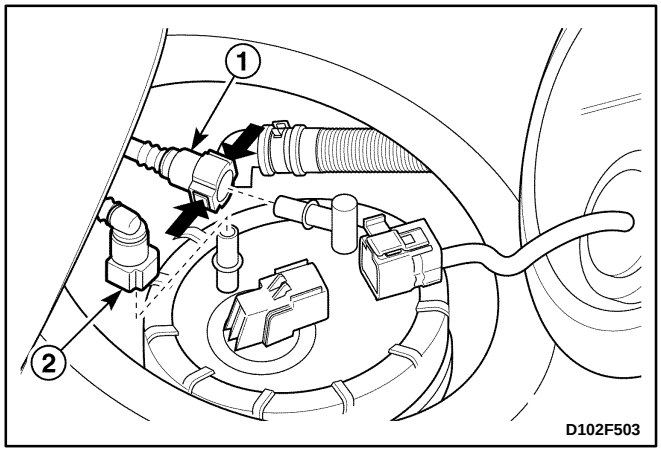
DW 140–010A Fuel Pump Lock Ring Remover/Installer.

Removal Procedure

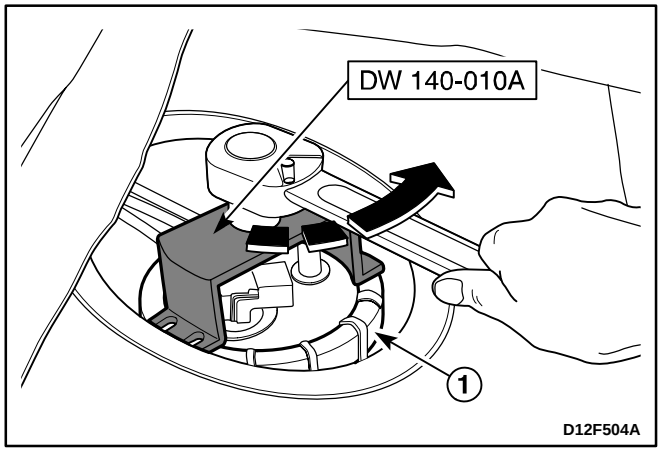
Caution: The fuel system is under pressure. To avoid fuel spillage and the risk of personal injury or fire, it is necessary to relieve the fuel system pressure before disconnecting the fuel lines.

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.

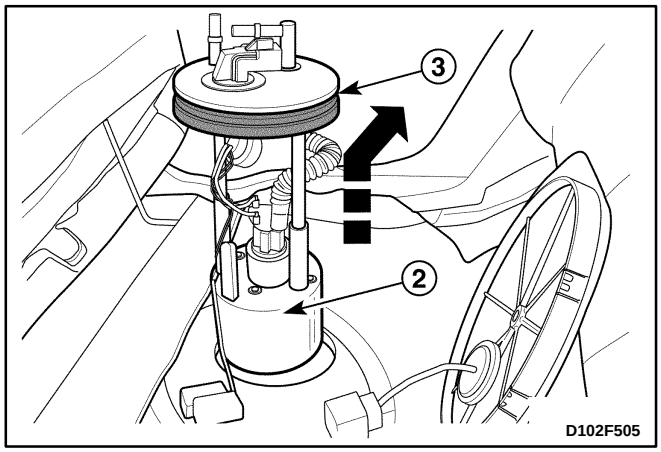




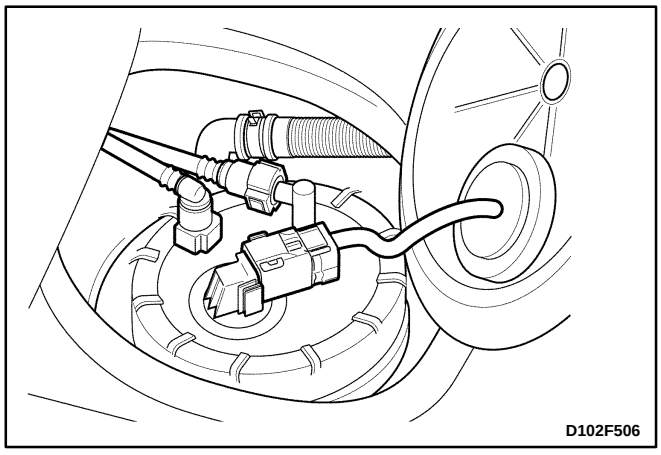
2. Disconnect the fuel lines from the fuel pump.
   - Disconnect the fuel outlet line (1).
   - Disconnect the fuel tank return line (2).



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).

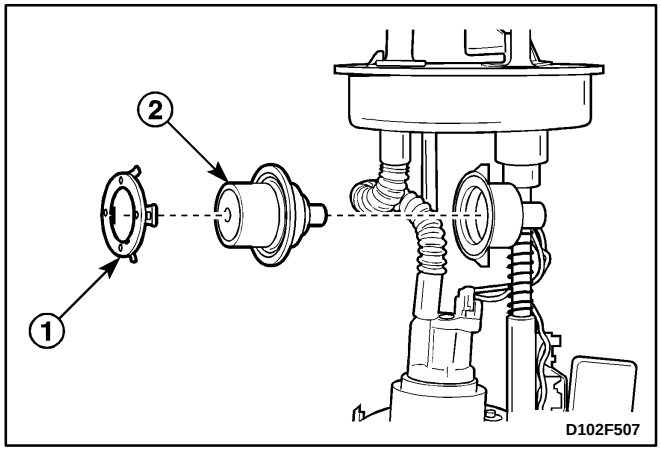


   - Remove the fuel pump assembly (2).
   - Remove the fuel pump gasket (3).



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.

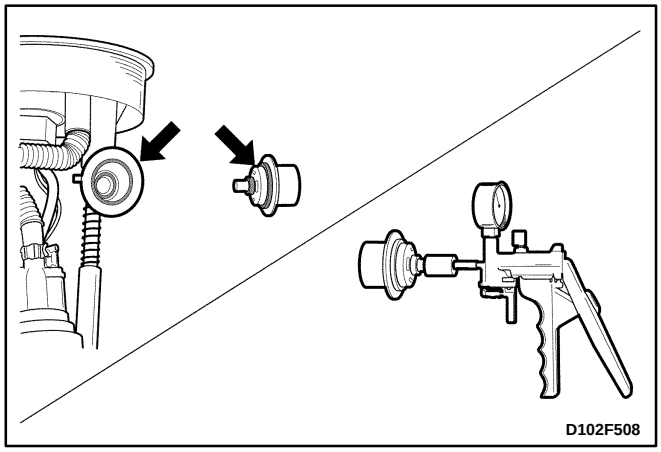


FUEL PRESSURE REGULATOR

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.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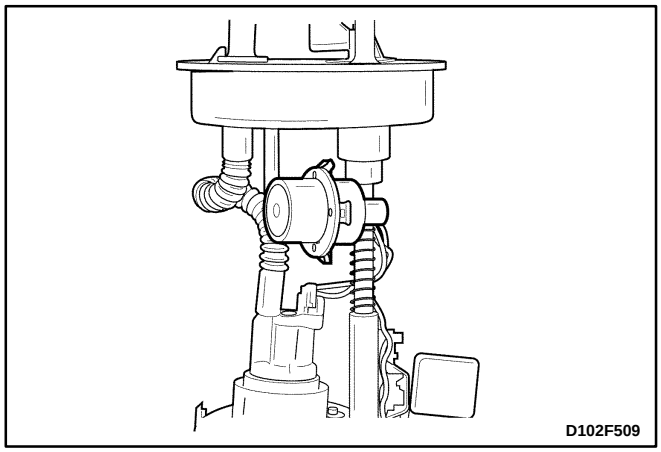
2. Remove the fuel pressure regulator from the fuel pump.
   - Remove the retainer from the fuel pump assembly (1).
   - Remove the fuel pressure regulator (2).
   - Check the O–ring seals for the damage or the rip.
   - Use a vacuum gauge to check the diaphram for damage and the spring for operation.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Installation Procedure

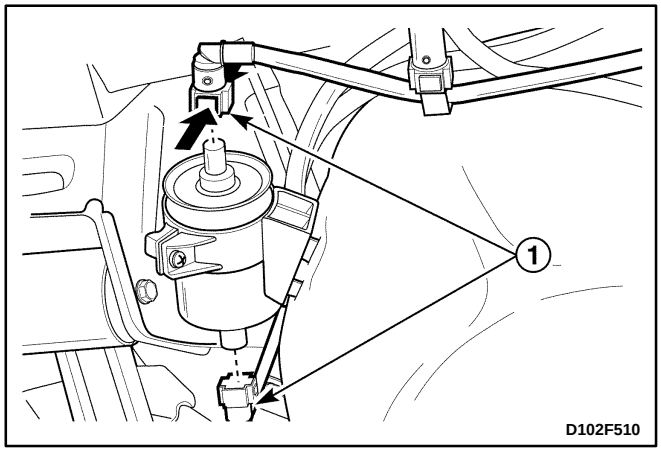
1. Install in the reverse order of removal.
   - Do not reuse the removed O–ring seals. Replace the removed O–ring seals with the new ones.

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).



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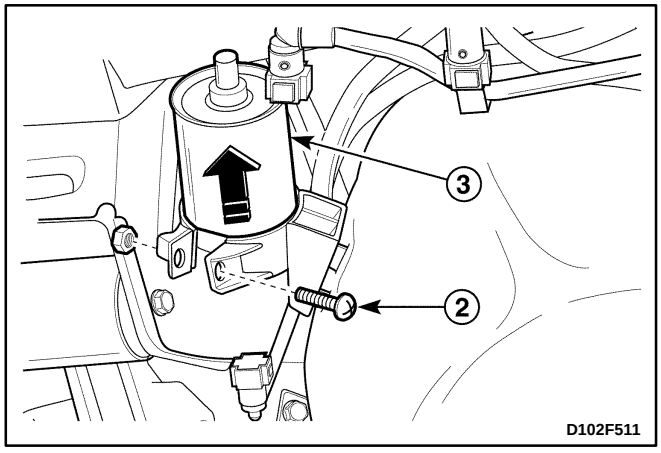

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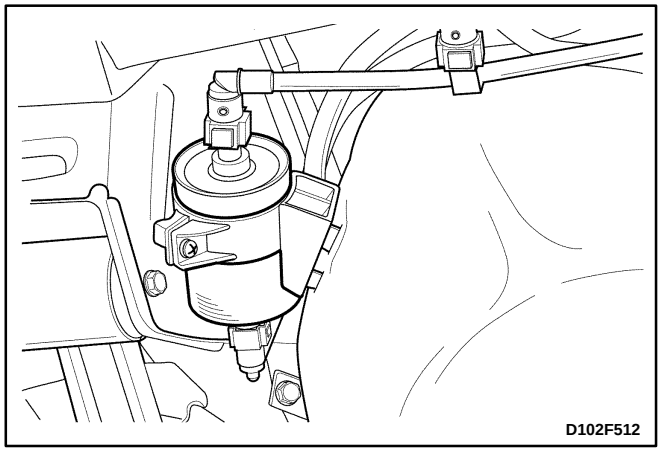
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Installation Procedure

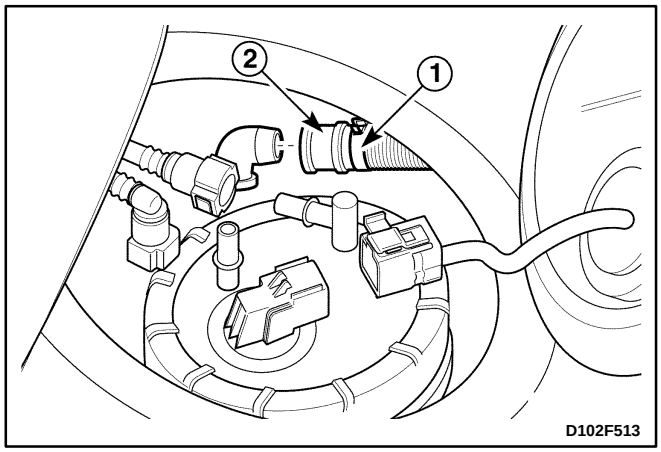
1. Install in the reverse order of removal.
   - Install the new fuel filter into the retaining clamp. Note the flow direction.
   - Connect the inlet/outlet lines. Secure the lines with the connector lock.
   - Perform a leak test of the fuel filter.

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).



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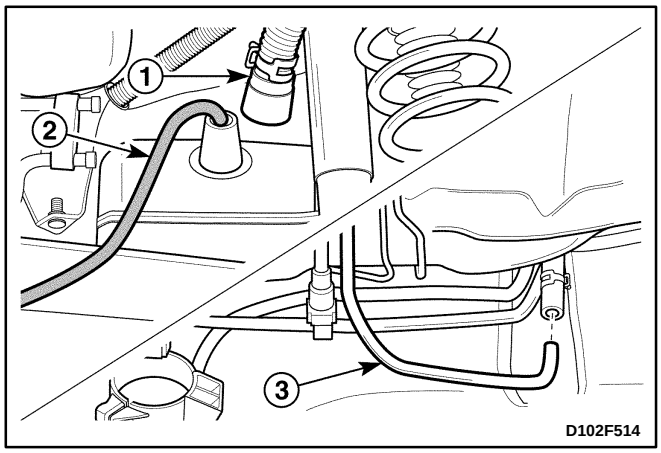
3. Drain the fuel tank.
   - Place a pan below the fuel tank to catch the draining fuel.
   - Disconnect the fuel tank filter tube (1).
   - Drain the fuel from the fuel tank using the ventilation tube joint port (2).
   - Disconnect the evaporative emission canister line (3).



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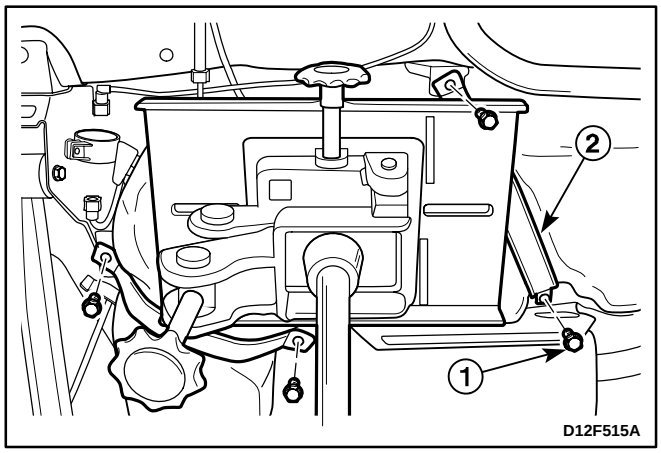
4. Remove the fuel filter. Refer to “Fuel Filter” in this section.
5. Install the jack to remove the fuel tank.
   - Install the jack on the center of the fuel tank.
   - Remove the strap bolts (1).
   - Remove the straps (2).



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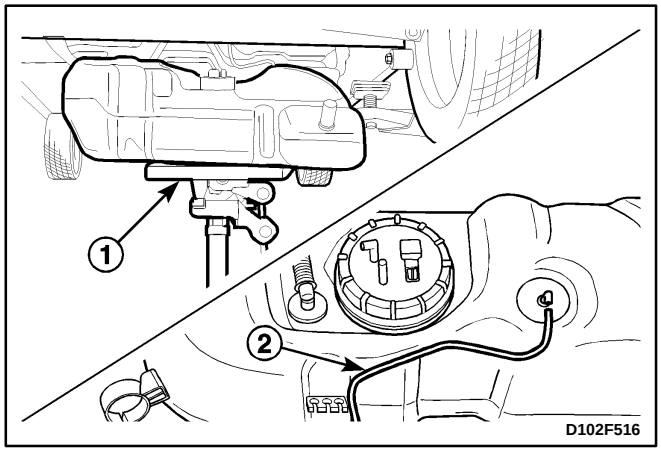
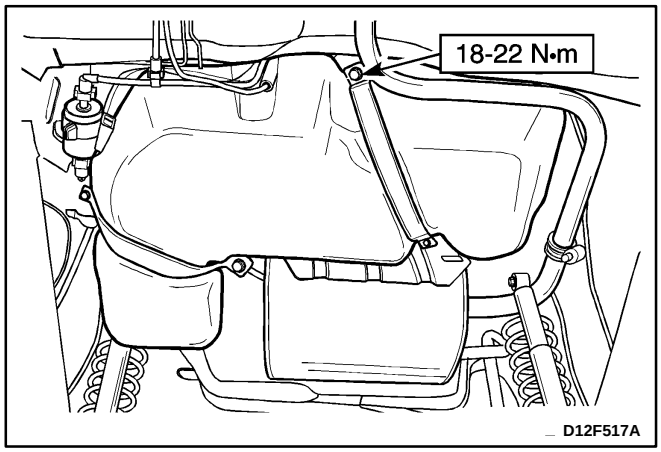


6. Remove the fuel tank.
   - Lower slowly the jack to remove the fuel tank easily (1).
   - Disconnect the canister hose which is connected to the roll over valve from the fuel tank removed (2).
   - Inspect the fuel tank for clacks, damages, and contaminations.
   - Inspect the fuel lines for cracks and damages.

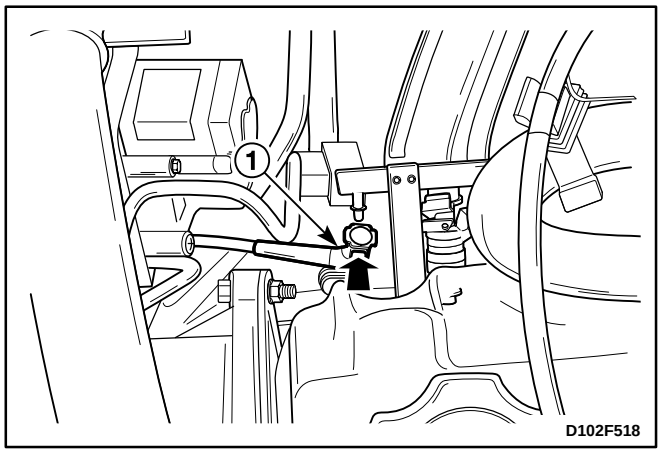


Installation Procedure

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).

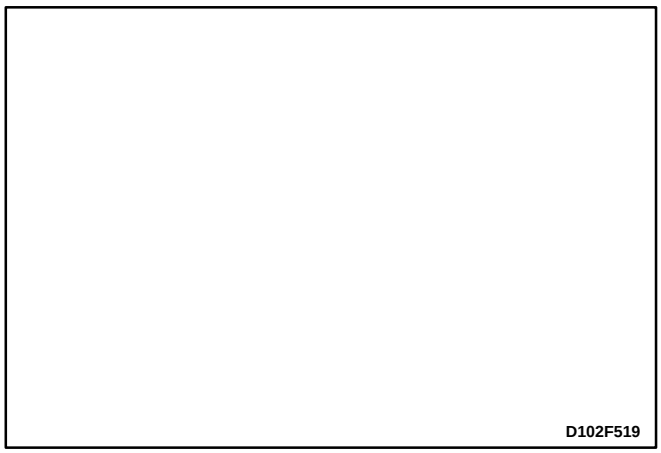


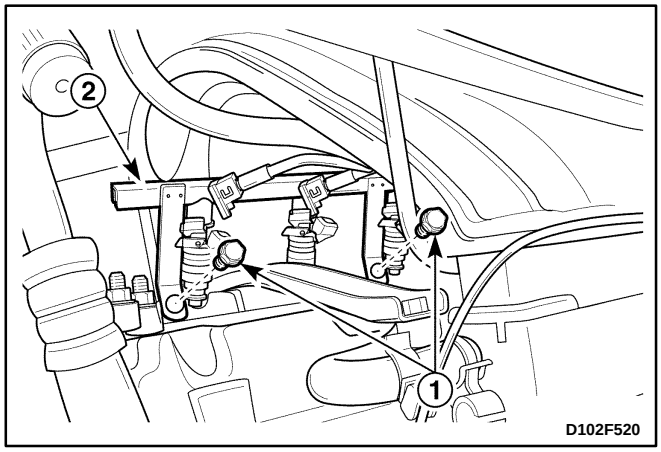
FUEL RAIL AND INJECTORS

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.

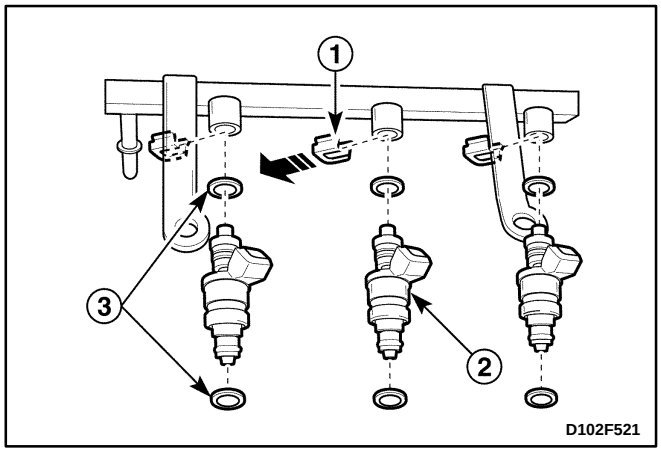
1. Relieve the fuel system pressure.
   Refer to “Fuel Pump” in this section.
2. Remove the canister from the engine room. Refer to “Evaporative Emission Canister” in this section.
3. Disconnect the fuel inlet line (1).
4. Disconnect the fuel injector harness connectors (2).





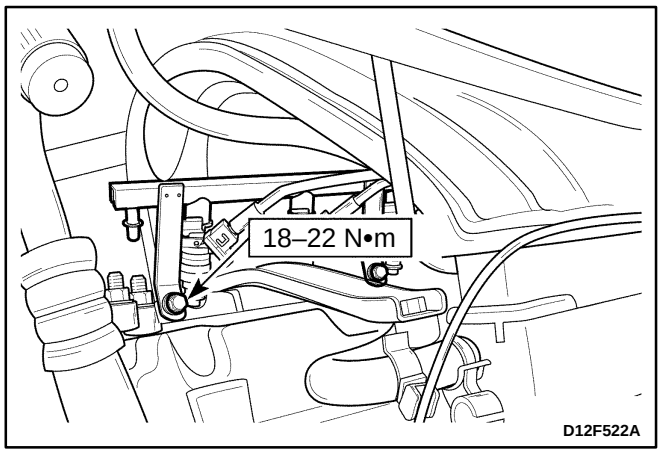
5. Remove the fuel rail with the fuel injectors attached.
   - Remove the bolts (1).
   - Remove the fuel rail with the fuel injectors attached (2).

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.

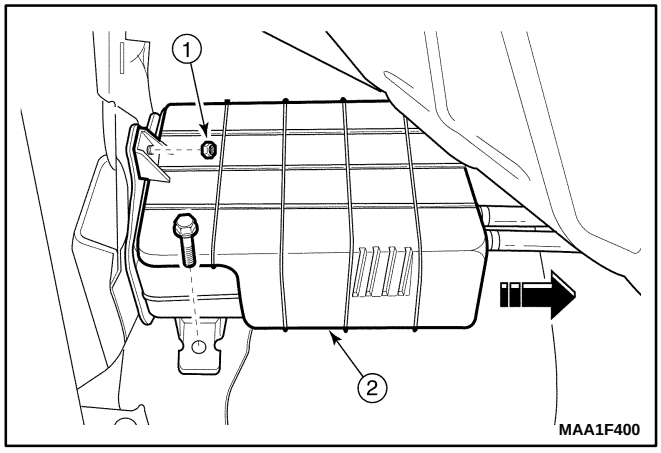
- Lubricate the new fuel injector O–rings with engine oil. Install the new O–rings on the fuel injectors.

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.

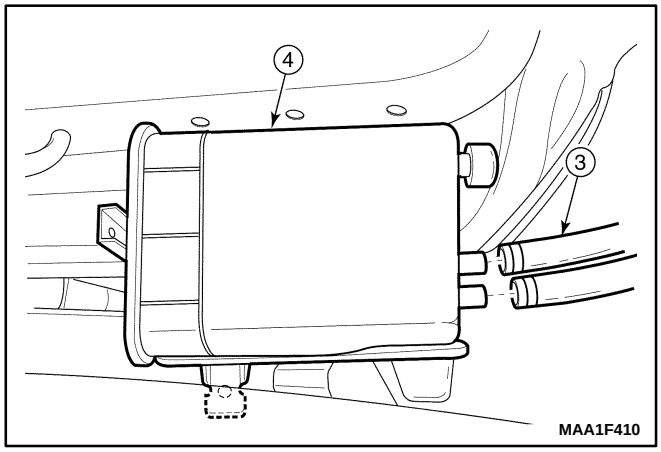


EVAPORATIVE EMISSION CANISTER

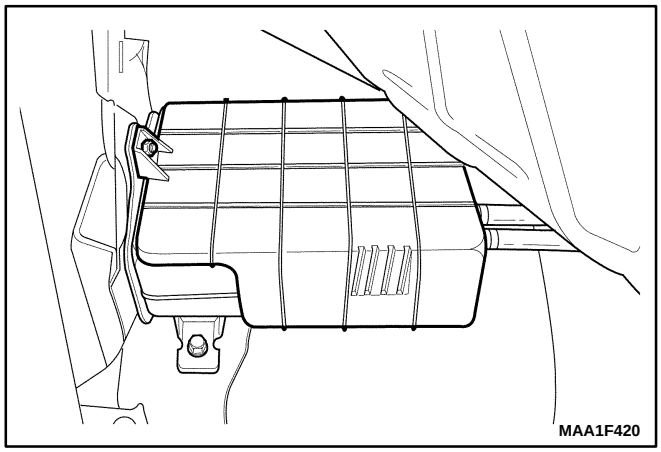
Removal Procedure

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).

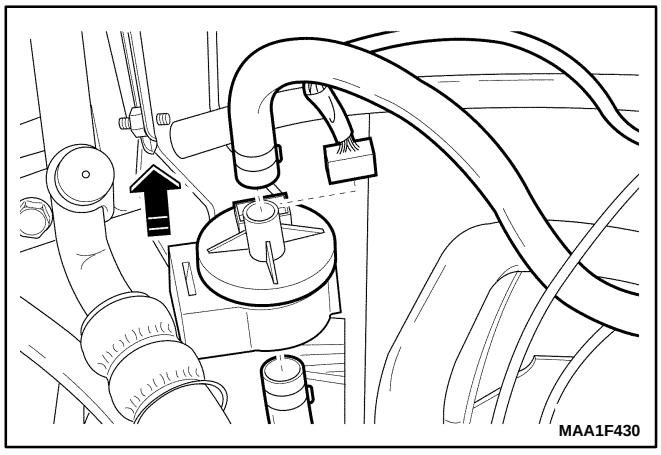


- Disconnect the canister hoses (3).
- Remove the evaporative emission casnister (4).



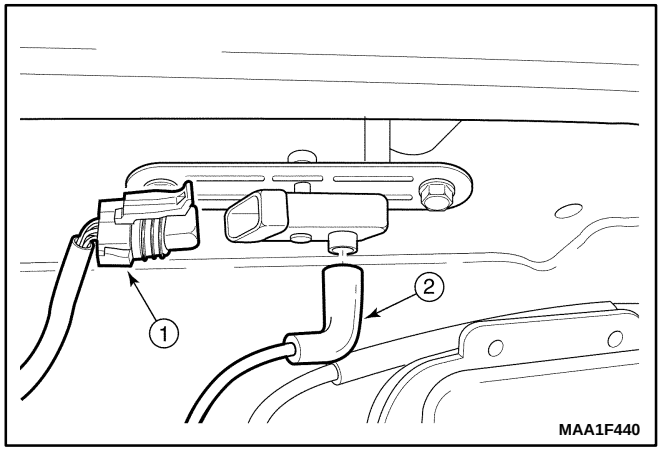
Installation Procedure

1. Install in the reverse order of removal.



EVAPORATIVE EMISSION CANISTER PURGE SOLENOID

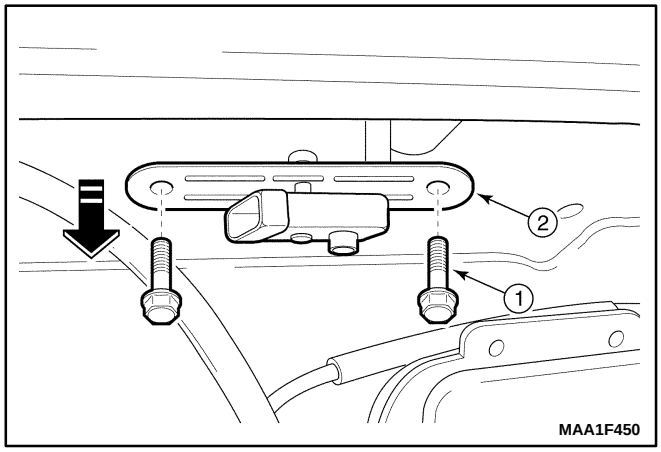
1. Disconnect the negative battery cable.
2. Disconnectthe evaporative (EVAP) emission canister purge solenoid connector.
3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.
4. Unclip the EVAP emission canister purge solenoid from the mounting bracket.
5. Installation should follow the removal procedure in the reverse order.



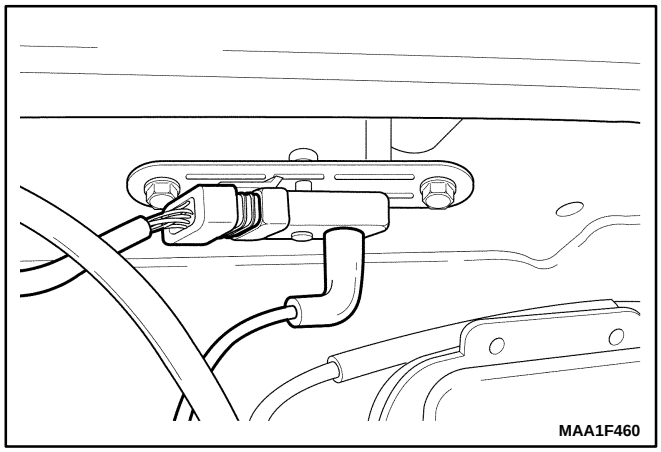
MANIFOLD ABSOLUTE PRESSURE SENSOR

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).



2. Remove the MAP sensor.
   - Remove the bolts (1).
   - Remove the MAP sensor with bracket (2).



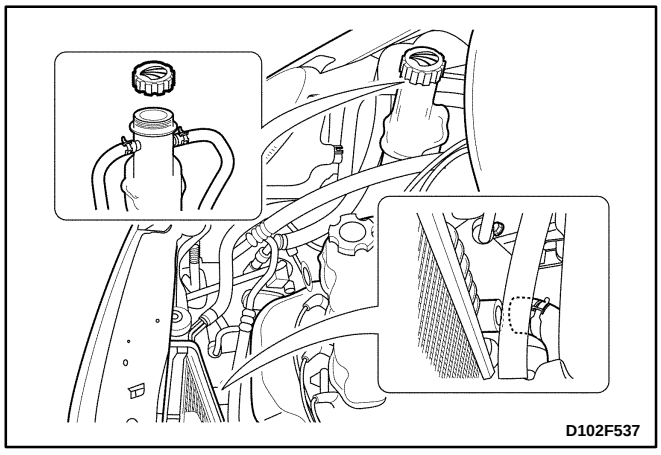
Installatin Procedure

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).

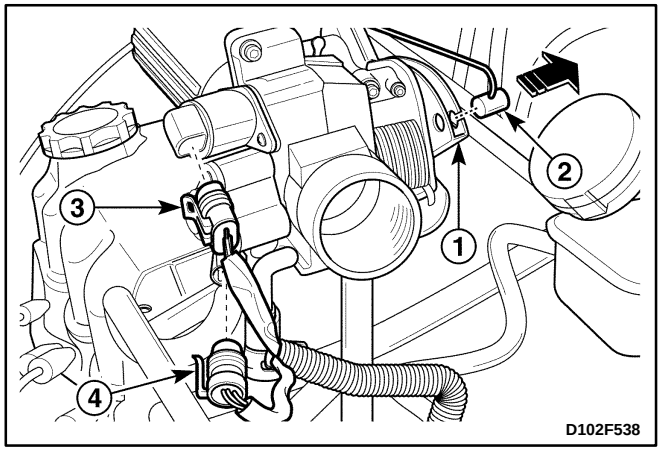
Tighten the MAP sensor bracket bolt to 8–12 N•m (71–106 lb-in).



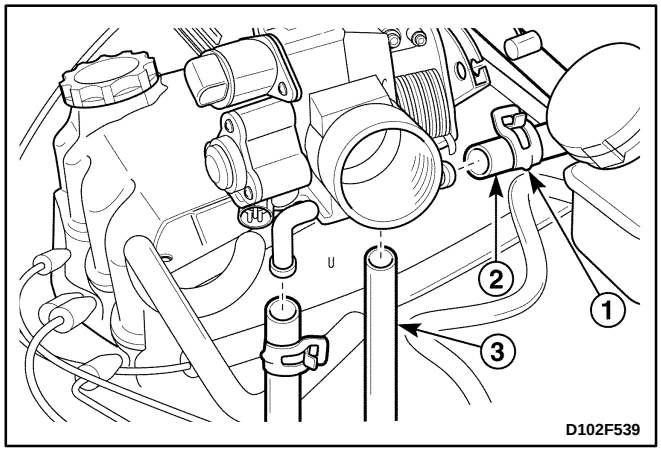
THROTTLE BODY

Removal Procedure

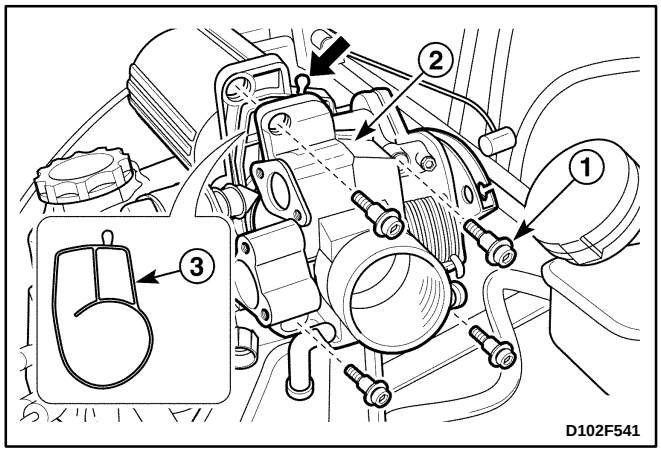
1. Remove the air cleaner/resonator assembly and air intake tube. Refer to *Section 1B, SOHC Engine Mechanical*.
2. Drain the engine coolant. Refer to *Section 1D, Engine Cooling.*



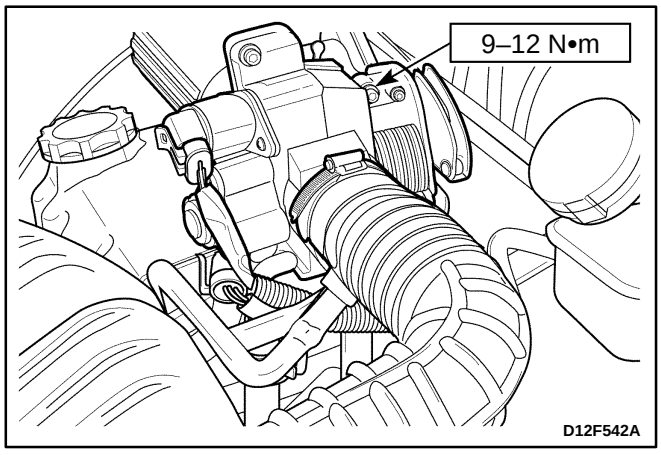
3. Disconnect the throttle cable, the throttle position sensor and the idle air control valve connectors.
   - Open the throttle valve (1).
   - Disconnect the throttle cable (2).
   - Disconnect the idle air control valve connector (3).
   - Disconnect the throttle position sensor connector (4).



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

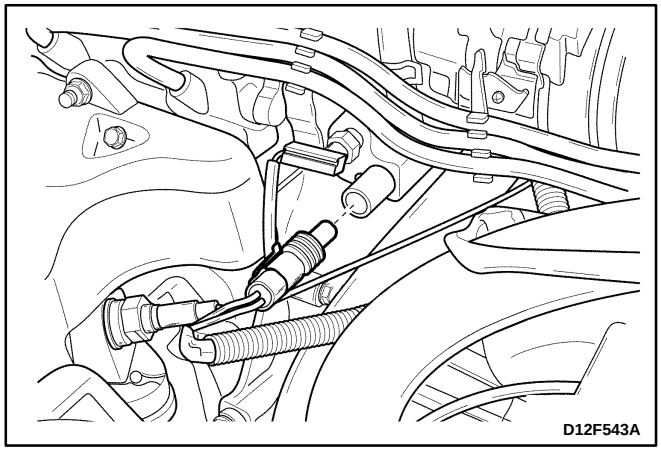
1. Install in the reverse order of removal.

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

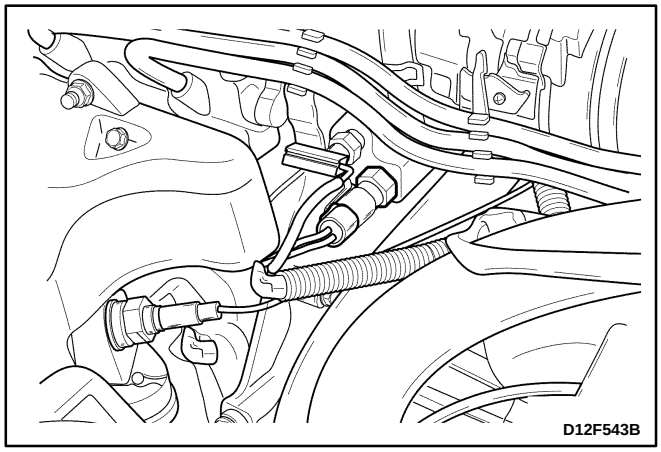
Tighten the throttle body bolts to 9–12 N•m (80–106 lb-in).



ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Removal Procedure

1. Remove the engine coolant temperature (ECT) sensor. Refer to *Section 1D, Engine Coolings*.

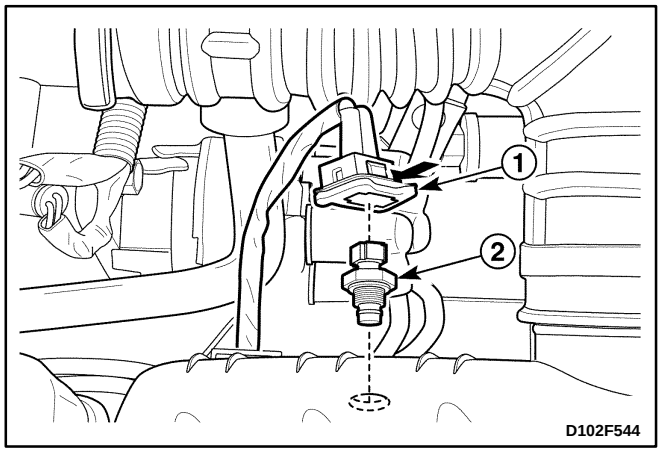


Installation Procedure

1. Install the engine coolant temperature sensor.

Tighten

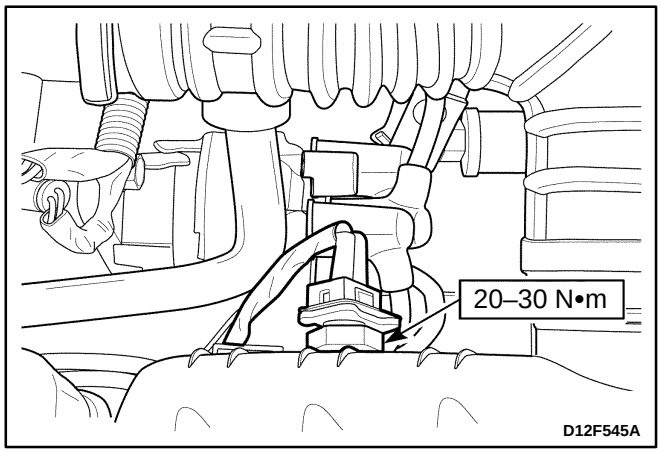
Tighten the engine coolant temperature sensor to 8–12 N•m (71–106 lb-ft).



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.

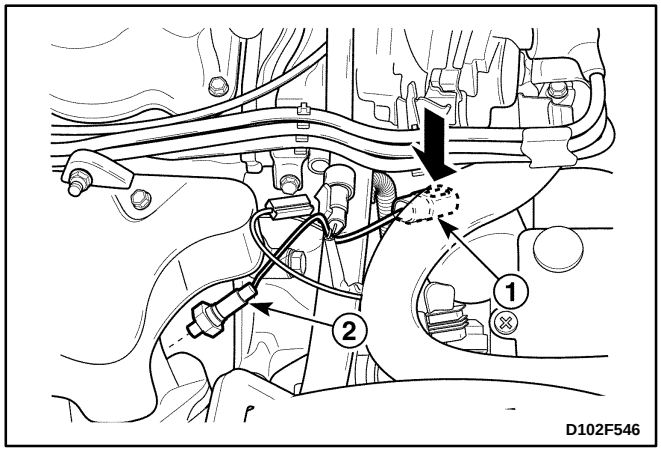


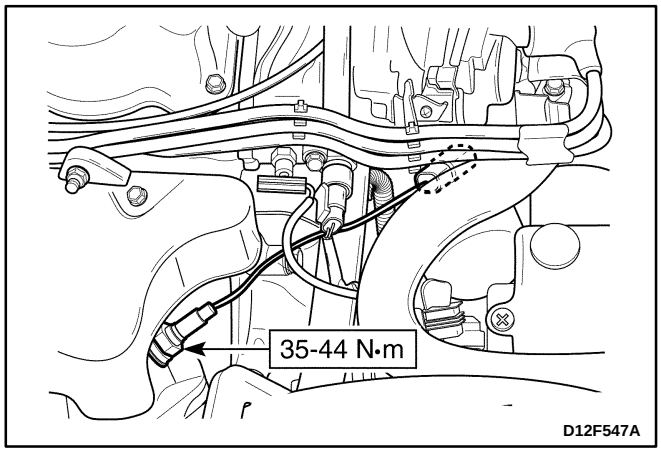
Installation Procedure

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

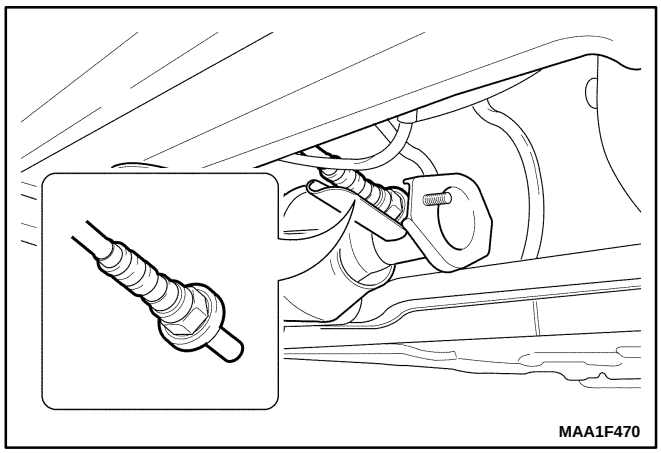
1. Install in the reverse order of removal.

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

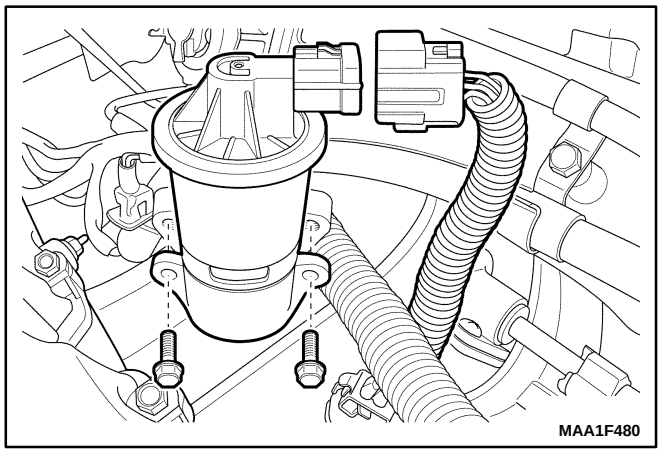
1. Install in the reverse order of removal.

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

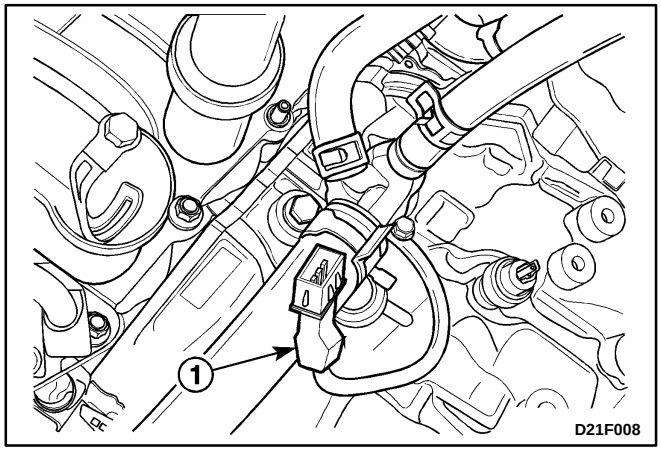
Tighten the oxygen sensor to 35~44 N•m (26~33 lb-ft).



EXHAUST GAS RECIRCULATION VALVE

Removal Procedure

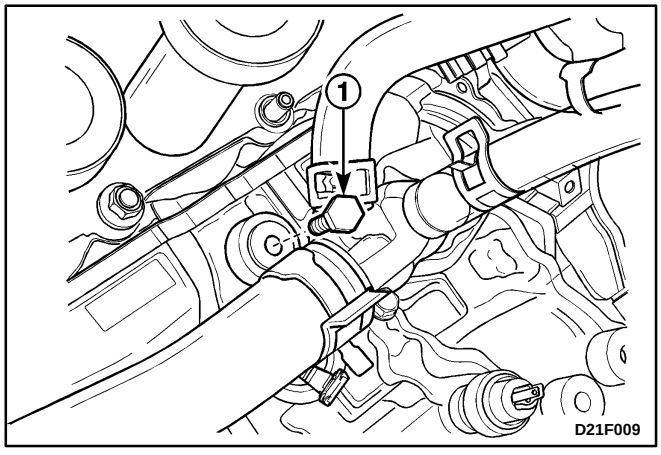
1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly.
3. Disconnect the electric exhaust gas recirculation (EEGR) valve connector.



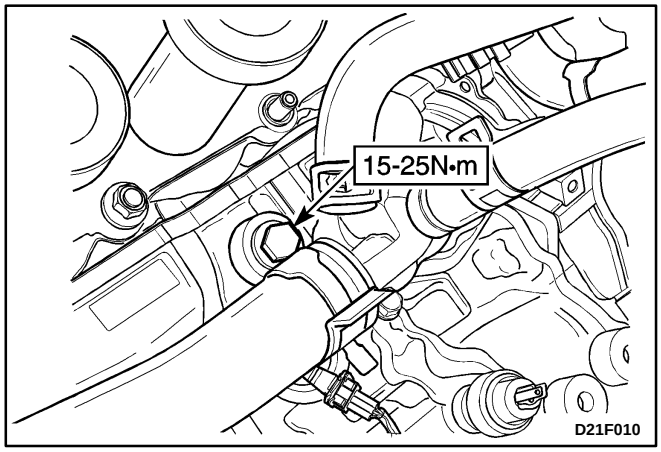
KNOCK SENSOR

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.



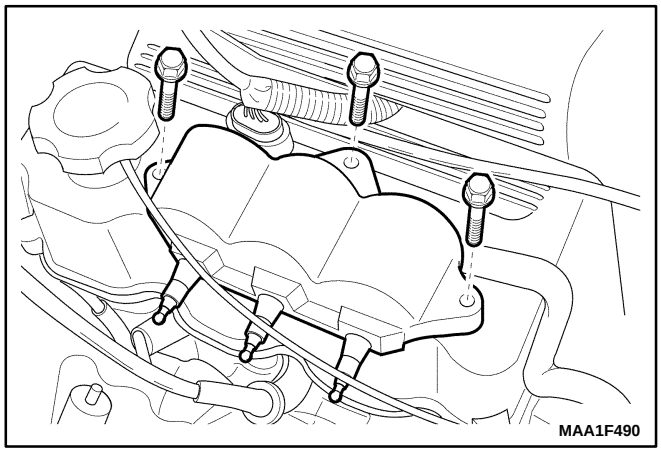
Installation Procedure

1. Install the knock sensor with the bolt.

Tighten

Tighten the knock sensor retaining bolt to 15–25 N•m (11–18 lb-ft).

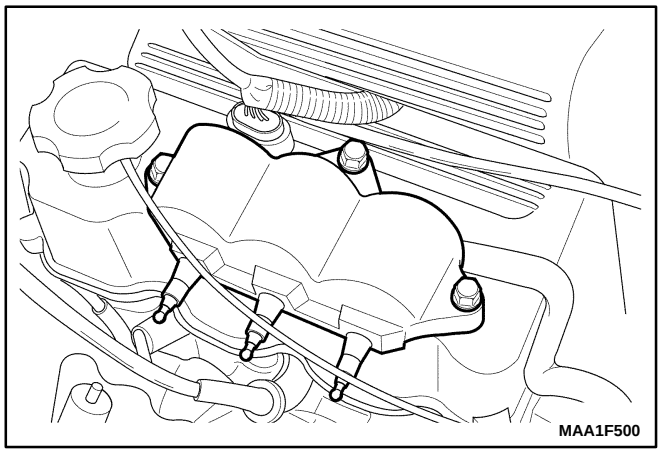
2. Connect the electrical connector to the knock sensor.
3. Install the starter. Refer to *Section 1E, Engine Electrical*.
4. Connect the negative battery cable.



ELECTRONIC IGNITION (EI) SYSTEM IGNITION COIL

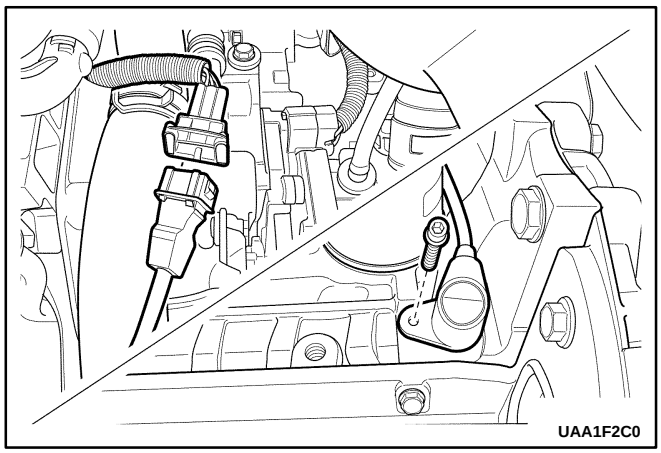
Removal Procedure

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

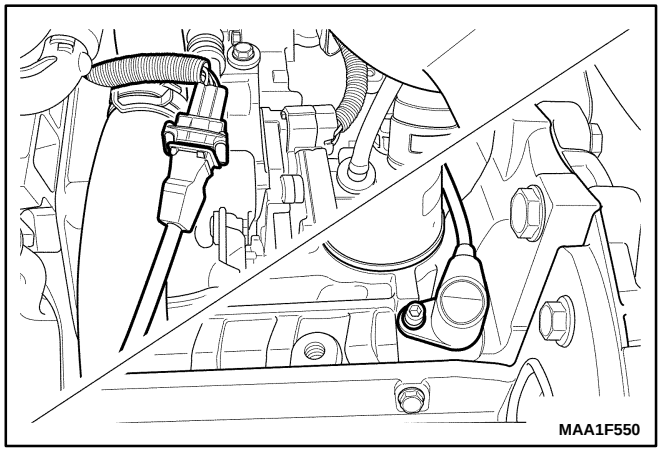
1. Install the EI system ignition coil.
2. Tighten the EI system ignition coil to 8–12 N•m (71–106 lb-in).



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.



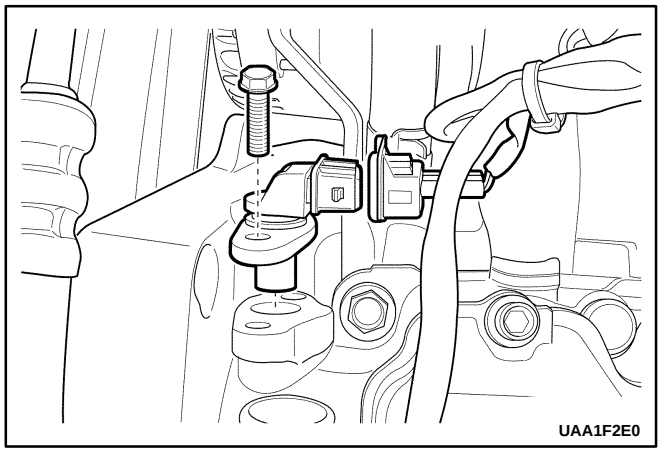
Installation Procedure

1. Install the CKP sensor.
2. Tighten the CKP sensor retaining bolt to 5–8 N•m (44–71 lb-in).

CAMSHAFT POSITION (CMP) SENSOR

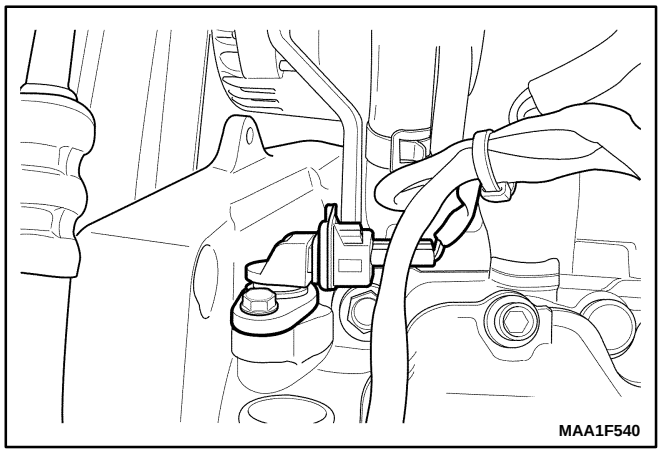
Removal Procedure

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.



Installation Procedure

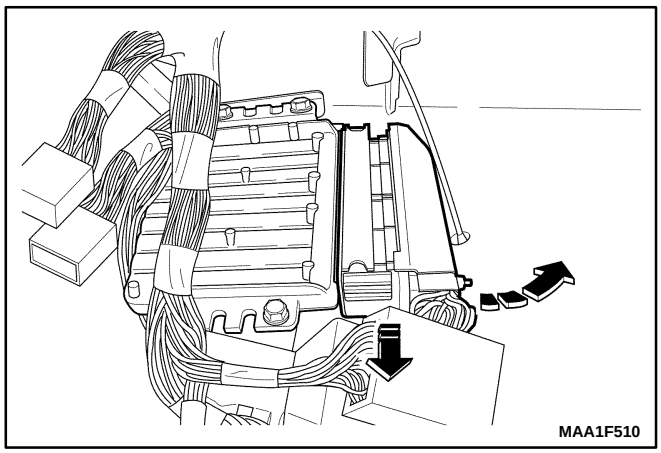
1. Install the CMP sensor.
2. Tighten the CMP sensor retaining bolt to 10–14 N•m (89–124 lb-in).

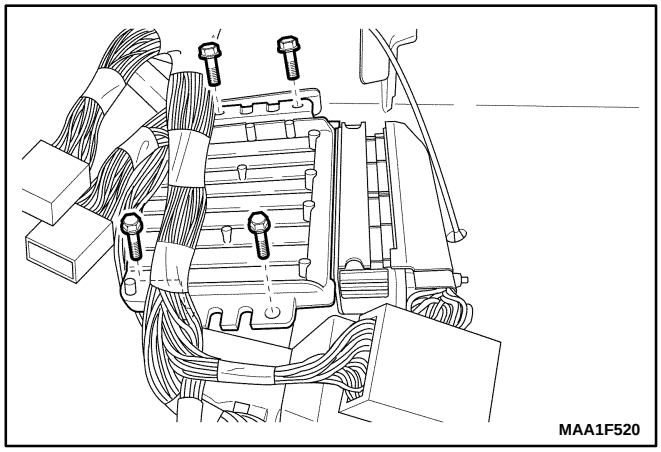


ENGINE CONTROL MODULE (ECM)

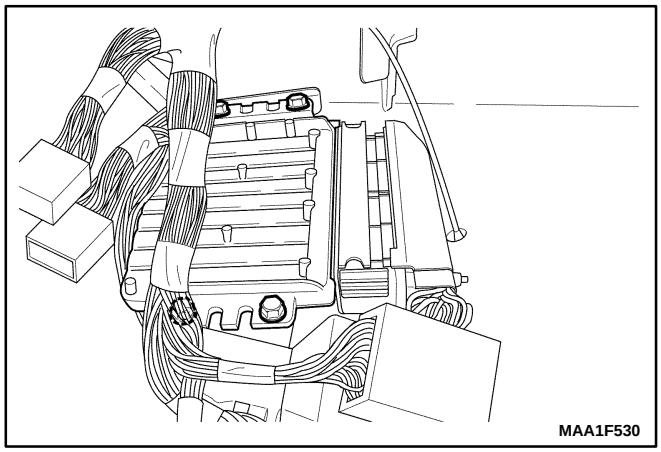
Removal Procedure

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).

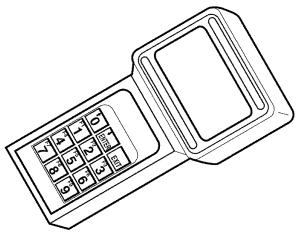
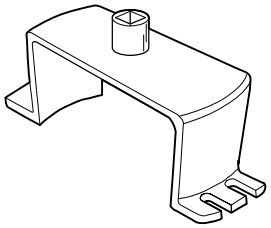
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

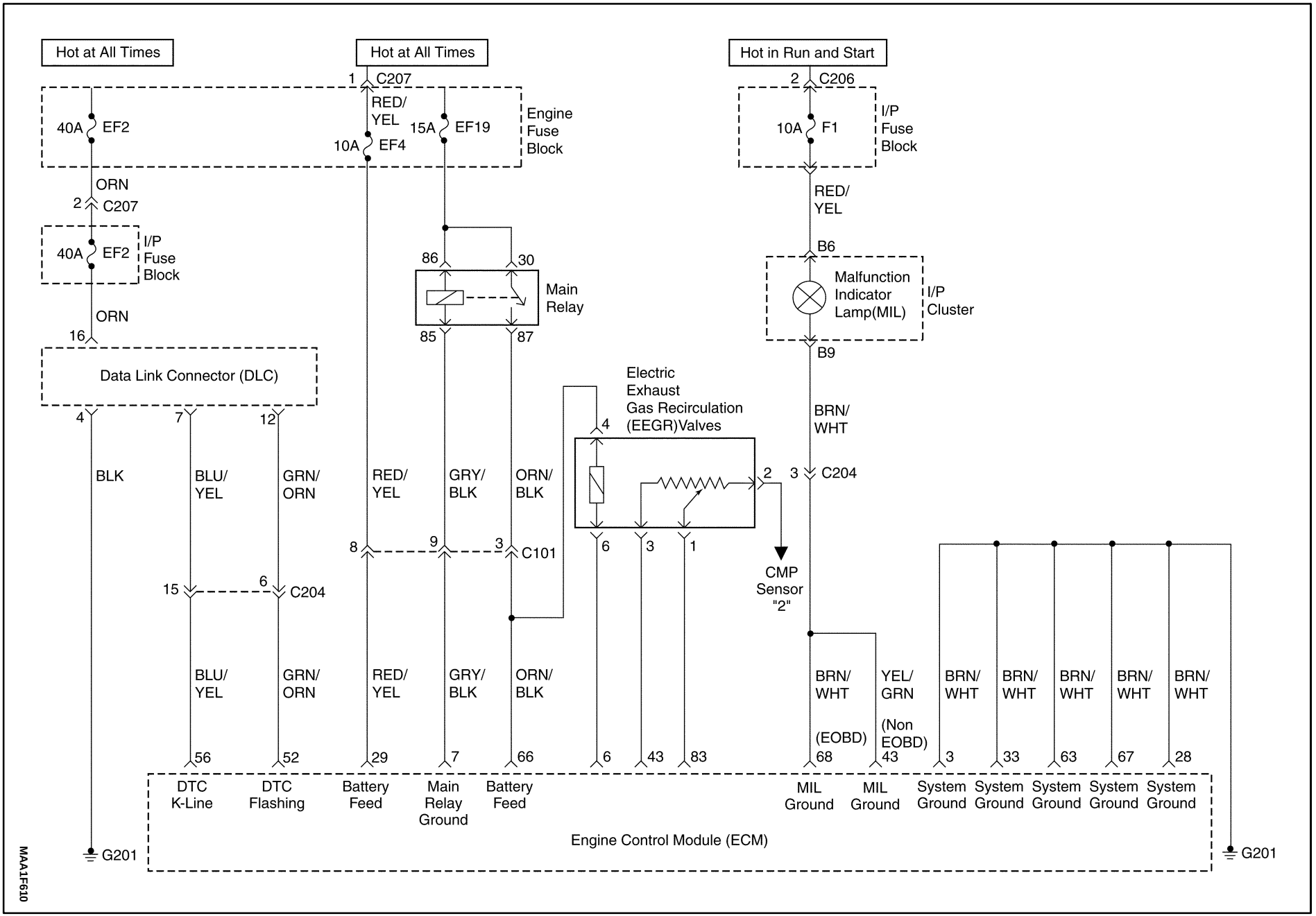
Application	N•m	Lb-Ft	Lb-In
Camshaft Position Sensor Bolts	10–14	–	89–124
Engine Coolant Temperature (ECT) Sensor	8–12	–	71–106
Crankshaft Position (CKP) Sensor Retaining Bolt	5–8	–	44–71
Electronic Ignition (EI) System Ignition Coil Retaining Bolts	8–12	–	71–106
Evaporative Emission Canister Protective 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)



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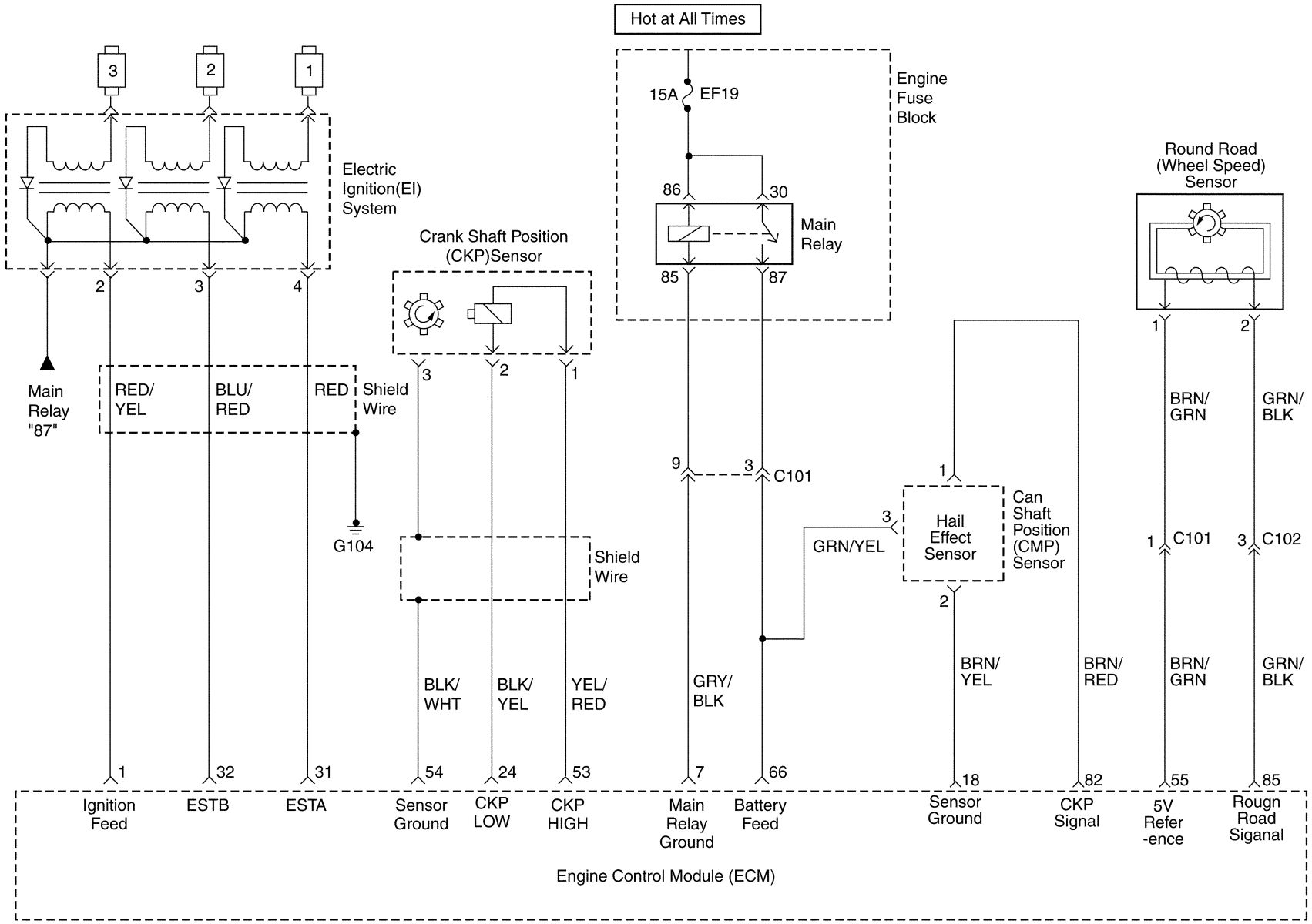
ECM WIRING DIAGRAM (SIRIUS D3 – 2 OF 5)



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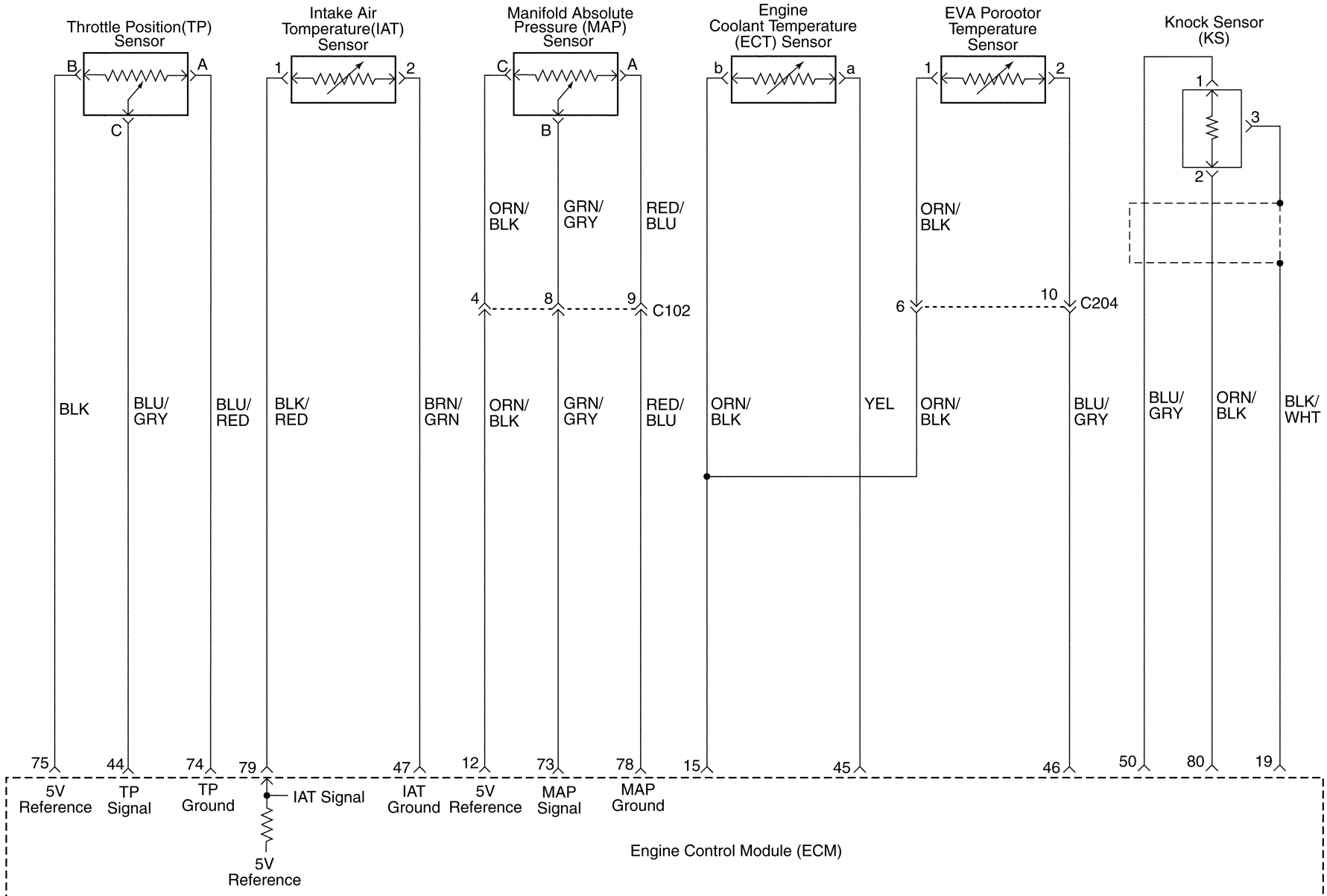
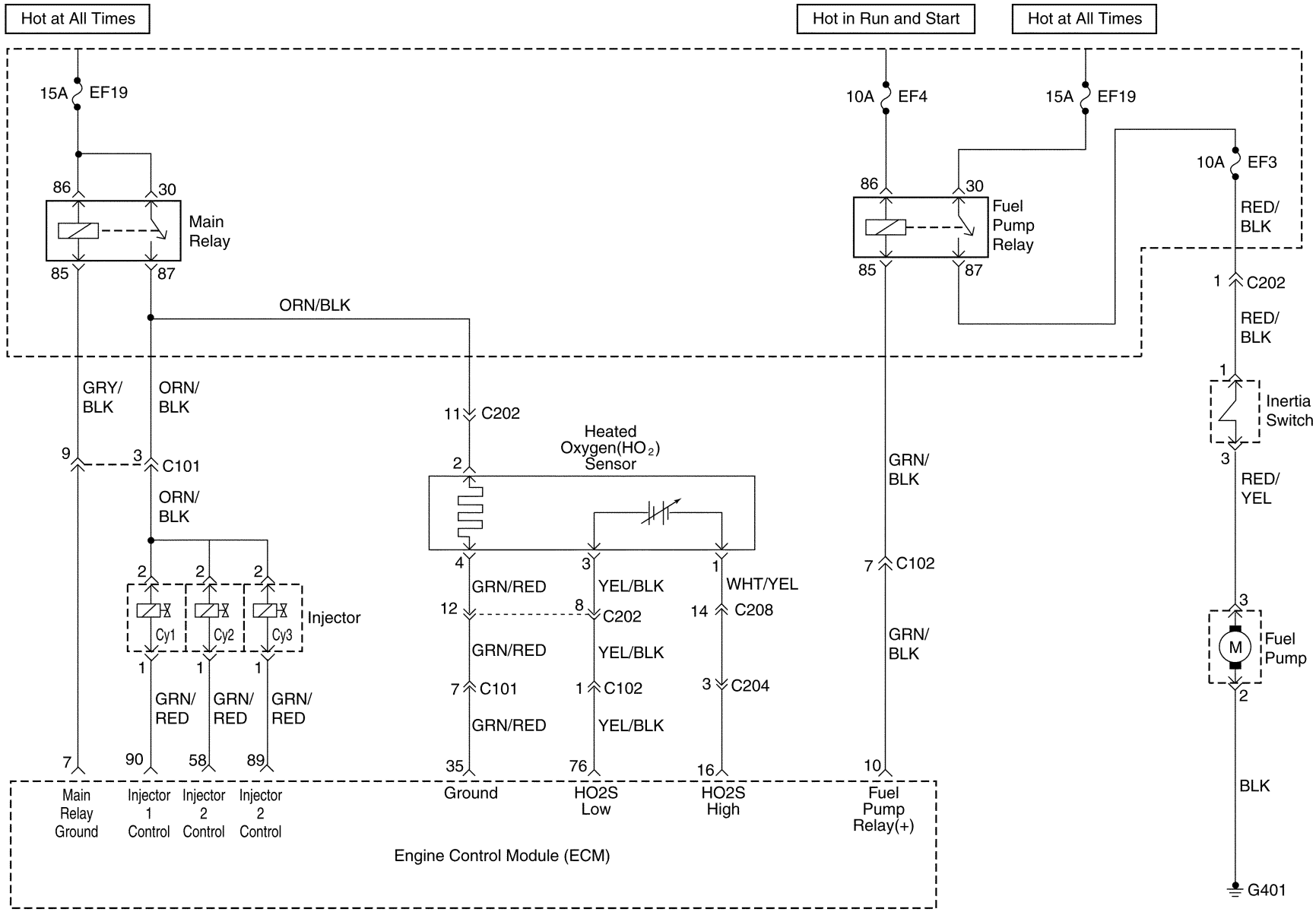
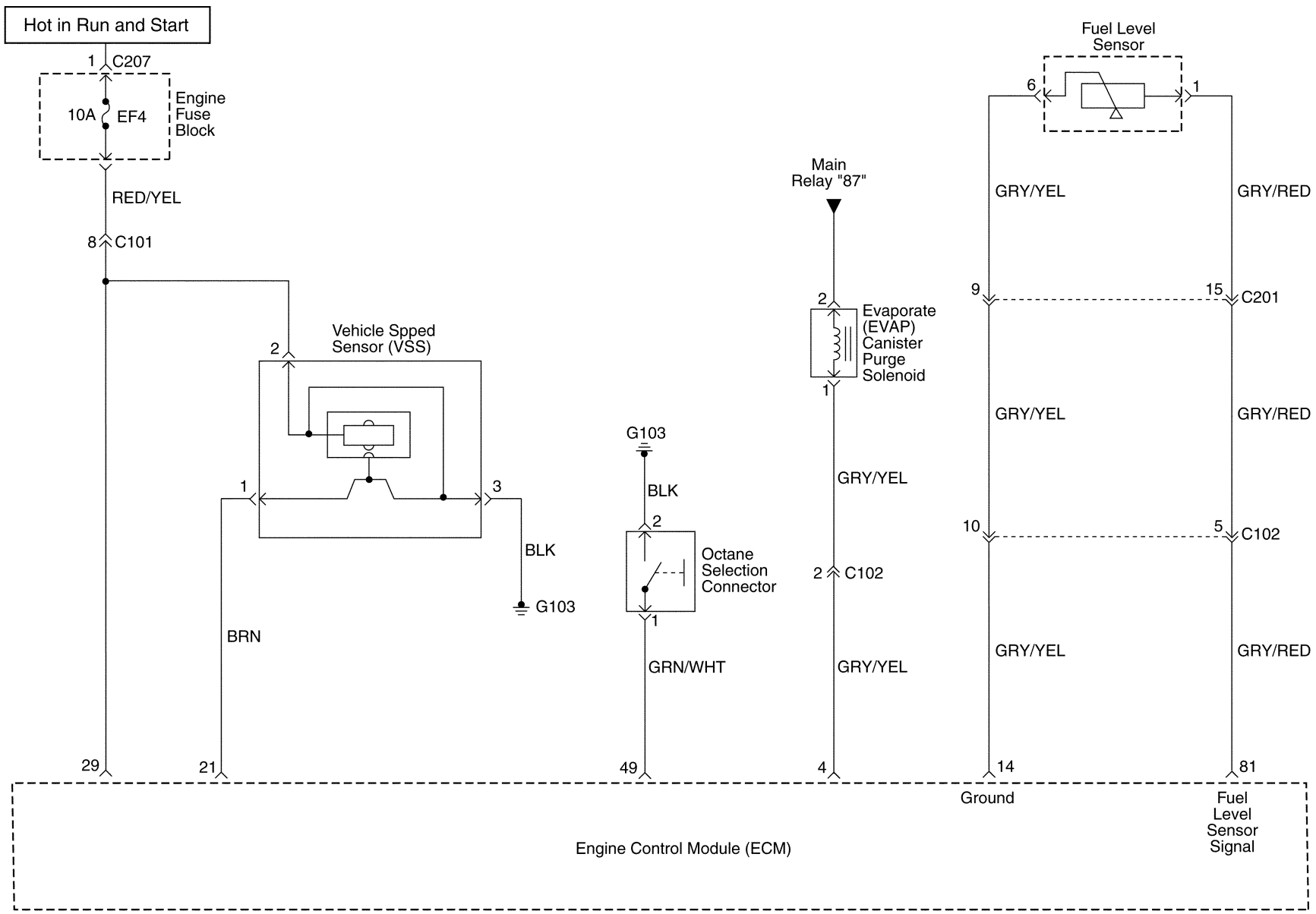
ECM WIRING DIAGRAM (SIRIUS D3 – 3 OF 5)



ECM WIRING DIAGRAM (SIRIUS D3 – 4 OF 5)



ECM WIRING DIAGRAM (SIRIUS D3 – 5 OF 5)



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SECTION 1G

ENGINE EXHAUST

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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.

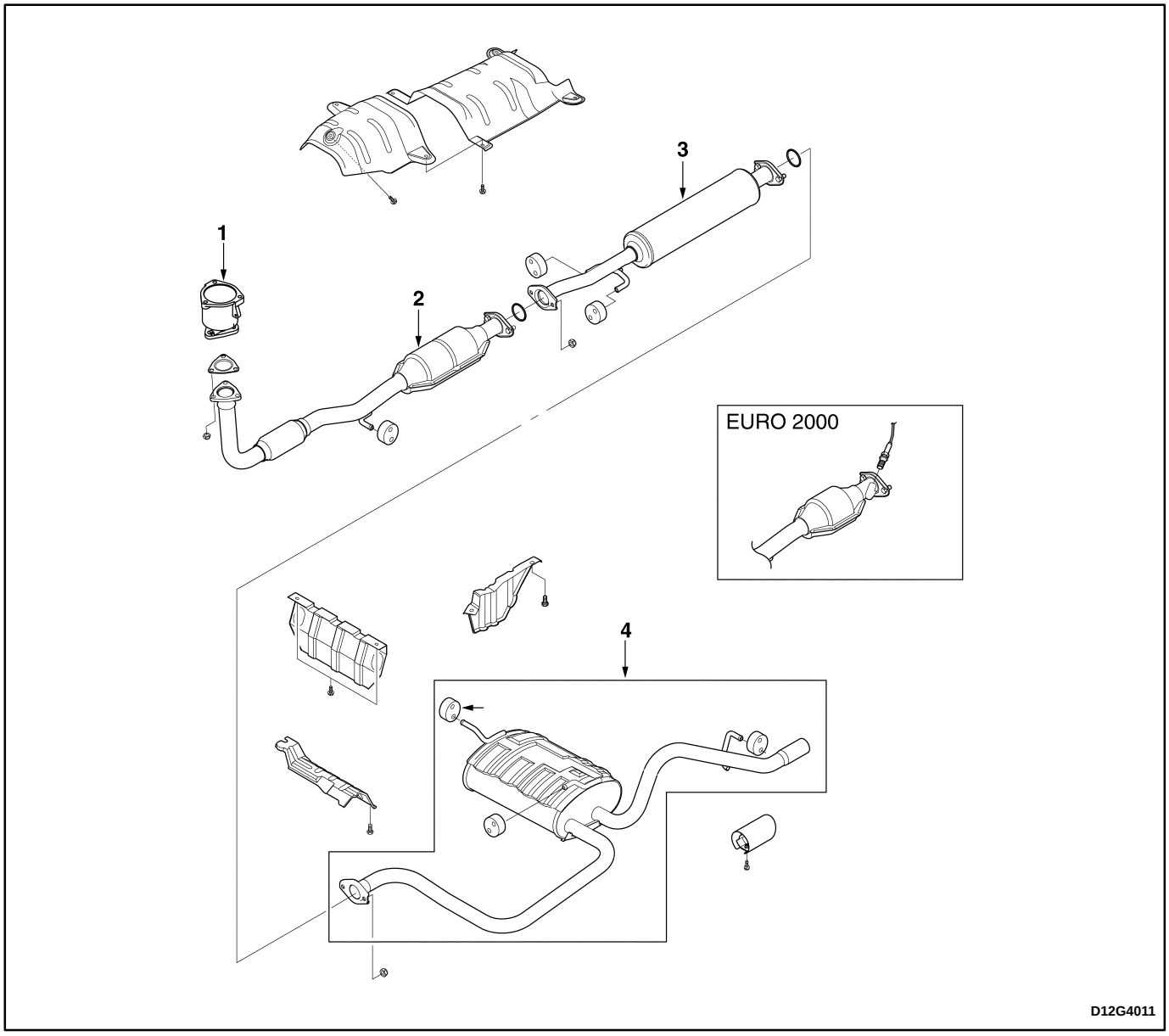
Notice: The catalytic converter requires the use of unleaded fuel only, or damage to the catalyst will result.

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

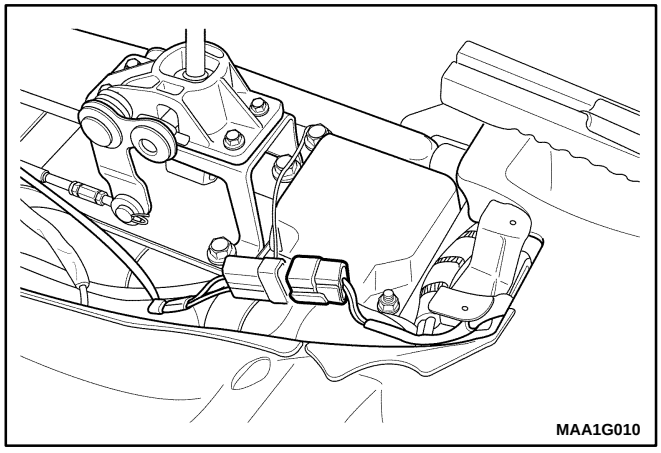
EXHAUST SYSTEM



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

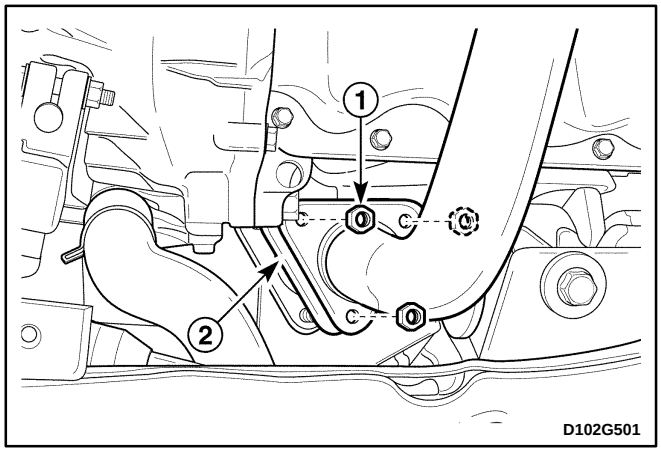

MAA1G010

EXHAUST PIPE/CATALYTIC CONVERTER

Caution : Make sure to confirm that the components is cool. And do work.

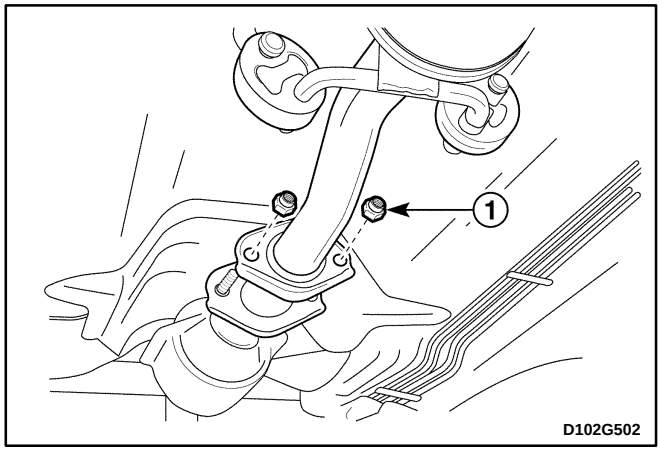
Removal Procedure

1. Remove the floor console. Refer to *Section 9G, Interior Trim*, if equipped Heated Oxygen Sensor (HO2S).
2. Disconnect HO2S connector.



D102G501

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.



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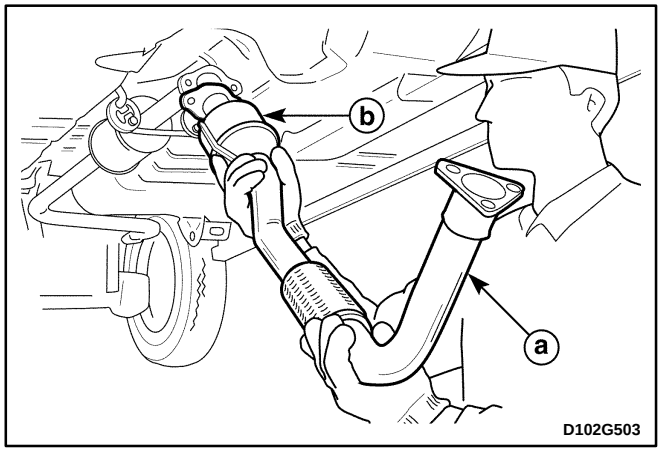
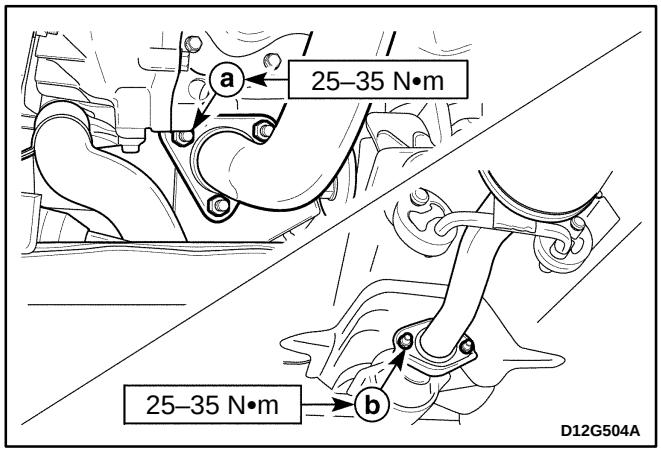
5. Remove the front exhaust pipe from the front muffler pipe.
   - Remove the nuts (1).



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.

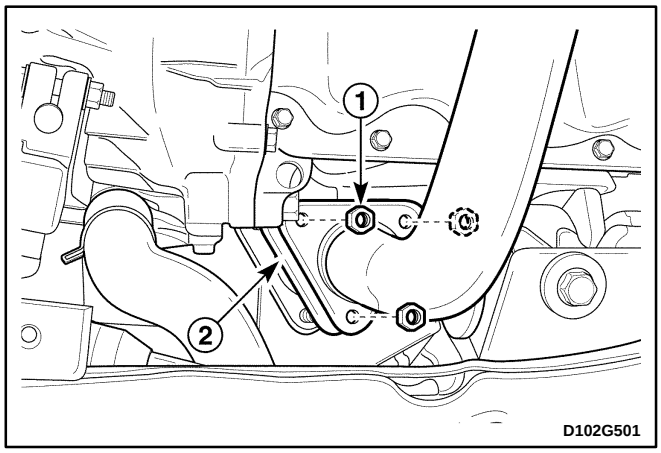
   #### Tighten

   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.

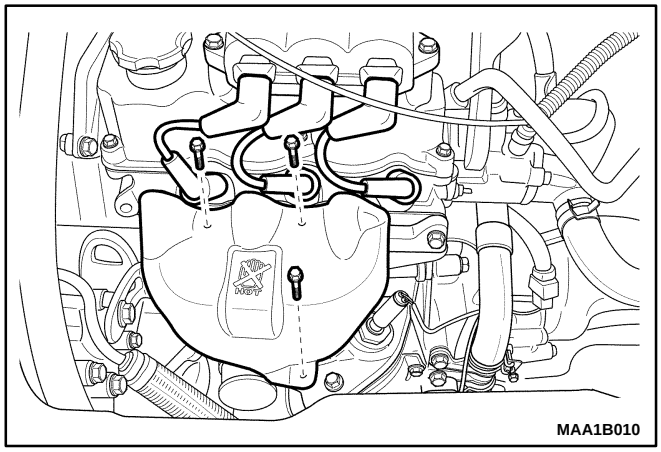
3. Connect the Heated Oxygen Sensor (HO2S) connector.
4. Install the floor console. Refer to *Section 9G, Interior Trim.*



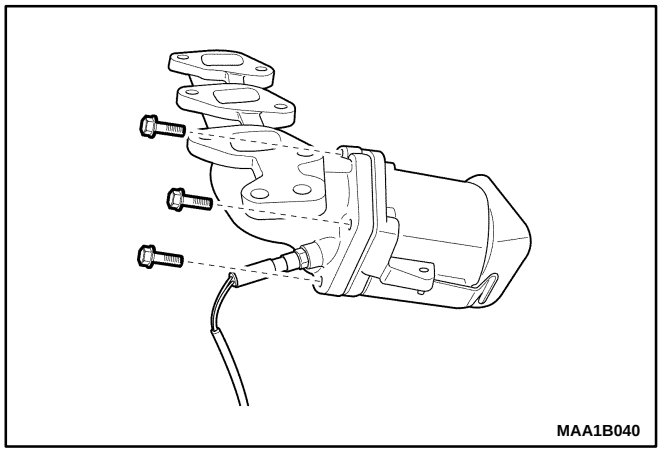
PUP-UP CATALITIC CONVERTER

Removal Procedure

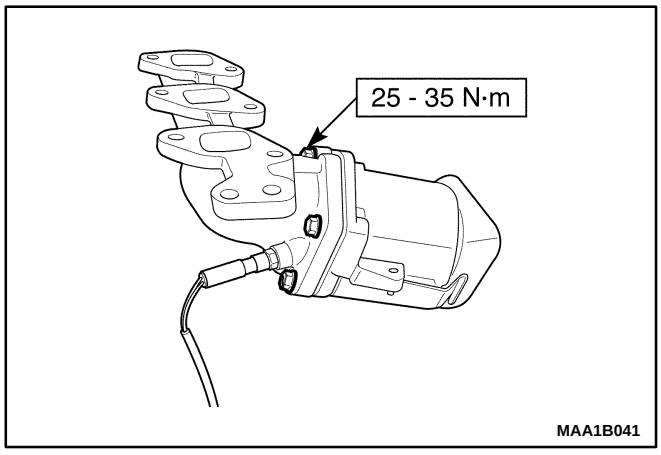
1. Remove the front exhaust pipe from the pup-up catalitic converter.
   - Remove the nuts (1).
   - Remove the gasket (2).
2. Check the gasket for damage or leak.



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.*



7. Remove pup-up catalytic convertor.
   - Remove the bolts.

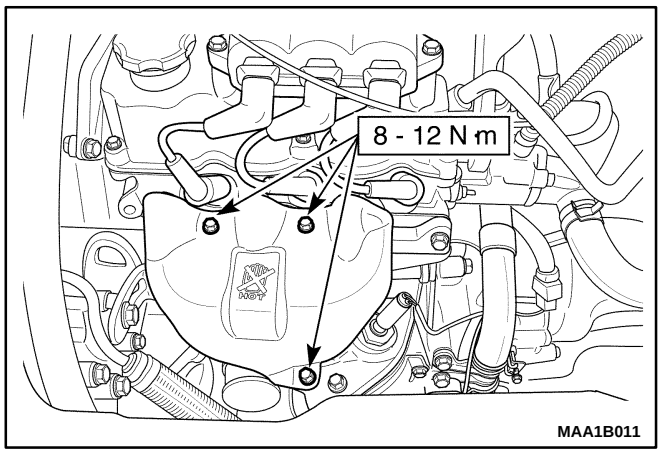


Installation Procedure

1. Install pup-up catalytic convertor to exhaust pipe.

Tighten

Tighten the bolts to 25–35 N•m (18–25 lb-ft).

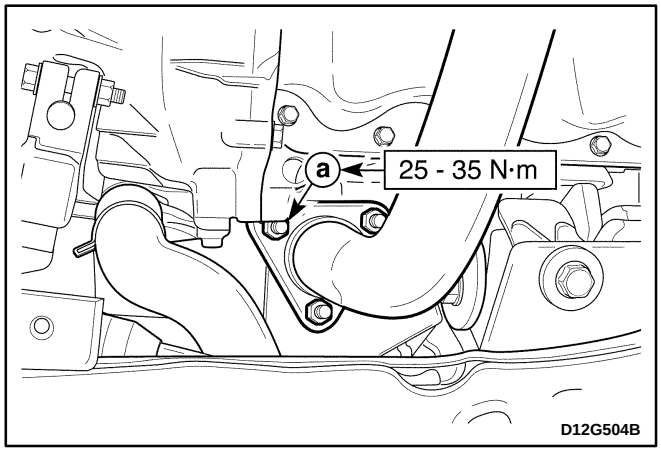


2. Install exhaust manifold. Refer to *Section 1B, SOHC Engine Mechanical.*

Tighten

Tighten the bolts and nuts to 17–27 N•m (13–20 lb-ft).

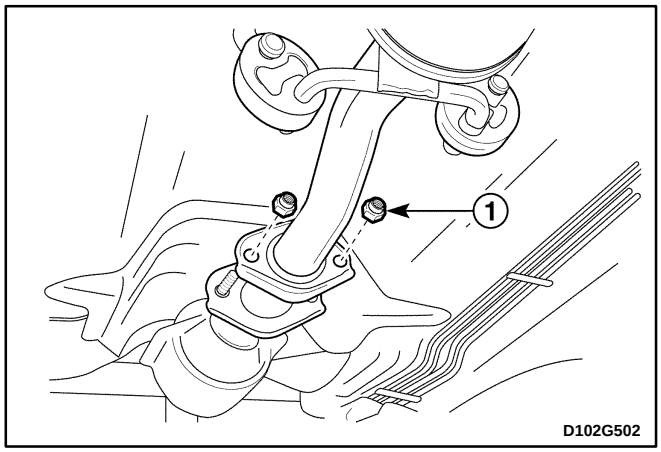
Tighten the exhaust manifold heat shield bolts to 8–12 N•m (71–106 lb-in).



3. Install the front exhaust pipe to pup-up catalytic convertor.

Tighten

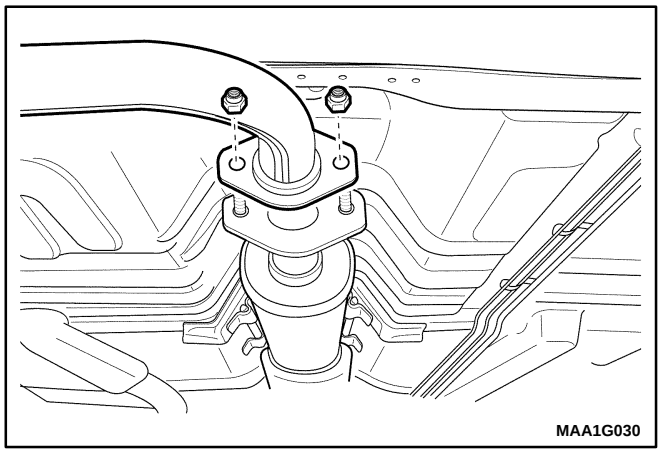
Tighten the bolts to 25–35 N•m (18–25 lb-ft).



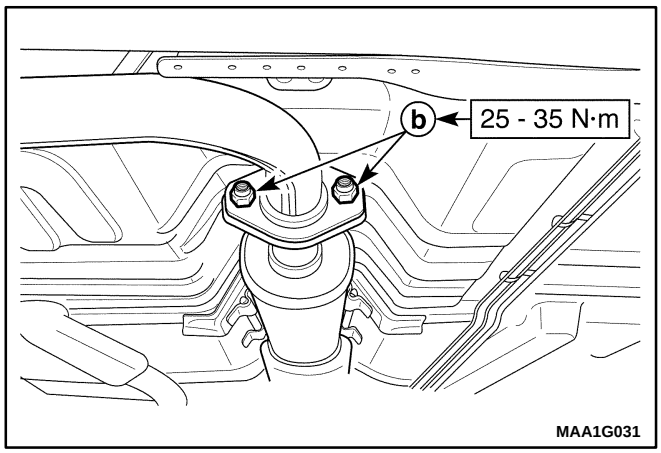
FRONT MUFFLER

Removal Procedure

1. Remove the front exhaust pipe-to-front muffler nuts.
   - Remove the nuts (1).



2. Remove the front muffler-to-rear muffler nuts.
3. Detach the front muffler from rubber hanger and remove the front muffler.



Installation Procedure

1. Hang the front muffler to rubber hanger.
2. Install the front muffler-to-rear muffler nuts.

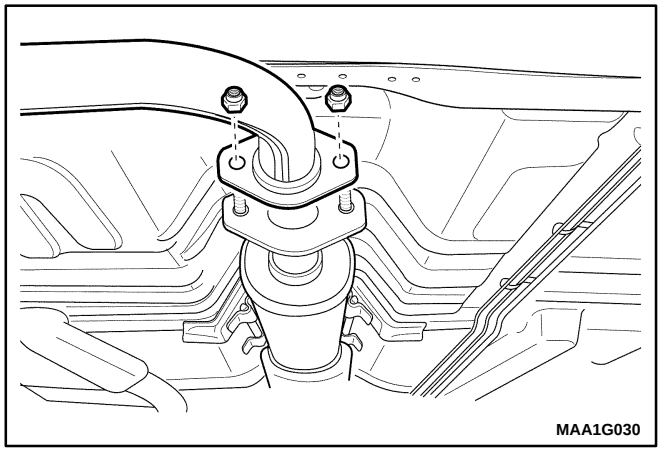
Tighten

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).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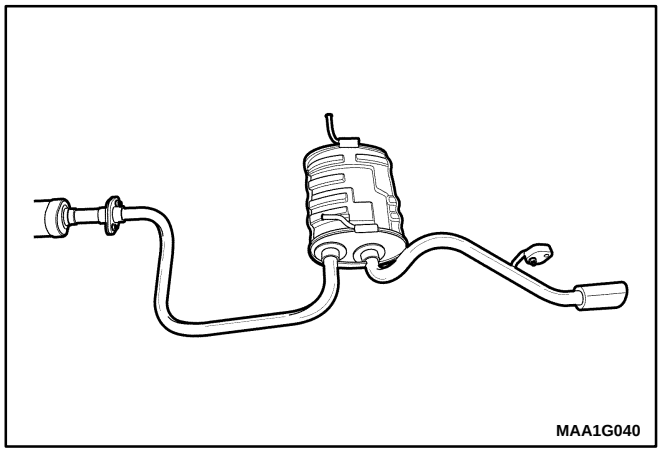
REAR MFFLER

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.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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

SECTION 2A

SUSPENSION DIAGNOSIS

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DIAGNOSTIC INFORMATION AND PROCEDURES

GENERAL DIAGNOSIS

Problems in the steering, the suspension, the tires, and the wheels involve several systems. Consider all systems when you diagnose a complaint. Some problems, such as abnormal or excessive tire wear and scuffed tires, may be the result of hard driving. Always road test the vehicle first. If possible, do this road test with the customer.

Proceed with the following preliminary checks. Correct any substandard conditions.

Application	Checks	Correction
Preliminary Checks	• Inspect the tires for improper pressure and uneven wear.	• Inflate the tires to the proper pressure.
	• Inspect the joint from the steering column to the intermediate shaft for loose connections or wear. • Inspect the joint from the intermediate shaft to the steering gear for loose connections or wear.	• Tighten the coupling flange pinch bolts. • Replace the intermediate shaft as needed.
	• Inspect the front and the rear suspension, the steering gear, and the linkage for loose or damaged parts.	• Tighten the front and the rear suspension. • Tighten the steering gear mounting bracket bolts. • Replace the front and the rear suspension as needed. • Replace the steering gear as needed. • Replace the coupling flange as needed.
	• Inspect for out–of–round tires.	• Perform free runout test. • Match–mount the tires.
	• Inspect for out–of–balance tires, bent wheels, and worn or loose wheel bearings.	• Balance the wheels. • Replace the wheels. • Replace the wheel bearings.
	• Check the power steering pump drive belt tension.	• Tighten the power steering pump drive belt.
	• Inspect the power steering system. Also, check the power steering fluid level.	• Repair any leaks. • Perform a power steering gear test. • Add power steering fluid.

Condition	Probable Cause	Correction
Car Lead/Pull	● Mismatched or uneven tires.	● Replace the tires.
	● A broken or a sagging coil spring.	● Replace the coil spring.
	● A improperly radial tire lateral force.	● Check the wheel alignment. ● Switch the tire and wheel assemblies. ● Replace the tires as needed.
	● The front–wheel alignment is out–of–align.	● Align the front wheels.
	● Off–center steering gear.	● Reseat the pinion valve assembly. ● Replace the pinion valve assembly as needed.
	● Front–brake dragging.	● Adjust the front brakes.
Abnormal or Excessive Tire Wear	● The front–wheel and rear–wheel alignment is out–of–align.	● Align the front and the rear wheels.
	● Excessive toe.	● Adjust the toe.
	● A broken or a sagging coil spring.	● Replace the coil spring.
	● Out–of–balance tires.	● Balance the tires.
	● Worn strut dampeners.	● Replace the strut dampeners.
	● A failure to rotate tires.	● Rotate the tires. ● Replace the tires as needed.
	● Overloaded vehicle.	● Maintain the proper load weight.
	● Low tire inflation.	● Inflate the tires to the proper pressure.
Scuffed Tires	● Incorrect toe.	● Adjust the toe.
	● A twisted or a bent suspension arm.	● Replace the suspension arm.
Wheel Tramp	● An out–of–balance tire or wheel.	● Balance the tire or the wheel.
	● Improper strut dampener action.	● Replace the strut dampeners.
Shimmy, Shake, or Vibration	● An out–of–balance tire or wheel.	● Balance the tire or the wheel.
	● Excessive wheel hub runout.	● Measure the hub flange runout. ● Replace the hub as needed.
	● Excessive brake drum or brake rotor imbalance.	● Adjust the brakes. ● Replace the brake rotor or the brake drum as needed.
	● Worn tie rod ends.	● Replace the tie rod ends.
	● Wheel trim imbalance.	● Balance the wheel.
	● A worn ball joint.	● Replace the control arm and ball joint assembly.
	● Excessive wheel runout.	● Measure the wheel runout. ● Replace the wheel as needed.
	● Excessive loaded radial runout on the tire and wheel assembly.	● Match–mount the tire and wheel assembly.

Condition	Probable Cause	Correction
Hard Steering (Manual)	● A lack of lubrication of the ball joints, the tie rods and the steering gear.	● Lubricate the ball joints, the tie rods, and the steering gear. ● Replace the control arm and ball joint assembly, the tie rods, and the steering gear as needed.
	● The front–wheel alignment is out–of–align.	● Align the front wheels.
	● Steering gear adjustment is out–of–adjustment.	● Adjust the steering gear.
Hard Steering (Power)	● The steering preload adjustment is out–of–adjustment.	● Perform a rack bearing preload on–vehicle adjustment.
	● The leaked hydraulic system.	● Test the power steering system pressure with a gauge. ● Replace the seals and the hoses as needed.
	● A loose steering gear mounting.	● Tighten the steering gear mounting bracket bolts.
Too Much Play in Steering.	● Worn or loose wheel bearings.	● Tighten the drive axle nut. ● Replace the wheel bearing as needed.
	● A loose steering gear mounting.	● Tighten the steering gear mounting bracket bolts.
	● The steering preload adjustment is out–of–adjustment.	● Perform a rack bearing preload on–vehicle adjustment.
	● Loose connections or wear of the joint from the steering column to the intermediate shaft. ● Loose connections or wear of the joint from the intermediate shaft to the steering gear.	● Tighten the coupling pinch bolts. ● Replace the intermediate shaft as needed.
Poor Returnability	● Binding in the ball joints.	● Replace the control arm and ball joint assembly.
	● Binding in the steering column.	● Lubricate the steering column. ● Replace the steering column as needed.
	● The front–wheel alignment is out–of–align.	● Align the front wheels.
	● The steering preload adjustment is out–of–adjustment.	● Perform a rack bearing preload on–vehicle adjustment.
	● A sticking valve.	● Lubricate the pinion valve assembly. ● Replace the pinion valve assembly as needed.
	● Binding in the coupling on the intermediate shaft.	● Replace the intermediate shaft.
Abnormal Noise, Front Suspension	● Damaged suspension components.	● Replace the damaged suspension components.
	● Worn control arm bushings or tie rod ends.	● Replace the control arm bushings or the tie rods.

Condition	Probable Cause	Correction
Abnormal Noise, Front Suspension	● A loose stabilizer shaft link.	● Tighten the stabilizer shaft link.
	● Loose wheel nuts.	● Tighten the wheel nuts.
	● Loose suspension bolts or nuts.	● Tighten the suspension bolts or the nuts.
	● Loose wheel covers.	● Tighten the wheel covers.
	● Worn strut dampeners or strut mountings.	● Replace the strut dampeners. ● Tighten the strut mounting nuts.
	● An improperly positioned strut spring.	● Adjust the strut spring to the proper position.
Wander or Poor Steering Ability	● Mismatched or uneven tires.	● Replace the tires.
	● Worn strut dampeners.	● Replace the strut dampeners.
	● A loose stabilizer shaft link.	● Tighten the stabilizer shaft link.
	● A broken or a sagging coil spring.	● Replace the coil spring.
	● The steering preload adjustment is out–of–adjustment.	● Perform a rack bearing preload on–vehicle adjustment.
	● The front–wheel and the rear–wheel alignment are out–of–align.	● Align the front and the rear end wheels.
Erratic Steering when Braking	● Worn or loose wheel bearings.	● Replace the wheel bearings.
	● A broken or a sagging coil spring.	● Replace the coil spring.
	● A leaking caliper.	● Replace the caliper.
	● Warped rotors.	● Replace the rotors.
	● An incorrect or an uneven caster.	● If the caster is beyond specifications, check the frame and repair it as needed.
Low or Uneven Trim Height	● A broken or a sagging coil spring.	● Replace the coil spring.
	● An overloaded vehicle.	● Maintain the proper load weight.
	● An incorrect or weak coil spring.	● Replace the coil spring.
Ride Too Soft	● Worn strut dampeners.	● Replace the strut dampeners.
	● A broken or a sagging coil spring.	● Replace the coil spring.
Ride Too Harsh	● Incorrect strut dampeners.	● Replace the strut dampeners.
	● An incorrect coil spring.	● Replace the coil spring.
Body Leans or Sways in Corners	● A loose stabilizer shaft link.	● Tighten the stabilizer shaft link.
	● Worn strut dampeners or strut mountings.	● Replace the strut dampeners. ● Tighten the strut assembly mounting nuts.
	● an overloaded vehicle.	● Maintain the proper load weight.
	● A broken or a sagging coil spring.	● Replace the coil spring.
Suspension Bottoms	● Worn strut dampeners.	● Replace the strut dampeners.
	● An overloaded vehicle.	● Maintain the proper load weight.
	● A broken or a sagging coil spring.	● Replace the coil spring.

Condition	Probable Cause	Correction
Steering Wheel Kickback (Power)	● Air in the power steering system.	● Bleed the power steering system.
	● A loose steering gear mounting.	● Tighten the steering gear mounting bracket bolts.
	● Loose connections or wear of the joint from the steering column to the intermediate shaft. ● Loose connections or wear of the joint from the intermediate shaft to the steering gear.	● Tighten the coupling pinch bolts. ● Replace the intermediate shaft as needed.
	● Loose tie rod ends.	● Tighten the tie rod ends. ● Replace the tie rods as needed.
	● Loose or worn wheel bearings.	● Tighten the drive axle nut. ● Replace the wheel bearing as needed.
Steering Wheel Surges or Jerks (Power)	● Low pressure in the power steering system.	● Replace the seals and the hoses as needed.
	● A sluggish steering gear valve.	● Clean the pinion valve assembly. ● Replace the pinion valve assembly as needed.
	● A loose power steering pump drive belt.	● Adjust the power steering pump drive belt.
Cupped Tires	● The front–wheel and the rear–wheel alignment are out–of–align.	● Align the front and the rear wheels.
	● Worn strut dampeners.	● Replace the strut dampeners.
	● Worn or loose wheel bearing.	● Tighten the drive axle nut. ● Replace the wheel bearings as needed.
	● Excessive tire or wheel runout.	● Match–mount the tires. ● Replace the tires as needed. ● Replace the wheels as needed.
	● A worn ball joints.	● Replace the control arm and ball joint assembly.
	● The steering gear preload adjustment is out–of–adjustment.	● Perform a rack bearing preload on–vehicle adjustment.

WHEEL BEARING DIAGNOSIS

This vehicle with non–serviceable bearings in the rear wheels. If any fault is found with a wheel bearing, it must be replaced.

Wheel Bearing Noise

A road test usually reveals excessive wheel bearing noise. Wheel bearings emit a howling sound when loose or damaged. Wheel bearing noise is present only when the vehicle is moving. It is constant and unwavering and increases with the speed of the vehicle. If the wheel bearing noise cannot be positively diagnosed, or if the origin of the noise cannot be determined, perform the following test :

1. Raise and suitably support the vehicle.
2. Spin the wheels using your hand. Check for out–of–round or out–of–balance tires, bent rims, or loose wheel bearings.
3. Spin the rear wheels using a commercial wheel spiner.
4. If a noise can be heard from the passenger compartment, replace the noisy wheel bearings. Refer to *Section 2D, Rear Suspension*.
5. Lower the vehicle.

SECTION 2B

WHEEL ALIGNMENT

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DESCRIPTION AND OPERATION

FOUR WHEEL ALIGNMENT

The first responsibility of engineering is to design safe steering and suspension systems. Each component must be strong enough to withstand and absorb extreme punishment. Both the steering system and the front and the rear suspension must function geometrically with the body mass.

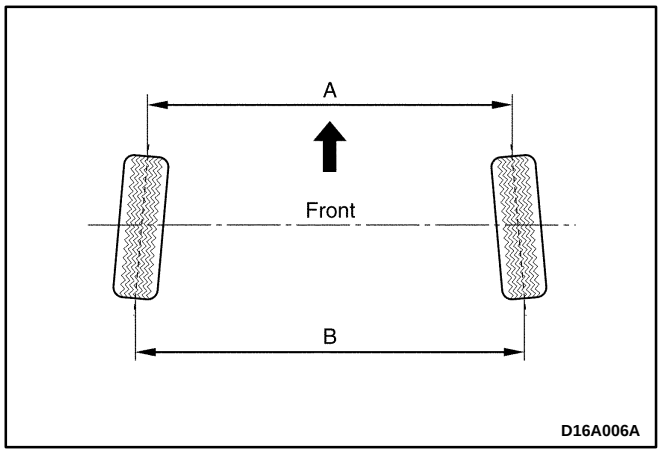
The steering and the suspension systems require that the front wheels self-return and that the tire rolling effort and the road friction be held to a negligible force in order to allow the customer to direct the vehicle with the least effort and the most comfort.

A complete wheel alignment check should include measurements of the rear toe and camber.

Four-wheel alignment assures that all four wheels will be running in precisely the same direction.

When the vehicle is geometrically aligned, fuel economy and tire life are at their peak, and steering and performance are maximized.

TOE



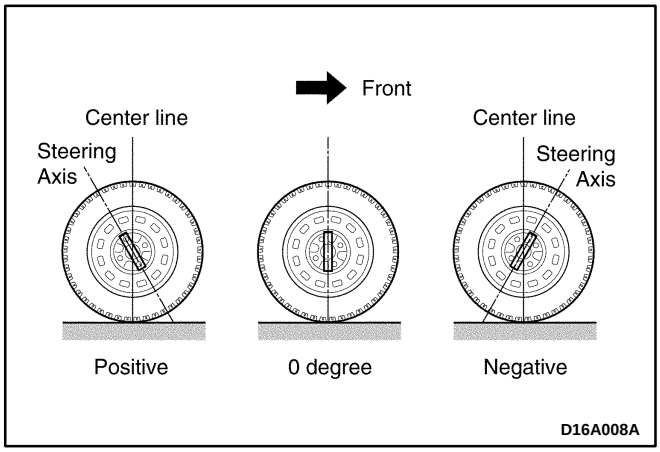
Toe–in is the turning in of the tires, while toe–out is the turning out of the tires from the geometric centerline or thrust line. The toe ensures parallel rolling of the wheels.

The toe serves to offset the small deflections of the wheel support system which occur when the vehicle is rolling forward. The specified toe angle is the setting which achieves–degrees (0°) of toe when the vehicle is moving.

Incorrect toe-in or toe-out will cause tire wear and reduced fuel economy. As the individual steering and suspension components wear from vehicle mileage, additional toe will be needed to compensate for the wear.

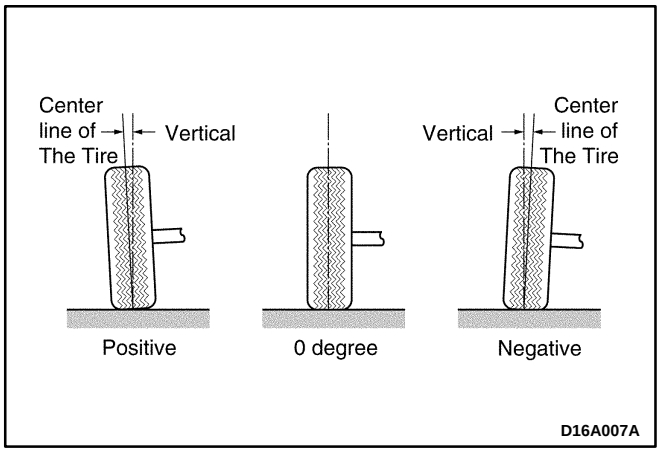
Always correct the toe dimension last.

CASTER



Caster is the tilting of the uppermost point of the steering axis either forward or backward from the vertical when viewed from the side of the vehicle. A backward tilt is positive, and a forward tilt is negative. Caster influences directional control of the steering but does not affect tire wear. Weak springs or overloading a vehicle will affect caster. One wheel with more positive caster will pull toward the center of the car. This condition will cause the car to move or lean toward the side with the least amount of positive caster. Caster is measured in degrees and is not adjustable.

CAMBER



Camber is the tilting of the top of the tire from the vertical when viewed from the front of the vehicle. When the tires tilt outward, the camber is positive. When the tires tilt inward, the camber is negative. The camber angle is measured in degrees from the vertical. Camber influences both directional control and tire wear.

If the vehicle has too much positive camber, the outside shoulder of the tire will wear. If the vehicle has too much negative camber, the inside shoulder of the tire will wear. Camber is measured in degrees and is not adjustable.

STEERING AXIS INCLINATION

Steering Axis Inclination (SAI) is the tilt at the top of the steering knuckle from the vertical. Measure the SAI angle from the true vertical to a line through the center of the strut and the lower ball joint as viewed from the front of the vehicle.

SAI helps the vehicle track straight down the road and assists the wheel back into the straight ahead position. SAI on front wheel drive vehicles should be negative.

INCLUDED ANGLE

The included angle is the angle measured from the camber angle to the line through the center of the strut and the lower ball joints as viewed from the front of the vehicle.

The included angle is calculated in degrees Most alignment racks will not measure the included angle directly. To determine the included angle, subtract the negative or add the positive camber readings to the Steering Axis Inclination (SAI).

SCRUB RADIUS

The scrub radius is the distance between true vertical and the line through the center of the strut and lower ball joint to the road surface. Scrub radius is bulit into the design of the vehicle. Scrub radius is not adjustable.

SETBACK

The setback is the distance in which one front hub and bearing assembly may be rearward of the other front hub and bearing assembly. Setback is primarily caused by a road hazard or vehicle collision.

TURNING ANGLE

The turning angle is the angle of each front wheel to the vertical when the vehicle is making a turn.

DIAGNOSTIC INFORMATION AND PROCEDURES

TIRE DIAGNOSIS

Condition	Probable cause	Correction
Irregular and Excessive Tire Wear	● Incorrect inflation pressure.	● Inflate the tires to the proper pressure.
	● Inbalanced wheel.	● Balance the wheel. ● Replace the wheel.
	● A lack of regular rotation.	● Rotate the tires.
	● Incorrect alignment.	● Align the front and rear wheels.
Premature Tire Wear	● Excessive inflation pressure.	● Inflate the tires to the proper pressure.
	● High speed driving with the low inflation pressure.	● Inflate the tires to the proper pressure.
Uneven Braking	● Inbalanced inflation pressure.	● Inflate the tires to the proper pressure.
	● Irregular tire wear.	● Replace the tires.
Noise and Vibration of The Body	● Low inflation pressure.	● Inflate the tires to the proper pressure.
	● Inbalanced wheel.	● Balance the wheel. ● Replace the wheel.
	● Damaged wheel or tire.	● Replace the wheel and the tire.
	● Irregular tire wear.	● Replace the tire.
Vibration of The Steering Wheel	● Irregular tire wear.	● Replace the tire.
	● Inbalanced inflation pressure.	● Inflate the tires to the proper pressure.
	● Damaged tire.	● Replace the tire.
	● Bent or damaged wheel.	● Replace the wheel.

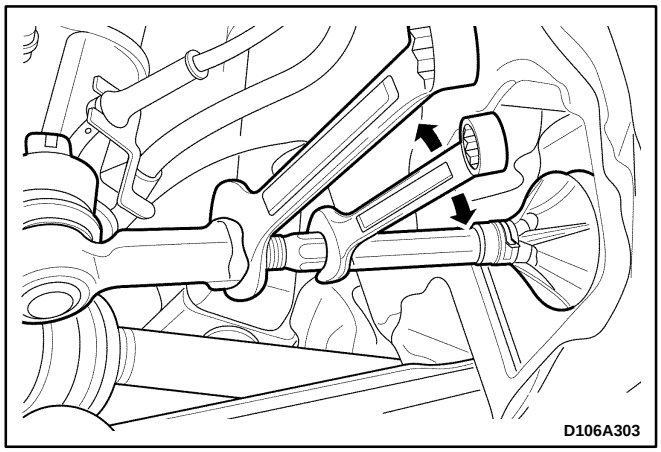
FRONT TOE ADJUSTMENT

1. Separate the clamps from the both rack and pinion boots.
2. Loosen the right and the left tie rod end lock nuts.
3. Turn the right and the left tie rod to align the toe.

In this adjustment, the right and left tie rods must be equal in length.

Front Toe–In	10′ ± 10′

Rotation Number of Tie Rod	Difference of Toe–In
1/2	0.75 mm (0.03 in.)
1	1.5 mm (0.06 in.)



4. Tighten the tie rod end lock nut to 45 N•m (33 lb-ft).
5. Install the rack and pinion boots clamp.

FRONT CAMBER AND CASTER CHECK

The front camber and caster are not adjustable. Refer to “Wheel Alignment Specifications” in this section. Jounce the bumper three times before measuring the camber or the caster in order to prevent an incorrect reading. If the front camber or caster measurements deviate from the specifications, locate and replace or repair any damaged, loose, bent, dented, or worn suspension part. If the problem is body related, repair the body.

REAR CAMBER CHECK

The rear camber is not adjustable. Refer to “Wheel Alignment Specifications” in this section. If the rear camber deviates from the specification, locate the cause and correct it. If damaged, loose, bent, dented, or worn suspension parts are found, they should be repaired or replaced. If the problem is body related, repair the body.

REAR TOE CHECK

The rear toe is not adjustable. Refer to “Wheel Alignment Specifications” in this section. If the toe deviates from the specification, check the rear axle assembly and the wheel spindle on vehicles without an anti–lock braking system (ABS) or the rear axle assembly and the hub and bearing assembly on vehicles with ABS for possible damage.

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

Application	Front	Rear
Camber	0°30′ ± 0°30′	0° ± 20′
Caster–Manual Steering	2°48′ ± 30′	–
Caster–Power Steering	2°48′ ± 30′	–
Toe–in (2–person load)	10′ ± 10′	20′ ± 20′

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Tie Rod End Lock Nut	45	33	–

SECTION 2C

FRONT SUSPENSION

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DESCRIPTION AND OPERATION

FRONT SUSPENSION

The front suspension for this vehicle is a combination knuckle/strut and spring design.

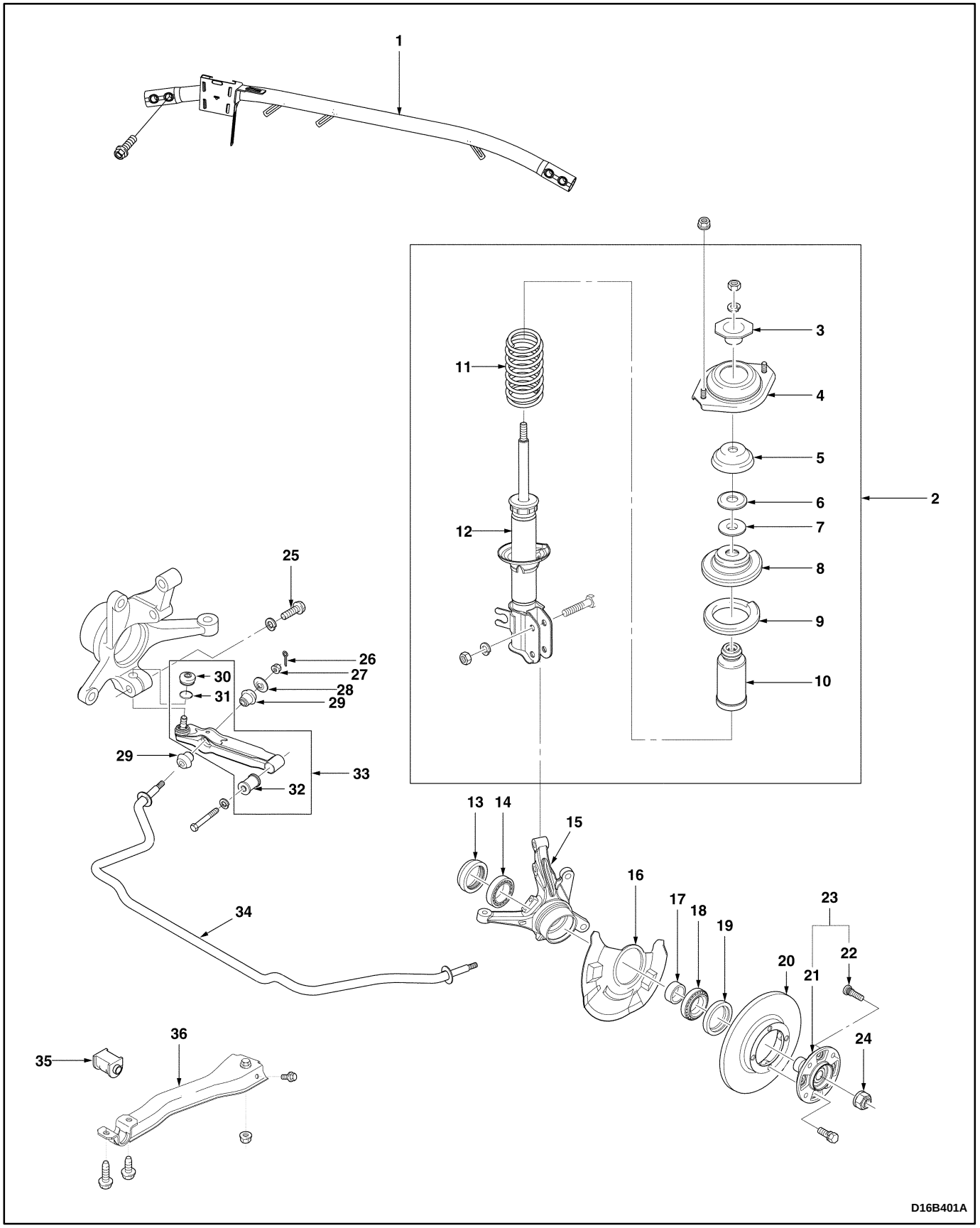
The control arms pivot from the body. The lower control arm pivots use rubber bushing. The upper end of the strut is isolated by a rubber mount and contains a bearing to allow the wheel to turn.

The lower end of the steering knuckle pivots on a ball joint bolted to the control arm. The ball joint is fastened to the steering knuckle with a bolt.

When servicing the control arm-to-body attachment and the stabilizer shaft-to-body insulators, make sure the attaching bolts are loose until the control arms are moved to the trim height, which is curb height. Trim height is the normal position to which the control arms move when the vehicle is sitting on the ground. Refer to “General Specifications” in this section.

COMPONENT LOCATOR

FRONT SUSPENSION



1. Strut Bar
2. Front Suspension Strut Assembly
3. Strut Inner Support
4. Strut Mount Assembly
5. Strut Mount Seat
6. Strut Bearing Seat
7. Strut Bearing
8. Coil Spring Upper Seat
9. Coil Spring Seat
10. Bumper Stopper
11. Coil Spring
12. Strut
13. Inner Bearing Oil Seal
14. Inner Hub Bearing
15. Steering Knuckle
16. Dust Cover
17. Hub Bearing Spacer
18. Outer Hub Bearing
19. Outer Bearing Oil Seal
20. Rotor
21. Wheel Hub
22. Hub Bolt
23. Hub Assembly
24. Drive Axle–to–Hub Caulking Nut
25. Control Arm Ball Stud Bolt
26. Cotter Pin
27. Castellated Nut
28. Washer
29. Stabilizer Shaft Bushing
30. Control Arm Dust Seal
31. Clip
32. Control Arm Bushing
33. Control Arm Assembly
34. Stabilizer Shaft
35. Stabilizer Shaft Mount
36. Front Under Longitudinal Frame

DIAGNOSTIC INFORMATION AND PROCEDURES

STRUT DAMPENER

A strut dampener is basically a shock absorber. However, strut dampeners are easier to extend and retract by hand than are shock absorbers. Strut dampeners are used only on the front in most vehicles, including this vehicle. Shock absorbers are used on the rear wheels.

Condition	Probable cause	Correction
Struts Seem Weak	• Improper tire pressures.	• Adjust the tire pressures to the specifications on the tire placard.
	• Abnormal load conditions.	• Consult with the owner to confirm the owner's understanding of normal load conditions.
	• Improper compression and rebound effectiveness of the strut dampener.	• Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested. • Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality. • Replace the strut dampener, if needed.
Struts are Noisy	• Loose or damaged mountings.	• Tighten the strut dampener. • Replace the strut dampener if needed.
	• Improper compression and rebound effectiveness of the strut dampener.	• Quickly push down and then lift up on the corner of the bumper nearest the strut dampener being tested. • Compare the compression and rebound with those of a similar vehicle that has an acceptable ride quality. • Replace the strut dampener, if needed.
Leaks	• A slight trace of fluid.	• The strut dampener is OK.
	• Leaks of the seal cover on the fully extended strut.	• Replace the strut dampener.
	• Excessive leaks of fluid on the strut dampener.	• Replace the strut dampener.

BALL JOINT AND KNUCKLE

Ball Joint Inspection

1. Raise the front of the vehicle to allow the front suspension to hang free.
2. Grasp the tire at the top and the bottom.
3. Move the top of the tire in an in-and-out motion.
4. Look for any horizontal movement of the knuckle relative to the control arm.
5. Control arms assembly must be replaced if the following conditions exist:
   - The joint is loose.
   - The ball seal is cut.
   - The ball stud is disconnected from the knuckle.
   - The ball stud is loose at the knuckle.
   - The ball stud can be twisted in its socket with finger pressure.

Ball Stud Inspection

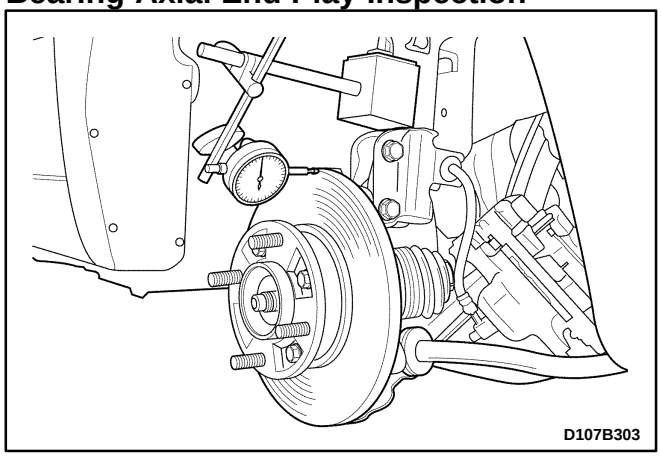
Make sure to check the tightness of the ball stud in the knuckle boss during each inspection of the ball joint. One way to inspect the ball stud for wear is to shake the wheel and feel for movement of the stud end or the castellated nut at the knuckle boss.

Another way to inspect the ball stud for wear is to check the fastener torque at the castellated nut. A loose nut can indicate a stressed stud or a hole in the knuckle boss.

Worn or damaged ball joints and knuckles must be replaced.

FRONT WHEEL BEARING

Bearing Axial End Play Inspection



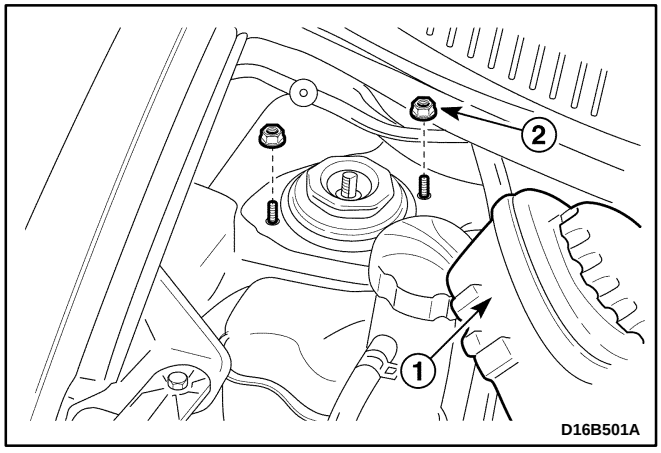
1. Lift and suitably support the vehicle.
2. Inspect the end play of the bearing.
3. If excessive play is defeeted, free shoes from the disc or remove the calipers.
4. Check the standard torque of the drive nut (spec. : 210 N•m (155 lb-ft)).
5. Check the bearing end play according to the following method.
   - Place a dial guage against the disc surface, grasp the disc.
   - Using a push–pull movement, note gage readings.

Specification	0.130mm or less (0.005 in)	Standard tighting torque of drive shaft nut : 210 N•m (155 lb-ft)

6. If the axial end play of the front wheel bearing exceed 0.130mm torque the drive shaft nut successively (Max. allowance : 240 N•m (177 lb-ft))
7. Check the axial end play again.
8. If the axial end play is above spec., replace the front wheel bearing.

REPAIR INSTRUCTIONS

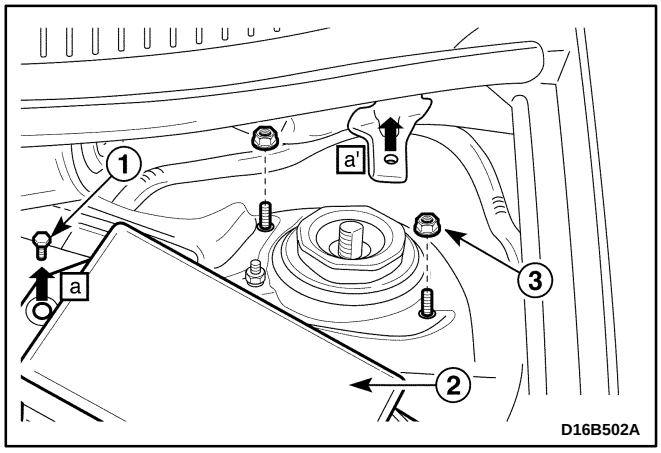
ON–VEHICLE SERVICE



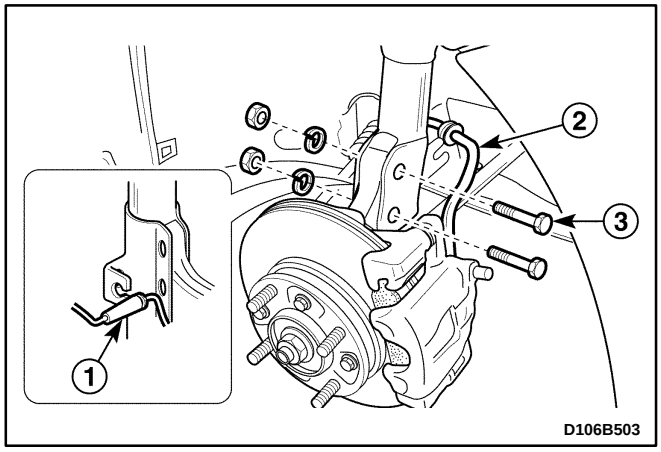
STRUT ASSEMBLY

Removal Procedure

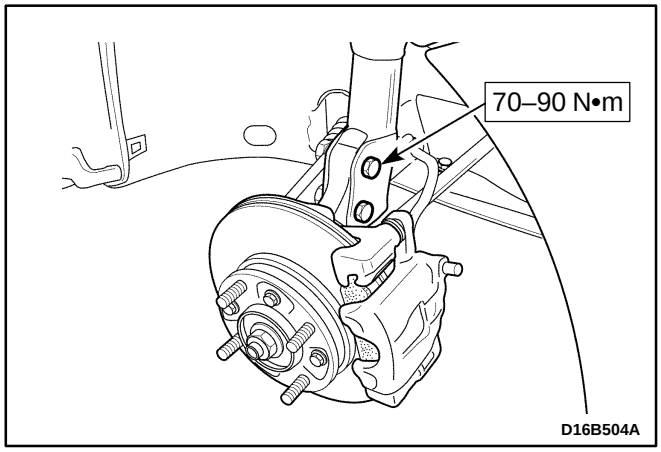
1. Open the hood.
2. Remove the top of the strut assembly at passenger seat side.
   - For vehicle with power steering, remove the power steering fluid reservoir (1).
   - Remove the nuts (2).



3. Remove the top of the strut assembly at driver side.
   - Remove the bolt and the fuse box (1, 2).
   - Remove the nuts (3).



4. Remove the lower of the strut assembly.
   - Raise and suitably support the vehicle.
   - Remove the wheel. Refer to *Section 2E, Tires and Wheels.*
   - Remove the ABS front speed sensor electrical wire from the bracket, if applicable (1).
   - Disconnect the brake hose from the bracket (2).
   - Remove the strut bracket bolts (3).
5. Remove the strut bracket assembly from the vehicle.



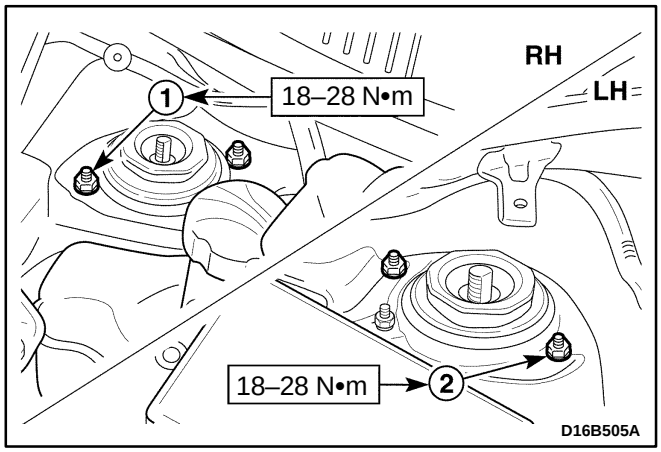
Installation Procedure

1. Install the strut assembly to the vehicle with the strut assembly–to–strut bracket bolts.

Tighten

Tighten the strut assembly–to–strut bracket bolts to 70–90 N•m (52–66 lb-ft).

2. Connect the brake hose to the bracket.
3. Install the ABS front speed sensor electrical wire to the bracket, if applicable.



4. Install the wheel. Refer to *Section 2E, Tires and Wheels.*
5. Lower the vehicle.
6. Install the nuts.
   - Install the nuts at passenger side (1).

Tighten

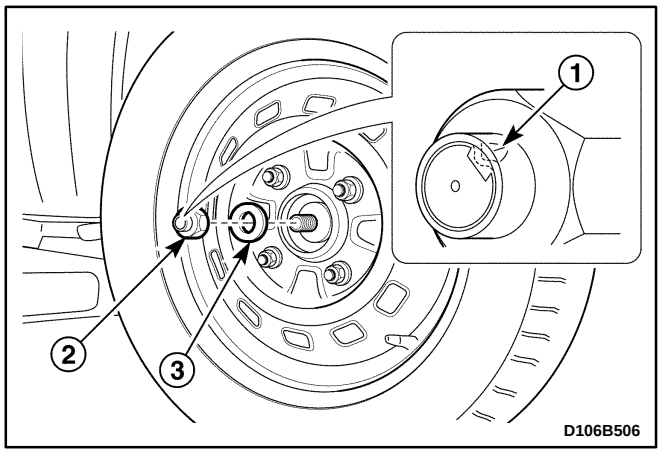
Tighten the nuts to 18–28 N•m (13–21 lb-ft).

- Install the nuts at driver side (2).

Tighten

Tighten the nuts to 18–28 N•m (13–21 lb-ft).

7. Install the power steering fluid reservoir.
8. Install the fuse box and bolt.



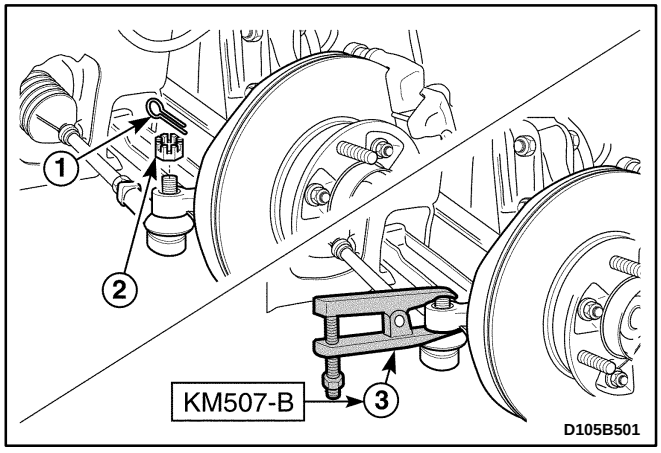
KNUCKLE ASSEMBLY

Tools Required

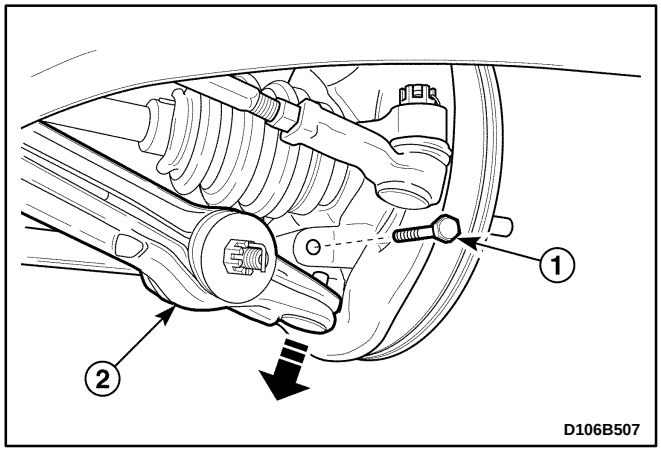
KM 507–B Ball Joint Remover

Removal Procedure

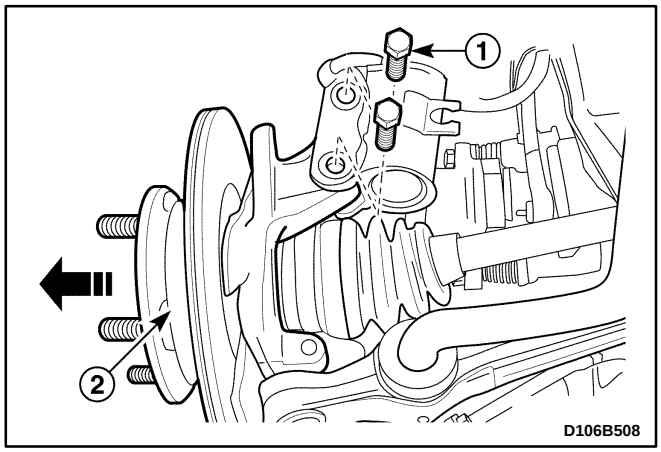
1. Remove the caulking nut.
   - Straighten the bent flange caulking nut (1).
   - Remove the caulking nut (2).
   - Remove the washer (3).
2. Remove the wheel. Refer to *Section 2E, Tires and Wheels.*



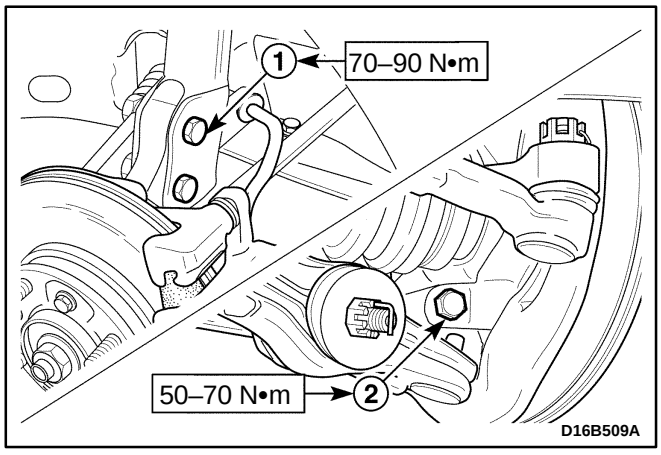
3. Separate the tie rod end from the knuckle assembly.
   - Remove the cotter pin (1).
   - Remove the castellated nut (2).
   - Install the ball joint remover KM 507–B.
   - Separate the tie rod end from the knuckle assembly using a ball joint remover KM 507–B (3).



4. Remove the control arm from the knuckle assembly.
   - Remove the stud bolt (1).
   - Separate the control arm from the knuckle assembly (2).



5. Remove the brake caliper from the knuckle assembly. Refer to *Section 4D, Front Disc Brakes.*
6. Remove the ABS wheel speed sensor from the knuckle assembly, if applicable. Refer to *Section 4F, Anti–lock Brake System*.
7. Remove the steering knuckle assembly from the vehicle.
   - Remove the strut bracket bolts (1).
   - Separate the knuckle assembly from the drive shaft by pulling the steering knuckle assembly (2).



Installation Procedure

1. Install in the reverse order of removal.
2. Install the steering knuckle assembly in the vehicle with strut bracket bolts (1).

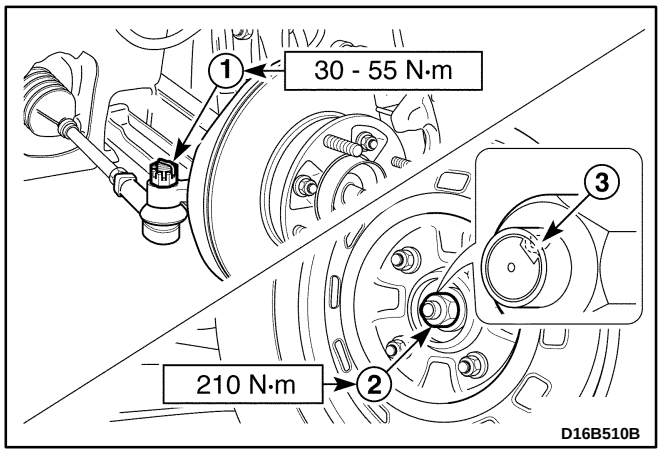
Tighten

Tighten the strut bracket bolts to 70–90 N•m (52–66 lb-ft).

3. Install the brake caliper from the knuckle assembly.
4. Install the control arm into the knuckle assembly with the stud bolt (2).

Tighten

Tighten the stud bolt to 50–70 N•m (36–52 lb-ft).



5. Install the tie rod end to the knuckle assembly.
6. Install the tie rod end–to–knuckle castellated nut (1) and the cotter pin.

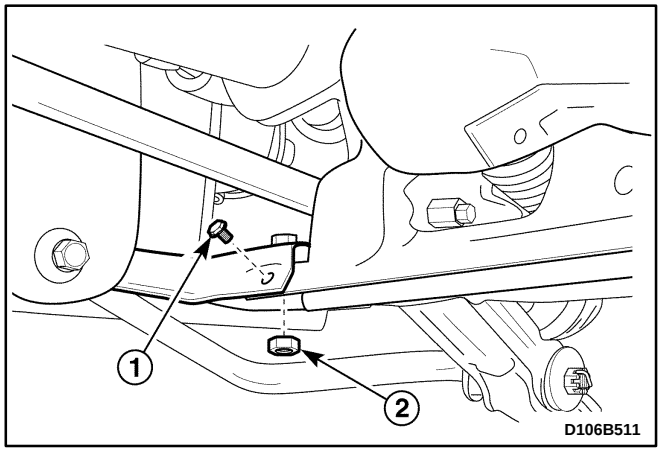
Tighten

Tighten the castellated nut to 30–55 N•m (22–41 lb-ft).

7. Install the caulking nut (2).
   - Bend the caulking nut flange (3).

Tighten

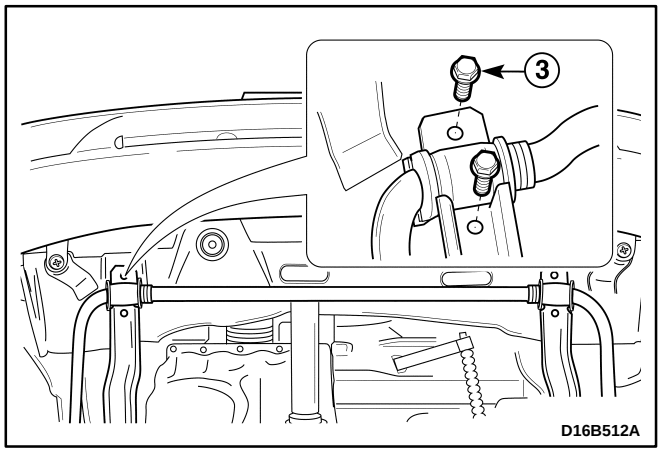
Tighten the caulking nut to 210 N•m (155 lb-ft).



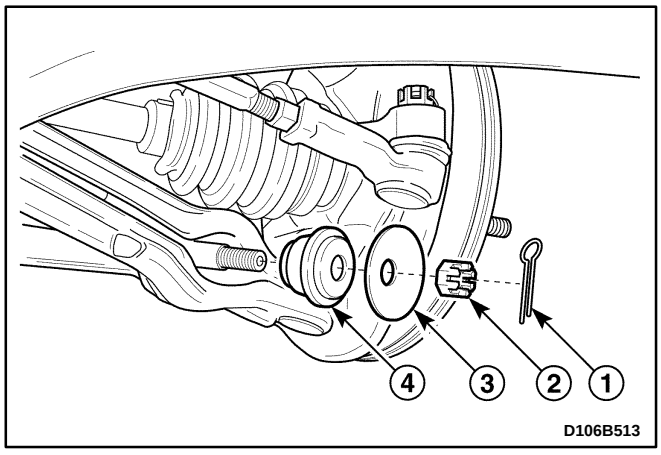
FRONT LONGITUDINAL FRAME AND STABILIZER SHAFT

Removal Procedure

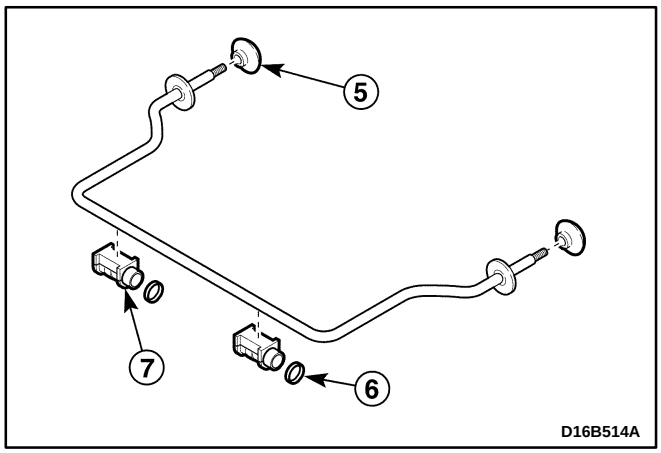
1. Removed the front under longitudinal frame.
   - Raise and suitably support the vehicle.
   - Remove the front wheel. Refer to *Section 2E, Tires and Wheels.*
   - Remove the transaxle under cover. Refer to *Section 5B, Manual Transaxle*.
   - Remove the front under longitudinal frame bolt (1).
   - Remove the front under longitudinal frame nut (2).



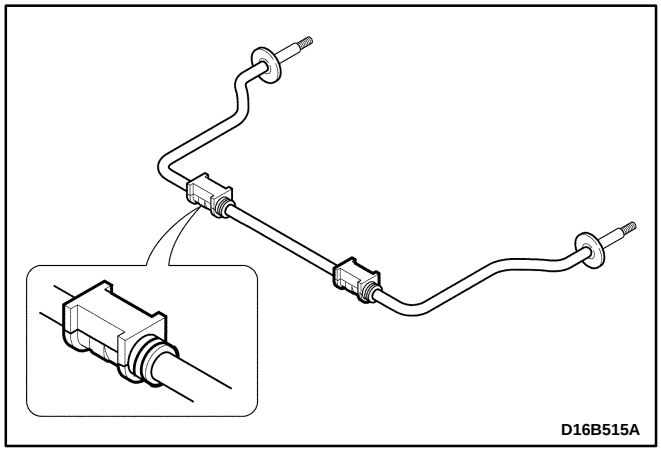
   - Remove the stabilizer shaft mounting bolts (3).
   - Remove the front under longitudinal frame.



2. Remove the stabilizer shaft from the vehicle.
   - Remove the cotter pin (1).
   - Remove the castellated nut (2).
   - Remove the washer (3).
   - Remove the rear bushing with separating the stabilizer shaft from the control arm (4).



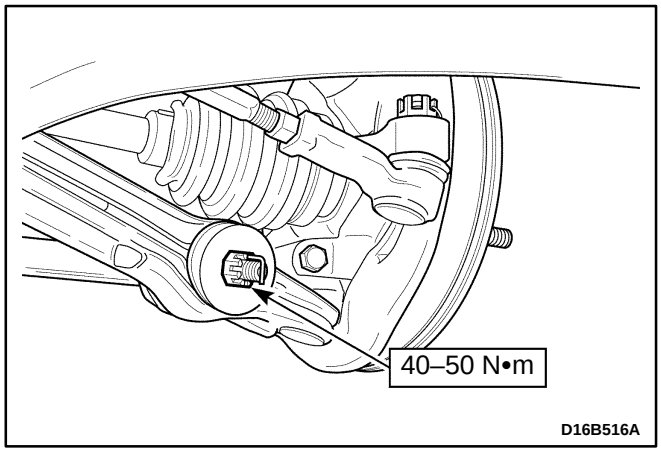
   - Remove the bushing (5).
   - Remove the wire clamps (6).
   - Remove the mountings (7).



Installation Procedure

1. Install in the reverse order of removal.

Important: When installing the mountings, position the opened mountings forward.

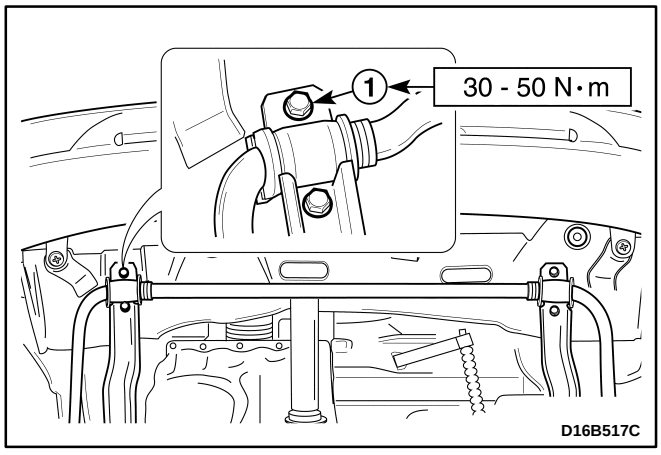


2. Install the stabilizer shaft to the vehicle.
   - Install the castellated nut.

Tighten

Tighten the stabilizer shaft–to–body castellated nut to 40–50 N•m (30–36 lb-ft).

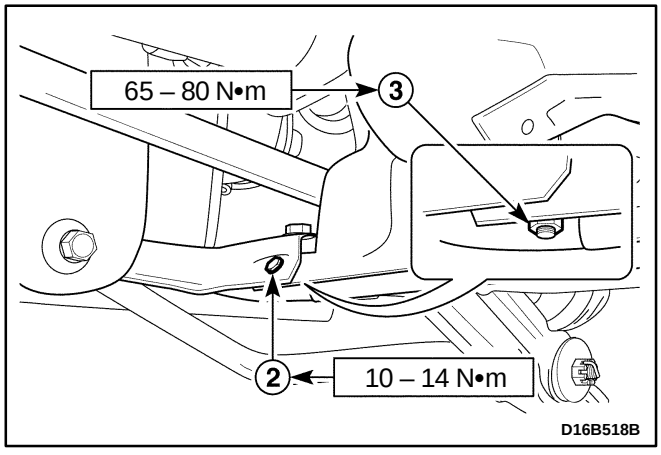
- Install the cotter pin.



3. Install the front under longitudinal frame.
   - Install the stabilizer shaft mounting bolts (1).

Tighten

Tighten the mounting bolts to 30–50 N•m (22–36 lb-ft).



- Install the front under longitudinal frame bolt (2).

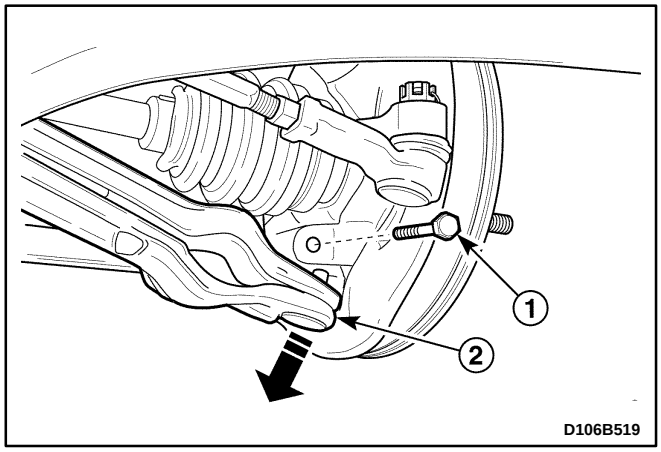
Tighten

Tighten to bolt to 10–14 N•m (89–124 lb-in).

- Install the front under longitudinal frame nut (3).

Tighten

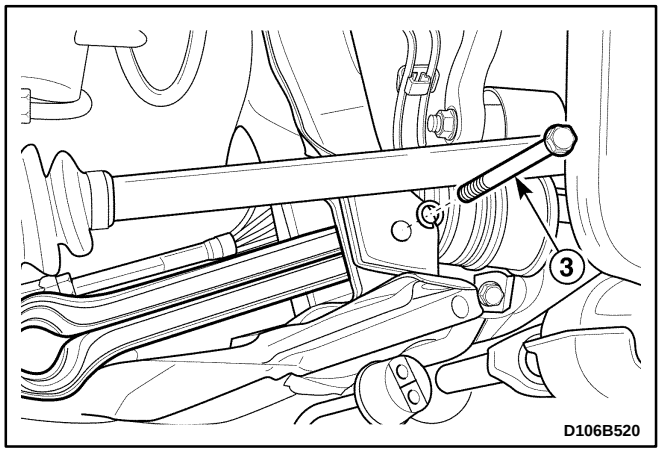
Tighten to nut to 65–80 N•m (48–59 lb-ft).



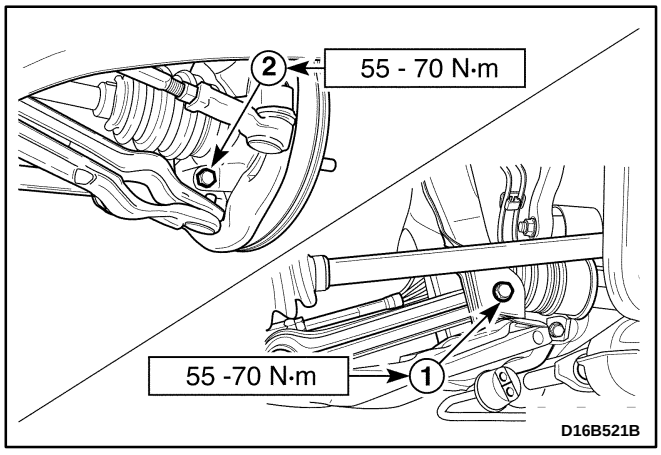
CONTROL ARM

Removal Procedure

1. Remove the stabilizer shaft. Refer to “Front Longitudinal Frame and Stabilizer Shaft” in this section.
2. Remove the control arm.
   - Remove the stud bolt (1).
   - Separate the control arm from the knuckle assembly using a lever (2).



   - Remove the bolt (3).
   - Remove the control arm.



Installation Procedure

1. Install the control arm onto the vehicle.
   - Install the control arm bolt (1).

Tighten

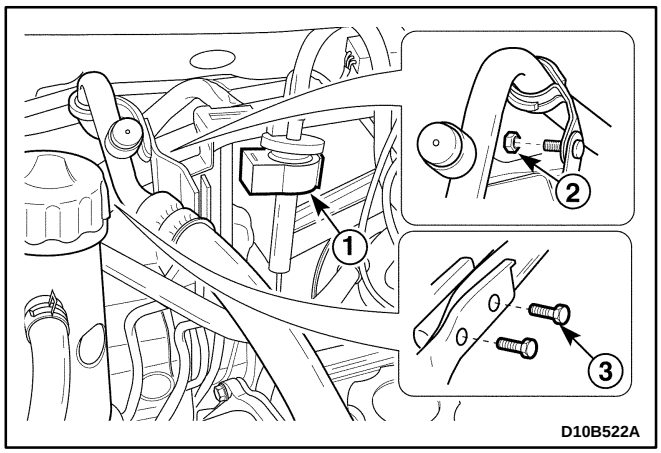
Tighten the control arm bolt to 55–70 N•m (41–52 lb-ft).

   - Install the control arm to the knuckle assembly.
   - Install the stud bolt (2).

Tighten

Tighten the stud bolt to 50–70 N•m (36–52 lb-ft).

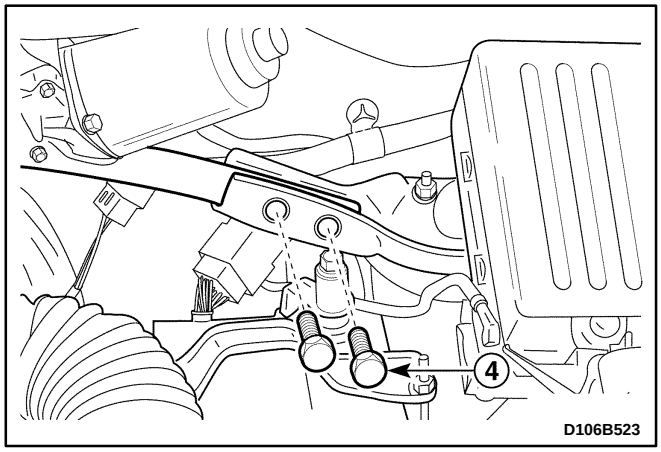
2. Install the stabilizer shaft.



STRUT BAR

Removal Procedure

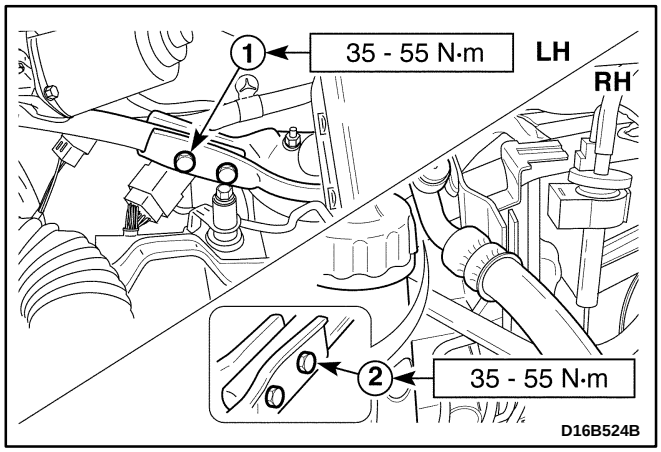
1. Open the hood.
2. Remove the strut bar from the vehicle.
   - Remove the purge control valve (1).
   - Remove the A/C low pressure pipe bracket–to–strut bar nut (2).
   - Remove the strut bar bolts at passenger side (3).



- Remove the strut bar bolts at driver side (4).

Important: When removing the bolts using the tool, do not contact the battery terminal.

- Remove the strut bar at passenger side



Installation Procedure

1. Install the strut bar to the vehicle.
   - Install the strut bar at passenger side.
   - Install the strut bar bolts at driver side (1).

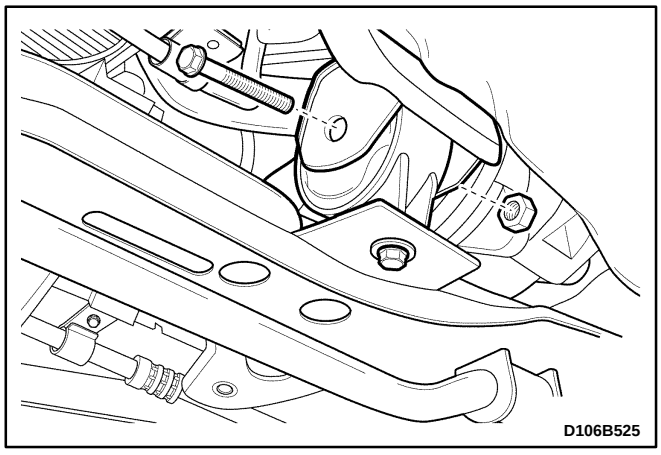
Important: When installing the bolts using the tool, do not contact the battery terminal.

- Install the strut bar bolts at passenger side (2).
- Install the A/C low pressure pipe bracket–to–strut bar nut.

Tighten

Tighten the strut bar bolts to 35–55 N•m (25–41 lb-ft).

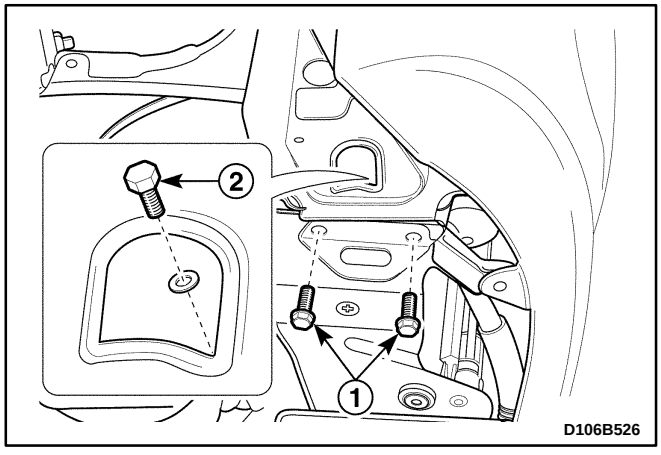
- Install the purge control valve to the strut bar.



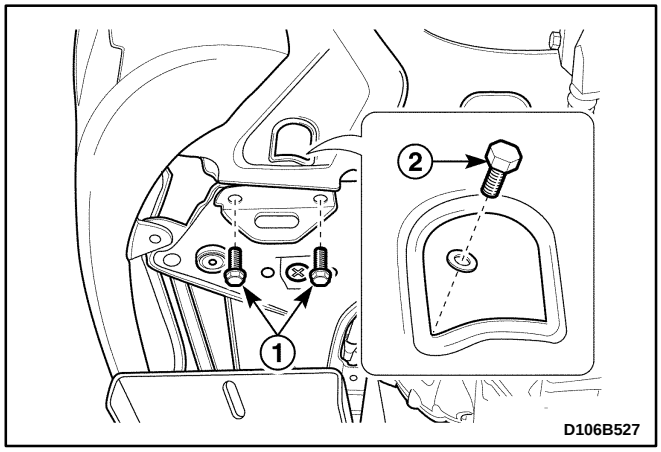
CROSSMEMBER

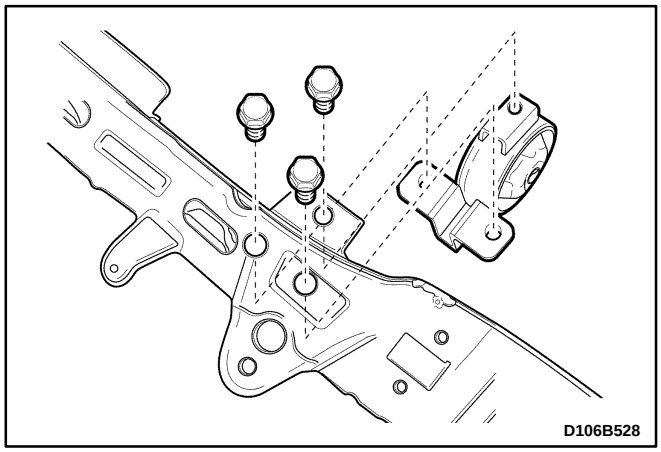
Removal Procedure

1. Remove the transaxle under cover. Refer to *Section 5B, Five–Speed Manual Transaxle.*
2. Remove the front under longitudinal frame. Refer to “Stabilizer Shaft” in this section.
3. Remove the damping bush bolt and nut.

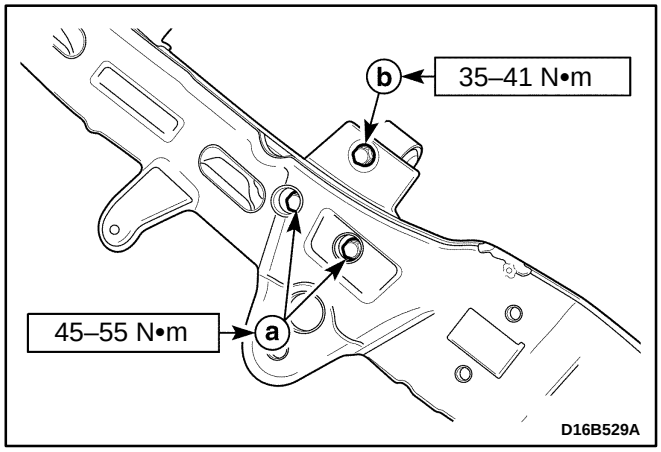


4. Disconnect the power steering pressure line from the crossmember. Refer to *Section 6B, Power Steering Pump.*
5. Remove the crossmember from the vehicle.
   - Place support jack under the crossmember.
   - Remove the bumper fascia screws.
   - Remove the rear bolts (1).
   - Remove the side bolts (2).
   - Lower the support jack and remove the crossmember from the vehicle.





6. Remove the front damping bush bolts and damping bush from the crossmember.

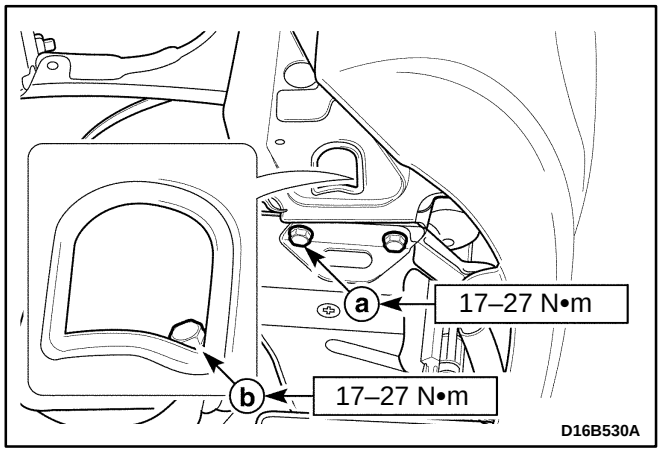


Installation Procedure

1. Install in the reverse order of removal.
2. Install the front damping bush to the crossmember.

Tighten

- Tighten the bolts to 45–55 N•m (33–41 lb-ft).
  a. Front damping bush bolt.
- Tighten the bolt to 35–41 N•m (25–30 lb-ft).
  b. Front damping bush bolt.

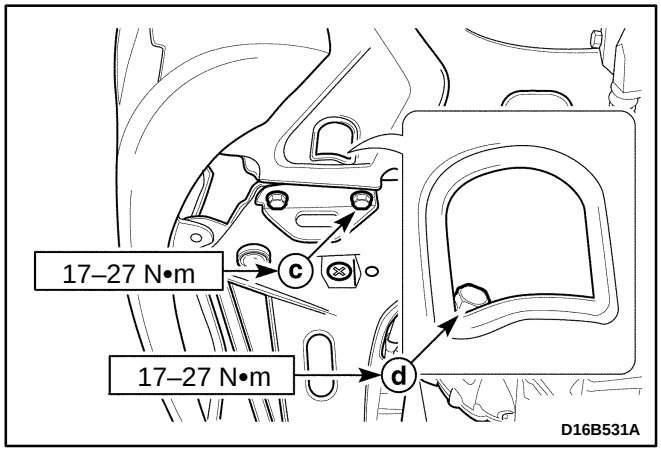


3. Install the crossmember to the vehicle with the bolts.

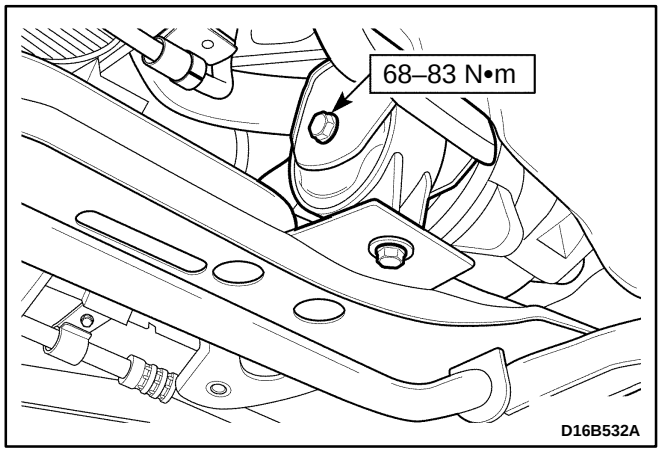
Tighten

Tighten the bolts to 17–27 N•m (13–20 lb-ft).

a. Crossmember right rear bolt.
b. Crossmember right side bolt.



c. Crossmember left rear bolt.
d. Crossmember leftt side bolt.



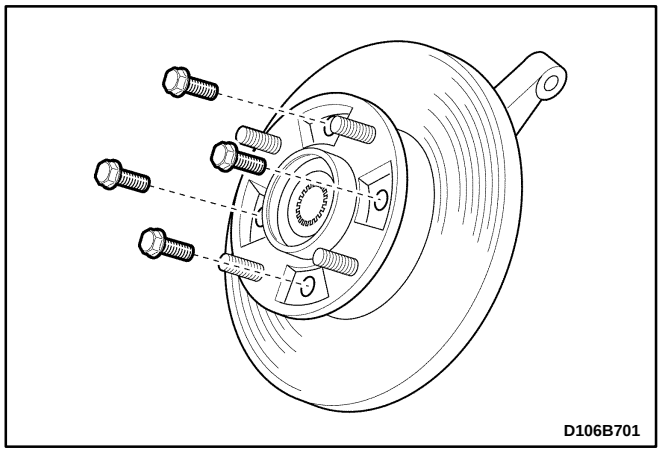
4. Install the front damping bush to the vehicle.

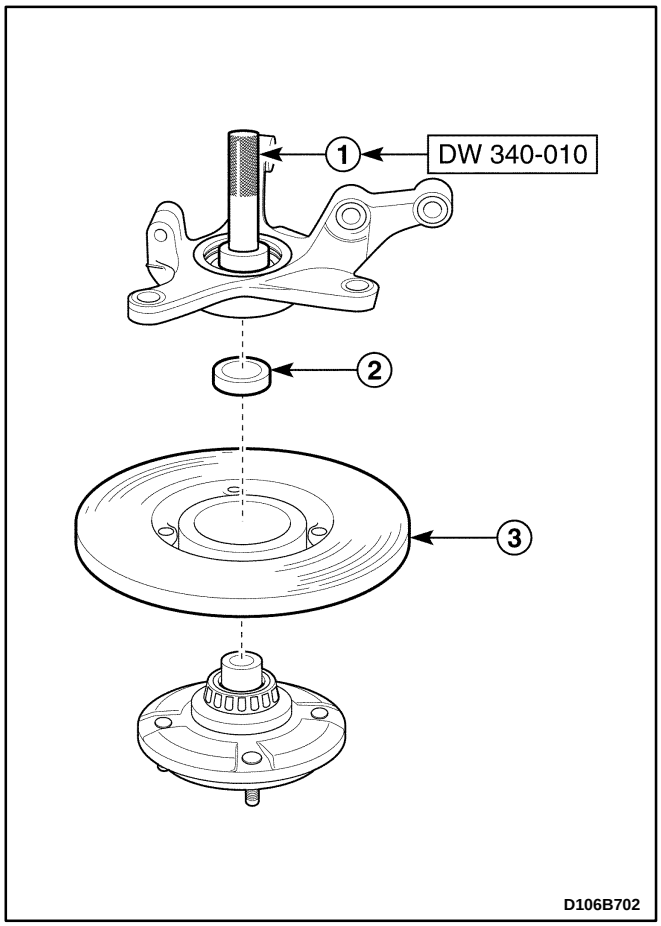
Tighten

Tighten the front damping bush bolt and nut to 68–83 N•m (51–61 lb-ft).

5. Install the front under longitudinal frame. Refer to “Stabilizer Shaft” in this section.

UNIT REPAIR


D106B701



D106B702

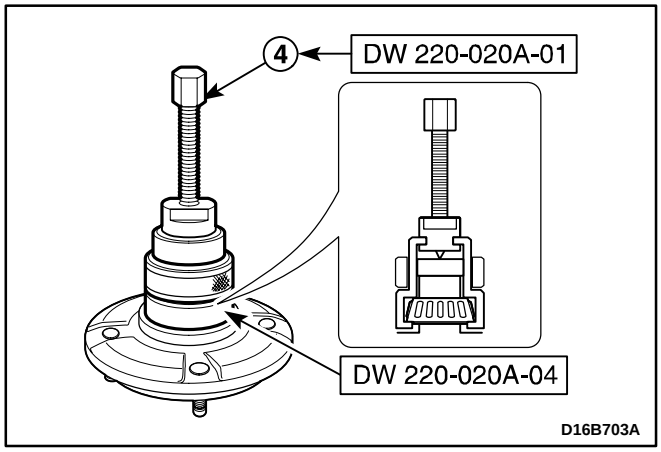
HUB BEARING AND KNUCKLE

Tools Required

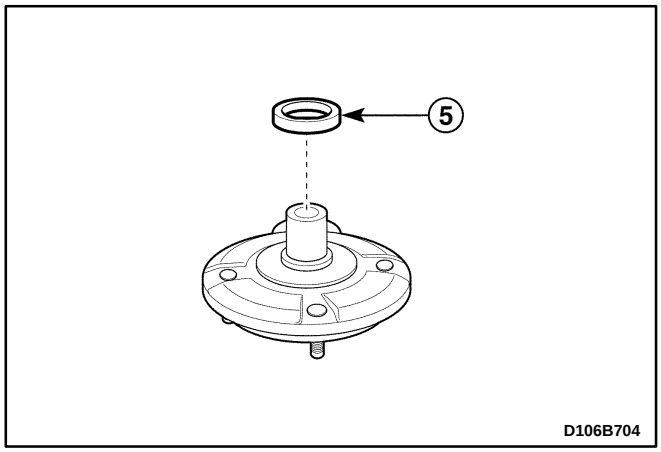
DW 220–020A–01	Differential Bearing Puller.
DW 220–020A–04	Differential Bearing Plate Adapter.
DW 340–010	Front Wheel Hub Remover.
DW 340–020	Front Wheel Bearing Race Installer.
DW 340–030	Front Wheel Bearing Installer.
09940–71430	Front Spring Compressor.

Disassembly Procedure

1. Remove the steering knuckle assembly. Refer to “Knuckle Assembly” in this section.
2. Remove the bolts from the wheel hub.
3. Remove the wheel hub from the knuckle assembly using the front wheel hub remover DW 340–010.
   - Remove the wheel hub using the front wheel hub remover DW 340–010 (1).
   - Remove the bearing spacer (2).
   - Remove the brake rotor (3).



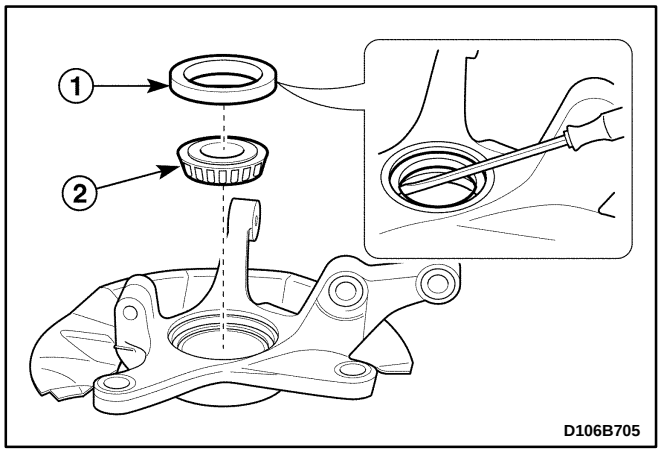
- Remove the wheel bearing from the wheel hub using the differential bearing puller DW 220–020A–01 and differential bearing plate adapter DW 220–020A–04 (4).



- Remove the oil seal from the wheel hub (5).

Important: Do not use removed oil seal.

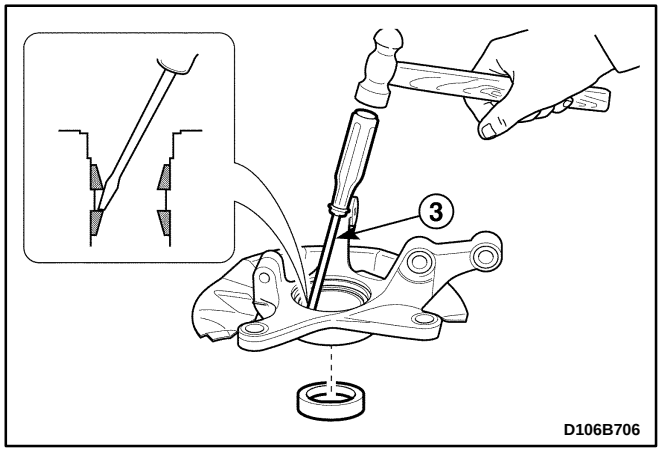
4. Remove the steering knuckle assembly.



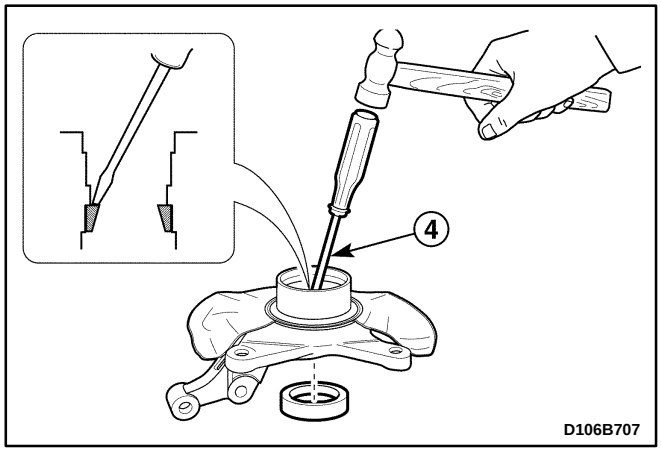
- Remove the oil seal (1).

Important: Do not use removed oil seal.

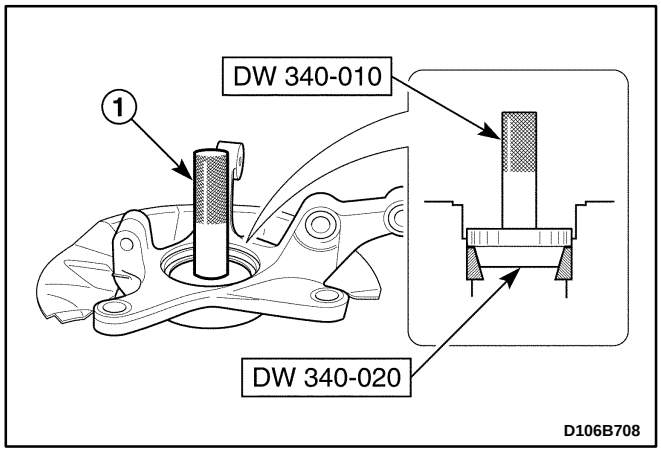
- Remove the wheel bearing (2).



- Remove the outer bearing race (3).

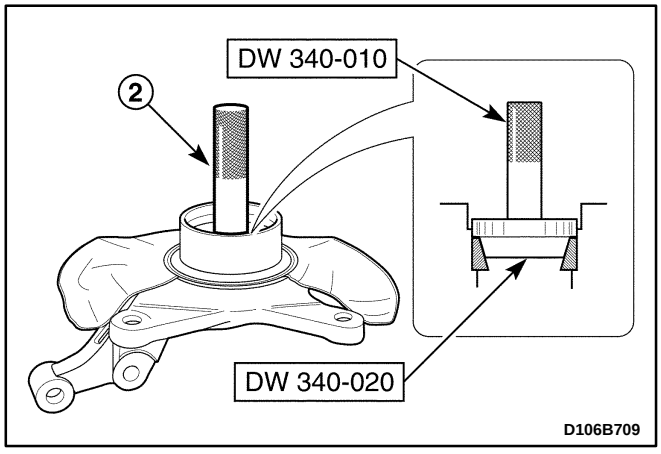


- Remove the inner bearing race (4).

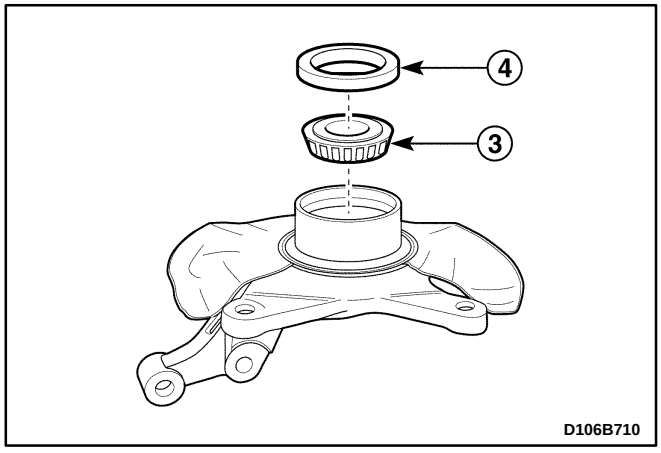


Assembly Procedure

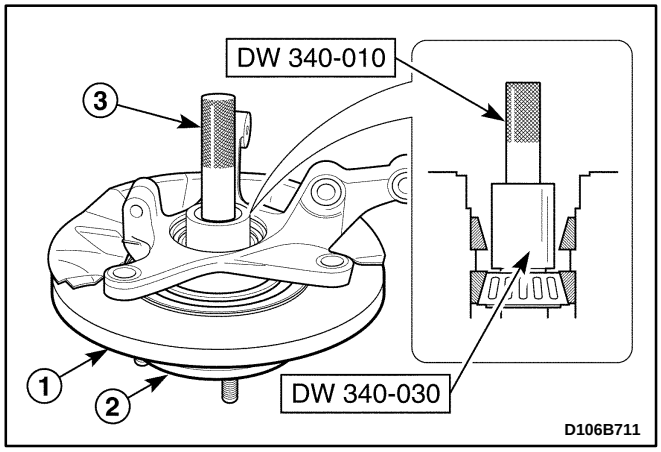
1. Assemble the steering knuckle assembly.
   - Assemble the inner bearing race using the front wheel hub remover DW 340–010 and the front bearing race installer DW 340–020 (1).



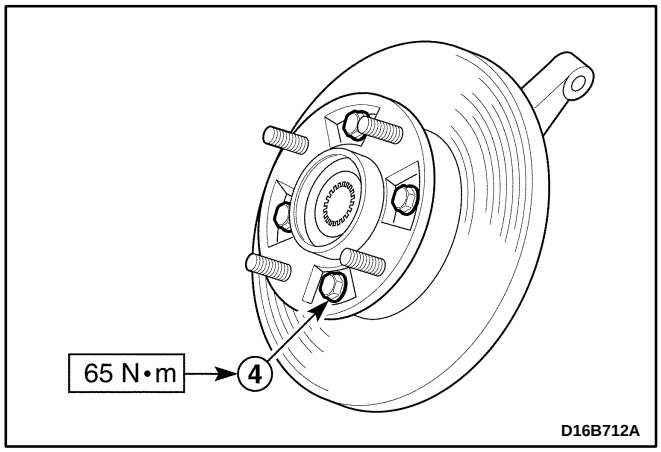
   - Assemble the outer bearing race using the front wheel hub remover DW 340–010 and the front wheel bearing race installer DW 340–020 (2).



   - Assemble the outer wheel bearing (3).
   - Assemble the outer wheel bearing oil seal (4).



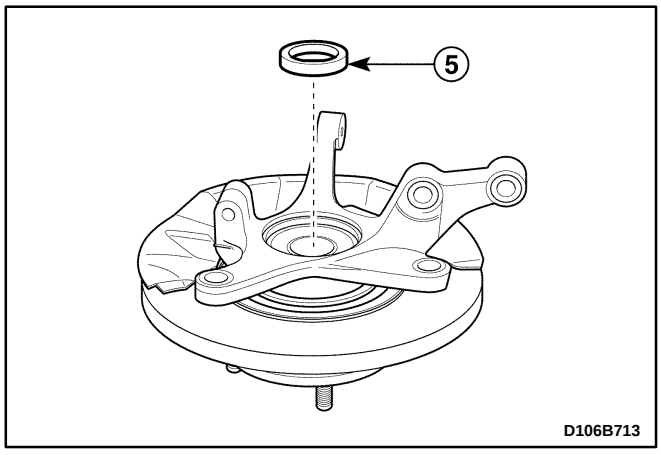
2. Install the wheel hub to steering knuckle assembly.
   - Install the brake rotor (1).
   - Install the wheel hub to the steering knuckle assembly temporary (2).
   - Press the outer wheel bearing into the wheel hub using the front wheel hub remover DW 340–010 and the front wheel bearing installer DW 340–030 (3).



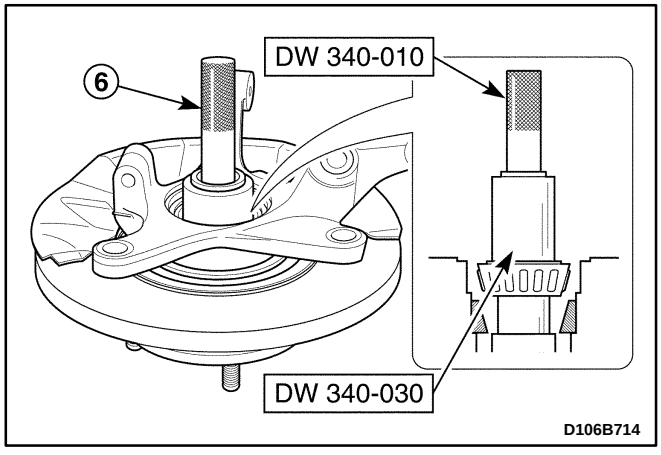
- Tighten the bolts (4).

Tighten

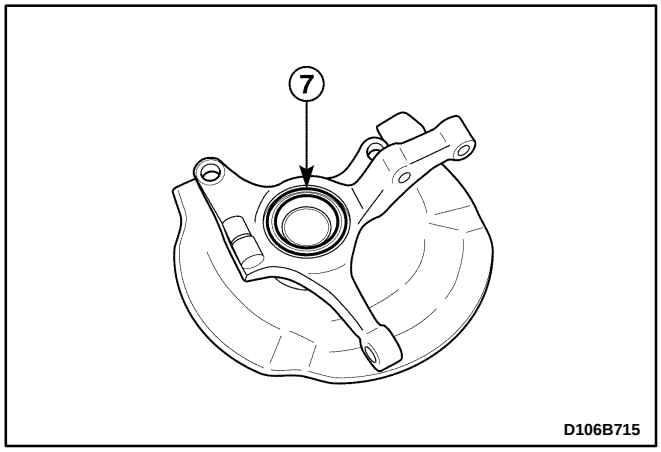
Tighten the bolt to 65 N•m (48 lb-ft).



- Install the bearing spacer (5).

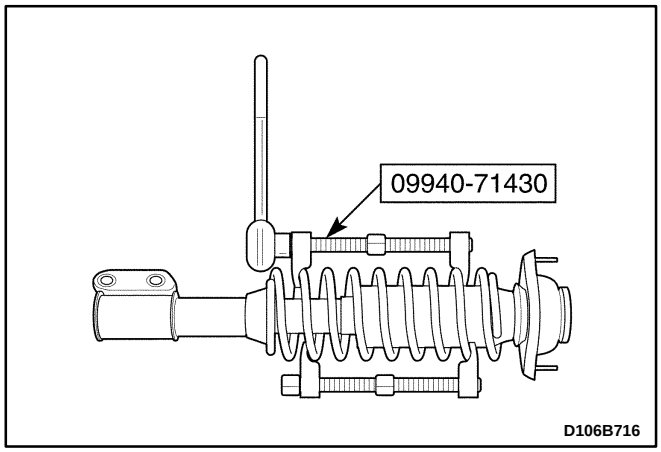


- Press the inner wheel bearing into the wheel hub using the front wheel hub remover DW 340–010 and the front wheel bearing installer DW 340–030 (6).



- Install the inner wheel bearing oil seal (7).

3. Install the steering knuckle assembly.
   Refer to “Knuckle Assembly” in this section.



FRONT STRUT (INCLUDING COIL SPRING)

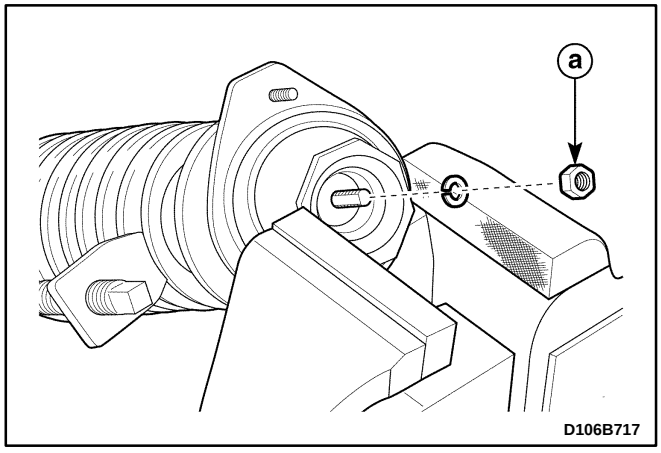
Tools Required

09940–71430 Front Spring Compressor.

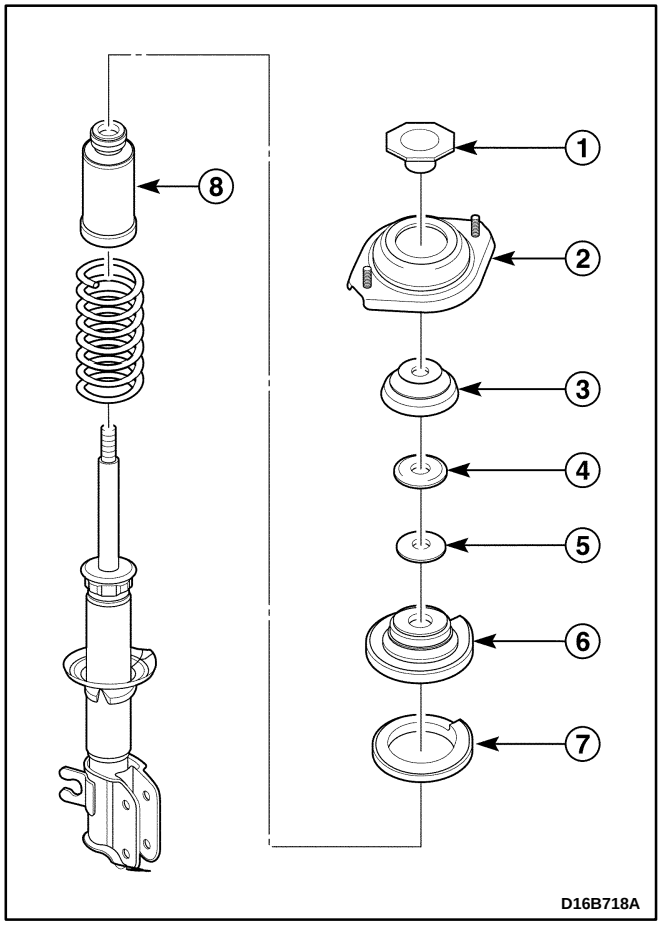
Disassembly Procedure

1. Remove the strut assembly. Refer to “Strut Assembly” in this section.
2. Compress the front spring with the front spring compressor 09940–71430.

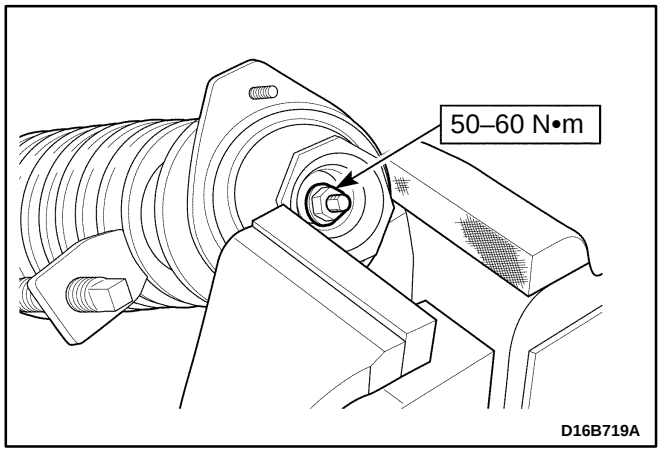
Caution: During compressing spring, do not make spring end point to operator or dangerous direction.



3. Fix the strut support using the bench vise and remove the strut nut.
   a. Strut nut.



4. Remove the coil spring.
   - Remove the strut inner support (1).
   - Remove the strut mount assembly (2).
   - Remove the strut mount seat (3).
   - Remove the strut bearing seat (4).
   - Remove the strut bearing (5).
   - Remove the coil spring upper seat (6).
   - Remove the coil spring seat (7).
   - Remove the bumper stopper (8).

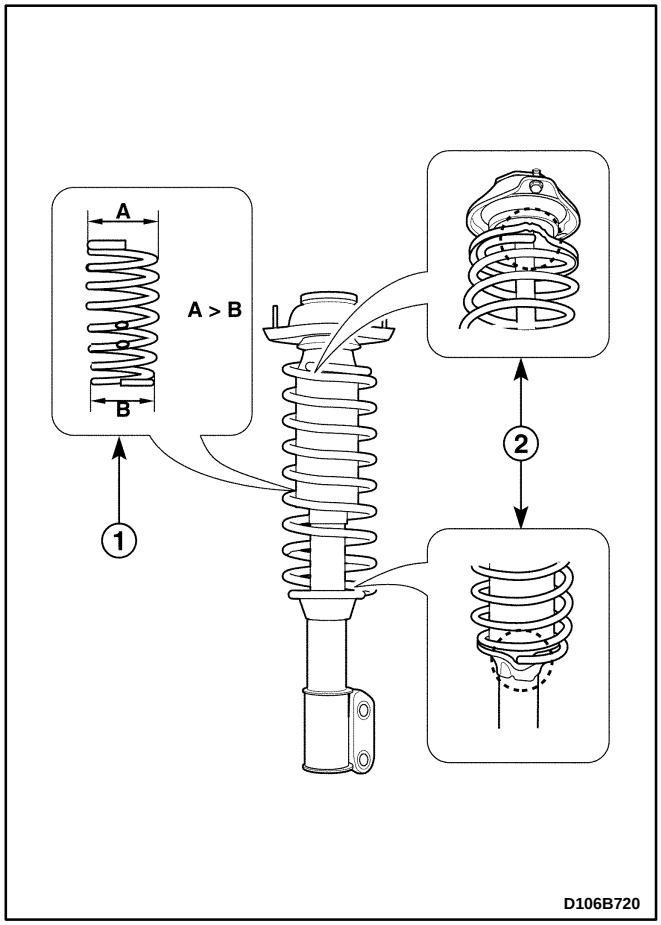


Assembly Procedure

1. Install the coil spring, front bumper stopper, coil spring seat, coil spring upper seat, strut bearing, bearing seat, mounting seat, mount assembly and inner support to the strut.
2. Tighten the strut nut.
   - Fix the strut support using the bench vise.
   - Tighten the nut.

Tighten

Tighten the strut nut to 50–60 N•m (36–44 lb-ft).



3. Inspect the installation of coil spring (1, 2).
4. Install the strut assembly. Refer to “Strut Assembly” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

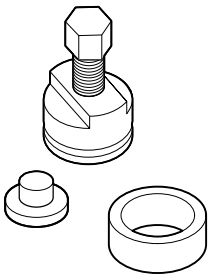
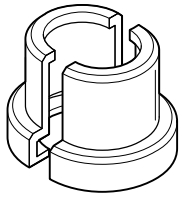
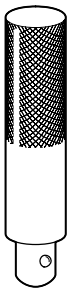
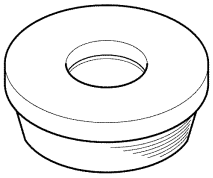
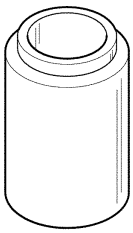
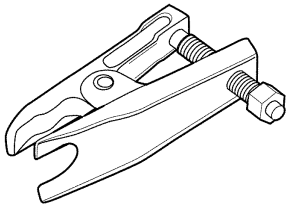
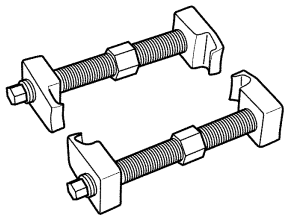
Application		Unit	Description
Suspension Type		–	Mcpherson (Strut)
Shock Absorber	Maximum Length	mm (in.)	475–481 (18.7–18.94)
	Minimum Length	mm (in.)	321–327 (12.64–12.87)
	Stroke	mm (in.)	154 (6.06)
Stabilizer Shaft Diammeter		mm (in.)	24 (0.94)
Coil Spring Height (No Load)		mm (in.)	374 (14.72)
Grease Type (Front Wheel Bearing and Hub)		–	M–8143 ANTIF BRG GREASE

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Strut Assembly–to–Body Nuts	18 – 28	13 – 21	–
Strut Closure Nut	50 – 60	36 – 44	–
Strut Assembly–to–Knuckle Bolts	70 – 90	52 – 66	–
Control Arm Mounting Bolt	55 – 70	41 – 52	–
Control Arm Ball Stud Bolt	50 – 70	36 – 52	–
Stabilizer Shaft Castellated Nut	40 – 50	30 – 36	–
Stabilizer Shaft Mounting Bolt	30 – 50	22 – 36	–
Front Under Longitudinal Frame Bolts	10 – 14	–	89 – 124
Front Under Longitudinal Frame Nut	65 – 80	48 – 59	–
Drive Axle–to–Hub Caulking Nut	210	155	–
Crossmember Bolt	17 – 27	13 – 20	–
Strut Bar Bolts	35 – 55	25 – 41	–
ABS Front Speed Sensor Retaining Bolt	18 – 28	13 – 21	–
Wheel Hub–to–Brake Disc Bolt	55 – 75	41 – 55	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D13B112A	**DW 220–020A–01** **Differential Bearing Puller**
 D13B113A	**DW 220–020A–04** **Differential Bearing Plate Adapter**
 D16B101A	**DW 340–010** **Front Wheel Hub Remover**
 D106B102	**DW 340–020** **Front Wheel Bearing Race Installer**
 D106B103	**DW 340–030** **Front Wheel Bearing Installer**
 D105B101	**KM 507–B** **Ball Joint Remover**
 D106B104	**09940–71430** **Front Spring Compressor**

SECTION 2D

REAR SUSPENSION

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DESCRIPTION AND OPERATION

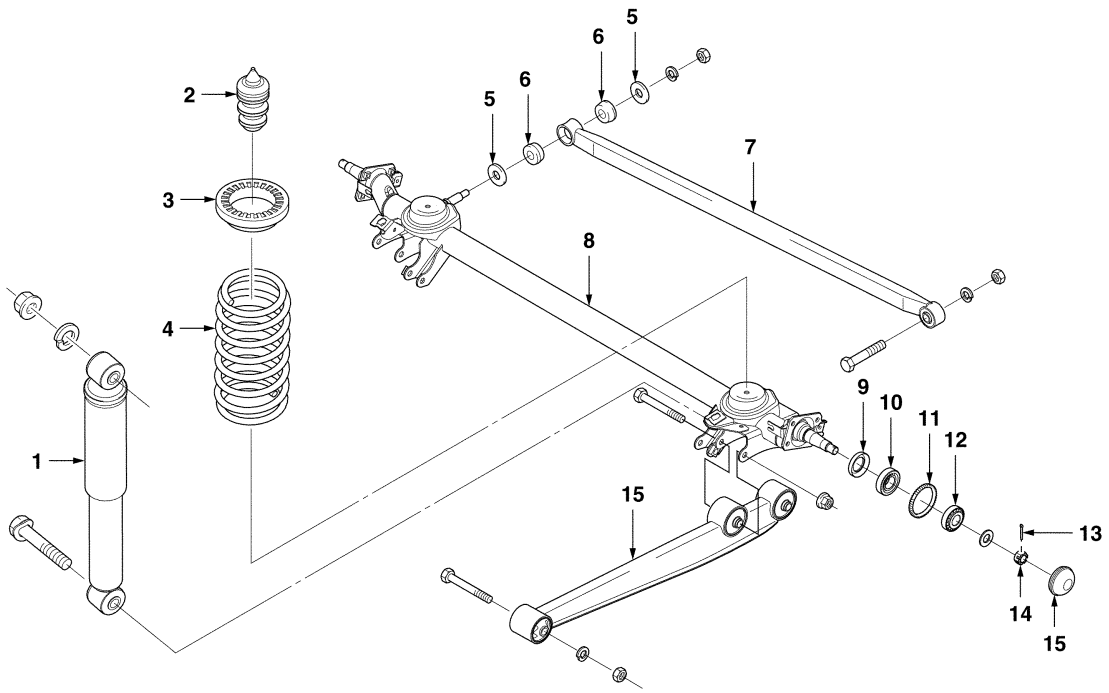
REAR SUSPENSION

The rear suspension consists of an axle with trailing arms and a lateral rod, two coil springs, two shock absorbers, two upper spring seats, and two bump stoppers. The axle structure maintains the relationship of the wheels to the body.

Each coil spring is retained between a seat in the underbody and a seat welded to the top of the rear axle.

COMPONENT LOCATOR

REAR SUSPENSION



1. Shock Absorber
2. Bumper Stopper
3. Coil Spring Upper Seat
4. Coil Spring
5. Washer
6. Bushing
7. Lateral Rod
8. Rear Axle
9. Oil Seal
10. Wheel Bearing Inner
11. ABS Wheel Speed Ring
12. Wheel Bearing Outer
13. Cotter Pin
14. Castellated Nut
15. Spindle Cap
16. Trailing Arm

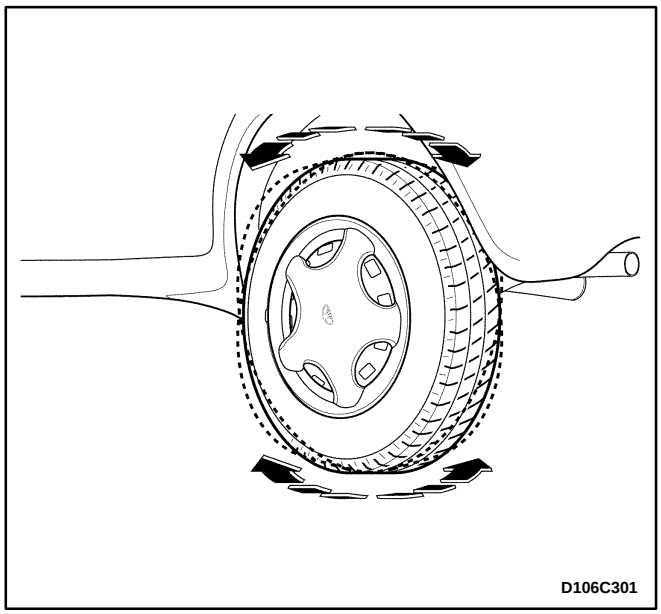
DIAGNOSTIC INFORMATION AND PROCEDURES

REAR SUSPENSION

Condition	Probable cause	Correction
Noise	● The loosened joints.	● Tighten the joints.
	● Wheel bearing is worn or damaged.	● Replace the wheel bearing.
	● Faulty shock absorber.	● Replace the shock absorber.
Uncomfortable	● Faulty shock absorber.	● Replace the shock absorber.
	● Faulty coil spring.	● Replace the coil spring.
	● Lateral rod bushing is worn or damaged.	● Replace the lateral rod bushing.
	● Trailing arm bushing is worn or damaged.	● Replace the trailing arm bushing.
Vehicle Leans Toward the Side	● Rear axle deformation.	● Replace the rear axle.
	● Lateral rod deformation.	● Replace the lateral rod.
	● Trailing arm deformation.	● Replace the trailing arm.
	● Faulty coil spring.	● Replace the coil spring.
	● Lateral rod bushing is worn or damaged.	● Replace the lateral rod bushing.
	● Trailing arm bushing is worn or damaged.	● Replace the trailing arm bushing.

CHECKING THE REAR WHEEL BEARING END PLAY

1. Release the parking brake.
2. Raise the vehicle.
3. Check the wheel bearing play by moving the top and the down of the tire in an in–and–out motion.



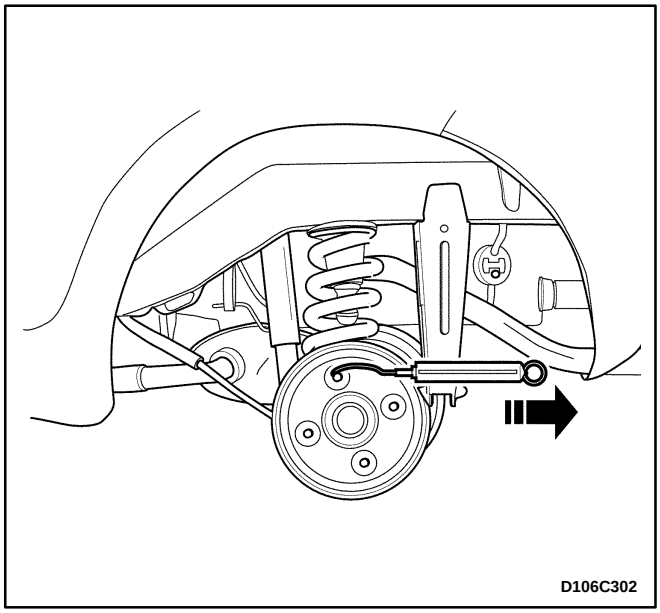
Rear Wheel Bearing Play	0 mm (0 in.)

4. If the bearing play is high, tighten the castellated nut.
5. If the bearing play is high after tightening, replace the wheel bearing.

REAR WHEEL BEARING FREE LOAD

1. Release the parking brake.
2. Raise the vehicle and rotate the wheel.
3. Remove the wheels.
4. Check the torque when the hub moves by a spring scale.

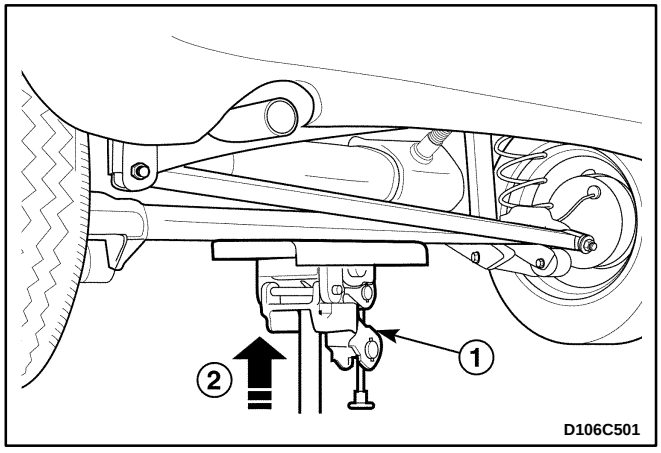
Standard (No Load)	0.137 – 0.422 N•m (0.9 – 3.7 lb-in)



5. If the checked torque exceeds the specification, tighten the castellated nut.
6. If the checked torque exceeds the specification after tightening, replace the wheel bearing.

REPAIR INSTRUCTIONS

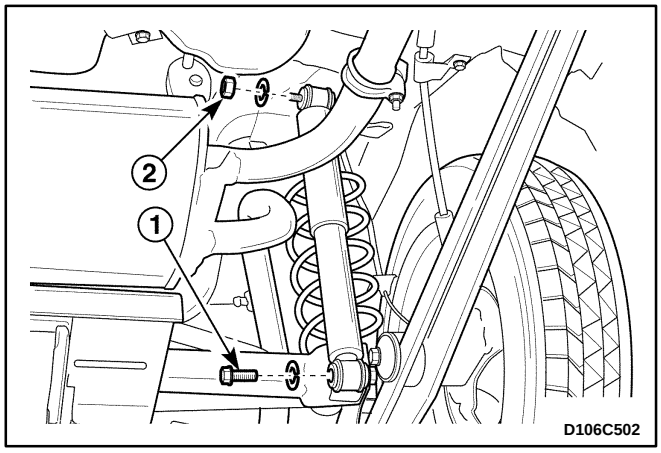
ON–VEHICLE SERVICE



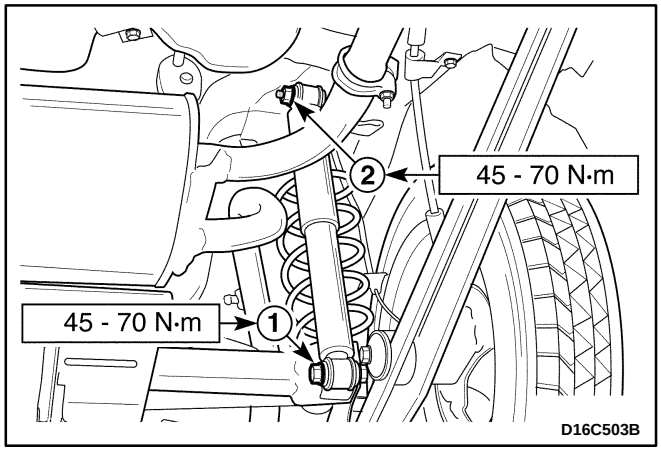
SHOCK ABSORBER

Removal Procedure

1. Support the rear axle with adjustable jack stands.
   - Raise the vehicle and support the rear axle assembly (1, 2).



2. Remove the shock absorber.
   - Remove the bolt (1).
   - Remove the nut (2).



Installation Procedure

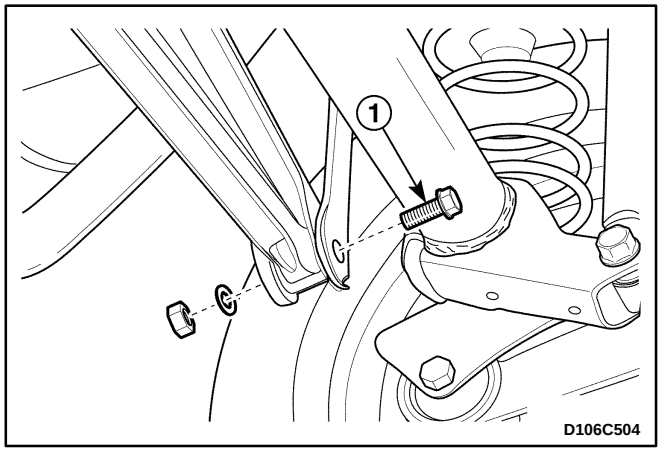
1. Install the shock absorber.
   - Install the shock absorber–to–rear axle bolt (1).

   Tighten

   Tighten the bolt to 45–70 N•m (33–52 lb-ft).
   - Install the shock absorber–to–body bracket nut (2).

   Tighten

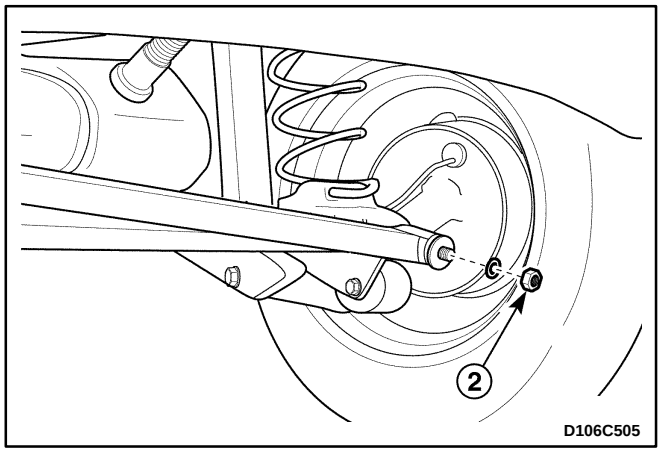
   Tighten the shock absorber nut to 45–70 N•m (33–52 lb-ft).
2. Remove the jack stand and lower the vehicle.



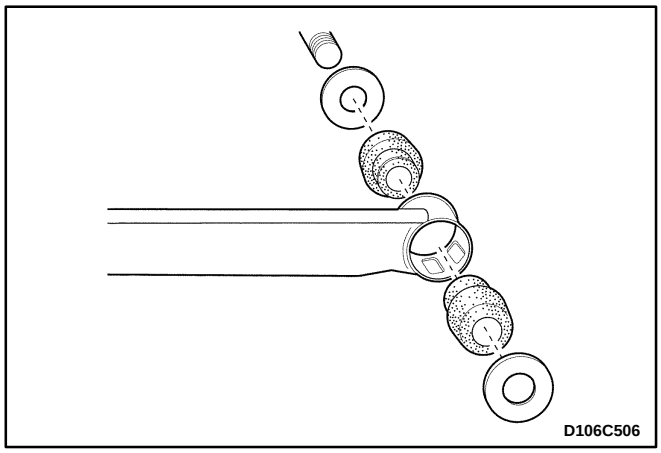
LATERAL ROD

Removal Procedure

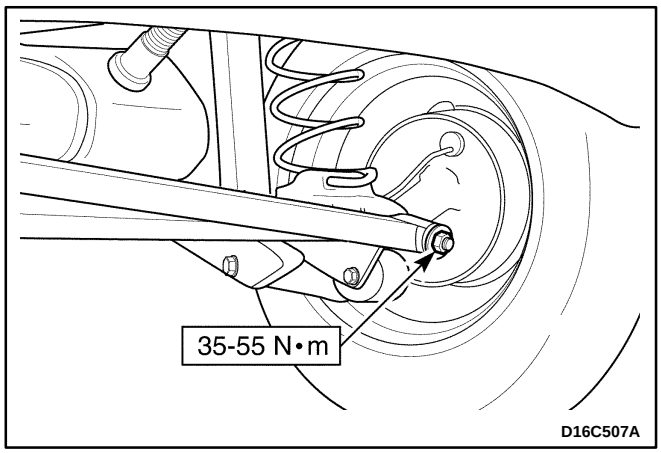
1. Raise and suitably support the vehicle.
2. Remove the lateral rod.
   - Remove the lateral rod–to– body bracket bolt (1).



   - Remove the lateral rod–to–rear axle nut (2).



2. Remove the lateral rod axle side bushing and washer from the lateral rod.

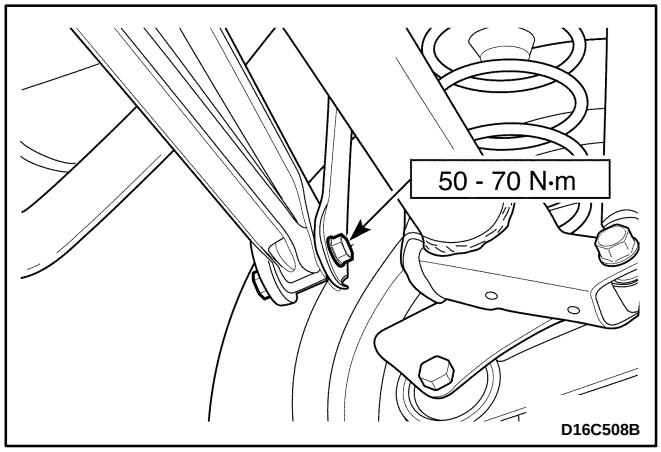


Installation Procedure

1. Install in the reverse order of removal.
2. Install the lateral rod–to–rear axle side nut.

Tighten

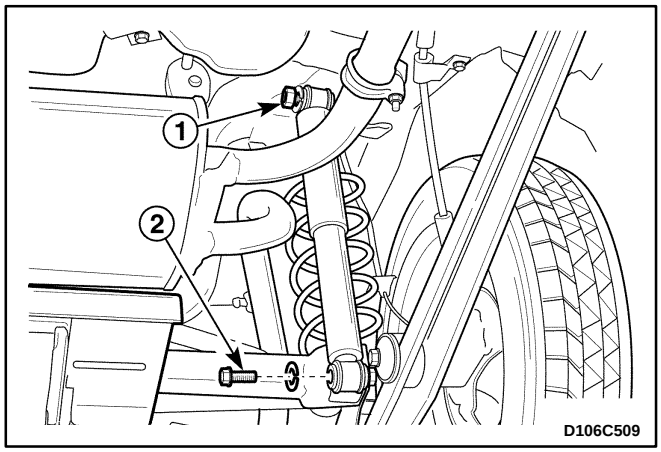
Tighten the lateral rod axle side nut to 35–55 N•m (25–41 lb-ft).



3. Install the lateral rod–to–body bracket bolt.

Tighten

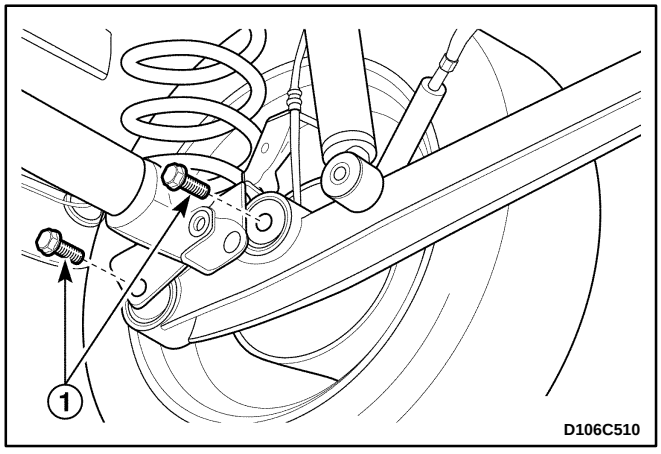
Tighten the lateral rod–to–body bracket bolt to 50–70 N•m (37–52 lb-ft).



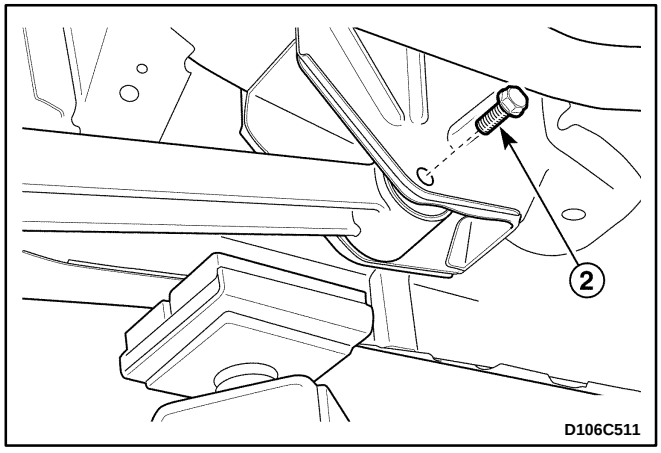
TRAILING ARM

Removal Procedure

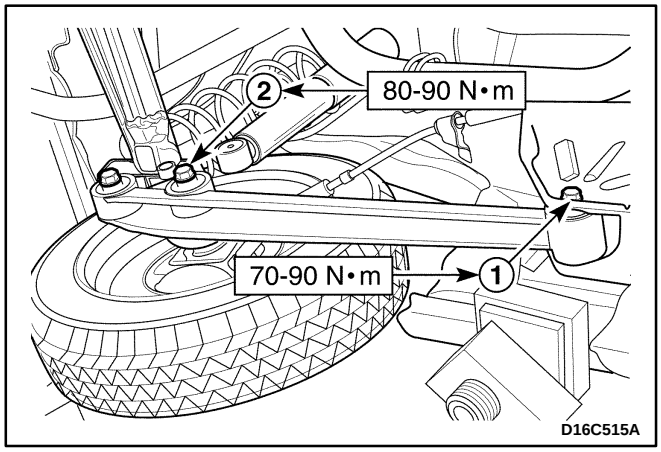
1. Raise and suitably support the vehicle.
2. Support the rear axle with adjustable jack stands.
3. Separate the rear shock absorber from the rear axle assembly.
   - Loosen the shock absorber–to–body bracket nut (1).
   - Remove the shock absorber–to–rear axle bolt (2).

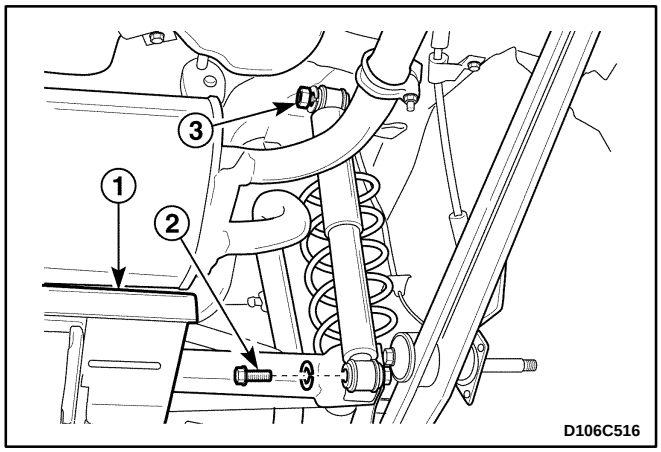


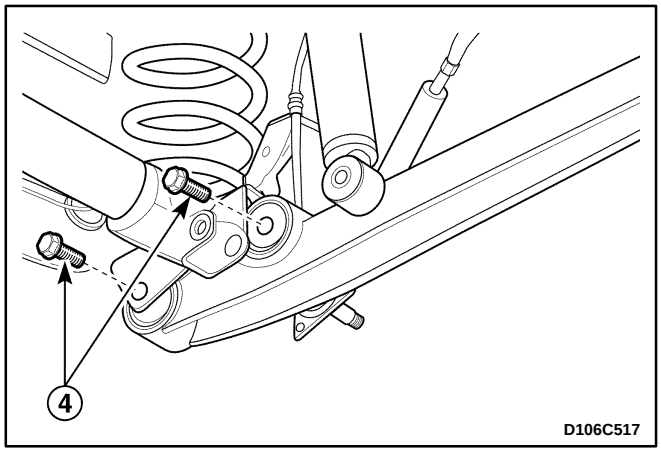
4. Remove the trailing arm.
   - Remove the trailing arm–to–rear axle bolts (1).

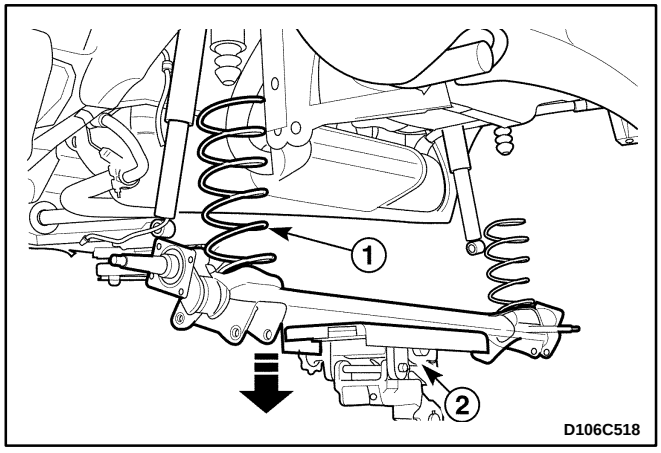


- Remove the trailing arm–to–body bracket bolt (2).









Installation Procedure

1. Install the trailing arm.
   - Install the trailing arm–to–body bracket bolt (1).

Tighten

Tighten the trailing arm–to–body bracket bolt to 70–90 N•m (55–66 lb-ft).

- Install the trailing arm–to–rear axle bolts (2).

Tighten

Tighten the trailing arm–to–rear axle bolts to 80–90 N•m (59–66 lb-ft).

2. Install the rear shock absorber. Refer to “Shock Absorber” in this section.

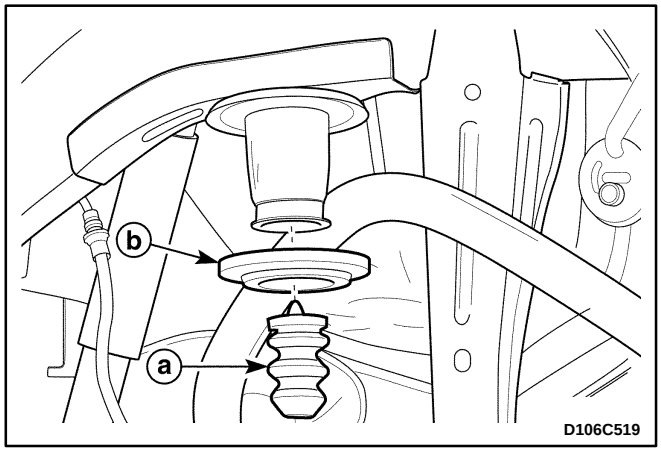
REAR AXLE ASSEMBLY (INCLUDING COIL SPRING)

Removal Procedure

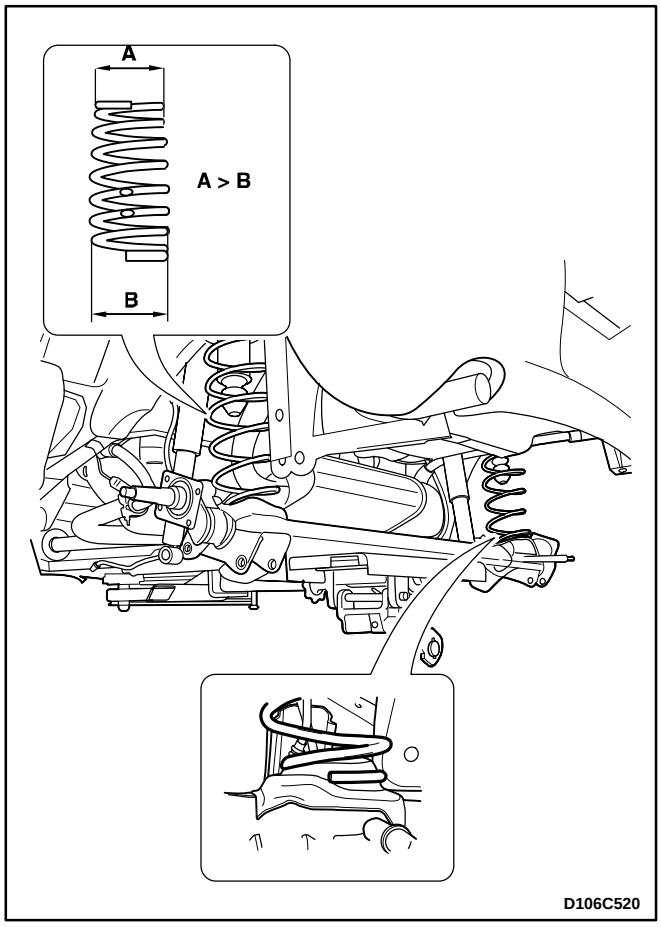
1. Remove the rear brake drum, shoe and brake plate. Refer to *Section 4E, Rear Drum Brakes.*
2. Remove the lateral rod. Refer to “Lateral Rod” in this section.
3. Disconnect the rear axle and the trailing arm.
   - Support the rear axle with adjustable jack stands (1).
   - Remove the shock absorber–to–rear axle bolt (2).
   - Loosen the shock absorber–to–body bracket nut (3).
   - Remove the trailing arm–to–rear axle bolt (4).

Caution: When disconnecting the rear axle and the trailing arm, coil spring tension may cause the adjustable jack stand to slip from the rear axle. This may result in personal injury. Carry out the operation with co–worker.

4. Remove the rear axle from the vehicle.
   - Remove the coil spring by lowering the jack stand slowly (1).
   - Lower the support jack and remove the rear axle (2).



5. Remove the rear bumper stopper and rear spring upper seat.
   a. Rear bumper stopper.
   b. Rear spring upper seat.

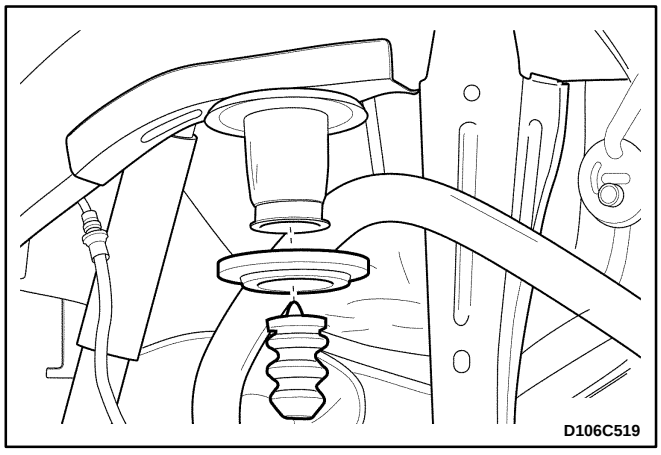


Installation Procedure

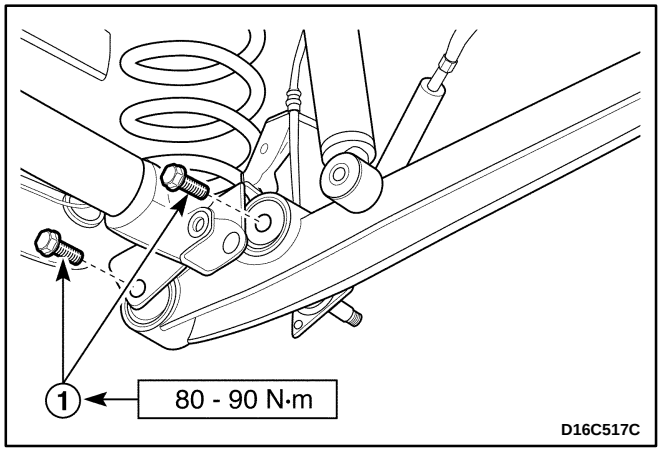
1. Install in the reverse order of removal.

Important: Make sure the spring diameter prior to installing the spring. Upper spring diameter is smaller than lower spring diameter.

Caution: Support the jack stand to the rear axle securely until installing the trailing arm bolts.



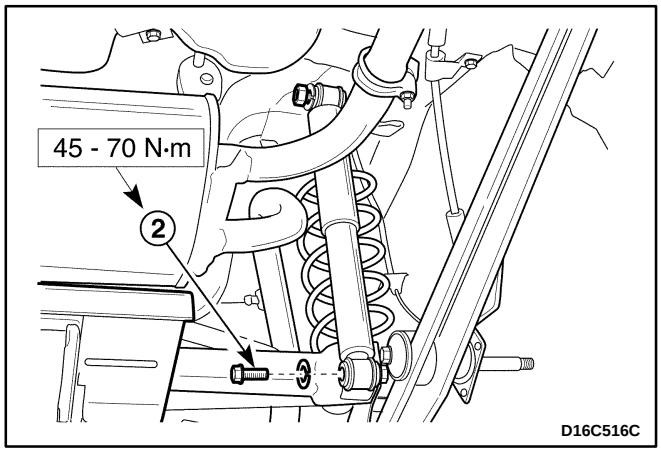
2. Install the rear bumper stopper and rear spring upper seat.



3. Install the trailing arm and the shock absorber to the rear axle.
   - Install the trailing arm–to–rear axle bolt (1).

   Tighten

   Tighten the trailing arm–to–rear axle bolt to 80–90 N•m (59–66 lb-ft).

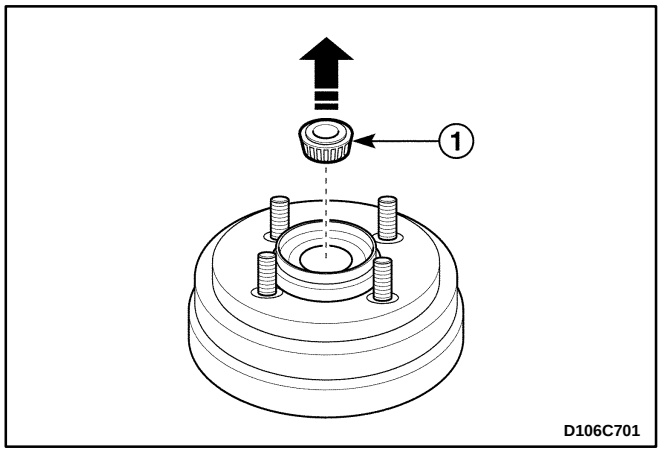


   - Install the shock absorber–to–rear axle bolt (2).

   Tighten

   Tighten the shock absorber–to–rear axle bolt to 45–70 N•m (33–52 lb-ft).
4. Install the lateral rod. Refer to “Lateral Rod” in this section.
5. Install the rear brake drum, shoe and brake plate. Refer to *Section 4E, Rear Drum Brake.*

UNIT REPAIR



HUB AND BEARING ASSEMBLY

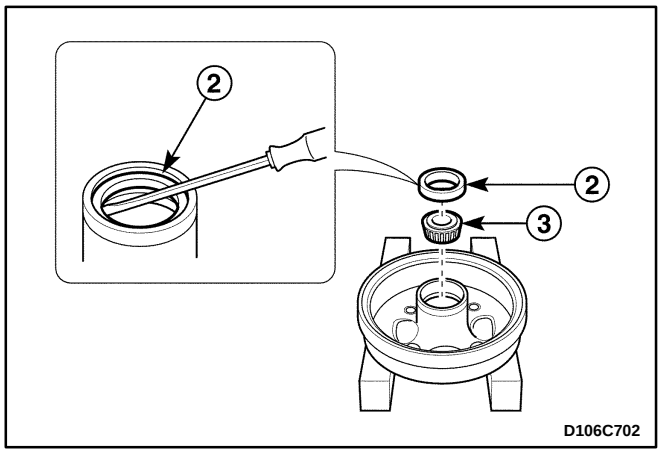
Tools Required

DW 340–010 Front Wheel Hub Remover

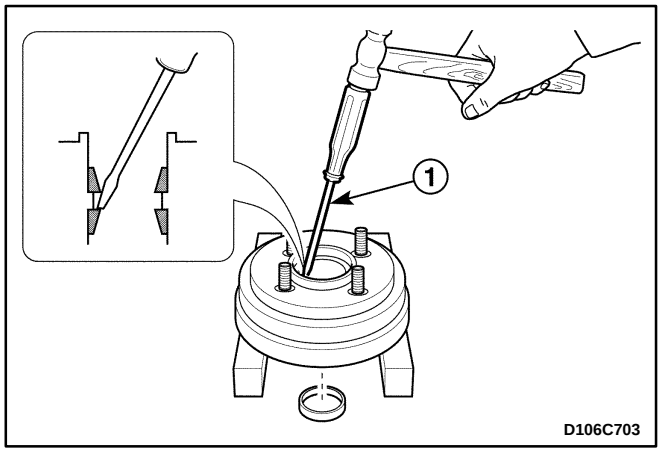
DW 350–030 Rear Wheel Bearing Race Installer

Disassembly Procedure

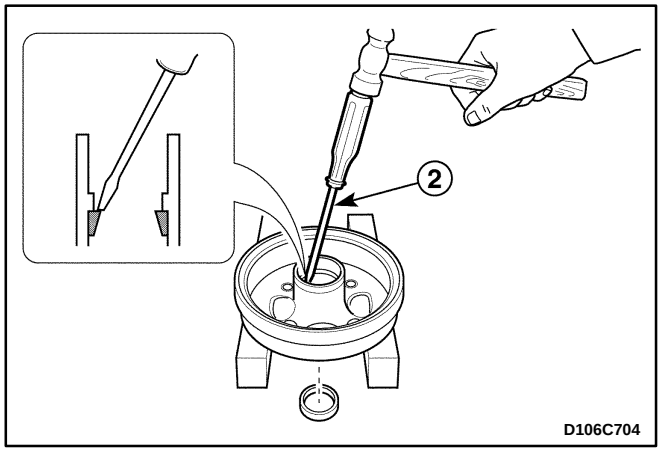
1. Remove the rear brake drum. Refer to *Section 4E, Rear Drum Brakes.*
2. Remove the rear wheel bearing.
   - Remove the outer tapered roller bearing (1).



   - Remove the oil seal (2).
   - Remove the inner tapered roller bearing (3).

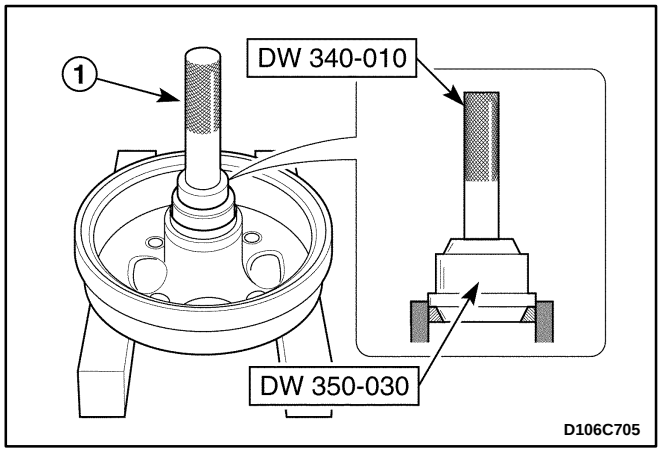


3. Remove the bearing races from the brake drum.
   - Remove the inner bearing race (1).



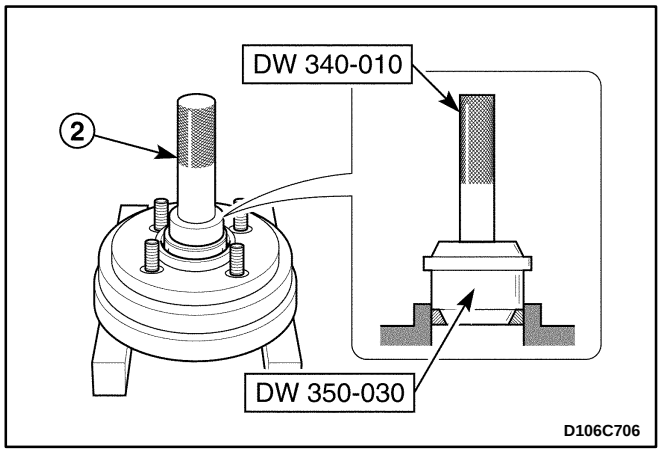
- Remove the outer bearing race (2).

Important: Use only new bearing race.

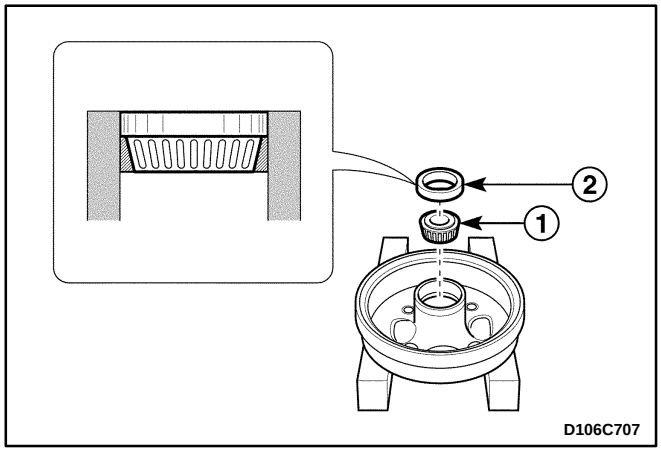


Assembly Procedure

1. Press the bearing race into the break drum using the front wheel hub remover DW 340–010 and the rear wheel bearing race installer DW 350–030.
   - Press the inner bearing race (1).



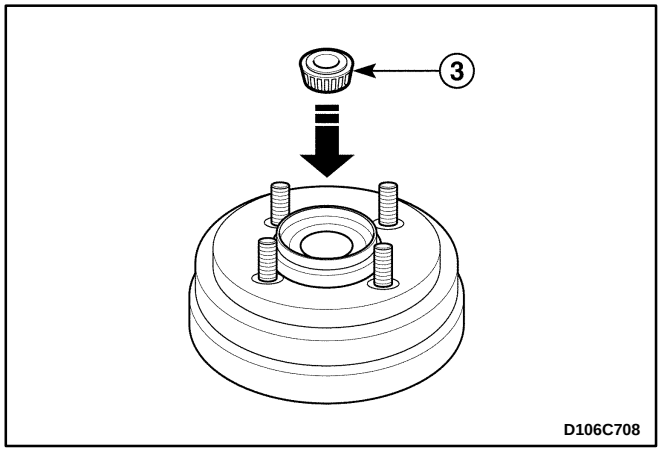
- Press the outer bearing race (2).



2. Install the wheel bearing and oil seal into the brake drum.

Important: Coat or fill all the hollow spaces of both wheel bearing, the ring seal lip and the brake drum with antifriction grease.

- Install the inner bearing (1).
- Install the oil seal (2).



- Install the outer bearing (3).

3. Install the brake drum. Refer to *Section 4E, Rear Drum Brakes.*
4. Adjust the end play and free load of the bearing. Refer to “Check and Adjustments” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Suspension Type		–	Isolated Trailing Link
Shock Absorber	Maximum Length	mm (in.)	394.5 ± 3 (15.53 ± 0.12)
	Minimum Length	mm (in.)	257.5 ± 3 (10.14 ± 0.12)
	Stroke	mm (in.)	137 (5.39)
Rear Wheel Bearing	Clearance	mm (in.)	0
	No Load	N•m (lb-in.)	0.137 – 0.422 (0.9 – 3.7)
Coil Spring Height (No Load)		mm (in.)	291 (11.46)
Grease Type (Rear Wheel Bearing and Hub)		–	M–8143 ANTIF BRG GREASE

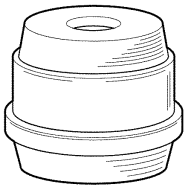
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Shock Absorber–to–Body Bracket Nut	45 – 70	33 – 52	–
Shock Absorber–to–Rear Axle Bolt	45 – 70	33 – 52	–
Trailing Arm–to–Rear Axle Bolt	80 – 90	59 – 66	–
Trailing Arm–to–Body Bracket Bolt	70 – 90	55 – 66	–
Lateral Rod–to–Body Bracket Bolt	50 – 70	37 – 52	–
Lateral Rod–to–Rear Axle Nut	35 – 55	25 – 41	–
Rear Axle Castellated Nut*	–	–	–
ABS Rear Speed Sensor Retaining Bolt	9 – 13	–	80 – 115

* Rear Axle Castellated Nut : Refer to *Section 4E, Rear Drum Brakes*

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

D16B101A	**DW 340–010** **Front Wheel Hub Remover**
 D106C101	**DW 350–030** **Rear Wheel Bearing Race Installer**

SECTION 2E

TIRES AND WHEELS

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DESCRIPTION AND OPERATION

TIRE

Tread

A part (that contacts) road surfaces directly is fixed on the outside of carcass and breaker. It is a strong rubber coat made of high anti–abrasion rubber. Its running performance depends on is surface profile.

Breaker

A cord belt between tread and carcass prevents damages of inner code due to outer shock and vibration.

Carcass

This major part made by pilling code papers of strong synthetic fiber forms a structure of tire. Since it maintains tire pressure and endures applied load and shock to tire, it should have a high anti–fatigue characteristic.

Bead

A steel wire winding the ending part of carcass code, coated with rubber film and wrapped with nylon cord papers. It fixes tire to a rim.

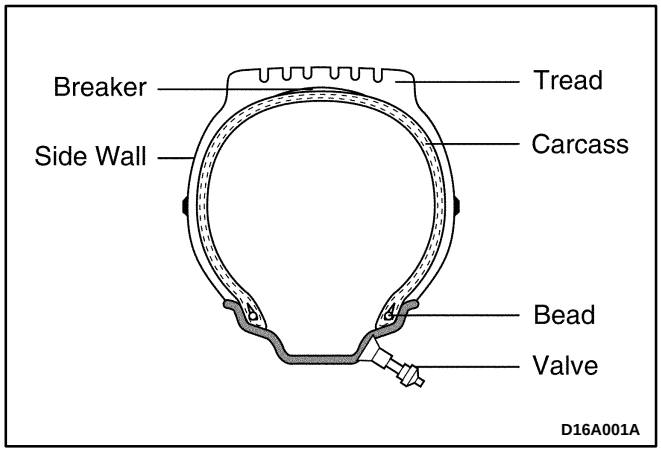
Tube

Tires used in mostly current vehicle are mostly tubeless tires.

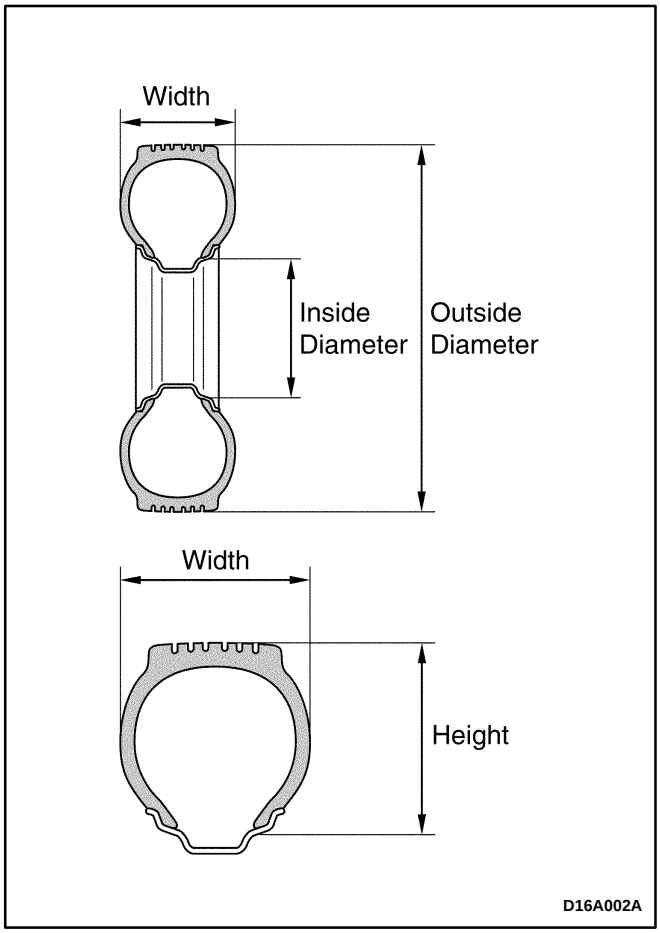
Side Wall

It is provided to improve the comfortable driving by protecting carcass and cushion movement.

Structure of Tubeless Tube



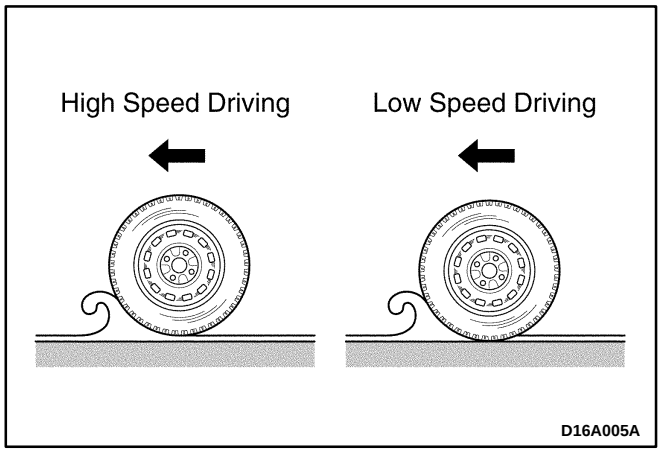
Nomenclature



175/60R13 77H	175	Width (mm)
	60	Flatness ratio 60% (Height/Width) × 100
	R	Radial
	13	Rim diameter (= Tire I.D, Inch)
	77	Max. load index
	H	Max. speed symbol

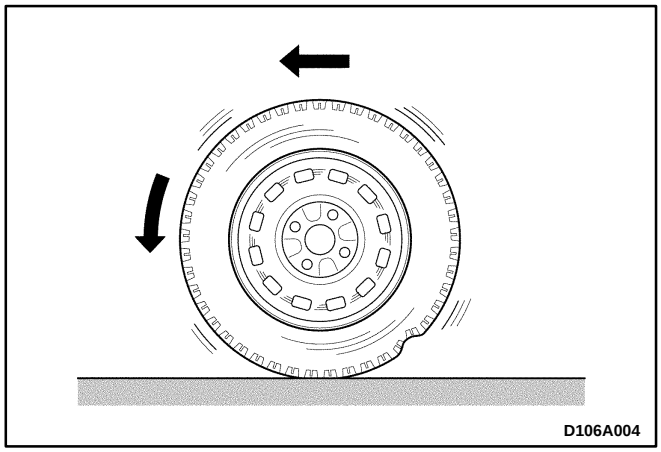
Hydroplaning

The condition of driving a vehicle fast on the road surface covered with water can cause tires to fail to rotate with a good contact on the surface, so results in remaining them afloat. This is so–called hydroplaning. It causes brake failure, lower tractive force, and losing the steering performance so it is very vulnerable condition.



Standing Wave

During running the rotating tire repeats deformation and restoring movement generated in tread. But when the wheel rotating speed reaches high, the next deformation applied to tire before restoring last deformation so the trembling wave appears in the tread portion. The lower the tire pressure the severe the trembling wave appears. And during the high speed.



REPLACEMENT TIRES

A Tire Performance Criteria (TPC) specification number is molded in the sidewall near the tire size of all original equipment tires. This specification number assures that the tire meets performance standards for traction, endurance, dimensions, noise, handling and rolling resistance. Usually a specific TPC number is assigned to each tire size.

Caution: Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

Caution: Do not change 145/70 R13 tires or 155/65 R13 tires for 175/60 R13 tires, because vehicle hancling may be seriously affected and may result in loss of control. If you change 145/70 R13 tires or 155/65 R13 tires for 175/60 R13 tires, you have to change the steering gear assembly.

Use only replacement tires with the same size, load range, and construction as the original. The use of any other tire size or construction type may seriously affect ride, handling, speedometer/odometer calibration, vehicle ground clearance, and tire clearance to the body and the chassis. This does not apply to the spare tire furnished with the vehicle.

It is recommended that new tires be installed in pairs on the same axle.

If it is necessary to replace only one tire, pair it with the tire having the most tread to equalize the braking action.

Although they may appear different in tread design, tires built by different manufacturers with identical TPC specifications may be used on the same vehicle.

ALL SEASON TIRES

Most vehicles are now equipped with steel-belted all season radial tires as standard equipment. These tires qualify as snow tires, with a 37 percent higher average rating for snow traction than the non-all season radial tires previously used. Other performance areas, such as wet traction, rolling resistance, tread life, and air retention, have also been improved. This was done by improvements in both tread design and tread compounds. These tires are identified by an “M + S” molded in the tire sidewall following the size number. The suffix “MS” is also molded in the sidewall after the TPC specification number.

The optional handling tires used on some vehicles are not all season tires. These will not have the “MS” marking after the tire size or the TPC specification number.

TIRE LABEL

The tire label is permanently located on the rear face of the driver’s door and should be referred to for tire information. It lists the maximum vehicle load, the tire size (including the spare tire), and the cold inflation pressure (including the spare tire).

SPARE TIRE

This vehicle comes equipped with a full-sized spare tire and wheel.

WHEELS

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, leak air through welds, have elongated bolt holes, or if the wheel bolts won't stay tight or are heavily rusted. Wheels with excessive runout may cause vehicle vibration. Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim width, offset, and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer/odometer calibration, vehicle ground clearance, and tire clearance to the body and the chassis.

INFLATION OF TIRES

The pressure recommended for any vehicle line is carefully calculated to give a satisfactory ride, handling, tread life, and load-carrying capacity.

Tire pressure should be checked monthly or before any extended trip. Check the tires when they are cold, after the vehicle has sat for 3 hours or more or has been driven less than 1 mile. Set the tire pressure to the specifications on the tire label located on the rear face of the driver's door. Tire inflation pressure is also given under "Tire Size and Pressure Specifications" in this section.

Valve caps or extensions should be on the valves to keep dust and water out.

Higher than recommended tire pressure can cause:

- Hard ride
- Tire bruising or damage
- Rapid tread wear at the center of the tire

Lower than recommended pressure can cause:

- Tire squeal on turns
- Hard steering
- Rapid and uneven wear on the edges of the tread
- Tire rim bruises and rupture
- Tire cord breakage
- High tire temperatures

Unequal tire pressures on same axle can cause:

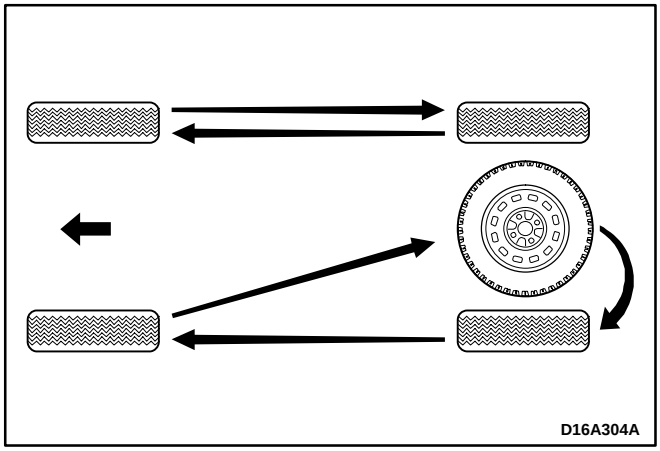
- Uneven braking
- Steering lead
- Reduced handling
- Swerve on acceleration
- Torque steer

ROTATION TIRES

Front and rear tires perform different jobs and can wear differently depending on the tires of road driven, driving habit, etc.

The front tires will wear faster than the rear ones.

To avoid uneven wear of tires and to prolong tire life, inspect and rotate the tires every 5,000 km (3,100 miles). After rotating the tires, adjust the tire inflation pressures and be sure to check wheel nuts tightness.



WHEEL BALANCE

Balance is the easiest procedure to perform and should be done first if the vibration occurs at high speeds, or if the tires or the wheels are replaced.

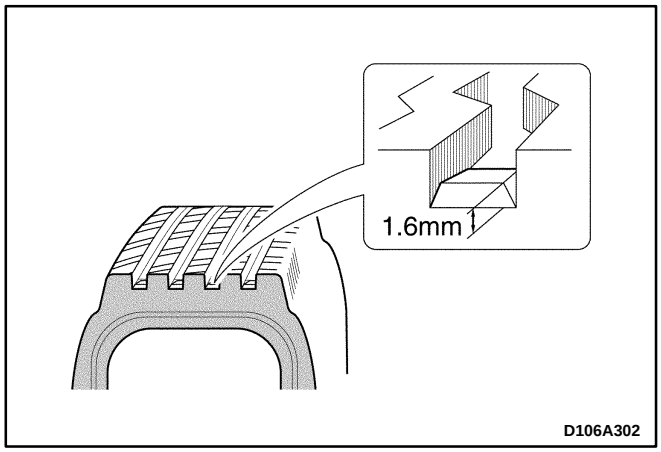
When proceeding the wheel balancing procedure regard the belows.

1. Do not use the wheel weight over two at the inboard and the outboard flanges.
2. The total weight of the wheel weights should not exceed the 100 grams (3.5 ounces).
3. Blanching the assemblies with factory aluminum wheels requires the use of special nylon–coated, clip–on wheel weights.

DIAGNOSTIC INFORMATION AND PROCEDURES

TIRE WEAR

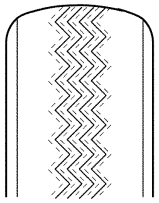
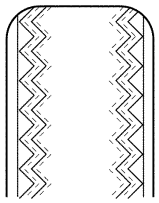
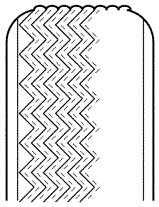
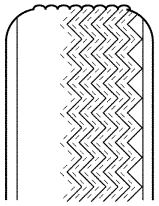
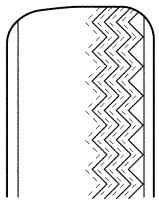
1. Measure the depth of the tire tread.
2. If the depth of the tread is below the specified value, replace the tire.



Limit of The Tread Wear	1.6mm (0.06 in.)

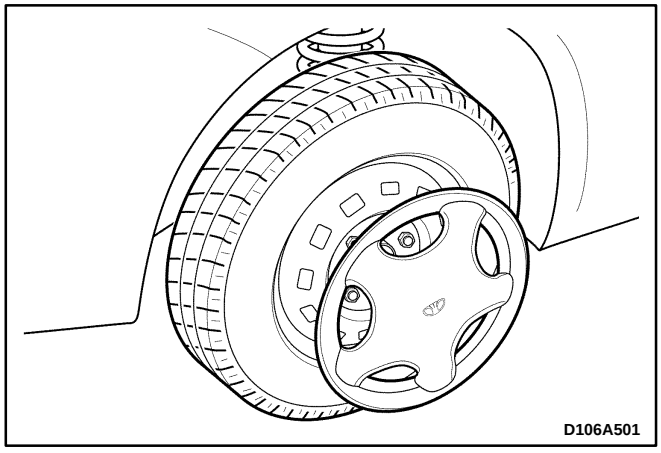
3. Indicators appear when the tire tread depth becomes shallow (less than 1.6mm (0.06 in.)).

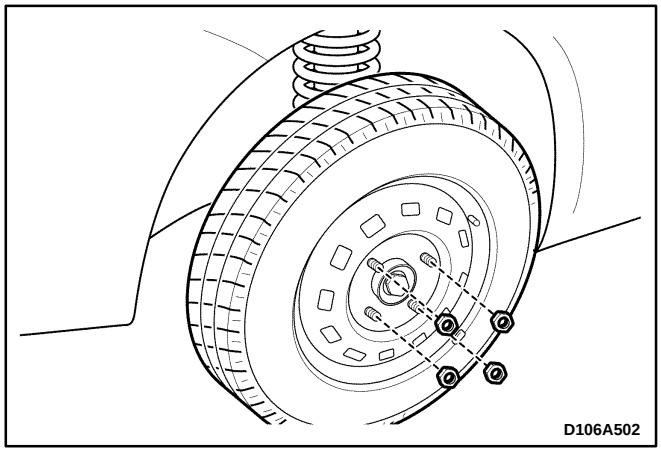
IRREGULAR OR EXCESSIVE TIRES WEAR

Condition	Probable Cause	Correction
 D16A305A	● Low tire inflation pressures. ● Improper the tire rotation.	● Adjust tire inflation pressures. ● Rotate the tires.
 D16A305B	● Excessive tire inflation pressures. ● Improper the tire rotation.	● Adjust tire inflation pressures. ● Rotate the tires.
 D16A305C	● Poor toe–in.	● Adjust the toe–in.
 D16A305D	● toe–out.	● Adjust the toe–in.
 D16A305E	● Poor camber or caster. ● Faulty suspensions. ● Poor wheel balancing. ● Improper the tire rotation.	● Check the steering knuckle, control arm, drive axle, and suspensions. Repair or replace them, as needed. ● Adjust the wheel balancing. ● Rotate the tires.

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE





WHEEL

Removal Procedure

1. Remove the wheel cover on the vehicle equipped with steel wheel.
2. Loosen the wheel nuts.
3. Raise and suitably support the vehicle.
4. Remove the wheel nuts.

Notice: Never use heat to loosen a tight wheel. It can shorten the life of the wheel, the wheel nuts and the wheel bearings. Excessive force, such as hammering the wheel or tire, can also cause damage and is not recommended. Slight tapping of the wheel sidewall with one's hand or with a rubber mallet is acceptable.

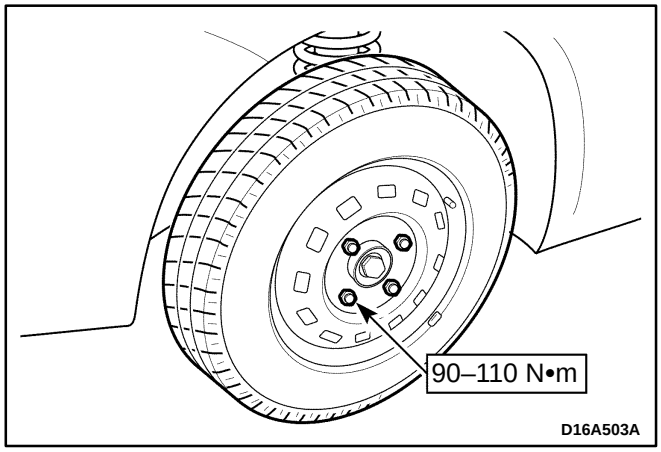
5. Remove the wheel.

Difficulty in removing the wheels from the vehicle can be due to foreign material or to a tight fit between the wheel centerhole and the hub or the rotor. These wheels can be removed by

1. Retightening the wheel nuts on the affected wheel and then loosening the wheel nuts by two turns.
2. Lowering the vehicle and rocking it from side to side as hard as possible, using one or more person's body weight to loosen the wheel.
3. Raising the vehicle and removing the wheel.

Caution: Do not allow the penetrating oil to get on the vertical surfaces between the wheel and the drum (or rotor) because penetrating oil in this area could cause the wheel to work loose as the vehicle is driven, resulting in loss of control and an injury accident.

Penetrating oil is not effective in removing tight wheels. If it is used, however, apply it sparingly and only to the wheel's centerhole area.



Installation Procedure

Notice: Before installing the wheels, remove any build-up of corrosion on the wheel mounting surface and the brake drum or the rotor mounting surface by scraping and brushing them with a wire brush. Installing the wheels without good metal-to-metal contact at the mounting surfaces can cause the wheel nuts to loosen, which can later allow a wheel to come off while the vehicle is moving. Wheel nuts must be tightened in sequence and to the proper torque to avoid bending the wheel, the brake drum or the rotor.

1. Mount the wheel.
2. Install the wheel nuts in the diagonally. Do not tighten the wheel nuts.
3. Lower the vehicle.

Tighten

Tighten the wheel nuts to 90–110 N•m (66–81 lb-ft).

ON-VEHICLE BALANCING

On-vehicle balancing will help correct vibrations due to brake drum, rotor, and wheel cover imbalances.

Notice: Do not allow the front suspension to hang free. When the drive axle is run at an extreme angle, extra vibrations can occur, as well as damage to seals and joints.

1. During on-vehicle balancing, do not remove the balance weights from the off-vehicle dynamic balance.
2. If more than 1 ounce of additional weight is required, split the weight between the inner and the outer rim flanges.
3. Spin the driven tire and wheel assemblies using the engine.

OFF-VEHICLE BALANCING

Perform wheel balancing with an electronic off-vehicle balancer. The balancer is easy to use and gives both a static and a dynamic balance. Unlike on-vehicle balancing, the off-vehicle balancer does not correct for drum or rotor imbalance. This drawback is overcome by its accuracy. Secure the wheel on the balancer with a cone through the back side of the centerhole, not through the wheel nut holes.

CORRECTING NON-UNIFORM TIRES

There are two ways to correct properly balanced tires which still vibrate. One method uses an automatic machine which loads the tire and buffs small amounts of rubber from high spots on the outer two tread rows. Correction by this method is usually permanent and, if it is done properly, does not significantly affect the appearance or the tread life of the tire. Tire truing with a blade-type machine is not recommended because it substantially reduces the tread life and often does not correct the problem permanently.

Another method is to dismount the tire and rotate it 180 degrees on the rim. Do this only on the tire and wheel assemblies which are known to be causing a vibration because this method is just as likely to cause good assemblies to vibrate.

TIRE AND WHEEL MATCH-MOUNTING

The tires and wheels are match-mounted at the assembly plant. Match-mounting aligns the radially stiffest part of the tire, or high spot, to the smallest radius, or low spot, of the wheel.

The high spot of the tire is originally marked by a red paint mark or an adhesive label on the outboard sidewall.

The low spot of the wheel will be at the location of the valve stem.

Before dismounting a tire from its wheel, scribe a line on the tire at the valve stem to assure that it is remounted in the same position.

Replacement tires that are of original equipment quality will have their high and low spot marked in the same manner.

SPECIFICATIONS

TIRE SIZE AND PRESSURE SPECIFICATIONS

Inflation Pressure

Engine	Tires	Wheel	Front		Rear	
			kPa	psi	kPa	psi
0.8 SOHC	145/70 R13	4.5Jx13 (Steel)	207 (207)*	30 (30)*	207 (234)*	30 (34)*
	155/65 R13	4.5Jx13 (Alloy)	207 (207)*	30 (30)*	207 (234)*	30 (34)*

Important: ( )* : 4 – 5 occupants

INFLATION PRESSURE CONVERSION SPECIFICATIONS

kPa	psi	kPa	psi	kPa	psi
140	20	186	27	234	34
145	21	193	28	241	35
152	22	200	29	248	36
159	23	207	30	276	40
166	24	214	31	310	45
172	25	221	32	345	50
179	26	228	33	379	55

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Wheel Nuts (Aluminum Wheel)	90 – 110	66 – 81	–
Wheel Nuts (Steel Wheel)	90 – 110	66 – 81	–

SECTION 3B

MANUAL TRANSAXLE DRIVE AXLE

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DESCRIPTION AND OPERATION

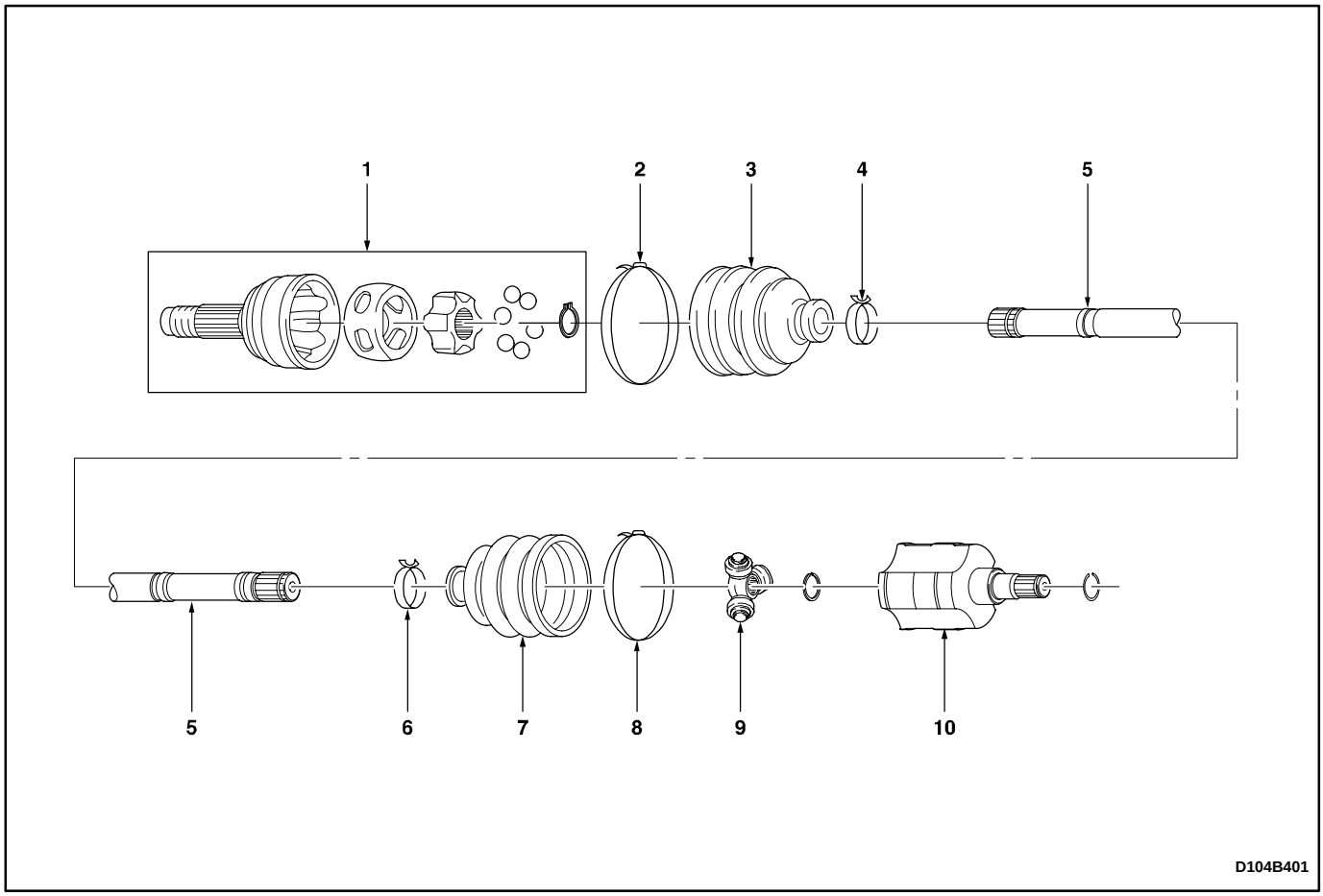
FRONT DRIVE AXLE

Drive axles are flexible shaft assemblies that transmit a rotational force from the transaxle to the front wheel assemblies. Each axle assembly consists of an inner constant-velocity joint and an outer constant-velocity joint connected to an axle shaft. The inner joint is completely flexible and has the ability to move in and out. The outer joint is also flexible, but it cannot move in and out.

The drive axles use a Rzeppa–style joint on the outboard side and a Tripot–style joint on the inboard side.

COMPONENT LOCATOR

DRIVE AXLE ASSEMBLY



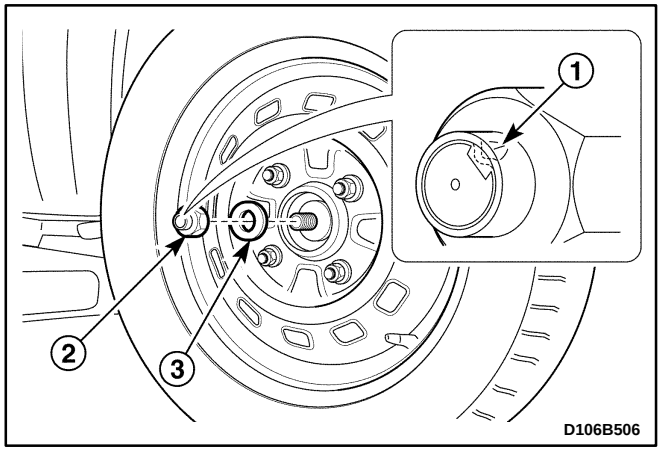
1. Outer Joint (Rzeppa)
2. Outer Large Boot Clamp
3. Outer Boot
4. Outer Small Boot Clamp
5. Drive Axle Shaft
6. Inner Small Boot Clamp
7. Inner Boot
8. Inner Large Boot Clamp
9. Inner Joint (Tripot)
10. Inner Joint Housing

DIAGNOSTIC INFORMATION AND PROCEDURES

Condition	Probable Cause	Correction
Noise	• Bent drive axle shaft.	• Replace drive axle.
	• Worn the spline of drive axle shaft or joint shaft.	• Replace drive axle.
	• Worn joint by grease leakage.	• Replace drive axle.
Steering Wheel Vibration	• Bent drive axle shaft.	• Replace drive axle.
	• Worn the spline of drive axle shaft or joint shaft.	• Replace drive axle.
Car Lead / Pull	• Worn joint by grease leakage.	• Replace drive axle.
Boot Leak	• Poor assembly of boot clamp.	• Replace boot clamp.
	• Torn boot.	• Replace Boot.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



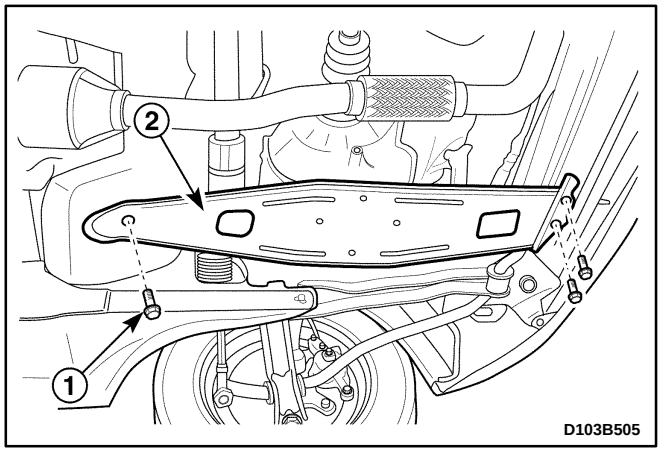
DRIVE AXLE ASSEMBLY

Tool Required

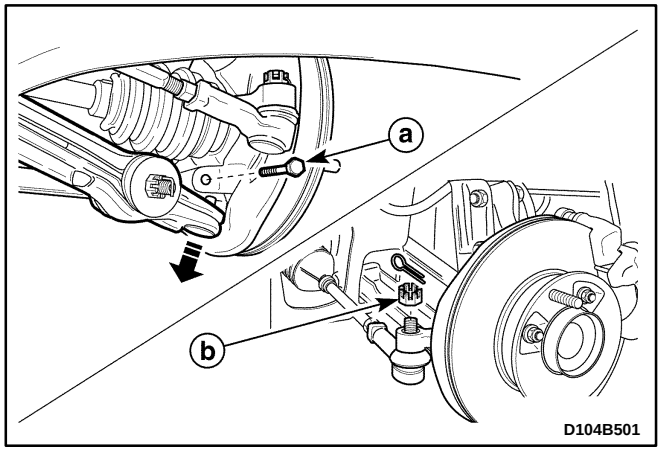
KM–507–B Tie Rod End Joint Remover

Removal Procedure

1. Remove the drive axle shaft nut.
   - Fix the hub not to rotate by pressing the brake pedal.
   - Loosen the caulking (1).
   - Remove the nut (2).
   - Discard the nut.
   - Remove the washer (3).

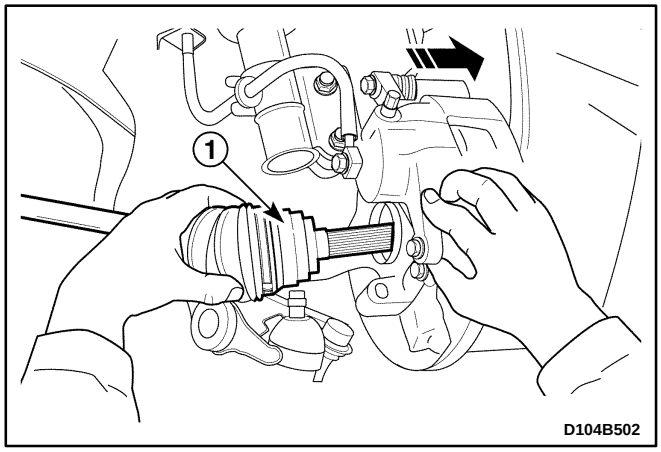


2. Remove the wheels. Refer to *Section 2E, Tires and Wheels.*
3. Remove the transaxle under cover.
   - Remove the bolts (1).
   - Remove the under cover (2).



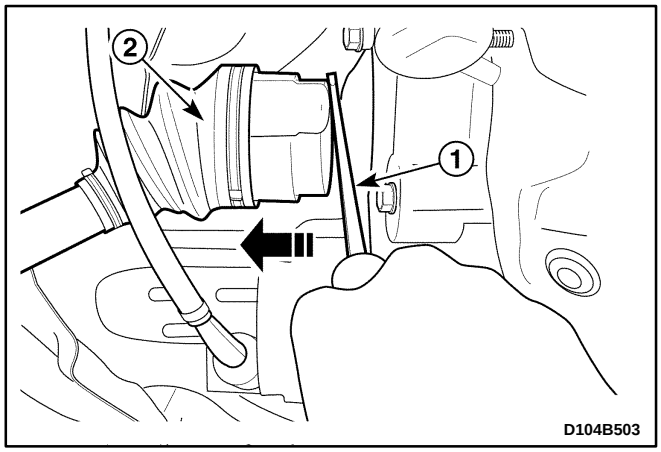
4. Drain the transaxle fluid through the drain plug.
5. Remove the stabilizer bar. Refer to *Section 2C, Front Suspension*.
6. Separate the control arm ball joint and the tie rod end from the knuckle. Refer to *Section 6D, Manual Steering gear* and *Section 2C, Front Suspension.*
   a. Control arm ball joint bolt.
   b. Tie rod end joint castellated nut.

Notice: Use only the recommended tool for separating the tie rod from the knuckle/strut assembly. Failure to use the recommended tool may cause damage to the knuckle/strut assembly or the tie rod end.



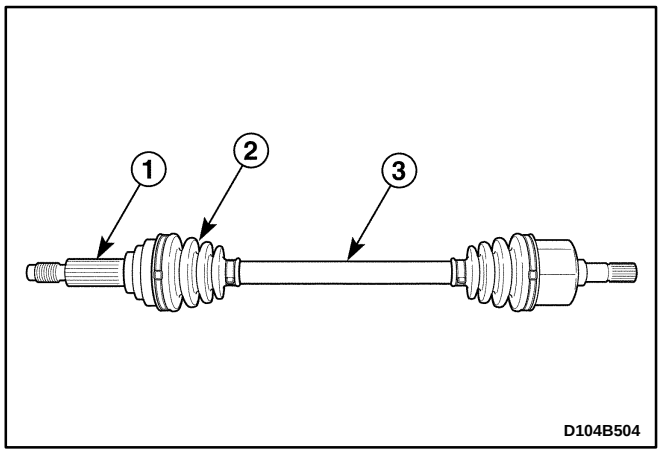
7. Pull the drive axle shaft (1) from the wheel hub.

Important: Support the unfastened end of the drive axle. Do not allow the drive axle to dangle freely from the transaxle for any length of time after it has been removed from the wheel hub.



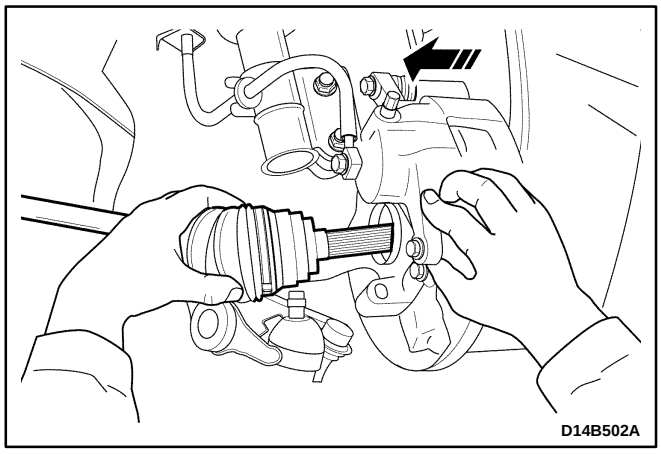
8. Remove the drive axle from the transaxle.
   - Insert a flathead screwdriver between the transaxle case and the drive axle joint case (1).
   - Remove the drive axle (2).

Important: Cap the transaxle drive opening after the drive axle has been removed to keep any contamination out.



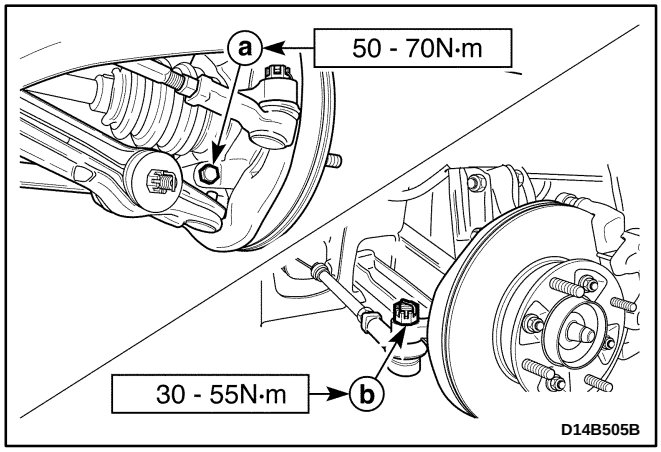
Inspection Procedure

1. Inspect for worn or damaged spline of drive axle (1).
2. Inspect for a leaking boot (2).
3. Inspect for a bent shaft (3).



Installation Procedure

1. Clean the transaxle seal.
2. Install the drive axle into the transaxle.
3. Install the wheel hub onto the drive axle shaft.
4. Mount the knuckle onto the control arm ball joint.



5. Install the control arm ball joint bolt.

Tighten

Tighten the control arm ball joint bolt to 50–70 N•m (36–52 lb-ft).

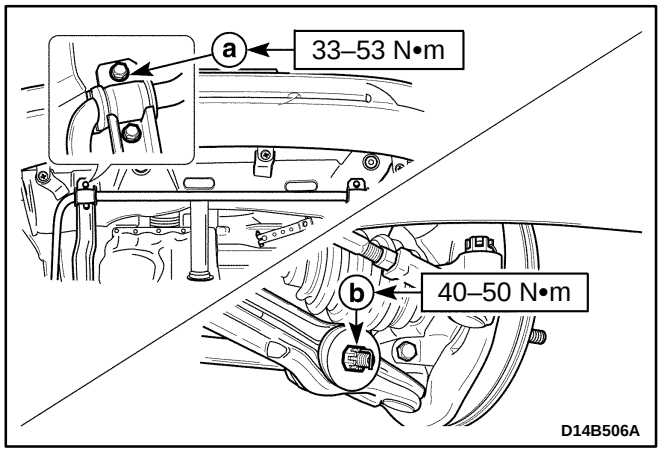
a. Control arm ball joint bolt

6. Install the tie rod into the knuckle and install the tie rod end joint castellated nut.

Tighten

Tighten the tie rod end joint castellated nut to 30–55 N•m (21–41 lb-ft).

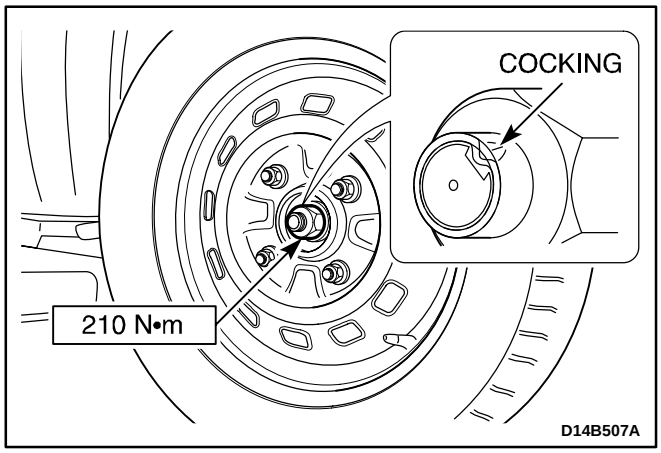
b. Tie rod end joint castellated nut.



7. Install the stabilizer bar.

Tighten

- Tighten the stabilizer bar mounting bolts 33–53 N•m (24–39 lb-ft).
- Tighten the stabilizer bar castellated nut to 40–50 N•m (30–36 lb-ft).
  a. Stabilizer bar mounting bolt.
  b. Stabilizer bar castellated nut.



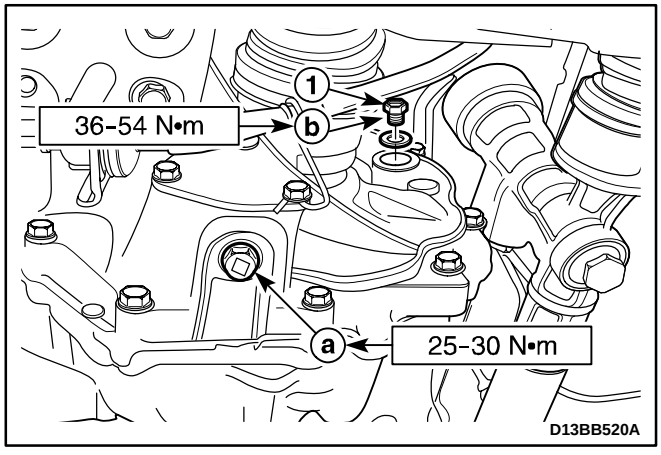
8. Install the drive axle shaft nut.

Tighten

Tighten the drive axle shaft nut to 210 N•m (155 lb-ft)

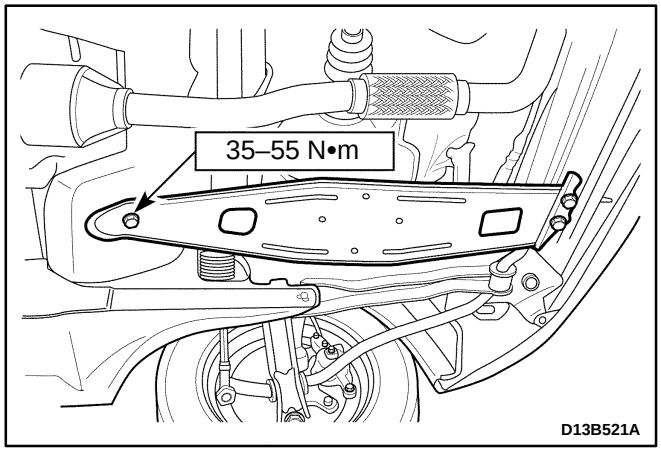
Notice: Always use a new nut. Always peen the caulking nut with a punch and a hammer until the nut is locked into place on the wheel hub.

9. Install the wheels. Refer to *Section 2E, Tires and wheels*.



10. Refill the transaxle fluid to the proper level.
    - Tighten the drain plug to 25-30 N•m (18-22 lb-ft) (a).
    - Remove the oil level plug (1).
    - Refill recommended fluid to the proper level.
    - Tighten the oil level plug to 36-54 N•m (26–40 lb-ft) (b).

Classification	75W–85 (GL–4)
Capacity	2.1L (2.21 gt)

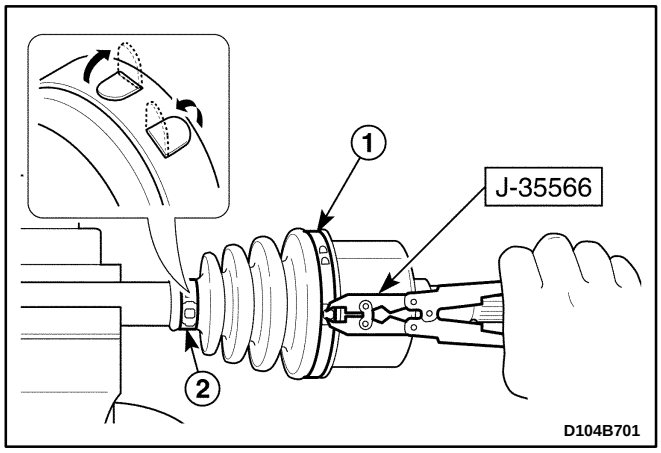


11. Install the transaxle under cover.

Tighten

Tighten the transaxle under cover bolts to 35–55 N•m (25–41 lb-ft)

UNIT REPAIR



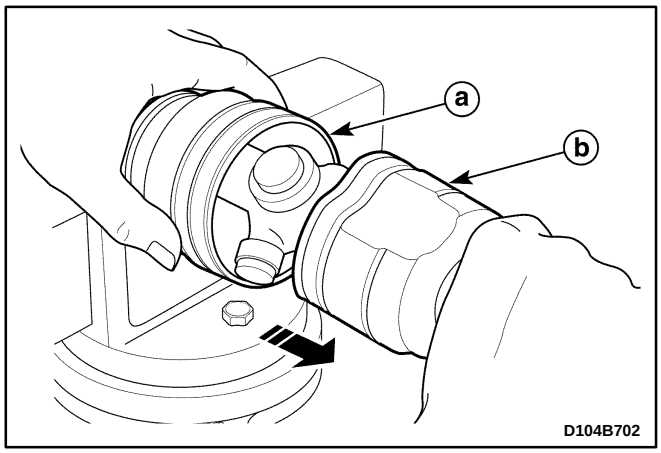
INNER JOINT (TRANSAXLE SIDE)

Tool Required

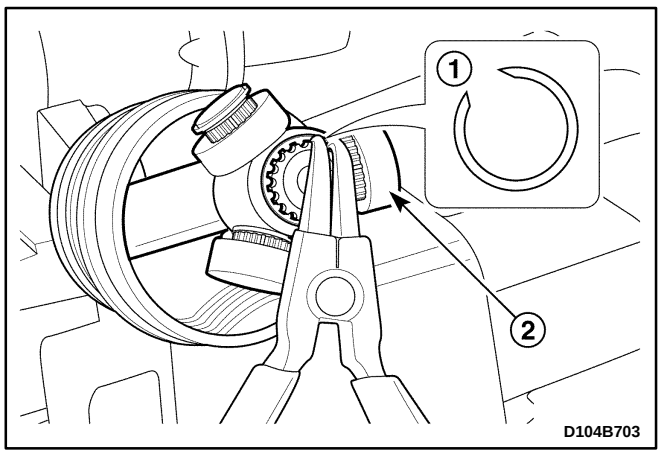
J–35566 Boot Clamp Pliers

Disassembly Procedure

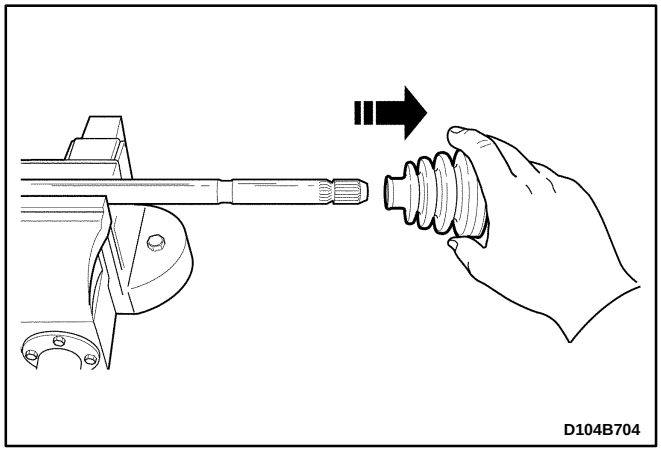
1. Remove the drive axle. Refer to “Drive Axle Assembly” in this section.
2. Remove the clamps on the joint boot.
   - Remove the boot clamp (large) using the boot clamp pliers J–35566 (1).
   - Remove the boot clamp (small) (2).



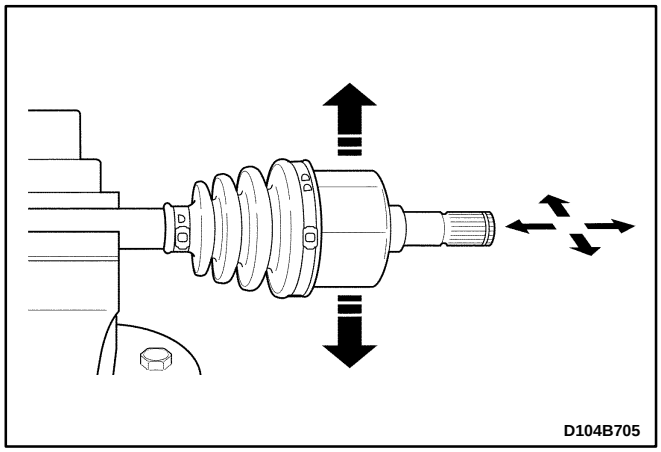
3. Remove the joint housing from boot.
   a. Boot.
   b. Joint housing.



4. Degrease the joint assembly.
5. Remove the tripot joint.
   - Remove the circlip (1).
   - Remove the tripot joint (2).



6. Remove the drive axle shaft boot.



Assembly Procedure

1. Install in the reverse order of removal.
2. Fill the joint housing with recommended grease when installing.

Capacity	90–100 g (3.2–3.5 ounces)

Notice: Always use the recommended grease. If not, joint and boot can be damaged.

Important: Always use new clamps.

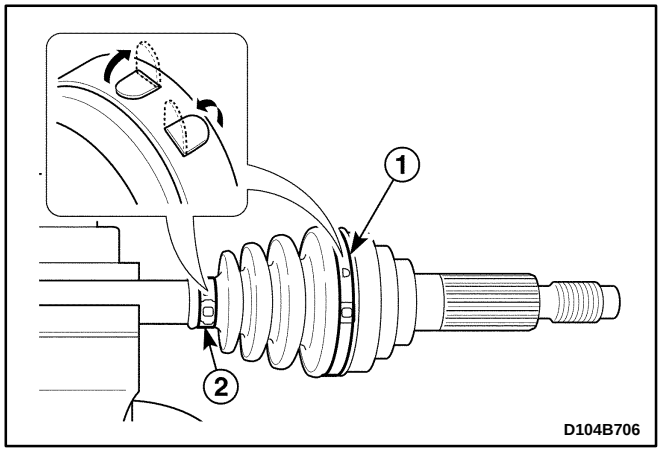
Inspection Procedure

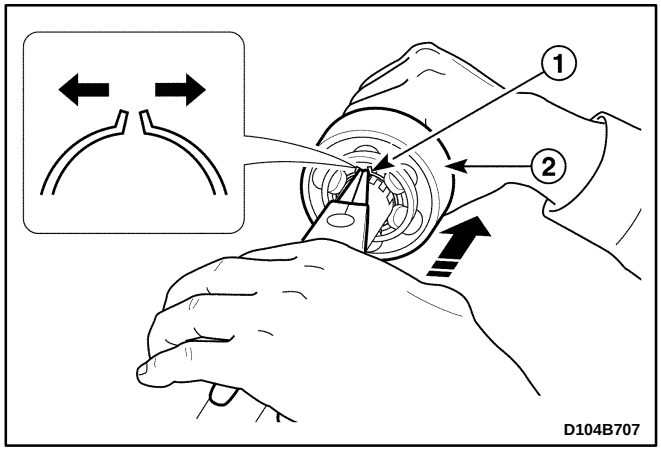
1. Inspect the operation of joint.
2. Inspect for a leaking boot through the clamp side.

OUTER JOINT (WHEEL SIDE)

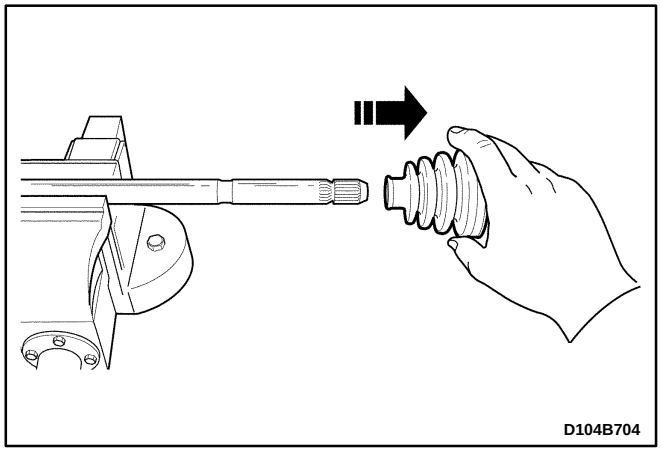
Disassembly Procedure

1. Remove the drive axle. Refer to “Drive Axle Assembly” in this section.
2. Remove the clamps on the joint boot.
   - Remove the boot clamps (1,2).

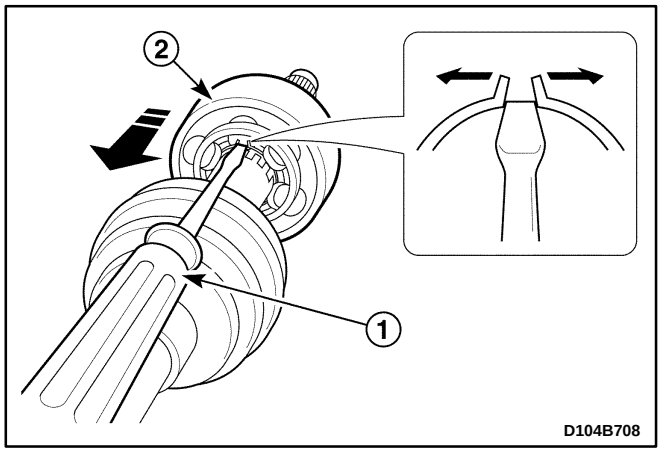




3. Degrease the joint assembly.
4. Remove the joint assembly.
   - Widen the circlip (1).
   - Remove the joint assembly while widening the circlip (2).


D104B704

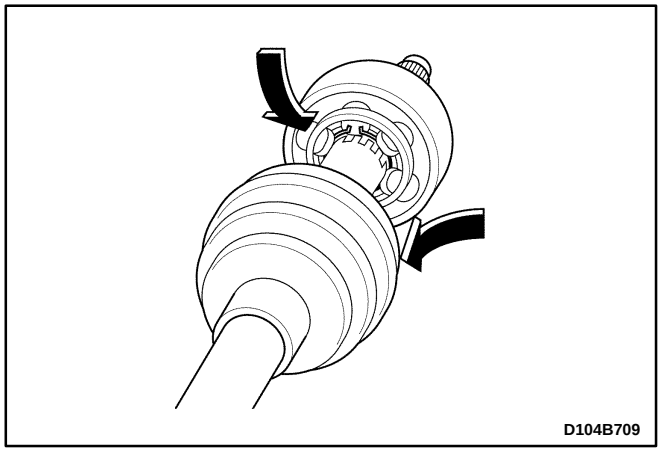
5. Remove the drive axle shaft boot.



D104B708

Assembly Procedure

1. Install in the reverse order of removal.
2. Install the joint assembly.
   - Pre–install the joint assembly by pushing to the drive axle shaft to widen the circlip.
   - Keep the circlip widened (1).
   - Push the joint assembly to the drive axle shaft (2).

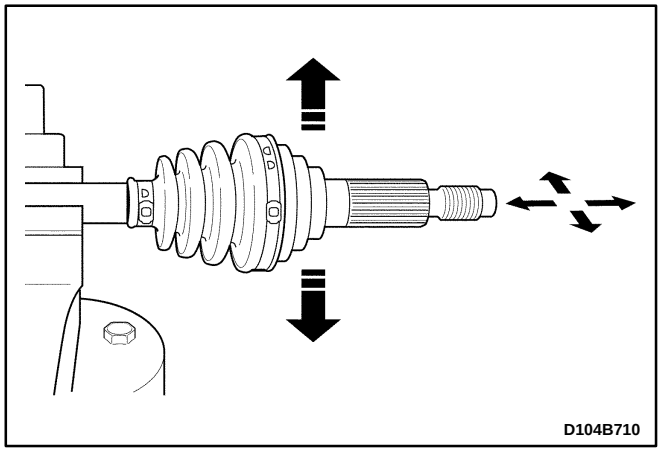

D104B709

3. Fill the joint housing with recommended grease when installing.

Capacity	80–90 g (2.8–3.2 ounces)

Notice: Always use the recommended grease. If not, joint and boot can be damaged.

Important: Always use new clamps.


D104B710

Inspection Procedure

1. Inspect the operation of joint.
2. Inspect for a leaking boot through the clamp side.

Important: Do not disassemble the outer joint assembly. Parts are match fit and can not be serviced separately. Improper reassembly will adversely affect both performance and safety.

SPECIFICATIONS

GENERAL SPECIFICATIONS

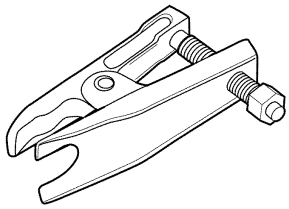
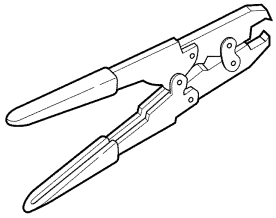
Application	Description		Unit	Standard	Limit
Drive Axle	Type	Inner	–	Tripot Joint	–
		Outer	–	Rzeppa Joint	–
	Length	Right	mm (in.)	553.5(21.79)	–
		Left	mm (in.)	386.5(15.22)	–
	Shaft Diameter		mm (in.)	22 (0.87)	–
	Grease Capacity	Inner	g (ounce)	90 – 100 (3.2 – 3.5)	–
		Outer	g (ounce)	80 – 90 (2.8 – 3.2)	–

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Control Arm Ball Joint Bolt	50 – 70	36 – 52	–
Tie Rod End Joint castellated Nut	30 – 55	21 – 41	–
Stabilizer Bar Bolt	33 – 53	24 – 39	–
Stabilizer Bar Castellated Nut	40 – 50	30 – 36	–
Drive Axle Shaft Nut	210	155	–
Wheel Nut	90 – 110	66 – 81	–
Transaxle Under Cover Bolt	35 – 55	25 – 41	–
Oil Drain Plug	25 – 30	18 – 22	–
Oil Level Plug	36 – 54	26 – 40	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D104B101	**KM–507–B Tie Rod End Joint Remover**
 D105B101	**J–35566 Boot Clamp Pliers**

SECTION 4A

HYDRAULIC BRAKES

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.

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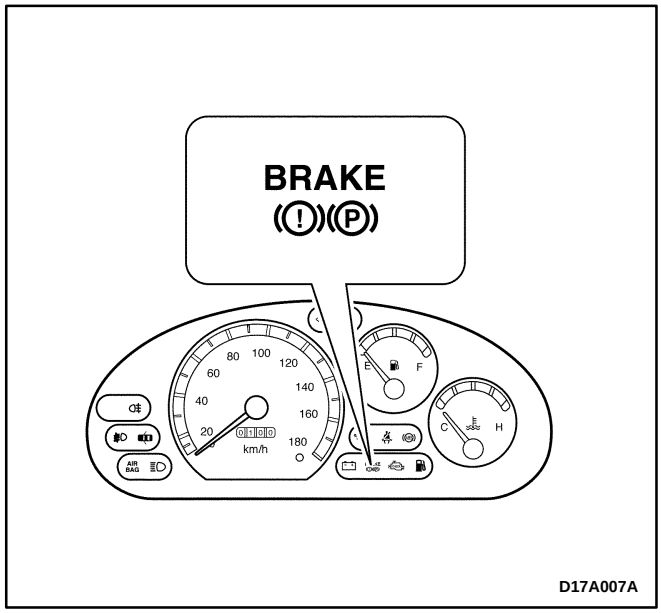
DESCRIPTION AND OPERATION

WARNING LAMP OPERATION

This brake system uses a BRAKE warning lamp located in the instrument panel cluster. When the ignition switch is in the III position, the BRAKE warning lamp should illuminate. It should go off when the ignition switch return to II position. The following conditions will activate the BRAKE warning lamp.

- The lamp should be on whenever the parking brake applied and the ignition switch is in the II position.
- A low fluid level in the master cylinder will turn the BRAKE warning lamp on.



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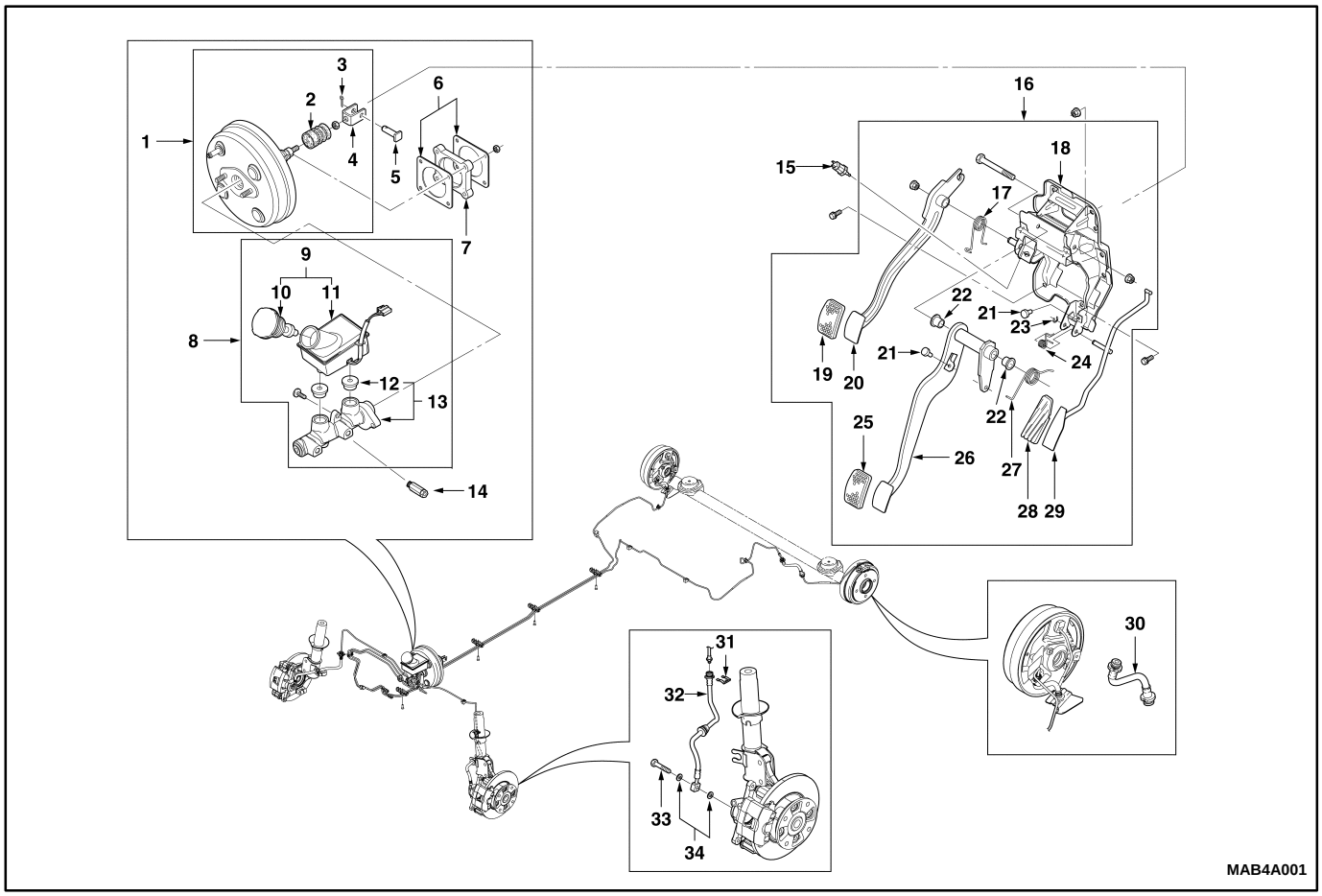
COMPONENT LOCATOR

BRAKE SYSTEM (NON–ABS)

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



1. Power Booster
2. Power Booster Boot
3. Cotter Pin
4. Clevis
5. Clevis Pin
6. Packing
7. Spacer
8. Master Cylinder Assembly
9. Fluid Reservoir Assembly
10. Reservoir Cap
11. Reservoir
12. Grommet Seal
13. Master Cylinder
14. Proportioning Valve
15. Stoplamp Switch
16. Brake Pedal Assembly
17. Clutch Pedal Spring
18. Pedal Bracket Assembly
19. Clutch Pedal Pad
20. Clutch Pedal
21. Cushion
22. Bushing
23. Retaining Ring
24. Spring
25. Brake Pedal Pad
26. Brake Pedal
27. Brake Pedal Spring
28. Accelator Pedal Pad
29. Accelator Pedal
30. Rear Drum Brake Hose
31. E Ring
32. Front Disc Brake Hose
33. Brake Hose Coupling Bolt
34. Plain Washer

DIAGNOSITIC INFORMATION AND PROCEDURES

BRAKE SYSTEM TESTING

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

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy, or covered with loose dirt whereby all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight so roughly that the wheels tend to bounce.

Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the brakes and sliding the tires. Locked brakes and sliding tires do not indicate brake efficiency since heavily braked, but turning, wheels will stop the vehicle in less distance than locked brakes. More tire-to-road friction is present with a heavily braked, turning tire than with a sliding tire.

Because of the high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

There are three major external conditions that affect brake performance:

- Tires having unequal contact and grip of the road will cause unequal braking. Tires must be equally inflated, and the tread pattern of the right and the left tires must be approximately equal.
- Unequal loading of the vehicle can affect the brake performance since the most heavily loaded wheels require more braking power, and thus more braking effort, than the others.
- Misalignment of the wheels, particularly conditions of excessive camber and caster, will cause the brakes to pull to one side.

To check for brake fluid leaks, hold constant foot pressure on the pedal with the engine running at idle and the shift lever in NEUTRAL. If the pedal gradually falls away with the constant pressure, the hydraulic system may be leaking. Perform a visual check to confirm any suspected leaks.

Check the master cylinder fluid level. While a slight drop in the reservoir level results from normal lining wear, an abnormally low level indicates a leak in the system. The hydraulic system may be leaking either internally or externally. Refer to the procedure below to check the master cylinder. Also, the system may appear to pass this test while still having a slight leak. If the fluid level is normal, check the vacuum booster pushrod length. If an incorrect pushrod length is found, adjust or replace the rod.

Check the master cylinder using the following procedure:

- Check for a cracked master cylinder casting or brake fluid leaking around the master cylinder. Leaks are indicated only if there is at least one drop of fluid. A damp condition is not abnormal.
- Check for a binding pedal linkage and for an incorrect pushrod length. If both of these parts are in satisfactory condition, disassemble the master cylinder and check for an elongated or swollen primary cylinder or piston seals. If swollen seals are found, substandard or contaminated brake fluid should be suspected. If contaminated brake fluid is found, all the components should be disassembled and cleaned, and all the rubber components should be replaced. All of the pipes must also be flushed.

Improper brake fluid, or mineral oil or water in the fluid, may cause the brake fluid to boil or cause deterioration of the rubber components. If the primary piston cups in the master cylinder are swollen, then the rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston seals on the drum brake wheels.

If rubber deterioration is evident, disassemble all the hydraulic parts and wash the parts with alcohol. Dry these parts with compressed air before reassembly to keep alcohol out of the system. Replace all the rubber parts in the system, including the hoses. Also, when working on the brake mechanisms, check for fluid on the linings. If excessive fluid is found, replace the linings.

If the master cylinder piston seals are in satisfactory condition, check for leaks or excessive heat conditions. If these conditions are not found, drain the fluid, flush the master cylinder with brake fluid, refill the master cylinder, and bleed the system. Refer to “Manual Bleeding the Brakes” in this section.

BRAKE HOSE INSPECTION

The hydraulic brake hoses should be inspected at least twice a year. The brake hose assembly should be checked for road hazard damage, cracks, chafing of the outer cover, and for leaks or blisters. Inspect the hoses for proper routing and mounting. A brake hose that rubs on a suspension component will wear and eventually fail. A light and a mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

WARNING LAMP OPERATION

This brake system uses a BRAKE warning lamp located in the instrument panel cluster. When the ignition switch is in the III position, the BRAKE warning lamp should glow and then go OFF when the ignition switch returns to the II position.

The following conditions will activate the BRAKE lamp:

- Parking brake applied. The light should be on whenever the parking brake is applied and the ignition switch is II.
- Low fluid level. A low fluid level in the master cylinder will turn the BRAKE lamp ON.

BRAKE SYSTEM FAULT

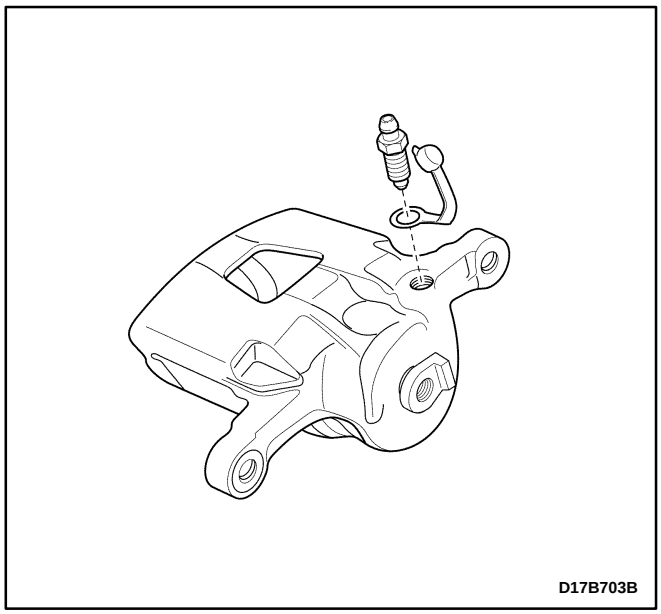
Condition	Probable cause	Correction
Brake Warning Lamp ON	● Brake fluid leaks.	● Repair the leaks or add th fluid.
	● Parking brake switch shorted to ground.	● Repair the short ground.
	● Faulty the fluid level sensor.	● Replace the sensor.
Stoplamp ON	● Faulty the stoplamp switch.	● Replace the stoplamp switch.
	● Push rod length is short.	● Adjust the push rod length of the power booster.
	● Stoplamp switch circuit shorted to battery.	● Repair or Replace the wiring harness.
Poor Braking	● Brake fluid lacks or leaks.	● Repair the leaks or add the fluid.
	● Brake fluid contamination.	● Replace the fluid.
	● Air in the brake system.	● Bleed the brake system.
	● Damaged brake lines.	● Replace the brake lines.
	● Damaged vacuum hose or faulty check valve.	● Replace the vacuum hose or check value.
Dragging Brake	● No free play at the brake pedal.	● Adjust the free play.
	● Weakened the brake pedal return spring.	● Replace the return spring.
	● Faulty master cylinder.	● Replace the master cylinder.
	● Air in the brake system.	● Bleed the brake system.
Pedal Over Stroke	● Brake fluid lacks or leaks.	● Repair the leaks or add the fluid.
	● Poor adjustment of the brake pedal free play.	● Adjust the push rod length of the power booster.

MANUAL BLEEDING THE BRAKES

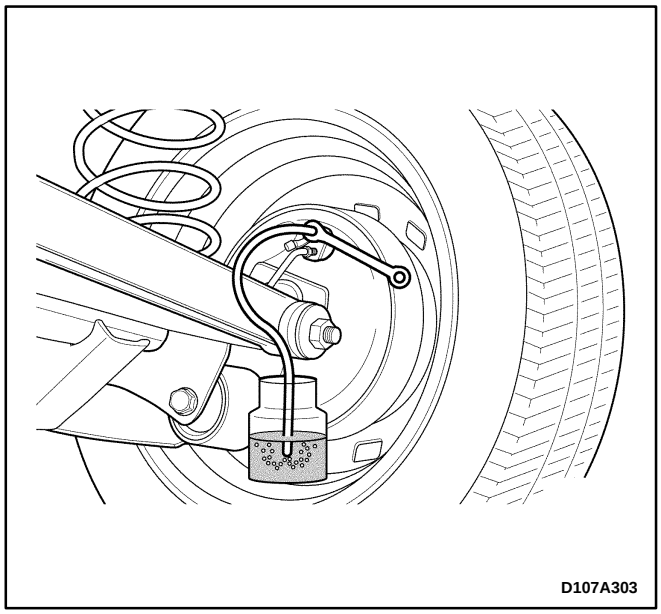
Important: The bleeding sequence is as follows; right rear, left rear, right front, and left front.

Important: Check the fluid level and add the fluid during the bleeding operation.

1. Raise the vehicle.
2. Remove the bleeder screw and cap.



3. Attach a transparent tube over the valve. Allow the tube to hang submerged in brake fluid in a transparent container.



4. Slowly push the brake pedal several times and hold the brake pedal.
5. Tighten the bleeder screw after loosening the bleeder screw and draining the fluid.

Caution: Hold the brake pedal until tightening the bleeder screw.

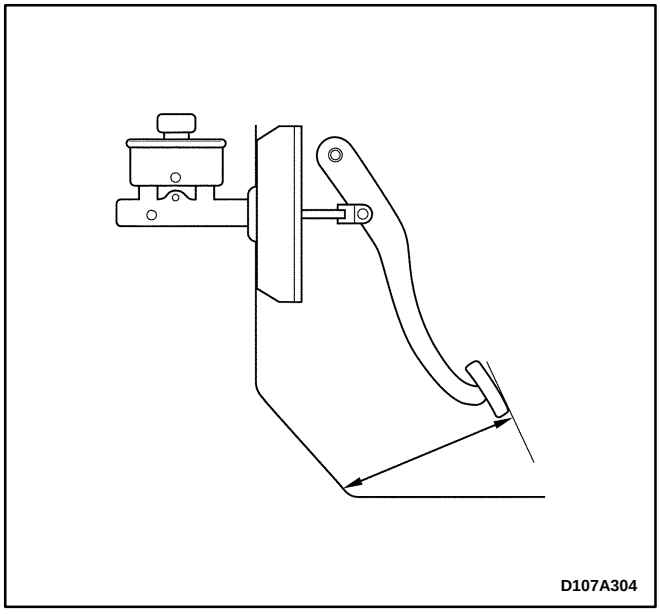
6. Repeat the step 5, 6 until all the air is removed.
7. Check the leaks for the bleeder screw.

PEDAL TRAVEL CHECK

1. Start the engine.
2. Push the pedal three times.
3. With brake pedal depressed with a about 30Kg (66.15 lb) load, measure the clearance between the pedal pad and the lower dash panel.

Unit : mm (in.)

Specification	60 (2.36)



4. If clearance is less than 60mm (2.36 in.), the most possible cause is either rear drum brake shoes are worn out beyond the specification value or air is in lines. Clearance still remains less than 60mm (2.36 in.) even after replacement of brake shoes and bleeding of the brake system, other possible but infrequent cause is malfunction of rear drum brake shoe adjusters or booster push rod length out of adjustment.
5. Automatic clearance adjuster check is performed after removing brake drums. If the faulty is found, repair or replace it.

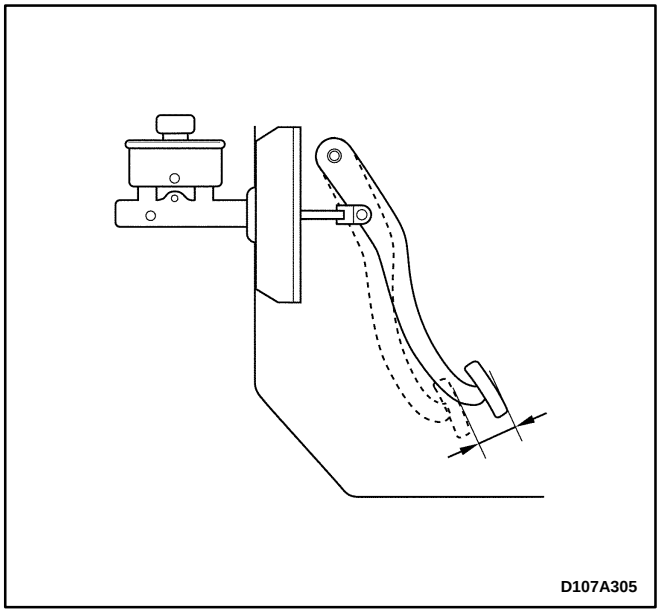
BRAKE PEDAL FREE PLAY INSPECTION

1. Push the brake pedal several times to discharge the vacuum of the power booster.
2. Measure the pedal movement until the hardness is felt when pushing the brake pedal by hand.

Unit : mm (in.)

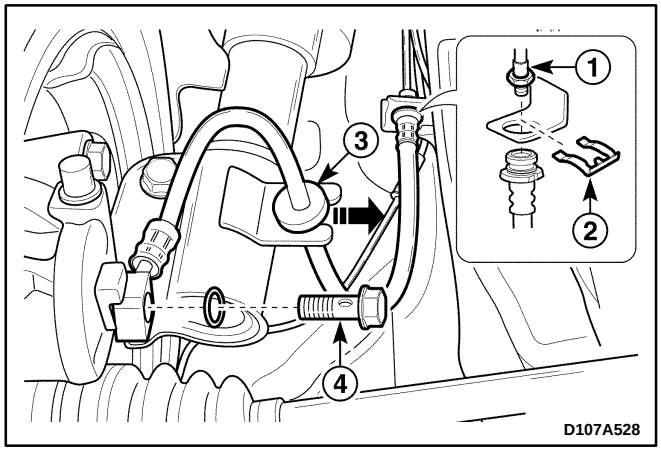
Specification	6–10 (0.24–0.31)

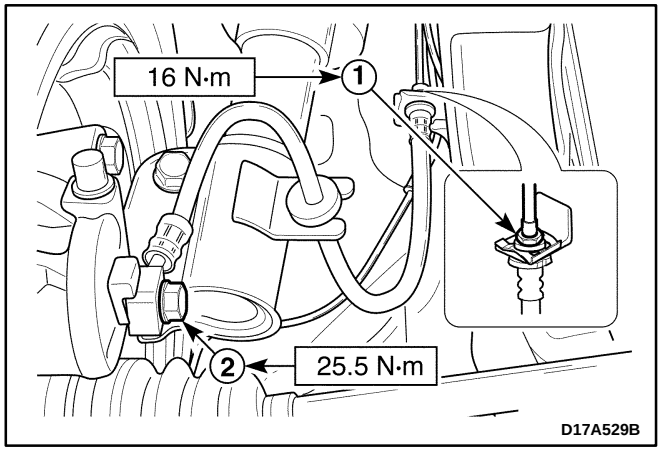
3. Brake pedal free play can not be adjusted.



REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE





BRAKE HOSE (FRONT)

Removal Procedure

1. Remove the wheels. Refer to *Section 2E, Tires and Wheels.*
2. Remove the brake hose.
   - Remove the fitting (1).
   - Remove the E–ring retainer (2).
   - Disconnect the brake hose mounting from the strut (3).
   - Remove the coupling bolt (4).
   - Plug the opening in the brake pipe and caliper to prevent fluid loss or contamination.

Installation Procedure

1. Connect the brake lines to the brake hose (1).

   Tighten

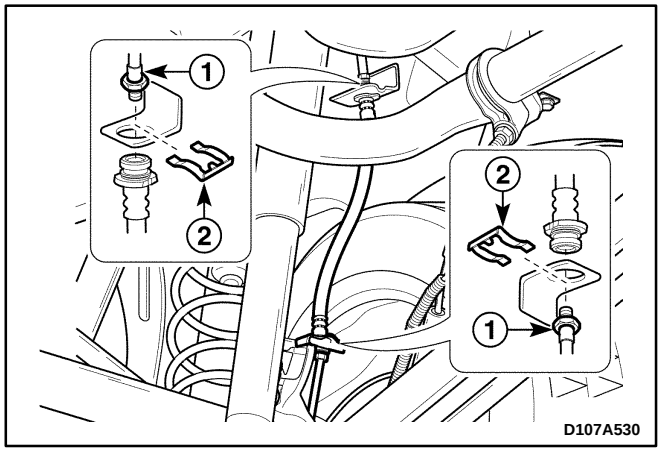
   Tighten the brake pipe–to–hose fitting to 16 N•m (12 lb-ft).
2. Install the brake hose coupling bolt (2).

   Tighten

   Tighten the bolt to 25.5 N•m (19.1 lb-ft).

Important: Use only Daewoo recommended brake fluid.

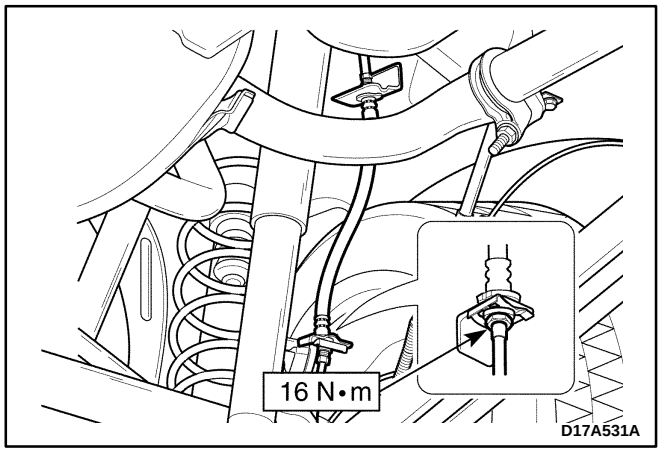
3. Bleed the brake system. Refer to “Manual Bleeding the Brakes” in this section.
4. Check the brake system for leaks.
5. Install the wheels. Refer to *Section 2E, Tires and Wheels*.



BRAKE HOSE (REAR)

Removal Procedure

1. Remove the wheels. Refer to *Section 2E, Tires and Wheels.*
2. Remove the brake hose.
   - Remove the fittings (1).
   - Remove the E–rings (2).
   - Plug the opening in the brake pipe to prevent fluid loss or contamination.



Installation Procedure

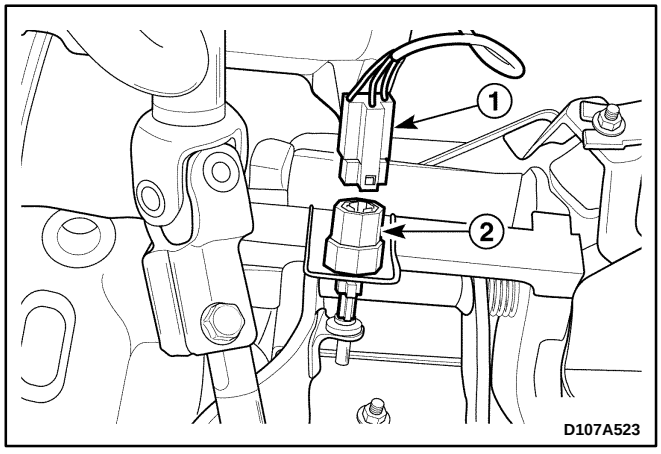
1. Connect the brake lines to the brake hose.
2. Install the fitting and E–rings.

Tighten

Tighten the fitting to 16 N•m (12 lb-ft).

Important: Use only Daewoo recommended brake fluid.

3. Bleed the brake system. Refer to “Manual Bleeding the Brakes” in this section.
4. Check the brake system for leaks.
5. Install the wheels. Refer to *Section 2E, Tires and Wheels*.

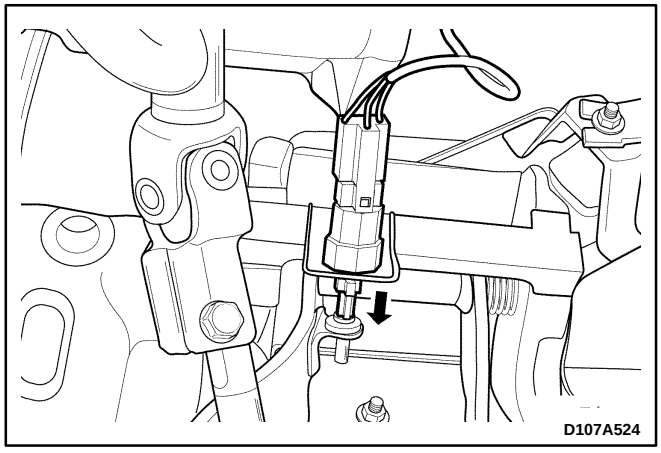


STOPLAMP SWITCH

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

Removal Procedure

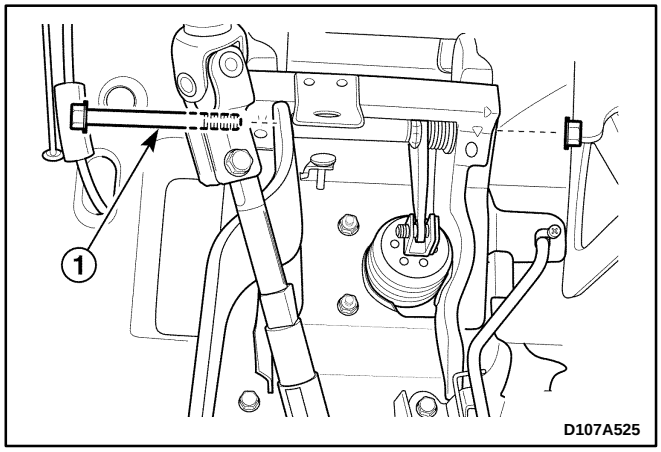
1. Disconnect the negative battery cable.
2. Remove the stoplamp switch.
   - Disconnect the connector (1).
   - Turn the stoplamp switch (2).



Installation Procedure

1. Install the stoplamp switch.
2. Connect the electrical connector.
3. Connect the negative battery cable.

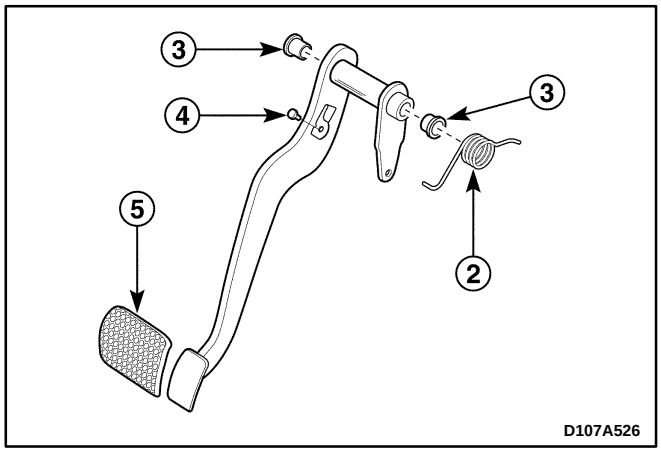
Important: After installing the stoplamp switch, pull the lever completely.



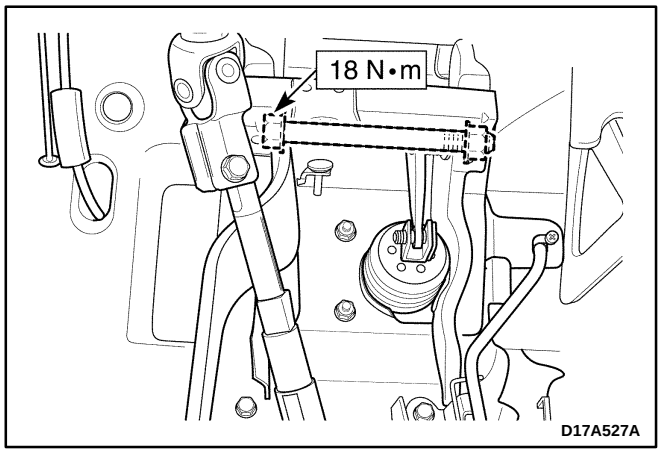
BRAKE PEDAL (LEFT–HAND DRIVE)

Removal Procedure

1. Remove the stoplamp switch. Refer to “Stoplamp Switch” in this section.
2. Disconnect the brake pedal from the power booster. Refer to *Section 4C, Power Booster.*
3. Remove the brake pedal.
   - Remove the bolt (1).



   - Remove the brake pedal spring (2).
   - Remove the bushing (3).
   - Remove the cushion (4).
   - Remove the brake pedal pad (5).

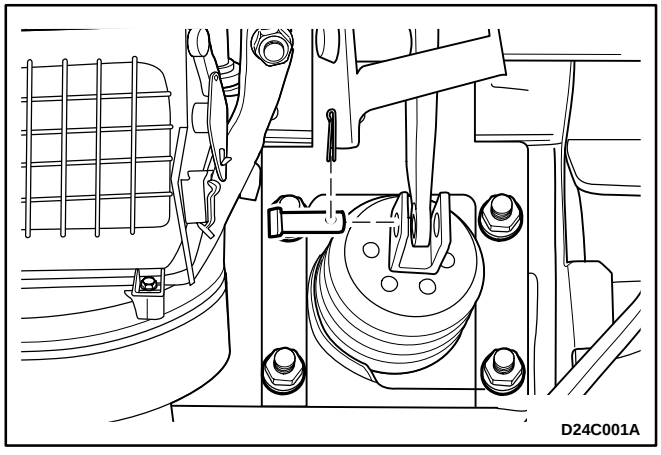


Installation Procedure

1. Install the pad to the brake pedal.
2. Install the brake pedal with spring, bushing, and cushion.
3. Connect the brake pedal to the power booster.

   ### Tighten

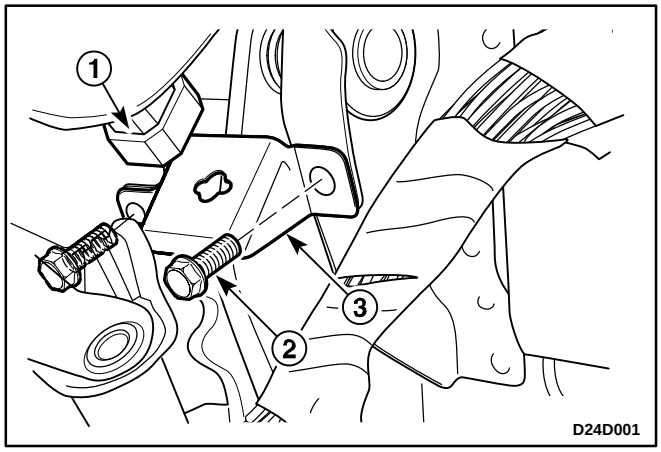
   Tighten the brake pedal–to–pedal bracket bolt to 18 N•m (13 lb-ft).
4. Install the stoplamp switch. Refer to “Stoplamp Switch” in this section.



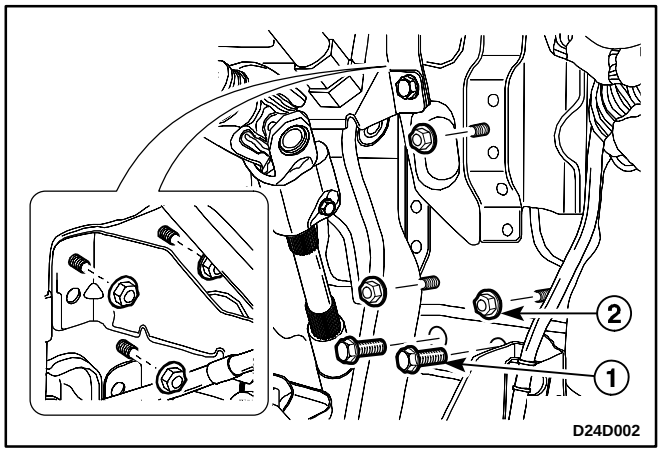
BRAKE PEDAL (RIGHT–HAND DRIVE)

Removal Procedure

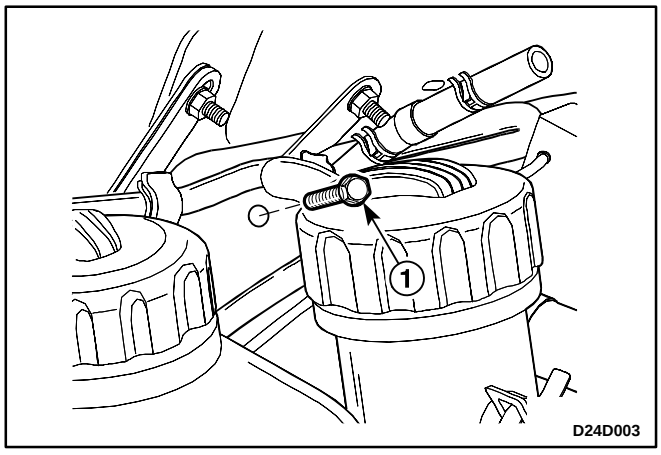
1. Remove the instrument panel assembly. Refer to *Section 9E, Instrument/Driver Information*.
2. Disconnect the brake pedal rod from the power booster. Refer to *Section 4C, Power Booster*.



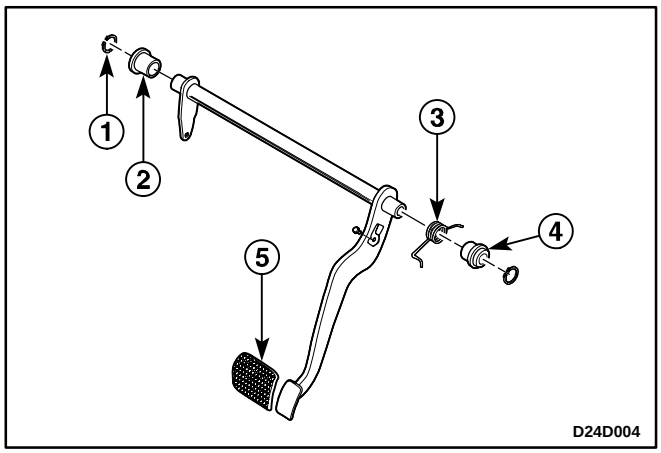
3. Remove the stoplamp switch.
   - Remove the stoplamp switch (1).
   - Remove the bolts (2).
   - Remove the stoplamp switch bracket (3).



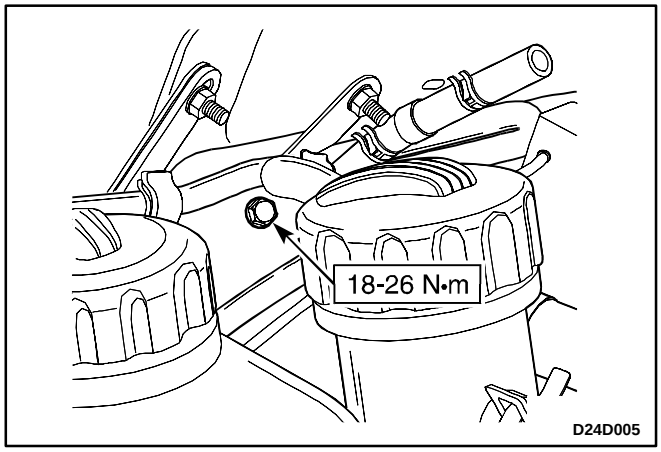
4. Remove the bolts mounting brake pedal bracket (1).
5. Remove the nuts mounting brake pedal bracket (2).



6. Remove the canister. Refer to *Section 1F, Engine Controls*.
7. Remove the bolt mounting brake pedal bracket in the engine compartment (1).



8. Remove the brake pedal.
   - Remove the snap rings (1).
   - Remove the bushings (2).
   - Remove the brake pedal spring (3).
   - Remove the cushion (4).
   - Remove the brake pedal pad (5).



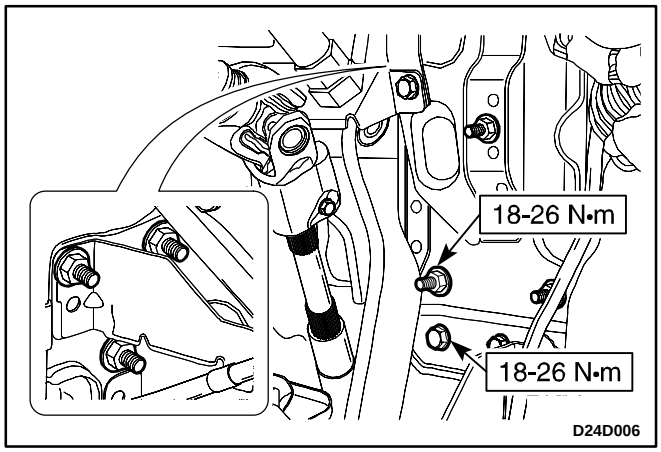
Installation Procedure

1. Install the brake pedal with pad, spring, bushings, and cushion.
2. Install the bolt mounting brake pedal bracket in the engine compartment.

Tighten

Tighten the bolt to 18–26 N•m (13–20 lb-ft).

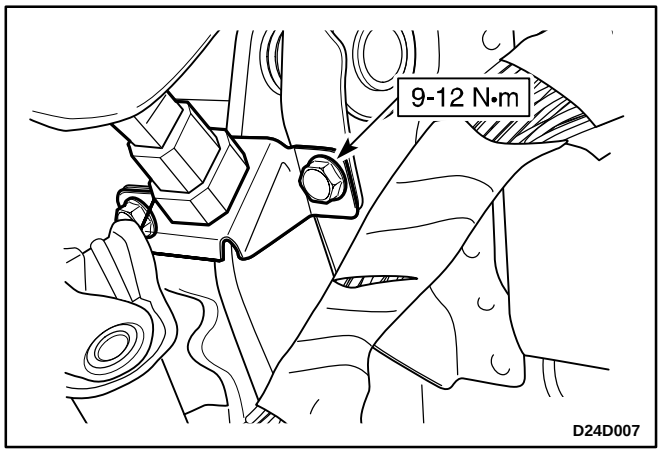
3. Install the canister. Refer to *Section 1F, Engine Controls*.



4. Install the brake pedal with the snap rings.
5. Install the bolts and nuts mounting brake pedal bracket.

Tighten

- Tighten the bolts mounting brake pedal bracket to 18–26 N•m (13–20 lb-ft).
- Tighten the nuts mounting brake pedal bracket to 18–26 N•m (13–20 lb-ft).



6. Install the stoplamp switch with the bracket and the bolts.

Tighten

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

7. Connect the brake pedal rod to the power booster. Refer to Section 4C, Power Booster.
8. Install the instrument panel assembly. Refer to *Section 9E, Instrument/Driver Information*.

SPECIFICATIONS

GENERAL SPECIFICATIONS

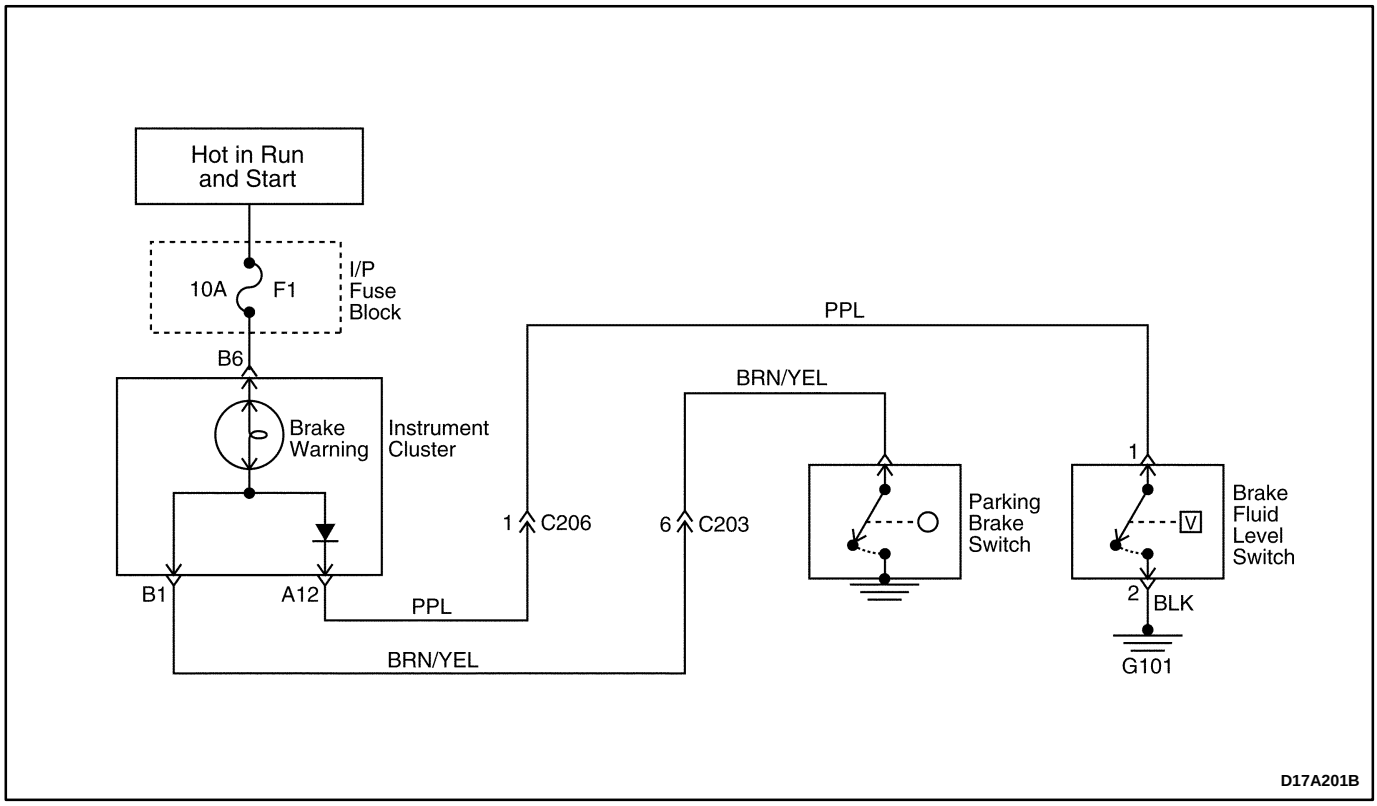
Application		0.8 SOHC Engine	
		Millimeters	Inches
Brake Drums:			
Inside Diameter		180	7.09
Maximum Rebore Diameter		182	7.17
Out-of-Round		0.04	0.0016
Brake Rotors:			
Discard Thickness		10	0.4
Lateral Runout (Installed)		0.05	0.002
Rotor Diameter		236	9.3
Rotor Thickness (New)		12.7	0.5
Master Cylinder:			
Bore Diameter		20.64	0.81
Caliper:			
Piston Diameter		48	1.89
Wheel Cylinder Diameter:		17.46	0.69
Brake Pedal:			
Free Play		6 – 10	0.24 – 0.31
Height		200	7.87
Stroke		30	1.18
Brake Fluid	Type	DOT–3 or DOT–4	
	Capacity	0.45 L (0.48 qt.)	

FASTENER TIGHTENING SPECIFICATIONS

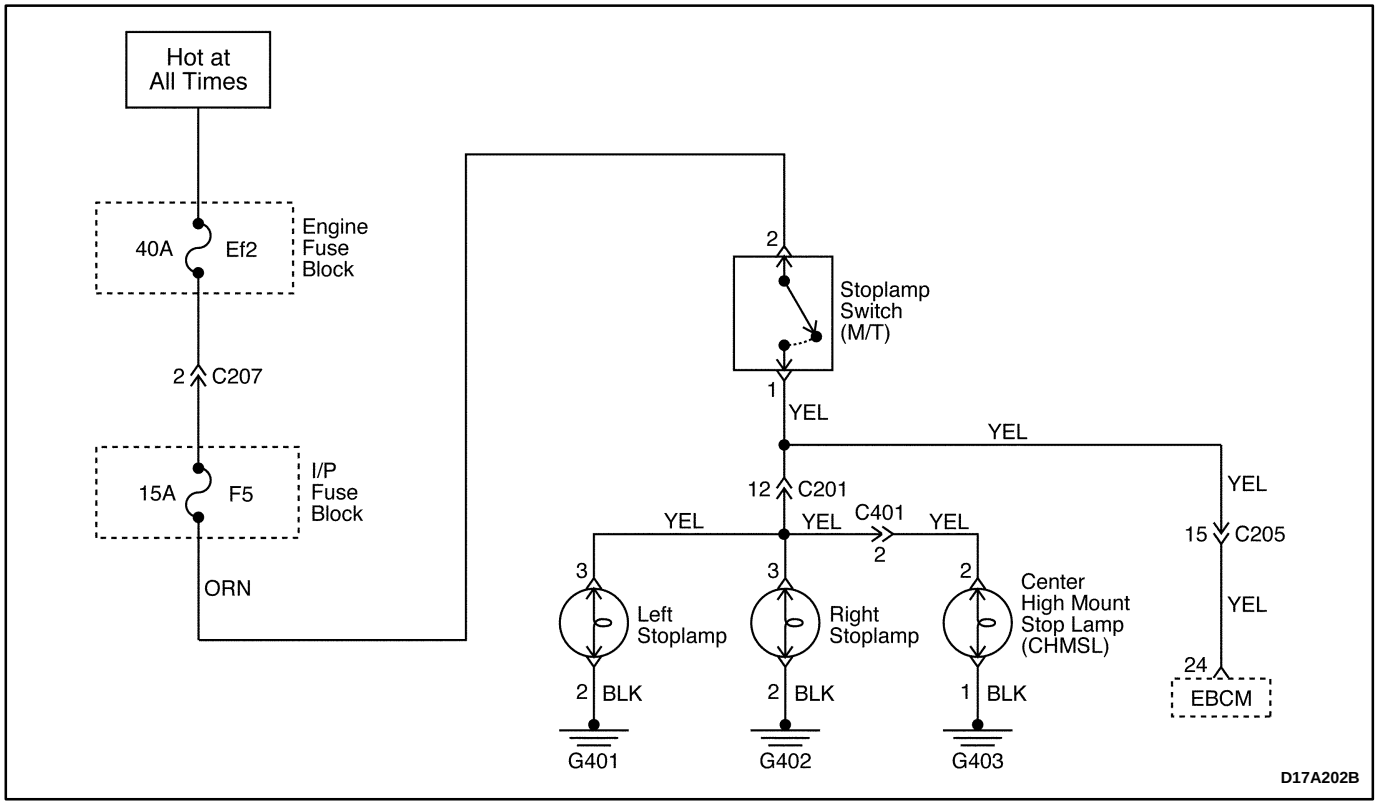
Application	N•m	Lb-Ft	Lb-In
Brake Pipe Fittings	16	12	–
Front Brake Hose-to-Caliper Bolt	25.5	19.1	–
Brake Pedal–to–Pedal Bracket Hex Bolt	18	13	–
Brake Pedal Bracket Mounting Bolts	18 – 26	13 – 20	–
Brake Pedal Bracket Mounting Nuts	18 – 26	13 – 20	–
Stoplamp Switch Mounting Bracket Bolts	9 – 12	–	80 – 106

SCHEMATIC AND ROUTING DIAGRAMS

BRAKE LAMP WARNING CIRCUIT



STOPLAMP SWITCH CIRCUIT



SECTION 4B

MASTER CYLINDER

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DESCRIPTION AND OPERATION

MASTER CYLINDER

The master cylinder is designed for use in a direct–split system. Front right brake and rear left brake are served by the primary piston. Front left brake and rear right brake are served by the secondary piston.

The master cylinder incorporates the functions of the standard dual master cylinder, plus a low fluid level indicator and the proportioning valve in the non–antilock braking system.

The proportioning valves limit the outlet pressure to the rear brakes after a predetermined master cylinder has been reached.

Important:

- Replace all the components included in the repair kits used to service this master cylinder.
- Lubricate rubber parts with clean brake fluid to ease assembly.
- Do not use lubricated shop air on brake parts, as this may damage rubber components.
- If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
- The torque values specified are for dry, unlubricated fasteners.
- Perform all service operations on a clean bench, free from all traces of mineral oil.

PROPORTIONING VALVE

The proportioning valve limits the outlet pressure to the rear brakes on the non-ABS after a predetermined master cylinder pressure has been reached. This is used when less rear apply force is needed to obtain optimum braking and is usually found on disc/drum brake configurations. On ABS-equipped vehicles, refer to *Section 4F, Antilock Brake System*.

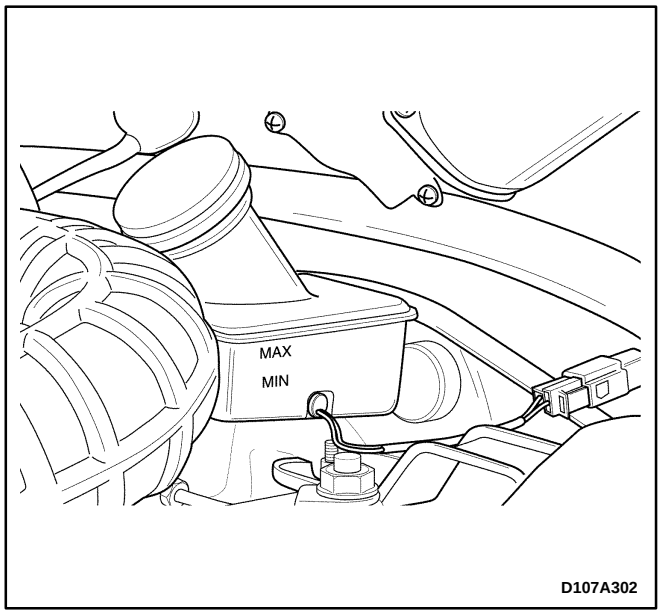
FLUID LEVEL SENSOR

Fluid level sensor is attached at the brake fluid reservoir. This sensor will activate the BRAKE light if a low fluid level condition is detected. Once the fluid level is corrected, the BRAKE light will go out.

DIAGNOSTIC INFORMATION AND PROCEDURES

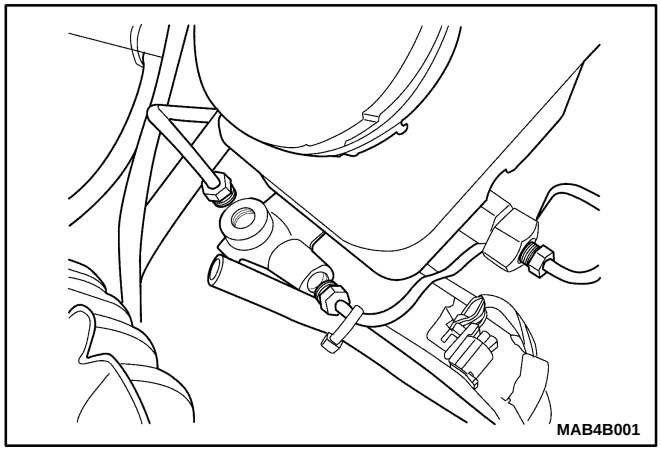
CHECKING THE BRAKE FLUID LEVEL

1. Check the fluid level.
2. If the fluid level is below MAX, refill the fluid to MAX.



REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE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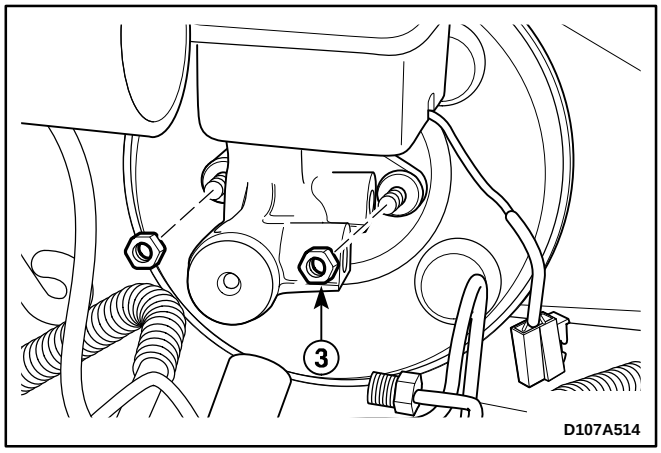
MASTER CYLINDER ASSEMBLY

Removal Procedure

1. Remove the air filter assembly. Refer to *Section 1B, Engine Mechanical*.
2. For vehicles with the non–ABS braking system, remove the proportioning valve. Refer to “Proportioning Valve” in this section.
3. Remove the master cylinder.
   - Disconnect the electrical connector.
   - Loosen the brake pipe fittings.
   - Plug the opening in the master cylinder to prevent fluid loss or contamination.

Notice: Brake fluid may damage paintwork, if spillage onto paintwork, wash with cold water immediately.

- Remove the nuts mounting the master cylinder (3).



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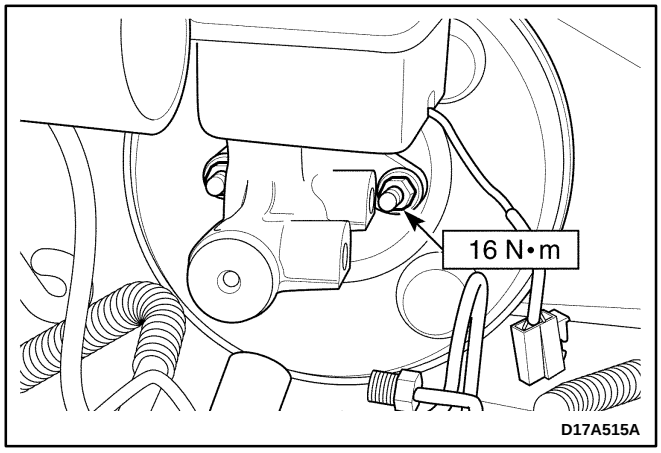
Installation Procedure

Important: Use only Daewoo recommended brake fluid.

1. Install the master cylinder assembly with the nuts.

Tighten

Tighten the attaching nuts to 16 N•m (12 lb-ft).



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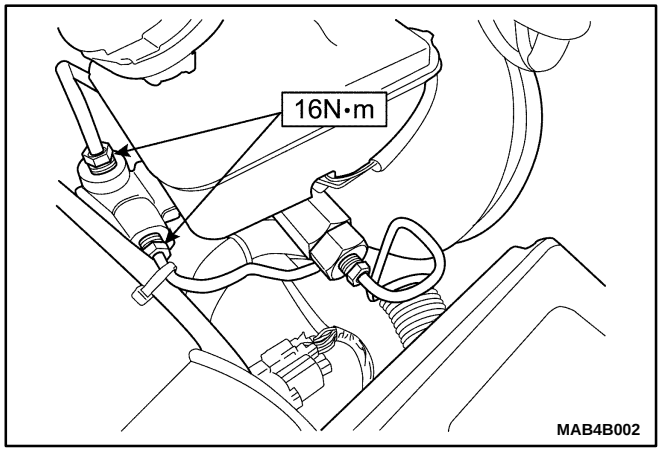
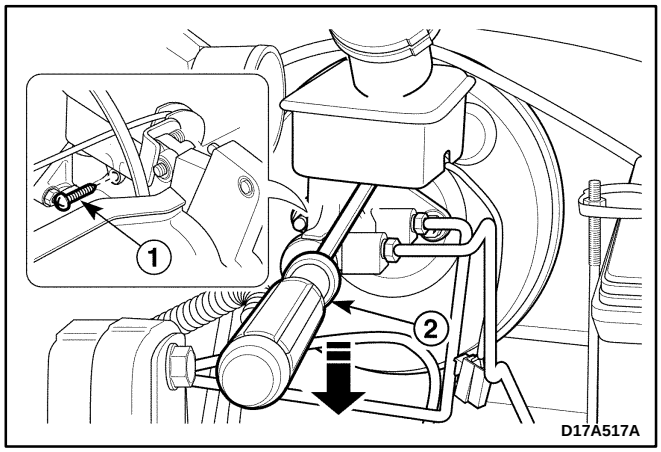


2. Install the brake pipe fittings to the master cylinder.

Tighten

Tighten the fittings to 16 N•m (12 lb-ft).

3. Connect the electrical connector.
4. For vehicles with the non–ABS braking system, install the proportioning valve. Refer to “Proportioning Valve” in this section.
5. Install the air filter assembly. Refer to *Section 1B, Engine Mechanical*.
6. Bleed the brake system. Refer to Section 4A, Hydraulic Brakes.

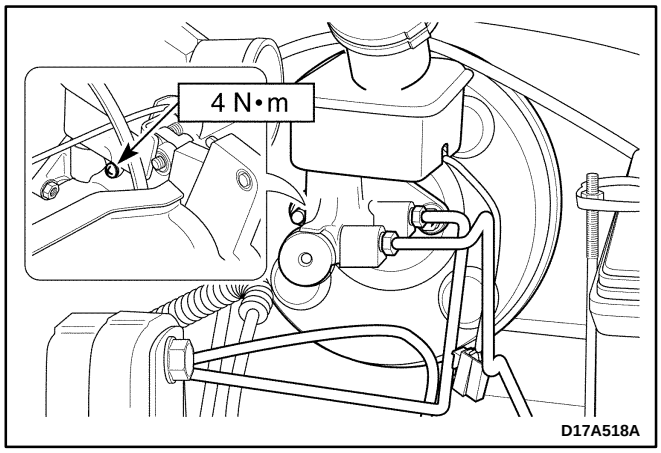


BRAKE FLUID RESERVOIR

Removal Procedure

1. Remove the fluid level switch connector. Refer to “Brake Fluid Level Switch” in this section.
2. Remove the reservoir.
   - Drain the brake fluid.
   - Remove the screw (1).
   - Remove the fluid reservoir using a flathead screwdriver (2).

Notice: Do not force one side strongly to prevent damage of reservoir when removing the reservoir.



Installation Procedure

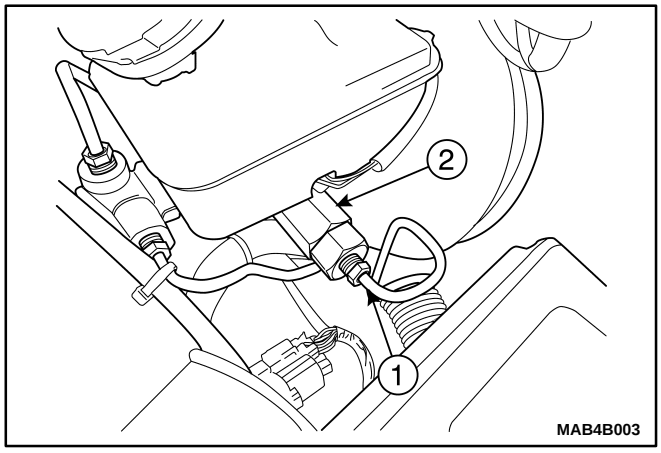
Important: Use only Daewoo recommended brake fluid.

1. Install the reservoir with the screw.

Tighten

Tighten the screw to 4 N•m (35 lb-ft).

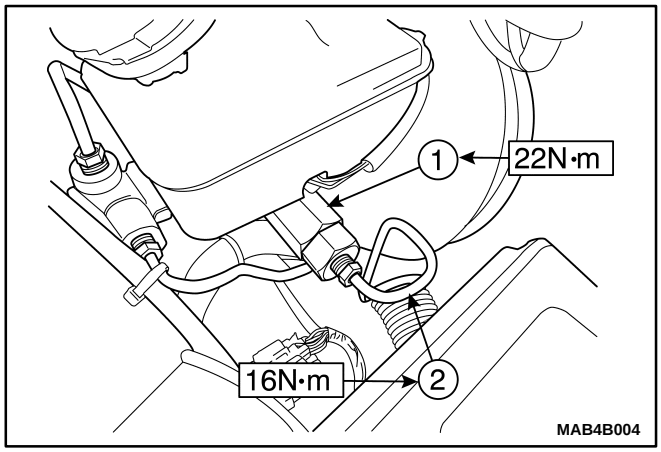
2. Install the fluid level switch connector. Refer to “Brake Fluid Level Switch” in this section.
3. Add brake fluid.
4. Bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.



PROPORTIONING VALVE (FOR VEHICLE WITH THE NON–ABS BRAKING SYSTEM)

1. Remove the proportioning valve.
   - Loosen the brake pipe fittings–to–proportioning valve (1).
   - Remove the proportioning valve (2).
   - Plug the opening in the proportioning valve and brake pipe fitting to prevent fluid loss or contamination.

Notice: Brake fluid may damage paintwork, if spillage onto paintwork, wash with cold water immediately.



Installation procedure

1. Install the proportioning valve (1).

Tighten

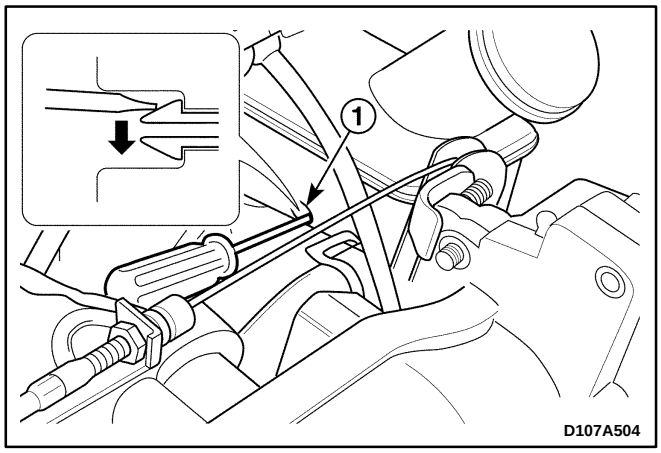
Tighten the proportioning valve to 22 N•m (16 lb-ft).

2. Install the brake pipe fitting (2).

Tighten

Tighten the brake pipe fitting–to–proportioning valve to 16 N•m (12 lb-ft).

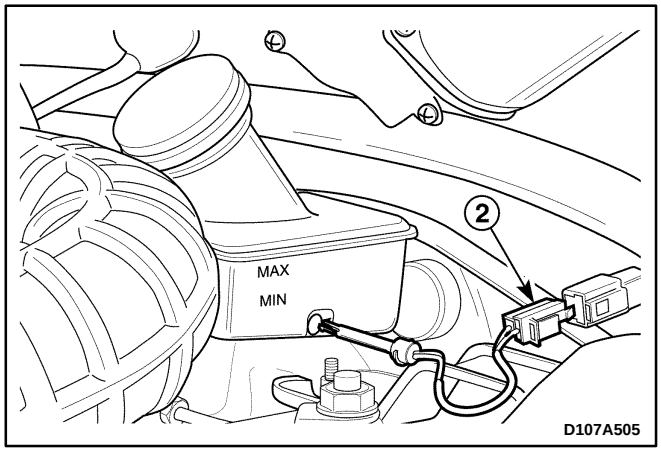
3. Bleed the brake system. Refer to *Section 4A, Hydraulic Brakes*.



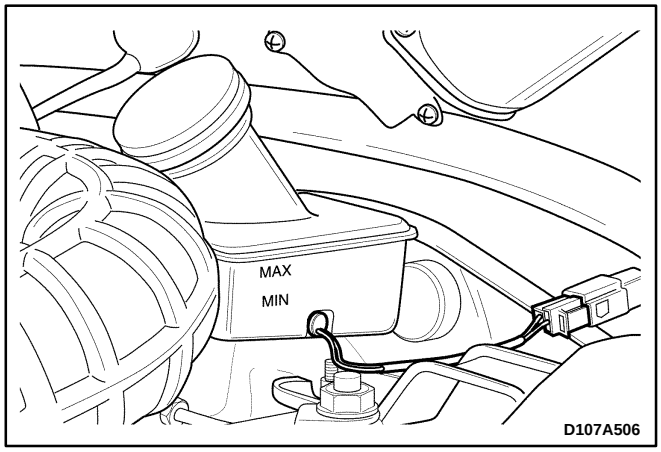
BRAKE FLUID LEVEL SWITCH

Removal procedure

1. Remove the vacuum hose from the power booster. Refer to *Section 4C, Power Booster.*
2. Remove the brake fluid level switch.
   - Remove the brake fluid level switch locking system by the flathead screwdriver (1).



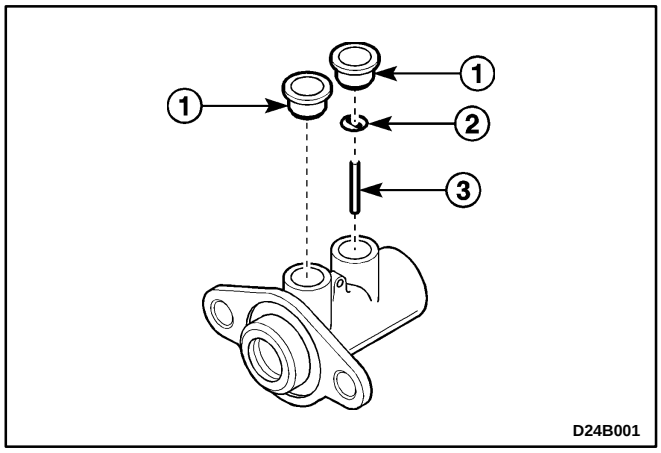
- Disconnect the electrical connector (2).



Installation procedure

1. Install the brake fluid level switch.
2. Connect the electrical connector.
3. Install the vacuum hose to the power booster. Refer to *Section 4C, Power Booster.*

UNIT REPAIR

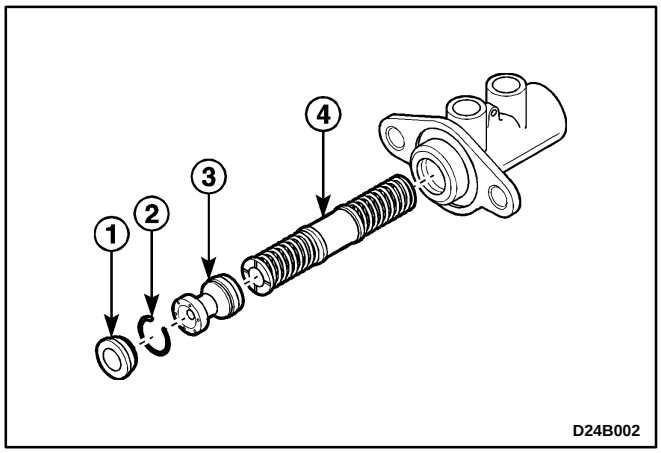


MASTER CYLINDER

(ABS Type Master Cylinder is Shown, Non–ABS Type Master Cylinder is Similar)

Disassembly Procedure

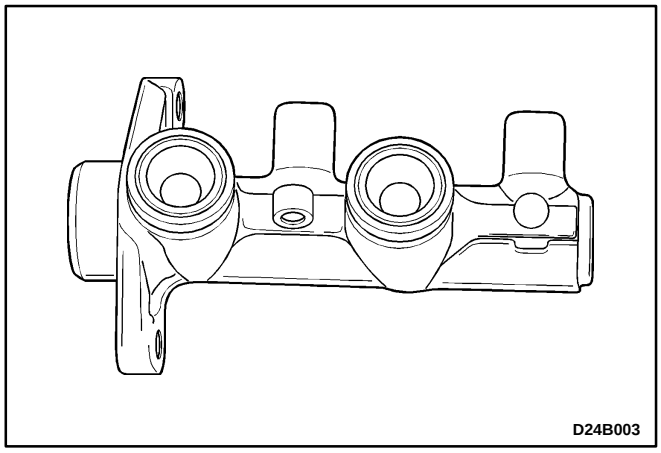
1. Remove the master cylinder. Refer to “Master Cylinder Assembly” in this section.
2. Remove the brake fluid reservoir. Refer to “Brake Fluid Reservoir” in this section.
3. Remove the reservoir seals (1).
4. Remove the washer (2).
5. Remove the stop pin (3).



6. Remove the boot (1).
7. Remove the retaining ring (2).

Notice: When removing the retaining ring, avoid damaging the piston or the cylinder wall.

8. Remove the primary piston (3).
9. Carefully remove the secondary piston assembly and the spring from the master cylinder bore (4).



Assembly Procedure

1. Install the secondary piston assembly .
2. Install the stop pin.
3. Install the primary piston.
4. Install the retaining ring.
5. Install the boot.
6. Install the washer.
7. Install the reservoir seals.
8. Install the brake fluid reservoir. Refer to “Brake Fluid Reservoir” in this section.
9. Install the master cylinder. Refer to “Master Cylinder Assembly” in this section.
10. Raise and suitably support the vehicle.
11. Bleed the braking system. Refer to *Section 4A, Hydraulic Brakes*.
12. Lower the vehicle.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Master Cylinder	Type	–	Tandem
	Bore Diameter	mm (in.)	20.64 (0.81)
Proportioning Valve	Cut–In Pressure	kPa (psi)	3,000(435.1)
	Pressure Ratio	–	0.25 : 30

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Fluid Reservoir Screw	4	–	35
Master Cylinder Attaching Nuts	16	12	–
Brake Pipe Fittings to Master Cylinder	16	12	–
Brake Pipe Fittings to Proportioning Valve	16	12	–
Brake Pipe Fittings to Rear Wheel Cylinder	16	12	–
Brake Pipe Fittings to Front Caliper	16	12	–
Proportioning Valve	22	16	–

SECTION 4C

POWER BOOSTER

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Fastener Tightening Specifications 4C-8

DESCRIPTION AND OPERATION

POWER BOOSTER

This booster is a single diaphragm, vacuum-suspended unit. In a normal operating mode, with the service brakes in the release position, a vacuum-suspended booster operates with a vacuum on both sides of its diaphragm. When the brakes are applied, air at atmospheric pressure is admitted to one side of the diaphragm to provide the power assist. When the brakes are released, atmospheric air is shut off from that side of the diaphragm. The air is then drawn from the booster through the vacuum check valve by the vacuum source.

Important: If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER BOOSTER FUNCTIONAL CHECK

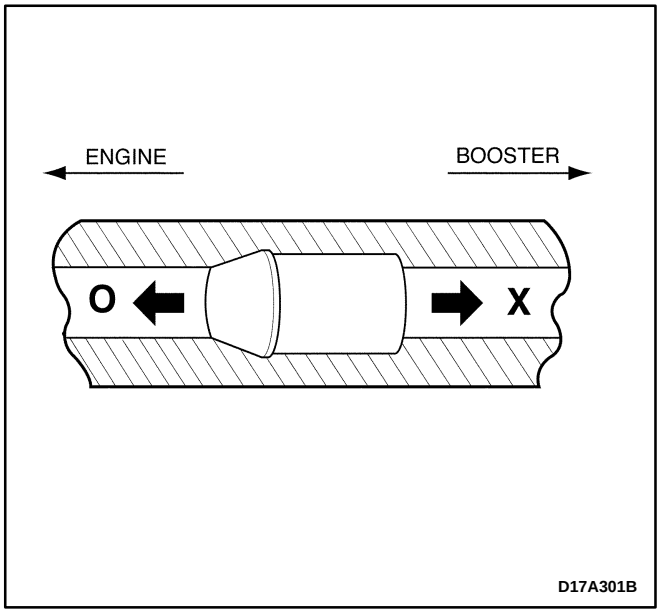
1. With the engine stopped, eliminate the vacuum in the booster by pumping the brake pedal several times.
2. Push the pedal down and hold it in this position.
3. Start the engine.
4. The booster is OK if the pedal drops further because of extra force produced.

If the brake pedal does not drop, the vacuum system (vacuum hoses, check valve, etc.) is probably defective and should be checked.

If no defect is revealed by checking the vacuum system, the defect is in the booster itself.

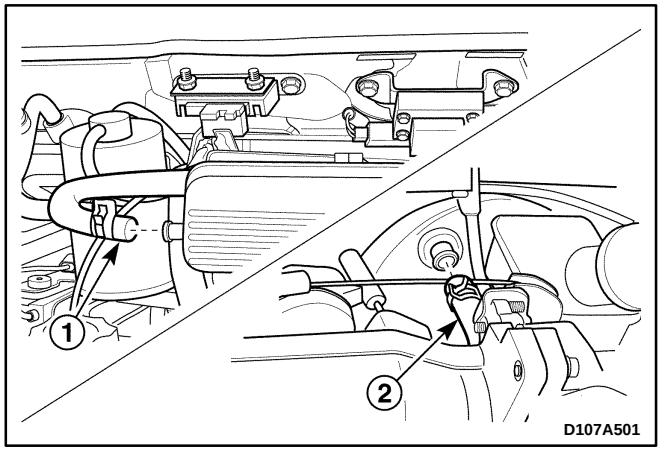
CHECK VALVE FUNCTIONAL CHECK

1. Remove the vacuum hose.
2. Suck the vacuum hose to power booster. And also, suck the vacuum hose to engine.
3. If the air pass through the check valve or not, replace the check valve. And if the vacuum hose to engine is only sucked, the check valve OK.



REPAIR INSTRUCTIONS

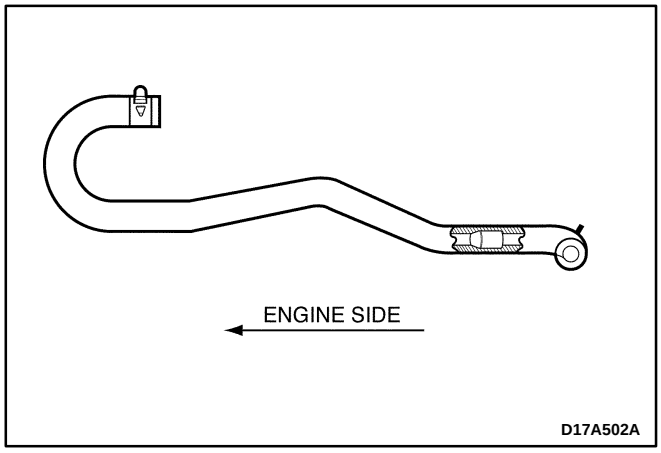
ON–VEHICLE SERVICE



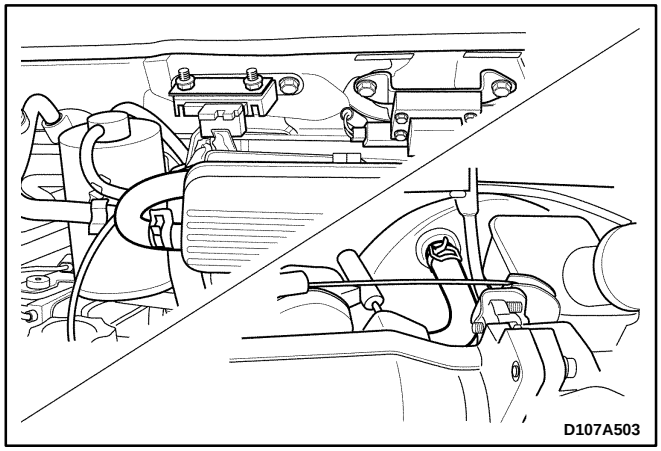
VACUUM HOSE AND CHECK VALVE

Removal Procedure

1. Remove the vacuum hose.
   - Disconnect the vacuum hose from the intake manifold (1).

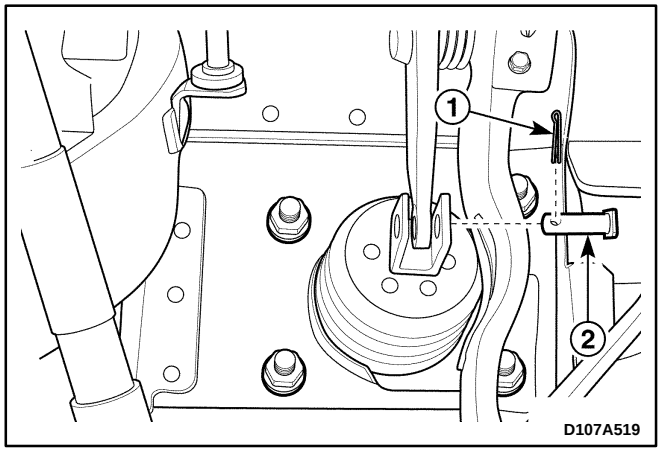


   - Disconnect the vacuum hose from the power booster (2).



Installation Procedure

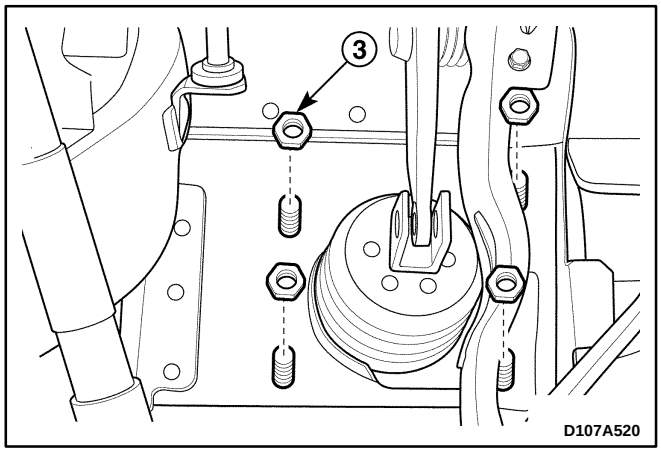
1. Connect the vacuum hose to the power booster.
2. Connect the vacuum hose to the intake manifold.



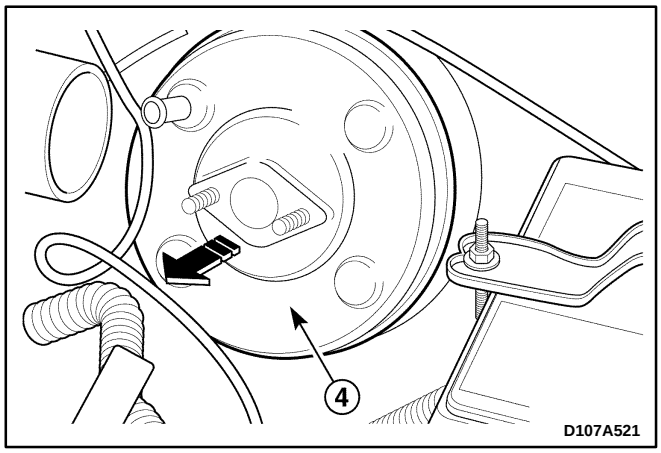
POWER BOOSTER ASSEMBLY (LEFT–HAND DRIVE)

Removal Procedure

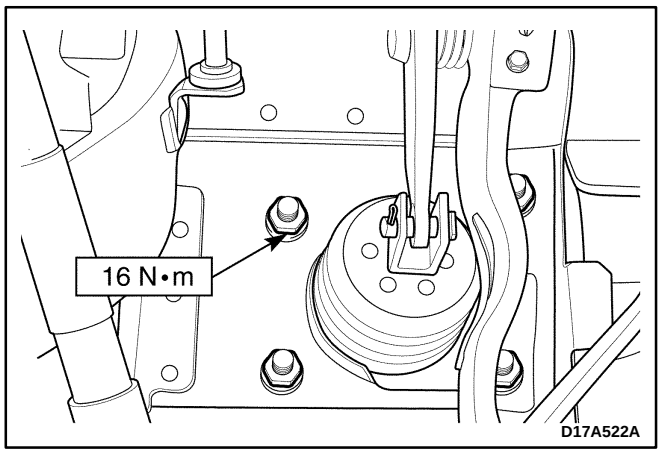
1. Remove the master cylinder assembly. Refer to *Section 4B, Master Cylinder.*
2. Disconnect the vacuum hose from the power booster.
3. Remove the power booster.
   - Straighten the cotter pin and remove it (1).
   - Remove the clevis pin (2).



   - Remove the nuts (3).



   - Remove the power booster (4).



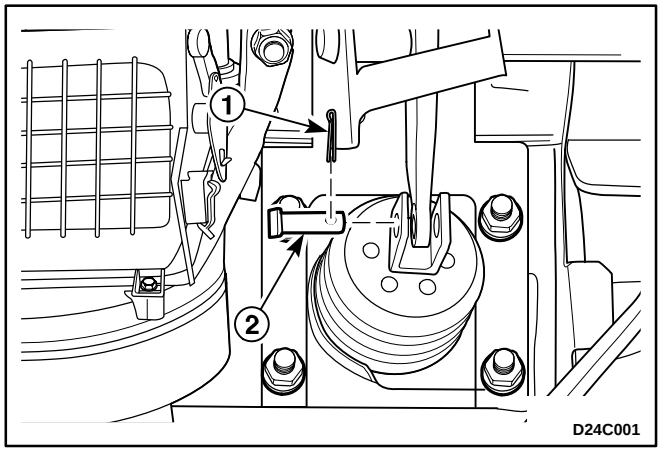
Installation Procedure

1. Install the power booster with the new cotter pin, clevis pin and nuts.

   ### Tighten

   Tighten the nuts to 16 N•m (12 lb-ft).

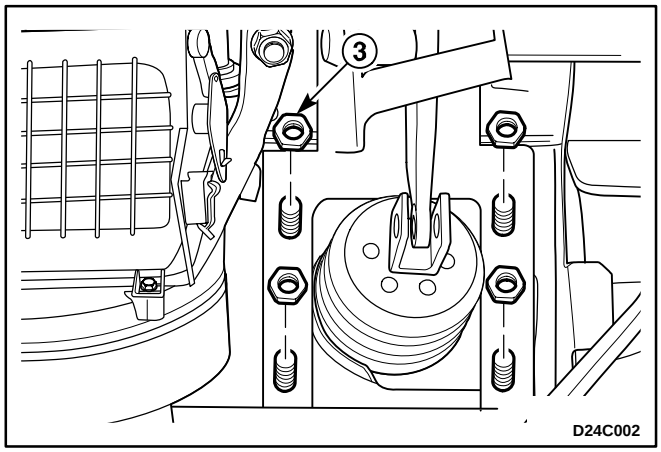
   Important: Make sure the distance from the booster to the center of the clevis bore should be 100mm (3.94 in.).
2. Install the master cylinder assembly. Refer to *Section 4B, Master Cylinder*.
3. Connect the vacuum hose to the power booster.
4. Bleed the brake system. Refer to Section 4A, Hydraulic Brakes.



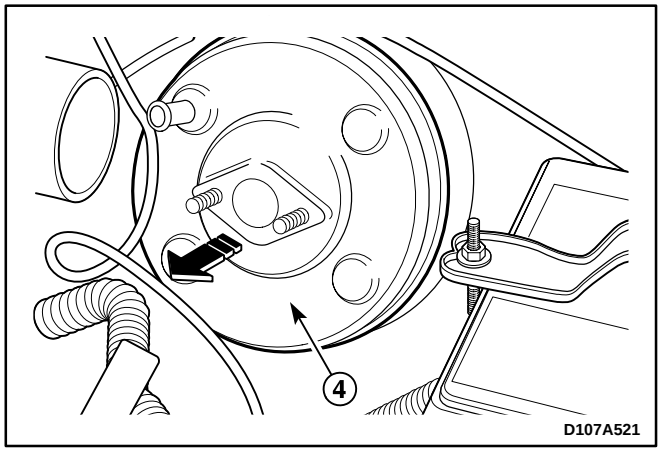
POWER BOOSTER ASSEMBLY (RIGHT–HAND DRIVE)

Removal Procedure

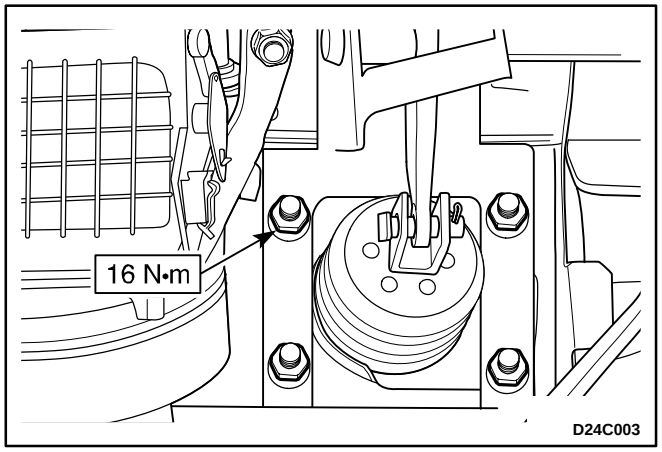
1. Remove the master cylinder assembly. Refer to *Section 4B, Master Cylinder.*
2. Disconnect the vacuum hose from the power booster.
3. Remove the instrument panel assembly. Refer to *Section 9E, Instrument/Driver Information*.
4. Remove the evaporator unit mounting screws and take off the evaporator unit a little. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
5. Remove the power booster.
   - Straighten the cotter pin and remove it (1).
   - Remove the clevis pin (2).



- Remove the nuts (3).



- Remove the power booster (4).



Installation Procedure

1. Install the power booster with the new cotter pin, clevis pin and nuts.

Tighten

Tighten the nuts to 16 N•m (12 lb-ft).

Important: Make sure the distance from the booster to the center of the clevis bore should be 100mm (3.94 in.).

2. Install the evaporator unit with the screws. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
3. Install the instrument panel assembly. Refer to Section 9E, Instrument/Driver Information.
4. Connect the vacuum hose to the power booster.
5. Install the master cylinder assembly. Refer to *Section 4B, Master Cylinder*.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Power Booster	Type	–	Vacuum–Suspended
	Diameter	mm (inch)	177.8 (7)
	Servo Force Ratio	–	3.7 : 1
	Distance from the booster to the center of the clevis bore	mm (inch)	96(3.78)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Booster–to-Dash Panel Nuts	16	12	–
Master Cylinder Attaching Nuts	16	12	–

SECTION 4D

FRONT DISC BRAKES

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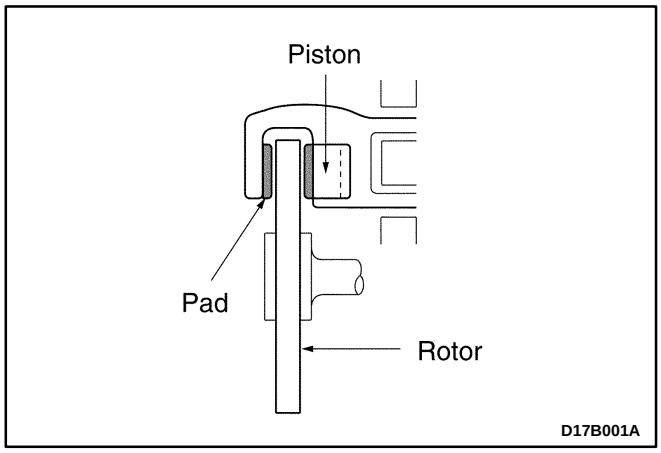
DESCRIPTION AND OPERATION

DISC BRAKE CALIPER ASSEMBLY

This caliper has a single bore and is mounted to the steering knuckle with two mounting bolts. Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to slide the caliper inward, resulting in a clamping action on the rotor. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.



Important:

- Replace all components included in the repair kits used to service this caliper.
- Lubricate the rubber parts with clean brake fluid to ease assembly.
- Do not use lubricated shop air on brake parts, as damage to the rubber components may result.
- If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
- Replace the pads in axle sets only.
- The torque values specified are for dry, unlubricated fasteners.
- Perform the service operations on a clean bench, free from all mineral oil materials.

CLEARANCE CALIBRATION

When the hydraulic pressure is applied to the piston, the piston moves leftward. The piston seal, which extent considerable pressure against the piston, moves with cylinder.

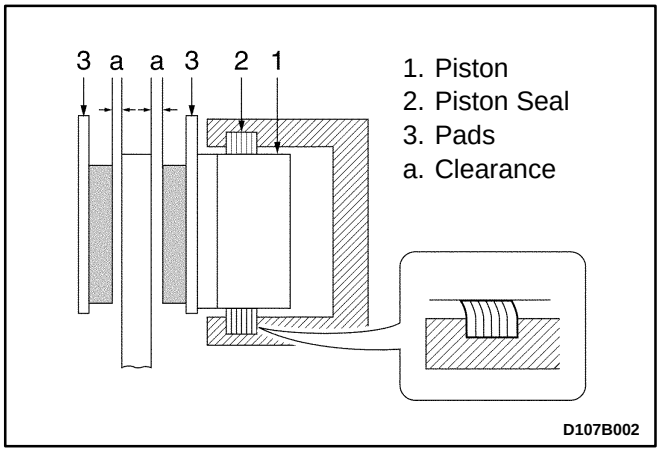
However, as a part of the piston seal is fixed into a grove in the cylinder shape of the seal is as shown in below figure, distorted toward the piston moving direction.

When the pressure is taken off from the brake pedal and the hydraulic pressure is released from the piston, a restoring elastic force is generated at the seal and pushes the piston rightward and back it in original position.

As the pads wear away and the clearance between rotor and pads becomes larger, the piston moves larger.

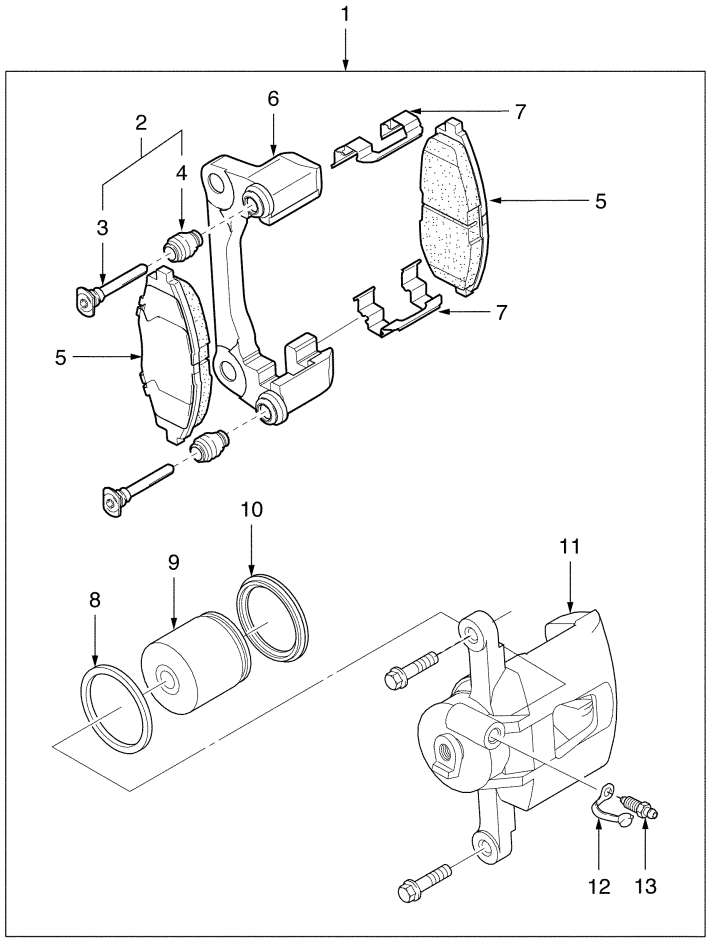
The seal then could change in shape further, but since end of the seal is fixed into the groove in the cylinder, the distortion is limited to the same amount as previously described.

The piston moves further to cover the distance of clearance. As the piston returns by the same distance and the rubber seal recovers its original shape, the clearance between the rotor and pads is maintained in original condition.



COMPONENT LOCATOR

FRONT DISC BRAKES



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1. Front Brake Caliper Assembly
2. Front Brake Boot Assemblies
3. Pins
4. Pin Boots
5. Front Brake Pads
6. Carrier
7. Pad Spring
8. Piston Boot
9. Piston
10. Piston Seal
11. Cylinder
12. Bleeder Screw Cap
13. Bleeder Screw

DIAGNOSTIC INFORMATION AND PROCEDURES

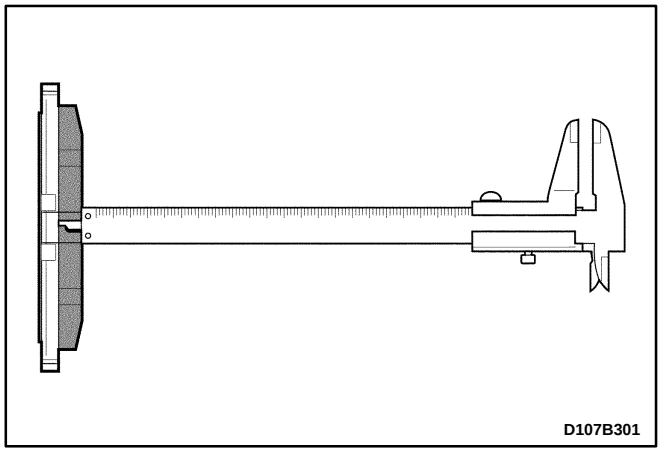
FRONT DISC BRAKE

Condition	Probable cause	Correction
Uneven Braking	● Inoperative carrier.	● Replace the carrier.
	● Sticked caliper piston.	● Repair the caliper piston or replace the caliper assembly, if needed.
Dragging Brake	● Sticked caliper piston.	● Repair the caliper piston or replace the caliper assembly if needed.
Noise and Vibration When Brake Applied	● Excessive rotor run out.	● Replace the rotor.
	● Interference of the dust cover.	● Repair the dust cover.
	● Loose caliper mounting bolts.	● Tighten the mounting bolts.

LINING INSPECTION

1. Raise and suitably support the vehicle.
2. Remove the front wheels. Refer to *Section 2E, Tires and Wheels*.
3. Visually check the linings for minimum thickness and wear.
4. Measure the thickness.

Important: The minimum thickness of the shoe and lining together is 8 mm (0.31 in.).


D107B301

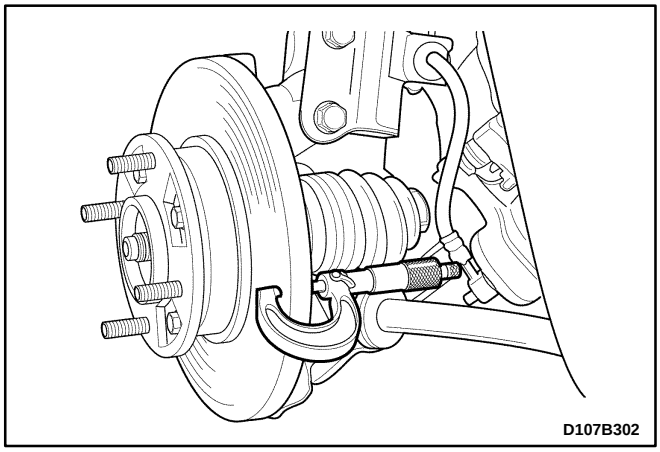
5. Install the shoe and linings in axle sets only.
6. Install the front wheels. Refer to *Section 2E, Tires and Wheels*.
7. Lower the vehicle.

ROTOR INSPECTION

Thickness variation can be checked by measuring the thickness of the rotor at four or more points around the circumference of the rotor. All measurements must be made at the same distance in from the edge of the rotor.

If the thickness of the rotor is below 10 mm (0.40 in.), replace the brake rotor.

During manufacturing, the brake rotor and the tolerances of the braking surface regarding flatness and lateral runout are held very close. The maintenance of close tolerances on the shape of the braking surfaces is necessary to prevent brake roughness.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In addition to these tolerances, the surface finish must be held to a specified range. The control of the braking surface finish is necessary to avoid pulls and erratic performance and to extend lining life.

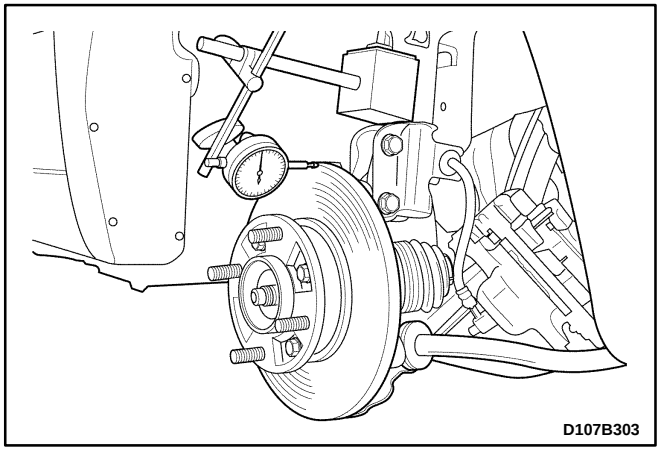
Using a commercially-available dial indicator, check lateral runout as follows:

Notice: Permissible lateral runout is a maximum 0.05 mm (0.002 in.). If lateral runout exceeds the specification, ensure there is no dirt between the rotor and the hub and that contact surfaces are smooth and free from burrs.

1. Position the transaxle in NEUTRAL.
2. Remove the rotor. Refer to “Rotor” in this section.
3. Fasten a dial indicator to the strut.
4. Set the gauge probe tip to approximately 10 mm (0.4 in.) from the outer edge of the brake rotor, perpendicular to the disc and under slight preload.
5. Remove the dial indicator.

Important: Since accurate control of the rotor tolerances is necessary for proper performance of the disc brakes, refinishing of the rotor should be done only with precision equipment.

6. Refinish the rotor, if required, with precision equipment. Discard the rotor if it fails to meet the above specifications after refinishing.
7. Install the rotor. Refer to “Rotor” in this section.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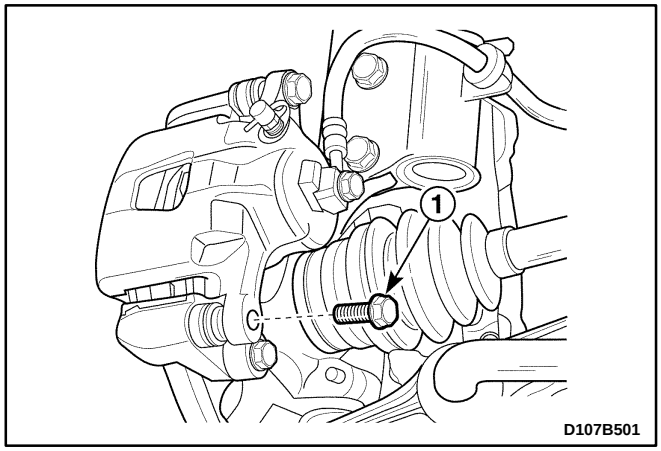
REPAIR INSTRUCTIONS

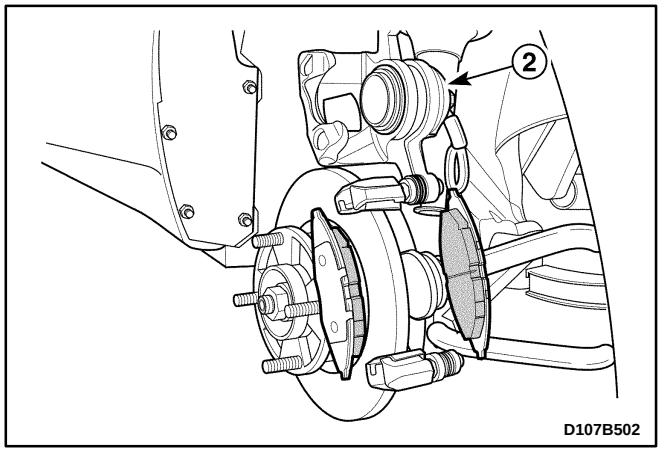
ON–VEHICLE SERVICE



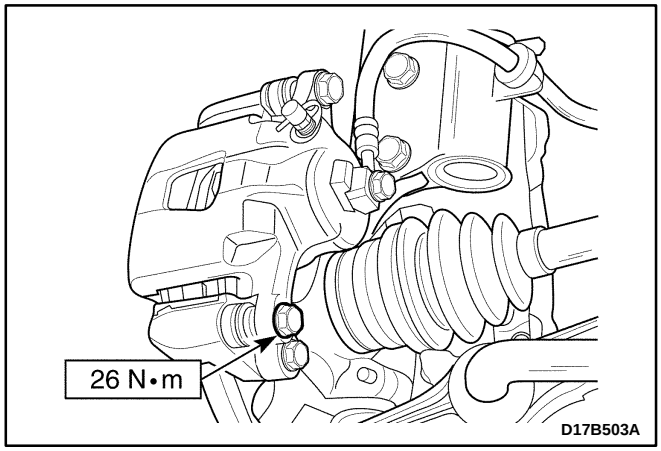
SHOE AND LINING

Removal Procedure

1. Remove the front wheels. Refer to *Section 2E, Tires and Wheels.*
2. Remove the brake pads.
   - Remove the pin bolt (1).



   - Lift up the cylinder assembly (2).

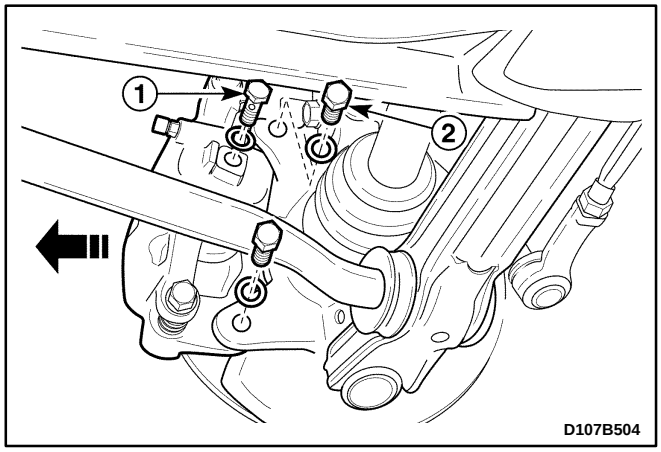


Installation Procedure

1. Install the brake pads and the cylinder assembly with the pin bolt.

   Tighten

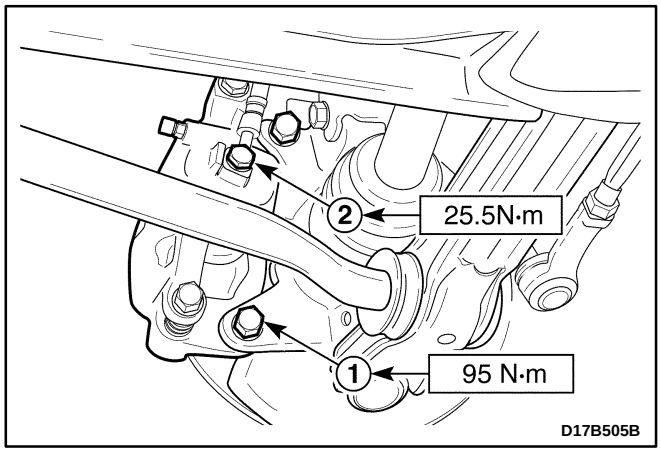
   Tighten the pin bolt to 26 N•m (19 lb-ft).
2. Install the front wheels. Refer to *Section 2E, Tires and Wheels*.



CALIPER ASSEMBLY

Removal Procedure

1. Remove the front wheels. Refer to *Section 2E, Tires and Wheels.*
2. Remove the caliper assembly.
   - Remove the brake hose coupling bolt (1).
   - Plug the opening in the brake hose to prevent fluid loss and contamination.
   - Remove the caliper mounting bolts (2).



Installation Procedure

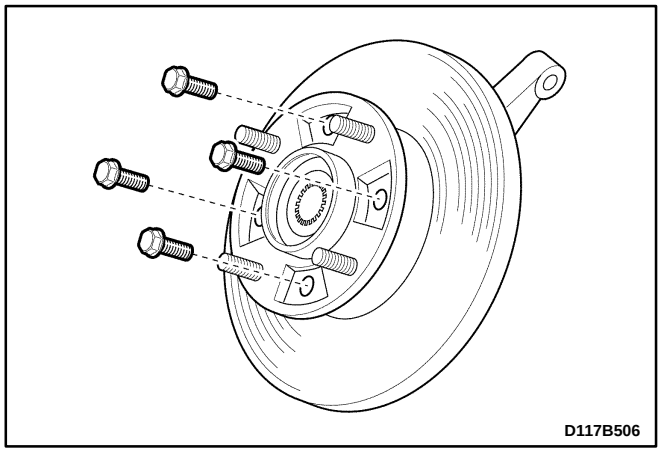
1. Install the caliper assembly with the bolts (1).

   Tighten

   Tighten the caliper–to–steering knuckle bolts to 95 N•m (70 lb-ft).
2. Connect the brake hose (2).

   Tighten

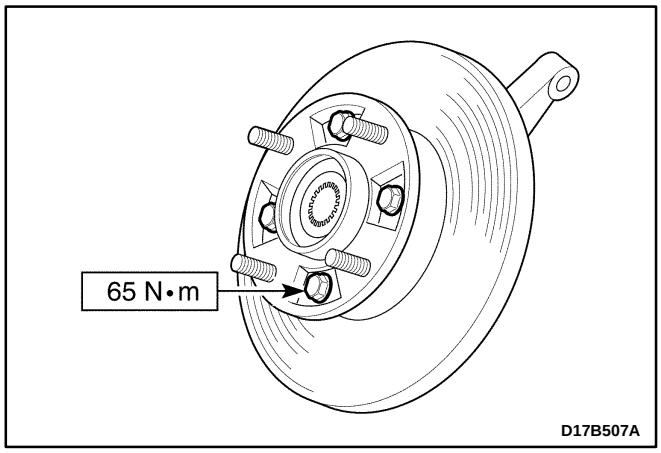
   Tighten the brake hose inlet fitting–to–coupling bolt to 25.5 N•m (19.1 lb-ft).
3. Install the front wheels. Refer to *Section 2E, Tires and Wheels.*
4. Bleed the brake system. Refer to *Section 4A, Hydraulic Brakes.*



ROTOR

Removal Procedure

1. Remove the steering knuckle. Refer to *Section 2C, Front Suspension*.
2. Remove the rotor bolts from the front wheel hub.
3. Remove the rotor. Refer to *Section 2C, Front Suspension*.



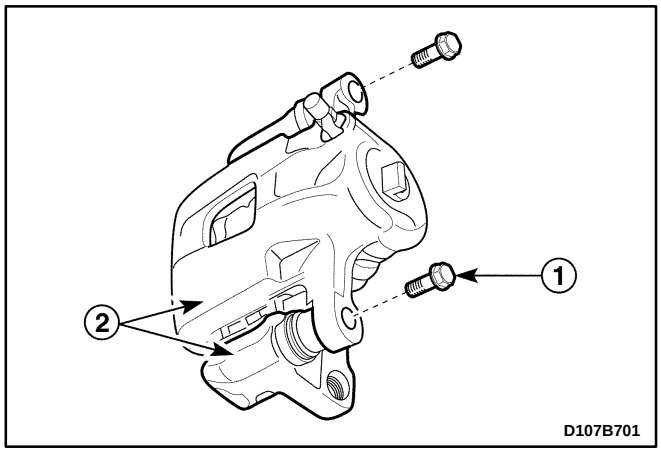
Installation Procedure

1. Install the rotor to the front wheel hub by tightening the detent bolts.

   Tighten

   Tighten the rotor–to–front wheel hub detent bolts to 65 N•m (48 lb-ft).
2. Install the steering knuckle. Refer to *Section 2C, Front Suspension*.

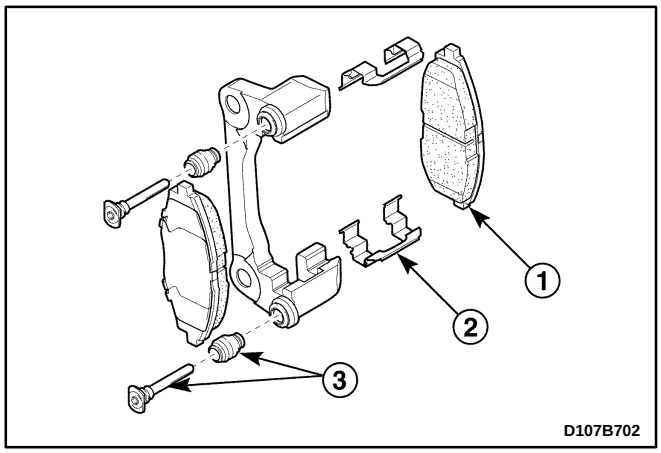
UNIT REPAIR



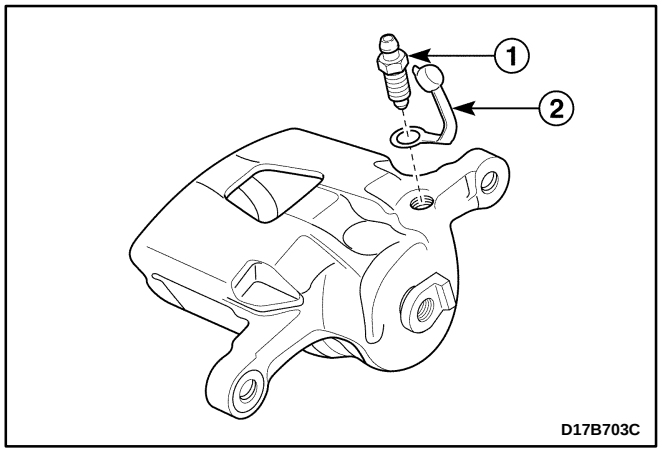
CALIPER OVERHAUL

Disassembly Procedure

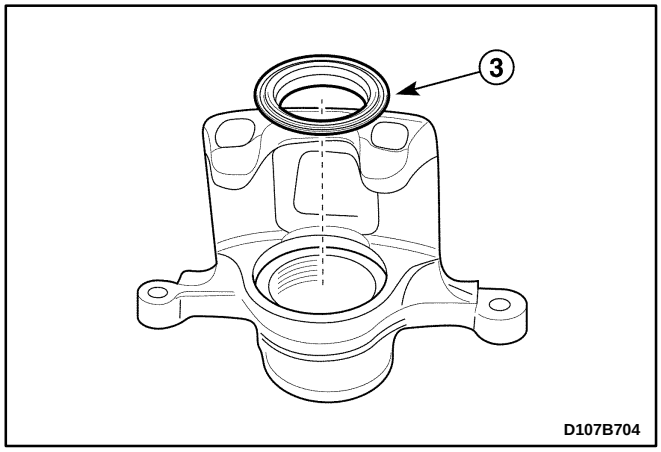
1. Remove the caliper assembly. Refer to “Caliper Assembly” in this section.
2. Separate the cylinder assembly and the carrier.
   - Remove the pin bolts (1).
   - Separate the cylinder assembly and the carrier (2).



3. Disassemble the carrier.
   - Remove the front brake pad set (1).
   - Remove the springs (2).
   - Remove the guide pins and boots (3).
     Refer to “Shoe and Lining” in this section.

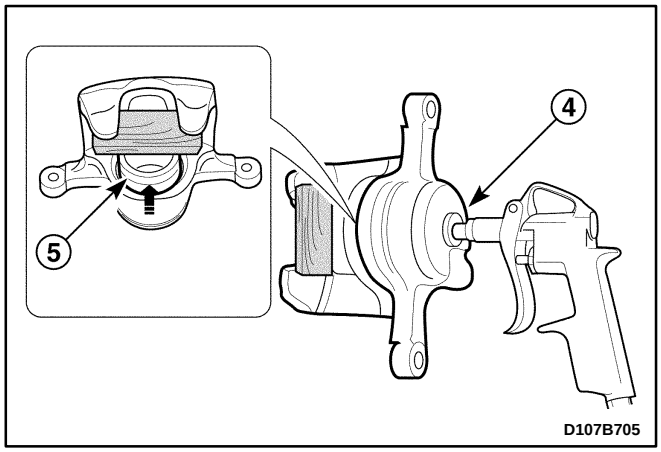


   - Remove the bleeder plug (1).
   - Remove the bleeder plug cap (2).

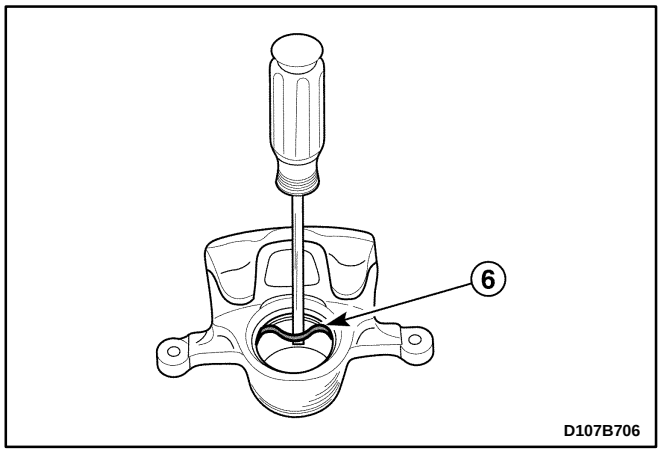


- Remove the piston boot (3).

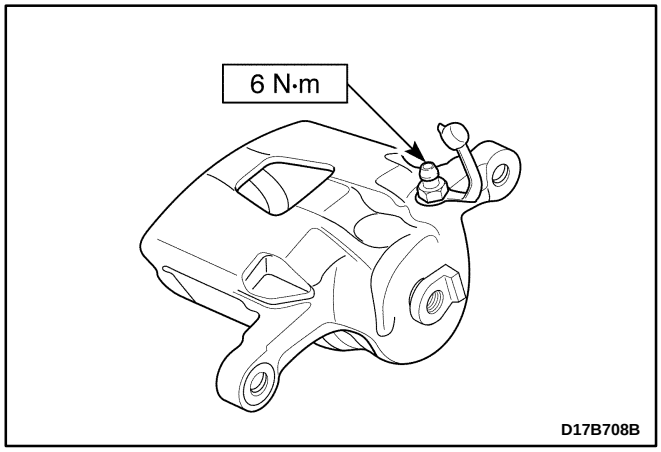
Caution: Do not face in the direction of removing.

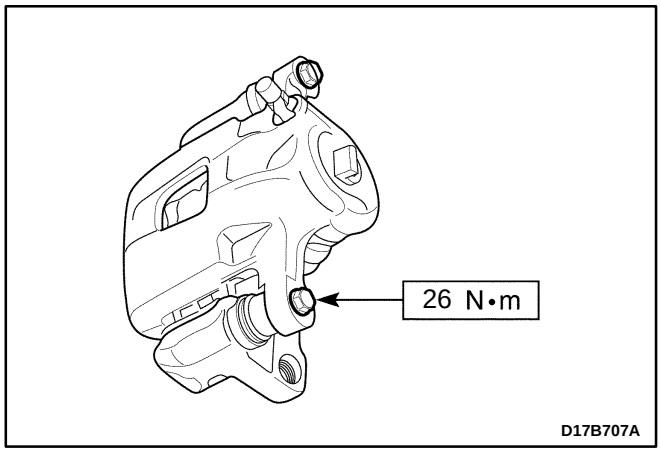


- Using compressed air, blow out the piston from the cylinder (4).
- Remove the piston (5).



- Remove the piston seal (6).





Assembly Procedure

Important: Clean all parts in denatured alcohol. Dry the parts with unlubricated compressed air.

Important: Lubricate the piston with brake fluid.

1. Assembly the cylinder assembly.
   - Install the piston seal.
   - Push the piston inward until it is properly seated.
   - Install the piston boot.
   - Install the bleeder plug.

   ### Tighten

   Tighten the bleeder plug to 6 N•m (53 lb-in).
   - Install the bleeder plug cap.
2. Assemble the carrier.
   - Install the guide pin and boot.
   - Install the spring.
   - Install the pads.
3. Install the pin bolt connecting the cylinder assembly and carrier.

   ### Tighten

   Tighten the pin bolt to 26 N•m (19 lb-ft).
4. Install the caliper assembly. Refer to “Caliper Assembly” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Rotor	Outer Diameter	mm (in.)	236 (9.3)
	Thickness	mm (in.)	12.7 (0.5)
	Discard Thickness	mm (in.)	10 (0.4)
	Runout	mm (in.)	0.05 (0.002)
Caliper	Pad Thickness	mm (in.)	10 (0.40)
	Pad Discard Thickness	mm (in.)	8 (0.31)
	Diameter of the Position	mm (in.)	48 (1.89)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Rotor Bolts	65	48	–
Caliper Mounting Bolts	95	70	–
Pin Bolts	26	19	–
Brake Hose Coupling Bolt	25.5	19.1	–
Bleeder Screw	6	–	53

SECTION 4E

REAR DRUM BRAKES

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DESCRIPTION AND OPERATION

DRUM BRAKES

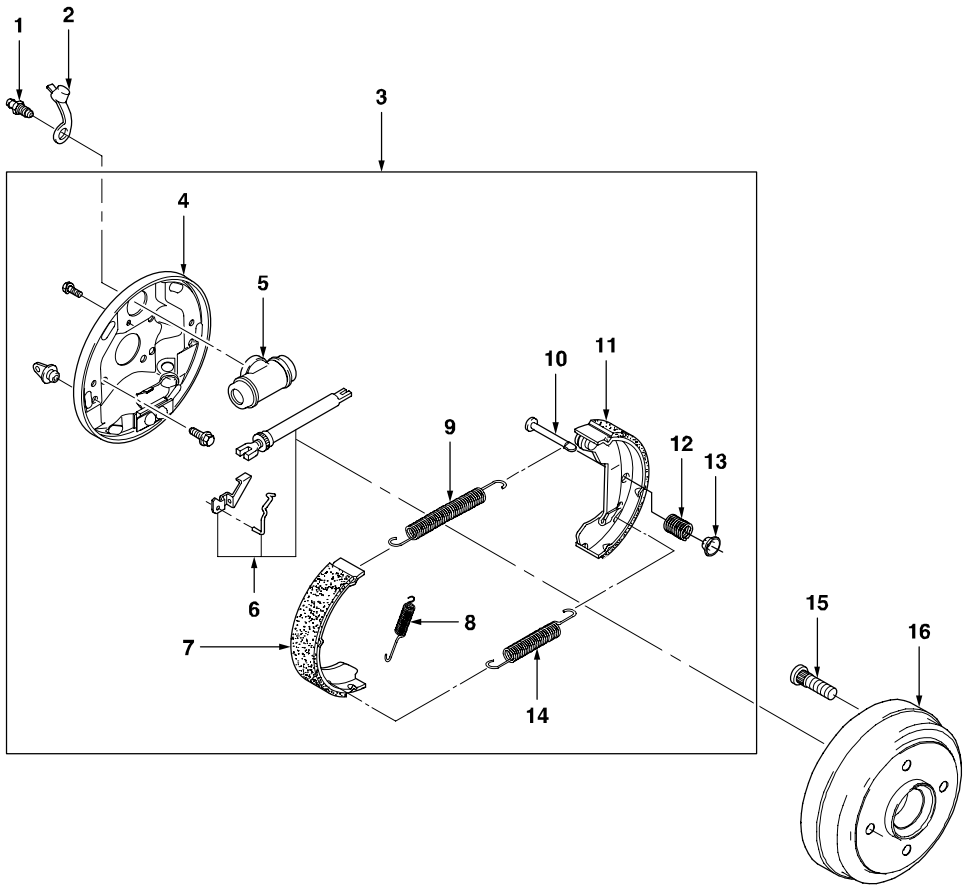
This drum brake assembly is a leading/trailing shoe design. Both brake shoes are held against the wheel cylinder pistons by the lower return spring and the fixed anchor plate near the lower return spring. When the brakes are applied, the wheel cylinder pistons move both shoes out to contact the drum. With forward wheel rotation, the forward brake shoe will wrap into the drum and become self-energized. With reverse wheel rotation, the rear brake shoe is self-energized. Force from the brake shoes is transferred to the anchor plate through the backing plate to the axle flange. Adjustment is automatic and occurs on any service brake application. Do not switch the position of shoes that have been in service, as this may render the self-adjustment feature inoperative and result in increased pedal travel.

Notice:

- Replace all the components included in the repair kits used to service this drum brake.
- Do not use lubricated shop air on the brake parts, as damage to the rubber components may result.
- If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the braking system.
- The torque values specified are for dry, unlubricated fasteners.
- Perform service operations on a clean bench that is free from all mineral oil materials.

COMPONENT LOCATOR

REAR DRUM BRAKES



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1. Bleeder Screw
2. Bleeder Screw
3. Rear Brake Assembly
4. Rear Brake Plate
5. Wheel Cylinder
6. Strut Assembly
7. Brake Leading Shoe
8. Middle Return Spring
9. Upper Return Spring
10. Brake Shoe Retain Spring Pin
11. Trailing Shoe
12. Brake Shoe Retain Spring
13. Brake Shoe Retain Spring Cap
14. Lower Return Spring
15. Hub Bolt
16. Rear Brake Drum

DIAGNOSTIC INFORMATION AND PROCEDURES

REAR DRUM BRAKE

Condition	Probable cause	Correction
Not Enough Braking Force	● Badly worn brake shoe lining.	● Replace the lining.
	● Lining stained with oil.	● Check the wheel cylinder leaks and then replace the wheel cylinder or the lining, if needed.
	● Wheel cylinder condition faulty.	● Replace the wheel cylinder.
	● Malfunctioning self–adjustment feature.	● Repair the self–adjustment feature.
Uneven Braking	● Lining stained with oil.	● Check the wheel cylinder leaks and then replace the wheel cylinder or the lining, if needed.
	● Wheel cylinder condition faulty.	● Replace the wheel cylinder.
	● Malfunctioning self–adjustment feature.	● Repair the self–adjustment feature.
Dragging Brakes After Pedal is Released	● Weakened brake shoe return spring.	● Replace the brake shoe return spring.
	● Wheel cylinder condition faulty.	● Replace the wheel cylinder.
Excessive Pedal Travel	● Excessively worn lining.	● Replace the lining.
	● Malfunctioning self–adjustment feature.	● Repair the self–adjustment feature.
Braking Noise or Vibration	● Foreign material stuck to drum.	● Clean the rear drum brake.
	● Loosen brake plate bolt.	● Tighten the brake plate bolt.
	● Damaged drum.	● Replace the drum.
Poor Braking Force of Parking Brake	● Lining stained with oil.	● Check the wheel cylinder leaks and then replace the wheel cylinder or the lining, if needed.
	● Damaged self–adjustment feature.	● Repair the self–adjustment feature.
	● Poor adjustment of parking brake cable.	● Adjust the parking brake cable.

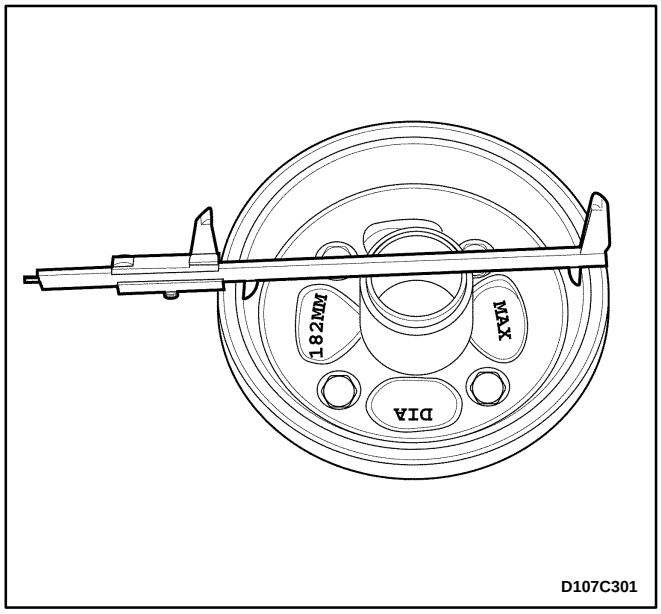
DRUMS

Inspect the brake drum as follows ;

1. Inspect the drum for crack or damage.
2. Measure the inside diameter.

Unit : mm (in.)

Inside Diameter Wear Limit Value	182 (7.165)



D107C301

3. If the measured value is over the limit value, or if the defect is found, replace the drum.

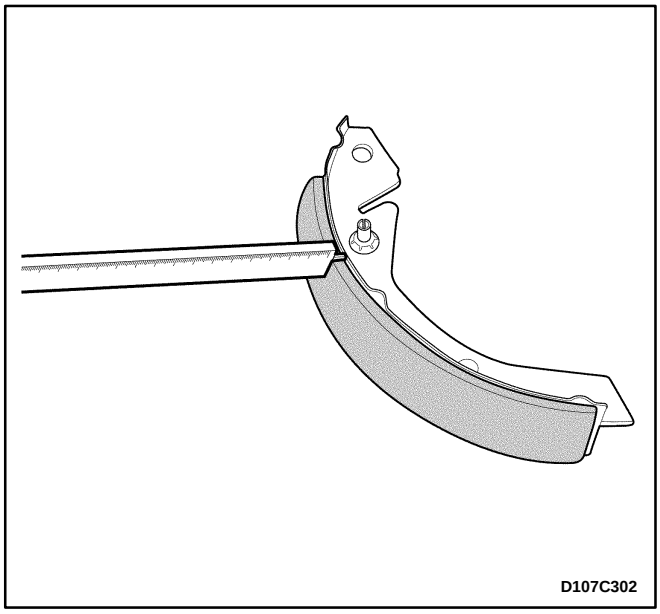
LINING

Inspect the brake drum as follows ;

1. Inspect the lining for wear or stain with oil.
2. Measure the thickness.

Unit : mm (in.)

Lining Wear Limit Value	1 (0.039)

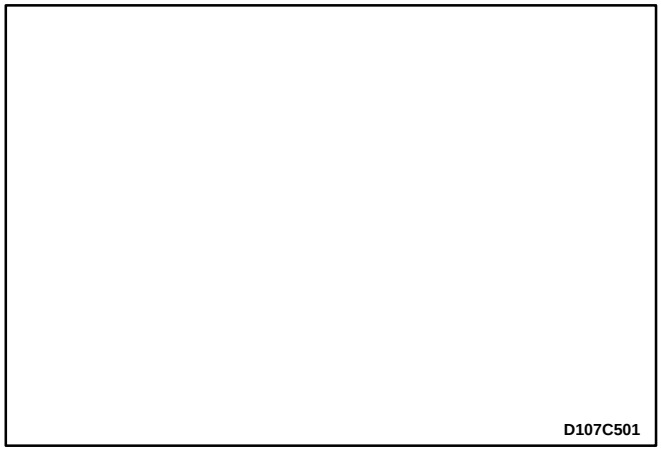


D107C302

3. If the measured value is within the limit value, or if the defect is found, replace the lining.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE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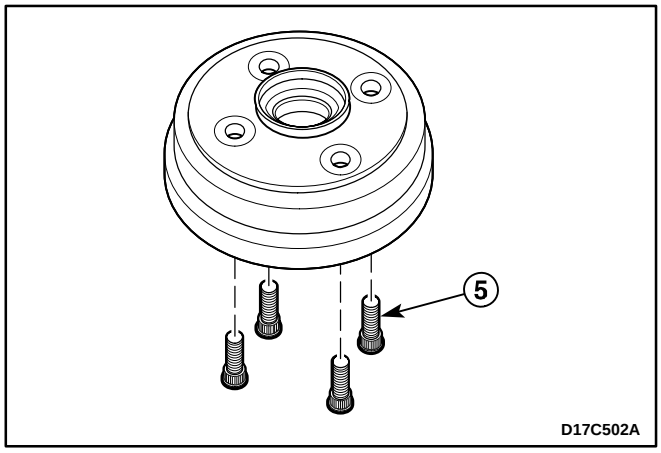

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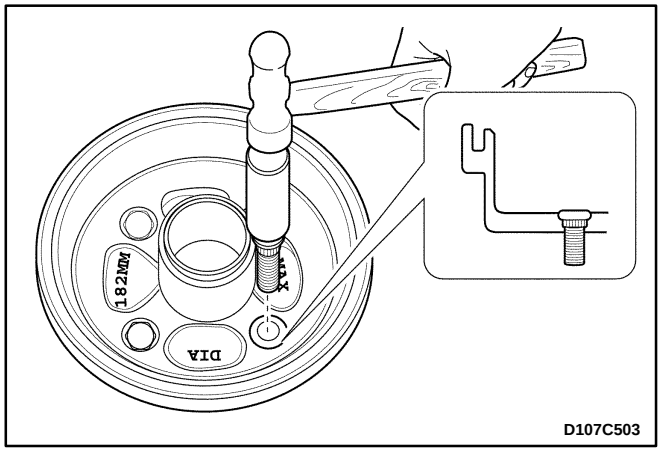

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REAR BRAKE DRUM

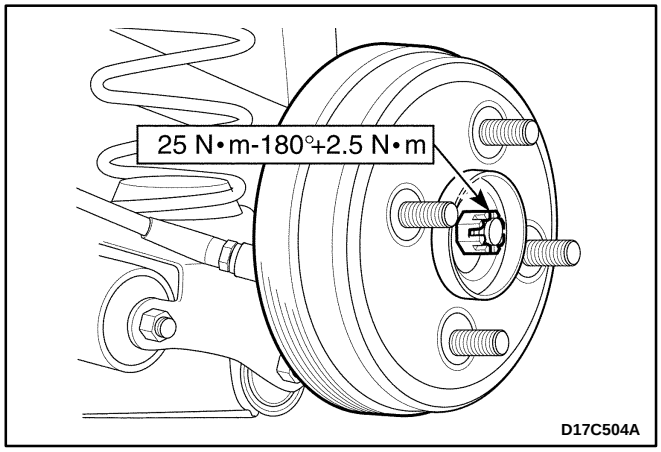
Removal Procedure

1. Remove the rear wheels. Refer to *Section 6E, Tires and Wheels.*
2. Release the parking brake.
3. Remove the brake drum.
   - Remove the spindle cap (1).
   - Remove the cotter pin and do not reuse it (2).
   - Remove the castellated nut (3).
   - Remove the rear axle washer (4).
   - Remove the bearing, race and oil seal. Refer to *Section 2D, Rear Suspension*.
   - Remove the hub bolts using a hammer (5).

Important: Do not reuse removed hub bolts.

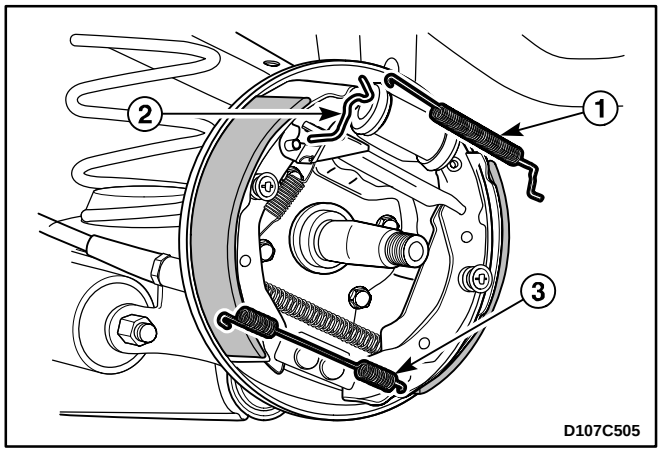
Installation Procedure

1. Install the brake drum.
   - Insert the new hub bolts using a hammer.
   - Install the bearing, race, oil seal and rear axle washer.



- Tighten the castellated nut to 25 N•m (18 lb-ft).
- Loosen the castellated nut to 180°.
- Retighten the castellated nut to 2.5 N•m (22 lb-in).
- Install the new cotter pin and spindle cap.

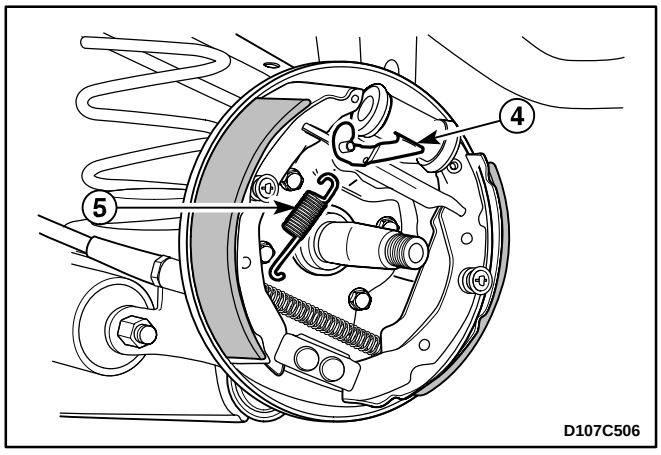
2. Adjust the parking brake.
3. Install the rear wheels. Refer to *Section 6E, Tires and Wheels.*



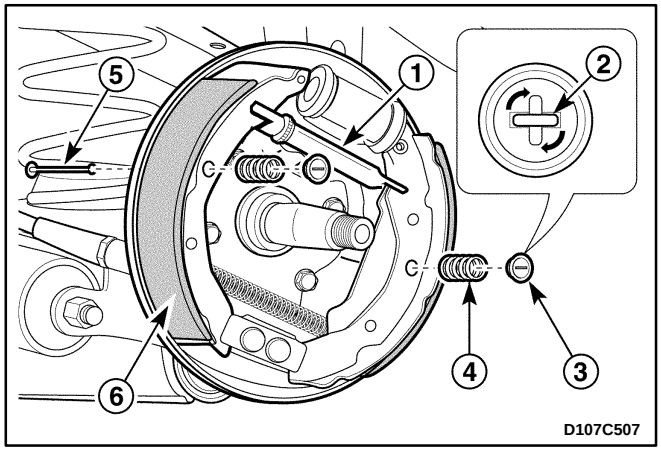
BRAKE SHOE

Removal Procedure

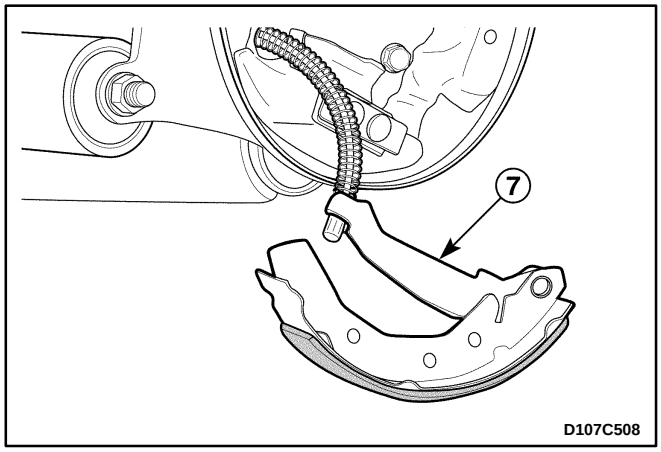
1. Remove the brake drum. Refer to “Brake Drum” in this section.
2. Remove the return spring.
   - Remove the upper return spring (1).
   - Remove the upper return spring bracket (2).
   - Remove the lower return spring (3).



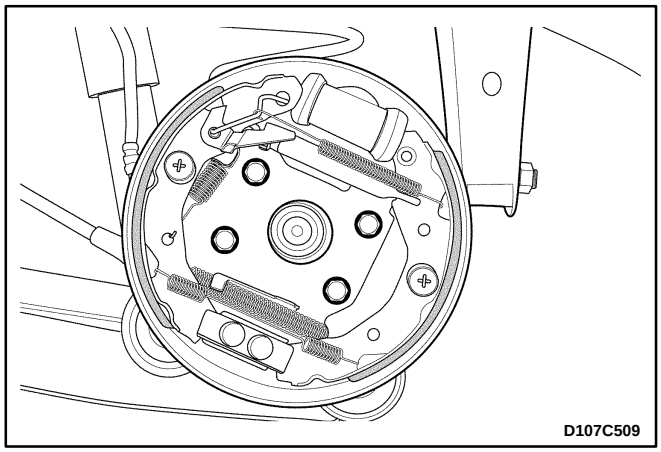
- Remove the adjust lever (4).
- Remove the middle return spring (5).



3. Remove the brake shoe.
   - Remove the readjusting unit (1).
   - Turn the brake shoe retaining spring pin rectangularly by the pliers (2).
   - Remove the brake shoe retain spring cap (3).
   - Remove the retaining spring (4).
   - Remove the retaining spring pin (5).
   - Remove the leading shoe (6).



4. Disconnect the parking brake cable from the trailing shoe and remove the trailing shoe (7).

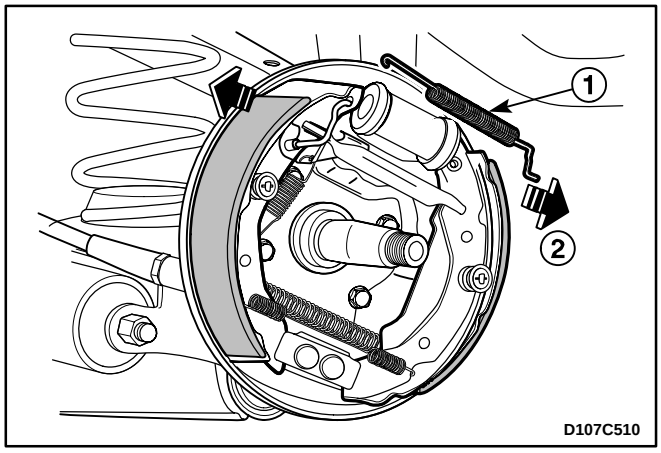


Installation Procedure

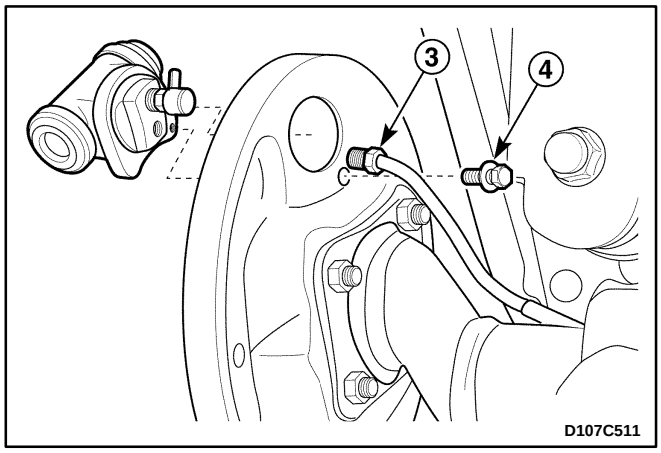
1. Install in the reverse of removal.
2. Clean the adjust assembly and apply grease.
3. Connect the parking brake cable from the trailing shoe.
4. Install the brake shoe.
5. Install the return spring.
   - Install the middle return spring and adjust lever.
   - Install the lower return spring.
   - Install the upper return spring bracket.
   - Install the upper return spring.
6. Install the brake drum. Refer to “Brake Drum” in this section.

WHEEL CYLINDER ASSEMBLY

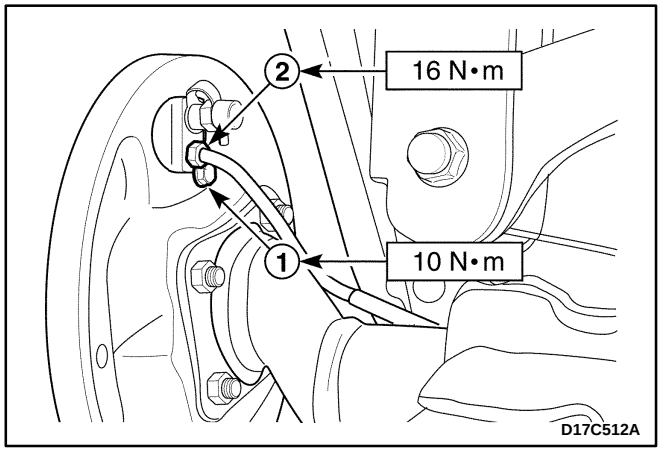
Removal Procedure



1. Remove the brake drum. Refer to “Rear Brake Drum” in this section.
2. Remove the wheel cylinder.
   - Remove the brake shoe upper spring (1).
   - Widen the leading shoe and trailing shoe (2).



   - Disconnect the brake line fitting (3).
   - Plug the opening in the brake line to prevent fluid loss or contamination.
   - Remove the wheel cylinder–to–backing plate bolt (4).



Installation Procedure

1. Install the wheel cylinder to the backing plate with the wheel cylinder bolt (1).

   Tighten

   Tighten the wheel cylinder–to–backing plate bolt to 10 N•m (89 lb-in).
2. Connect the brake line fitting (2).

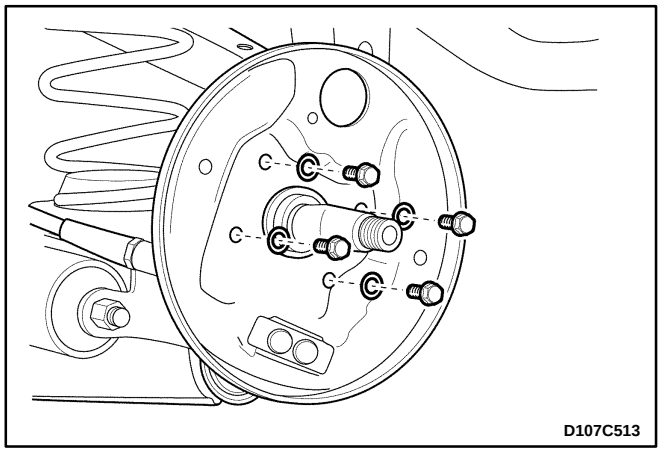
   Tighten

   Tighten the brake line fitting to 16 N•m (12 lb-ft).
3. Install the brake shoe. Refer to “Brake Shoe” in this section.
4. Install the brake drum. Refer to “Rear Brake Drum” in this section.

BACKING PLATE

Removal Procedure

1. Remove the brake drum. Refer to “Rear Brake Drum” in this section.
2. Remove the brake shoe components. Refer to “Brake Shoe” in this section.
3. Remove the wheel cylinder assembly. Refer to “Wheel Cylinder Assembly” in this section.
4. Remove the bolts and the backing plate.

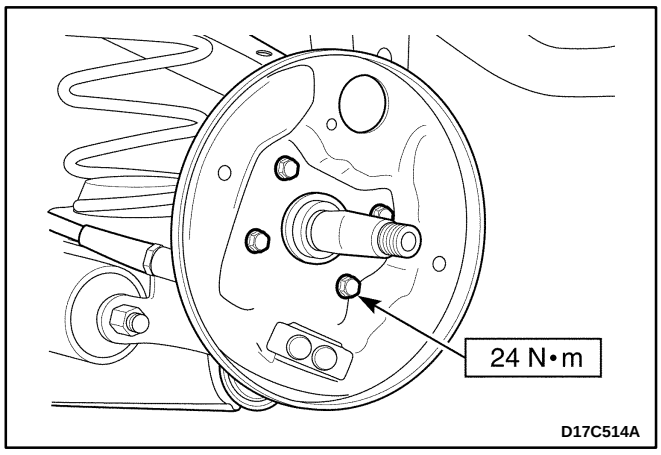


Installation Procedure

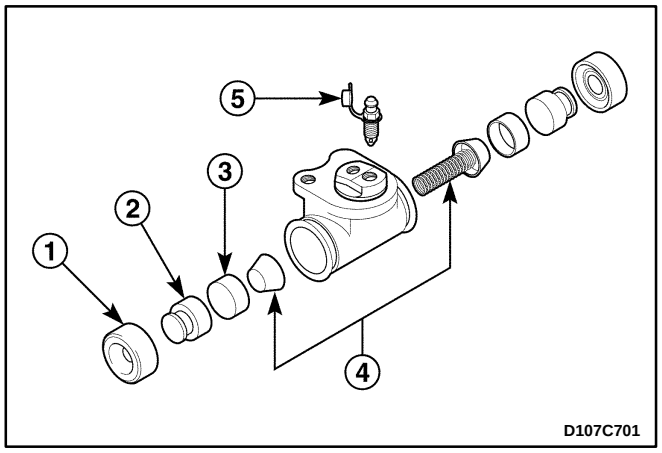
1. Install the bolts and the backing plate.

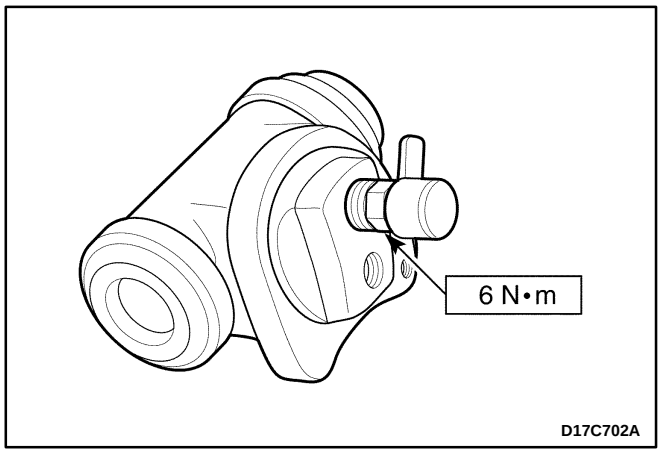
   Tighten

   Tighten the backing plate–to–rear axle bolts to 24 N•m (18 lb-ft).
2. Install the wheel cylinder assembly. Refer to “Wheel Cylinder Assembly” in this section.
3. Install the brake shoe components. Refer to “Brake Shoe” in this section.
4. Install the brake drum.



UNIT REPAIR





WHEEL CYLINDER

Disassembly Procedure

1. Remove the wheel cylinder assembly. Refer to “Wheel Cylinder Assembly” in this section.
2. Disassemble wheel cylinder assembly.
   - Remove the dust boots and do not reuse them (1).
   - Remove the piston (2).
   - Remove the piston cup and do not reuse it (3).
   - Remove the spring assembly (4).
   - Remove the bleeder screw (5).
3. Clean all parts with denatured alcohol. Dry the parts with unlubricated compressed air.

Assembly Procedure

Important: Lubricate the new seals, the piston, the piston cup and the wheel cylinder bore with clean brake fluid before assembly.

1. Assemble wheel cylinder assembly.
   - Insert the bleeder screw.

   #### Tighten

   Tighten the bleeder screw to 6 N•m (53 lb-in).
   - Install the spring and the new piston cup.
   - Install the piston and the new boots.
2. Inspect the piston for free movement.
3. Install the wheel cylinder assembly. Refer to “Wheel Cylinder Assembly” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Unit	Description
Drum	Inside Diameter	mm (in.)	180 (7.086)
	Wear Limit	mm (in.)	182 (7.165)
	Out of Round	mm (in.)	0.04 (0.001)
	Cylindricty	mm (in.)	0.02 (0.0008)
Brake Lining	Thickness	mm (in.)	4 (0.157)
	Wear Limit	mm (in.)	1 (0.039)
	Distance Between Lining and Drum	mm (in.)	0.3 (0.011)
Wheel Cylinder	Inside Diameter	mm (in.)	17.46 (0.687)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Castellated Nut*	–	–	–
Wheel Cylinder Bolt	10	–	89
Brake Backing Plate Bolt	24	18	–
Brake Pipe Fitting	16	12	–
Bleeder Screw	6	–	53

✻ Castellated Nut : 25 N•m – 180° + 2.5 N•m (18 lb-ft – 180° + 22 lb-in.)

SECTION 4F

ANTILOCK BRAKE SYSTEM

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.

CAUTION: Don't diagnosis the Antilock Brake System (ABS) under the vehicle moving status. Because the ABS function will be stopped.

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DESCRIPTION AND OPERATION

ABS SYSTEM COMPONENTS

The Antilock Braking System (ABS) consists of a conventional hydraulic brake system plus antilock components. The conventional brake system includes a vacuum booster, master cylinder, front disc brakes, rear drum brakes, interconnecting hydraulic brake pipes and hoses, brake fluid level sensor and the BRAKE indicator.

The ABS components include a hydraulic unit, an electronic brake control module (EBCM), two system fuses, four wheel speed sensors (one at each wheel), interconnecting wiring, the ABS indicator, and the rear drum brake. See “ABS Component Locator” in this section for the general layout of this system.

HYDRAULIC UNIT

The hydraulic unit with the attached EBCM is located between the surge tank and the fire wall on the right side of the vehicle. The basic hydraulic unit configuration consists of return pump motor, return pump, four isolation valves, four dump valves, two Low Pressure Accumulators (LPA), two High Pressure Attenuators (HPA). The hydraulic unit controls hydraulic pressure to the front calipers and rear wheel cylinders by modulating hydraulic pressure to prevent wheel lockup.

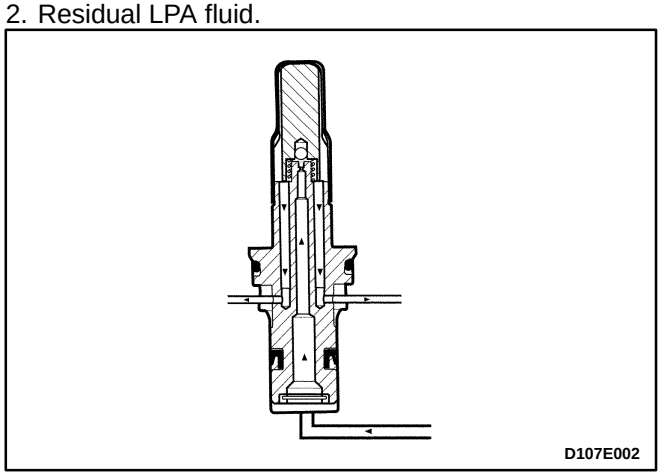
Isolation valve

The isolation valve is placed in the brake fluid path from the master cylinder to the relevant brake caliper and allows free flow as commanded by the driver during normal braking and reapply phases.

In the isolation phase the coil moves the armature down, which closes the normally open isolation orifice and prevents any further increase of pressure in the brake. The valve also remains closed during the dump phase.

The lip seal provides a one way return path for brake fluid to flow through in:

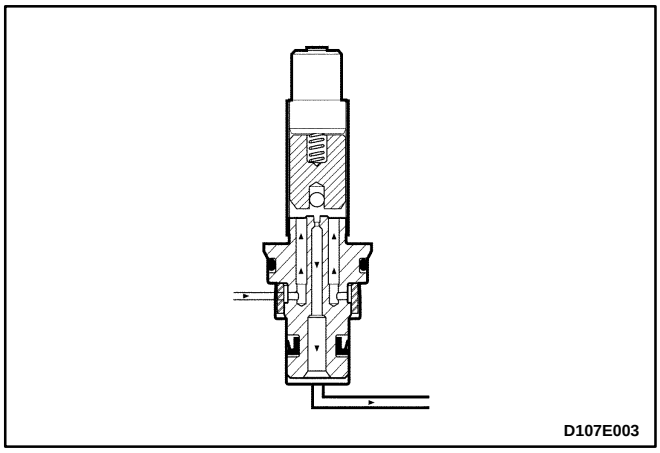
1. Foot off pedal during isolation.
2. Residual LPA fluid.



Dump Valve

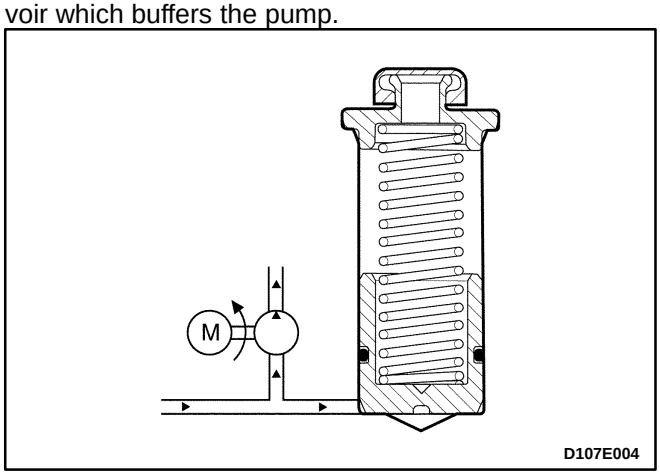
The dump valve creates a flow path from the isolation cartridge (brake side) to the low pressure accumulator (LPA). The valve keeps this path permanently closed except during the dump phase in the ABS mode. On activation (dump phase), the coil moves up the armature which opens the normally closed dump orifice and allow to drain the pressure in the brake line with the brake fluid flowing into the LPA.

The lip seal provides a return path for residual brake fluid in the LPA.



Low Pressure Accumulator (LPA)

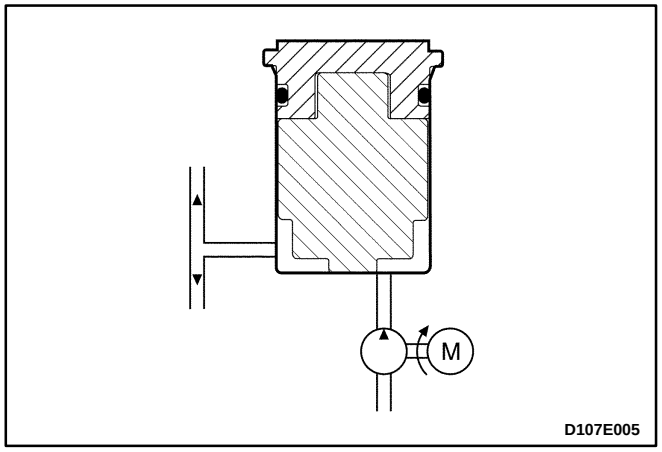
LPA provides a variable chamber for brake fluid to be quickly pushed in through the dump valve at the beginning of a departure. This chamber then acts as a reservoir which buffers the pump.



High Pressure Attenuator (HPA)

The HPA is in between the pump and the ISO valve (master cylinder side) and uses the bulk mode of the contained plastic damper and orifice size to dump out the pressure oscillations from the pump to reduce the

feed back to the master cylinder and brake pedal.



Return Pump Motor

The motor drives two pump elements through the eccentric wheel on its shaft.

Return Pump

Description: Each pump element consists of a fixed displacement piston driven by an eccentric on the end of the eccentric motor. It has two check valves (inlet and outlet) and is fed with fluid by the low pressure accumulator.

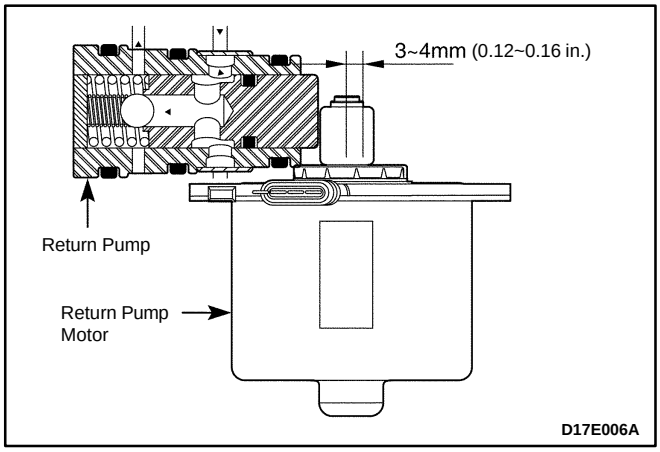
Operation:

Compression stroke: the pump is filled via the inlet ball seat, then the motor eccentric rotates moving the piston to displace the fluid. After the pressure build-up closes the inlet valve the piston displacement increases the pressure until the outlet ball opens. The outlet pressure will continue to increase for the rest of the piston stroke.

Return Stroke: The piston retracts, forced by its spring, as the motor eccentric returns to its low end position. The pressure at the inlet side of the outlet ball then decreases due to the displaced volume and the pressure difference across this ball holds it closed.

The pressure at the outlet side of the inlet ball seat, which is set to open at a certain pressure level also decreases until this valve opens. With the outlet ball closed, the pump is filled with additional fluid from the low pressure accumulator.

The pressure will continue until a stall point is reached and compression of the piston cannot generate enough differential pressure anymore to open the outlet ball seat.



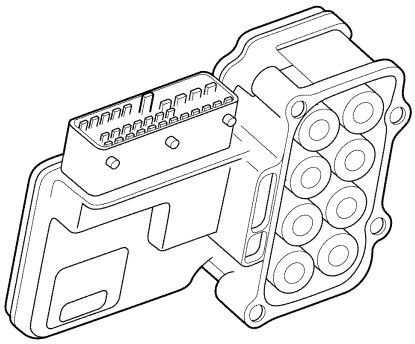
EBCM (ELECTRONIC BRAKE CONTROL MODULE)

Notice: There is no serviceable. The EBCM must be replaced as an assembly.

The EBCM is attached to the hydraulic unit in the engine compartment. The controlling element of ABS is a microprocessor-based EBCM. Inputs to the system include the four wheel speed sensors, the stoplamp switch, the ignition switch, and the unswitched battery voltage. There is an output to a bi-directional serial data link, located in pin M of the assembly line diagnostic link (ALDL), for service diagnostic tools and assembly plat testing.

The EBCM monitors the speed of each wheel. If any wheel begins to approach lockup and the brake switch is closed (brake pedal depressed), the EBCM controls the dump valve to reduce brake pressure to the wheel approaching lockup. Once the wheel regains traction, brake pressure is increased until the wheel again begins to approach lockup. The cycle repeats until either the vehicle comes to a stop, the brake pedal is released or no wheels approach lockup.

Additionally, the EBCM monitors itself, each input (except the serial data link), and each output for proper operation. If it detects any system malfunction, the EBCM will store a DTC in nonvolatile memory (DTCs will not disappear if the battery is disconnected).



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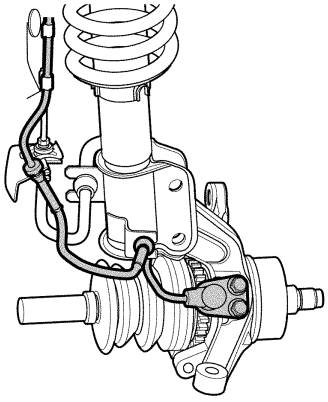
WHEEL SPEED SENSORS AND RINGS

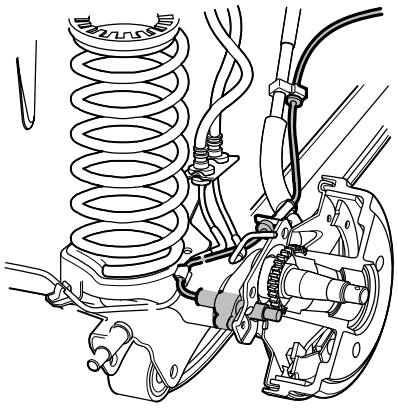
Front wheel speed sensors are installed to the front knuckle and rear wheel speed sensors are installed to the backing plate.

Wheel speed sensors are no serviceable. And the air cap is not adjusted. Front wheel speed sensor ring is pressed onto the drive axle shaft. Each ring contains 40 equally spaced teeth. Exercise care during service procedures to avoid prying or contacting this ring. Excessive contact may cause damage to one or more teeth.

Rear wheel speed sensor rings are incorporated into the hub drum.



D107E007

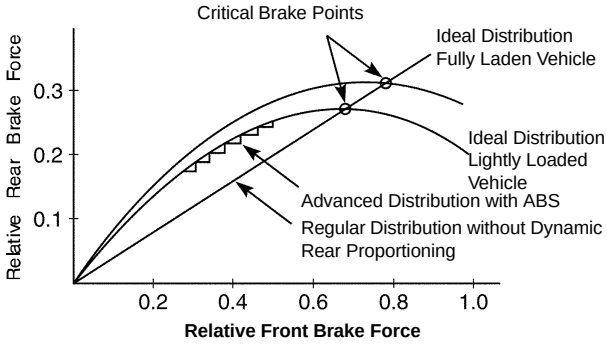


D107E008

ELECTRONIC BRAKE DISTRIBUTION

ABS features an enhanced algorithm which includes control of the brake force distribution between the front and rear axles. This is called Electronic Brake Distribution or Dynamic Rear Proportioning valve. In an unladen car condition the brake efficiency is comparable to the conventional system but for a fully loaden vehicle the efficiency of the Dynamic Rear Proportioning System is higher due to the better use of rear axle braking capability.

No indication is given to the driver when Dynamic Rear Proportioning is activated. Also, DRP remains active even in such cases where the anti-lock function of the ABS is disabled.

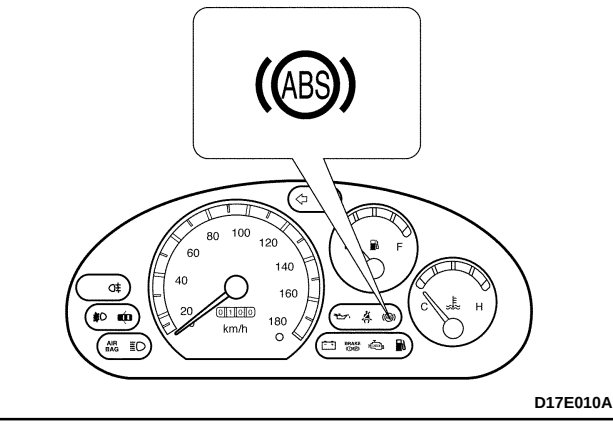


D17E009A

INDICATOR

It illuminates for four seconds immediately after the ignition has been turned on to show that the anti-lock system self-test is being carried out. If the light does not go off after this time it means that there may be a problem and ABS operation is not available.

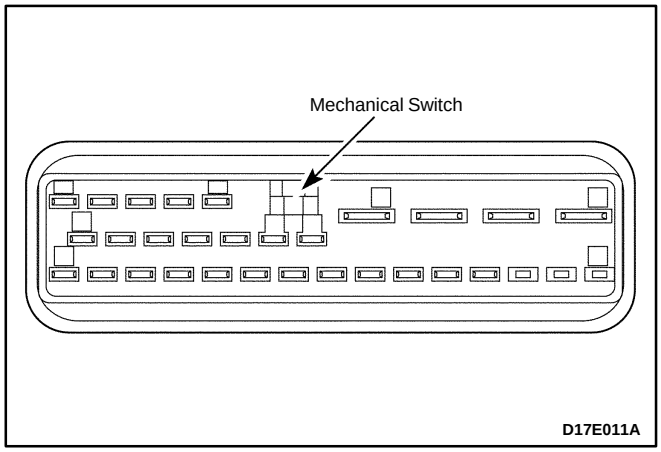
If any malfunction or error, including an unplugged EBCM connector, is detected during vehicle operation, the light will come on, warning the driver that the ABS is not operative and brake operation is in conventional, non-ABS mode.



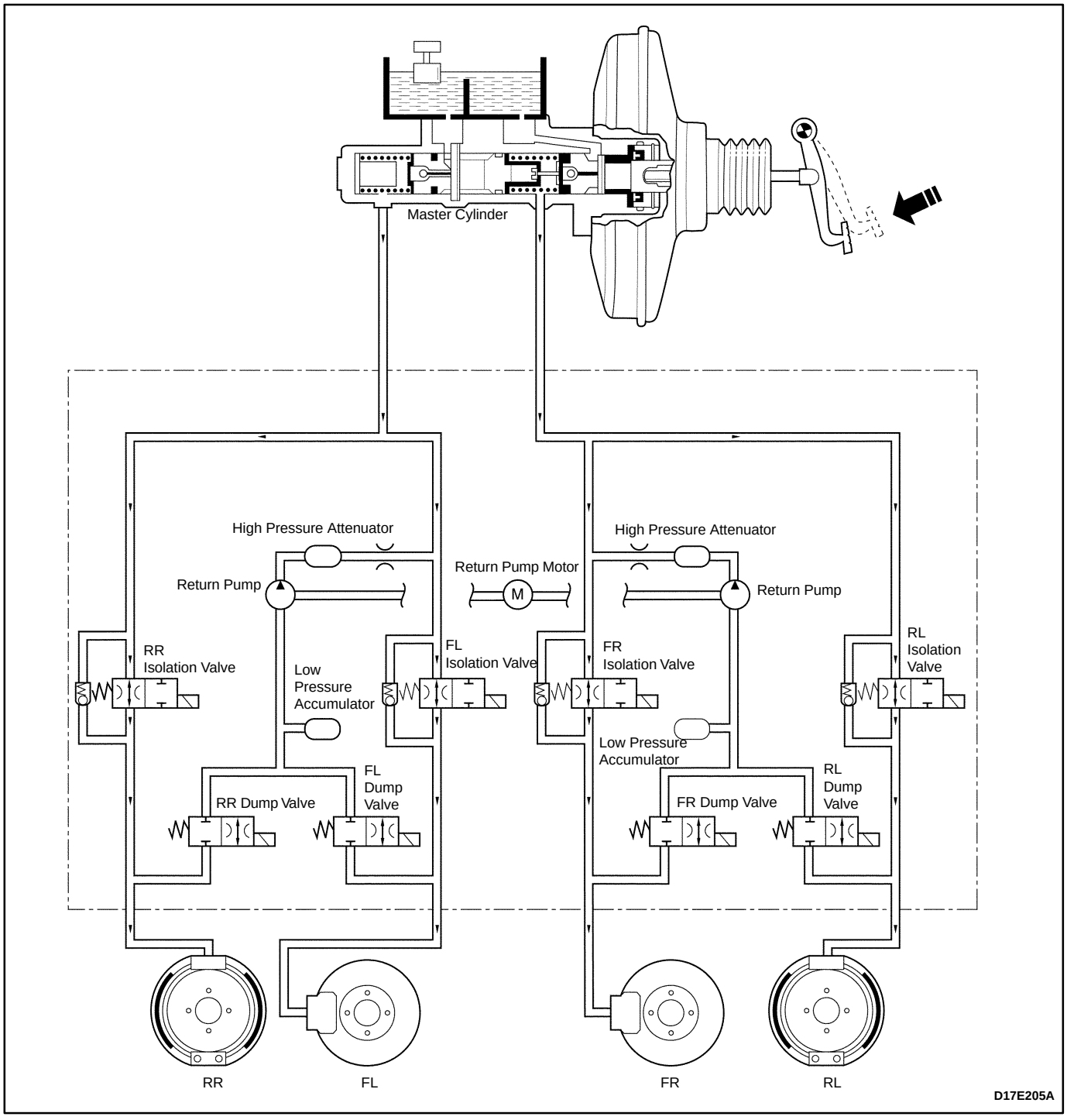
D17E010A

EBCM CONNECTOR

A Connector has 31 pins which are shown below figure. And a connector includes a warning switch which grounds and lights the ABS warning lamp if there is No EBCM unit plugged in, so that an indication is given that ABS is not available.

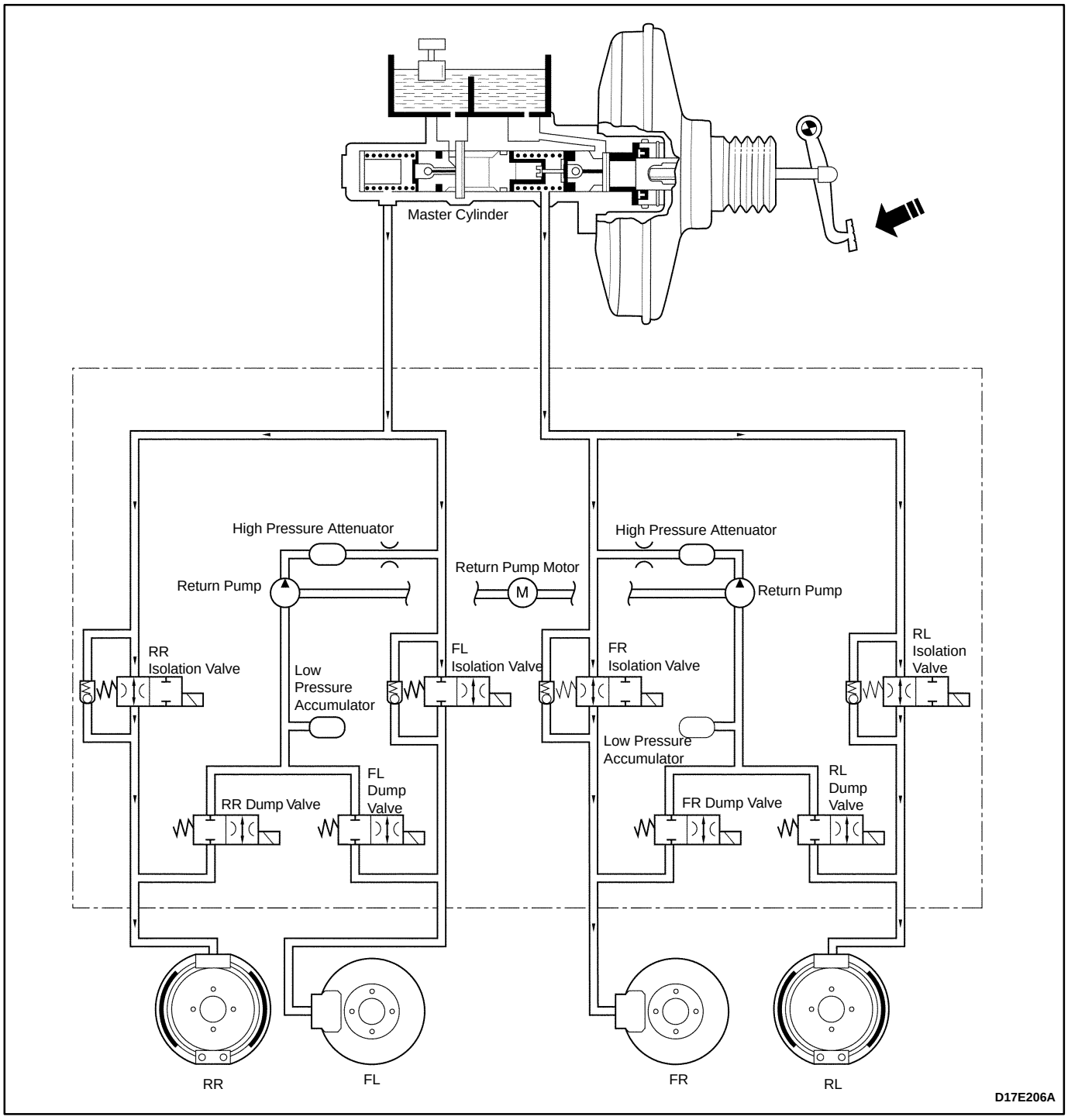


HYDRAULIC FLUID FLOW DIAGRAMS



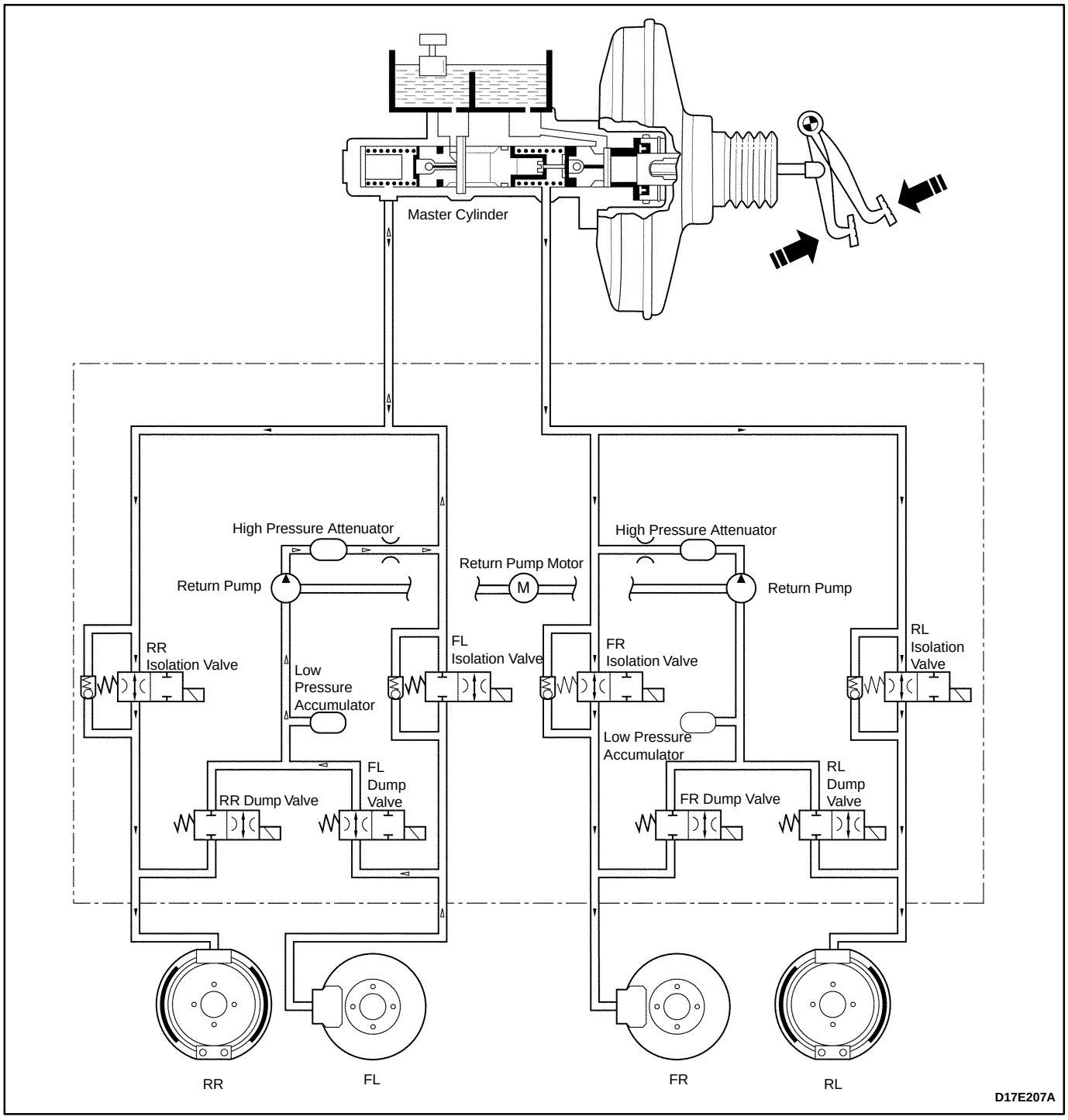
NORMAL BRAKE MODE

During non-antilock braking, pressure is applied through the brake pedal and fluid comes from the master cylinder into the hydraulic unit. The normally open isolation cartridge and normally closed dump cartridge would remain in these positions to allow fluid pressure to the calipers and the wheel cylinders. And each wheel begins locking.



ISOLATION MODE (PRESSURE MAINTAIN)

If the information from the wheel speed sensors indicate excessive wheel deceleration (imminent lockup), the first step in the antilock sequence is to isolate the brake pressure being applied by the driver. The EBCM sends a voltage to the coil to energize and close the isolation valves by pulling down on the armature. This prevents any additional fluid pressure applied by the driver from reaching the wheel. Though each channel of the 4-channel system can operate independently, once any front channel (brake) sees excessive deceleration, both front isolation valves are energized and close thus, with the isolation valves closed, further unnecessary increases in the brake pressure will be prohibited.

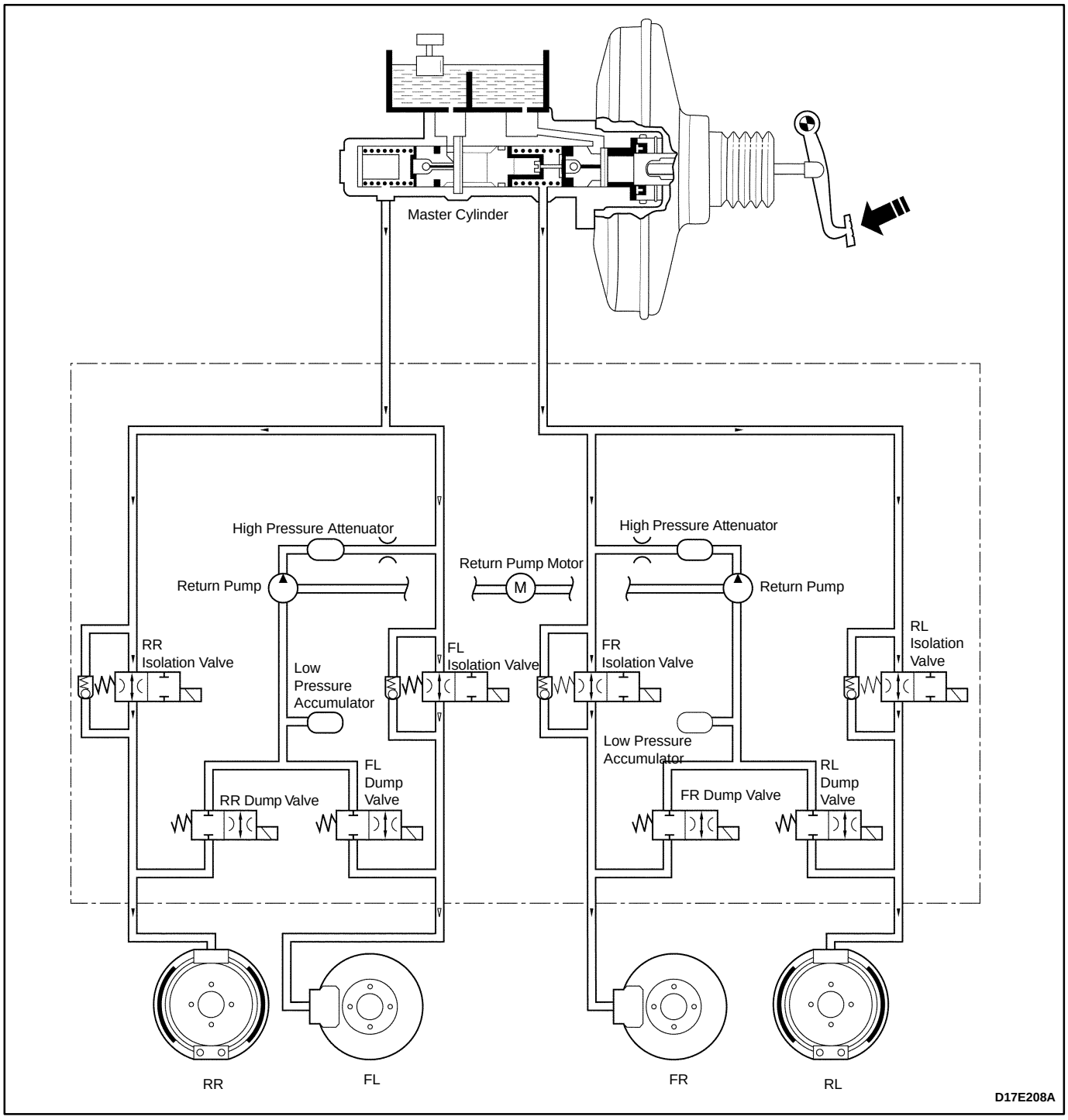


DUMP MODE (PRESSURE DECREASE)

Once the pressure is isolated, it must be reduced to get the wheels rolling once again. This is accomplished by dumping a portion of the brake fluid pressure into a low pressure accumulator (LPA).

The EBCM energizes the dump cartage coil(s) to open the dump cartridge, allowing fluid from the wheels to be dumped into the LPA. This done with very short activation pulses opening and closing the dump cartridge passageway. Brake pressure is lowered at the wheel and allows the wheel to begin spinning again.

The fluid taken from the wheels forces the spring back and is stored in the LPA. A portion of the fluid also primes the pump. The dump cartridges are operated independently to control the deceleration of the wheel.



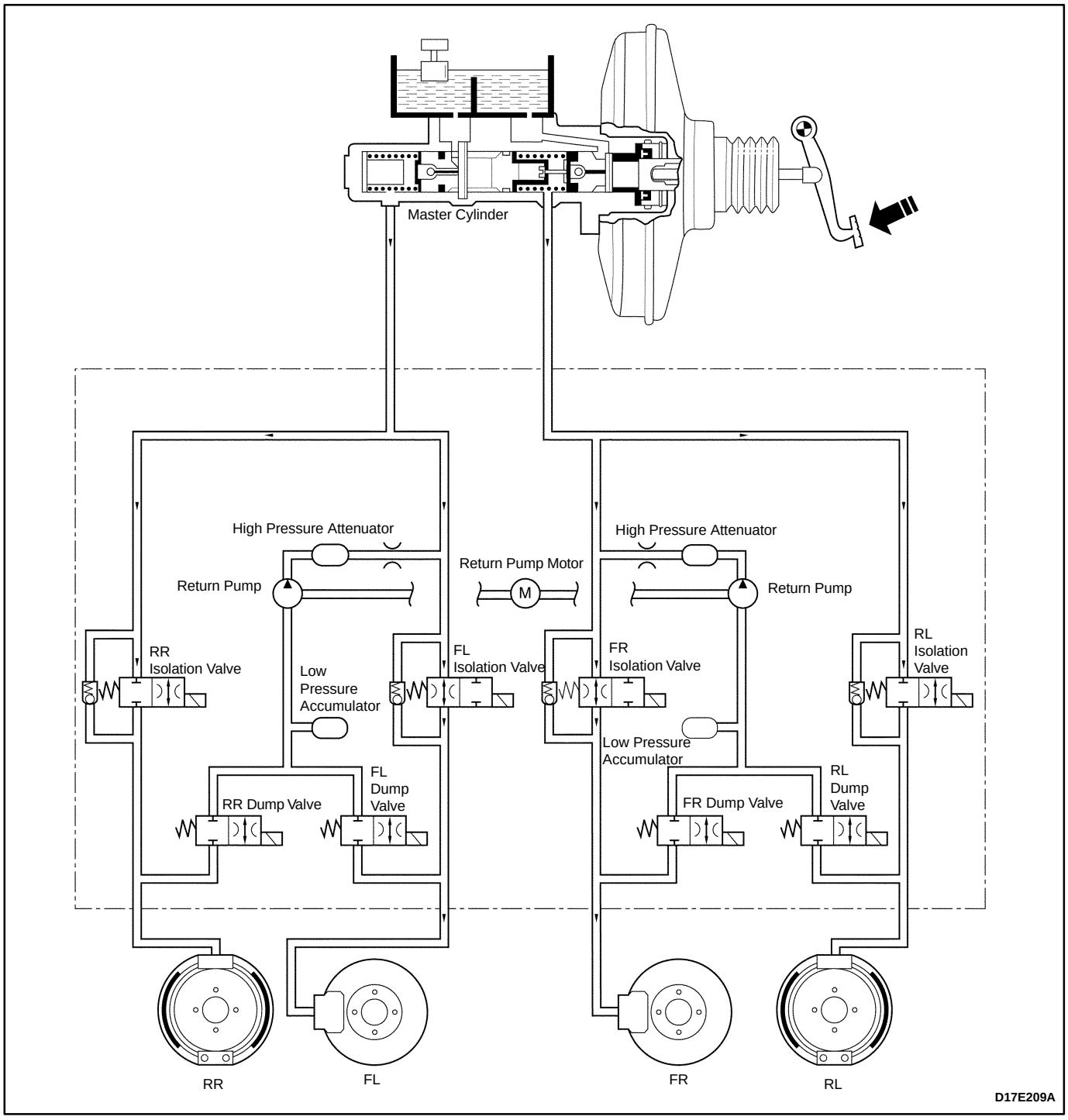
REAPPLY MODE (PRESSURE INCREASE)

This reapply sequence is initiated to obtain optimum braking. The isolation valve is momentarily pumped open to allow master cylinder and pump pressure to reach the brakes. This controlled pressure rise continues unitl the wheel is at optimum brake output or until the brake pressure is brough up to the master cylinder output pressure.

If more pressure is required, more fluid is drawn from the master cylinder and applied to the brakes. The driver may feel slight pedal pulsations, or pedal drop, this is normal and expected.

As fluid is reapplied to the wheel, they begin to slow down. If they approach imminent lockup again, the EBCM will isolate, dump and reapply again. The control cycle (isolation, dump, reapply) occurs in milli-second intervals, allowing seveal cycles to occur each second.

It is a much faster and more controlled way of “pumping the pedal”.



PROPORTIONING FUNCTION

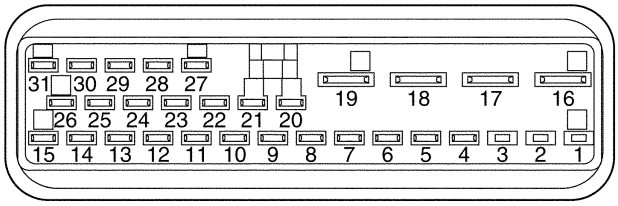
If the rear wheels lock formerly during braking, the vehicle may lose the stability. Therefore to prevent this, the ECM processes the speed sensor signal and brake signal to determine when the rear wheels are tending to lock up. The EBCM then actuates the rear wheel isolation valves to reduce the rear brake pressure and keep the wheels rolling.

VISUAL IDENTIFICATION

EBCM CONNECTOR FACE VIEW

Terminal 9 is identified as they appear from the wire entry end of the harness connector.

EBCM Connector

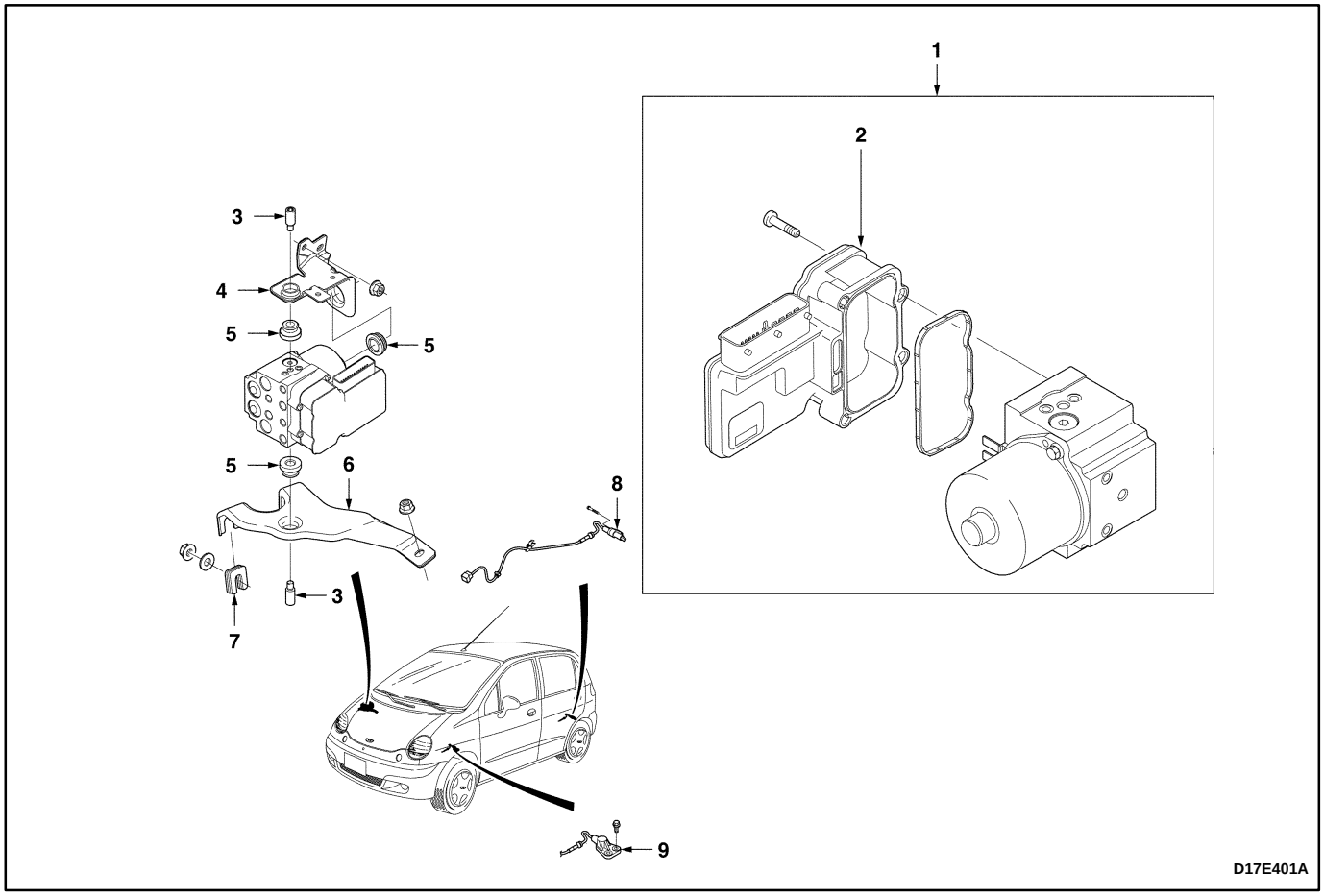


D107E204

Pin	Signal Name	Color	Circuit
2	ROUGH ROAD	GRY/YEL	Buffered Wheel Speed Signal : to ECM–55 (Sirius D3)
9	RRWSHI	BRN	Right Rear Wheel Speed High
10	RRWSLO	WHT	Right Rear Wheel Speed Low
11	SDLUART	BRN/DK GRN	Serial Data Link
12	RFWSHI	DK GRN/BLK	Right Front Wheel Speed High
13	RFWSLO	BRN/DK GRN	Right Front Wheel Speed Low
14	LFWSHI	DK BLU	Left Front Wheel Speed High
15	IGN	RED/YEL	Switched Ignition
16	GND	BLK	Negative Battery Terminal
17	BATT	RED	Battery
18	BATT	RED	Battery
19	GND	BLK	Negative Battery Terminal
20	ABSWARN	DK GRN/GRY	ABS Warning Indicator
22	LRWSHI	BLK	Left Rear Wheel Speed High
23	LRWSLO	RED	Left Rear Wheel Speed Low
24	BRAKESW	YEL	Brake Switch
25	LFWSLO	YEL	Left Front Wheel Speed Low

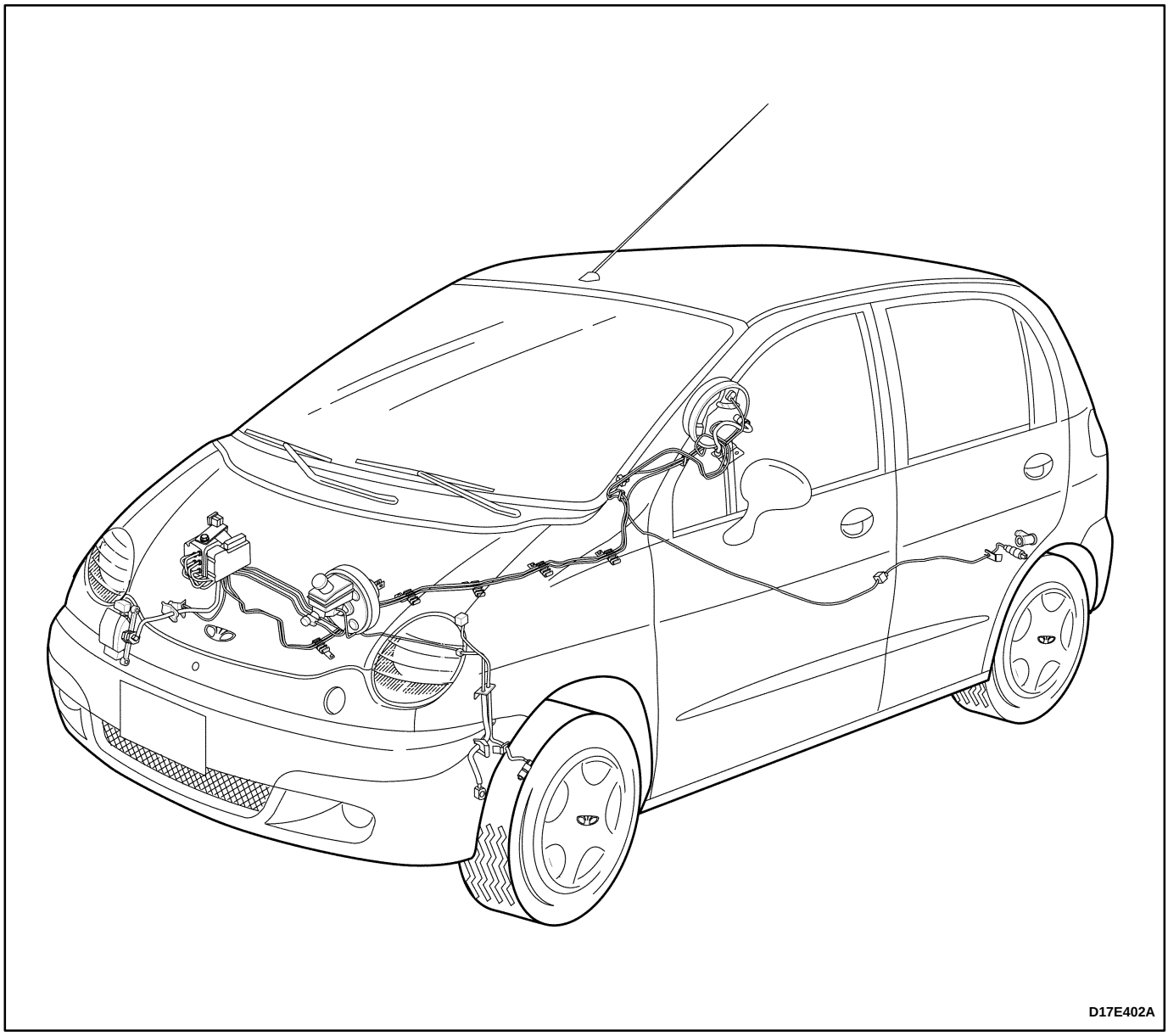
COMPONENT LOCATOR

ABS



1. Hydraulic Modulator Unit
2. Electronic Brake Control Module (EBCM)
3. Bolt
4. Upper Mounting Bracket
5. Grommet
6. Lower Mounting Bracket
7. Bracket Grommet
8. Rear Wheel Speed Sensor
9. Front Wheel Speed Sensor

ABS (Cont'd)



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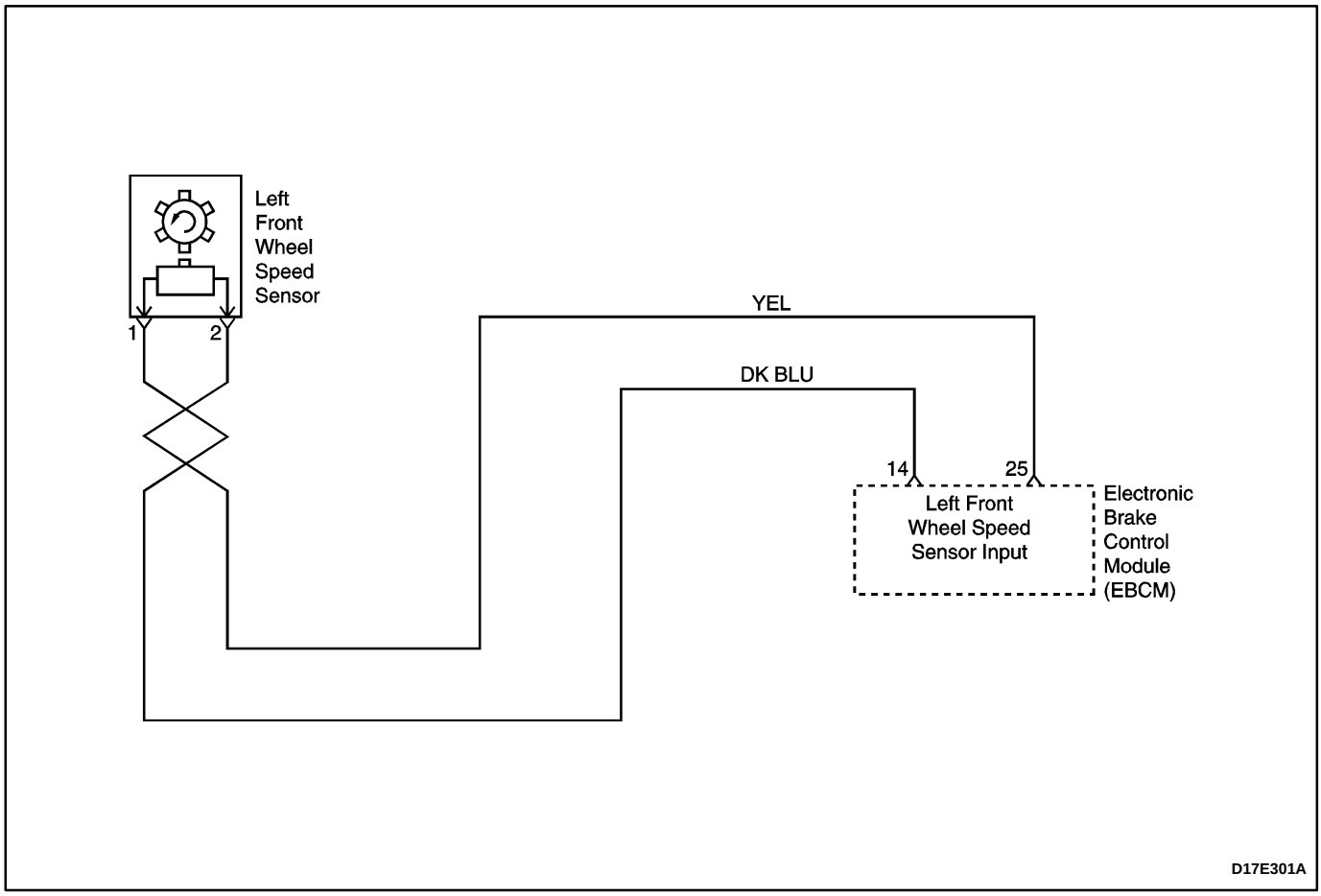
DIAGNOSTIC INFORMATION AND PROCEDURES



DIAGNOSTIC TROUBLE CODE (DTC) 0354
LEFT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the left front wheel speed sensor circuit.

Cause(s)

- The wheel speed circuit is open or shorted to the battery or ground.
- There is a loose connection in the wheel speed circuit.
- The wheel speed sensor resistance is very high.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Front Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0354 – Left Front Wheel Speed Sensor Circuit Open or Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 14 and 25 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the left front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between terminal 14 of the EBCM harness connector, and terminal 1 of the left front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1Ω	Go to *Step 6*	Go to *Step 5*
5	1. Repair the high resistance in circuit DK BLU. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 25 of the EBCM harness connector, and terminal 2 of the left front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1Ω	Go to *Step 8*	Go to *Step 7*
7	1. Repair the high resistance in circuit YEL. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 14 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 10*	Go to *Step 9*
9	Repair the short to ground in circuit DK BLU. Is the repair complete?	–	System OK	–

DTC 0354 – Left Front Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between ground and terminal 25 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 12*	Go to *Step 11*
11	Repair the short to ground in circuit YEL. Is the repair complete?	–	System OK	–
12	1. Reconnect all of the connectors. 2. Turn the ignition to ON. 3. Use a DVM to measure the voltage between ground and terminal 14 of EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 14*	Go to *Step 13*
13	Repair the short to voltage in circuit DK BLU. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the voltage between ground and terminal 25 of EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 16*	Go to *Step 15*
15	Repair the short to voltage in circuit YEL. Is the repair complete?	–	System OK	–
16	Replace the EBCM. Is the repair complete?	–	System OK	–

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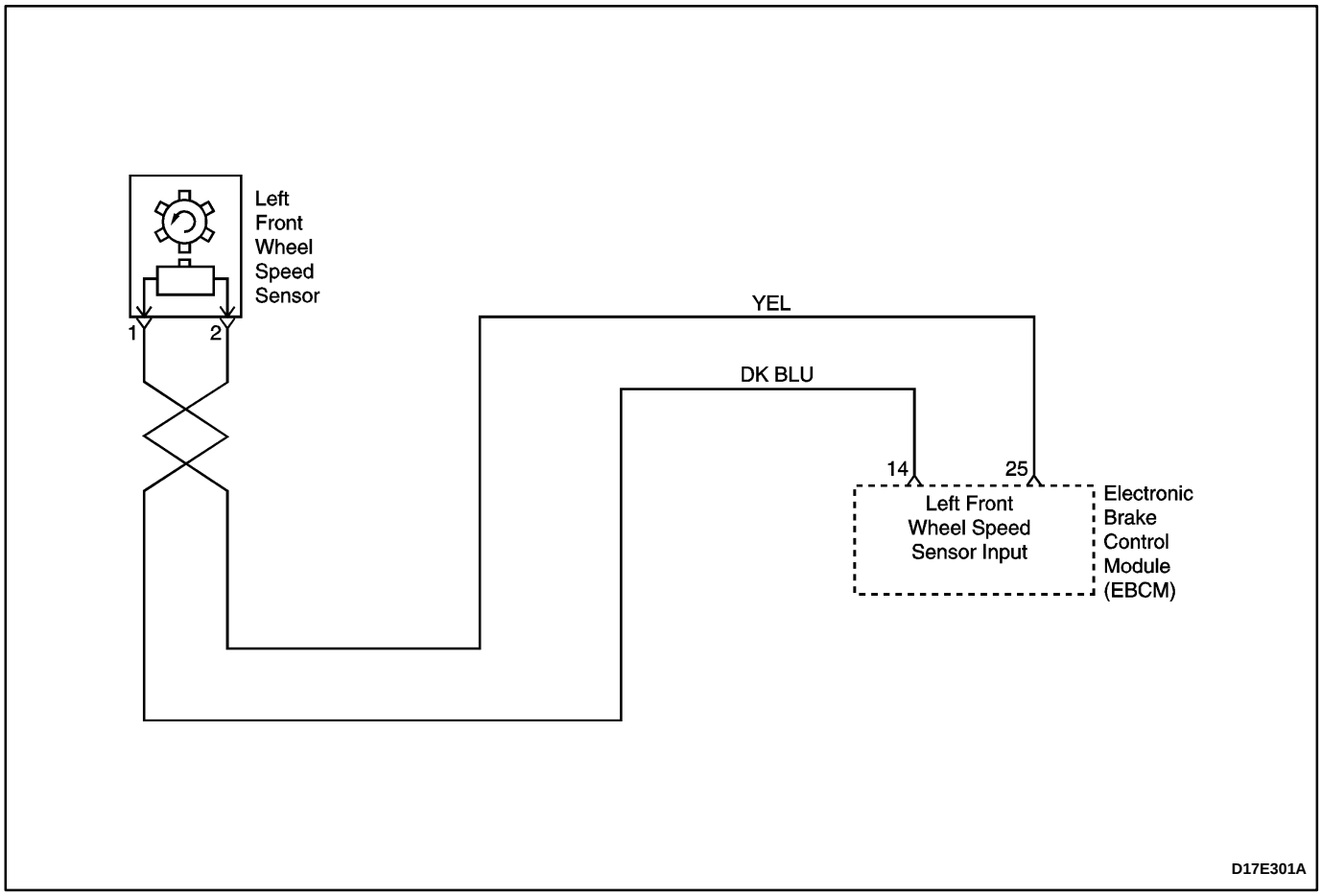


DIAGNOSTIC TROUBLE CODE (DTC) 0355 LEFT FRONT WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test checks for the left front wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

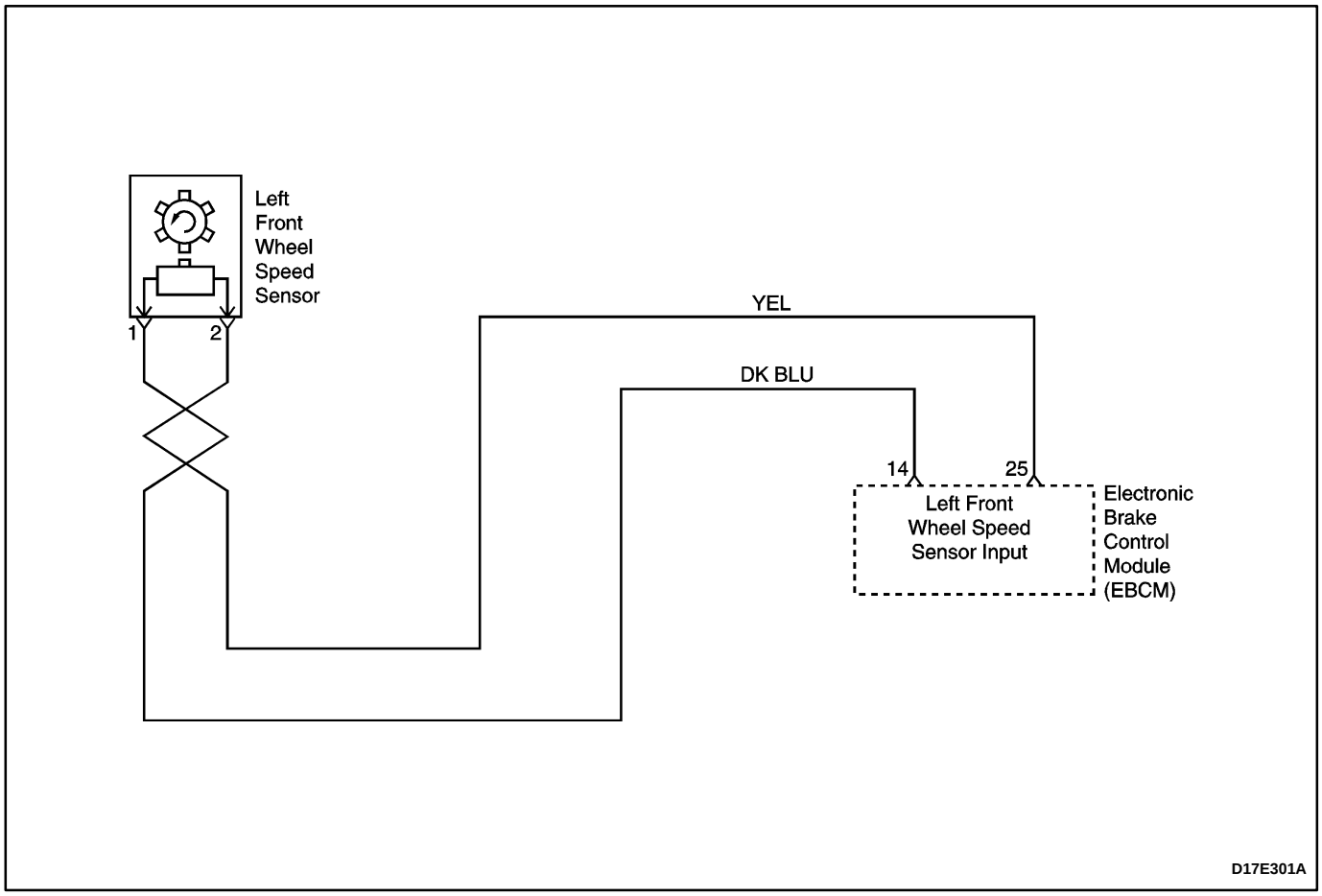
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed

sensor. Refer to “Front Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0355 – Left Front Wheel Speed Sensor poor air Gap or Missing Tooth Ring

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. ● Wheel speed sensor is loose. ● The air gap exceeds the required specifications. ● The speed ring is missing or damaged. 3. Repair or replace the damaged. Is the repair complete?	–	System OK	Go to *Step 2*
2	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0356
LEFT FRONT WHEEL SPEED SENSOR CIRCUIT
INTERMITTENT SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test intermittent the left front wheel speed sensor circuit.

Cause(s)

- The wheel speed sensor is intermittent shorted to the battery or ground.
- There is a loose connection in the wheel speed sensor circuit.
- There is a loose connection in the EBCM.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

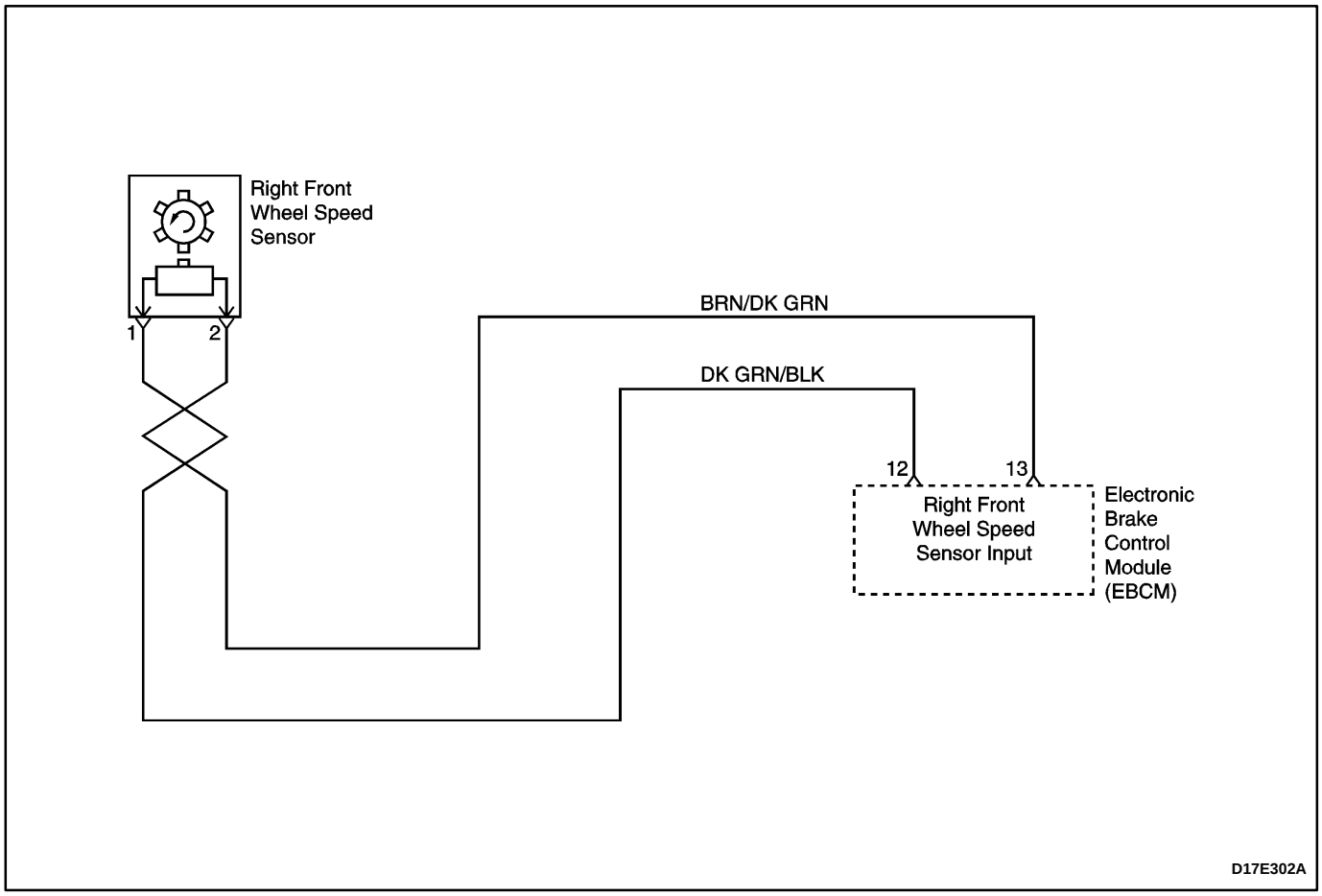
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Front Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0356 – Left Front Wheel Speed Sensor Circuit Intermittent Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 14 and 25 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the left front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 14 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short to ground in circuit DK BLU. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 25 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 8*	Go to *Step 7*
7	Repair the short to ground in circuit YEL. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 14 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 10*	Go to *Step 9*
9	Repair the short to voltage in circuit DK BLU. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 25 of the EBCM connector. Does the voltage within the specified value?	0 v	Go to *Step 12*	Go to *Step 11*
11	Repair the short to voltage in circuit YEL. Is the repair complete?	–	System OK	–
12	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0404
RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the right front wheel speed sensor circuit.

Cause(s)

- The wheel speed circuit is open or shorted to the battery or ground.
- There is a loose connection in the wheel speed circuit.
- The wheel speed sensor resistance is very high.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Front Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0404 – Right Front Wheel Speed Sensor Circuit Open or Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 12 and 13 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the right front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between terminal 12 of the EBCM harness connector, and terminal 1 of the right front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to *Step 6*	Go to *Step 5*
5	1. Repair the high resistance in circuit DK GRN/BLK. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 13 of the EBCM harness connector, and terminal 2 of the right front wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to *Step 8*	Go to *Step 7*
7	1. Repair the high resistance in circuit BRN/DK GRN. 2. If the wheel speed sensor harness is damaged, replace it. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 12 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 10*	Go to *Step 9*
9	Repair the short to ground in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–

DTC 0404 – Right Front Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between ground and terminal 13 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 12*	Go to *Step 11*
11	Repair the short to ground in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
12	1. Reconnect all of the connectors. 2. Turn the ignition to ON. 3. Use a DVM to measure the voltage between ground and terminal 12 of EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 14*	Go to *Step 13*
13	Repair the short to voltage in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the voltage between ground and terminal 13 of EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 16*	Go to *Step 15*
15	Repair the short to voltage in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
16	Replace the EBCM. Is the repair complete?	–	System OK	–

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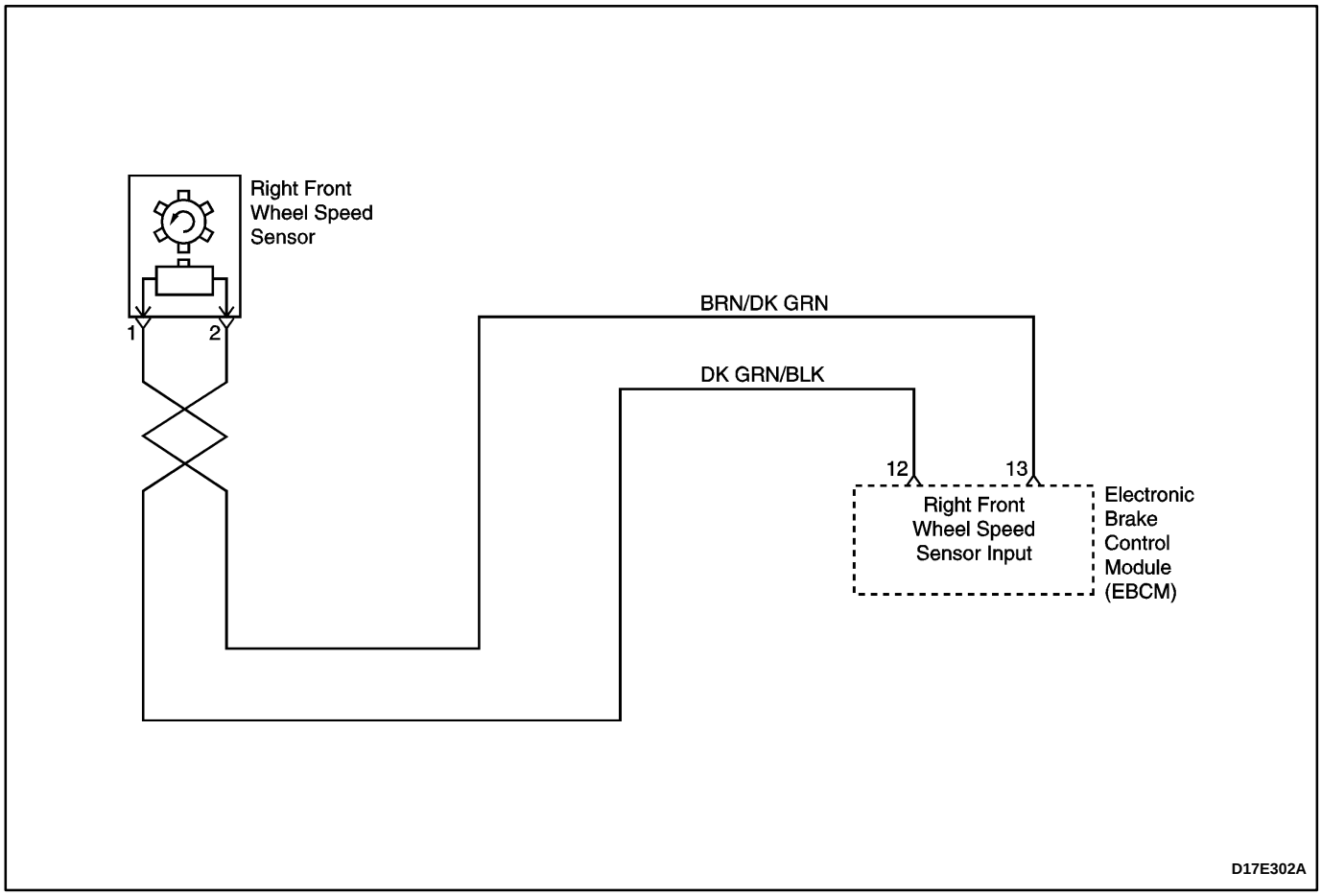


DIAGNOSTIC TROUBLE CODE (DTC) 0405 RIGHT FRONT WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test checks for the right front wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

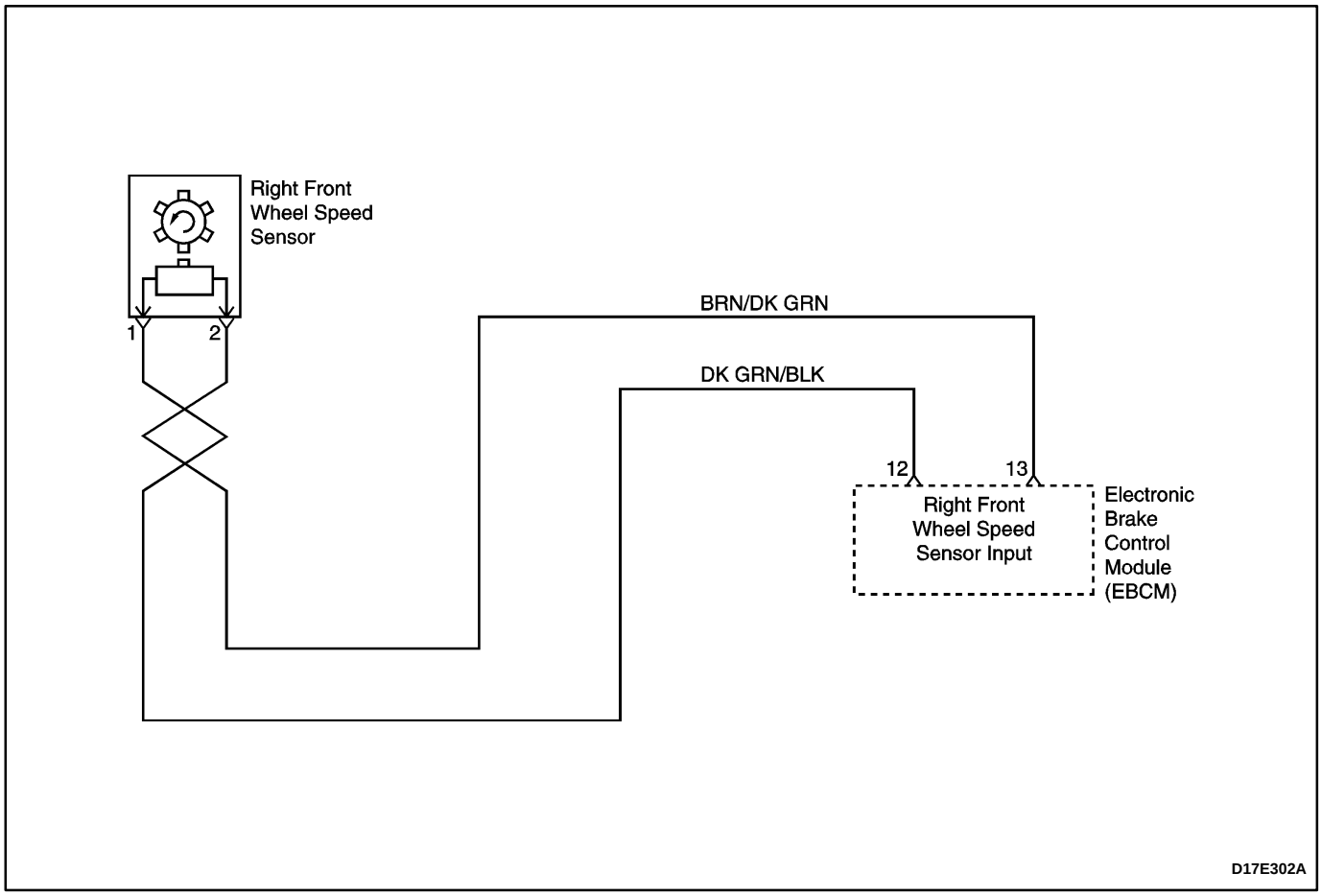
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed

sensor. Refer to “Front Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0405 – Right Front Wheel Speed Sensor poor air Gap or Missing Tooth Ring

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. ● Wheel speed sensor is loose. ● The air gap exceeds the required specifications. ● The speed ring is missing or damaged. 3. Repair or replace the damaged. Is the repair complete?	–	System OK	Go to *Step 2*
2	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0406
RIGHT FRONT WHEEL SPEED SENSOR CIRCUIT
INTERMITTENT SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test intermittent the right front wheel speed sensor circuit.

Cause(s)

- The wheel speed sensor is intermittent shorted to the battery or ground.
- There is a loose connection in the wheel speed sensor circuit.
- There is a loose connection in the EBCM.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

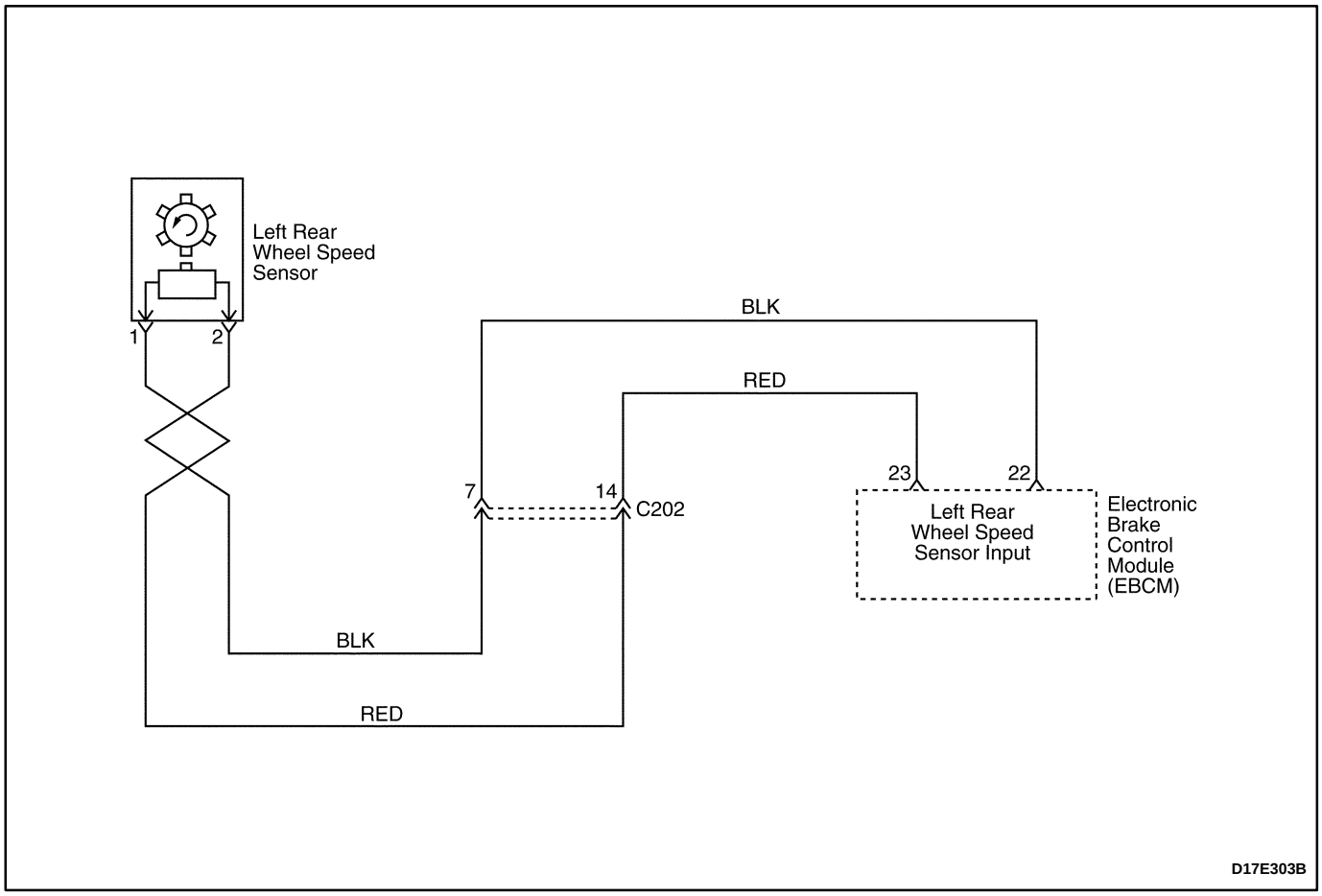
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Front Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0406 – Right Front Wheel Speed Sensor Circuit Intermittent Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 12 and 13 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the right front wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right front wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 12 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short to ground in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 13 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 8*	Go to *Step 7*
7	Repair the short to ground in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
8	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 12 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 10*	Go to *Step 9*
9	Repair the short to voltage in circuit DK GRN/BLK. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 13 of the EBCM connector. Does the voltage within the specified value?	0 v	Go to *Step 12*	Go to *Step 11*
11	Repair the short to voltage in circuit BRN/DK GRN. Is the repair complete?	–	System OK	–
12	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0454
LEFT REAR WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the left rear wheel speed sensor circuit.

Cause(s)

- The wheel speed circuit is open or shorted to the battery or ground.
- There is a loose connection in the wheel speed circuit.
- The wheel speed sensor resistance is very high.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Rear Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0454 – Left Rear Wheel Speed Sensor Circuit Open or Shorted

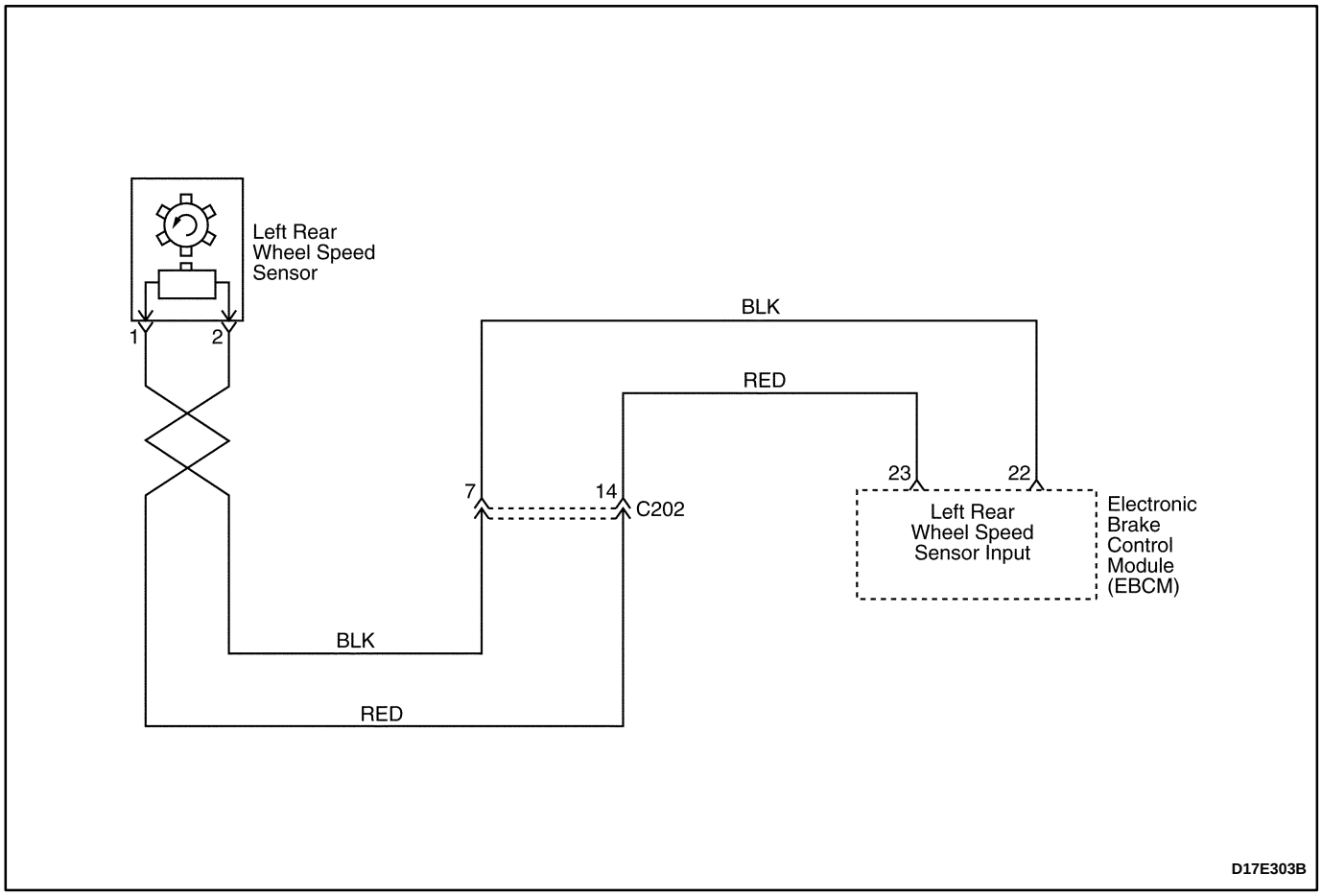
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 22 and 23 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the left rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	1. Disconnect the connector C202. 2. Use a DVM to measure the resistance between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Does the DVM show the specified value?	less than 1 Ω	Go to *Step 6*	Go to *Step 5*
5	Repair the high resistance between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to *Step 8*	Go to *Step 7*
7	Repair the high resistance between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Does the DVM show the specified value?	less than 1 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair the high resistance between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–

DTC 0454 – Left Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the resistance within specified value?	less than 1 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair the high resistance between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	Use a DVM to measure the resistance between ground and terminal 22 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 14*	Go to *Step 13*
13	Repair the short to ground between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the resistance between ground and terminal 7 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 16*	Go to *Step 15*
15	Repair the short to ground between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	Use a DVM to measure the resistance between ground and terminal 23 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 18*	Go to *Step 17*
17	Repair the short to ground between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
18	Use a DVM to measure the resistance between ground and terminal 14 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 20*	Go to *Step 19*
19	Repair the short to ground between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 22 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 22*	Go to *Step 21*
21	Repair the short to voltage between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
22	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 7 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 24*	Go to *Step 23*

DTC 0454 – Left Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
23	Repair the short to voltage between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
24	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 26*	Go to *Step 25*
25	Repair the short to voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
26	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 14 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 28*	Go to *Step 27*
27	Repair the short to voltage between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
28	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0455 LEFT REAR WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test checks for the left rear wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An ‘‘intermittent’’ malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

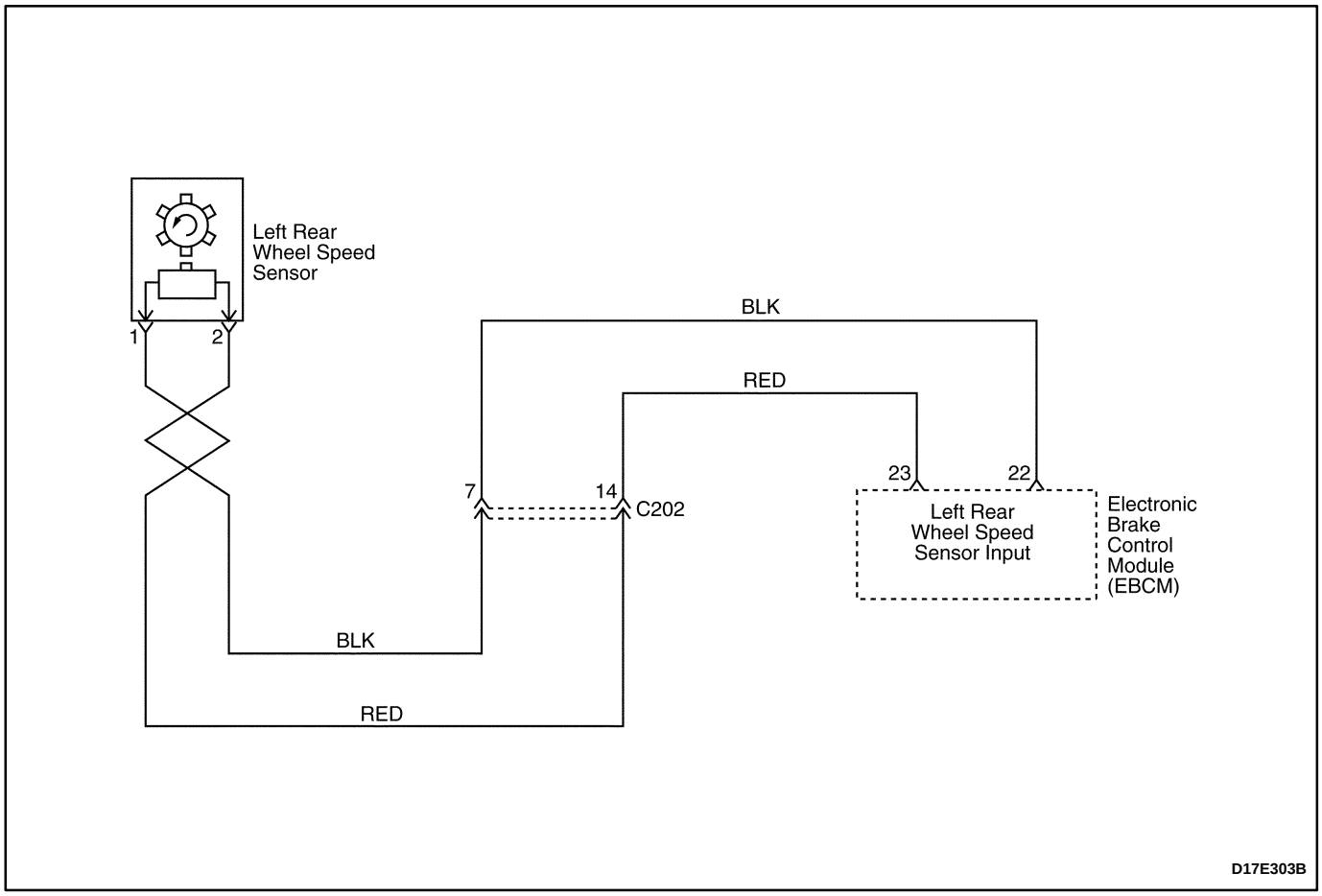
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed

sensor. Refer to “Rear Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0455 – Left Rear Wheel Speed Sensor poor air Gap or Missing Tooth Ring

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. ● Wheel speed sensor is loose. ● The air gap exceeds the required specifications. ● The speed ring is missing or damaged. 3. Repair or replace the damaged. Is the repair complete?	–	System OK	Go to *Step 2*
2	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0456
LEFT REAR WHEEL SPEED SENSOR CIRCUIT
INTERMITTENT SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test intermittent the left rear wheel speed sensor circuit.

Cause(s)

- The wheel speed sensor is intermittent shorted to the battery or ground.
- There is a loose connection in the wheel speed sensor circuit.
- There is a loose connection in the EBCM.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Rear Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0456 – Left Rear Wheel Speed Sensor Circuit Intermittent Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 22 and 23 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the left rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the left rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 22 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short to ground between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 7 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 8*	Go to *Step 7*
7	Repair the short to ground between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 23 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 10*	Go to *Step 9*
9	Repair the short to ground between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 14 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 12*	Go to *Step 11*

DTC 0456 – Left Rear Wheel Speed Sensor Circuit Intermittent Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
11	Repair the short to ground between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 22 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 14*	Go to *Step 13*
13	Repair the short to voltage between terminal 7 of the connector C202 and terminal 22 of the EBCM connector. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 7 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 16*	Go to *Step 15*
15	Repair the short to voltage between terminal 7 of the connector C202 and terminal 2 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 18*	Go to *Step 17*
17	Repair the short to voltage between terminal 14 of the connector C202 and terminal 23 of the EBCM connector. Is the repair complete?	–	System OK	–
18	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 14 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 20*	Go to *Step 19*
19	Repair the short to voltage between terminal 14 of the connector C202 and terminal 1 of the left rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	Replace the EBCM. Is the repair complete?	–	System OK	–

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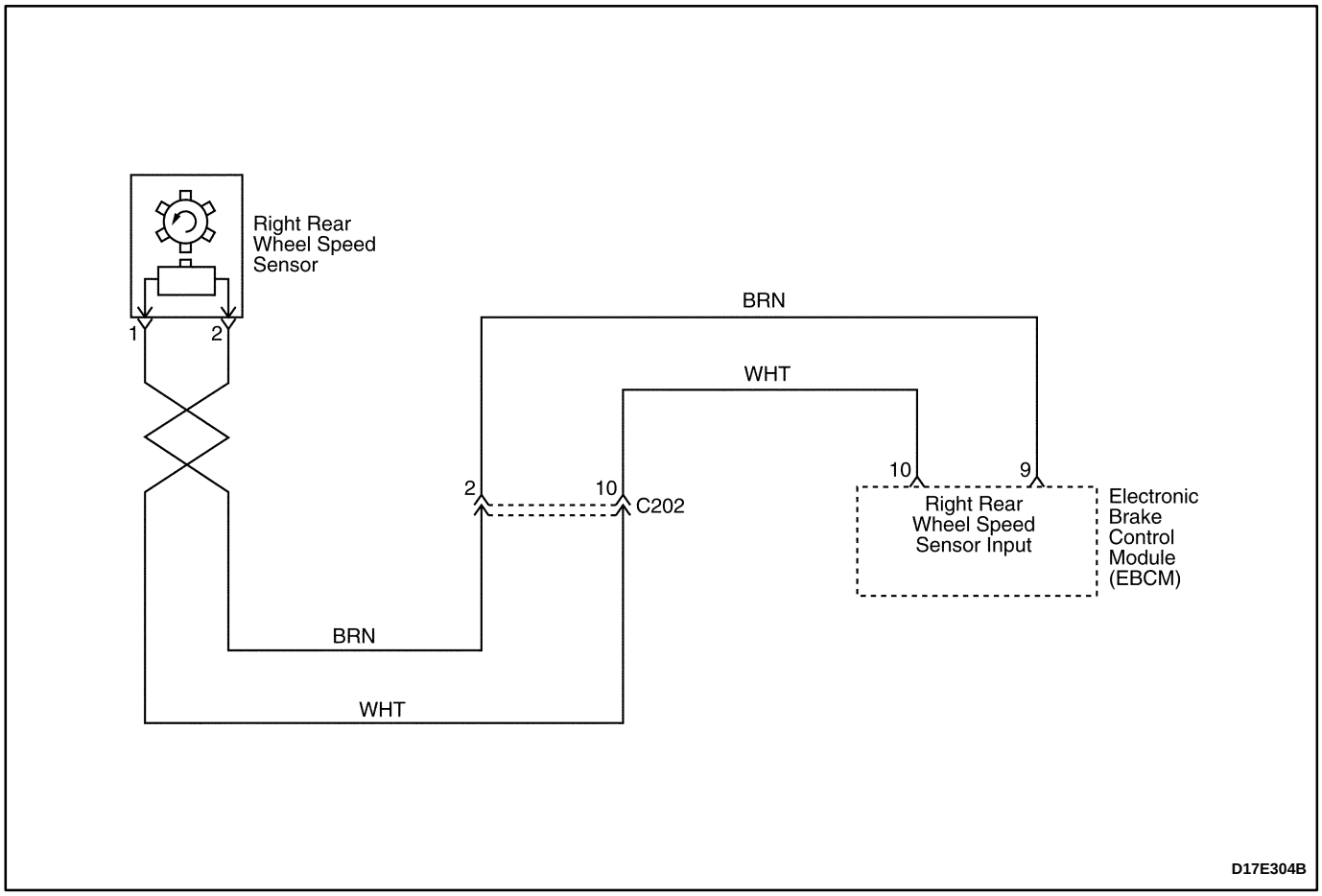


DIAGNOSTIC TROUBLE CODE (DTC) 0504
RIGHT REAR WHEEL SPEED SENSOR CIRCUIT OPEN OR SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test detects a short to battery, ground, or open in the right rear wheel speed sensor circuit.

Cause(s)

- The wheel speed circuit is open or shorted to the battery or ground.
- There is a loose connection in the wheel speed circuit.
- The wheel speed sensor resistance is very high.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Rear Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0504 – Right Rear Wheel Speed Sensor Circuit Open or Shorted

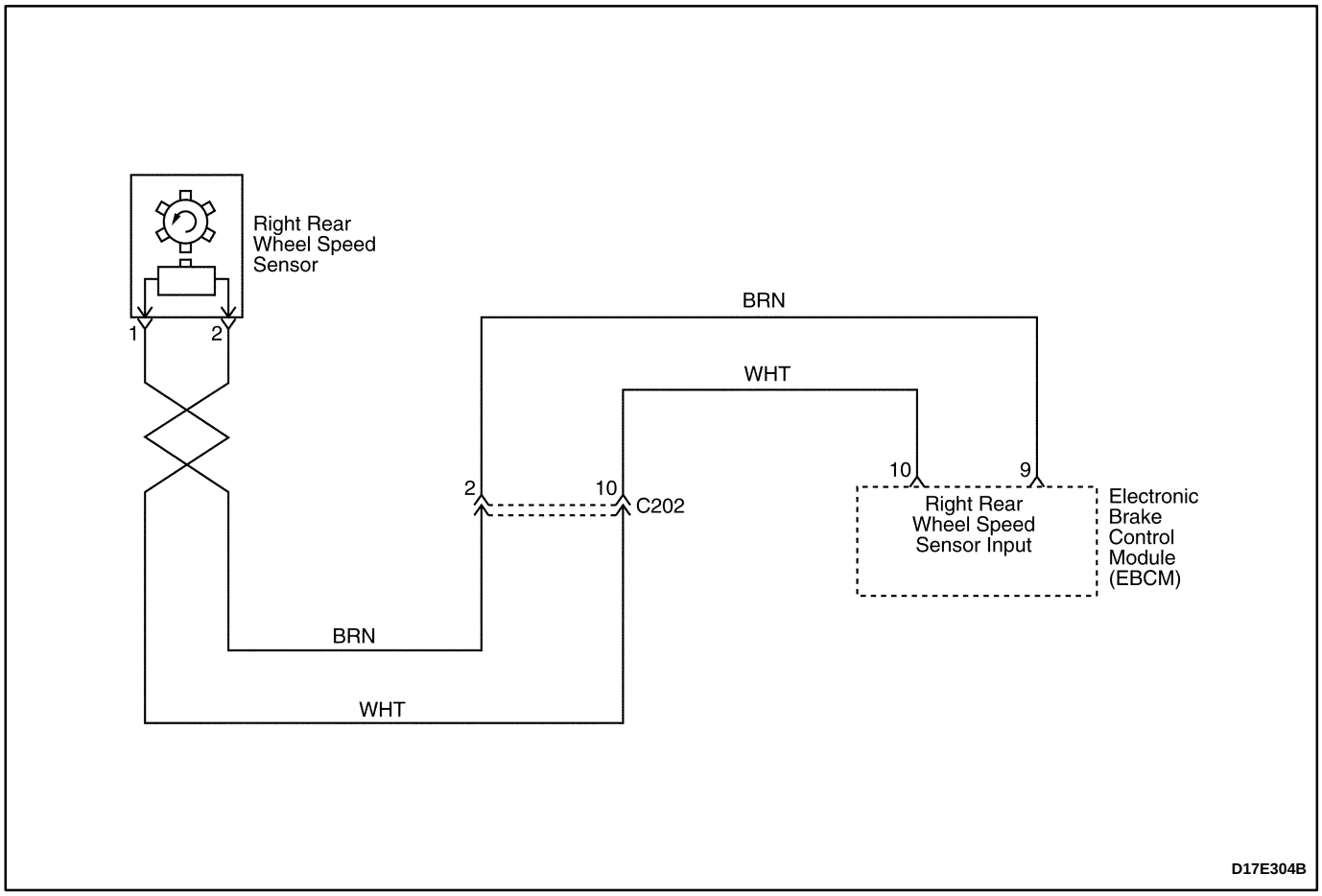
Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 9 and 10 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the right rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	1. Disconnect the connector C202. 2. Use a DVM to measure the resistance between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Does the DVM show the specified value?	less than 1 Ω	Go to *Step 6*	Go to *Step 5*
5	Repair the high resistance between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the resistance within the specified value?	less than 1 Ω	Go to *Step 8*	Go to *Step 7*
7	Repair the high resistance between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Does the DVM show the specified value?	less than 1 Ω	Go to *Step 10*	Go to *Step 9*
9	Repair the high resistance between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–

DTC 0504 – Right Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
10	Use a DVM to measure the resistance between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the resistance within specified value?	less than 1 Ω	Go to *Step 12*	Go to *Step 11*
11	Repair the high resistance between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	Use a DVM to measure the resistance between ground and terminal 9 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 14*	Go to *Step 13*
13	Repair the short to ground between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
14	Use a DVM to measure the resistance between ground and terminal 2 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 16*	Go to *Step 15*
15	Repair the short to ground between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	Use a DVM to measure the resistance between ground and terminal 10 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 18*	Go to *Step 17*
17	Repair the short to ground between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–
18	Use a DVM to measure the resistance between ground and terminal 10 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 20*	Go to *Step 19*
19	Repair the short to ground between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 9 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 22*	Go to *Step 21*
21	Repair the short to voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
22	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 2 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 24*	Go to *Step 23*

DTC 0504 – Right Rear Wheel Speed Sensor Circuit Open or Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
23	Repair the short to voltage between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
24	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 26*	Go to *Step 25*
25	Repair the short to voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
26	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 10 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 28*	Go to *Step 27*
27	Repair the short to voltage between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
28	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0505 RIGHT REAR WHEEL SPEED SENSOR POOR AIR GAP OR MISSING TOOTH RING

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test checks for the right rear wheel speed equal to 0 km/h (0 mph) for greater than 6 km/h (3.8 mph).

Cause(s)

- The tooth ring is missing.
- The air gap exceeds the required specifications.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

Diagnostic Aids

An ‘‘intermittent’’ malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

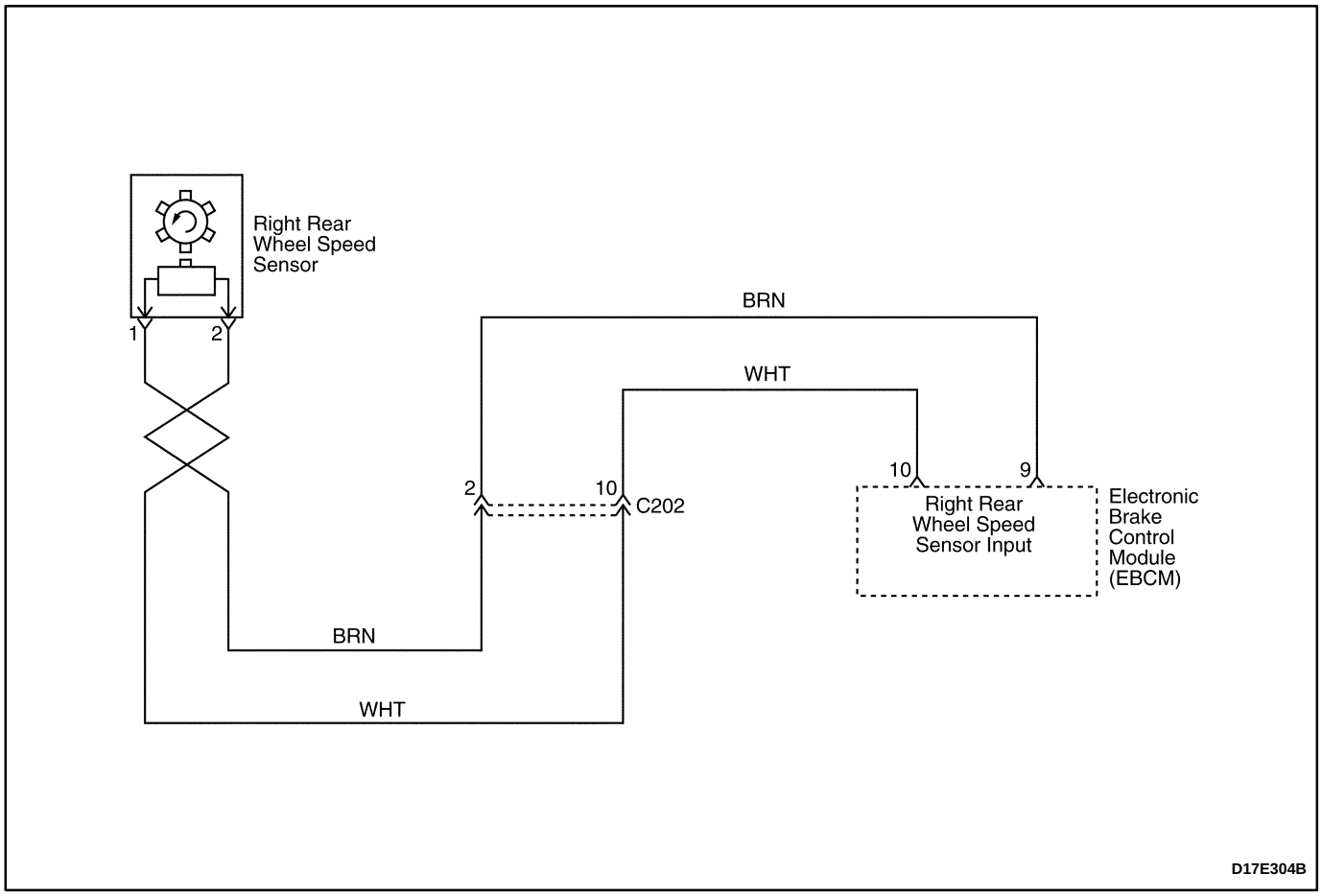
When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed

sensor. Refer to “Rear Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0505 – Right Rear Wheel Speed Sensor poor air Gap or Missing Tooth Ring

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Physically inspect the following components for damage. ● Wheel speed sensor is loose. ● The air gap exceeds the required specifications. ● The speed ring is missing or damaged. 3. Repair or replace the damaged. Is the repair complete?	–	System OK	Go to *Step 2*
2	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0506
RIGHT REAR WHEEL SPEED SENSOR CIRCUIT
INTERMITTENT SHORTED

Circuit Description

As a toothed ring passes by the wheel speed sensor, changes in the electromagnetic field cause the wheel speed sensor to produce a sinusoidal (AC) voltage signal whose frequency is proportional to the wheel speed. The magnitude of this signal is directly related to wheel speed and the proximity of the wheel speed sensor to the toothed ring often referred to as the air gap.

Diagnosis

This test intermittent the right rear wheel speed sensor circuit.

Cause(s)

- The wheel speed sensor is intermittent shorted to the battery or ground.
- There is a loose connection in the wheel speed sensor circuit.
- There is a loose connection in the EBCM.
- The EBCM is malfunctioning.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp repeat intermittent turned on, and off. The proportioning is operation.

Diagnostic Aids

An “intermittent” malfunction may be caused by a poor connection, rubbed through wire insulation, or a wire that is broken inside the insulation.

Thoroughly check any circuitry suspected of causing the intermittent complaint. Look 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.

Wheel speed sensor resistance will increase as the sensor temperature increases.

When replacing a wheel speed sensor, inspect the sensor terminals and harness connector for corrosion and/or water intrusion. If evidence of corrosion or water

intrusion exists, replace the wheel speed sensor harness. If replacing a wheel speed sensor harness, inspect the sensor terminals. If you find evidence of corrosion or water intrusion, replace the wheel speed sensor. Refer to “Rear Wheel Speed Sensor” in this section.

Important: Wheel speed sensor intermittent malfunctions may be difficult to locate. Take care not to disturb any electrical connections before performing an indicated step of this table. That will ensure that an intermittent connection will not be corrected before the source of the malfunction is found.

DTC 0506 – Right Rear Wheel Speed Sensor Circuit Intermittent Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Disconnect the EBCM harness connector from the EBCM. 3. Use a digital voltmeter (DVM) to measure the resistance between terminals 9 and 10 of connector on the EBCM harness. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 2*
2	1. Disconnect the harness from the right rear wheel speed sensor. 2. Use a DVM to measure the resistance between terminals 1 and 2 of the right rear wheel speed sensor connector. Is the resistance within the specified value?	1.0 kΩ to 1.5 kΩ	Go to *Step 4*	Go to *Step 3*
3	Replace the wheel speed sensor. Is the repair complete?	–	System OK	–
4	Use a DVM to measure the resistance between ground and terminal 9 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short to ground between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
6	Use a DVM to measure the resistance between ground and terminal 2 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 8*	Go to *Step 7*
7	Repair the short to ground between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
8	Use a DVM to measure the resistance between ground and terminal 10 of the EBCM connector. Does the DVM show the specified value?	∞	Go to *Step 10*	Go to *Step 9*
9	Repair the short to ground between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–
10	Use a DVM to measure the resistance between ground and terminal 10 of the connector C202. Does the DVM show the specified value?	∞	Go to *Step 12*	Go to *Step 11*

DTC 0506 – Right Rear Wheel Speed Sensor Circuit Intermittent Shorted (Cont'd)

Step	Action	Value(s)	Yes	No
11	Repair the short to ground between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
12	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 9 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 14*	Go to *Step 13*
13	Repair the short to voltage between terminal 2 of the connector C202 and terminal 9 of the EBCM connector. Is the repair complete?	–	System OK	–
14	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 2 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 16*	Go to *Step 15*
15	Repair the short to voltage between terminal 2 of the connector C202 and terminal 2 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
16	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the voltage within the specified value?	0 v	Go to *Step 18*	Go to *Step 17*
17	Repair the short to voltage between terminal 10 of the connector C202 and terminal 10 of the EBCM connector. Is the repair complete?	–	System OK	–
18	1. Turn the ignition switch to ON. 2. Use a DVM to measure the voltage between ground and terminal 10 of the connector C202. Is the voltage within the specified value?	0 v	Go to *Step 20*	Go to *Step 19*
19	Repair the short to voltage between terminal 10 of the connector C202 and terminal 1 of the right rear wheel speed sensor harness connector. Is the repair complete?	–	System OK	–
20	Replace the EBCM. Is the repair complete?	–	System OK	–

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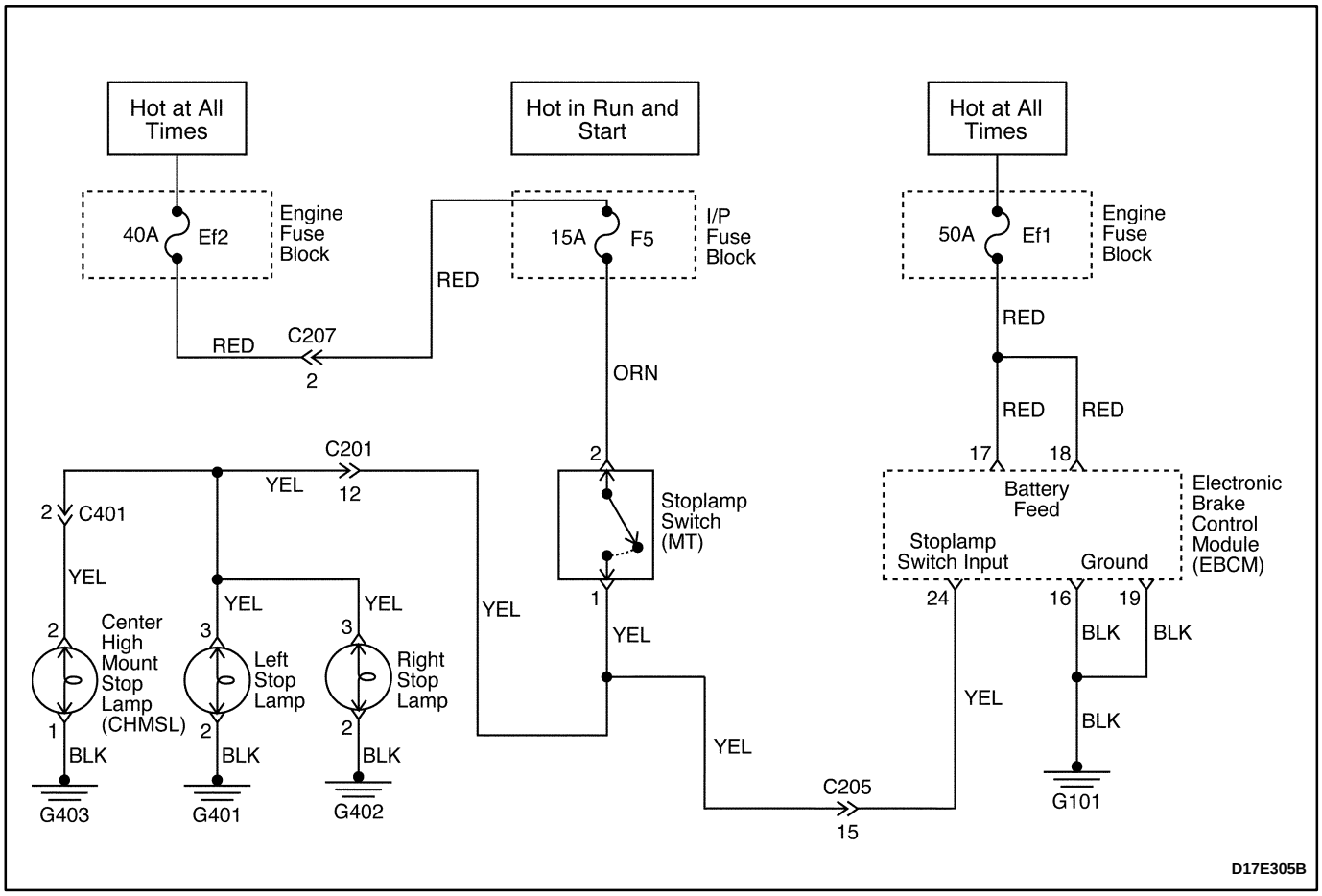


DIAGNOSTIC TROUBLE CODE (DTC) 0601
LEFT FRONT DUMP SHORTED OR DRIVER OPEN

Circuit Description

EBCM proceeds the self–test about the dump valve or the motor driver, if the EBCM senses the brake signal.

Diagnosis

If the EBCM proceeds the self–test about the dump valve or the motor driver and senses the fault, the EBCM may make the fault code.

Cause(s)

- EBCM internal fault (Left front dump voltage shorted or ground open).

Warning Lamp Operation

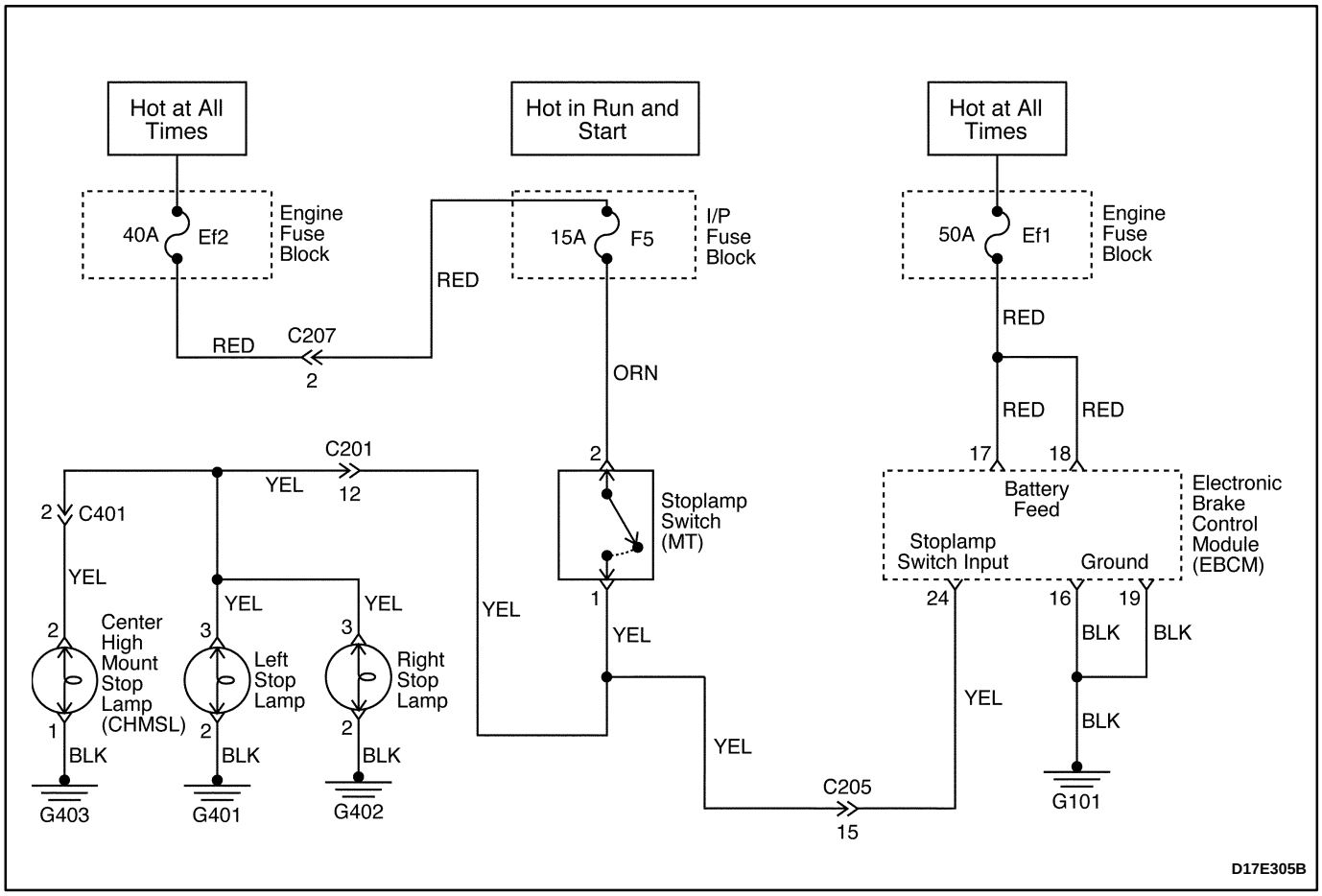
- ABS warning lamp ON.
- ABS warning lamp OFF if the ignition switch ON/OFF.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

DTC 0601 – Left Front Dump Shorted or Drive Open

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Remove the fuse Ef1 in the engine fuse block. 3. Check for an open in fuse Ef1. Is the fuse open?	–	Go to *Step 3*	Go to *Step 2*
2	Replace the fuse Ef1. Is the repair complete?	–	System OK	–
3	1. Disconnect the EBCM harness connector. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal 18 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to *Step 5*	Go to *Step 4*
4	Repair the short to voltage between terminal 18 of the EBCM connector and engine fuse block Ef1 output. Is the repair complete?	–	System OK	–
5	Use a DVM to measure the voltage between terminal 18 and terminal 19 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open between terminal 19 of the EBCM connector and ground G101. Is the repair complete?	–	System OK	–
7	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0602
LEFT FRONT DUMP OPEN OR DRIVER SHORTED

Circuit Description

EBCM proceeds the self–test about the dump valve or the motor driver, if the EBCM senses the brake signal.

Diagnosis

If the EBCM proceeds the self–test about the dump valve or the motor driver and senses the fault, the EBCM may make the fault code.

Cause(s)

- EBCM internal fault (Left front dump voltage open or ground shorted).

Warning Lamp Operation

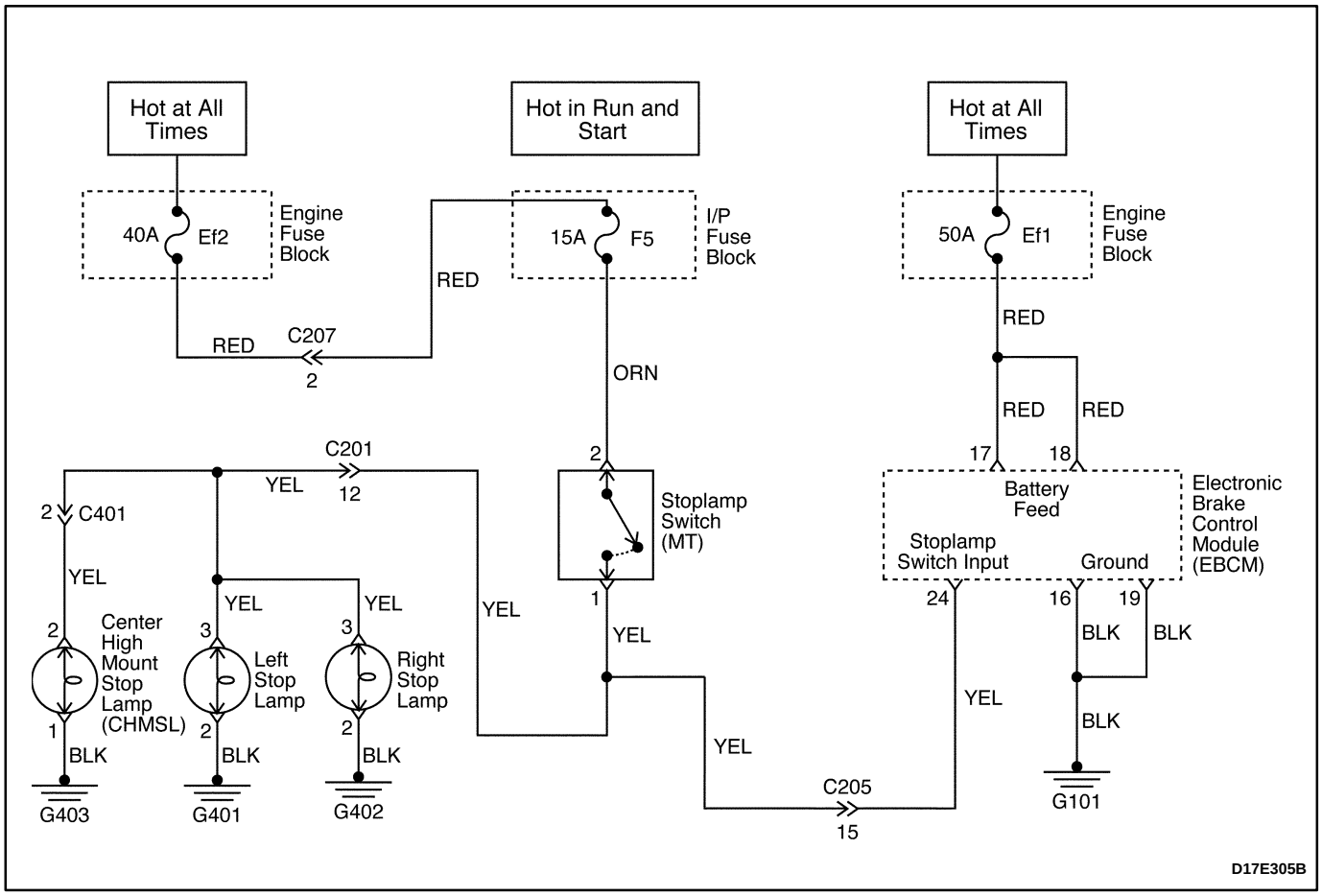
- ABS warning lamp ON.
- ABS warning lamp OFF if the ignition switch ON/OFF.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

DTC 0602 – Left Front Dump Open or Driver Shorted

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Remove the fuse Ef1 in the engine fuse block. 3. Check for an open in fuse Ef1. Is the fuse open?	–	Go to *Step 3*	Go to *Step 2*
2	Replace the fuse Ef1. Is the repair complete?	–	System OK	–
3	1. Disconnect the EBCM harness connector. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal 18 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to *Step 5*	Go to *Step 4*
4	Repair the short to voltage between terminal 18 of the EBCM connector and engine fuse block Ef1 output. Is the repair complete?	–	System OK	–
5	Use a DVM to measure the voltage between terminal 18 and terminal 19 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open between terminal 19 of the EBCM connector and ground G101. Is the repair complete?	–	System OK	–
7	Replace the EBCM. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 0651
LEFT FRONT ISOLATION SHORTED OR DRIVER OPEN

Circuit Description

EBCM proceeds the self–test about the dump valve or the motor driver, if the EBCM senses the brake signal.

Diagnosis

If the EBCM proceeds the self–test about the dump valve or the motor driver and senses the fault, the EBCM may make the fault code.

Cause(s)

- EBCM internal fault (Left front isolation voltage shorted or ground open).

Warning Lamp Operation

- ABS warning lamp ON.
- ABS warning lamp OFF if the ignition switch ON/OFF.

Fail Action

This is a critical operational fault. The ABS is disabled and the ABS warning lamp is turned on. The proportioning is operation.

DTC 0651 – Left Front Isolation Shorted or Driver Open

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition switch to OFF. 2. Remove the fuse Ef1 in the engine fuse block. 3. Check for an open in fuse Ef1. Is the fuse open?	–	Go to *Step 3*	Go to *Step 2*
2	Replace the fuse Ef1. Is the repair complete?	–	System OK	–
3	1. Disconnect the EBCM harness connector. 2. Turn the ignition switch to ON. 3. Use a digital voltmeter (DVM) to measure the voltage between ground and terminal 18 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to *Step 5*	Go to *Step 4*
4	Repair the short to voltage between terminal 18 of the EBCM connector and engine fuse block Ef1 output. Is the repair complete?	–	System OK	–
5	Use a DVM to measure the voltage between terminal 18 and terminal 19 of the EBCM connector. Is the voltage within the specified value?	10.5 v to 13.5 v	Go to *Step 7*	Go to *Step 6*
6	Repair the open between terminal 19 of the EBCM connector and ground G101. Is the repair complete?	–	System OK	–
7	Replace the EBCM. Is the repair complete?	–	System OK	–

SECTION 4G

PARKING BRAKE

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DESCRIPTION AND OPERATION

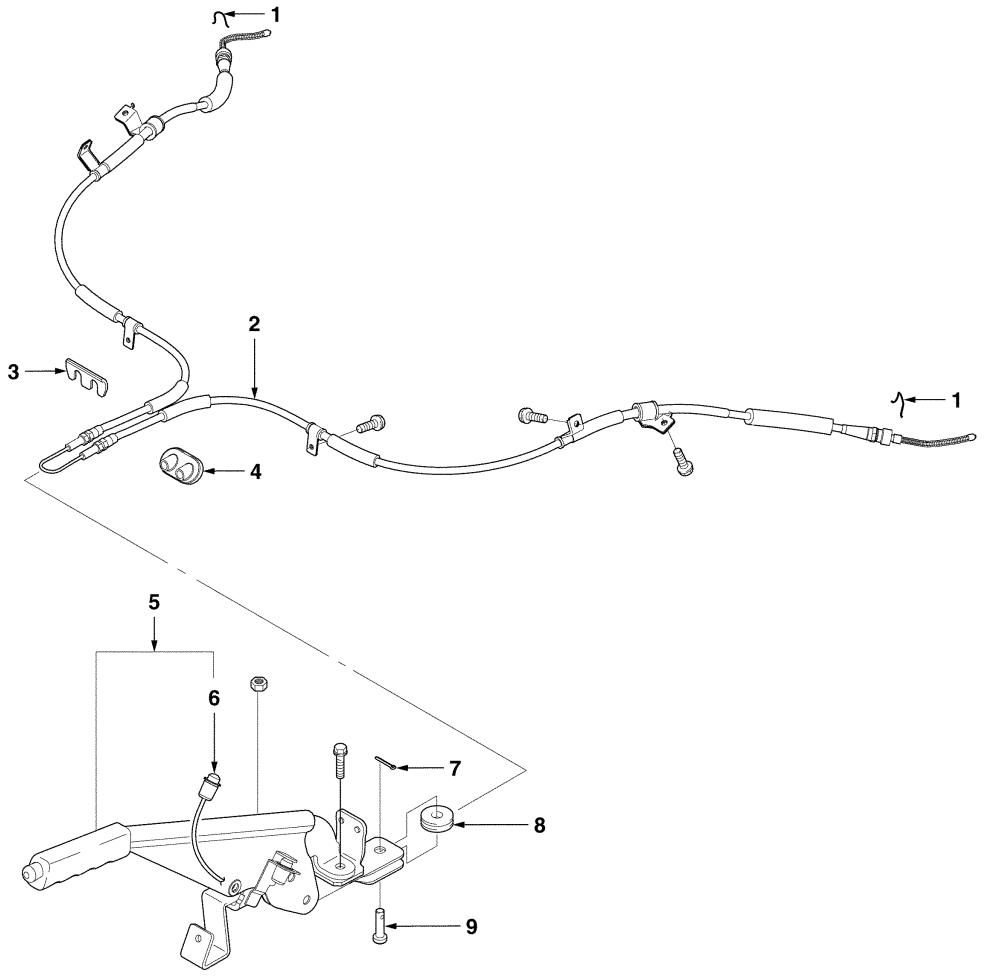
PARKING BRAKE

This braking system uses a BRAKE warning light located in the instrument panel cluster. When the ignition switch is in the III position, the BRAKE warning light should glow and go OFF when the parking brake lever is released. Whenever the parking brake is applied and the ignition switch is II, the BRAKE warning light should glow.

When the brake is firmly applied, the parking brake should securely hold the vehicle with ample pedal travel remaining. Check for frayed cables, rust, etc., or any condition that may inhibit present (or future) free movement of the parking brake lever assembly.

COMPONENT LOCATOR

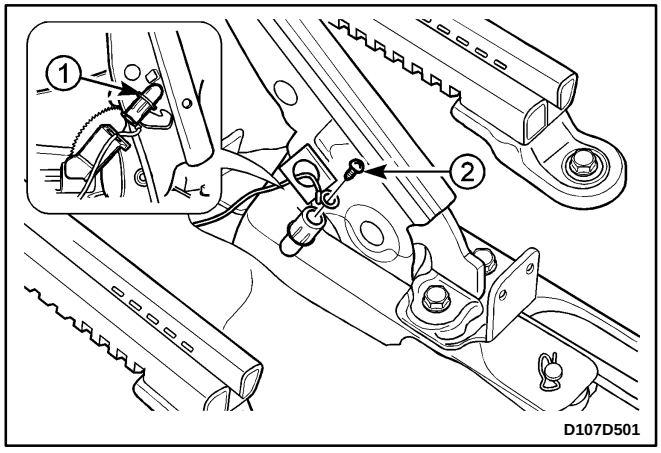
PARKING BRAKE



1. Parking Brake Cable Clip
2. Parking Brake Cable
3. Strengthener
4. Cable Grommet
5. Parking Brake Lever Assembly
6. Parking Brake Warning Lamp Switch
7. Cotter Pin
8. Cable Pulley
9. Pin

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE

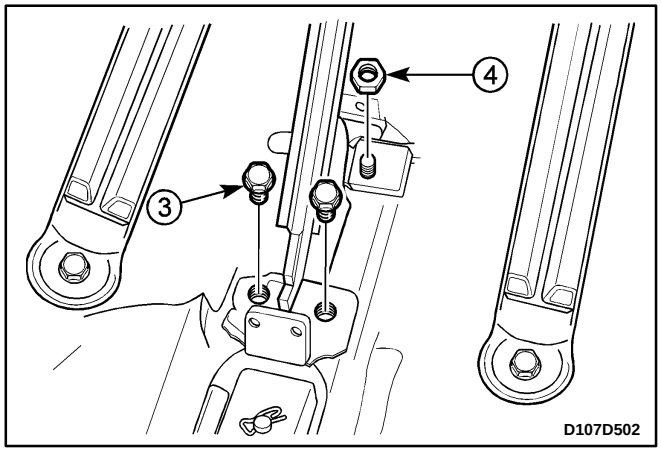


PARKING BRAKE LEVER

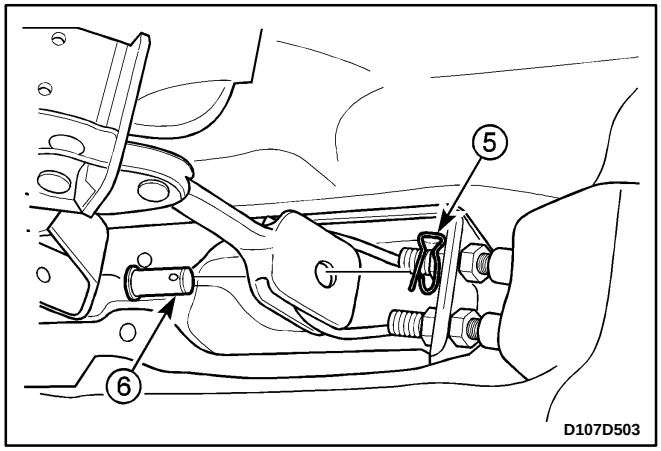
Removal Procedure

1. Remove the parking brake lever cover. Refer to *Section 9G, Interior Trim*.
2. Remove the parking brake cable cover. Refer to *Section 9G, Interior Trim*.
3. Remove the parking brake lever.
   - Disconnect the brake warning lamp switch (1).
   - Remove the brake warning switch lamp screw (2).

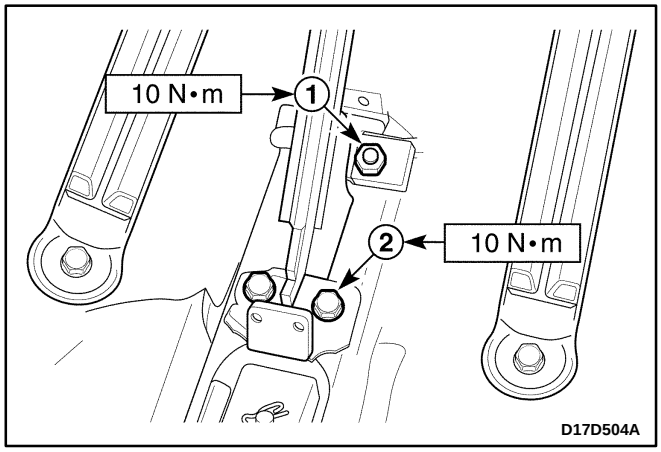
Important: The brake warning lamp switch screw should be removed with the lever fixed.



- Remove the bolts (3).
- Remove the nut (4).



- Remove the cotter pin (5).
- Remove the pin (6).



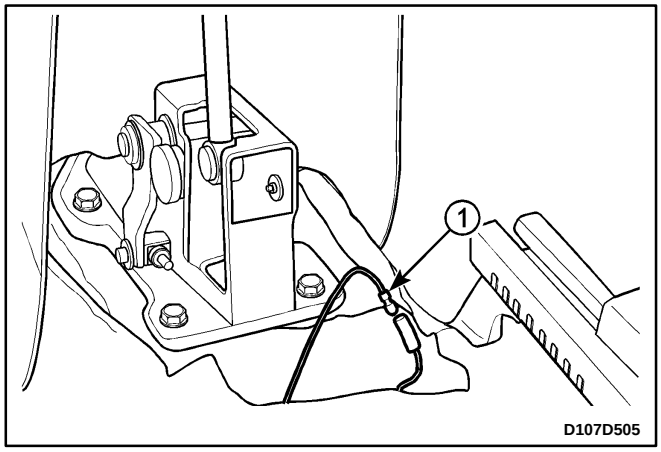
Installation Procedure

1. Install the parking brake lever with the cotter pin, pin, bolts, and nut.

Tighten

- Tighten the parking brake nut to 10 N•m (89 lb-in) (1).
- Tighten the parking brake bolts to 10 N•m (89 lb-in) (2).

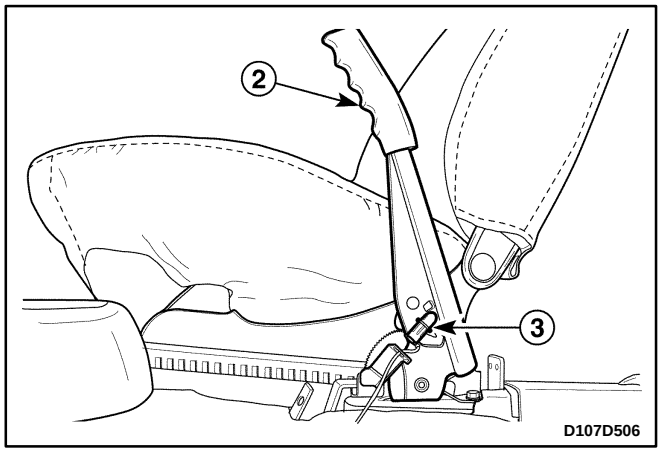
2. Connect the brake warning lamp switch.
3. Install the brake warning lamp switch screw.
4. Install the parking brake cable cover. Refer to *Section 9G, Interior Trim*.
5. Install the parking brake lever cover. Refer to *Section 9G, Interior Trim*.



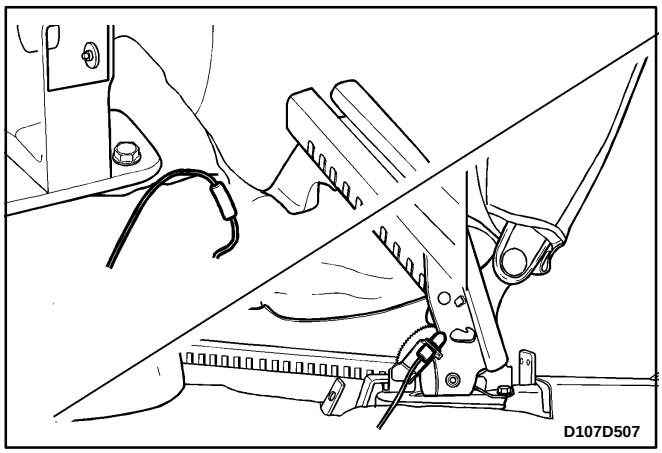
PARKING BRAKE WARNING LAMP SWITCH

Removal Procedure

1. Remove the gear shift lever cover. Refer to *Section 5B, Five–Speed Manual Transaxle*.
2. Remove the parking brake warning lamp switch.
   - Disconnect the parking brake warning lamp switch (1).

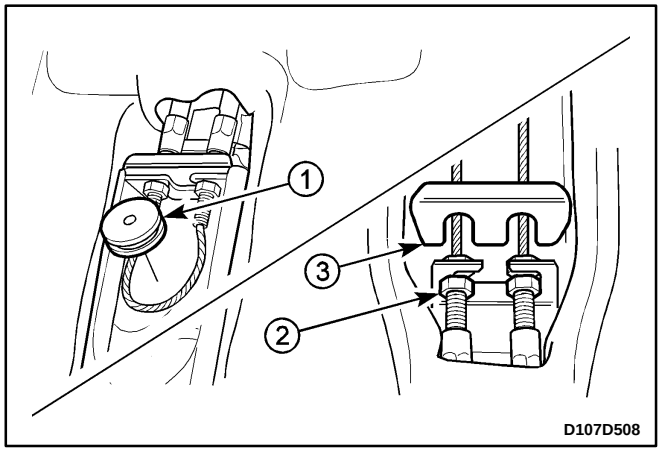


   - Apply the parking brake (2).
   - Remove the parking brake warning lamp switch carefully (3).



Installation Procedure

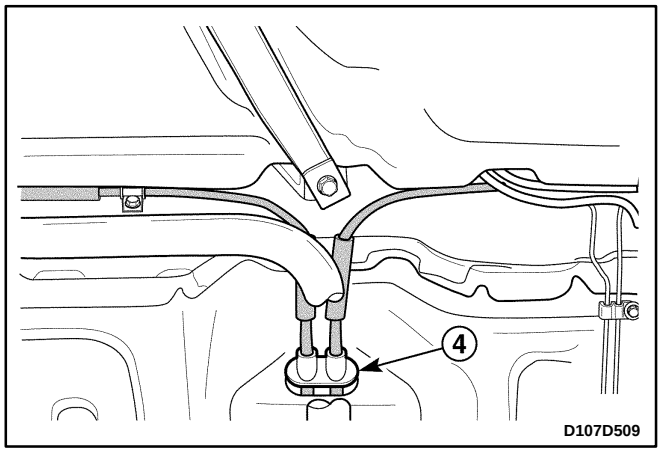
1. Install the parking brake warning lamp switch.
2. Release the parking brake.
3. Connect the parking brake warning lamp switch.
4. Install the gear shift lever cover. Refer to *Section 5B, Five–Speed Manual Transaxle*.



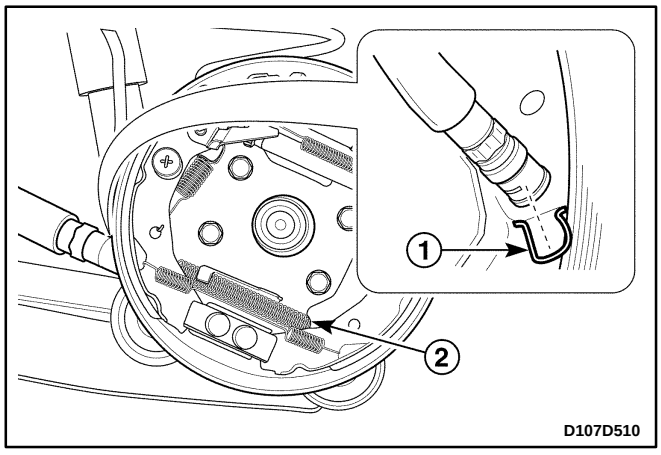
PARKING BRAKE CABLE

Removal Procedure

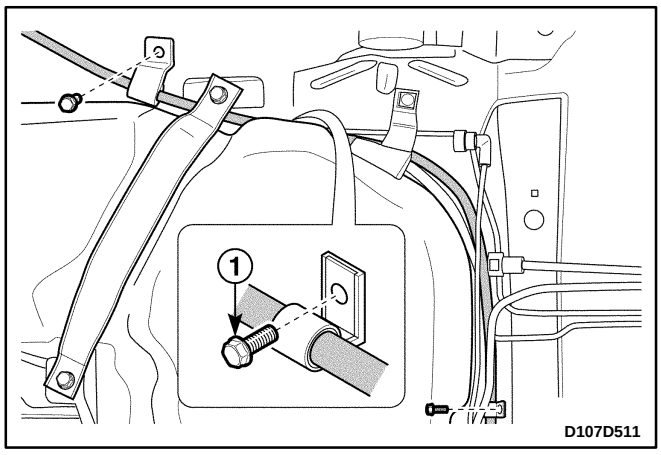
1. Remove the parking brake lever. Refer to “Parking Brake Lever” in this section.
2. Remove the parking brake cable.
   - Remove the cable pulley (1).
   - Loosen the adjustment nuts (2).
   - Remove the strengthener (3).



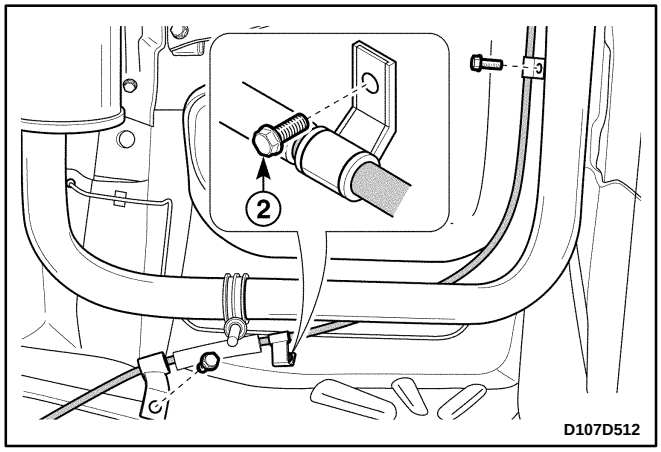
   - Remove the grommet (4).



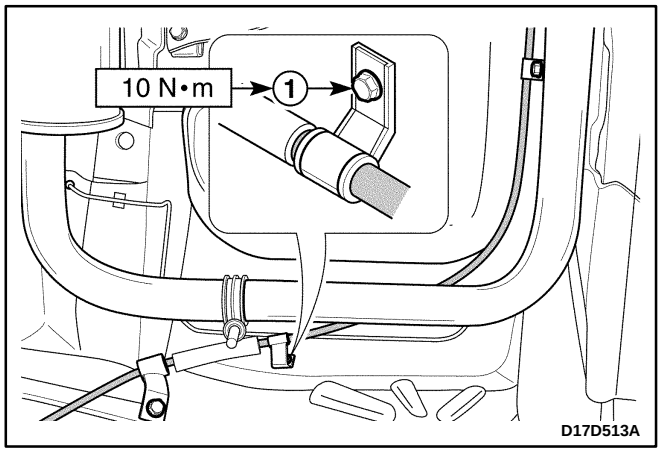
3. Remove the rear brake drum assembly. Refer to *Section 2D, Rear Suspension*.
4. Disconnect the parking brake cable from the rear brake drum assembly.
   - Remove the clip from the brake plate (1).
   - Disconnect the parking brake cable from the trailing shoe (2). Refer to *Section 4E, Rear Drum Brake*.



5. Remove the parking brake cable.
   - Remove the clamp bolts fastening the brake cable (RH Rear Brake Side) (1).
   - Remove the fuel filter. Refer to *Section 1F, Engine Controls*.



- Remove the clamp bolts fastening the brake cable (LH Rear Brake Side) (2).

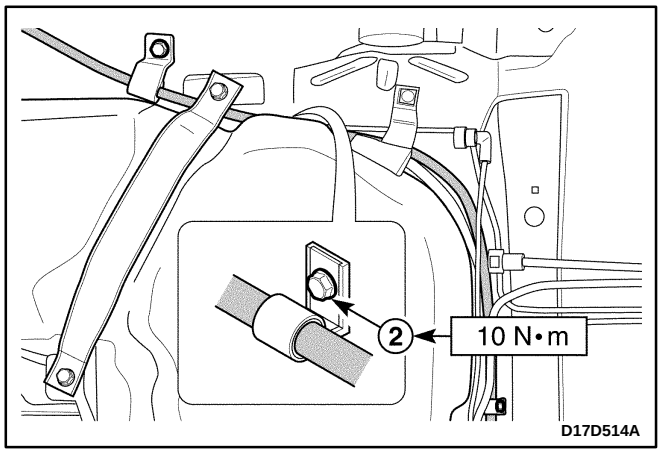


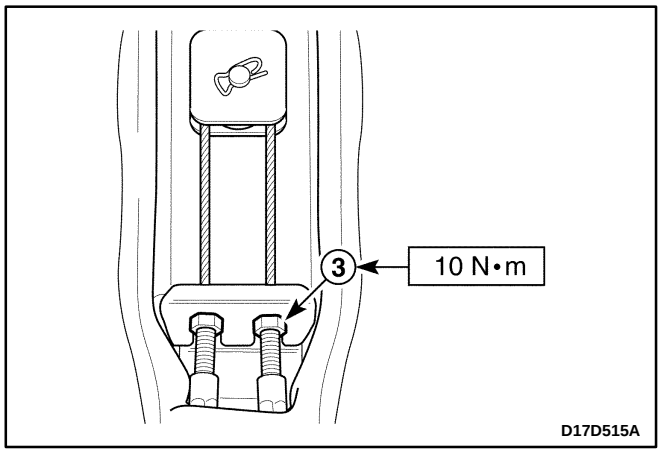
Installation Procedure

1. Install the fuel filter.
2. Install the parking brake cable with the clamp bolts.

Tighten

Tighten the parking brake cable clamp bolts to 10 N•m (89 lb-in) (1, 2).





3. Connect the parking brake cable to the rear brake drum assembly. Refer to *Section 4E, Rear Drum Brake*.
4. Install the rear brake drum assembly. Refer to *Section 2D, Rear Suspension*.
5. Install the grommet and the strengthener.
6. Install the cable pulley with the adjustment nuts.

Tighten

Tighten the adjustment nuts to 10 N•m (89 lb-in) (3).

7. Install the parking brake lever. Refer to “Parking Brake Lever” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

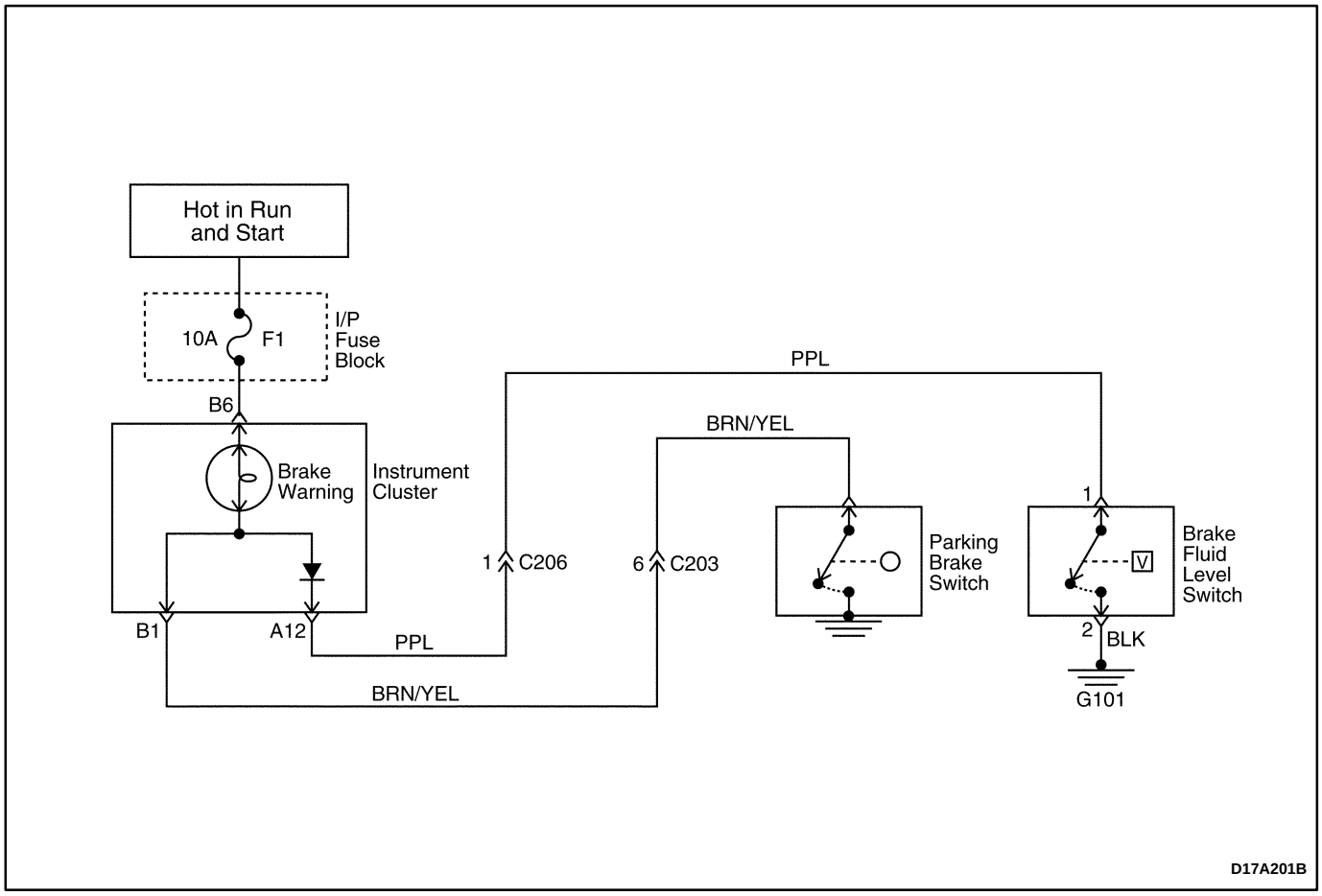
Application	Description
Parking Brake Lever Notch Number	5–7 (Loaded 44.1 lb)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Parking Brake Cable Clamp Bolts	10	–	89
Parking Brake Lever Bolts	10	–	89
Parking Brake Lever Nut	10	–	89
Parking Brake Cable Adjusting Nuts	10	–	89

SCHEMATIC AND ROUTING DIAGRAMS

PARKING BRAKE SYSTEM



SECTION 5B

FIVE-SPEED MANUAL TRANSAXLE

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.

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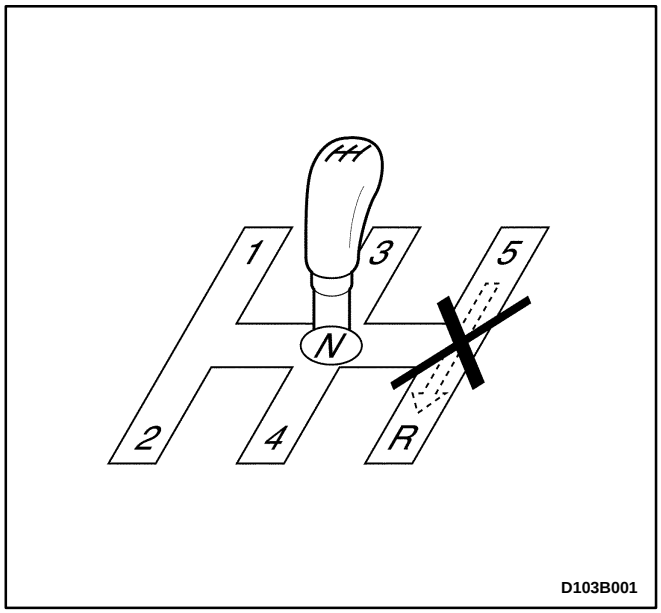
DESCRIPTION AND OPERATION

FIVE-SPEED MANUAL TRANSAXLE

This five-speed transaxle assembly adopts the synchronized mesh type of 5 forward speed. The reverse speed gear is driven by sliding idle gear without synchronizer.

REVERSE GEAR MISSHIFT PREVENTING MECHANISM

It prevents the gear from directly being shifted from 5th to reverse when shifting to reverse from 5th. Shift to the reverse in neutral position to prevent the shift cam from being interfered to the shift guide bolt.



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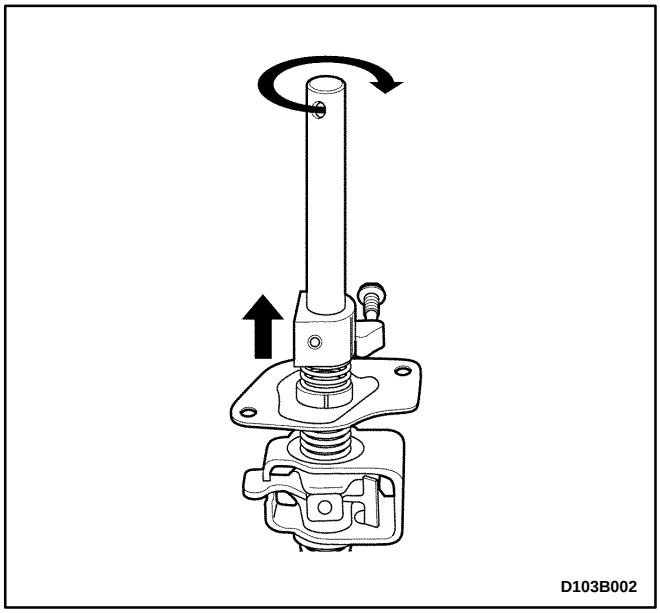
In case of shifting to 5th gear, shift and select shaft rotates to right that shift cam aparts from guide bolt and moves upwards by returning spring. Therefore, shifting to reverse in this condition is impossible because of interference of guide bolt.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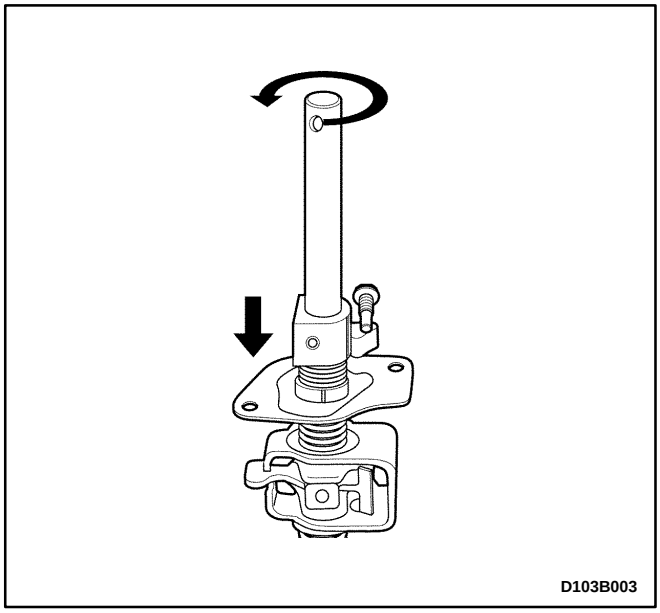
When shifting to reverse from neutral position between 5th and reverse, shift cam rotates to left and shifting is possible.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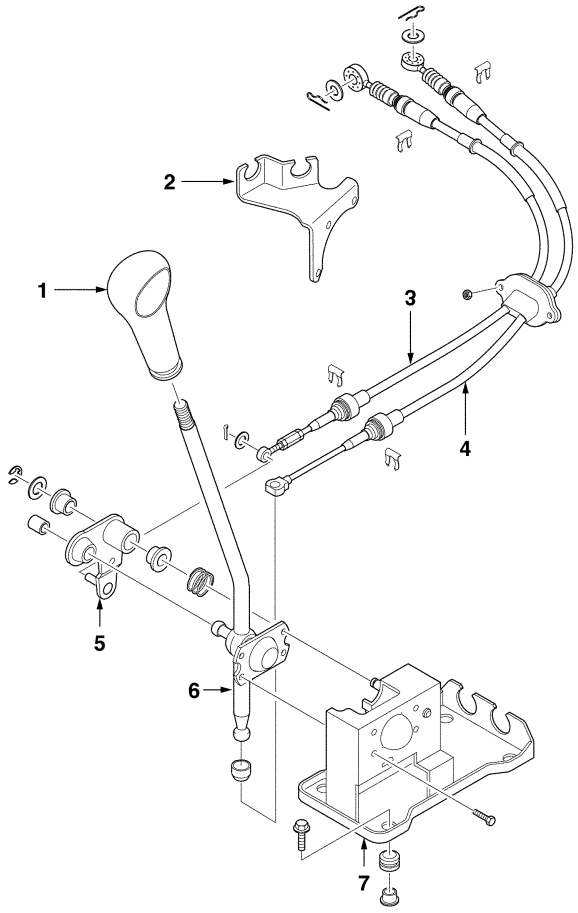
DIFFERENTIAL

Differential is integrated with transmission case and installed on chassis together with engine. It changes the direction of power and increase torque by reducing speed.

Reduction gear is installed parallel to counter shaft and is helical gear type. Differential gear is bevel gear type and is integrated with reduction gear.

COMPONENT LOCATORS

GEAR SHIFT CONTROL



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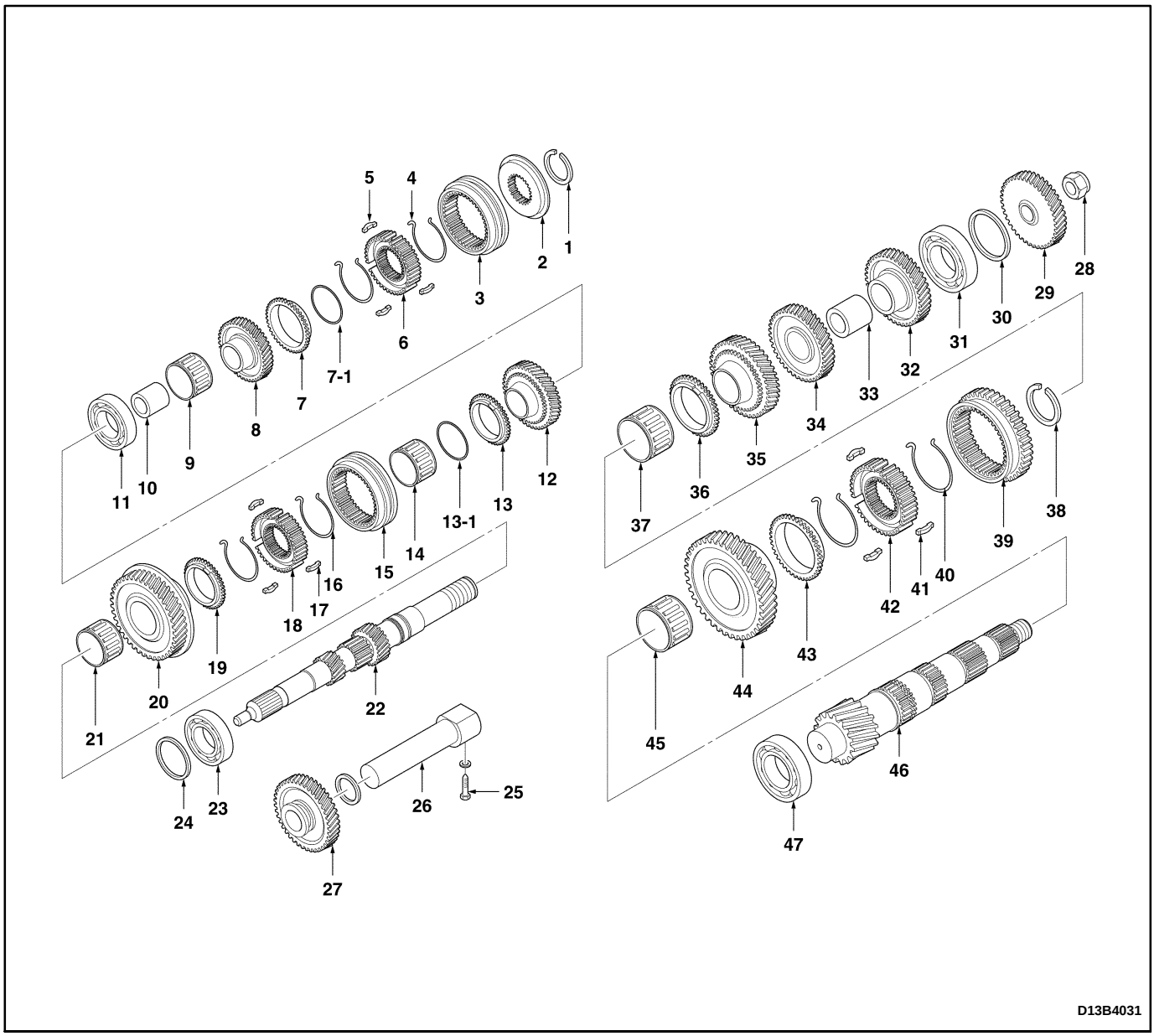
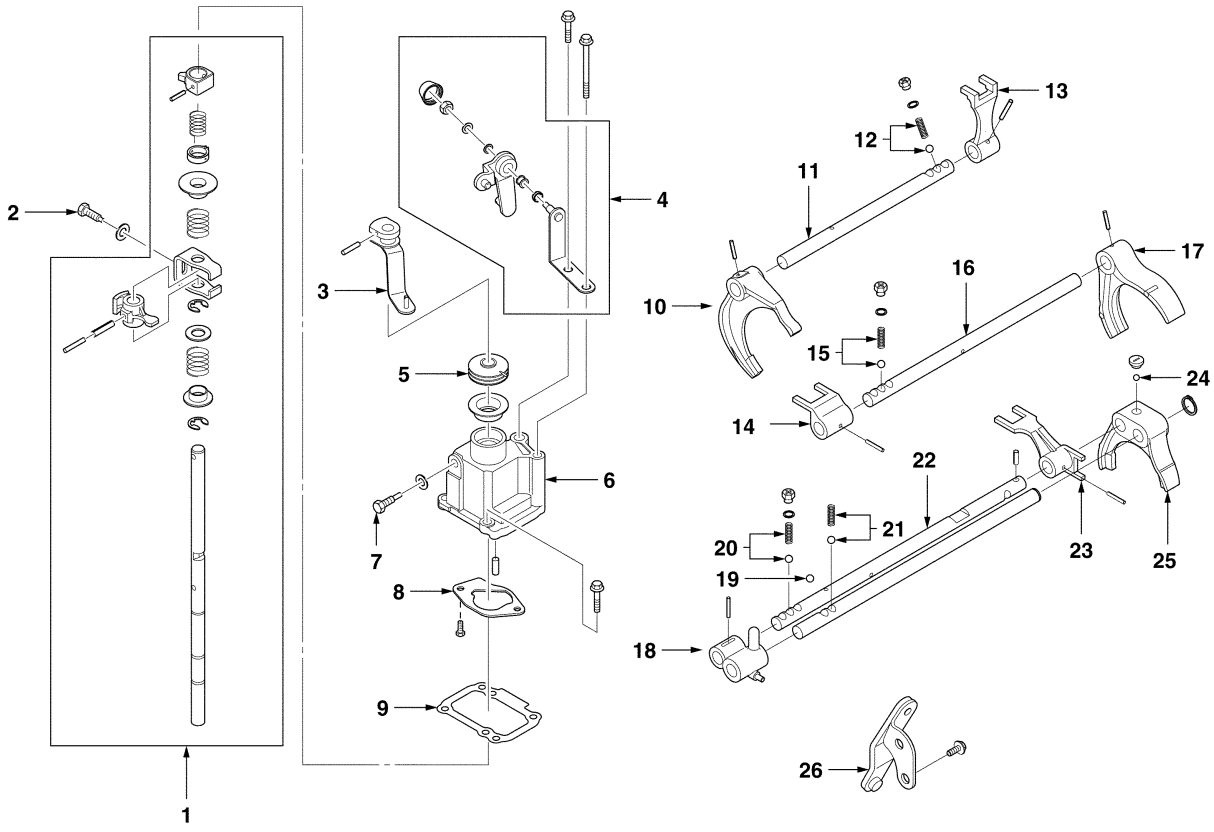
1 Gear Shift Control Lever Knob
2 Gear Shift Cable Bracket
3 Select Cable
4 Shift Cable
5 Select Arm
6 Gear Shift Control Lever
7 Gear Shift Control Lever Guide

INPUT SHAFT AND COUNTER SHAFT GEAR



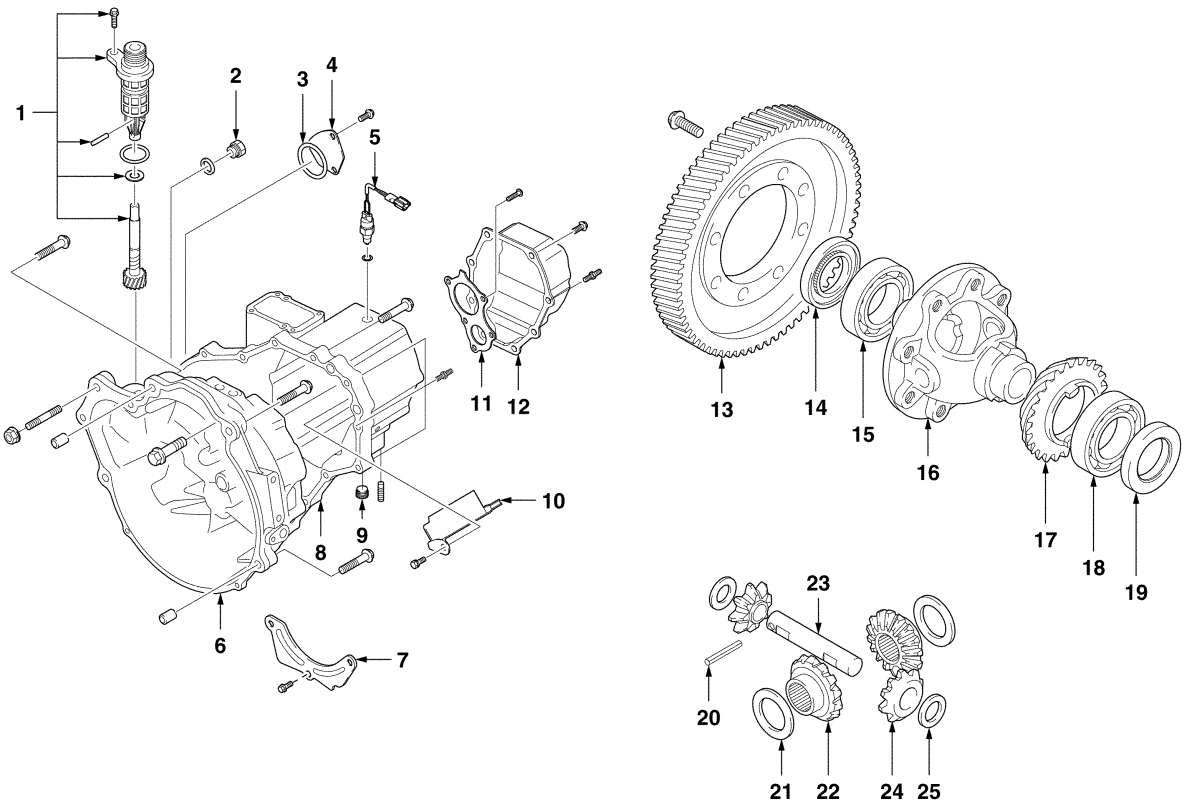
1 Input Shaft Circlip
2 5th Gear Synchronizer Plate
3 5th Gear Synchronizer Sleeve
4 5th Gear Synchronizer Spring
5 5th Gear Synchronizer Key
6 5th Gear Synchronizer Hub
7 5th Gear Synchronizer Ring
7-1 Wave Spring
8 Input Shaft 5th Gear
9 Input Shaft 5th Gear Bearing
10 Input Shaft 5th Gear Spacer
11 Input Shaft Bearing(Left)
12 Input Shaft 4th Gear
13 4th Gear Synchronizer Ring
13-1 Wave Spring
14 Input Shaft 4th Gear Bearing
15 3rd-4th Gear Synchronizer Sleeve
16 3rd-4th Gear Synchronizer Spring
17 3rd-4th Gear Synchronizer Key
18 3rd-4th Gear Synchronizer Hub
19 3rd Gear Synchronizer Ring
20 Input Shaft 3rd Gear
21 Input Shaft 3rd Gear Bearing
22 Input Shaft
23 Input Shaft Bearing(Right)
24 Input Shaft Oil Seal
25 Reverse Gear Shaft Bolt
26 Reverse Gear Shaft
27 Reverse Idle Gear
28 Counter Shaft Nut
29 Counter Shaft 5th Gear
30 Counter Shaft Bearing Shim
31 Counter Shaft Bearing(Left)
32 Counter Shaft 4th Gear
33 Counter Shaft 3rd-4th Gear Spacer
34 Counter Shaft 3rd Gear
35 Counter Shaft 2nd Gear
36 2nd Gear Synchronizer Ring
37 Counter Shaft 2nd Gear Bearing
38 1st-2nd Gear Synchronizer Circlip
39 1st-2nd Gear Synchronizer Sleeve
40 1st-2nd Gear Synchronizer Spring
41 1st-2nd Gear Synchronizer Key
42 1st-2nd Gear Synchronizer Hub
43 1st Gear Synchronizer Ring
44 Counter Shaft 1st Gear
45 Counter Shaft 1st Gear Bearing
46 Counter Shaft
47 Counter Shaft Bearing(Right)

GEAR SHIFT FORK



1 Shift and Select Shaft
2 Shift Interlock Bolt
3 Shift Lever
4 Select Lever
5 Shift and Select Shaft Boot
6 Gearshift Control Case
7 Shift Guide Bolt
8 Gearshift Control Case Guide Plate
9 Gearshift Control Case Gasket
10 Low Speed Shift Fork
11 Low Speed Shift Shaft
12 Low Speed Shift Shaft Spring/Ball
13 Low Speed Shift York
14 High Speed Shift York
15 High Speed Shaft Spring/Ball
16 High Speed Shift Shaft
17 High Speed Shift Fork
18 Reverse Shift Arm
19 5th/Reverse Shift Ball
20 5th/Reverse Shift Shaft Spring/Ball
21 Reverse Shift Shaft Guide Spring/Ball
22 5th/Reverse Shift Shaft
23 5th/Reverse Shift York
24 5th/Shift Fork Guide Ball
25 5th/Shift Fork
26 Reverse Shift Lever

DIFFERENTIAL AND CASE



1 Speedometer Driven Gear
2 Oil Level Plug
3 Case Cap O–ring(Left)
4 Case Cap(Left)
5 Back Up Light Switch
6 Transaxle Case(Right)
7 Oil Plate
8 Transaxle Case(Left)
9 Oil Drain Plug
10 Oil Gutter
11 Side Cover Plate
12 Side Cover
13 Differential Ring Gear
14 Differential Oil Seal(Left)
15 Differential Bearing(Left)
16 Differential Case
17 Speedometer Drive Gear
18 Differential Bearing(Right)
19 Differential Oil Seal(Right)
20 Differential Pinion Gear Shaft Pin
21 Differential Side Gear Adjust Shim
22 Differential Side Gear
23 Differential Pinion Gear Shaft
24 Differential Pinion Gear
25 Differential Pinion Gear Washer

DIAGNOSTIC INFORMATION AND PROCEDURE

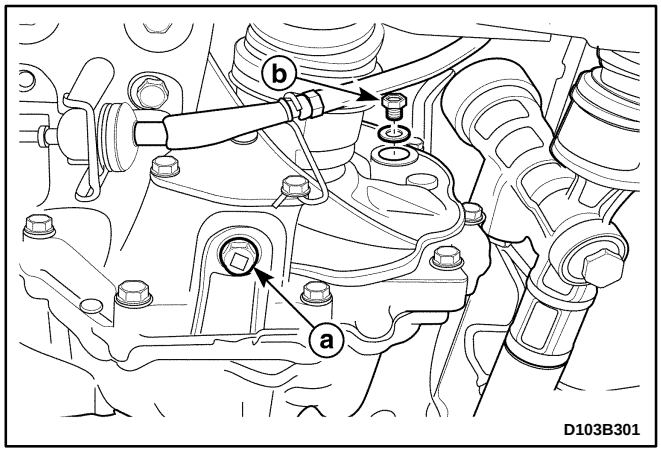
GENERAL DIAGNOSIS

Condition	Probable Cause	Correction
Gear Slipping Out of Mesh	● Worn shift fork.	● Replace shift fork.
	● Worn synchronizer sleeve or gear.	● Replace sleeve or gear.
	● Worn bearings on input shaft or counter shaft.	● Replace bearing.
	● Weakened or damaged location spring.	● Replace spring.
	● Loose or damaged synchronizer spring.	● Replace synchronizer spring.
	● Excessive back-lash of gear.	● Adjust back-lash of gear.
Gear Catching	● Bent or distorted shift shaft or shift fork.	● Replace shift shaft or shift fork.
	● Weakened or damaged synchronizer spring.	● Replace spring.
Hard Shifting	● Worn synchronizer ring.	● Replace synchronizer ring.
	● Worn synchronizer sleeve or gear.	● Replace sleeve or gear.
	● Bent or distorted shift shaft.	● Replace shift shaft.
	● Excessive free travel of all gears in axial direction.	● Replace gear.
	● Worn bearings on input shaft or counter shaft.	● Replace bearing.
	● Poor adjustment of clutch cable.	● Adjust clutch cable.
	● Distorted or broken clutch disc.	● Replace clutch disc.
	● Damaged pressure plate.	● Replace pressure plate.
Noise in the Neutral Gear	● Insufficient lubricant.	● Supply lubricant.
	● Worn input shaft gear.	● Replace gear.
	● Worn bearings on the input shaft gears.	● Replace bearing.
	● Worn clutch release bearing.	● Replace clutch release bearing.
Noise in the All Gears	● Insufficient lubricant.	● Supply lubricant.
	● Worn bearings on input shaft or counter shaft.	● Replace bearing.
	● Worn input shaft or counter shaft gear.	● Replace gear.
	● Worn or damaged synchronizer ring.	● Replace synchronizer ring.
	● Worn or damaged synchronizer sleeve.	● Replace synchronizer sleeve.
	● Worn differential gear or bearing.	● Replace gear or bearing.
Noise in the Peculiar Gear	● Worn or damaged synchronizer ring in the peculiar gear.	● Replace synchronizer ring.
	● Worn or damaged gear in the peculiar gear.	● Replace gear.
	● Worn or damaged bearing in the peculiar gear.	● Replace bearing.
Leak of Lubricant	● Damaged gasket, oil seal or O-ring.	● Replace gasket, oil seal or O-ing.

CHECKING FLUID LEVEL

Check for a leak in the area of transaxle case and sealing and then check fluid level and condition after removing oil level plug.

1. Operate the engine until it comes to normal operating temperature(Coolant temperature : 80~90°C (176~194°F)).
2. Stall the engine and raise the vehicle.
3. Remove the oil level plug and check the fluid level.
4. The fluid should slightly flow out from the oil level plug hole.
5. If the level is low, add the recommended fluid through the oil level plug hole until the fluid begins to run out.
6. If the fluid is contaminated or discolored, replace it with the recommended fluid.
7. Reinstall the oil level plug and tighten it securely.



CHANGING FLUID

1. Operate the engine until it comes to normal operating temperature(Coolant temperature : 80~90°C (176~194°F)).
2. Stall the engine and raise the vehicle.
3. Drain the fluid after removing the drain plug.
4. Reinstall the drain plug and tighten it securely after coating sealant.
5. Remove the oil level plug and replenish the fluid until it begins to run out.
   a. Oil drain plug.
   b. Oil level plug.
6. Reinstall the oil level plug and tighten it securely.

Fluid Specification	75W-85(GL-4)
Fluid Capacity	2.1L(2.21qt)
Service interval	Refer to Owner's Manual

CHECKING TRANSAXLE NOISE

Many noises that appear to come from the transaxle may actually originate with other sources such as tires, road surfaces, wheel bearings, or engine and exhaust system.

Identify the cause of any noise before attempting to repair the clutch, the transaxle, or their related linkages.

To verify suspected transaxle noises,

1. Select a smooth, level asphalt road to reduce tyre and resonant body noise.
2. Drive the vehicle far enough to warm up all the lubricants thoroughly.
3. Record the speed and the gear range of the transaxle when the noise occurs.
4. Check for noises with the vehicle stopped, but with the engine running.
5. Determine if the noise occurs while the vehicle operates in.
   - Drive – Under a light acceleration or a heavy pull.
   - Float – Maintaining a constant speed with a light throttle on a level road.
   - Coast – With the transaxle in gear and the throttle partly or fully closed.
   - All of the above.

CHECKING BEARING NOISE

Differential Side Bearing Noise

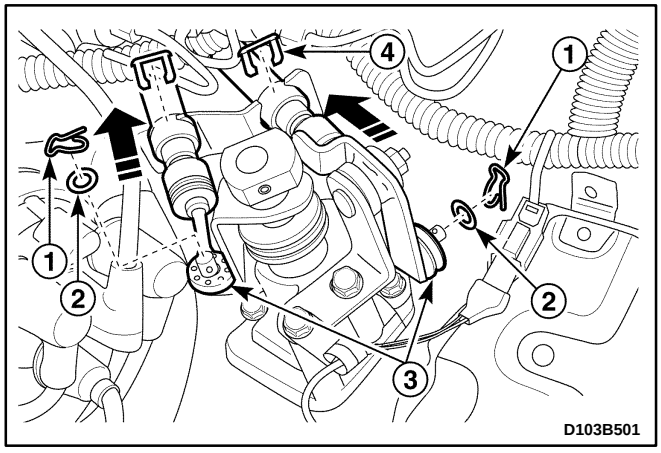
Differential side bearing noise and wheel bearing noise can be confused easily. Since side bearings are preloaded, a differential side bearing noise should not diminish much when the differential/transaxle is run with the wheels off the ground.

Wheel Bearing Noise

Wheel bearings produce a rough growl or grating sound that will continue when the vehicle is coasting and the transaxle is in NEUTRAL. Since wheel bearings are not pre-loaded, a wheel bearing noise should diminish considerably when the wheels are off the ground.

REPAIR INSTRUCTION

ON–VEHICLE SERVICE



MANUAL TRANSAXLE ASSEMBLY

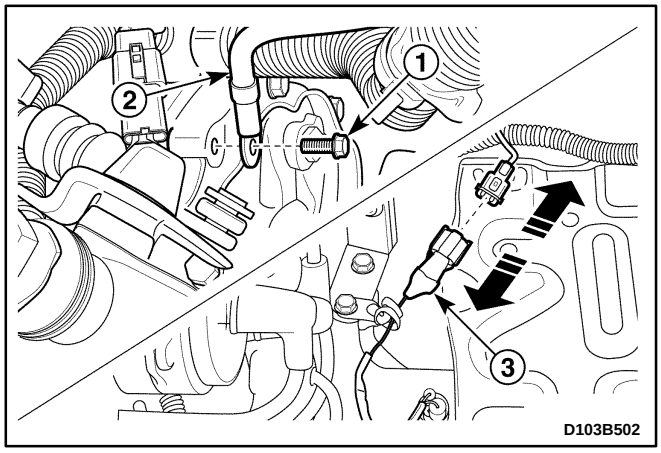
Tools Required

DW110–021 Engine Support Fixture

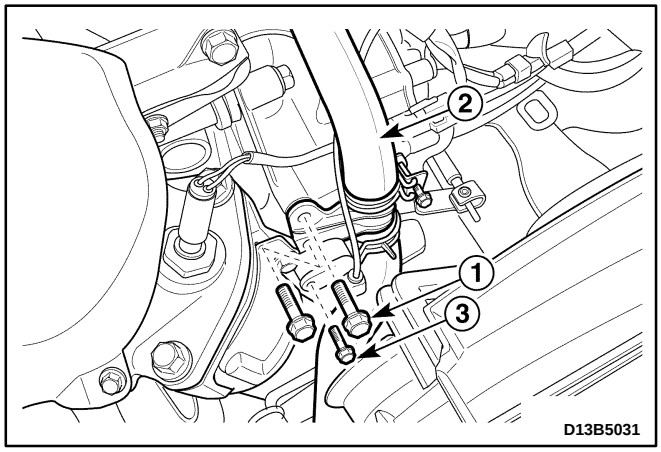
DW220–031 Transaxle Remove/Install Support

Removal Procedure

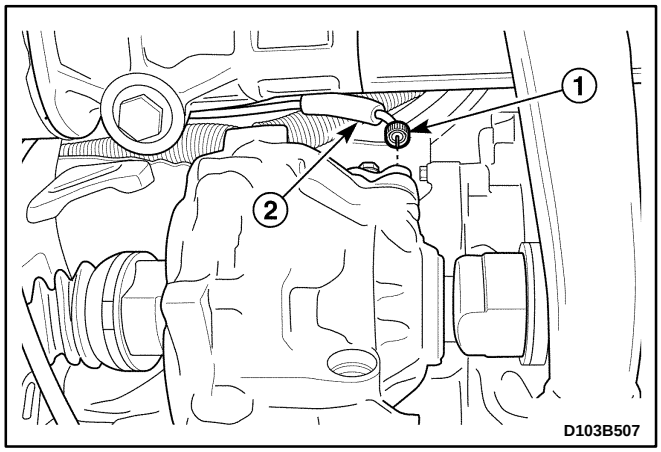
1. Remove the air cleaner assembly. Refer to *Section 1B, SOHC Engine Mechanical.*
2. Remove the battery and battery tray. Refer to *Section 1E, Engine Electrical*.
3. Disconnect the select and the shift cable.
   - Remove the cable pins (1).
   - Remove the washers (2).
   - Disconnect the select and the shift cable (3).
   - Remove the cable E–rings (4).
   - Disconnect the cables from the cable bracket.



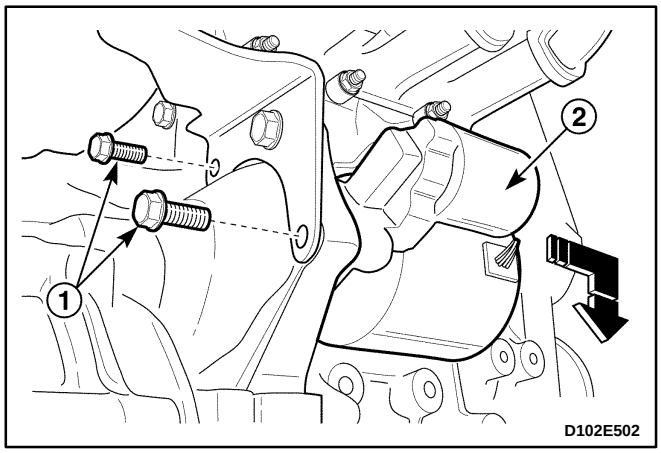
4. Remove the engine wiring harness bending strap.
5. Disconnect the ground wire and the backup lamp switch connector.
   - Remove the ground wire bolt (1).
   - Disconnect the ground wire (2).
   - Disconnect the backup lamp switch connector (3).



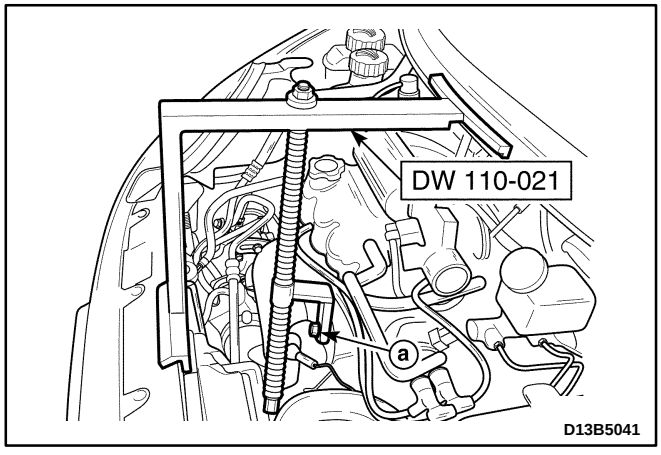
6. Disconnect the radiator lower hose.
   - Remove the bolts (1).
   - Disconnect the radiator lower hose (2).
7. Remove crankshaft position (CKP) sensor.
   - Remove the bolt (3).
   - Disconnect the CKP sensor connector
   - Remove the CKP sensor.



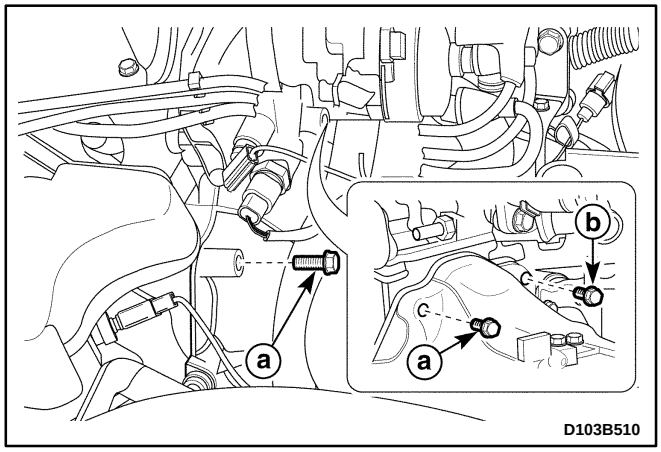
8. Disconnect the speedometer cable.
   - Loosen the nut (1).
   - Disconnect the cable (2).
9. Remove the vehicle speed sensor (VSS) if equipped.
   - Disconnect VSS connector.
   - Remove the VSS.



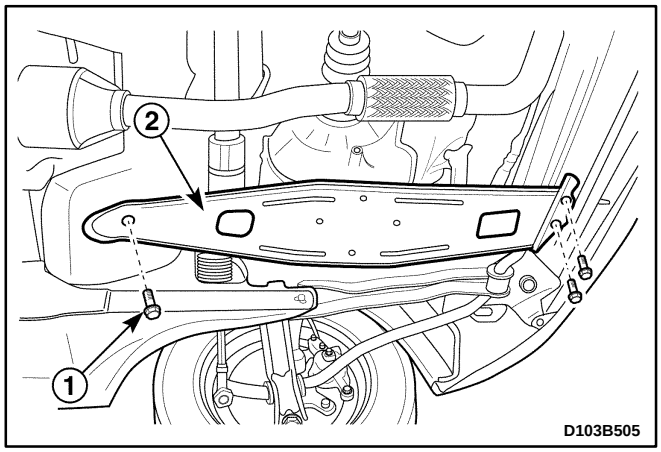
10. Remove the starter motor.
    - Remove upper two bolts that securing starter motor to transaxle.



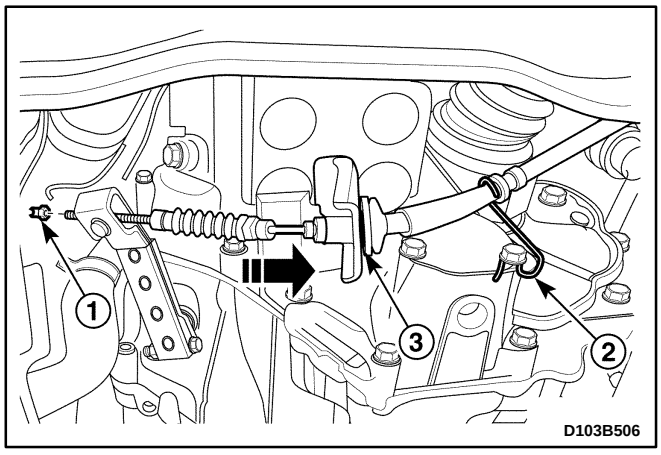
11. Fix the engine assembly.
    - Remove the cowl panel weatherstrip.
    - Position the engine support fixture DW110–021 on the cowl panel and the front upper panel.
    - Tighten the engine fixture joint with a bolt after removing exhaust manifold bolt (No.4).



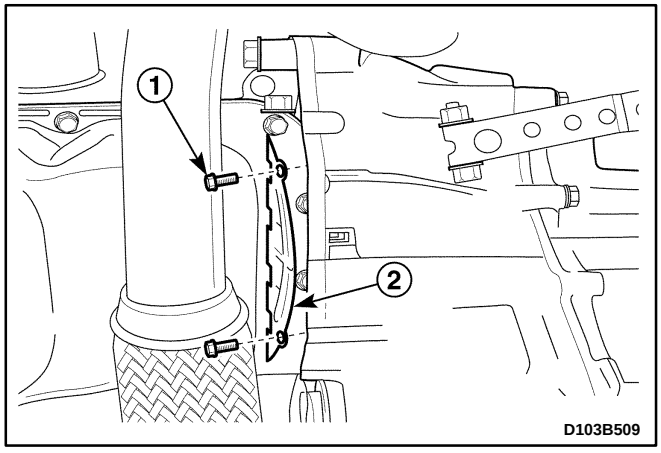
12. Remove the transaxle upper bolts.
    a. Exhaust manifold side bolt.
    b. Thermostat housing side bolt.



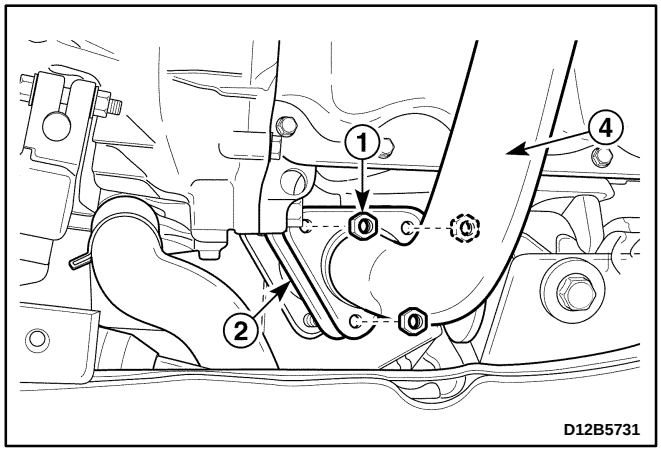
13. Remove the transaxle under cover.
    - Remove the bolts (1).
    - Remove the transaxle under cover (2).
14. Remove the front tires and wheels.



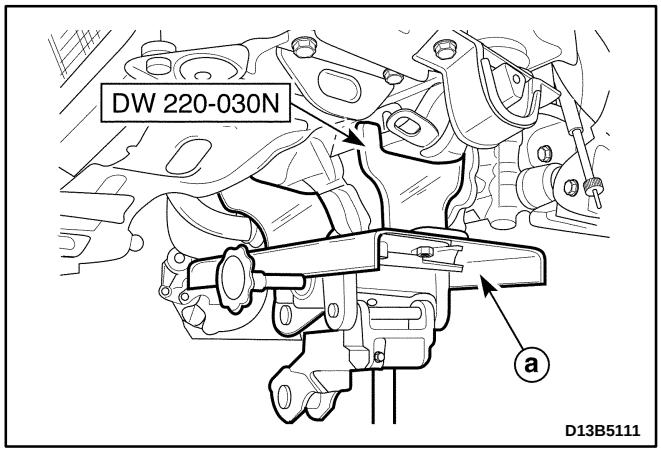
15. Drain the transaxle fluid.
    - Remove the drain plug and drain the fluid.
16. Disconnect the clutch cable.
    - Remove the cable adjust nut (1).
    - Disconnect the cable from the wire clip (2).
    - Disconnect the cable from the transaxle mount hole (3).



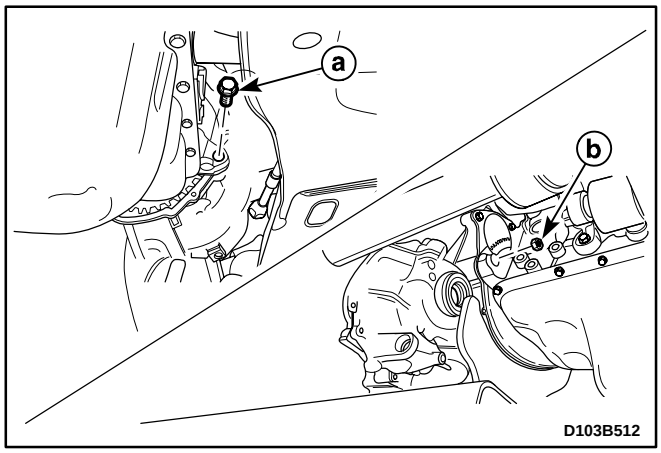
17. Remove the front under longitudinal frames and stabilizer. Refer to *Section 2C, Front Suspension.*
18. Remove the drive axle (only transaxle side). Refer to *Section 3B, Manual Transaxle Drive Axle.*
19. Remove the clutch housing lower plate.
    - Remove the bolts (1).
    - Remove the lower plate (2).



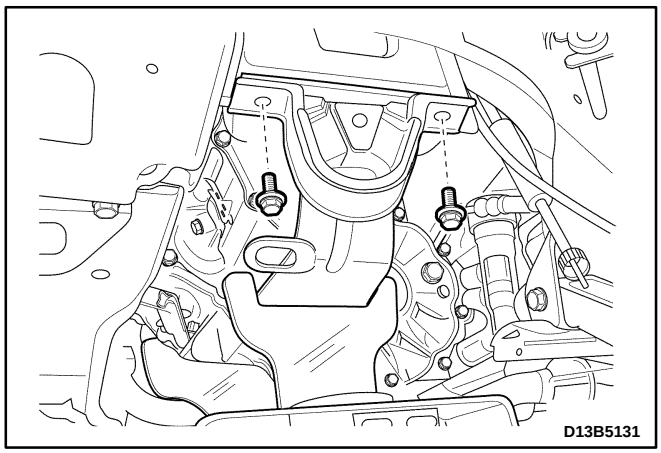
20. Remove the front exhaust pipe.
    - Remove the front exhaust pipe nuts (exhaust manifold side) (1).
    - Remove the gasket and separate exhaust manifold pipe (2).
    - Make free the front exhaust pipe.



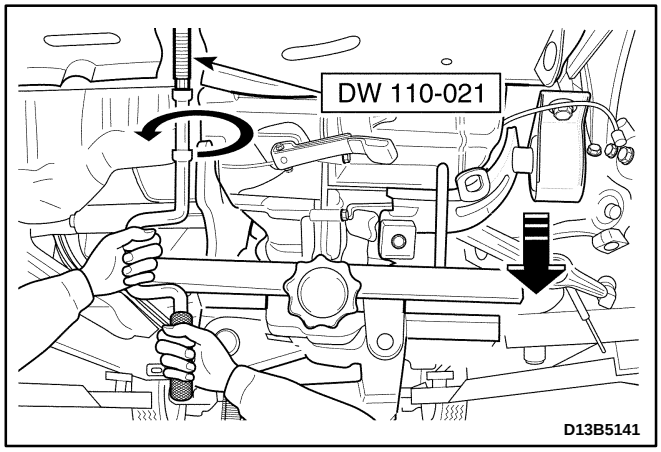
21. Support the transaxle with the transaxle remove/install support DW220–030N.
    - Position the support on the jack (a).
    - Support the transaxle case and mount using a jack and the transaxle remove/install support.



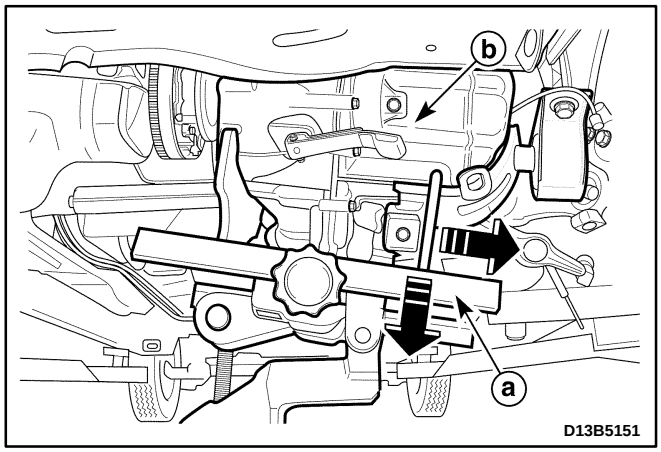
22. Remove the transaxle lower bolt and nut.
    a. Lower bolt.
    b. Lower nut.



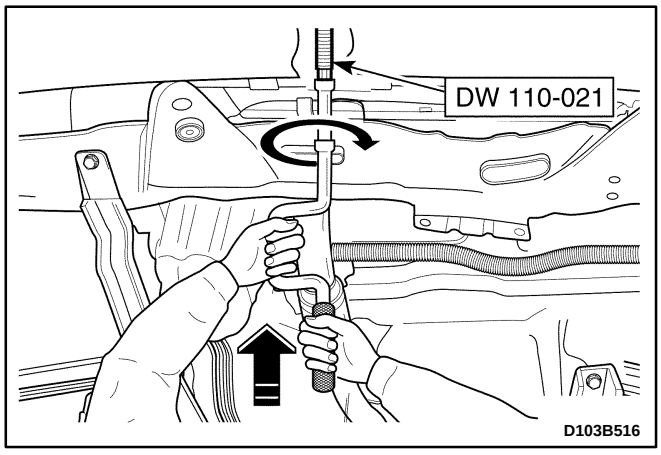
23. Remove the transaxle mount bolts.



24. Position the manual transaxle assembly in tilting.
    - To remove the manual transaxle side cover without the interference with the front under longitudinal panel (Left), tilt the engine/manual transaxle by loosening the engine support fixture DW110– 021 joint with the wrench.



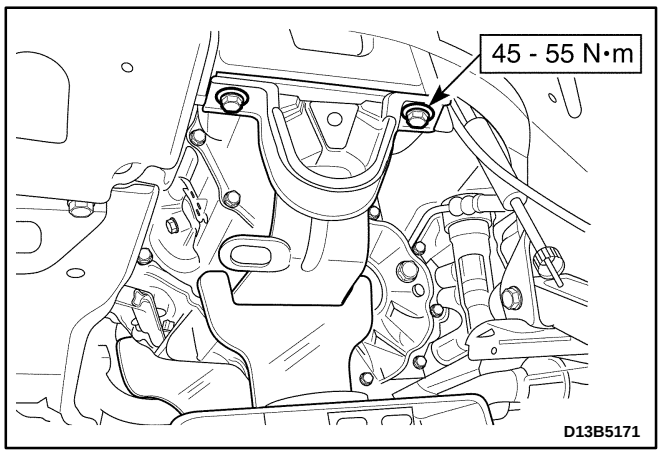
25. Remove the manual transaxle assembly.
    - Lower the transaxle assembly slowly by adjusting jack.
      a. Jack.
      b. Transaxle assembly.
    - Tilt the transaxle assembly by adjusting jack.
    - Remove the transaxle assembly by pulling and lowering it slowly.



26. Support the engine to normal position using the engine support fixture DW110–021.

Notice: The abnormal position of the engine may damage to the related parts or interfere with them. You have to support the engine to normal position when removing the transaxle.

Important: If it is impossible to use the special tool, support the engine to normal position with the auto jack.

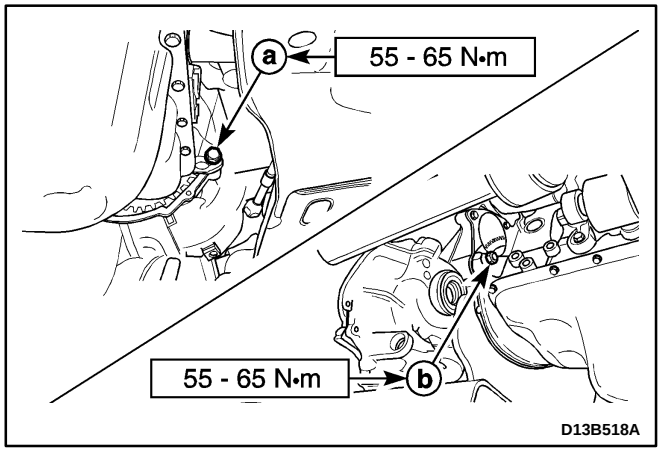


Installation Procedure

1. Install in the reverse order of removal.
2. Install the transaxle mounting bolts.

Tighten

Tighten the transaxle mounting bolts (body side) to 45–55 N•m (33–41 lb-ft).

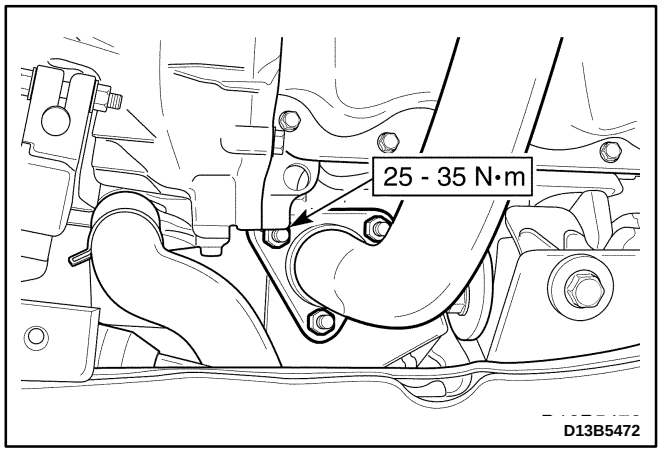


3. Install the transaxle lower bolt, nut.

Tighten

Tighten the bolt and nut to 55–65 N•m (41–48 lb-ft).

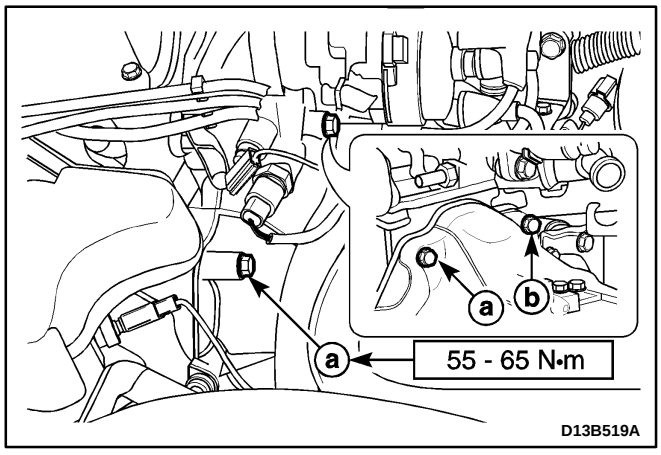
a. Lower bolt.
b. Lower nut.



4. Tighten the front exhaust pipe nuts.

Tighten

- Tighten the front exhaust pipe nuts (exhaust manifold side) to 25–35 N•m (18–25 lb-ft).

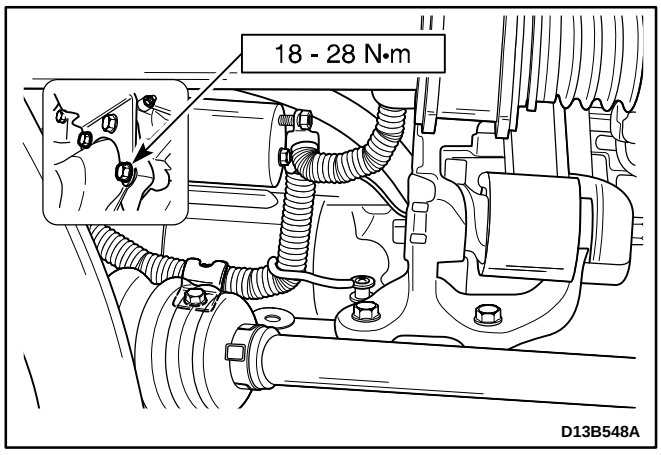


5. Install the transaxle upper bolts.

Tighten

Tighten the bolts to 55–65 N•m (41–48 lb-ft).

a. Exhaust manifold side bolt.
b. Thermostat housing side bolt.

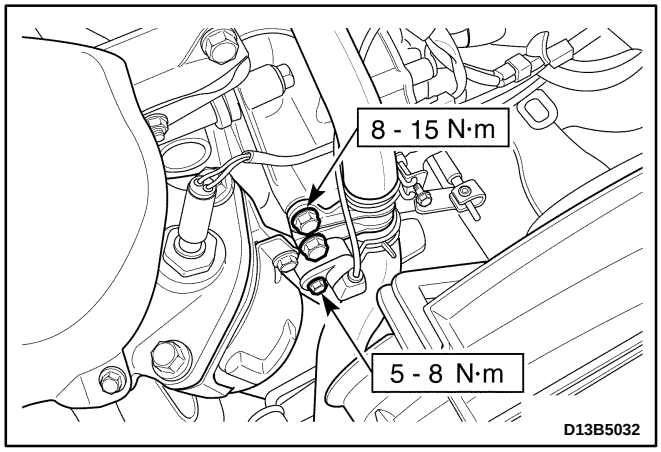


6. Install the starter motor.

Tighten

Tighten the starter motor bolts to 18–28 N•m (13–21 lb-ft).

7. Connect all electric connectors.

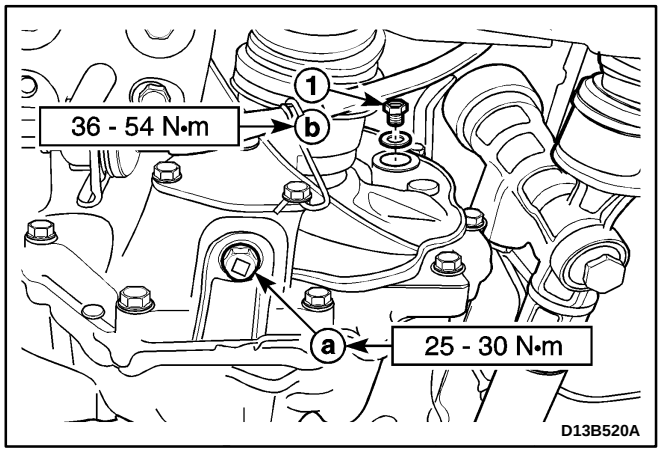


8. Install the radiator lower hose and crank position (CKP) sensor.

Tighten

Tighten the radiator lower hose bolt to 8–15 N•m (70–132 lb-in).

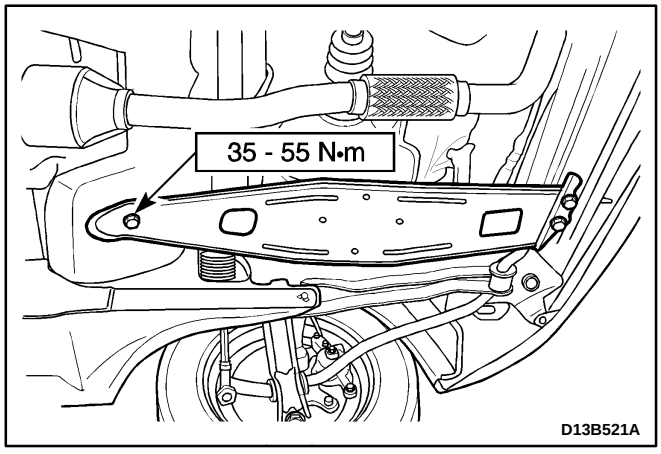
Tighten the CKP sensor bolt to 5–8 N•m (44–70 lb-in).



9. Refill the transaxle fluid.
   - Tighten the drain plug to 25–30 N•m (18–22 lb-ft) (a).
   - Remove the oil level plug (1).
   - Refill recommended fluid to the proper level.

Classification	75W – 85 (GL–4)
Capacity	2.1L (2.21 qt)

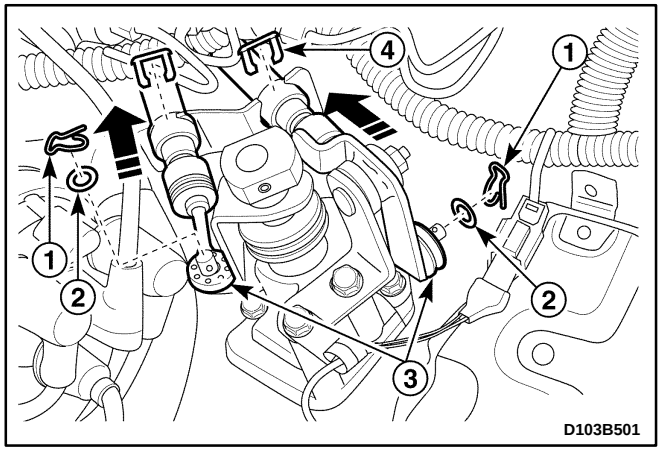
   - Tighten the oil level plug to 36–54 N•m (26–40 lb-ft) (b).



10. Adjust the clutch cable. Refer to *Section 5C, Clutch.*
    - Adjust the clutch cable by the clutch cable adjust nut.
11. Install the transaxle under cover.

Tighten

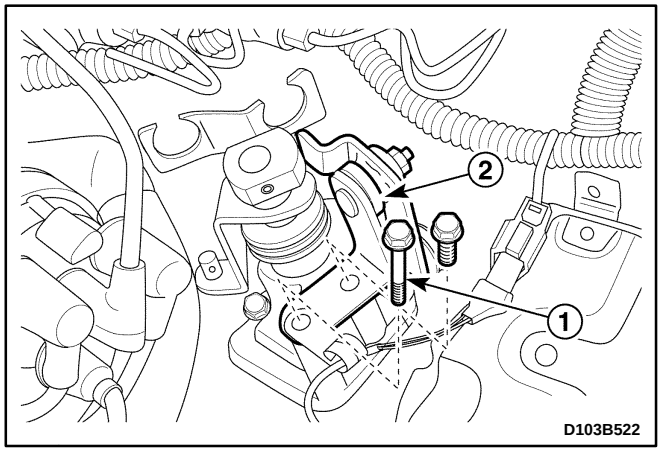
Tighten the transaxle under cover bolts to 35–55 N•m (25–41 lb-ft).



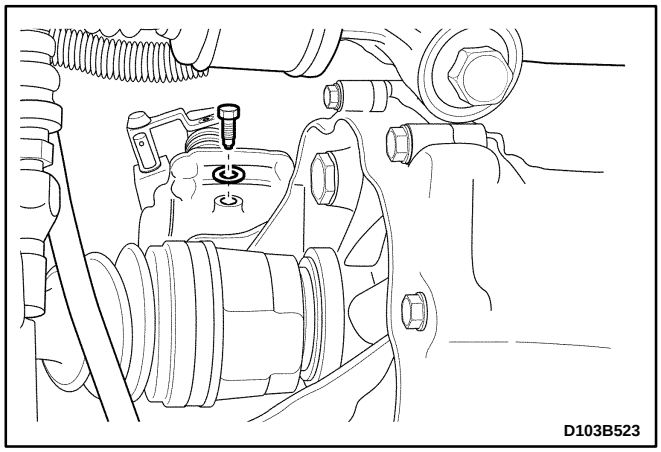
GEAR SHIFT CONTROL CASE ASSEMBLY

Removal Procedure

1. Remove the air hose (air cleaner to throttle body). Refer to *Section 1B, SOHC Engine Mechanical.*
2. Remove the battery.
3. Disconnect the select and the shift control cable.
   - Remove the cable pins (1).
   - Remove the washers (2).
   - Disconnect the select and the shift control cable (3).
   - Remove the cable E–rings (4).
   - Disconnect the cables from the cable bracket.

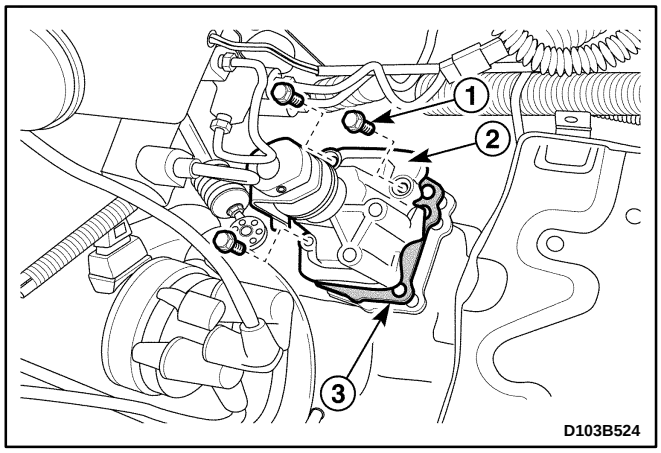


4. Remove the select lever.
   - Remove the bolts (1).
   - Remove the select lever (2).



5. Remove the shift interlock bolt.

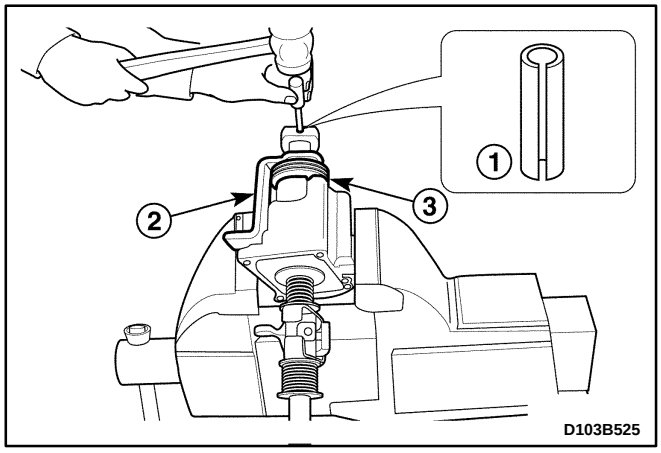
Important: Certainly remove the shift interlock bolt. Otherwise, the gear shift control case can not be removed.



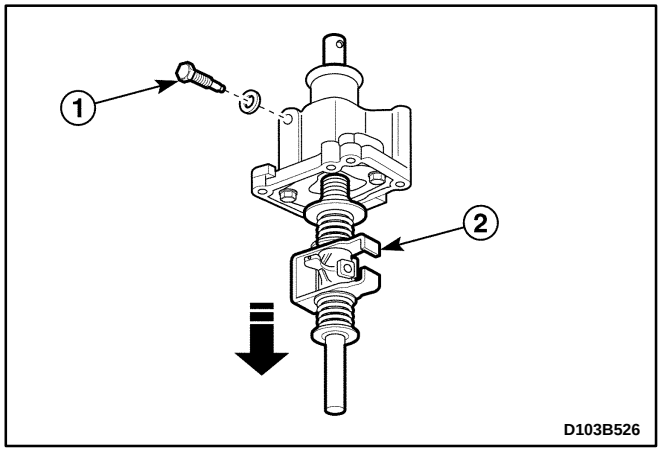
6. Remove the gear shift control case assembly.
   - Remove the bolts (1).

Important: Make sure the gear shift lever is in NEUTRAL.

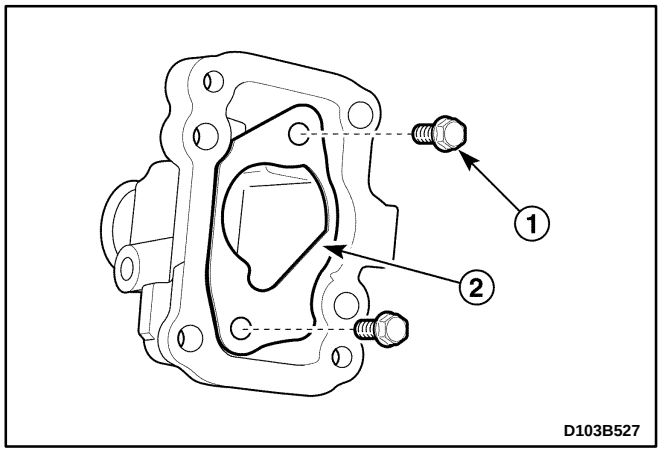
   - Remove the gear shift control case assembly (2).
   - Remove the gasket (3).



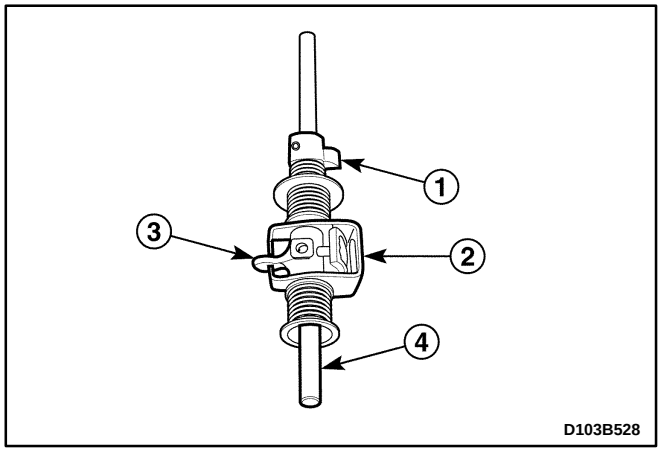
7. Remove the shift lever.
   - Position the gear shift control case assembly to the vice with a protector.
   - Remove the lever pin with a pin punch and a hammer (1).
   - Remove the shift lever (2).
   - Remove the boot (3).



8. Remove the select/shift shaft.
   - Remove the shift guide bolt (1).
   - Remove the select/shift shaft (2).

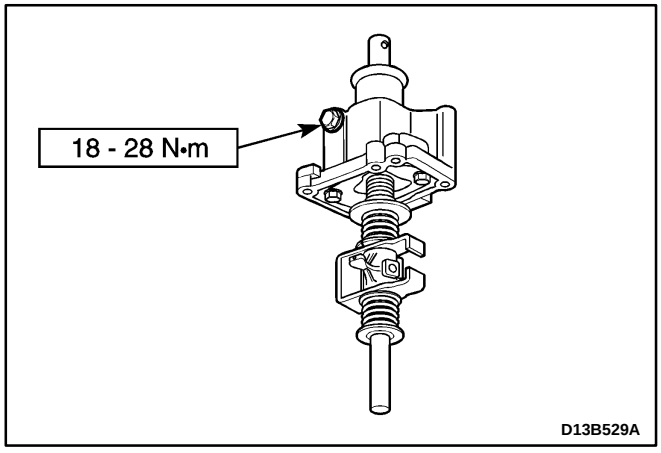


9. Remove the gear shift control case plate.
   - Remove the bolts (1).
   - Remove the Plate from the case (2).



Inspection Procedure

1. Inspect for worn or damaged the fifth/reverse shift cam (1).
2. Inspect for worn or damaged shift interlock plate (2).
3. Inspect for worn or damaged select/shift lever (3).
4. Inspect for bent or damaged select/shift shaft (4).

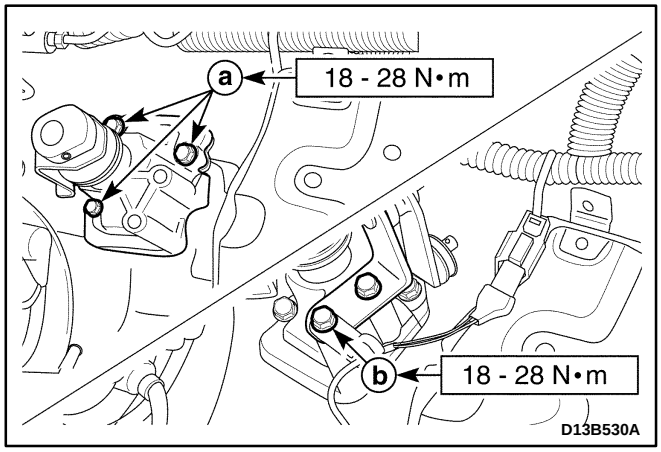


Installation Procedure

1. Install in the reverse order of removal.
2. Install the shift guide bolt.

Tighten

Tighten the shift guide bolt to 18–28 N•m (13–21 lb-ft).

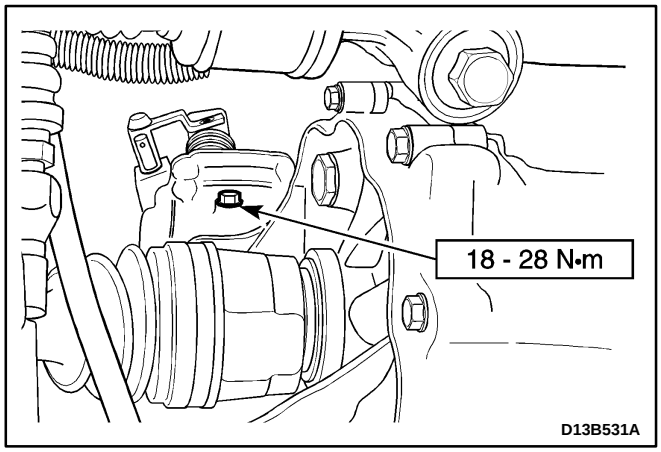


3. Install the gear shift control case and the select lever.

Tighten

- Tighten the gear shift control case bolts to 18–28 N•m (13–21 lb-ft).
  a. Gear shift control case bolt.
- Tighten the select lever bolts to 18–28 N•m (13–21 lb-ft).
  b. Select lever bolt.

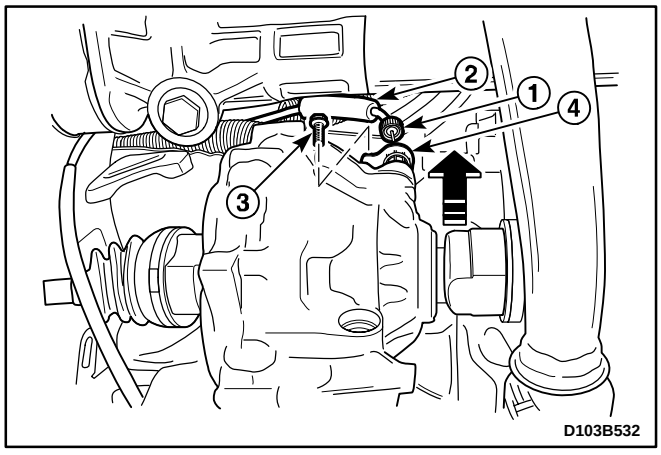
Important: Make sure a correct bolt. There is length difference between select lever bolts.



4. Install the shift interlock bolt.

Tighten

Tighten the shift interlock bolt to 18–28 N•m (13–21 lb-ft).

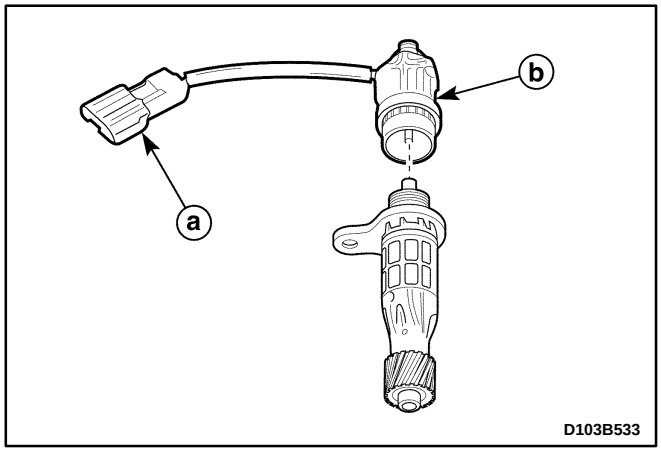


SPEEDOMETER DRIVEN GEAR AND CABLE

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

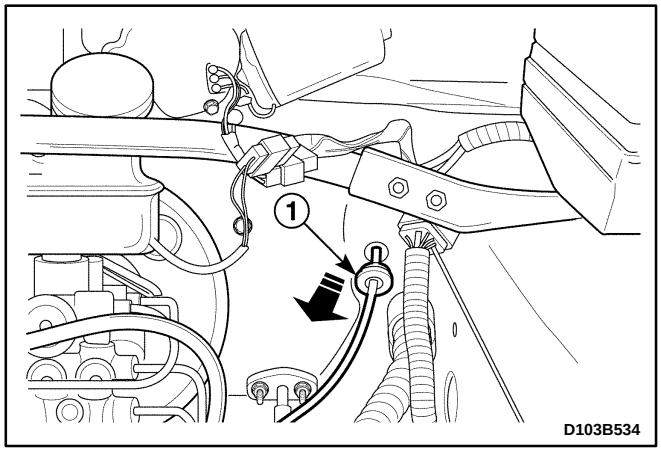
Removal Procedure

1. Remove the speedometer driven gear assembly.
   - Loosen the nut. (1).
   - Disconnect the cable (2).
   - Remove the bolt (3).
   - Remove the speedometer driven gear assembly (4).

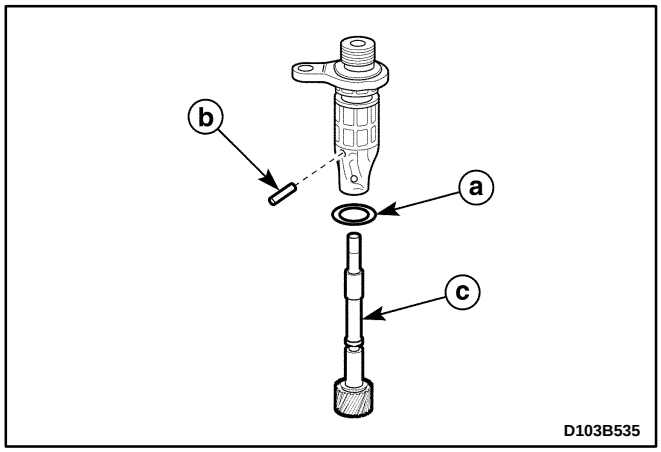


- Disconnect the vehicle speed sensor connector (If equipped).
  a. Vehicle speed sensor connector.
- Disconnect the vehicle speed sensor.
  b. Vehicle speed sensor.

Caution: Be careful to prevent personal injury while the exhaust pipe is hot.

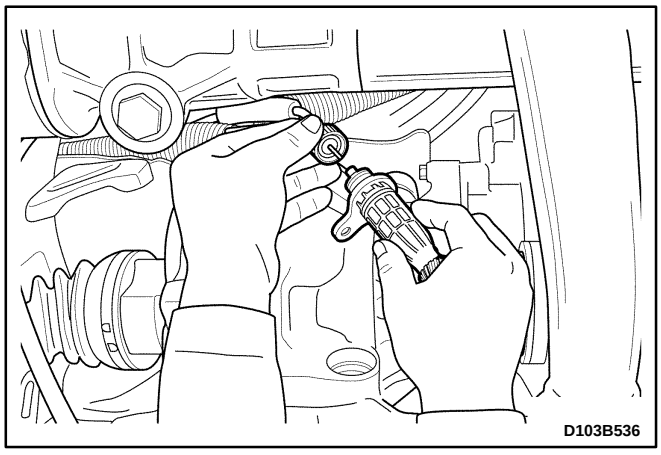


2. Remove the battery. Refer to *Section 1E, Engine Electrical*.
3. Disconnect the instrument cluster side cable. Refer to *Section 9E, Instrumentation/Driver Information.*
4. Remove the speedometer cable.
   - Remove the cable grommet (1).
   - Pull out the speedometer cable from the dash panel.



Inspection Procedure

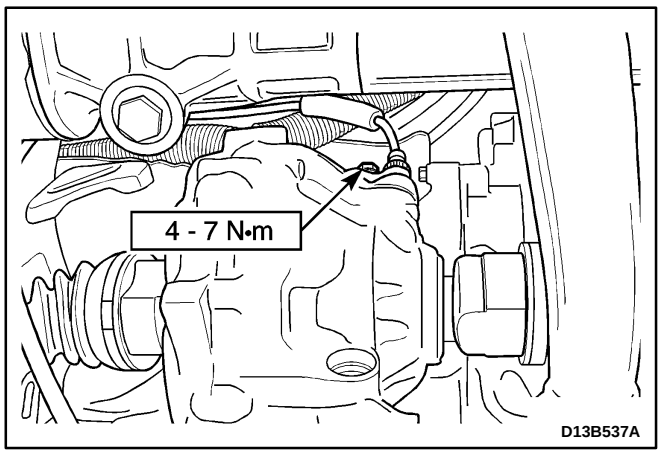
1. Remove the O–ring from the speedometer driven gear housing.
2. Remove the driven gear pin and disconnect the driven gear.
   - Check for a damaged or torn O–ring.
   - Check for a worn or damaged tooth of driven gear.
     a. O–ring.
     b. Driven gear pin.
     c. Driven gear.



Installation Procedure

1. Install in the reverse order of removal.

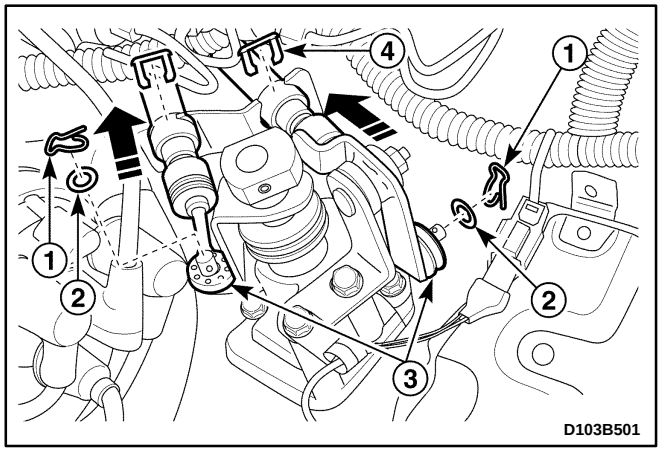
Important: Install the speedometer driven gear assembly after connecting the speedometer cable with the speedometer driven gear assembly completely.



2. Install the speedometer driven gear assembly to transaxle housing.

Tighten

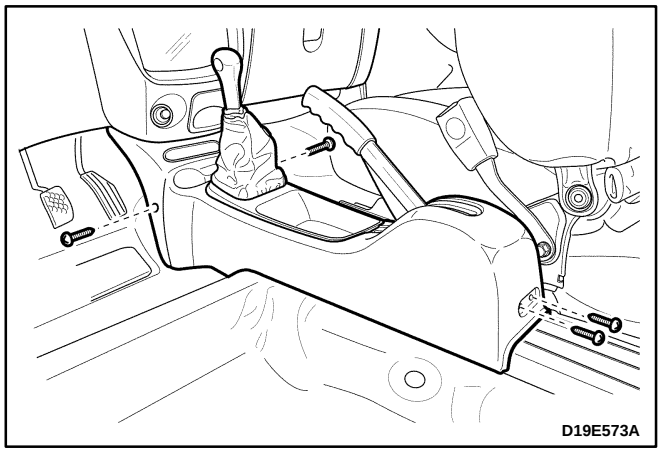
Tighten the speedometer driven gear assembly bolt to 4–7 N•m (35–62 lb-in).



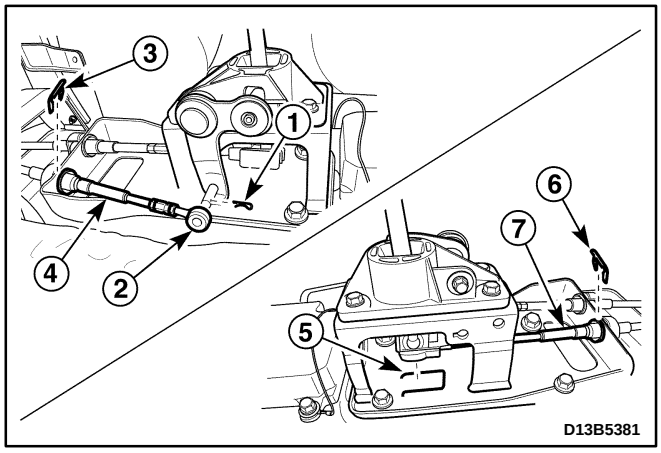
GEAR SHIFT CONTROL CABLE

Removal Procedure

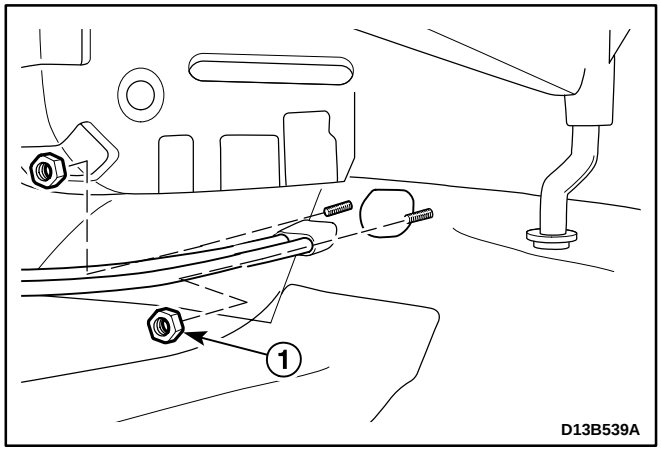
1. Remove the air hose (air cleaner to throttle body). Refer to *Section 1B, SOHC Engine Mechanical.*
2. Remove the battery.
3. Disconnect the transaxle side select and shift control cable.
   - Remove the cable pins (1).
   - Remove the washers (2).
   - Disconnect the select and shift control cable (3).
   - Remove the cable E–rings (4).
   - Disconnect the cables from the cable bracket.



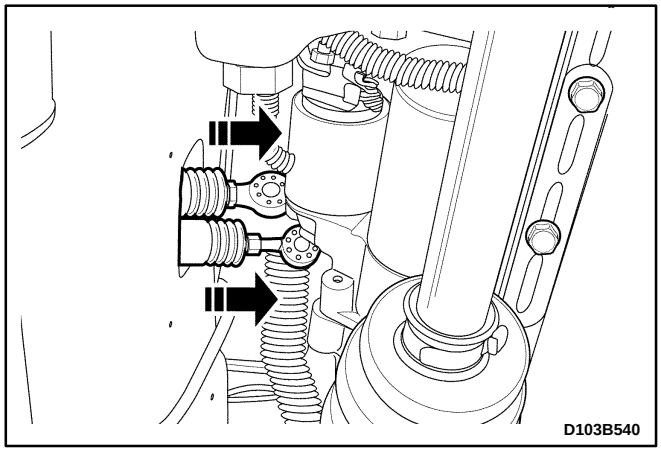
4. Remove the floor console. Refer to *Section 9G, Interior Trim.*
   - Put aside the floor carpet in order to get the gear shift cable shown.



5. Disconnect the gear shift lever side select and shift control cable.
   - Remove the select control cable clip (1).
   - Ply off the eye ring (2).
   - Remove the select control cable E–ring (3).
   - Disconnect the select control cable (4).
   - Remove the shift control cable pin (5).
   - Remove the shift control cable E–ring (6).
   - Ply off the shift control cable (7).



6. Remove the select and shift control cable.
   - Remove the nuts (1).
   - Pull the cables out in the passenger room.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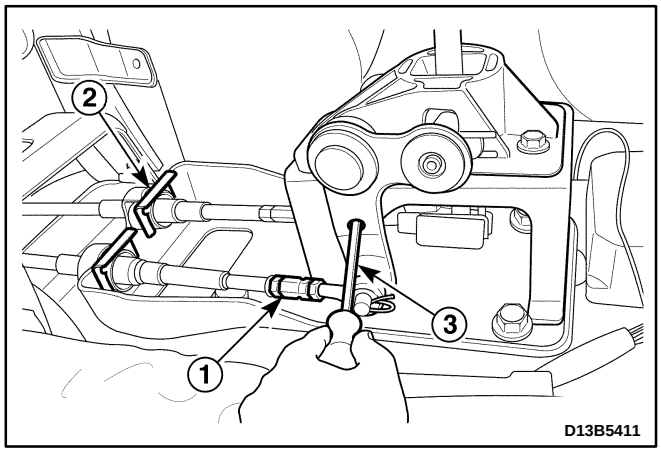
Installation Procedure

1. Install in the reverse order of removal.
2. Push the cables toward the engine compartment through dash panel's hole slightly.
3. Position the cables on the select and the shift lever.



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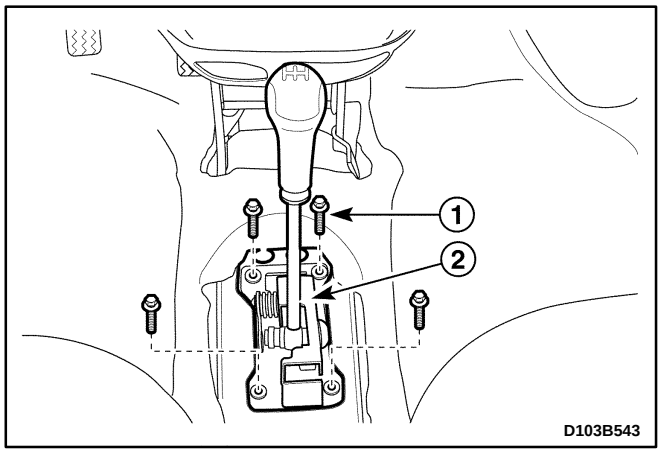
4. Connect the transaxle side select and shift control cable.
5. Connect the gear shift lever side shift control cable.
6. Connect the gear shift lever side select control cable.
   - Insert the select control cable eye ring to the select arm pin (1).
   - Install the selector lever control cable clip (2).
   - Install the select control cable to gear shift lever bracket with E–ring (3).
   - Insert a driver to the select arm adjustment hole to prevent the movement of gear shift lever in NEUTRAL (4).
7. Tighten the adjust nuts.

Tighten

Tighten the select cable adjust nut to 8–12 N•m (71–106 lb-in).



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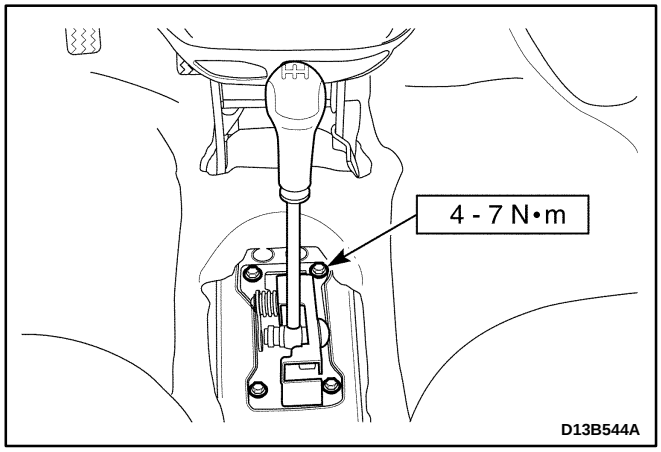
GEAR SHIFT CONTROL LEVER

Removal Procedure

1. Remove the floor console. Refer to *Section 9G, Interior Trim*.
2. Disconnect the select and shift control cable. Refer to "Gear Shift control cable" in this section.
3. Remove the gear shift control lever assembly.
   - Remove the bolts (1).
   - Remove the gear shift control lever assembly (2).
   - Remove the gear shift lever sensor connector. (If equipped with auto clutch).



Installation Procedure

1. Install in the reverse order of removal.
2. Install the gear shift control lever assembly.

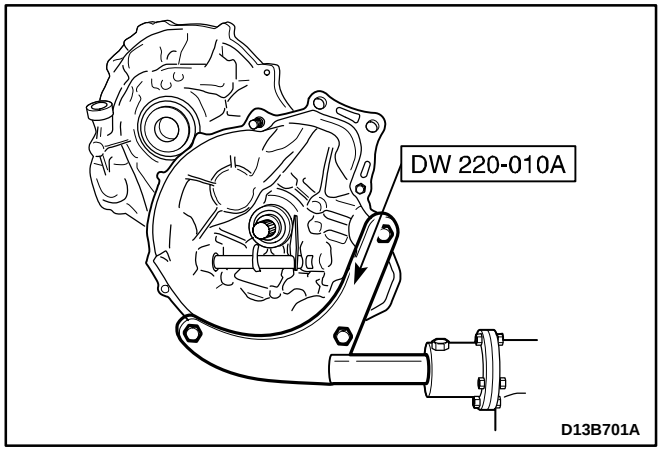
Tighten

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

3. Adjust the select cables. Refer to “Gear Shift Control Cable” in this section.

MAINTENANCE AND REPAIR

UNIT REPAIR



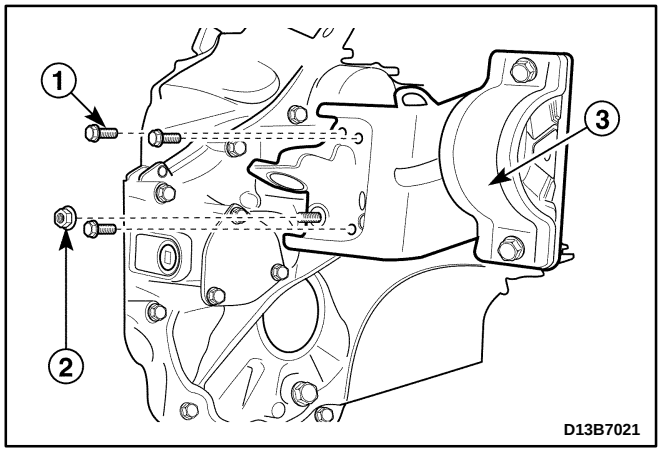
GEAR UNIT

Tools Required

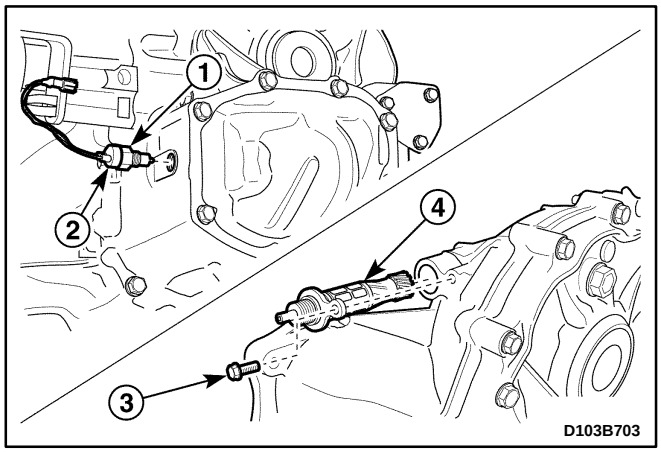
09913–76010	Bushing, Seal Installer
DW09940–53111	Gear, Bearing Installer
DW09943–78210	Bushing, Seal Installer
DW220–010A	Transaxle Fixture
KM519	Oil Seal Installer

Disassembly Procedure

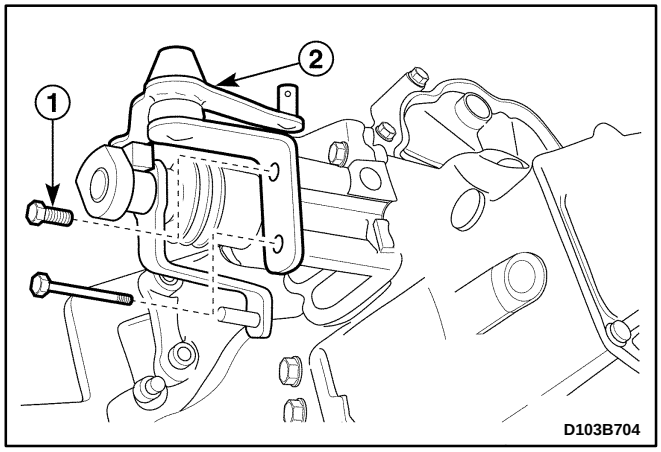
1. Remove the manual transaxle. Refer to “Manual Transaxle Assembly” in this section.
2. Position the manual transaxle to a transaxle stand using the transaxle fixture DW220–010.



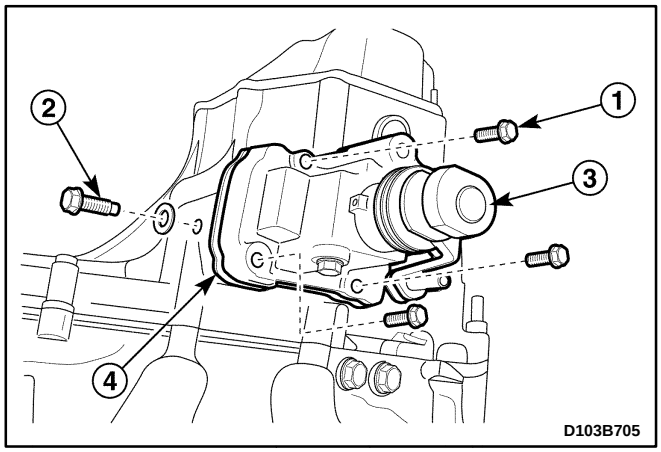
3. Remove the related clutch parts. Refer to *Section 5C, Clutch.*
4. Remove the manual transaxle mounting bracket.
   - Remove the bolts (1).
   - Remove the nut (2).
   - Remove the mounting bracket (3).



5. Disconnect the backup light switch and speedometer driven gear assembly.
   - Remove the nut (1).
   - Disconnect the backup light switch (2).
   - Remove the bolt (3).
   - Remove the speedometer driven gear assembly (4).



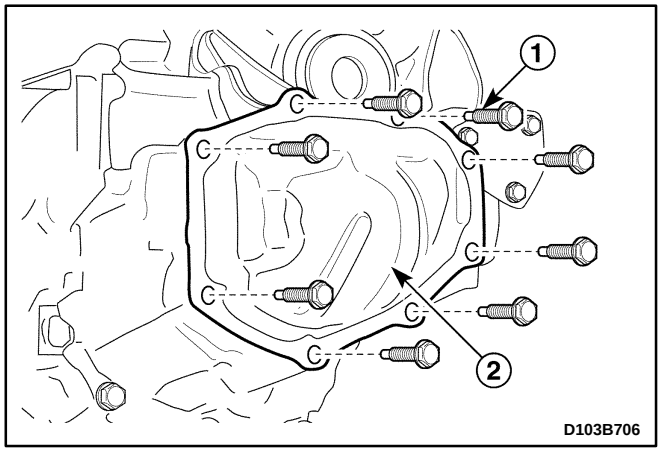
6. Remove the select lever.
   - Remove the bolt (1).
   - Remove the select lever (2).



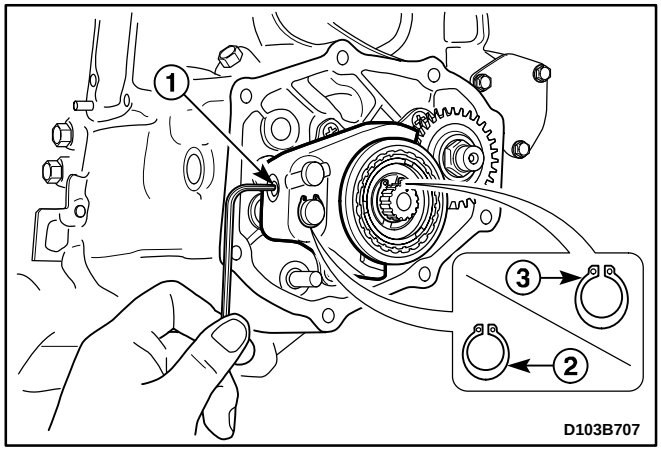
7. Remove the gear shift control case assembly.
   - Remove the bolts (1).
   - Remove the shift interlock bolt (2).

Important: Certainly remove the shift interlock bolt. Otherwise, gear shift control case can not be removed.

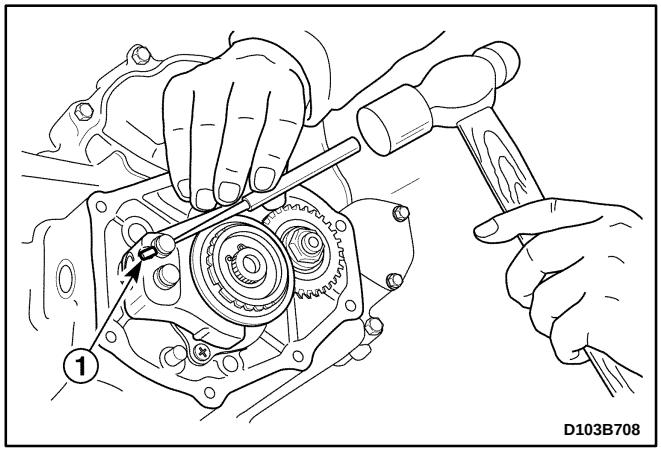
   - Remove the gear shift control case assembly (3).
   - Remove the gasket (4).



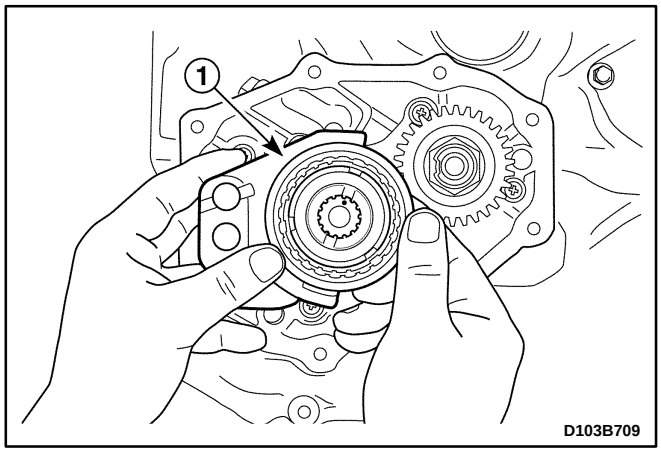
8. Remove the side cover.
   - Remove the bolts (1).
   - Remove the side cover using a rubber hammer (2).
   - Remove the sealant on the side cover and the transaxle case.



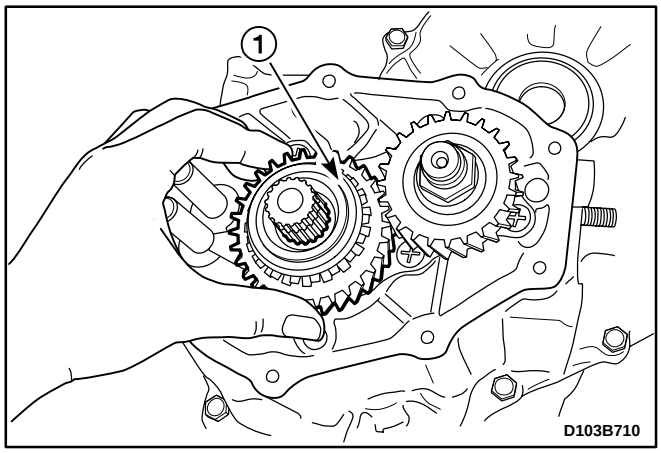
9. Remove the fifth–gear shift fork guide ball, the snap ring and the input shaft fifth–gear snap ring.
   - Remove the fifth–gear shift fork plug (1).
   - Remove the guide ball using a magnet.
   - Remove the fifth–gear shift fork snap ring (2).
   - Remove the fifth–gear snap ring (3).
   - Remove the fifth–gear synchronizer plate.



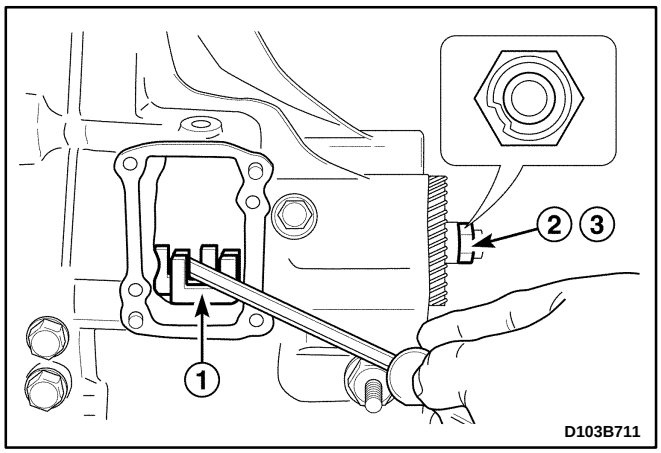
10. Remove the fifth–gear shift fork pin.
    - Shift the shift fork to the fifth–gear.
    - Remove the fork pin using a pin punch and a hammer (1).



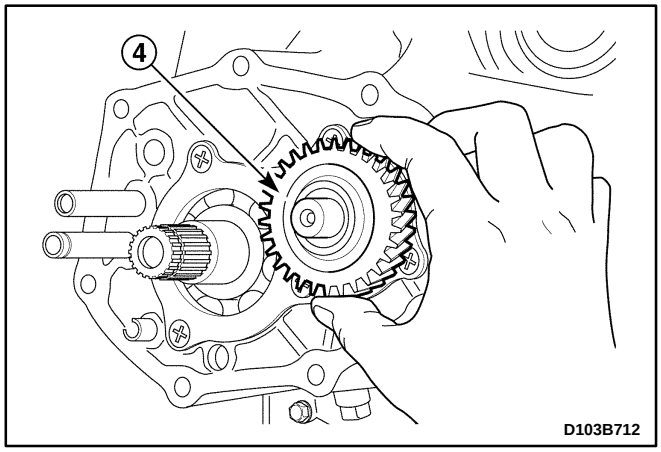
11. Remove the input shaft fifth–gear fork and synchronizer hub assembly.
    - Pull and remove the fork and the hub assembly together (1).
    - Remove the sleeve, key and spring from the synchronizer hub assembly.



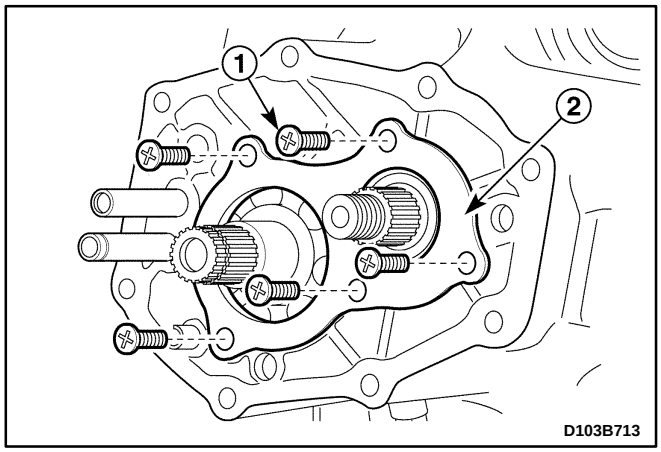
12. Remove the input shaft fifth–gear, the synchronizer ring and the fifth–gear bearing.
    - Pull and remove the fifth–gear, wave spring and synchronizer ring together (1).
    - Remove the fifth–gear bearing.



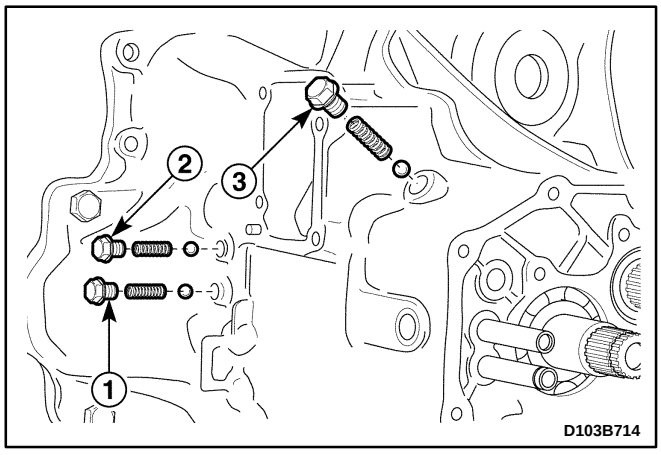
13. Remove the countershaft fifth–gear.
    - Shift the shift yoke using a driver to engage the first–gear and the third–gear or the second–gear and the fourth–gear (1).
    - Remove the caulking and the nut. (2, 3)



- Remove the counter shaft fifth–gear (4).

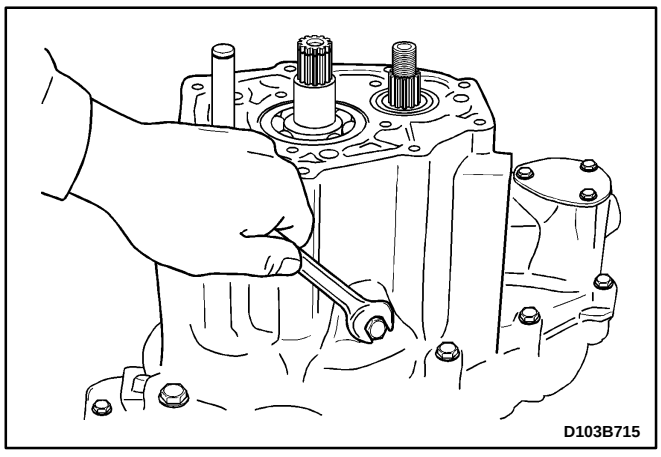


14. Remove the side cover plate and the counter shaft bearing shim.
    - Remove the screws (1).
    - Remove the side cover plate (2).
    - Remove the counter shaft bearing shim.



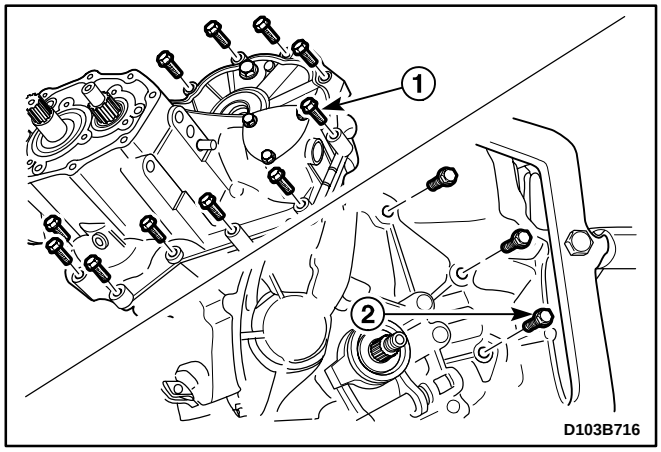
15. Remove the shift shaft spring and ball.
    - Remove the bolt and remove the fifth–reverse gear shift shaft spring and ball (1).
    - Remove the bolt and remove the third–fourth gear shift shaft spring and ball (2).
    - Remove the bolt and remove the first–second gear shift shaft spring and ball (3).

Important: There is difference between the fifth–reverse gear shift shaft spring and the others. Mark it to distinguish easily when installing.

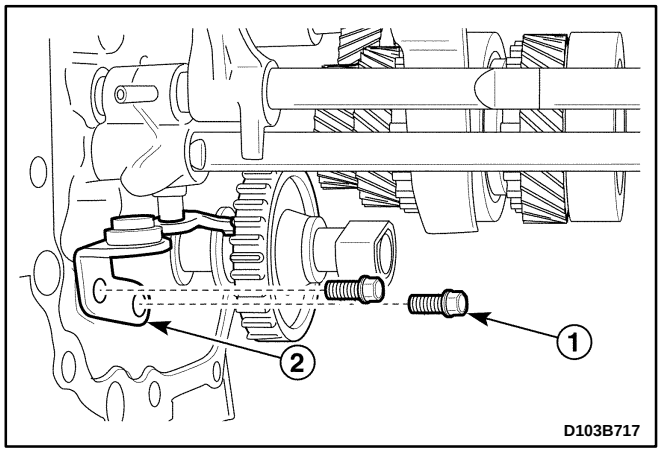


16. Remove the reverse idle gear shaft bolt.

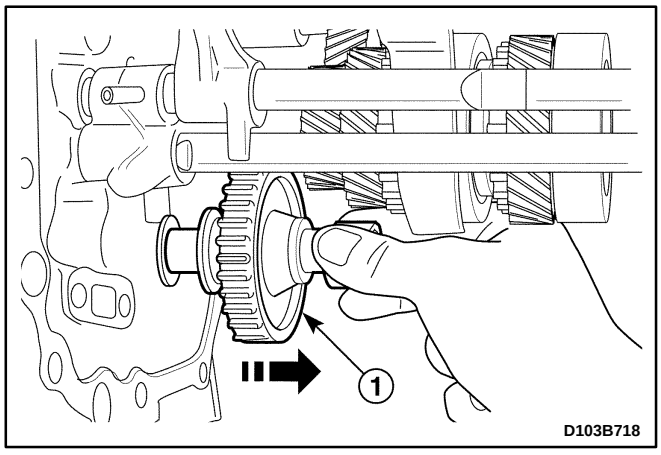
Important: The case (Left) can not be removed without removing the reverse idle gear shaft bolt.



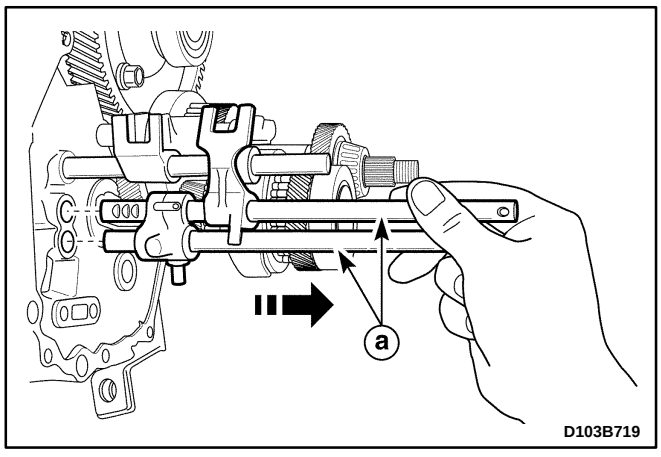
17. Remove the transaxle case (Left).
    - Remove the bolts from the left side case (1).
    - Remove the bolts, stud bolts if equipped with auto clutch.
    - Remove the bolts from the right side of case (2).
    - Remove the left side case by hitting with a rubber hammer lightly.
    - Remove the sealant on the case.



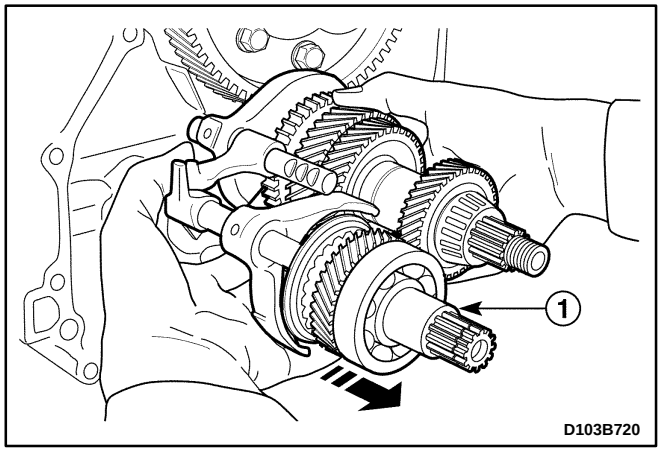
18. Remove the reverse gear shift lever.
    - Remove the bolts (1).
    - Remove the reverse gear shift lever (2).



19. Remove the reverse idle gear shaft assembly.
    - Push the reverse idle gear toward inner case.
    - Pulling shaft and remove the reverse idle gear and shaft (1).
    - Remove the reverse idle gear from the shaft.



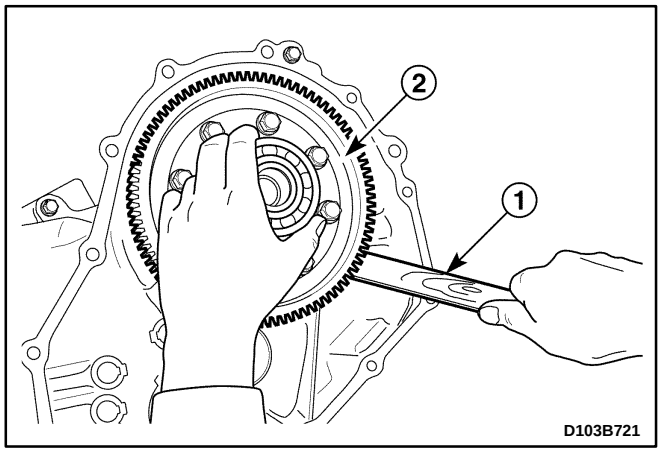
20. Remove the fifth–reverse gear shift shaft.
    a. Fifth–reverse gear shift shaft.



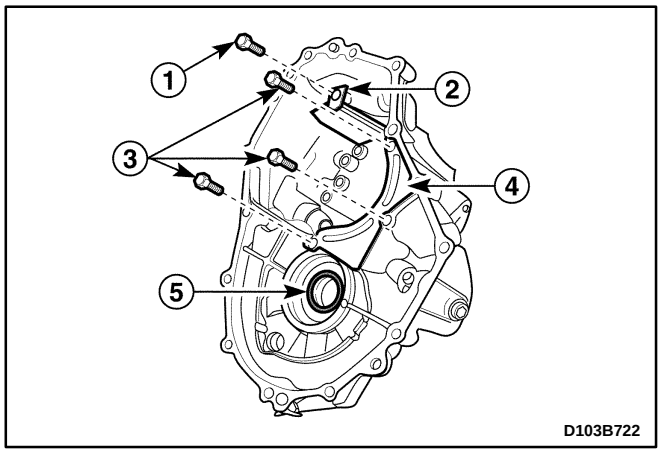
21. Remove the gear unit.
    - Remove the gear unit and the shift shaft assembly together (1).

Notice: Be careful not to damage teeth of the counter shaft pinion and the differential ring gear.

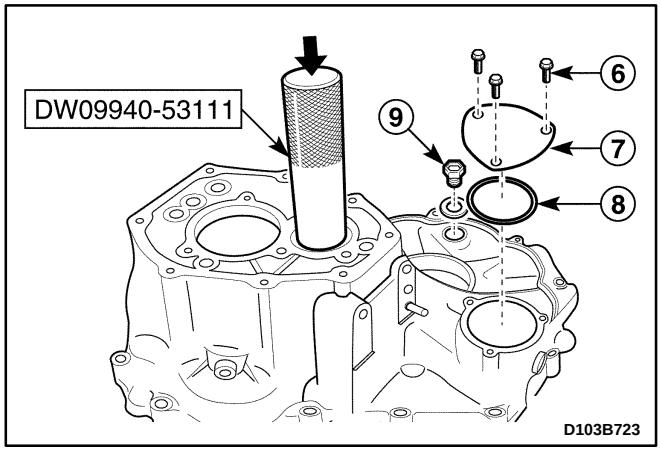
- Remove the high and the low speed shift shaft assembly from the gear unit.



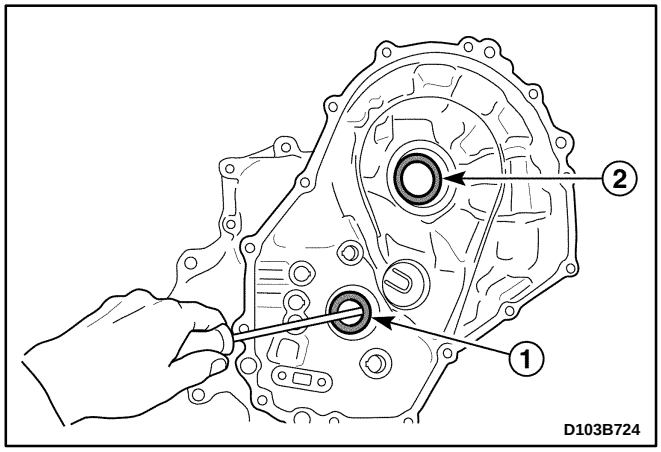
22. Remove the differential assembly.
    - Insert a wooden stick into the lower side of differential (1).
    - Remove the differential assembly by moving it right and left (2).



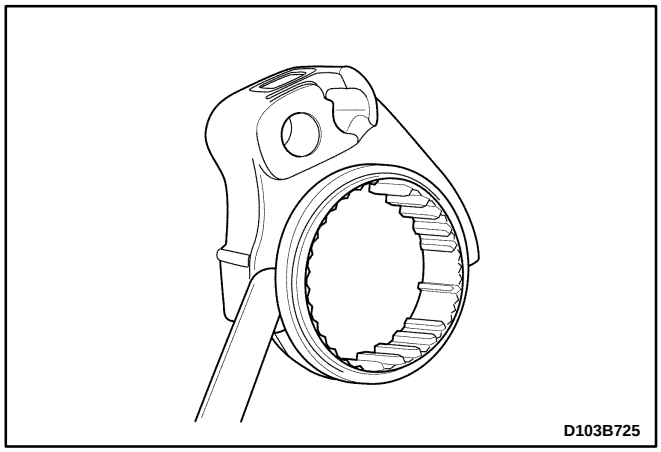
23. Remove the related parts of the transaxle case (Left Side).
    - Remove the bolt (1).
    - Remove the oil gutter (2).
    - Remove the bolts (3).
    - Remove the oil plate (4).
    - Remove the differential left side oil seal using a hammer and a copper chisel (5).



- Remove the bolts (6).
- Remove the case cap (Left Side) (7).
- Remove the case cap O–ring (Left Side) (8).
- Remove the oil level plug (including steel gasket) (9).
- Remove the counter shaft bearing outer race using a hammer and the gear, bearing installer DW 09940–53111.



24. Remove the related parts of the transaxle case (Right Side).
    - Remove the input shaft oil seal using a screwdriver (1).
    - Remove the differential left side oil seal using a hammer and a copper chisel (2).

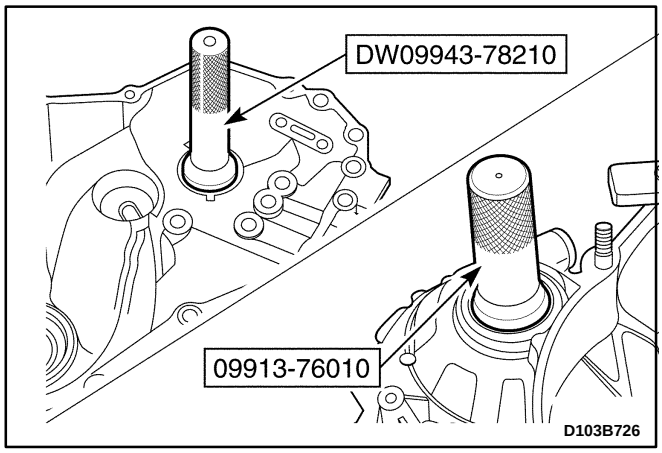


Synchronizer Sleeve and Shift Fork Inspection

1. Measure the clearance between synchronizer sleeve and shift fork and if the clearance exceeds the limit, replace the shift fork.

Unit : mm (in.)

	Standard	Limit
Clearance Between Sleeve and Shift Fork	0.2 ~0.6 (0.008~0.024)	1.0 (0.039)

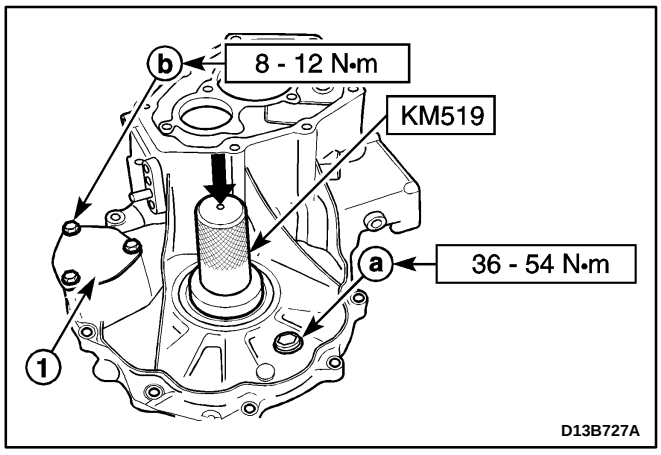


Assembly Procedure

1. Install the related parts of the transaxle case (Right Side).
    - Install the input shaft oil seal using the bushing seal installer DW09943–78210.
    - Install the differential right side oil seal using the bushing, seal installer 09913–76010.

Important: Use only a new oil seal.

Important: Coat the transaxle inner parts with gear fluid when installing.

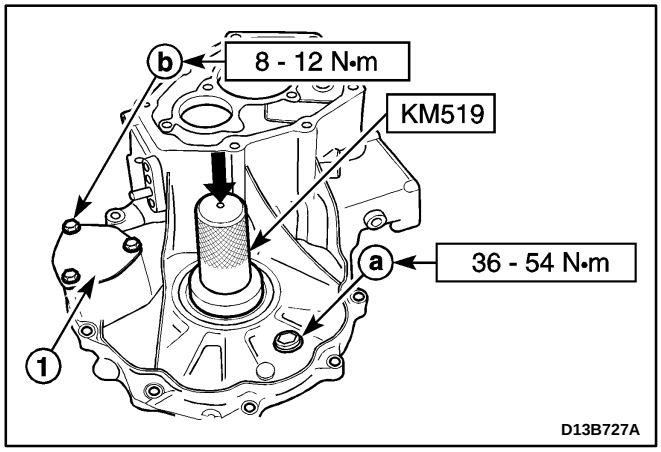


2. Install the related parts of the transaxle case (Left Side).
    - Install the oil plate with the bolts.
    - Install the oil gutter with the bolt.
    - Install the oil level plug (including steel gasket).
      a. Oil level plug.

Tighten

Tighten the oil level plug to 36–54 N•m (26–40 lb-ft).

- Install the left side case cap with the bolts (including O–ring) (1).

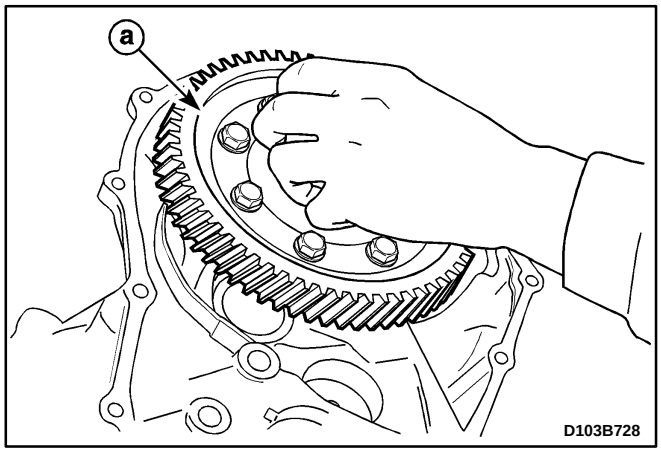


Tighten

Tighten the bolt to 8–12 N•m (71–106 lb-in).

b. Case cap retaining bolt.

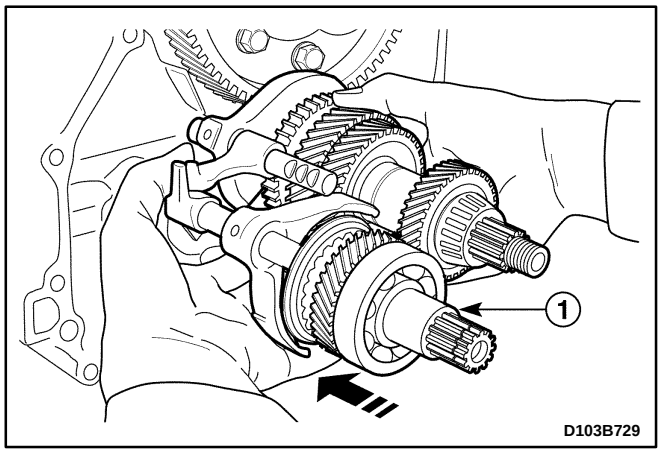
- Install the differential left side oil seal using the oil, seal installer KM519.



3. Install the differential assembly to the right side of transaxle case.

   a. Differential assembly.

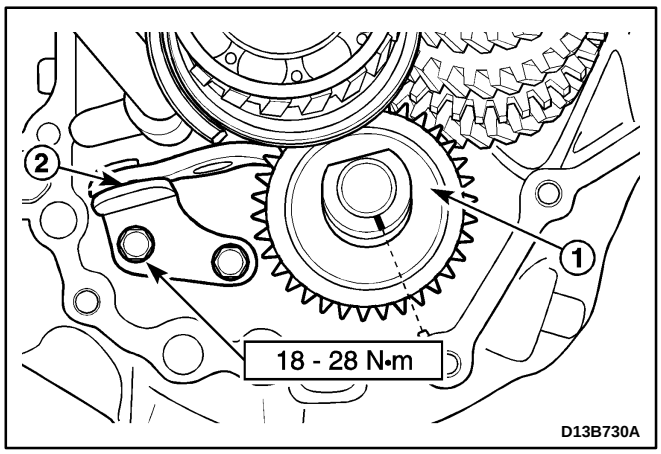
   - When the differential ring gear surface is lower than the right side of transaxle case surface, it is installed correctly.



4. Install the low and the high speed shift shaft assembly to the gear unit.
5. Install the gear unit.

   - Push the gear unit by matching it with the input and the counter shaft hole (1).

Notice: Be careful not to damage teeth of the counter shaft pinion and the differential ring gear.



6. Install the fifth–reverse gear shift shaft.
7. Install the reverse idle gear shaft assembly and the reverse gear shift lever.

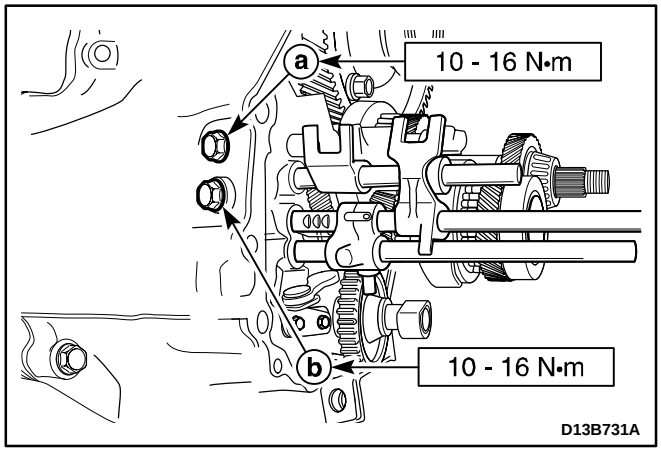
   - Install the reverse idle gear shaft assembly (1).

Important: Match the marking of the reverse idle gear shaft bolt hole with the protrusion of the transaxle case (Right Side).

- Install the reverse gear shift lever (2).

Tighten

Tighten the bolts to 18–28 N•m (13–21 lb-ft).



8. Install the shift shaft ball and spring.
   - Install the third–fourth gear shift shaft ball and spring.

Tighten

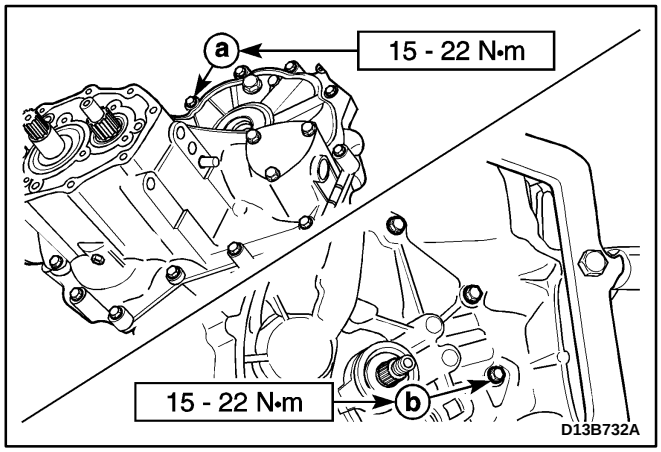
Tighten the bolt to 10–16 N•m (7–12 lb-ft) (a).

- Install the fifth–reverse gear shift shaft ball and spring.

Tighten

Tighten the bolt to 10–16 N•m (7–12 lb-ft) (b).

Important: Install the fifth–reverse gear shift shaft spring marked when removing.



9. Install the transaxle left side case.
   - Coat the transaxle case with recommended sealant.

Transaxle Case Sealant	THREE BOND 1215

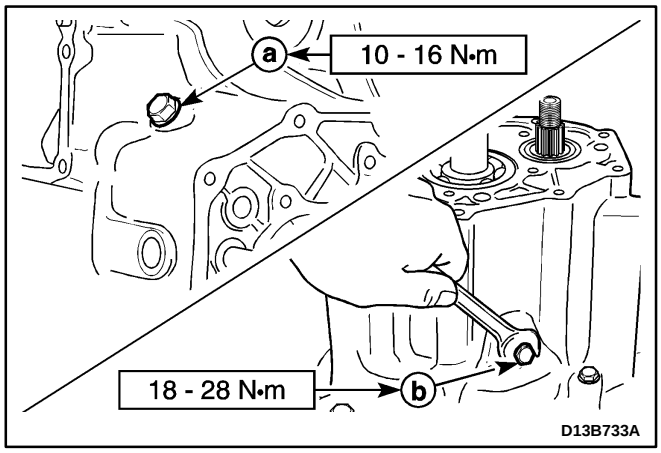
- Install the transaxle left side case to the transaxle right side case.

Tighten

Tighten the bolts to 15–22 N•m (11–16 lb-ft) (a).

- Tighten the bolts (8), stud bolts (3) if equipped with auto clutch.

Tighten the bolts to 15–22 N•m (11–16 lb-ft) (b).



10. Install the first–second gear shift shaft ball and spring.

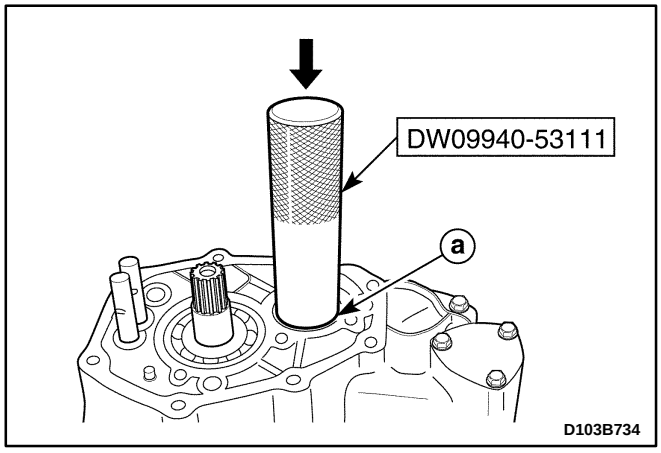
Tighten

Tighten the bolt to10–16 N•m (7–12 lb-ft) (a).

11. Install the reverse idle gear shaft bolt.

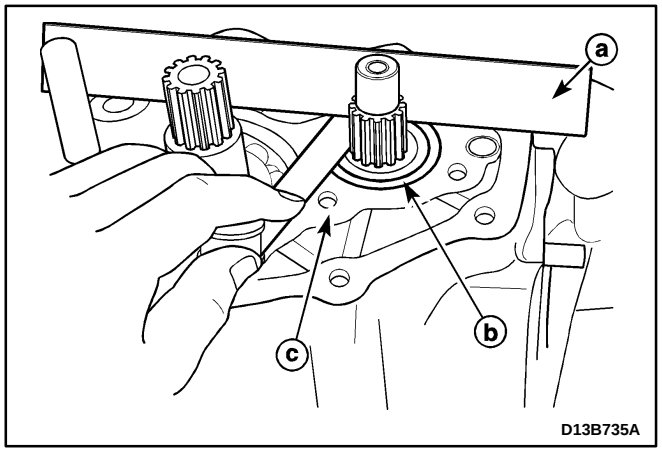
Tighten

Tighten the bolt to 18–28 N•m (13–21 lb-ft) (b).



12. Install the counter shaft bearing outer race.
    - Install the counter shaft bearing outer race using the gear, bearing installer DW09940–53111.
      a. Bearing outer race.

Important: Check if the bearing and the outer race are correctly installed by rotating counter shaft.

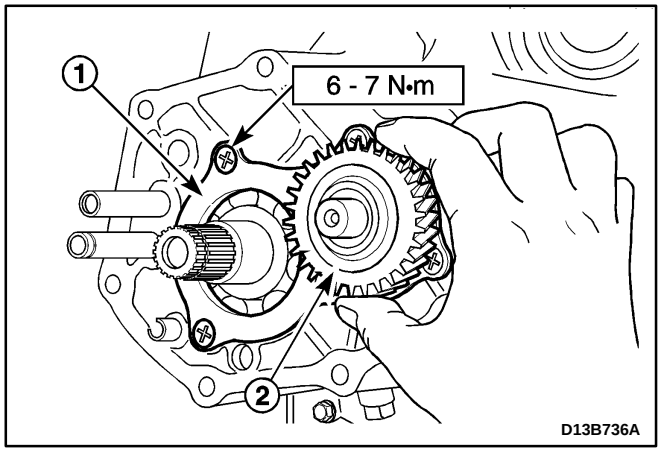


13. Install the counter shaft bearing shim.
    - Measure clearance between the transaxle case surface and the bearing outer race using a straight ruler and gauge.
    - Select shim in order that clearance is within standard.

Unit : mm (in.)

Measured value (A)	Shim thickness
0.33 – 0.37 (0.0130 – 0.0146)	0.45 (0.0177)
0.38 – 0.42 (0.0147 – 0.0165)	0.50 (0.0197)
0.43 – 0.47 (0.0169 – 0.0185)	0.55 (0.0217)
0.48 – 0.52 (0.0189 – 0.0205)	0.60 (0.0236)
0.53 – 0.57 (0.0209 – 0.0224)	0.65 (0.0256)
0.58 – 0.62 (0.0228 – 0.0244)	0.70 (0.0276)
0.63 – 0.67 (0.0248 – 0.0264)	0.75 (0.0295)
0.68 – 0.72 (0.0268 – 0.0283)	0.80 (0.0315)
0.73 – 0.77 (0.0287 – 0.0303)	0.85 (0.0335)
0.78 – 0.82 (0.0307 – 0.0323)	0.90 (0.0354)
0.83 – 0.87 (0.0327 – 0.0343)	0.95 (0.0374)
0.88 – 0.92 (0.0346 – 0.0362)	1.00 (0.0394)
0.93 – 0.97 (0.0366 – 0.0382)	1.05 (0.0413)
0.98 – 1.02 (0.0386 – 0.0402)	1.10 (0.0433)
1.03 – 1.07 (0.0406 – 0.0421)	1.15 (0.0453)

a. Straight ruler
b. Bearing outer race
c. Case surface



14. Install the side cover plate and the counter shaft fifth gear.
    - Install the side cover plate (1).

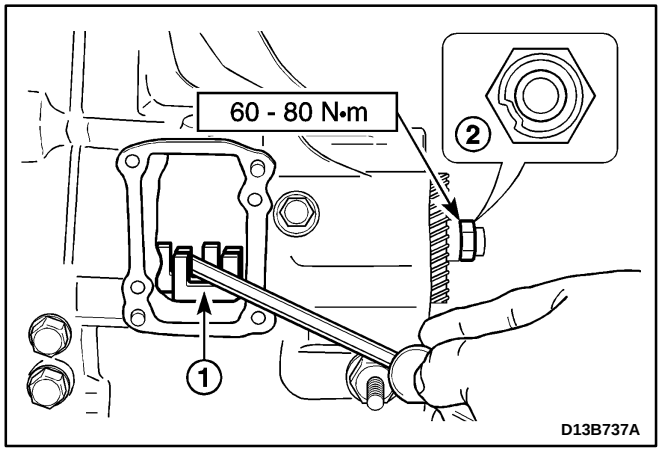
Tighten

Tighten the screws to 6–7 N.m (53–62 lb–in).

Important: Use only new screws.

- Install the counter shaft fifth gear (2).

Important: Position the machined boss side toward the side cover plate.

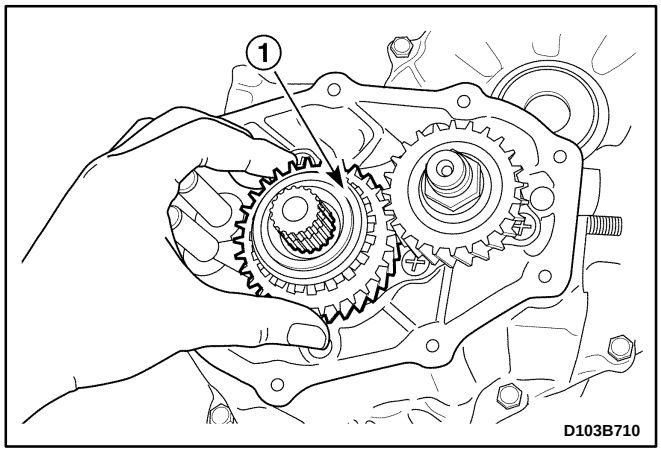


15. Install the counter shaft fifth gear nut.
    - Shift the shift yoke using a screwdriver to engage the first–gear and the third–gear or the second–gear and the fourth–gear (1).

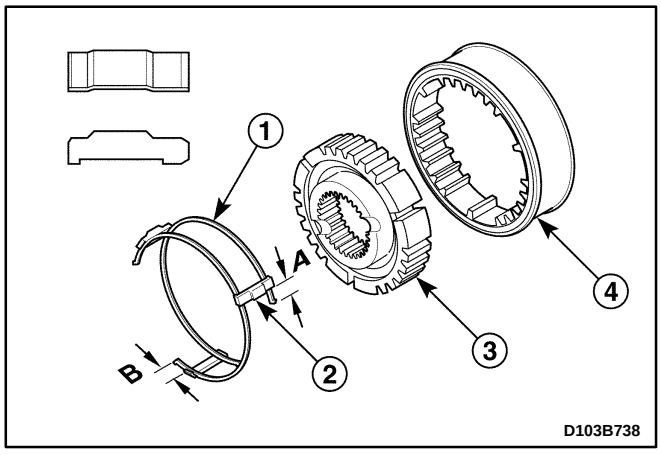
Tighten

Tighten the fifth gear nut to 60–80 N•m (44–59 lb-ft).

- Caulk the nut using a chisel and a hammer (2).



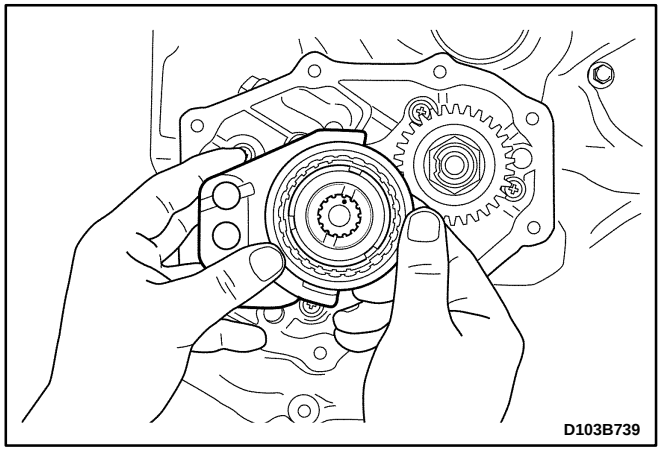
16. Install the input shaft fifth gear bearing and the fifth gear / synchronizer ring.
    - Insert the bearing into the input shaft.
    - Install the fifth gear, wave spring and synchronizer ring matching synchronizer's oil groove and input shaft punched mark (1).



17. Install the fifth gear synchronizer hub assembly.
    - Install the synchronizer springs to hub (1).
    - Install the synchronizer key (2).

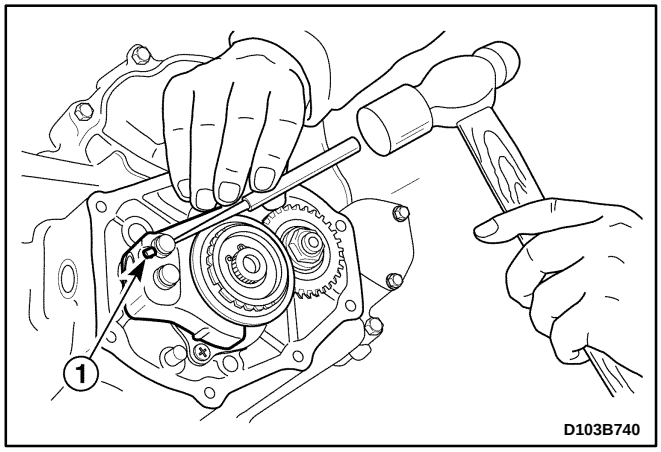
Important: In case of assembling synchronizer sleeve and hub, let A=B.

- Position the longer boss side of hub toward inner side (3).
- Position the chamfered spline of sleeve toward inner side and install the hub to the sleeve (4).



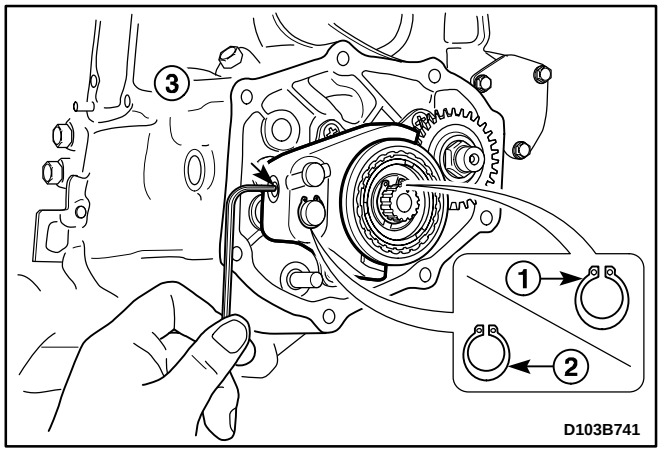
18. Install the fifth gear fork to the synchronizer hub assembly.
19. Install the fifth gear fork and the synchronizer hub assembly to the input shaft.

Important: Position the longer boss side of hub toward inner side and match the synchronizer key and the hub groove with the input shaft punched mark.



20. Install the fifth gear shift fork pin.
    - Push the shift fork toward the fifth gear.
    - Install the shift fork pin using a pin punch and a hammer(1).

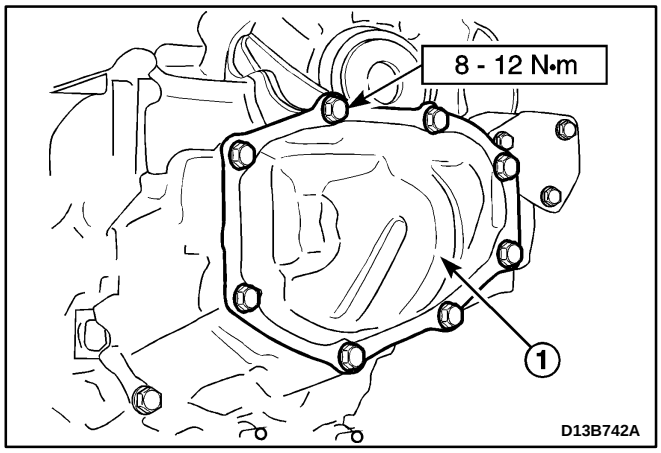
Important: Use only new shift fork pin.



21. Install the input shaft fifth gear snap ring, the fifth gear shift fork snap ring and guide ball.
    - Install the fifth gear synchronizer plate.
    - Install the fifth gear snap ring (1).
    - Install the fork snap ring (2).

Important: Use only new snap ring.

- Tighten the fork plug after inserting the guide ball into the fork hole.

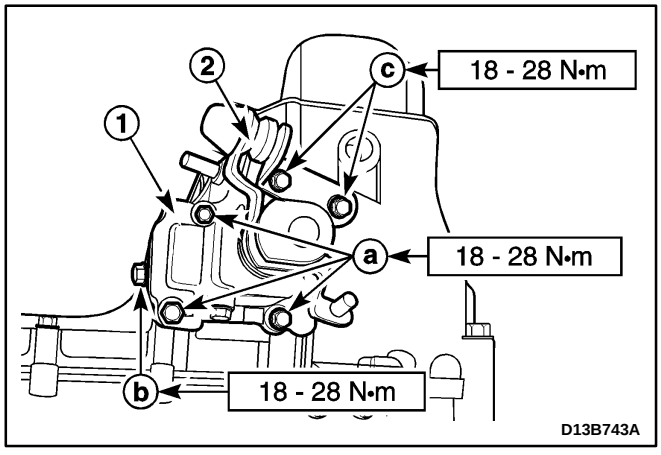


22. Install the side cover(1).
    - Coat the side cover with recommended sealant.

Side Cover Sealant	THREE BOND 1215

Tighten

Tighten the side cover bolts to 8–12 N•m (71–106 lb-in).



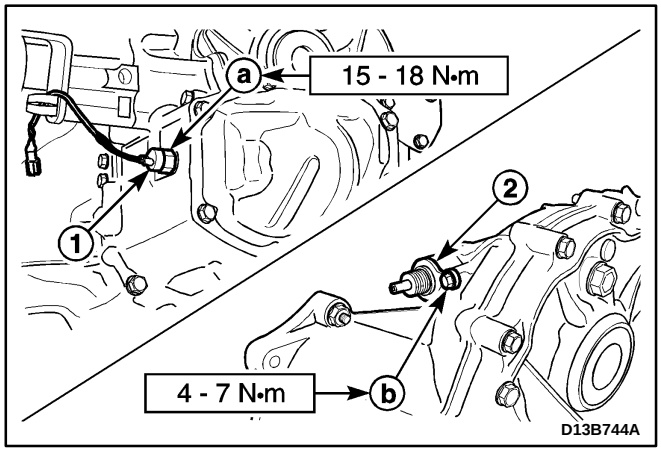
23. Install the gear shift control case assembly.
    - Install the case gasket.
    - Install the gear shift control case.

Tighten

- Tighten the bolts to 18–28 N•m (13–21 lb-ft) (a).
- Tighten the shift interlock bolt to 18–28 N•m (13–21 lb-ft) (b).
- Install the select lever.

Tighten

Tighten the bolts to 18–28 N•m (13–21 lb-ft) (c).



24. Install the backup light switch and the speedometer driven gear assembly.
    - Install the backup light switch (1).

Tighten

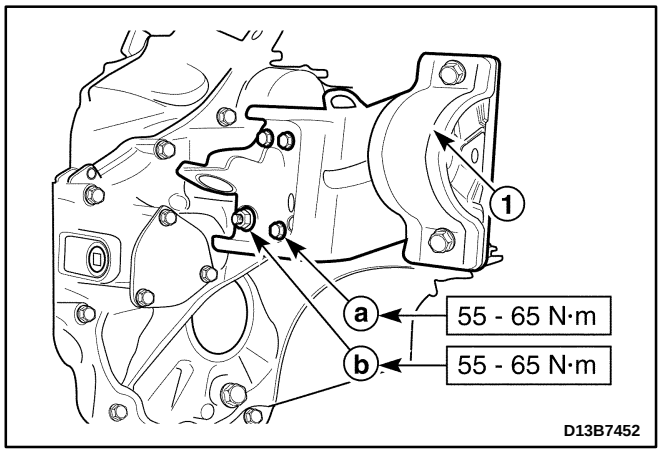
Tighten the nut to 15–18 N•m (11–13 lb-ft) (a).

- Install the speedometer driven gear assembly (2).

Tighten

Tighten the bolt to 4–7 N•m (35–62 lb-in) (b).

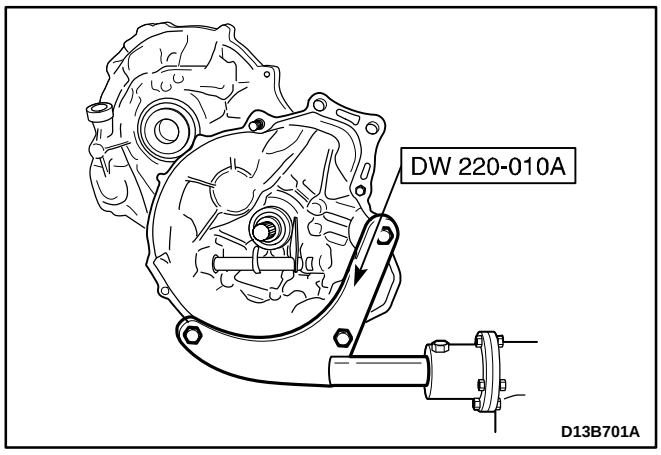
- Install the hydraulic pump assembly (If equipped with auto clutch). Refer to *Section 5D, Auto Clutch.*



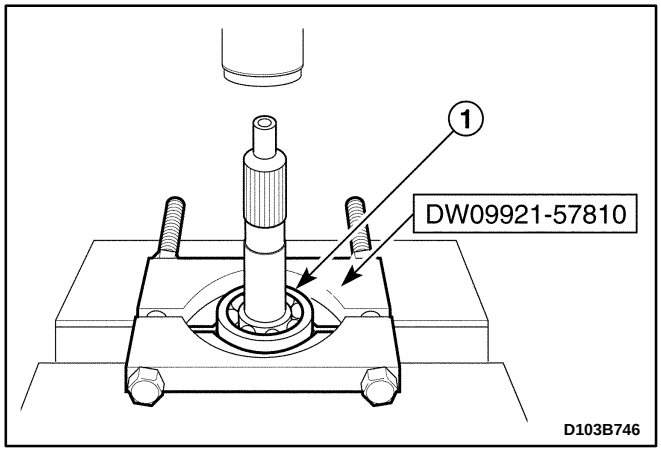
25. Install the transaxle mount.
    - Install the mount (1).

Tighten

- Tighten the bolts to 55–65 N•m (41–48 lb-ft) (a).
- Tighten the nut to 55–65 N•m (41–48 lb-ft) (b).



26. Install the related clutch parts. Refer to *Section 5C, Clutch.*
27. Remove the transaxle assembly from transaxle stand.
    - Remove the transaxle assembly using the transaxle fixture DW220–010A.
28. Install the transaxle assembly. Refer to “Manual Transaxle Assembly” in this section.



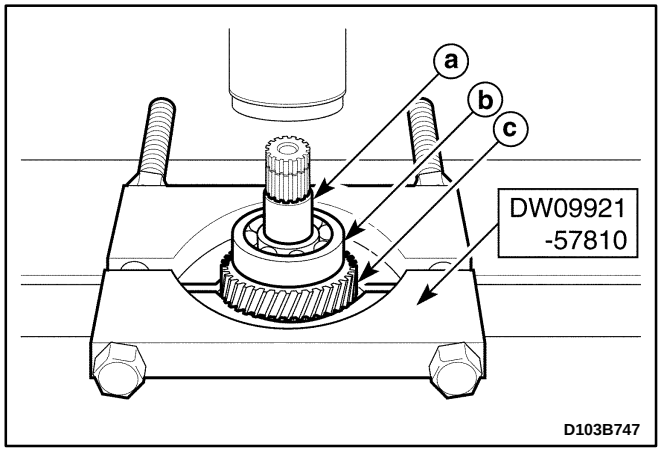
INPUT SHAFT

Tools Required

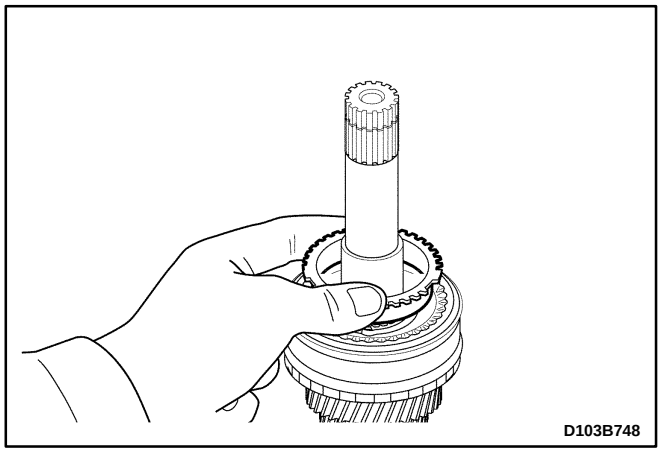
DW09921–57810 Gear, Bearing Remover
DW09925–98221 Gear, Bearing Installer
DW09940–53111 Gear, Bearing Installer

Disassembly Procedure

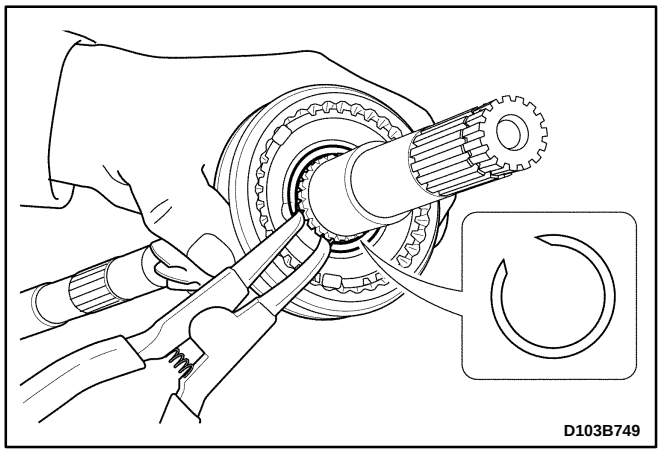
1. Remove the gear unit. Refer to “Gear Unit” in this section.
2. Remove the input shaft right side bearing.
    - Position the bearing to the gear, bearing remover DW09921–57810.
    - Remove the bearing by pressing (1).



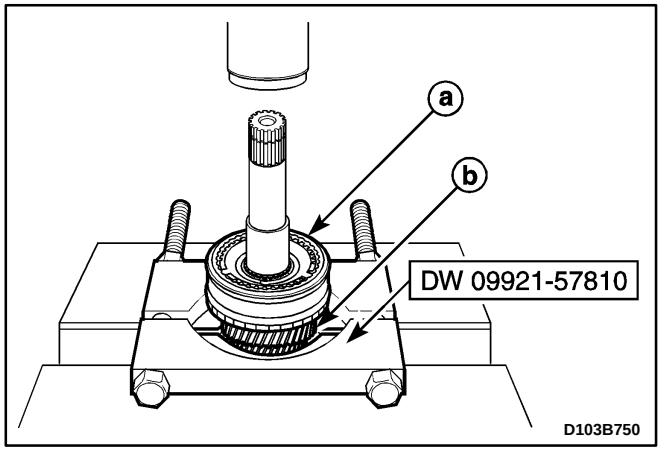
3. Remove the input shaft fifth gear spacer, the left side bearing and the fourth gear.
   - Position the fourth gear to the gear,bearing remover DW09921–57810.
   - Remove the following parts.
     a. Fifth gear spacer.
     b. Left side bearing.
     c. Fourth gear



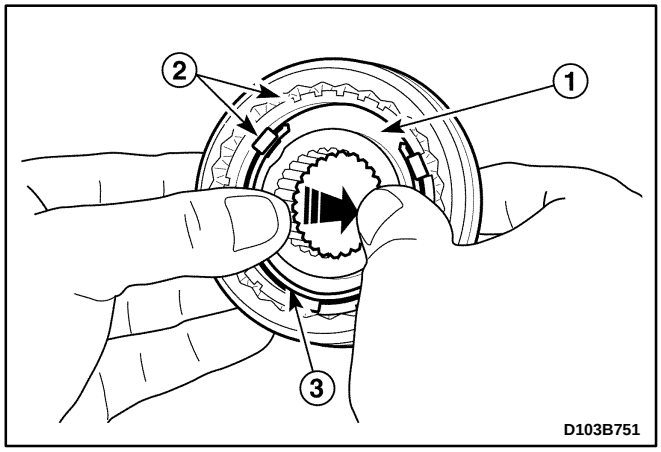
4. Remove the fourth gear bearing.
5. Remove the fourth gear synchronizer ring and wave spring.



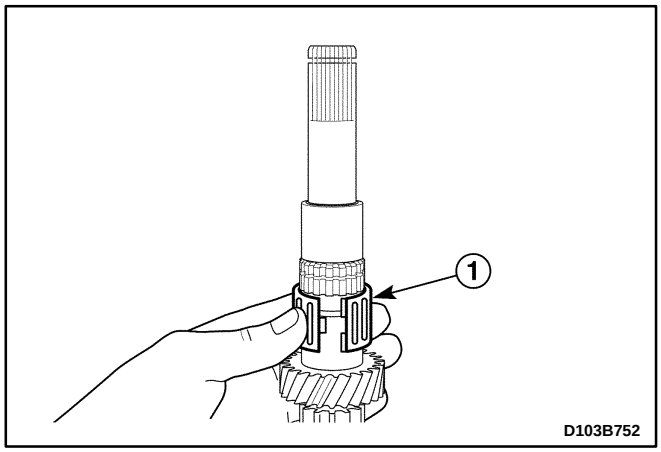
6. Remove the third–fourth synchronizer circlip.



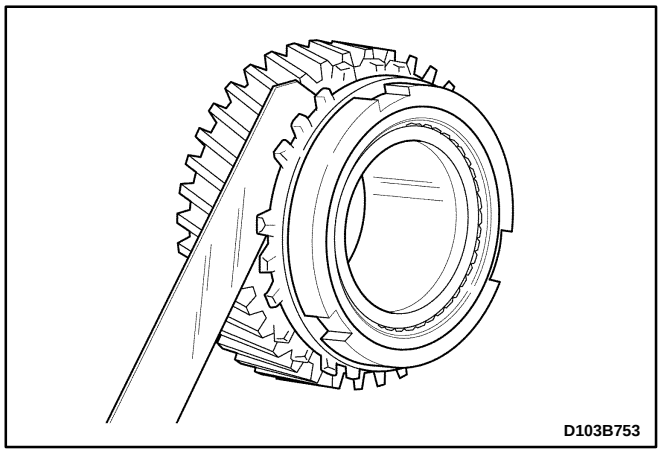
7. Remove the third–fourth synchronizer hub assembly, the third gear 1 synchronizer ring.
   - Position the third gear to the gear, bearing remover DW09921–57810.
   - Remove the following parts.
     a. Third–fourth synchronizer hub assembly.
     b. Third gear and synchronizer ring.



8. Disassemble the third–fourth synchronizer hub assembly.
   - Remove the hub (1).
   - Remove the synchronizer sleeve and the key (2).
   - Remove the synchronizer springs (3).



9. Remove the input shaft third gear bearing (1).

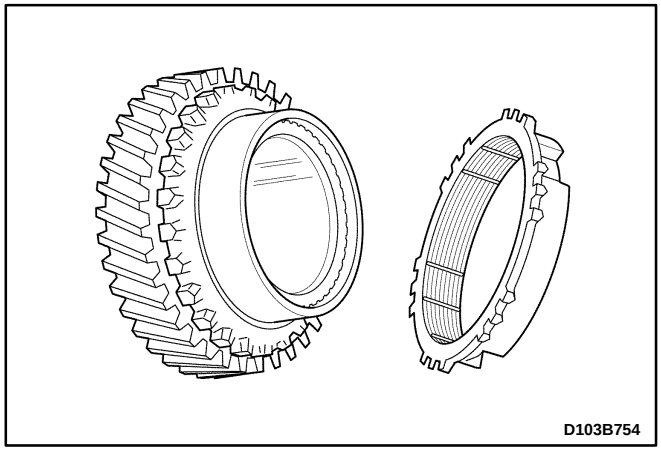


Synchronizer Assembly Inspection

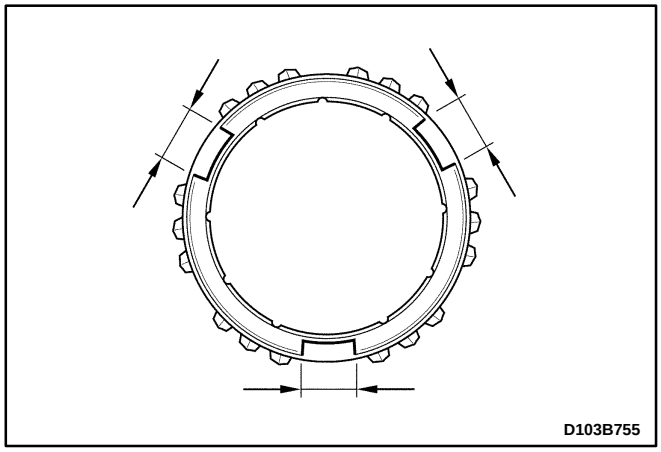
1. Inspecting wear of cone area.
   - After matching synchronizer ring to gear, measure as shown in figure. Replace if it is below limit.

Unit : mm (in.)

Clearance Between Gear and Ring	Standard	Limit
	1.0 (0.039)	0.5 (0.020)



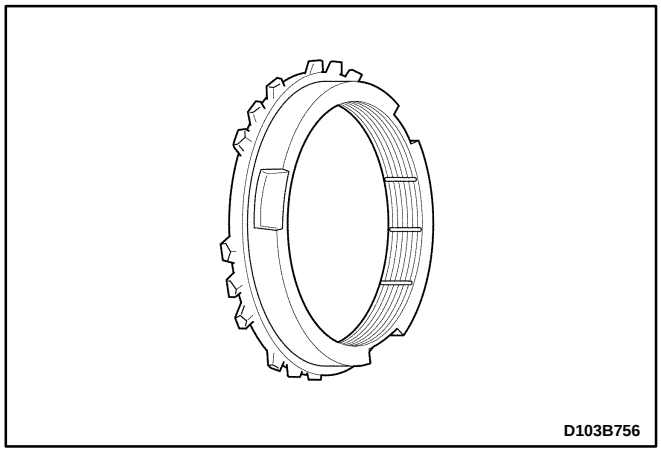
2. Inspecting cone contact condition.
   - When synchronizer mechanism is abnormal in operation, connection between ring inner surface and gear cone area is considered to be partially defective in spite of correct clearance between gear and ring. Therefore, cone area and ring inner surface shall be inspected. In this case, ring inner surface shall be glossy. Black area is abnormal and if inspection is difficult, check after applying red lead. Cone area can be worn in wave form.


D103B755

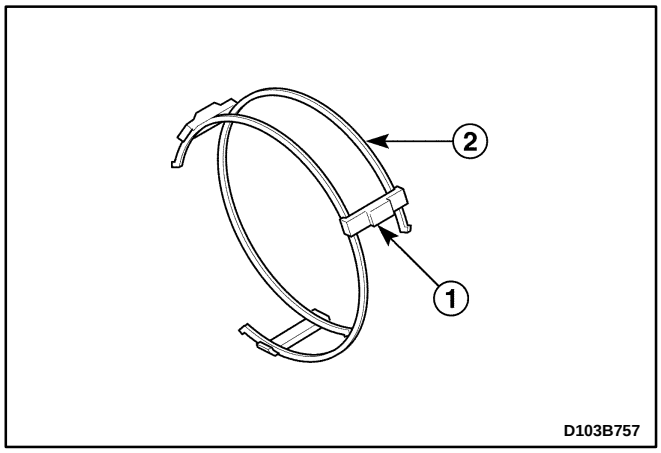
3. Inspecting key slot width of synchronizer ring.
   - Measure key slot width of synchronizer ring. Replace if it exceeds limit.

Unit : mm (in.)

Key Slot Width	Standard	Limit
1st gear	8.2 (0.323)	8.6 (0.339)
2nd, 3rd, 4th gear	9.6 (0.378)	10.0 (0.394)
5th gear	9.4 (0.370)	9.8 (0.386)

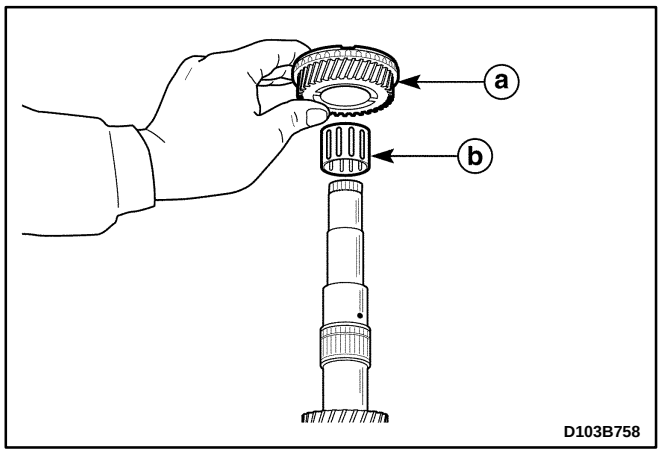

D103B756

4. Inspecting wear of synchronizer ring.
   - Check for worn or damaged synchronizer ring teeth. Replace it if necessary.



D103B757

5. Inspecting synchronizer key and spring.
   - Check for worn synchronizer key (1).
   - Check for weak, damaged or broken spring (2).

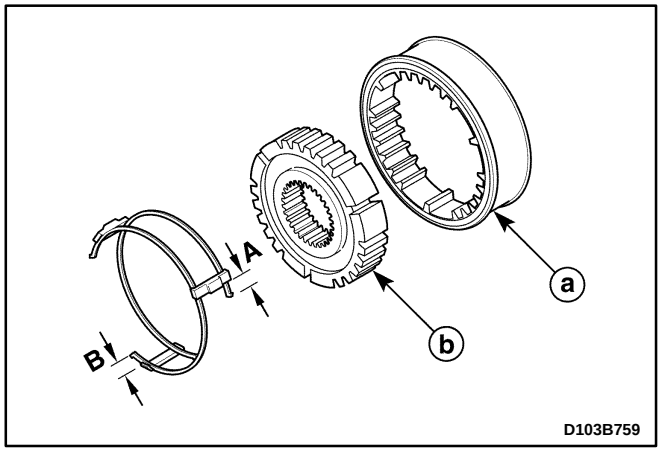


D103B758

Assembly Procedure

1. Install the third gear bearing, the third gear / synchronizer ring.
   a. Third gear / synchronizer ring.
   b. Third gear bearing.

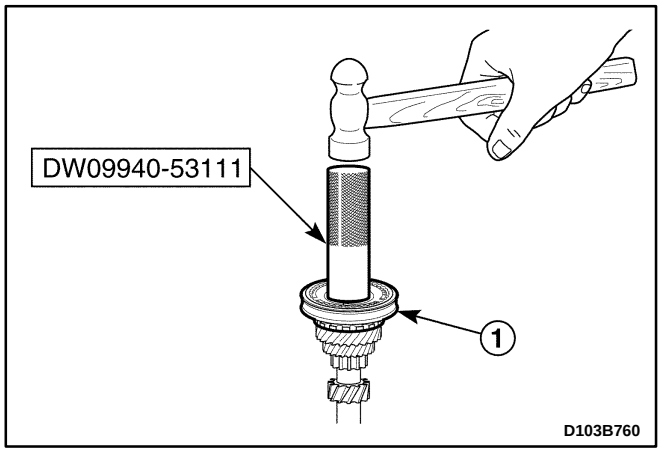
Important: Coat the inner parts; gear, bearing, oil seal etc. with gear fluid.



2. Assemble the third–fourth synchronizer hub assembly.
   - Install the synchronizer springs to the hub.
   - Install the synchronizer key to the hub.

Important: In case of assembling the synchronizer sleeve and the hub, let A=B.

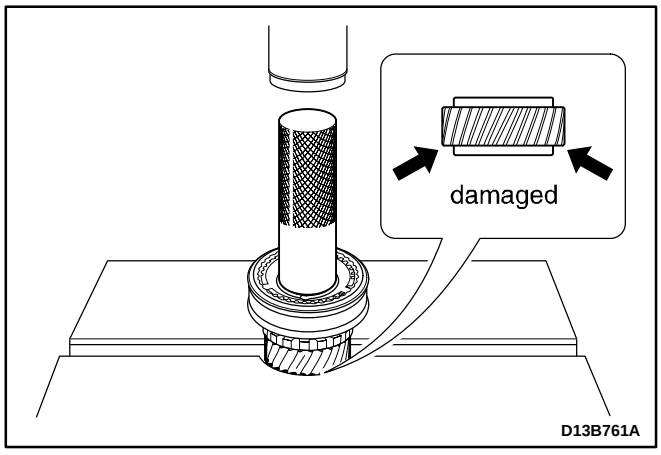
- Install the hub to the sleeve.
  a. Sleeve.
  b. Hub.



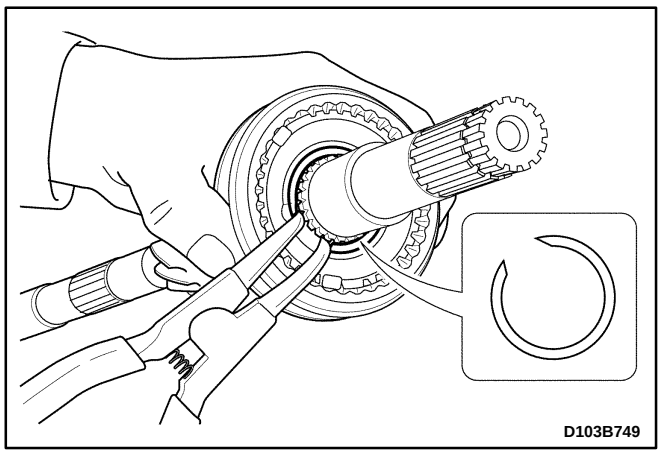
3. Install the third–fourth synchronizer hub assembly.
   - Insert the hub assembly into the input shaft (1).

Important: Position the longer flange of hub toward the third gear and match the key and the ring groove.

- Install the hub assembly using a hammer and the gear, bearing installer DW09940–53111.

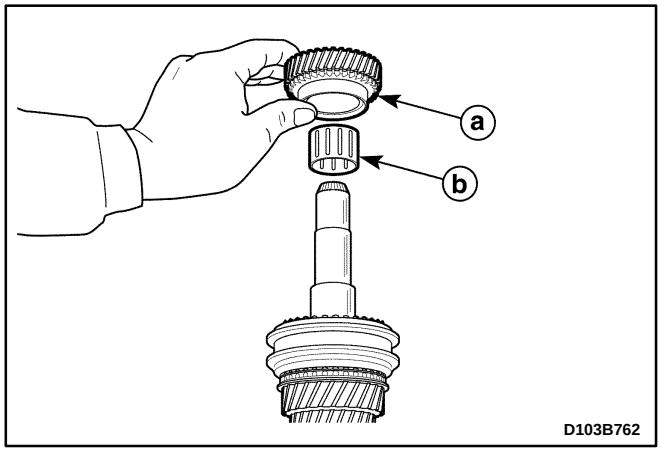


Notice: When installing gear, bearing and hub assembly, install them slowly using the gear, bearing installer DW09940–53111 and a hammer. If overpressed, the gear teeth may be damaged.

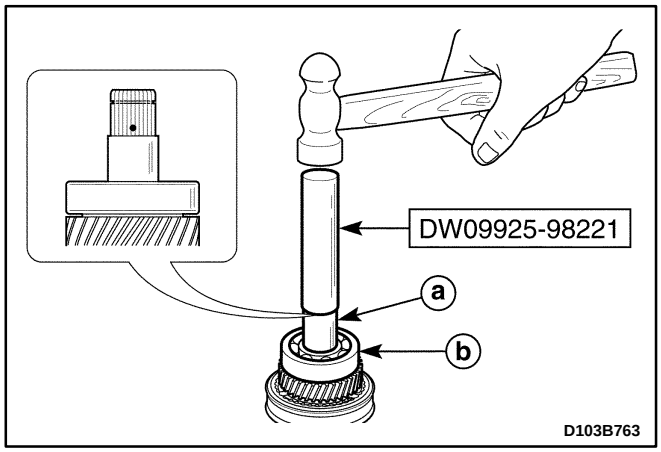


4. Install the third–fourth synchronizer circlip.
5. Install the fourth synchronizer ring and wave spring.

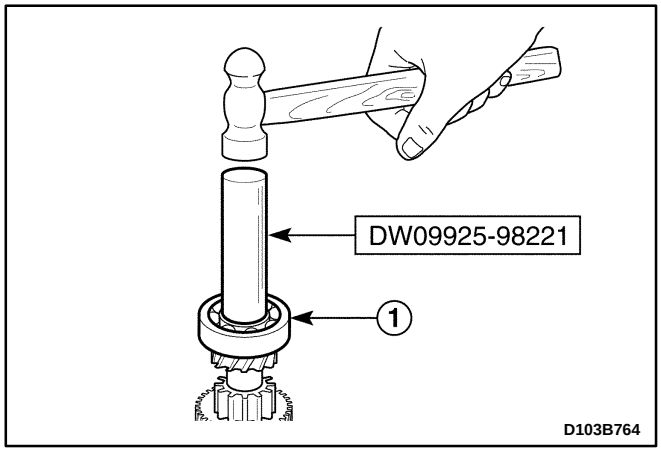
Important: Match the ring groove to the key of hub.



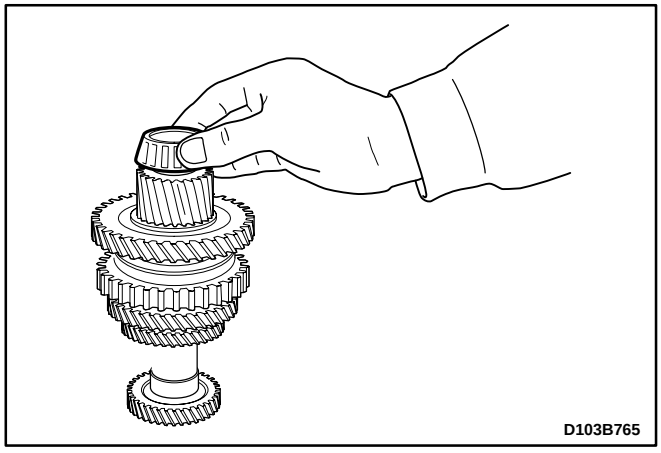
6. Install the input shaft fourth gear bearing and the fourth gear.
   a. Fourth gear.
   b. Fourth gear bearing.



7. Install the input shaft left side bearing and the fifth gear spacer.
   - Install the following parts using the gear, bearing installer DW09925–98221 and a hammer.
     a. Fifth gear spacer.
     b. Input shaft left side bearing.



8. Install the input shaft right side bearing.
   - Install the bearing to the input shaft using the gear, bearing installer DW09925–98221 and a hammer (1).
9. Install the gear unit. Refer to “Gear Unit” in this section.



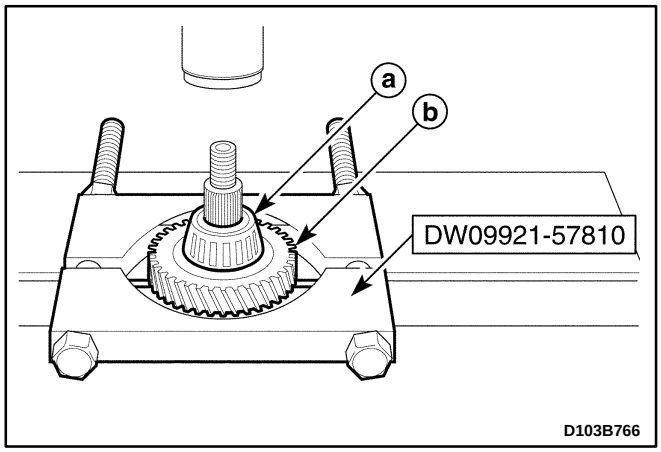
COUNTER SHAFT

Tools Required

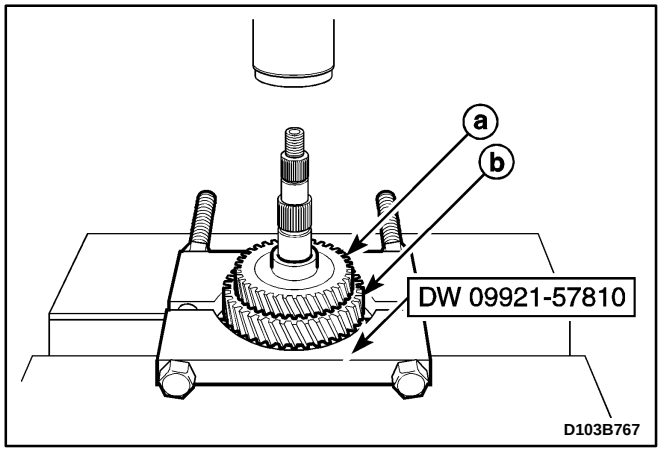
09913–76010	Bushing, Seal Installer
DW09913–80112	Gear, Bearing Installer
DW09921–57810	Gear, Bearing Remover
DW09925–98221	Gear, Bearing Installer
DW09940–53111	Gear,Bearing Installer
DW220–020–01	Differential Bearing Puller
DW220–020–02	Differential Bearing Plate Adapter
DW220–020–03	Differential Bearing Plate Adapter
KM466–A	Gear, Bearing Remover/Installer

Disassembly Procedure

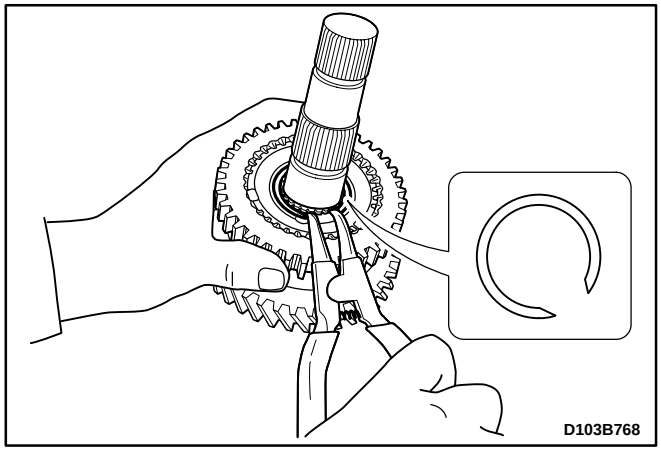
1. Remove the gear unit. Refer to “Gear Unit” in this section.
2. Remove the counter shaft right side bearing.



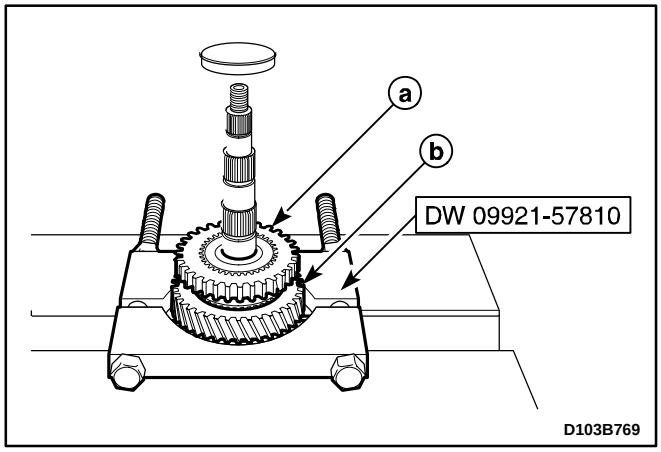
3. Remove the counter shaft left side bearing and the fourth gear.
   - Position the fourth gear to the gear, bearing remover DW09921–57810.
   - Remove the following parts by pressing.
     a. Counter shaft left side bearing.
     b. Fourth gear.



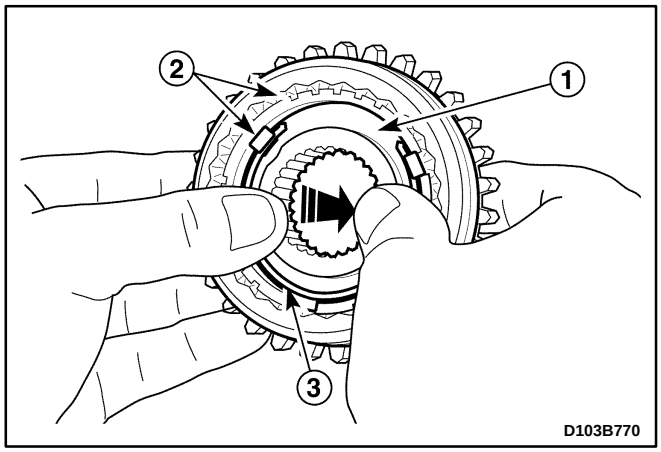
4. Remove the counter shaft third–fourth gear spacer.
5. Remove the counter shaft third gear and second gear.
   - Position the second gear to the gear, bearing remover DW09921–57810.
   - Remove the following parts by pressing
     a. Third gear.
     b. Second gear.



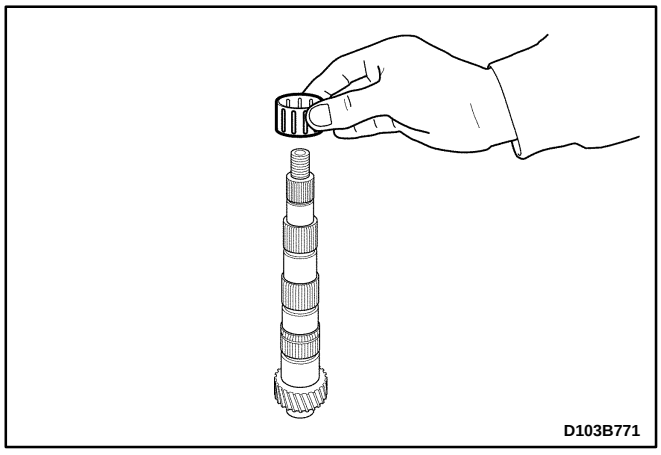
6. Remove the counter shaft second gear bearing.
7. Remove the second gear synchronizer ring.
8. Remove the first–second gear synchronizer circlip.



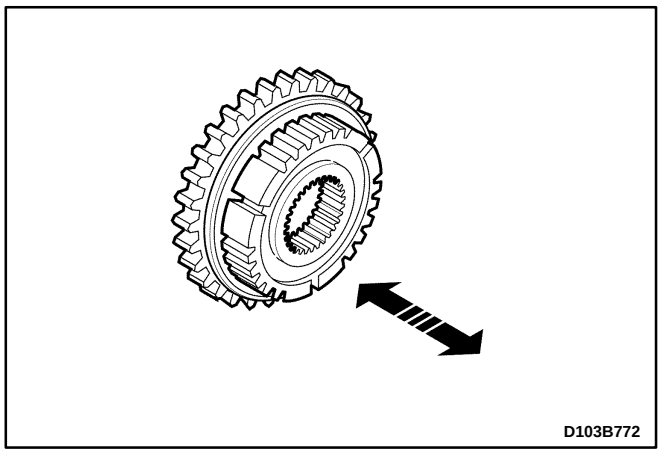
9. Remove the counter shaft first–second gear synchronizer hub assembly, the first gear / the first gear synchronizer ring.
   - Position the first gear to the gear, bearing remover DW09921–57810.
   - Remove the following parts by pressing.
     a. Synchronizer hub assembly.
     b. First gear / First gear synchronizer ring.
   - Remove the first gear synchronizer ring from the first gear.



10. Disassemble the first–second gear synchronizer hub assembly.
    - Push the hub from the hub assembly (1).
    - Disassemble the synchronizer sleeve and key (2).
    - Disassemble the synchronizer springs (3).

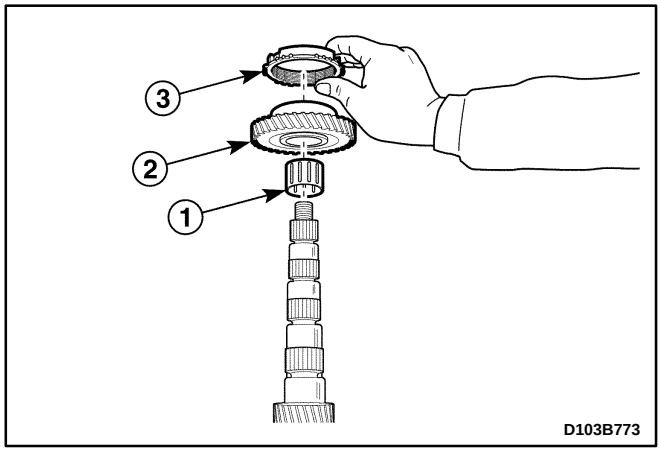


11. Remove the counter shaft first gear bearing.



Synchronizer Hub and Sleeve Inspection

- Check the sleeve for improper operation after assembling the hub and the sleeve.
- Check the wear of hub and sleeve.
- Replace synchronizer hub or sleeve if necessary.

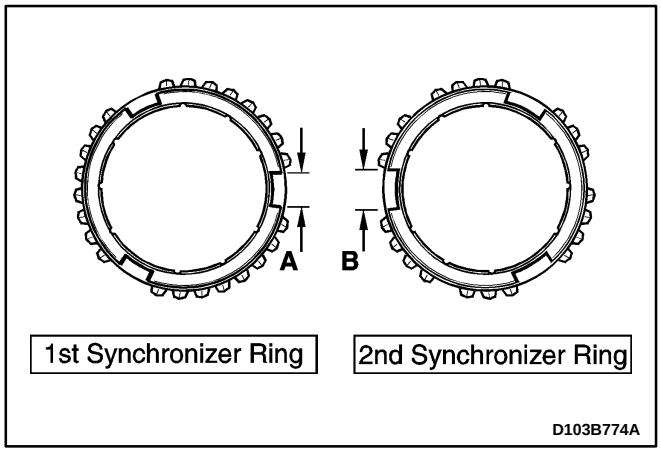


Assembly Procedure

1. Install the related counter shaft first gear.
   - Install the first gear bearing (1).
   - Install the first gear (2).
   - Install the first gear synchronizer ring (3)

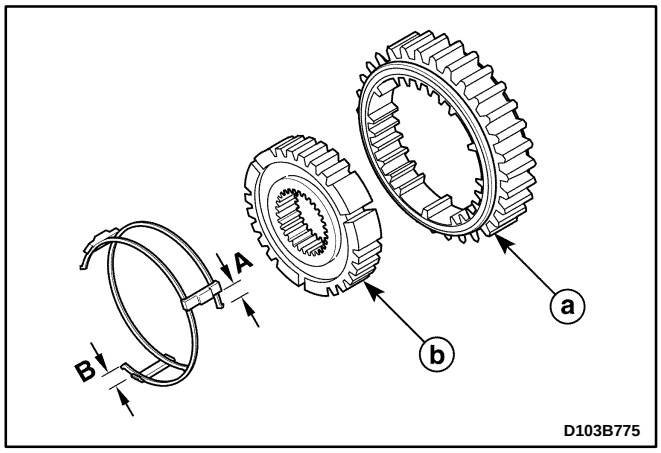
Important: Coat the inner parts; gear, bearing and oil seal etc. with gear fluid.

Important: Be careful there is the difference of key groove width between the first synchronizer ring and the second synchronizer ring.



Unit : mm (in.)

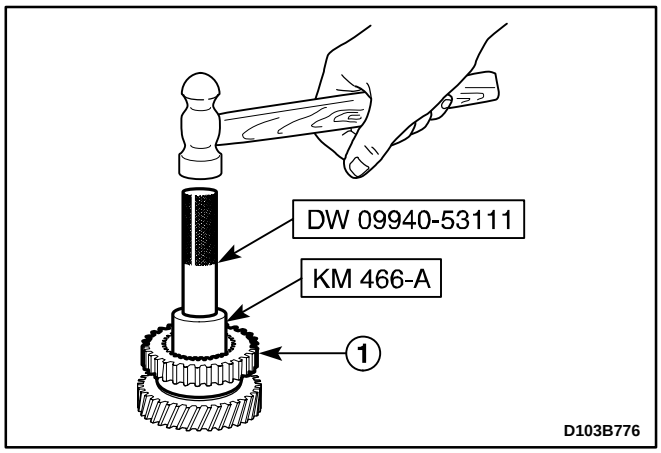
Key Groove Width	First synchronizer ring (A) : 8.2 (0.323)
	Second synchronizer ring (B) : 9.6 (0.378)



2. Assemble the first–second synchronizer hub assembly.
   - Install the synchronizer springs to hub.
   - Install the synchronizer keys to hub.

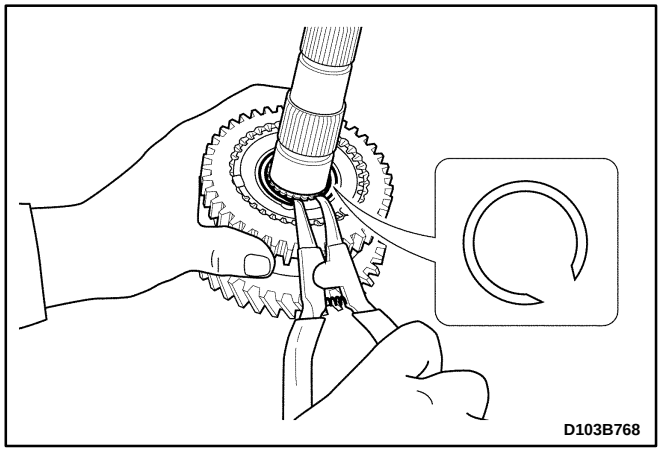
Important: Let (A)=(B) when installing the keys.

   - Install the hub to the sleeve.
     a. Sleeve.
     b. Hub.



3. Install the first–second synchronizer hub assembly.
   - Insert the hub assembly into the counter shaft using the gear, bearing installer DW09940–53111, the gear bearing remover/installer KM466–A and a hammer (1).

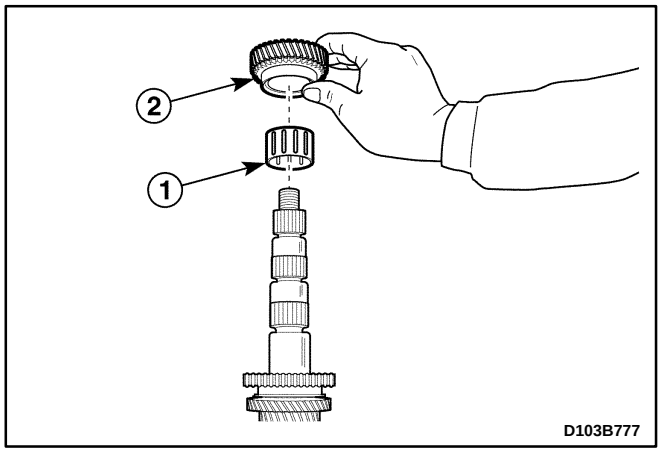
Important: Position the synchronizer key to the first gear synchronizer ring groove.



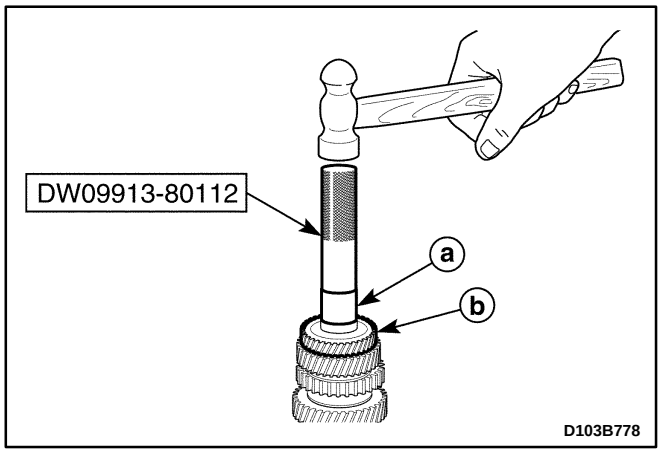
4. Install the second synchronizer ring.

Important: Position the second synchronizer ring groove to the synchronizer hub key.

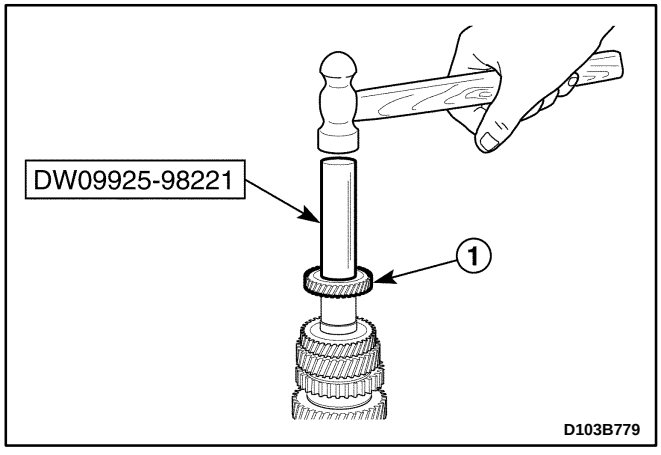
5. Install the first–second gear synchronizer circlip.



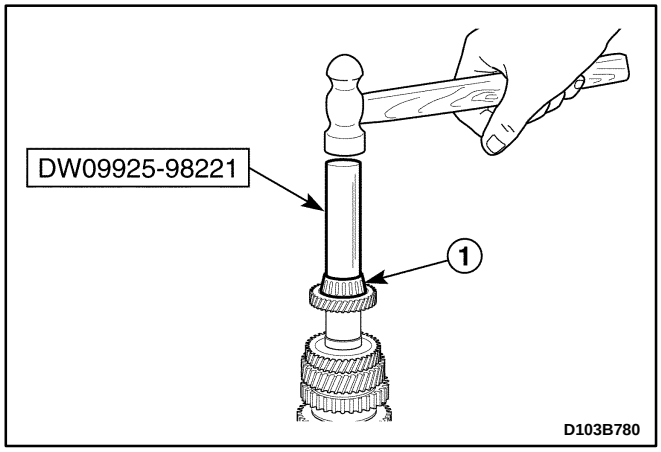
6. Install the related counter shaft second gear.
   - Install the second gear bearing (1).
   - Install the second gear (2).



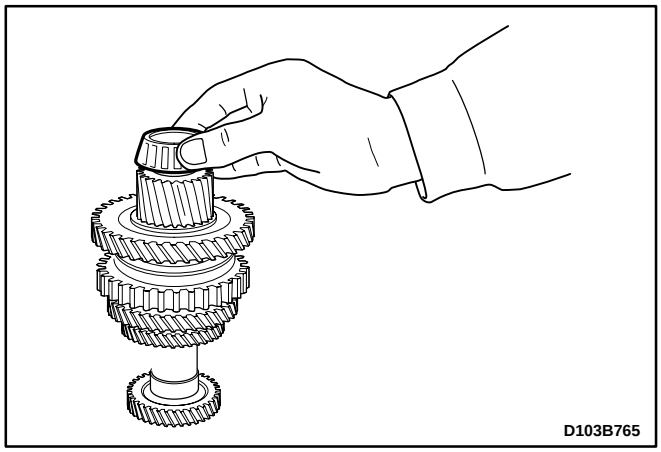
7. Install the counter shaft third gear and the third–fourth gear spacer.
   - Insert the third gear and the third–fourth gear spacer into the counter shaft.
   - Install the following parts using the gear, bearing installer DW09913–80112 and a hammer.
     a. Third–fourth gear spacer.
     b. Third gear.



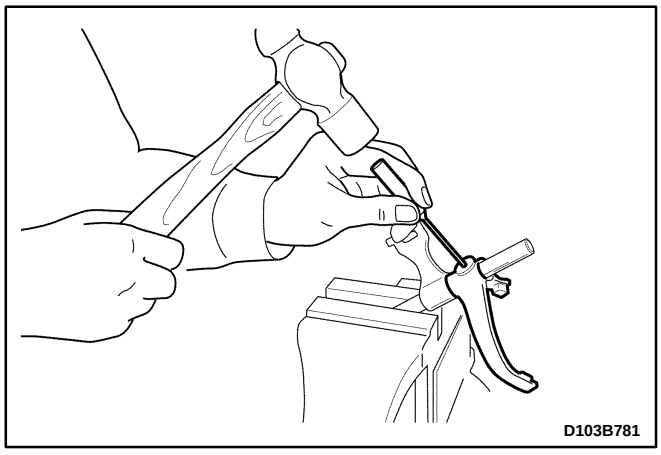
8. Install the counter shaft fourth gear.
   - Install the fourth gear to the counter shaft using the gear, bearing installer DW09925–98221 and a hammer (1).



9. Install the counter shaft left side bearing.
   - Install the left side bearing to the counter shaft using the gear, bearing installer DW09925–98221 and a hammer (1).



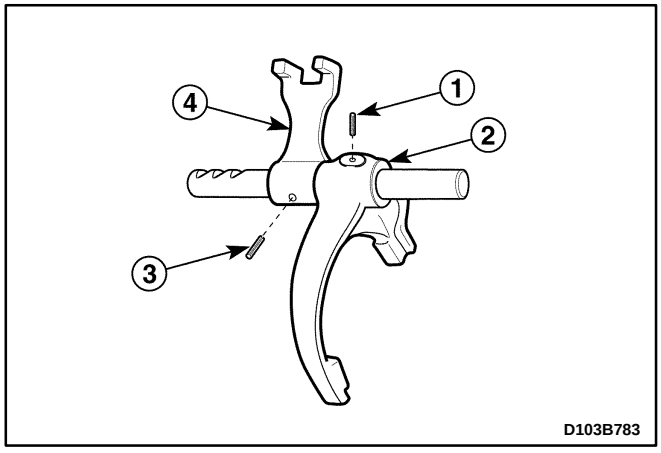
10. Install the counter shaft right side bearing.
11. Install the gear unit. Refer to “Gear Unit” in this section.



GEAR SHIFT FORK

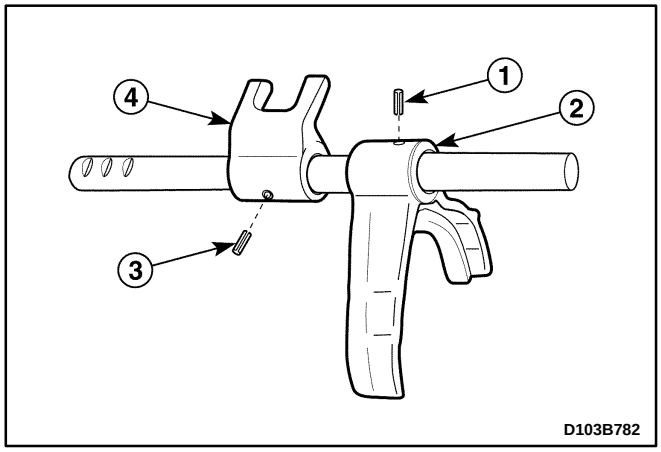
Disassembly Procedure

1. Remove the gear unit. Refer to “Gear Unit” in this section.
2. Remove the each shift shaft assembly from the gear unit.
3. Remove the first–second gear shift shaft assembly.
   - Fix the shift shaft assembly to a vise with protector.
   - Remove the first–second gear fork pin using a pin punch and a hammer (1).
   - Remove the first–second gear shift fork (2).

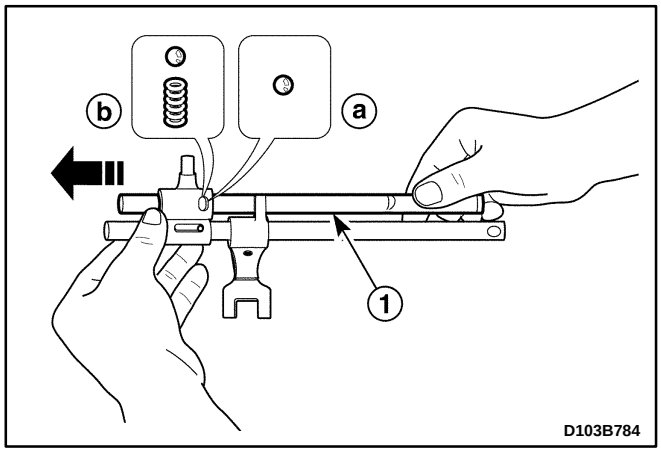


   - Remove the first–second gear shift yoke pin using a pin punch and a hammer (3).
   - Remove the first–second gear shift yoke (4).

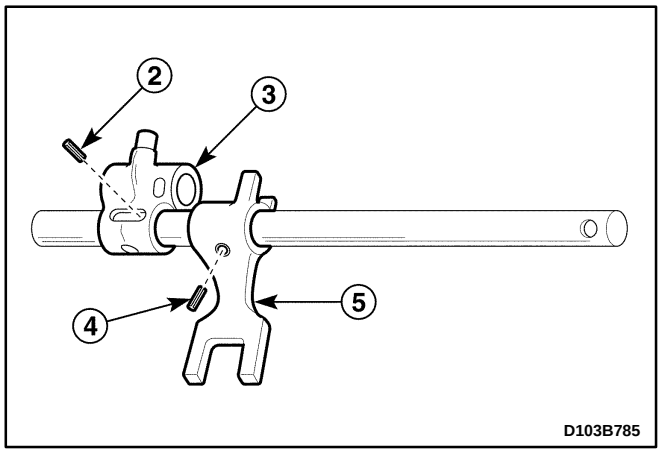
Important: Mark the place and direction of shift fork and yoke to install easily before removing them.



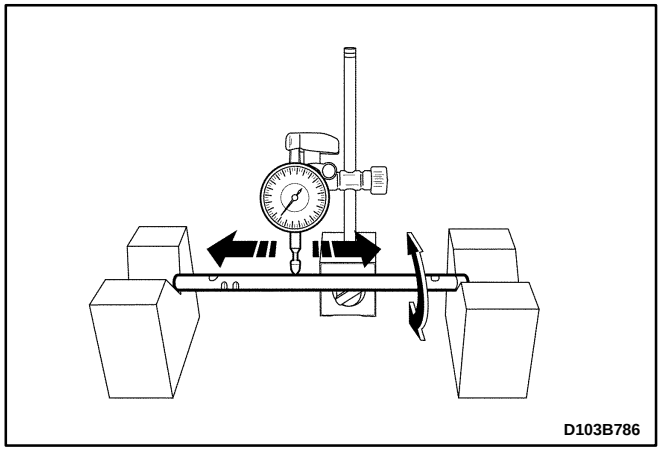
4. Disassemble the third–fourth gear shift shaft assembly.
   - Fix the third–fourth gear shift shaft assembly to a vise with protector.
   - Remove the third–fourth gear fork pin using a pin punch and a hammer (1).
   - Remove the third–fourth gear fork (2).
   - Remove the third–fourth gear shift yoke pin using a pin punch and a hammer (3).
   - Remove the third–fourth gear shift yoke (4).



5. Disassemble the fifth–reverse gear shift shaft assembly.
   - Remove the shift shaft not installed with yoke by pushing (1).
   - Remove the following parts from the reverse shift arm.
     a. Fifth–reverse gear ball.
     b. Reverse shift guide ball and spring.
   - Fix the shift shaft assembly to a vise with protector.
   - Remove the reverse gear shift arm pin using a pin punch and a hammer (2).
   - Remove the reverse gear shift arm (3).

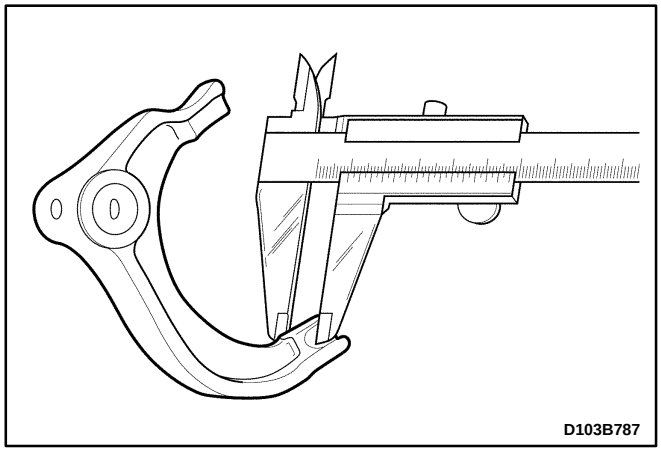


   - Remove the fifth gear shift yoke pin using a pin punch and a hammer (4).
   - Remove the fifth gear shift yoke (5).



Inspection Procedure – Shift Shaft

1. Check for bent, deformed or damaged shift shaft.
2. Replace shift shaft if necessary.

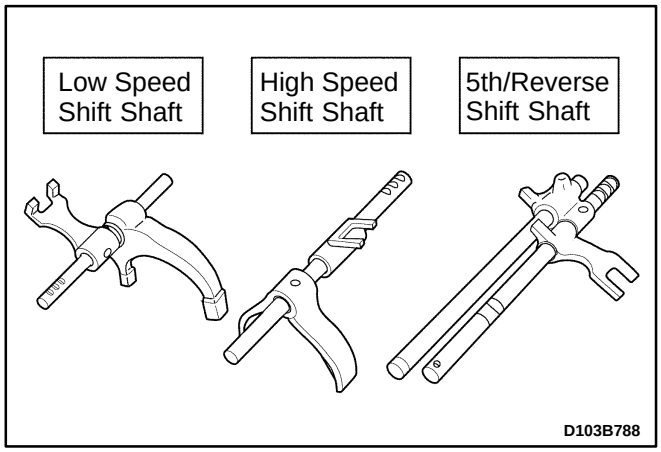

D103B787

Inspection Procedure – Shift Fork

1. Measure the end thickness of shift fork and replace if below limit.

Unit : mm (in.)

Shift fork end thickness (mm)	Standard	Limit
Low Speed Shift Fork	8.7 (0.343)	8.1 (0.319)
High Speed Shift Fork	7.8 (0.307)	7.2 (0.283)
Fifth Gear Shift Fork	7.8 (0.307)	7.2 (0.283)



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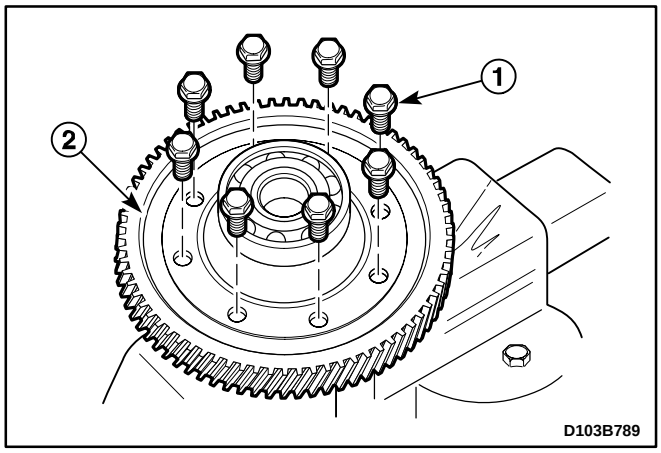
Assembly Procedure

1. Install in the reverse order of removal.

Important: Use only new fork fin and yoke pin.



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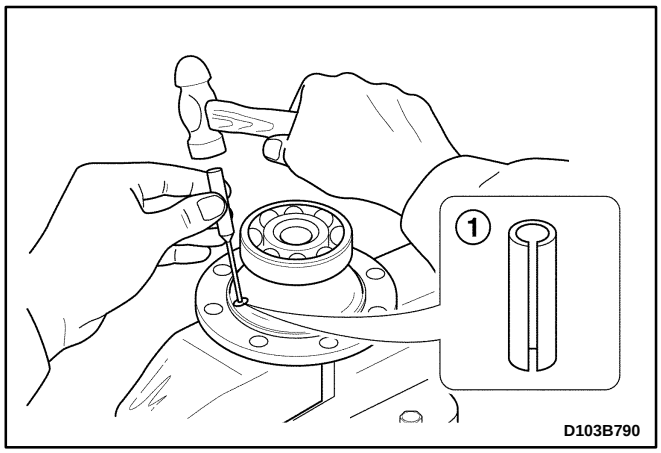
DIFFERENTIAL

Disassembly Procedure

1. Remove the differential assembly. Refer to “Gear Unit” in this section.
2. Remove the differential ring gear.
   - Fix the differential assembly to a vise with protector.
   - Remove the bolts (1).
   - Remove the ring gear (2).



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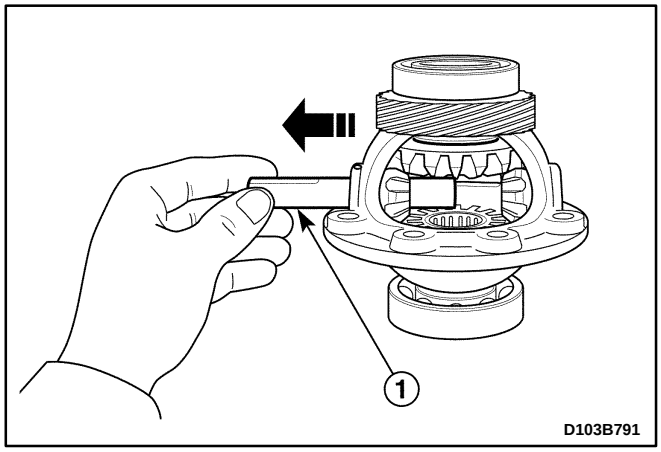
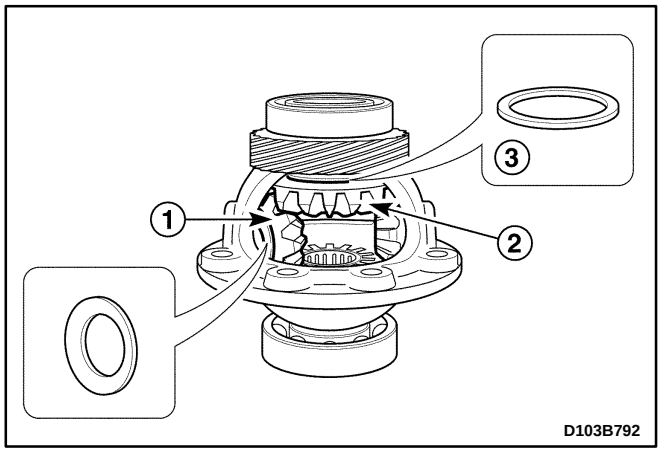
3. Remove the pinion gear pin.
   - Remove the pin using a pin punch and a hammer (1).



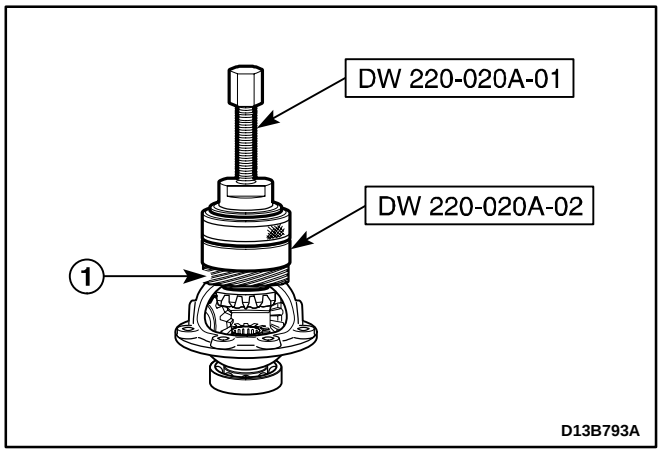
4. Remove the pinion gear shaft.
   - Remove the shaft from the case (1).



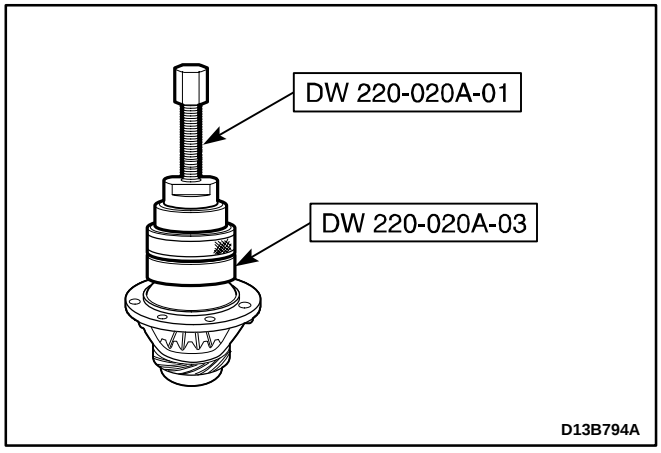
5. Remove the pinion gears and the side gears.
   - Remove the pinion gears and the washers (1).

Important: Remove the pinion gear and the washer by rotating the side gear.

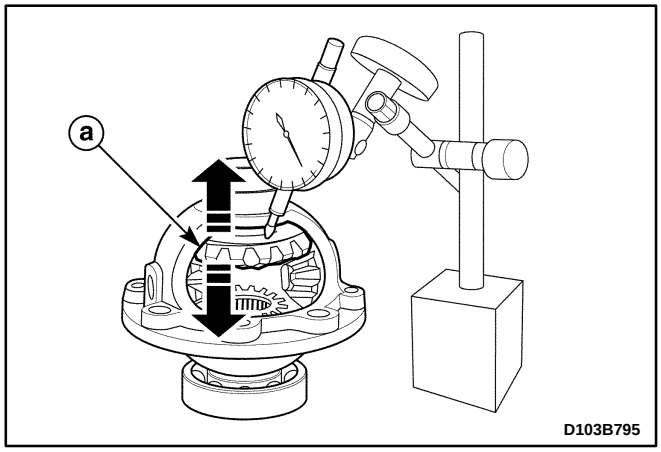
   - Remove the side gears (2).
   - Remove the adjust shims from the side gears (3).



6. Remove the differential right side bearing and speedometer drive gear.
   - Remove the right side bearing using the differential bearing puller DW220–020A–01 and the differential bearing plate adapter DW220–020A–02.
   - Remove the speedometer drive gear (1).



7. Remove the differential left side bearing.
   - Remove the left side bearing using the differential bearing puller DW220–020A–01 and the differential bearing plate adapter DW220–020A–03.



Side Gear Play Inspection

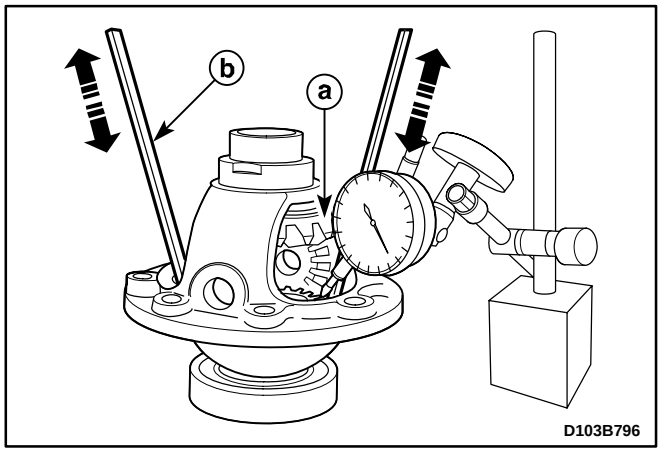
1. Measure the axle direction play of side gear and replace a side gear washer if it exceeds limit.

UNIT : mm (in.)

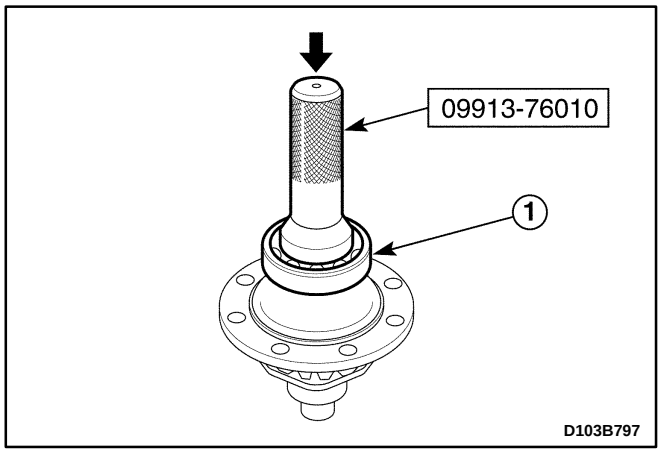
Thrust Free Play of Differential Side	0.05–0.33 (0.0020–0.0130)

UNIT : mm (in.)

Thrust Adjusting Shim	0.90 (0.0354) 0.95 (0.0374)
	1.00 (0.0394) 1.05 (0.0413)
	1.10 (0.0433) 1.15 (0.0453)
	1.20 (0.0472)



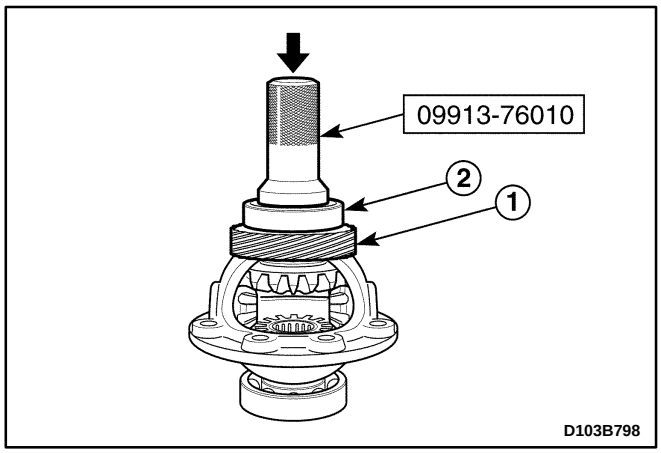
2. After checking for worn or scratched thrust adjusting shim, replace it if necessary.
   a. Side gear.
   b. Driver.



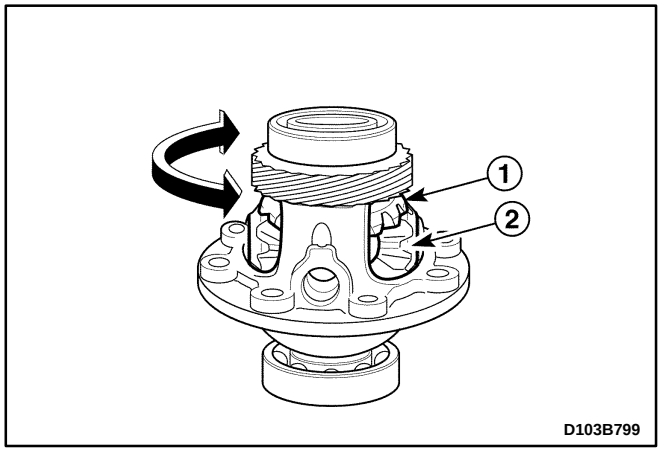
Assembly Procedure

1. Install the differential left side bearing.
   - Insert the left side bearing (1).
   - Install the left side bearing using the bushing, seal installer 09913–76010 and a hammer.

Important: Coat the inner parts; bearing, washer, shim etc. with gear fluid.

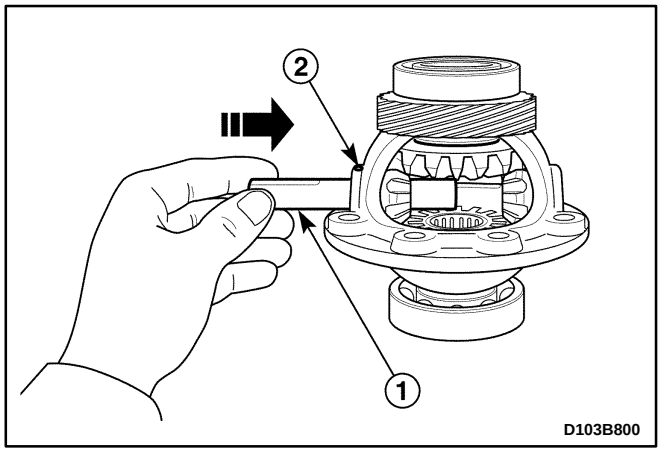


2. Install the speedometer drive gear and differential right side bearing.
   - Insert the speedometer drive gear(1).
   - Insert the differential right side bearing (2).
   - Install the right side bearing using the bushing, seal installer 09913–76010 and a hammer.



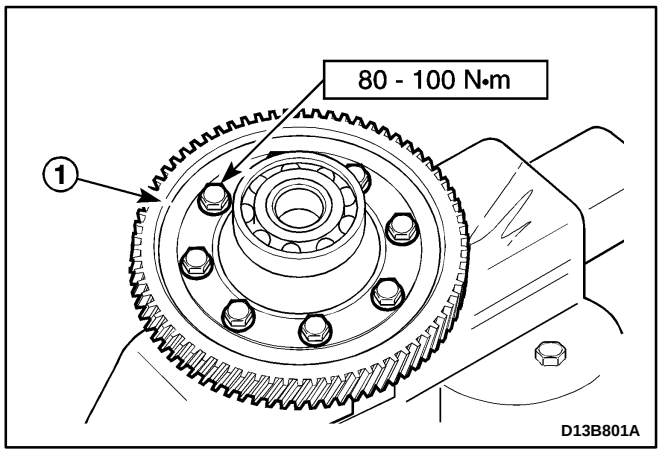
3. Install the side gears and the pinion gears.
   - Insert the trust adjusting shims to the side gears.
   - Install the side gears (1).
   - Install the pinion gears and washers (2).

Important: Install the pinion gears and washers simultaneously.



4. Install the pinion gear shaft and pin.
   - Insert the shaft into the gear pin hole by rotating (1).
   - Press the pin using a pin punch and a hammer (2).

Important: Use only new pin.



5. Install the differential ring gear.
   - Fix the differential assembly to a vise.
   - Install the ring gear with the bolts (1).

Tighten

Tighten the bolts to 80–100 N•m (59–74 lb-ft).

6. Install the differential assembly. Refer to “Gear Unit” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

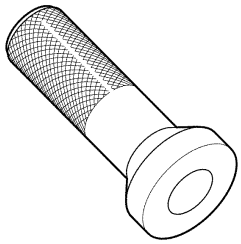
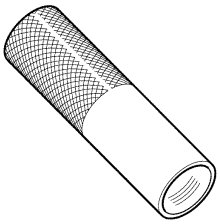
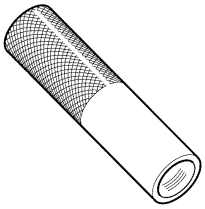
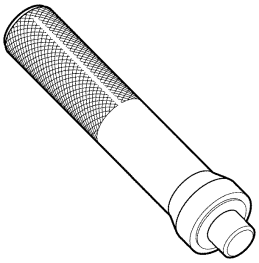
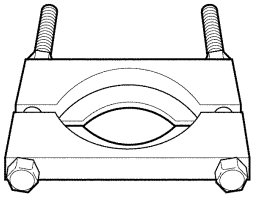
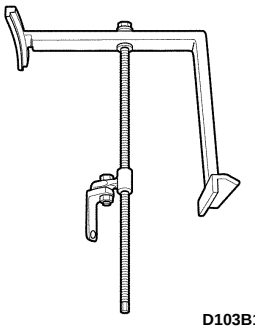
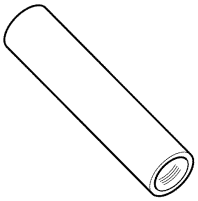
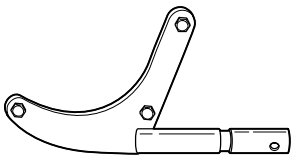
Application	Description		Unit	Standard	Limit
General	Type	Forward gear	–	Synchronized mesh type	–
		Reverse gear	–	Sliding mesh type	–
	Gear ratio	1st	–	3.818	–
		2nd	–	2.210	–
		3rd	–	1.423	–
		4th	–	1.029	–
		5th	–	0.837	–
		Reverse	–	3.583	–
	Final drive ratio		–	4.444	–
	Fluid capacity		L(qt)	2.1 (2.21)	–
	Fluid classification		–	75W-85 (GL-4)	–
Service	Key groove width of synchronizer ring	1st gear	mm(in.)	8.2 (0.323)	8.6 (0.339)
		2nd, 3rd, 4th gear	mm(in.)	9.6 (0.378)	10.0 (0.394)
		5th gear	mm(in.)	9.4 (0.370)	9.8 (0.386)
	Shift fork end thickness	Low speed shift fork (1st~2nd)	mm(in.)	8.7 (0.343)	8.1 (0.319)
		High speed shift fork (3rd~4th)	mm(in.)	7.8 (0.307)	7.2 (0.283)
		5th gear shift fork	mm(in.)	7.8 (0.307)	7.2 (0.283)
	Clearance between gear and synchronizer ring		mm(in.)	1.0 (0.039)	0.5 (0.020)
	Clearance between sleeve and shift fork		mm(in.)	0.2 – 0.6 (0.008 – 0.024)	1.0 (0.039)
	Thrust free play of differential side gear		mm(in.)	0.05 – 0.33 (0.002 – 0.013)	–
	Speedometer gear ratio(Driven/Drive)		–	17/18 (0.944)	–

FASTENER TIGHTENING SPECIFICATIONS

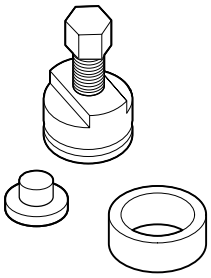
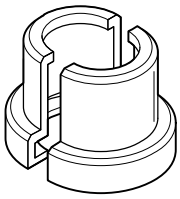
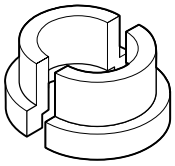
Application	N•m	Lb-Ft	Lb-In
5th/Reverse Gear Shift Shaft Bolt	10 – 16	7 – 12	–
Back Up Light Switch Nut	15 – 18	11 – 13	–
Counter Shaft 5th Gear Nut	60 – 80	44 – 59	–
Crankshaft Position Sensor Bolt	5 – 8	–	44 – 70
Differential Ring Gear Bolt	80 – 100	59 – 74	–
Engine Mounting Front Bracket Bolt (Cylinder Block Side)	35 – 41	25 – 30	–
Engine Mounting Front Damping Bush Bolt (Crossmember Side)	35 – 41	25 – 30	–
Engine Mounting Front Damping Bush Bolts (Crossmember Side)	45 – 55	33 – 41	–
Engine Mounting Front Damping Bush Bolt/Nut (Bracket Side)	68 – 83	51 – 61	–
Front Exhaust Pipe Nut (Exhaust Manifold Side/Muffler Side)	25 – 35	18 – 25	–
Gear Shift Control Case Bolt	18 – 28	13 – 21	–
Gear Shift Lever Bolt	4 – 7	–	35 – 62
High Speed Shift Shaft Bolt	10 – 16	7 – 12	–
Low Speed Shift Shaft Bolt	10 – 16	7 – 12	–
Oil Drain Plug	25 – 30	18 – 22	–
Oil Level Plug	36 – 54	26 – 40	–
Radiator Lower Hose Bracket Bolts	8 – 15	–	70 – 132
Reverse Idle Gear Shaft Bolt	18 – 28	13 – 21	–
Reverse Shift Lever Bolt	18 – 28	13 – 21	–
Select Cable Nut(Shift Lever Side)	8 – 12	–	71 – 106
Select Lever Bolt	18 – 28	13 – 21	–
Side Cover Plate Screw	6 – 7	–	53 – 62
Shift Guide Bolt	18 – 28	13 – 21	–
Shift Interlock Bolt	18 – 28	13 – 21	–
Side Cover Bolt	8 – 12	–	71 – 106
Speedometer Driven Gear Bolt	4 – 7	–	35 – 62
Starter Motor Bolt	18 – 28	13 – 21	–
Transaxle Case Bolt	15 – 22	11 – 16	–
Transaxle Case(left) Cap Bolt	8 – 12	–	71 – 106
Transaxle Lower Bolt and Nut(Engine Side)	55 – 65	41 – 48	–
Transaxle Mounting Bolt(Body Side)	45 – 55	33 – 41	–
Transaxle Mounting Bolt and Nut(Transaxle Side)	55 – 65	41 – 48	–
Transaxle Upper Bolt(Engine Side)	55 – 65	41 – 48	–
Transaxle Under Cover Bolt	35 – 55	25 – 41	–

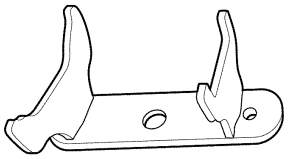
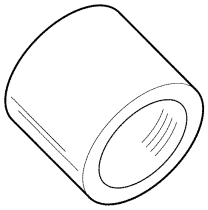
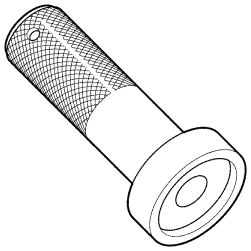
SPECIAL TOOLS

SPECIAL TOOLS TABLE

 D103B110	**09913–76010 Bushing, Seal Installer**
 D103B105	**DW09940–53111 Gear, Bearing Installer**
 D103B106	**DW09913–80112 Gear, Bearing Installer**
 D103B109	**DW09943–78210 Bushing, Seal Installer**
 D103B104	**DW09921–57810 Gear, Bearing Remover**
 D103B103	**DW110–021 Engine Assembly Support Fixture**
 D103B107	**DW09925–98221 Gear, Bearing Installer**
 D13B101A	**DW220–010A Transaxle Fixture**

SPECIAL TOOLS TABLE (Cont'd)

 D13B112A	**DW220–020A–01 Differential Bearing Puller**
 D13B113A	**DW220–020A–02 Differential Bearing Plate Adapter**
 D13B114A	**DW220–020A–03 Differential Bearing Plate Adapter**

 D103B102	**DW220–031 Transaxle Remove/ Install Support**
 D103B108	**KM466–A Gear, Bearing Remover / Installer**
 D103B111	**KM519 Oil Seal Installer**

SECTION 5C

CLUTCH

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.

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DESCRIPTION AND OPERATION

DRIVING MEMBERS

The driving members consist of two flat surfaces machined to a smooth finish. One of these is the rear face of the engine flywheel, and the other is the pressure plate. The pressure plate is fitted into a steel cover, which is bolted to the flywheel.

DRIVEN MEMBERS

The driven member is the clutch disc with a splined hub which is free to slide lengthwise along the splines of the input shaft, but which drives the input shaft through these same splines.

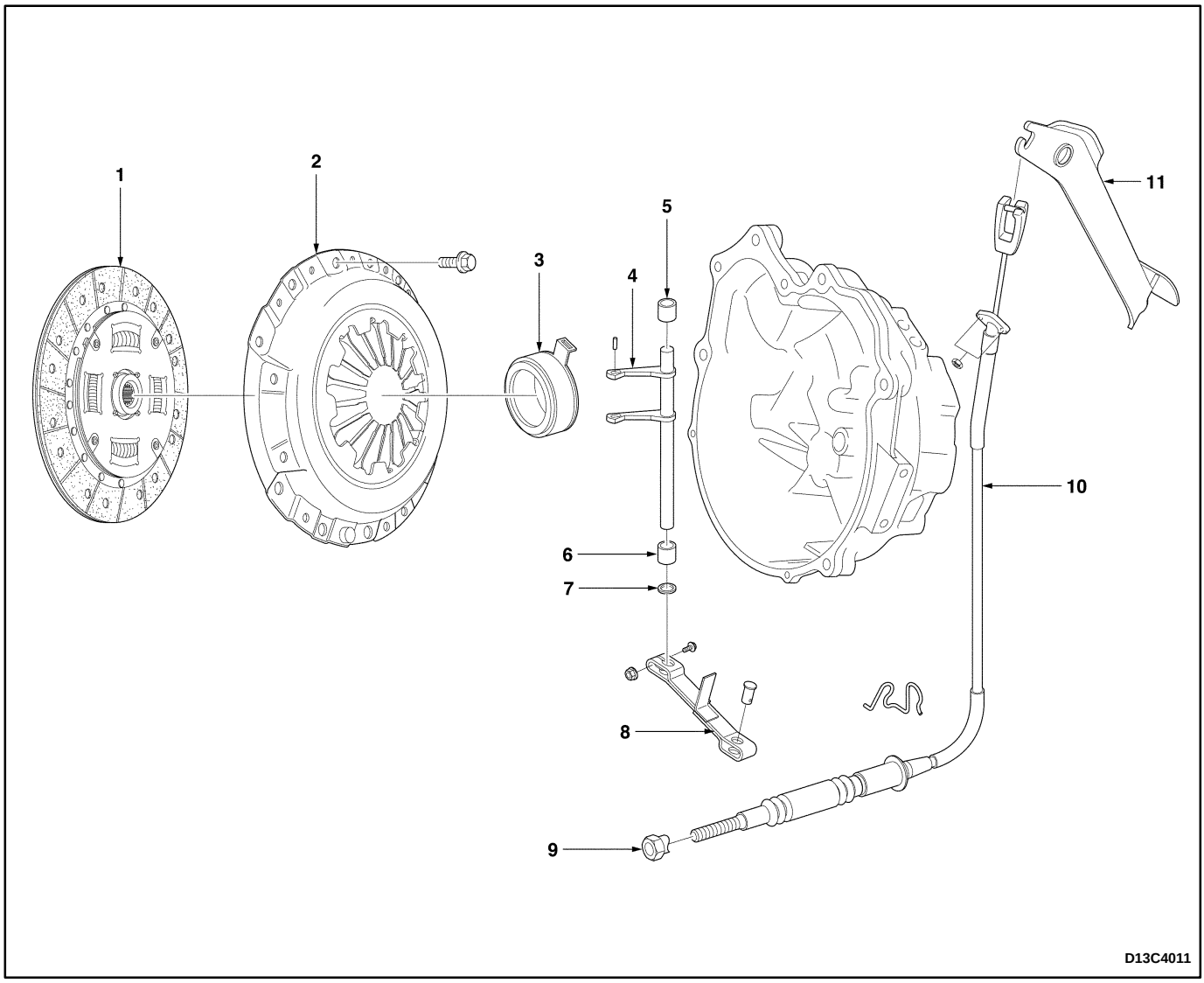
The driving and driven members are held in contact by spring pressure. This pressure is exerted by a diaphragm spring in the pressure plate assembly.

OPERATING MEMBERS

The clutch release system consists of the clutch pedal, the clutch release shaft, the clutch cable, the release arm and the release bearing. When pressure is applied to the clutch pedal, the clutch release shaft pushes against the release bearing by rotating. The bearing then pushes against the diaphragm spring in the pressure plate assembly, thereby releasing the clutch.

COMPONENT LOCATOR

CLUTCH COMPONENTS



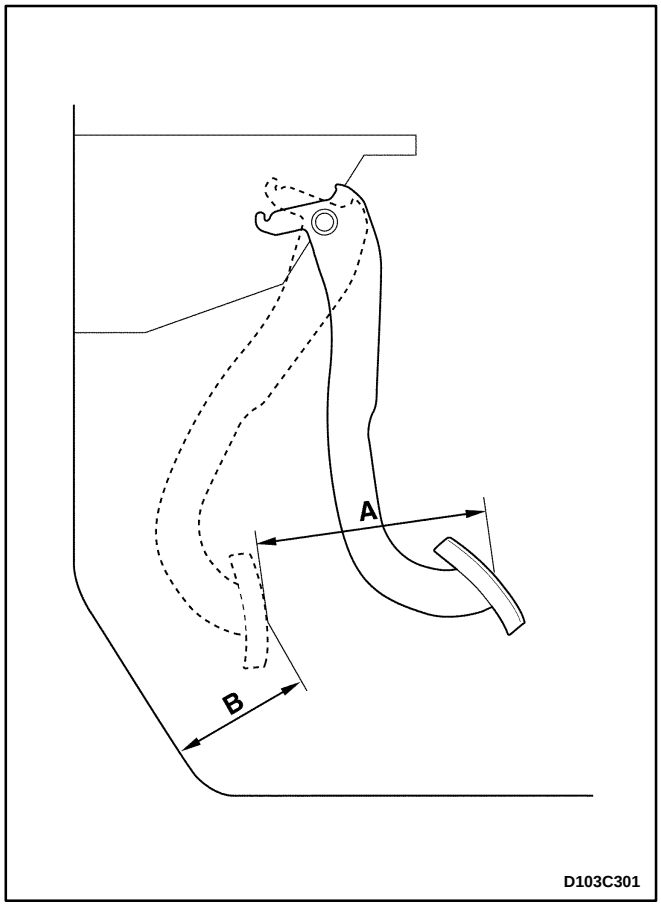
1 Clutch Disc
2 Pressure Plate
3 Release Bearing
4 Release Shaft
5 Release Shaft Bushing (No.1)
6 Release Shaft Bushing (No.2)
7 Release Shaft Seal
8 Release Arm
9 Clutch Cable Adjusting Nut
10 Clutch Cable
11 Clutch Pedal

DIAGNOSTIC INFORMATION AND PROCEDURES

GENERAL DIAGNOSIS

Condition	Probable Cause	Correction
Slipping Clutch	● Improper clutch cable adjustment.	● Adjust clutch cable.
	● Worn or oily contamination on clutch disc surface.	● Replace clutch disc.
	● Worn or oily contamination on pressure plate, flywheel surface.	● Replace pressure plate, flywheel.
	● Damaged or weakened diaphragm spring.	● Replace pressure plate.
	● Rusted clutch cable.	● Replace clutch cable.
Dragging Clutch	● Improper clutch cable adjustment.	● Adjust clutch cable.
	● Worn or weakened diaphragm spring.	● Replace pressure plate.
	● Worn or rusted splines of input shaft or clutch disc.	● Replace input shaft or clutch disc.
	● Excessively wobbly clutch disc.	● Replace clutch disc.
	● Worn clutch disc.	● Replace clutch disc.
Fails to Release	● Bent or damaged clutch disc.	● Replace clutch disc.
	● Worn or rusted splines of input shaft or clutch disc.	● Replace input shaft or clutch disc.
	● Improper operation of clutch release shaft.	● Replace clutch release shaft.
Pedal Stays on Floor When Disengaged	● Interfered clutch release bearing.	● Lubricate and adjust clutch release bearing.
	● Weakened diaphragm spring.	● Replace pressure plate.
Clutch Vibration	● Clutch facing with oily contamination.	● Replace clutch disc.
	● Release bearing slides unsmoothly on input shaft bearing retainer.	● Lubricate retainer release bearing.
	● Wobbly clutch disc or poor facing contact.	● Replace clutch disc.
	● Loose clutch disc rivets.	● Replace clutch disc.
	● Weakened clutch disc torsion spring.	● Replace clutch disc.
	● Distorted pressure plate or flywheel surface.	● Replace pressure plate or flywheel.
	● Weakened engine mounting or loosened installing bolt or nut.	● Retighten or replace mounting.
Clutch Noise	● Worn or broken release bearing.	● Replace release bearing.
	● Worn input shaft bearing.	● Replace input shaft bearing.
	● Cracked clutch disc.	● Replace clutch disc.
	● Pressure plate and diaphragm spring rattling.	● Replace pressure plate.
	● Improper clutch cable adjustment.	● Adjust clutch cable.
Grabbing Clutch	● Clutch disc facing with oily contamination.	● Replace clutch disc.
	● Excessively worn on clutch disc facing.	● Replace clutch disc.
	● Rivet head showing out of facing.	● Replace clutch disc.
	● Weakened clutch torsion spring.	● Replace clutch disc.

CLUTCH PEDAL OPERATION



Clutch pedal free travel

It is designed that there is no clutch pedal free travel.

Clutch pedal travel (A)

Pedal Travel	100–110 mm (3.9–4.3 in.)

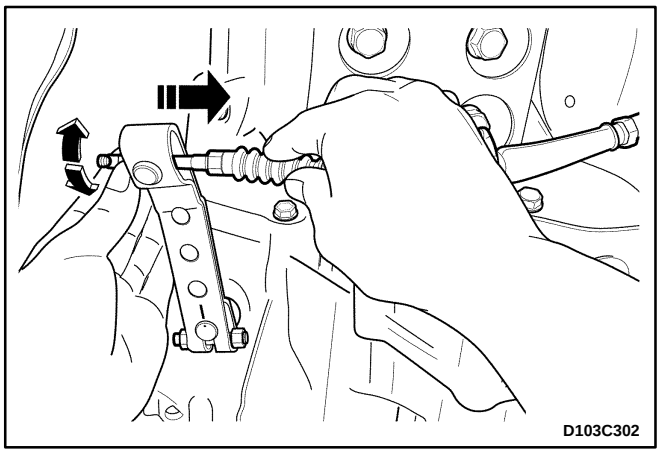
Clearance between pedal and floor just before clutch connection (B)

After starting the engine, check if the clearance between pedal and floor is within specified range in condition of idling, lifting, parking brake and drawing out clutch pedal.

Clearance Between Pedal and Floor just Before Clutch Connection	30–40 mm (1.2–1.6 in.)

Caution: During inspection, take care on sudden departure.

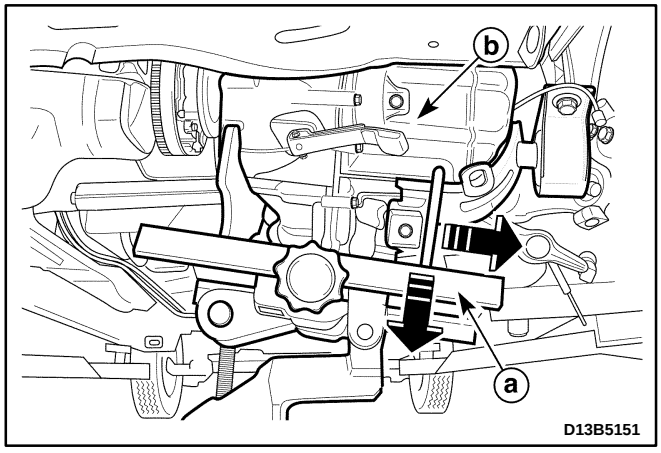
CLUTCH CABLE ADJUSTMENT

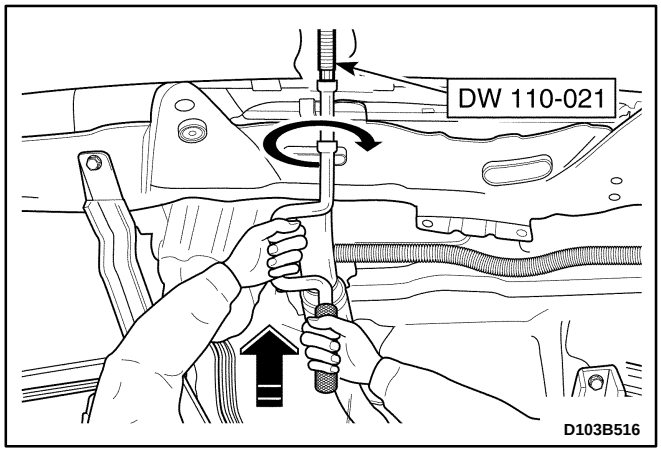


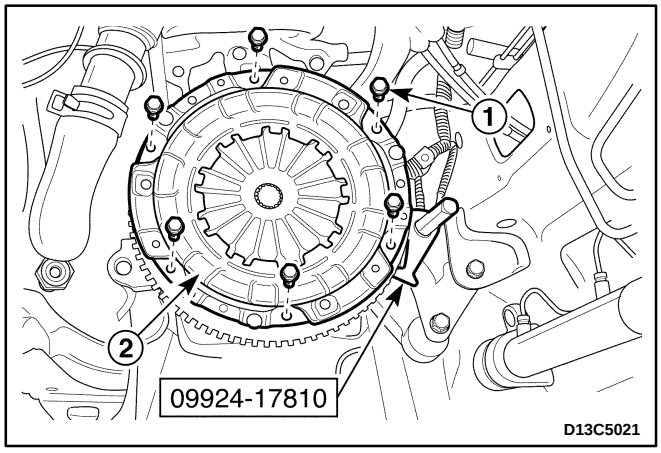
If clutch connection / disconnection is operated unsmoothly, adjust the clutch cable by adjusting clutch cable adjust nut.

INSTRUCTION REPAIR

ON–VEHICLE SERVICE







PRESSURE PLATE, CLUTCH DISC AND INPUT SHAFT BEARING

Tools Required

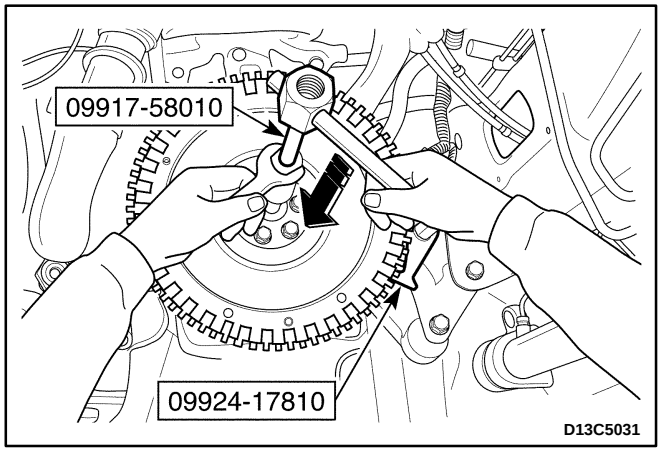
09917–58010	Input Shaft Bearing Remover
09924–17810	Flywheel Holder
09925–98210	Input Shaft Bearing Installer
DW110–021	Engine Fixture
DW210–010	Clutch Center Guide

Removal Procedure

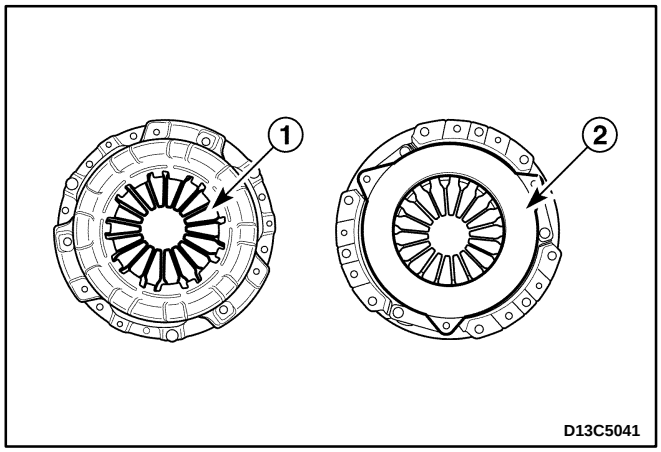
1. Remove the transaxle from the vehicle. Refer to *Section 5B, Manual Transaxle.*
2. Support the engine to normal position using the engine fixture DW110–021.

Notice: The abnormal position of the engine may damage to the related parts and interfere with them. You must support the engine to normal position after removing the transaxle.

3. Remove the pressure plate and the clutch disc.
   - Fix the fly wheel using the fly wheel holder 09924–17810.
   - Remove the pressure plate bolts (1).
   - Remove the pressure plate and the clutch disc (2).

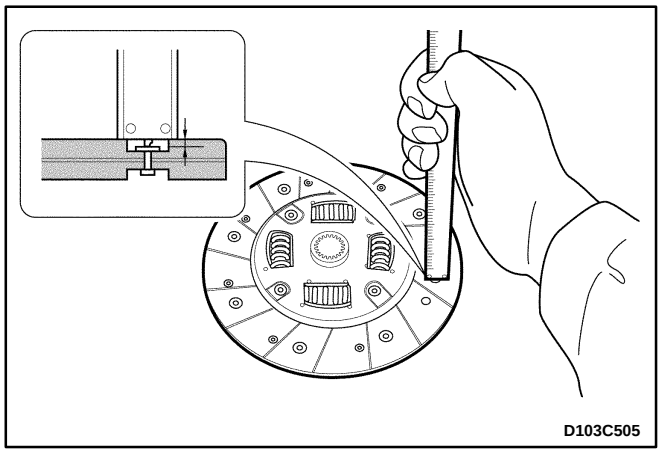


4. Remove the transaxle input shaft bearing using the input shaft bearing remover 09917–58010, the flywheel holder 09924–17810 and a spanner.



Inspection Procedure – Pressure Plate and Clutch Disc

1. Pressure plate inspection .
   - Check the weak and damaged diaphragm spring (1).
   - Check the polluted face by the oil, grease (2).

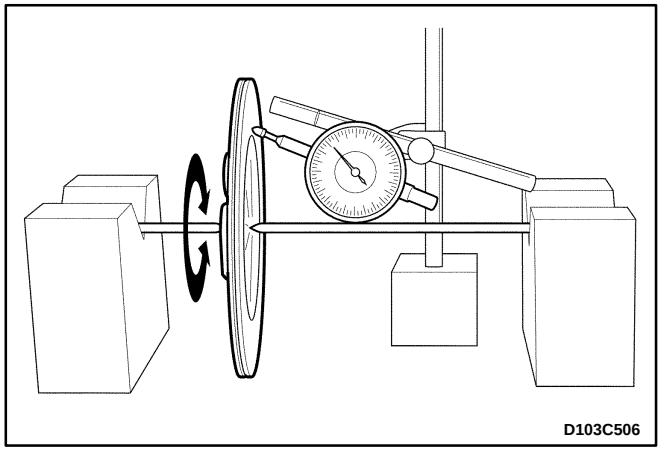


2. Clutch disc inspection
   - Measure rivet head depth from clutch disc surface and replace if below limit.

Unit : mm (in.)

	Standard	Limit
Rivet Head Depth	1.2 (0.047)	0.5 (0.02)

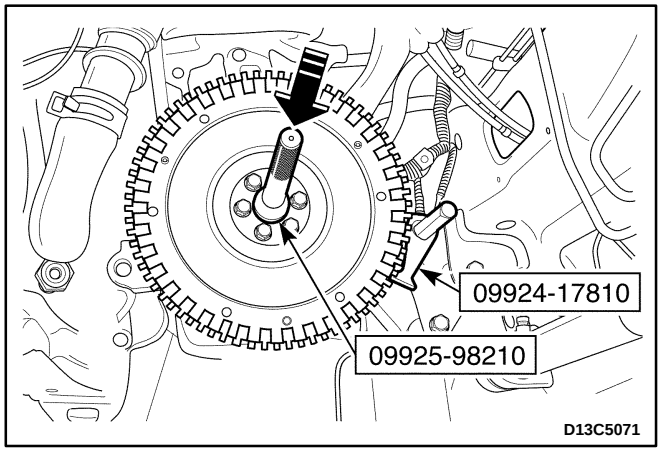
   - Replace the clutch disc if clutch disc surface is contaminated or clutch disc rivets are loosen.



3. Clutch disc runout in rotational direction inspection.
   - Measure runout in rotational direction and replace if runout exceeds limit.

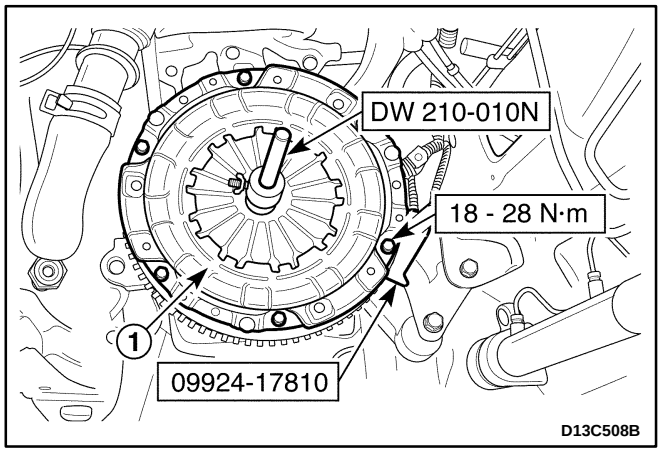
Unit : mm (in.)

Disc Runout Limit in Rotational Direction (Periphery)	0.7 (0.028)



Installation Procedure

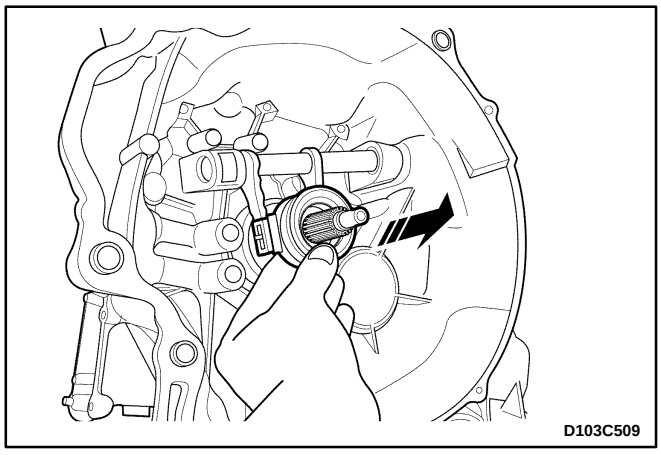
1. Install in the reverse order of removal.
2. Install the input shaft bearing using the input shaft bearing installer 09925–98210 and the flywheel holder 09924–17810.

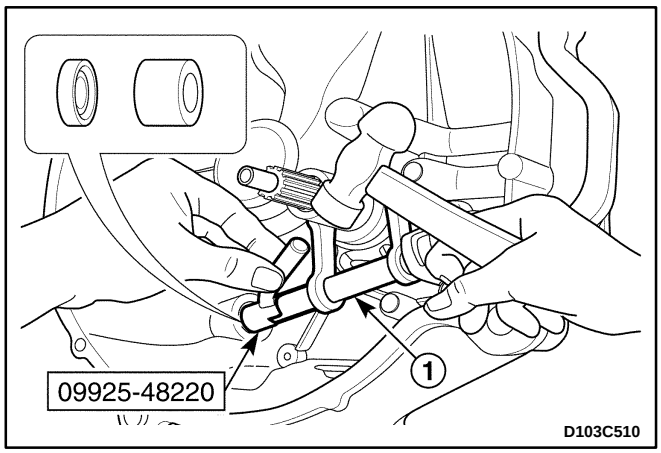


3. Install the pressure plate and the clutch disc.
   - Install the clutch disc.
   - Install the pressure plate (1).
   - Align the pressure plate and the clutch disc onto the flywheel using the clutch center guide DW210–010 and the flywheel holder 09924–17810.
   - Install the pressure plate bolts.

Tighten

Tighten the bolts to 18–28 N•m (13–21 lb-ft).





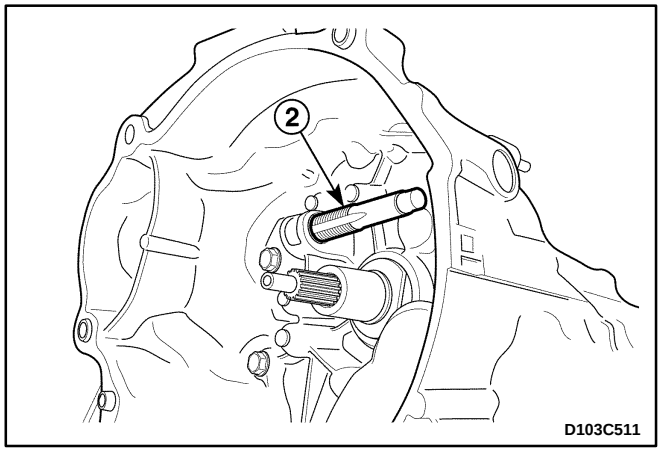
CLUTCH RELEASE BEARING, SHAFT AND BUSHING

Tools Required

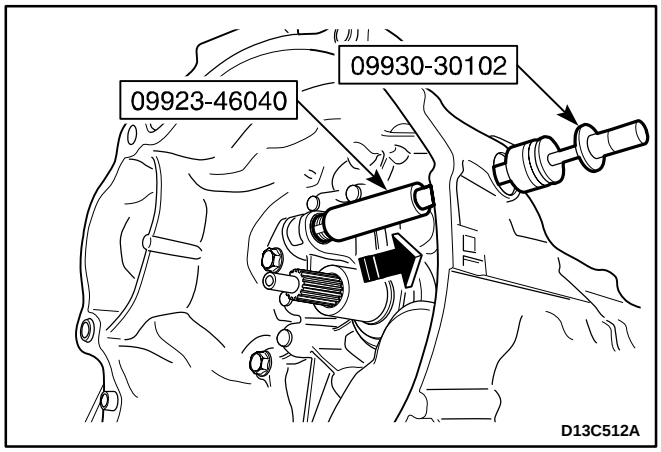
09923–46040	Bushing Joint Pipe
09925–48220	Bushing Remover/Installer
09930–30102	Sliding Shaft
09943–88211	Bushing, Bearing Installer

Removal Procedure

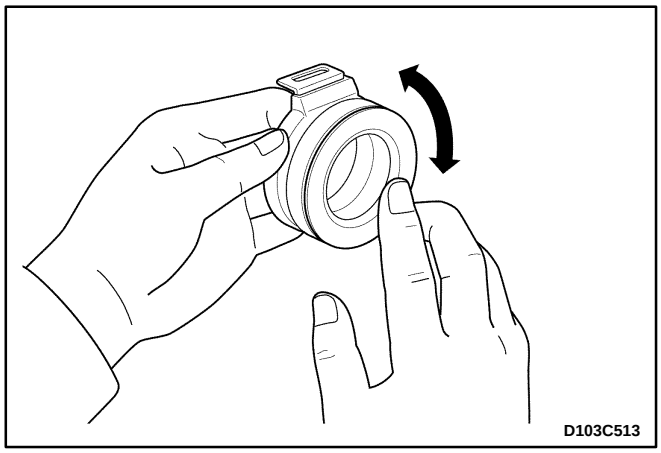
1. Remove the transaxle from the vehicle. Refer to *Section 5B, Manual Transaxle.*
2. Remove the release arm. Refer to “Clutch Release Arm” in this section.
3. Remove the release bearing.
4. Remove the release shaft and bushing.
   - Remove the bushing (No.2) and seal using the bushing remover 09925–48220 and hammer.
   - Remove the release shaft (1).



- Insert the tap (M14X1.5) to the busing (No.1) (2).

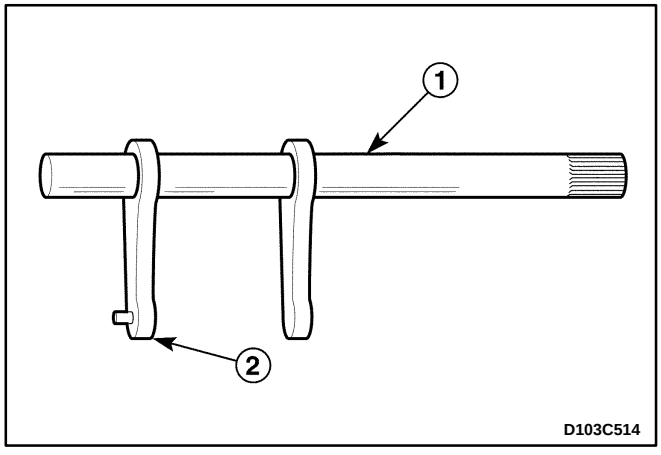


- Insert the bushing joint pipe 09923–46040 to the tab.
- Connect the sliding shaft 09930–30102 to the end of the bushing joint pipe 09923–46040.
- Remove the bushing (No.1) by pulling.

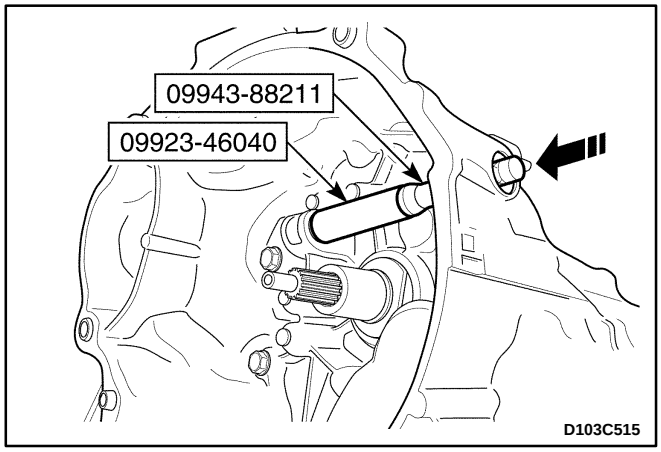


Inspection Procedure – Release Bearing and Shaft

1. Release bearing inspection
   - Check for noisy, worn and damaged release bearing.
   - Check for a grabbing rotation of release bearing.
   - Replace the release bearing if necessary.

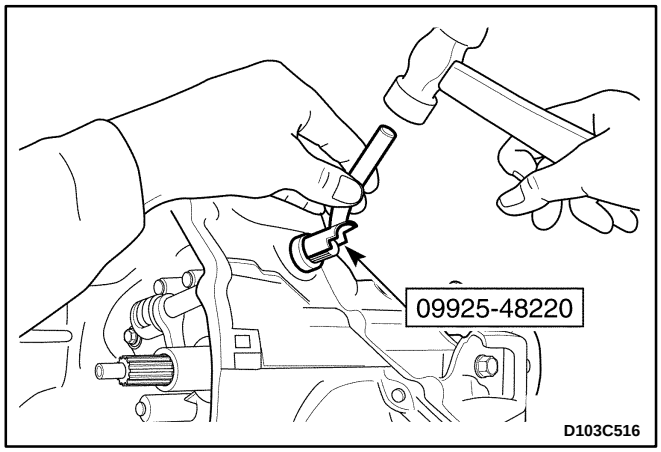


2. Release shaft inspection
   - Check for a warped shaft (1).
   - Check for a worn fork (2).
   - Replace the shaft if necessary.

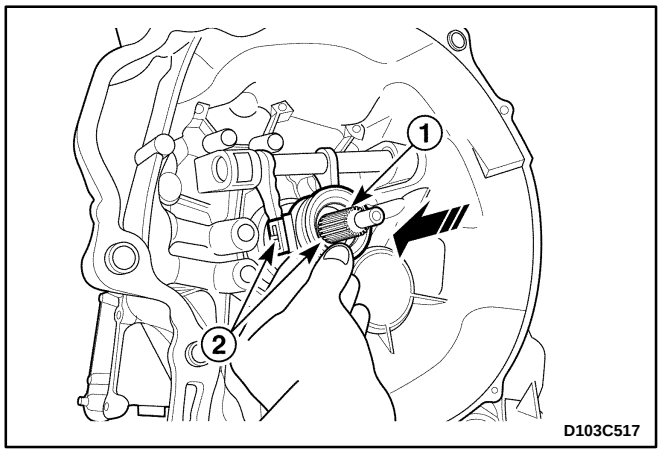


Installation Procedure

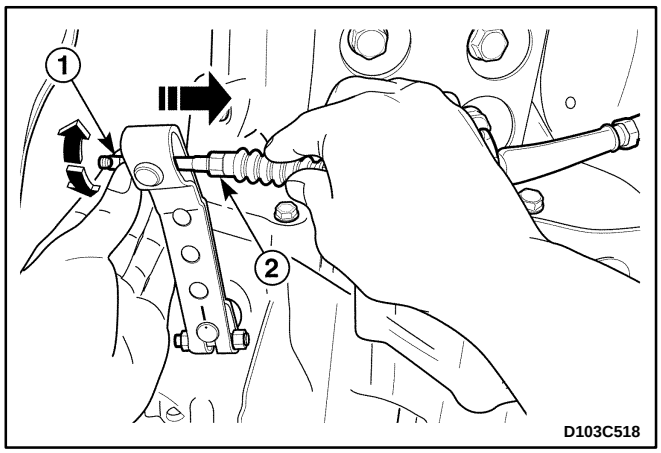
1. Install in the reverse order of removal.
2. Install the release shaft bushing (No.1) using the bushing joint pipe 09923–46040, bushing, bearing installer 09943–88211 and a hammer.



3. Install the release shaft bushing (No.2) and seal using the bushing remover/installer 09925–48220 and a hammer.



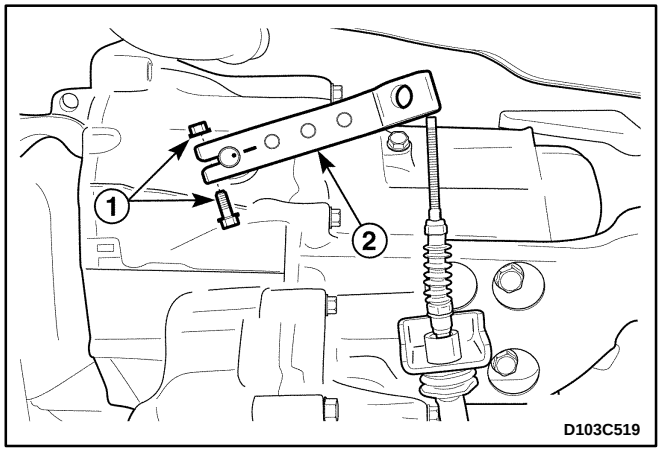
4. Install the release bearing.
   - Coat the spline of transaxle input shaft with multi–purpose grease (1).
   - Coat the release bearing bore and the connecting of release shaft with multi–purpose grease (2).
   - Install the release bearing.



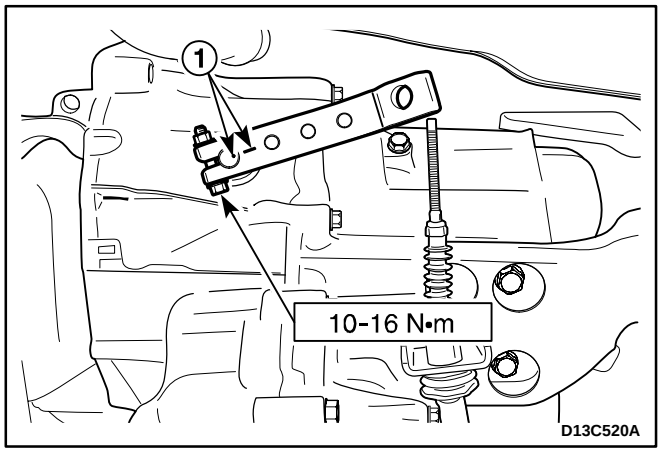
CLUTCH RELEASE ARM

Removal Procedure

1. Disconnect the clutch cable.
   - Remove the adjusting nut (1).
   - Disconnect the cable (2).



2. Remove the clutch release arm.
   - Remove the bolt and nut (1).
   - Remove the release arm (2).

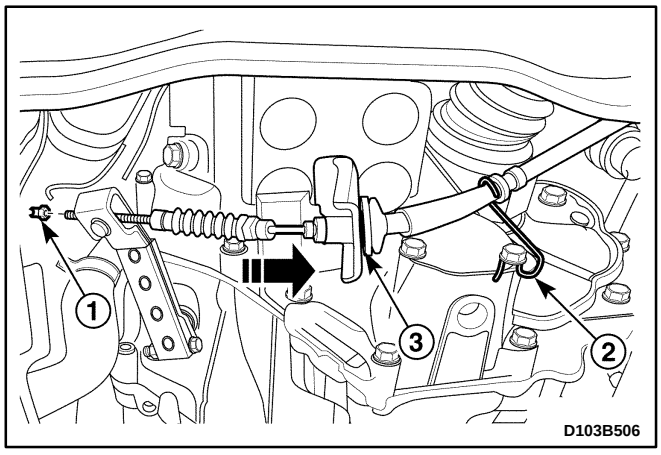


Installation Procedure

1. Install in the reverse order of removal.
2. Install the clutch release arm.
   - Install the clutch release arm matching to punched mark (1).

   Tighten

   Tighten the bolt and nut to 10–16 N•m (7.5–12 lb-ft).
3. Adjust the clutch cable. Refer to “Diagnosis” in this section.

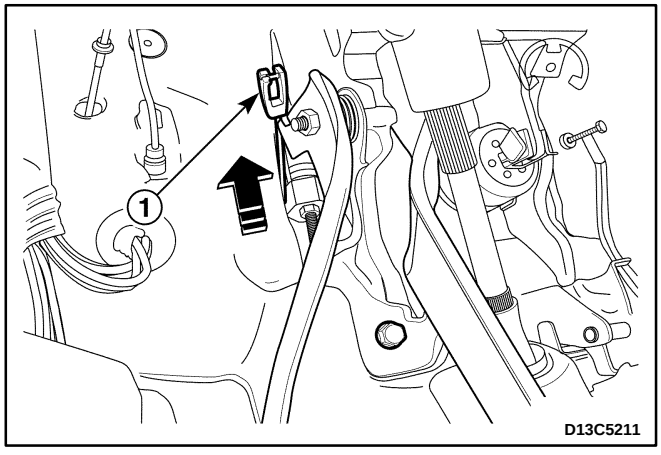


CLUTCH CABLE

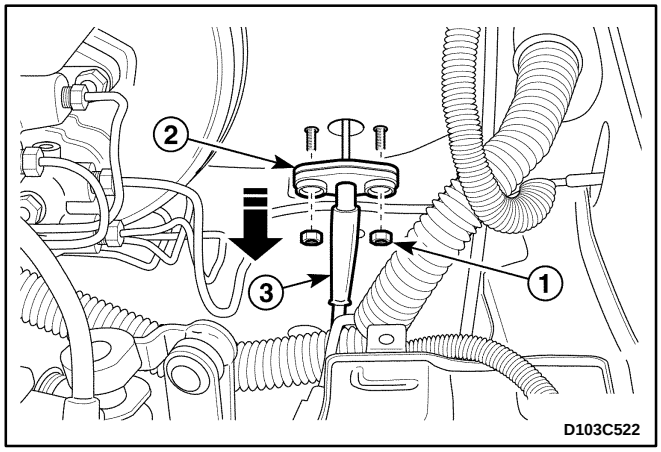
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

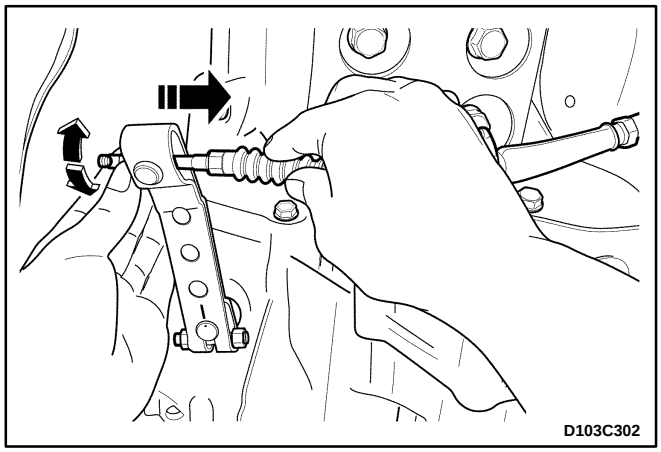
1. Disconnect the clutch cable from the transaxle.
   - Remove the adjusting nut (1).
   - Disconnect the cable from the wire clip (2).
   - Pull and remove the cable from the transaxle mount hole (3).



2. Disconnect the clutch cable from the pedal.
   - Pull upward and disconnect the cable from the pedal hook (1).

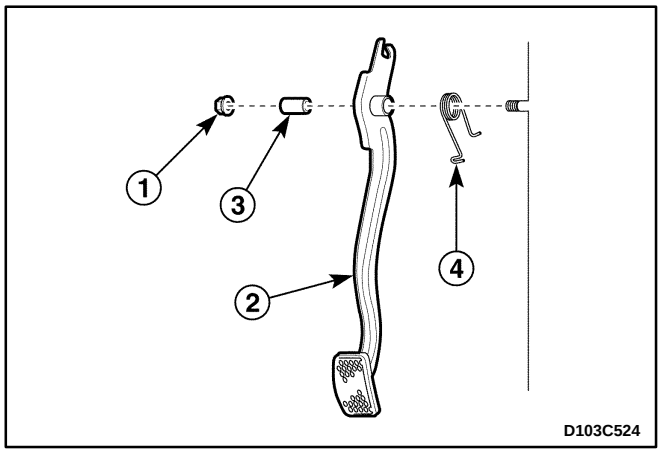


3. Remove the battery. Refer to *Section 1E, Engine Electrical.*
4. Remove the clutch cable.
   - Remove the nuts (1).
   - Remove the cable grommet (2).
   - Remove the cable from the pedal (3).



Installation Procedure

1. Install the clutch cable.
2 Install the battery.
3. Connect the clutch cable to the pedal.
4. Connect the clutch cable to the transaxle.
5. Adjust the clutch cable. Refer to “Diagnosis” in this section.

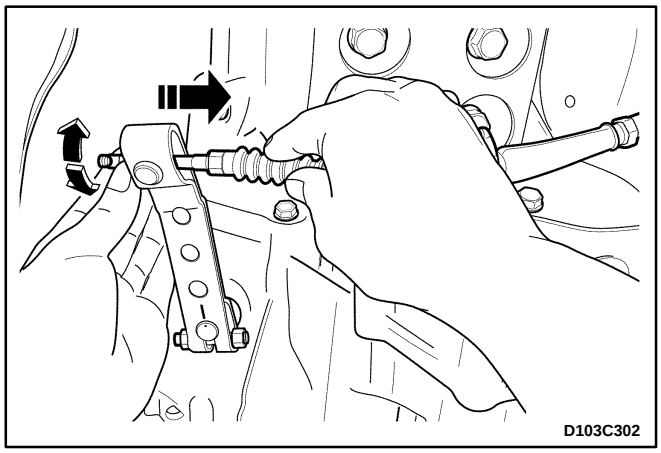


CLUTCH PEDAL

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

Removal Procedure

1. Disconnect the clutch cable. Refer to “Clutch Cable” in this section.
2. Remove the clutch pedal.
   - Release the pedal return spring.
   - Remove the nut (1).
   - Remove the clutch pedal (2).
   - Remove the bushing (3).
   - Remove the pedal return spring (4).



Installation Procedure

1. Install the pedal return spring.
2. Install the bushings.
3. Install the clutch pedal.
4. Install the nut.
5. Fix the pedal return spring.
6. Connect the clutch cable.
7. Adjust the clutch cable. Refer to “Diagnosis” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

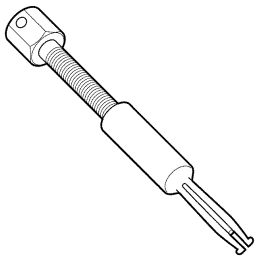
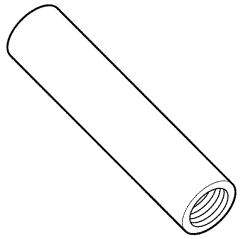
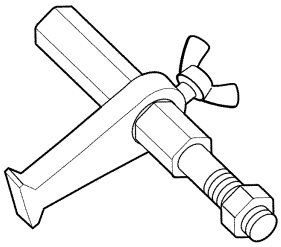
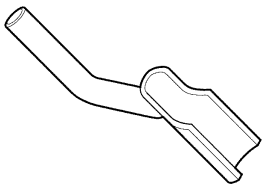
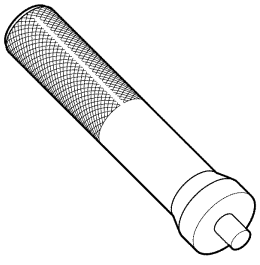
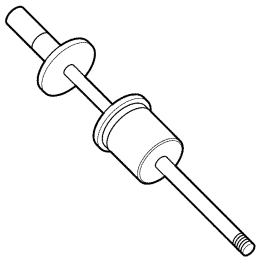
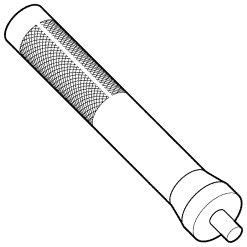
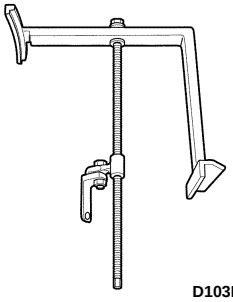
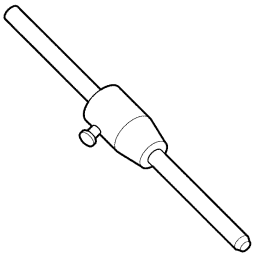
Application	Description	Unit	Standard	Limit
Clutch Disc	Type	–	Single Dry Plate	–
	Outside Diameter	mm (in.)	170 (6.7)	–
	Inside Diameter	mm (in.)	110 (4.3)	–
	Thickness	mm (in.)	7.15 (0.281)	–
	Rivet Head Depth	mm (in.)	1.2 (0.047)	0.5 (0.020)
	Disc Runout Limit in Rotational Direction	mm (in.)	–	0.7 (0.028)
Clutch Pedal	Pedal Free Travel	mm (in.)	0 (0)	–
	Pedal Travel	mm (in.)	100 – 110 (3.9 – 4.3)	–
	Clearance between pedal and floor just before clutch connection	mm (in.)	–	30 – 40 (1.2 – 1.6)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Pressure Plate Bolt	18 – 28	13 – 21	–
Clutch Release Arm Bolt and Nut	10 – 16	7.5 – 12	–

SPECIAL TOOLS

SPECIAL TOOLS TABLE

 D103C101	**09917–58010 Input Shaft Bearing Remover**
 D103C105	**09923–46040 Bushing Joint Pipe**
 D102B116	**09924–17810 Fly Wheel Holder**
 D103C104	**09925–48220 Bushing Remover/ Installer**
 D103C102	**09925–98210 Input Shaft Bearing Installer**
 D103C106	**09930–30102 Sliding Shaft**
 D103C107	**09943–88211 Bushing, Bearing Installer**
 D103B103	**DW110–021 Engine Assembly Support Fixture**
 D103C103	**DW210–010 Clutch Center Guide**

SECTION 6B

POWER STEERING PUMP

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DESCRIPTION AND OPERATION

POWER STEERING PUMP

The pump has a remote fluid reservoir. A pressure-relief valve inside the flow control valve limits pump pressure.

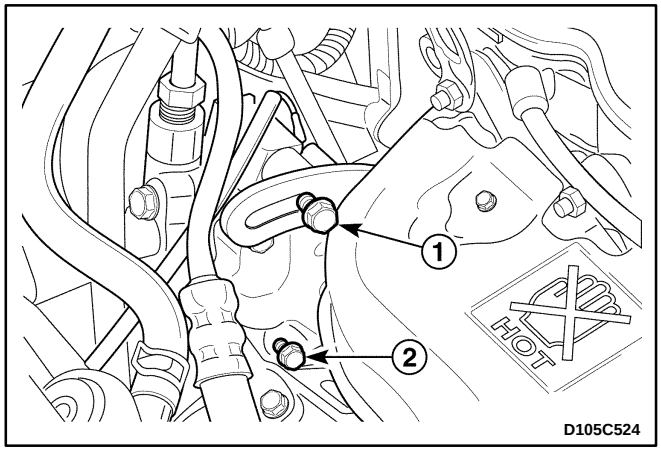
DIAGNOSTIC INFORMATION AND PROCEDURES

POWER STEERING PUMP

Condition	Probable Cause	Correction
Foaming, Milky Power Steering Fluid, Low Fluid Level, and Possible Low Pressure	● Insufficient power steering fluid level.	● Fill the power steering fluid reservoir.
	● Contaminated air in the power steering fluid.	● Bleed the power steering system.
	● Internal leaks and overflow of the power steering pump.	● Replace the power steering pump.
	● Leaks of the power steering pump housing and the soft plug.	● Replace the power steering pump.
Low Pressure Due to Steering Pump	● Stuck and improperly operated power steering pump flow control valve.	● Replace the power steering pump.
	● Worn power steering pump seats.	● Replace the power steering pump.
	● Scores, cracks, or breaks of the pressure plate, the pump ring, the thrust plate, and the rotor.	● Replace the power steering pump.
	● Sticking of the vanes in the rotor slots.	● Replace the power steering pump.
	● Internal leaks and overflow of the power steering pump.	● Replace the power steering pump.
Growling Noise in Steering Pump	● Restricted flow of the pump hoses and the steering gear pipes.	● Clean out the pipes and the hoses. ● Replace the pipes and the hoses as needed.
	● Scores, cracks, or breaks of the pressure plate, the pump ring, the thrust plate, and the rotor.	● Replace the power steering pump.
	● Improperly contacted power steering hose with the body.	● Secure the pump hose in a clamp away from the body.
	● Insufficient power steering fluid level.	● Fill the power steering pump reservoir.
Ratting Noise in the Steering Pump	● Contaminated air in the power steering fluid.	● Bleed the power steering system.
	● Improperly contacted power steering hose with the body.	● Secure the pump hose in a clamp away from the body.
	● Insufficient power steering fluid level.	● Fill the power steering pump reservoir.
	● Improperly installed pump mounting.	● Tighten the power steering pump attachment bolts.
Swishing Noise in the Steering Pump	● Damaged power steering pump flow control valve.	● Replace the power steering pump.
Whining Noise in the Steering Pump	● Scores of the pressure plate and the vanes.	● Replace the power steering pump.
	● Scores of the pump shaft bearing	● Replace the power steering pump.

REPAIR INSTRUCTIONS

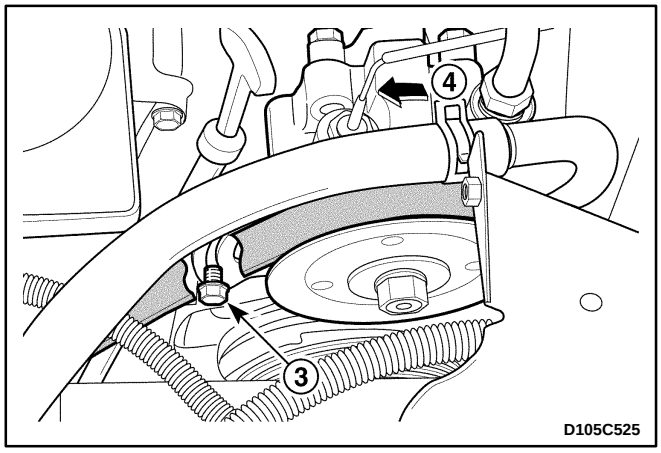
ON–VEHICLE SERVICE



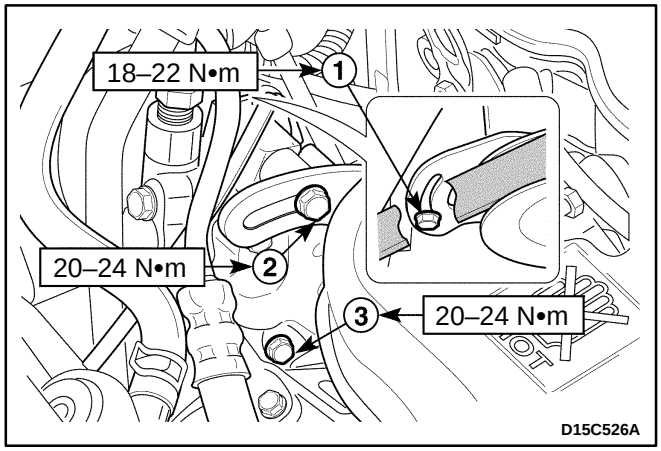
PUMP DRIVE BELT

Removal Procedure

1. Remove the front passenger side headlamp. Refer to *Section 9B, Lighting Systems.*
2. Remove the pump drive belt.
   - Loosen the rear bracket adjusting bolt (1).
   - Loosen the bolt (2).



   - Loosen the front bracket adjusting bolts (3).
   - Push the pump forward (4).

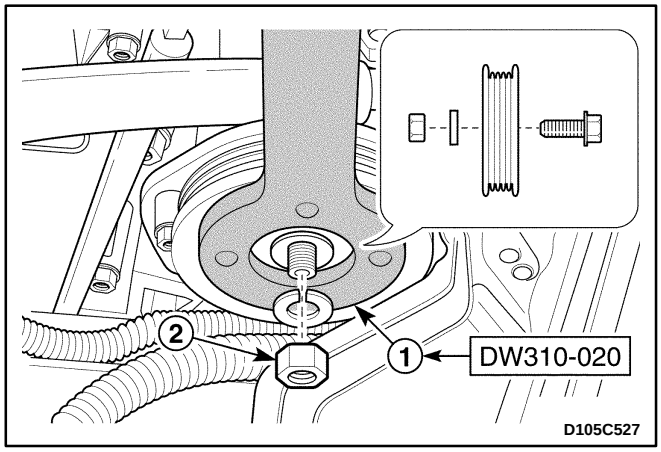


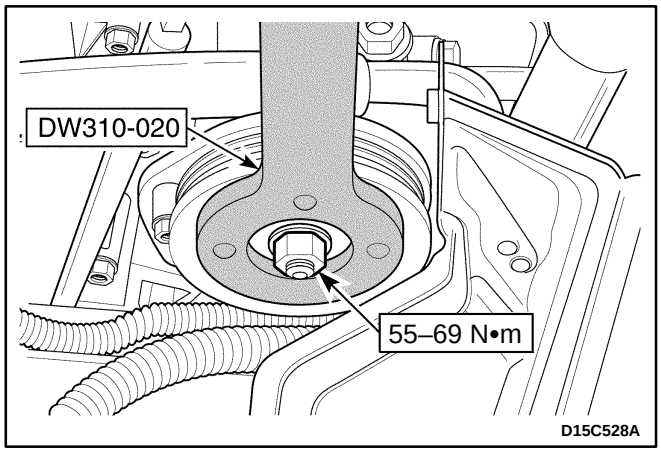
Installation Procedure

1. Install the pump drive belt with the bolts.

   Tighten

   - Tighten the front bracket adjusting bolt to 18–22 N•m (13–16 lb-ft) (1).
   - Tighten the rear bracket adjusting bolt to 20–24 N•m (15–18 lb-ft) (2).
   - Tighten the power steering pump bolt to 20–24 N•m (15–18 lb-ft) (3).
2. Install the front passenger side headlamp. Refer to *Section 9B, Lighting Systems*.





PUMP DRIVE PULLEY

Tools Required

DW310–020 Power Steering Pulley Remove Holder

Removal Procedure

1. Remove the front passenger side headlamp. Refer to *Section 9B, Lighting Systems.*
2. Remove the steering pump pulley.
   - Remove the pump drive belt. Refer to “Pump Drive Belt” in this section.
   - Fix the pulley using the power steering pulley remove holder DW310–020 (1).
   - Remove the pump drive pulley nut (2).

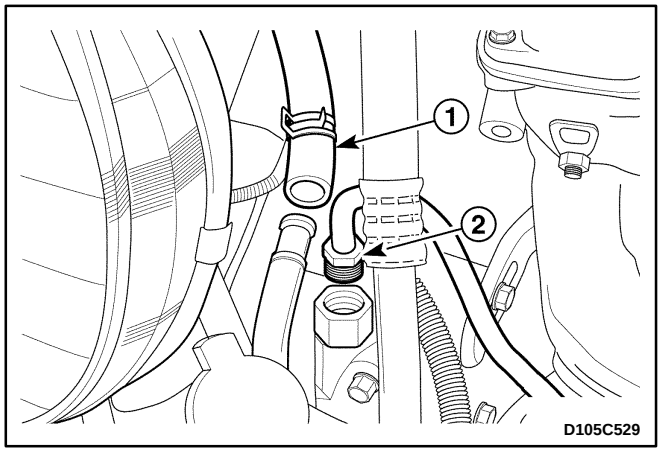
Installation Procedure

1. Install the pump drive pulley. Install the steering pump pulley nut.
2. Install the pump drive belt.
3. Tighten the steering pump pulley nut using the power steering pulley remove holder DW310–020.

Tighten

Tighten the steering pump pulley nuts to 55–69 N•m (41–51 lb-ft).

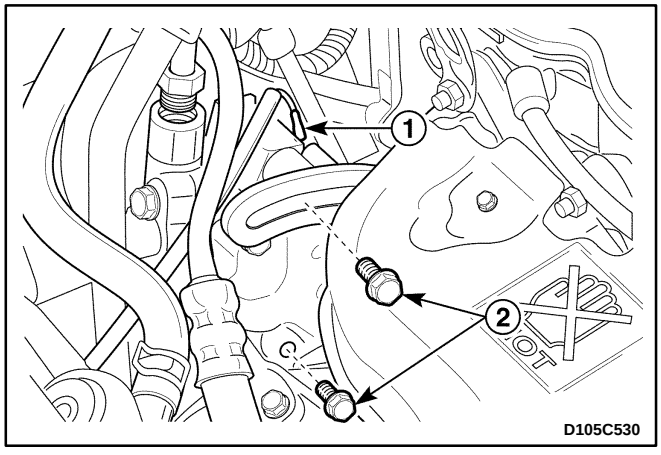
4. Install the front passenger side headlamp. Refer to *Section 9B, Lighting Systems.*



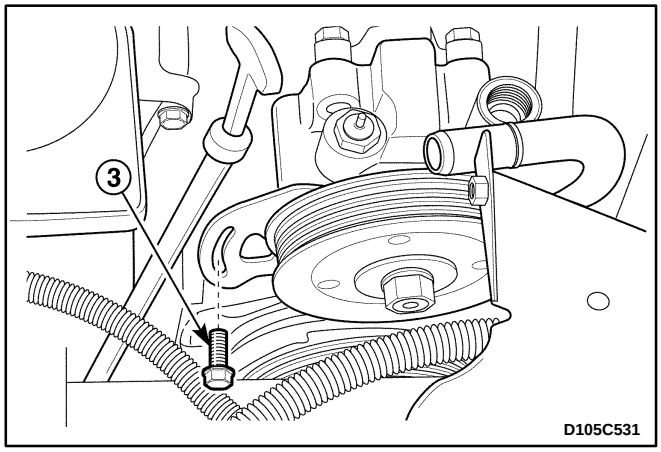
PUMP ASSEMBLY

Removal Procedure

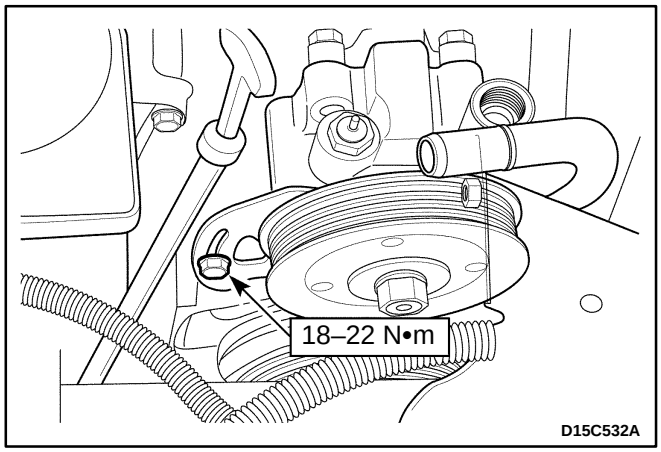
1.Remove the front passenger side headlamp. Refer to *Section 9B, Lighting Systems.*
2. Disconnect the pipe line from the pump.
   - Disconnect the supply line pipe hose (1).
   - Disconnect the pressure line pipe fitting (2).



3. Remove the power steering pump.
   - Remove the pump drive belt. Refer to “Pump Drive Belt” in this section.
   - Disconnect the power steering pressure switch connector (1). Refer to *Section 6A, Power Steering Systems.*
   - Remove the bolts (2).



- Remove the bolt (3).



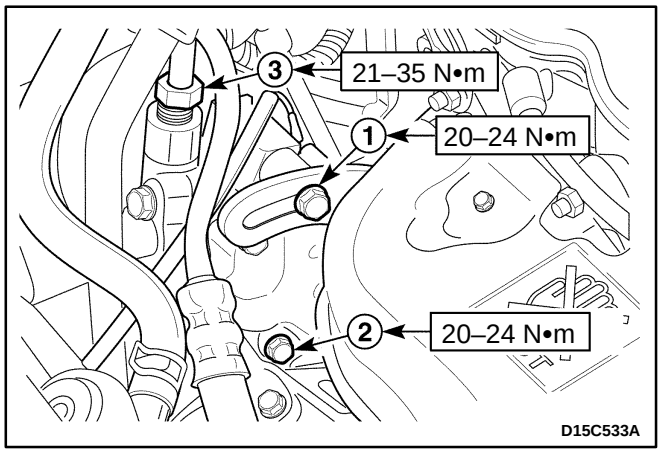
Installation Procedure

1. Install the power steering pump with the bolt.

Tighten

Tighten the bolt to 18–22 N•m (13–16 lb-ft).

2. Connect the power steering pressure switch connector. Refer to *Section 6A, Power Steering System.*
3. Install the pump drive belt. Refer to “Pump Drive Belt” in this section.



4. Install the bolts.

Tighten

- Tighten the rear bracket adjusting bolt to 20–24 N•m (15–18 lb-ft) (1).
- Tighten the power steering bolt to 20–24 N•m (15–18 lb-ft) (2).

5. Connect the pressure line pipe to the outlet connection on the steering pump.

Tighten

Tighten the pressure line pipe fitting to 21–35 N•m (16–26 lb-ft) (3).

6. Install the front passenger side headlamp.

   Refer to *Section 9B, Lighting Systems.*

Notice: When adding fluid or making a complete fluid change, always use DEXRON®-II or DEXRON®-III power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

7. Refill the pump with new fluid and bleed the air from the system. Refer to *Section 6A, Bleeding the Power Steering System.*
8. Inspect for leaks. If leaks are found, correct the cause of the leak and bleed the system.

UNIT REPAIR

PUMP

The power steering pump in this vehicle is not serviceable. A faulty pump must be replaced.

SPECIFICATIONS

GENERAL SPECIFICATIONS

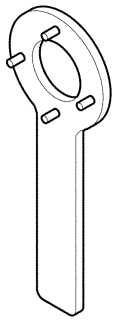
Application	Description
Lubricant	Power Steering Fluid DEXRON®-II, DEXRON®-III
Capacity	1.0 Liter (1.056 qt)
Type	Vane

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Power Steering Pump Bolt	20 – 24	15 – 18	–
Power Steering Pump Front Bracket Bolt	20 – 24	15 – 18	–
Power Steering Pump Front Bracket Adjusting Bolt	18 – 22	13 – 16	–
Power Steering Pump Rear Bracket Upper Bolt	35 – 45	26 – 33	–
Power Steering Pump Rear Bracket Lower Bolt	20 – 24	15 – 18	–
Power Steering Pump Rear Bracket Adjusting Bolt	20 – 24	15 – 18	–
Power Steering Pump Pulley Nut	55 – 69	41– 51	–
Power Steering Oil Pressure Line Fitting	21 – 35	16 – 26	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D105C101	**DW310–020 Power Steering Pulley Remove Holder**

SECTION 6C

POWER STEERING GEAR

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.

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DESCRIPTION AND OPERATION

POWER RACK AND PINION

The power rack and pinion steering system has a rotary control valve which directs the hydraulic fluid coming from the hydraulic pump to one side or the other side of the rack piston. The integral rack piston is attached to the rack. The rack piston converts hydraulic pressure to a linear force which moves the rack left or right. The force is then transmitted through the tie rods and the tie rod ends to the steering knuckles, which turn the wheels.

If hydraulic assist is not available, manual control is maintained. However, under these conditions, more steering effort is required. The movement of the steering wheel is transferred to the pinion. The movement of the pinion is then transferred through the pinion teeth, which meshs with the teeth on the rack, causing the rack to move.

DIAGNOSTIC INFORMATION AND PROCEDURES

POWER RACK AND PINION STERING GEAR

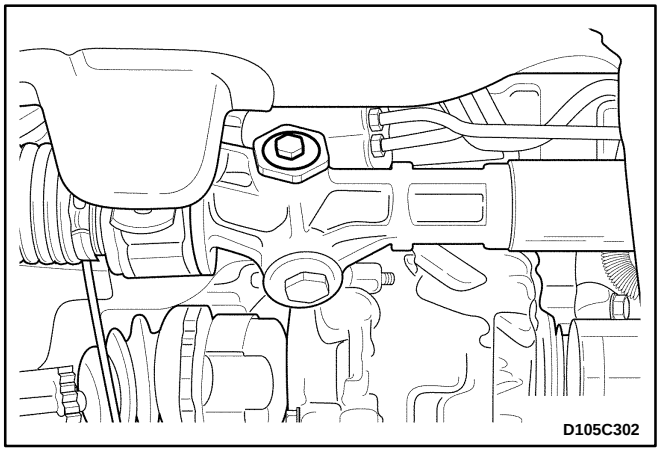
Condition	Probable Cause	Correction
Hissing Noise	● Loose steering coupling joints.	● Tighten the steering coupling joints.
	● Improperly contacted the power steering hose with other components.	● Fit the power steerng hose into the hose clips correctly.
Rattling Noise in Steering Gear	● Improperly contacted the power steering line with the body.	● Fix the steering line correctly.
	● Insufficient lubricant.	● Lubricate the steering gear.
	● Loose steering gear mounting.	● Tighten the steering gear mounting bracket bolts.
	● Improperly installed tie rod ends.	● Tighten the tie rod joints and replace the tie rod end as needed.
Poor Return of Steering Wheel to Center	● Improperly contacted the steering wheel with the turn signal housing.	● Adjust the turn signal housing.
	● Improper binding or looseness of steering coupling.	● Replace the intermediate shaft.
	● Stuck and improperly aligned power steering pump flow control valve.	● Replace the power steering pump.
	● Improper binding or looseness of tie rods and ball joints.	● Tighten the tie rods and the ball joints. Replace the tie rods and the ball joints as needed.
	● Poor adjustments of the steering gear.	● Perform a straight-ahead check.
Momentary Increase in Effect When Turning the Wheel Quickly	● Internal leaks of the power steering pump.	● Replace the power steering pump.
	● The damage or restricted flow of the hoses.	● Replace the power steering hoses and pipes.
	● Insufficient power steering fluid.	● Fill the power steering fluid reservoir.
	● Stuck and improperly operated power steering pump flow control valve.	● Replace the power steering pump.
Steering Surges or Jerks When Turning with Engine Running	● Insufficient pressure of the power steering pump.	● Replace the power steering pump.
	● Stuck and improperly operated power steering pump flow control valve.	● Replace the power steering pump.
	● The slippage of the pump drive belt.	● Tighten the pump drive belt.
	● Contaminated air in the power steering system.	● Bleed the power steering system.

POWER RACK AND PINION STERING GEAR (Cont'd)

Condition	Probable Cause	Correction
Excessive Wheel Kickback or Loose Steering	● Contaminated air in the power steering system.	● Bleed the power steering system.
	● Worn or damaged wheel bearings.	● Replace the wheel bearings.
	● Loose steering gear mounting.	● Tighten the steering gear mounting bracket bolts.
	● Improperly installed steering gear-to-intermediate shaft joints.	● Tighten the joint bolt.
	● Loose tie rods and ball joints.	● Tighten the tie rods and the ball joints. ● Replace the tie rods and the ball joints as needed.
Hard Steering or Lack of Assist (Especially During Parking)	● Stuck and improperly installed power steering pump flow control valve.	● Replace the power steering pump.
	● Insufficient pressure of the power steering pump.	● Replace the power steering pump.
	● Internal leaks of power steering pump.	● Replace the power steering pump.
	● Improper tension of the pump drive belt.	● Adjust the pump drive belt tension.

ADJUST THE FREE LOAD OF THE STEERING GEAR

1. Place the steering wheel in the straight-ahead position.
2. Raise and suitably support the vehicle.
3. Remove the adjust plug locknut.
4. Check the torque of the adjuster plug.
5. Check the torque is below the specification value or the measured torque is over the specification value, adjust the tightening torque.
   - Place the rack gear in the straight-ahead position.
   - Tighten the adjust plug to 10 N•m (89 lb-in).
   - Turn the steering wheel all the way to the right and the left about 5 times repeatedly.
   - Place the rack gear in the straight-ahead position.
   - Loosen the adjust plug.



   - Tighten the adjust plug to 4.5–5.5 N•m (40–49 lb-in).
   - Loosen the adjust plug to 67.5°.
6. Tighten the adjust plug locknut.

REPAIR INSTRUCTIONS

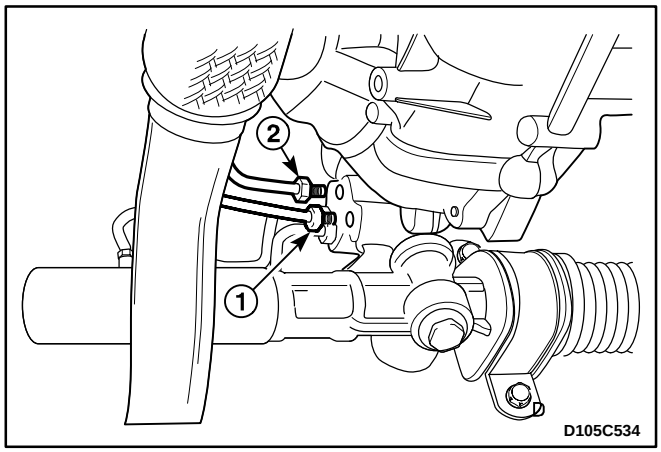
ON–VEHICLE SERVICE

RACK AND PINION ASSEMBLY

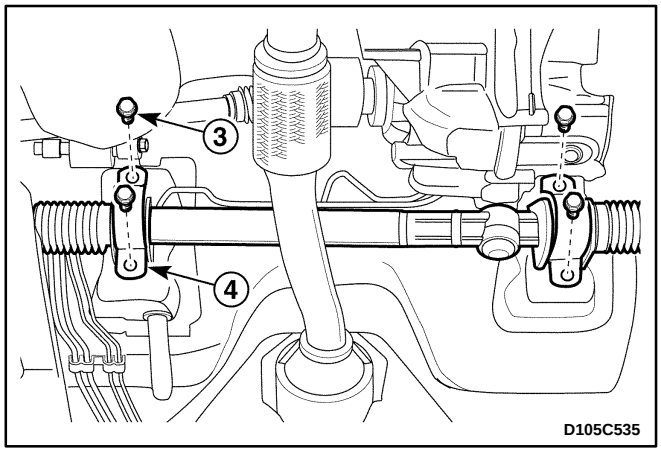
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

1. Remove the intermediate shaft lower pinch bolt. Refer to *Section 6E, Steering Wheel and Column.*
2. Remove the wheel. Refer to *Section 2E, Tires and Wheels.*
3. Remove the tie rod ends. Refer to *Section 6D, Manual Steering Gear.*
4. Remove the front exhaust pipe nuts. Refer to *Section 1G, Engine Exhaust*.

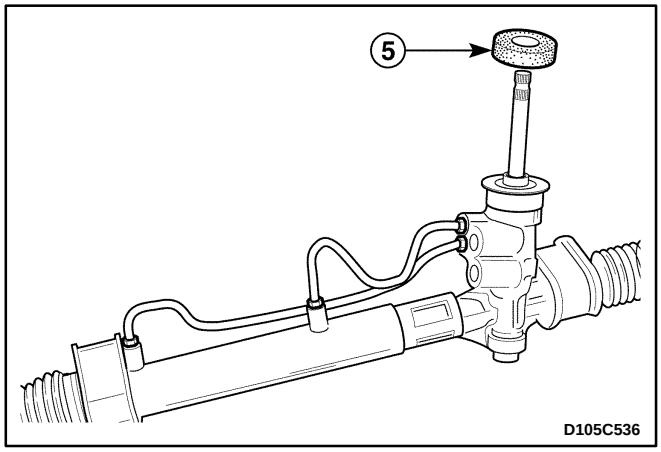


5. Remove the rack and pinion assembly.
   - Disconnect the return line pipe from the steering gear (1).
   - Disconnect the pressure inlet line pipe from the steering gear (2).
   - Plug the opening in the power steering pipe line to prevent fluid loss and contamination.

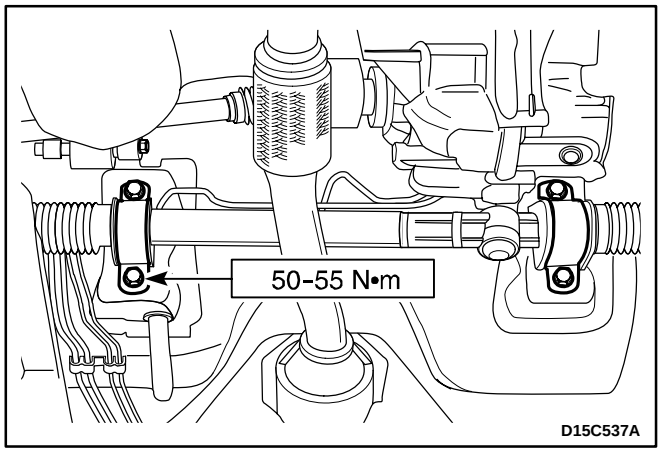


   - Remove the power steering gear retaining bracket tighten bolts (3).
   - Remove the power steering gear retaining bracket (4).

Important: After moving the gear toward the passenger side and pulling the gear of the driver side into the underbody hole, remove the steering gear.



6. Remove the packing (5).

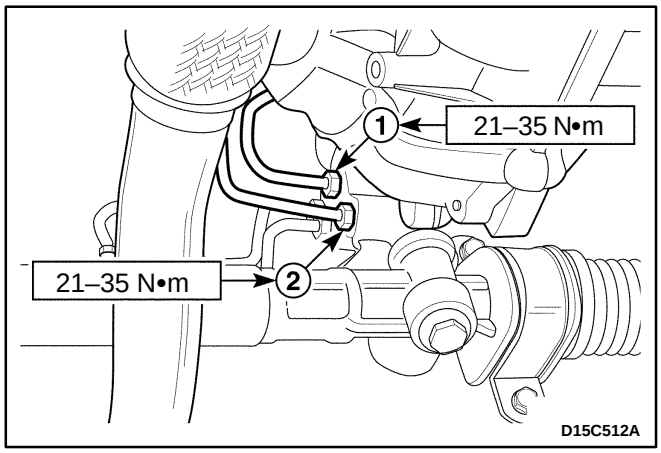


Installation Procedure

1. Install in the reverse order of removal.
2. Install the power steering gear bracket with the bolt.

Tighten

Tighten the bracket bolts to 50–55 N•m (36–41 lb-ft).



3. Connect the steering pipe. Refer to *Section 6A, Power Steering System.*

Tighten

Tighten the power steering pressure line fitting (1) to 21–35 N•m (16–25 lb-ft) (1).

Tighten the return line fitting to 21–35 N•m (16–25 lb-ft) (2).

Important: When adding fluid or making a complete fluid change, always use DEXRON® II or III power steering fluid. Failure to use the proper fluid will cause hose and seal change and fluid leaks.

4. Fill the fluid reservoir with power steering fluid.
5. Inspect for leaks. If there are leaks, correct the cause of the leaks and bleed the system. Refer to *Section 6A, Power Steering System.*

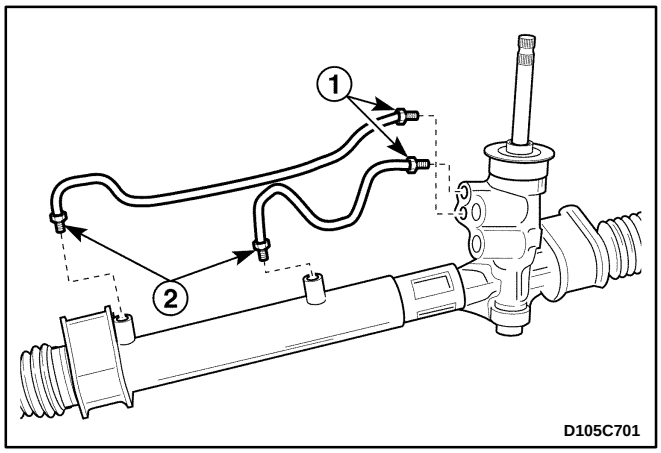
POWER STEERING GEAR RACK AND PINION BOOT

Refer to *Section 6D, Manual Steering Gear.*

UNIT REPAIR

TIE ROD END BOOT

Refer to *Section 6D, Manual Steering Gear.*

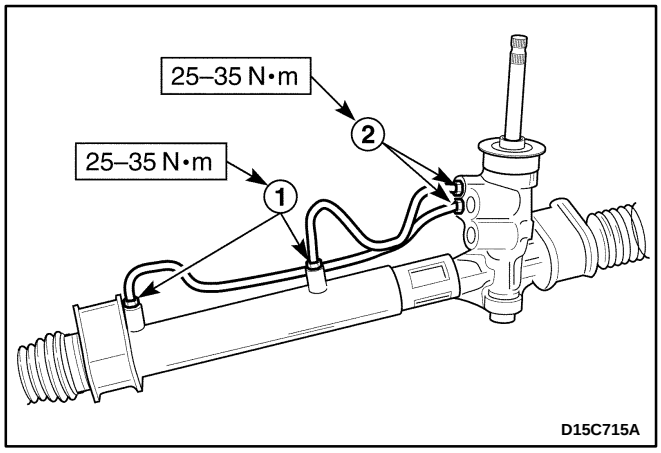


HYDRAULIC CYLINDER LINES

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

Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to “Rack and Pinion Assembly” in this section.
2. Disconnect the cylinder lines from the rack and pinion housing.
   - Remove the fitting (1).
   - Remove the fitting (2).



Assembly Procedure

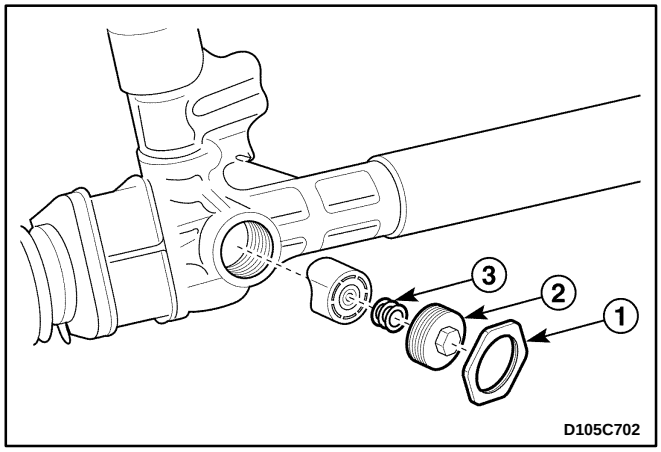
1. Connect the cylinder lines to the rack and pinion housing.
2. Install the power steering line fittings at the pinion valve end.

   Tighten

   Tighten the power steering line fittings to 25–35 N•m (18–25 lb-ft) (1).
3. Install the power steering line fittings at the cylinder end.

   Tighten

   Tighten the power steering line fittings to 25–35 N•m (18–25 lb-ft) (2).
4. Install the rack and pinion steering assembly to the vehicle. Refer to “Rack and Pinion Assembly” in this section.

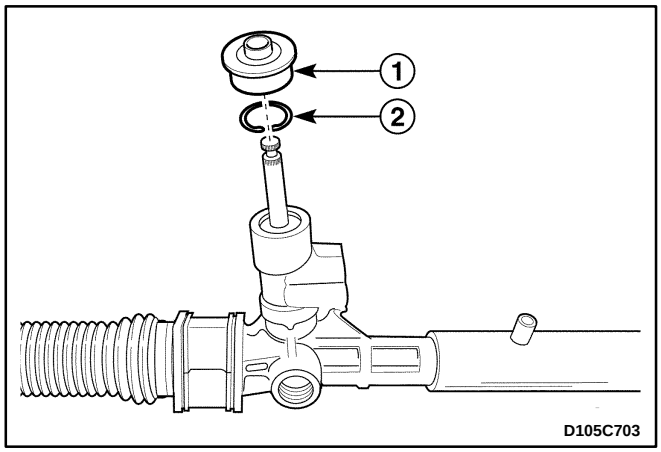


RACK AND PINION STEERING GEAR ASSEMBLY

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

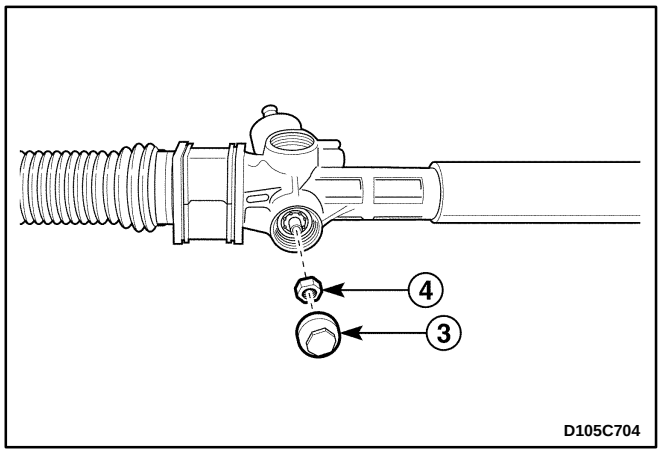
Disassembly Procedure

1. Remove the rack and pinion steering assembly from the vehicle. Refer to “Rack and Pinion Assembly” in this section.
2. Remove the rack bearing.
   - Remove the adjuster plug locknut (1).
   - Remove the adjuster plug (2).
   - Remove the adjuster spring (3).
3. Remove the steering pinion.
   - Remove the dust cap (1).
   - Remove the retaining ring (2).

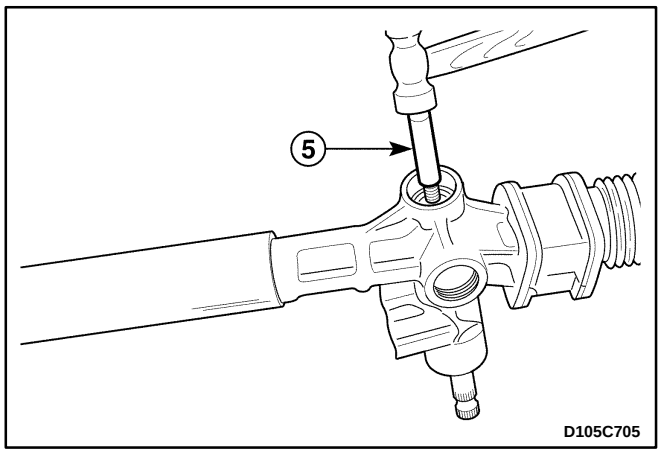


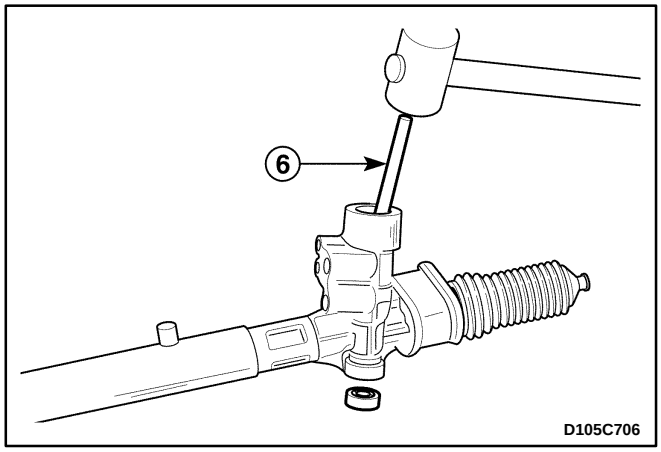
- Remove the steering pinion dust cap (3).
- Remove the steering pinion locknut (4).

Notice: If the stub shaft is not held, damage to the pinion teeth will occur. While holding the stub shaft, remove the locknut from the pinion.



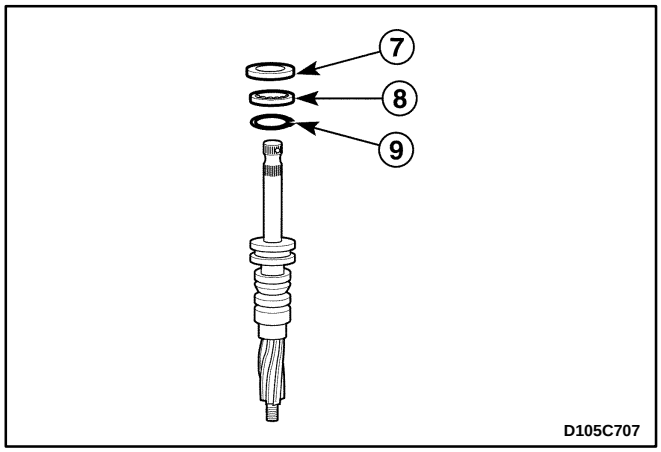
- Remove the steering pinion from the pinion bearing by hitting the pinion with the flated drift and hammer (5).





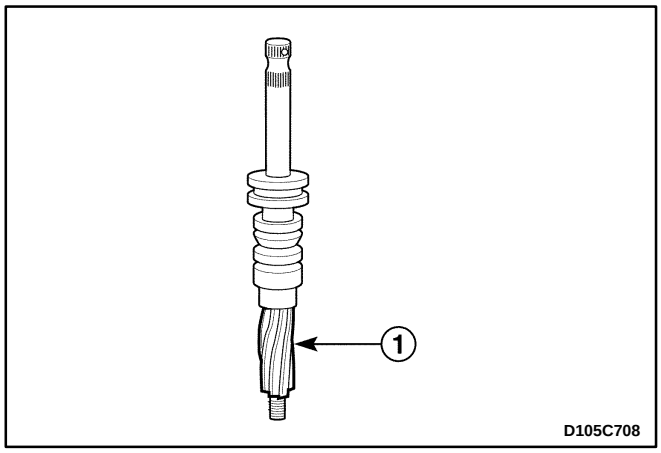
Important: Hit the drift using a hammer when the lower pinion is vertical with the drift.

- Remove the bearing by hitting the bearing with the flated drift and rubber hammer (6).



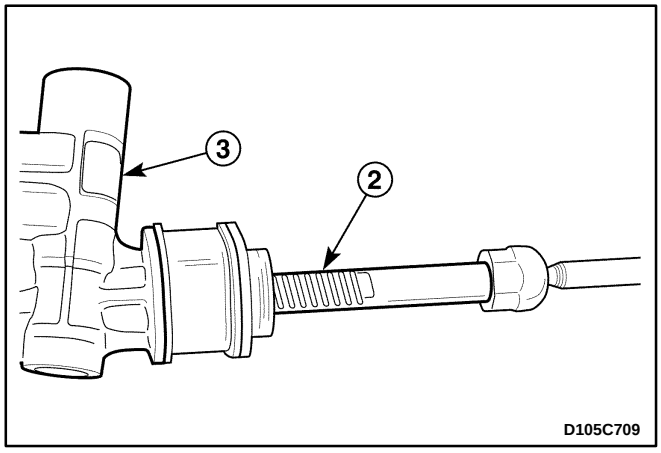
- Remove the pinion shaft seal (7).
- Remove the needle bearing (8).
- Remove the retaining ring (9).

Important: The power steering gear housing and the rack gear in this vehicle is not serviceable as unit.
The faulty parts must be replaced as whole units.

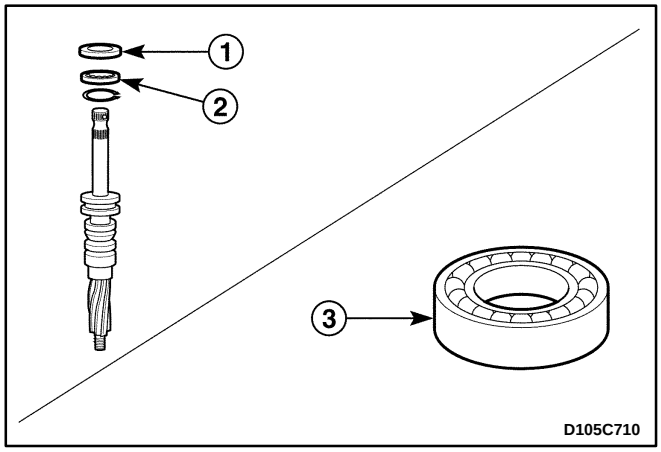


Inspection Procedure

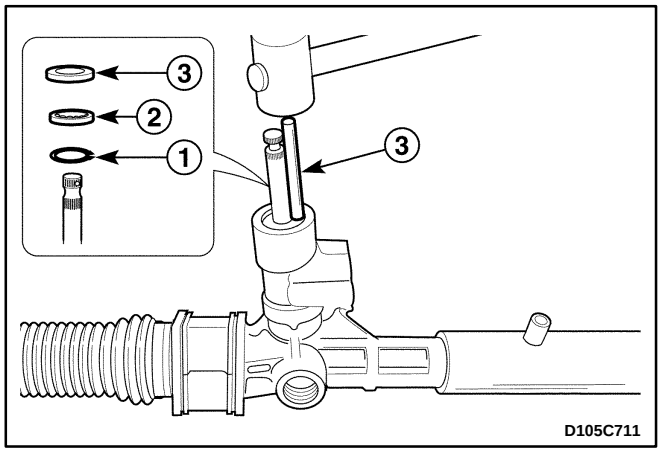
1. Inspect the tie rod ends and the ball joints for damage. Refer to *Section 6D, Manual Steering Gear.*
2. Inspect the tie rod ends and the rack/pinion boot for cracks or abnormal wear. Refer to *Section 6D, Manual Steering Gear.*
3. Inspect the metal part for damage.
   - Inspect the pinion gear for damage or wear (1).



- Inspect the rack gear for damage or wear (2).
- Inspect the steering gear housing for damage or wear(3).

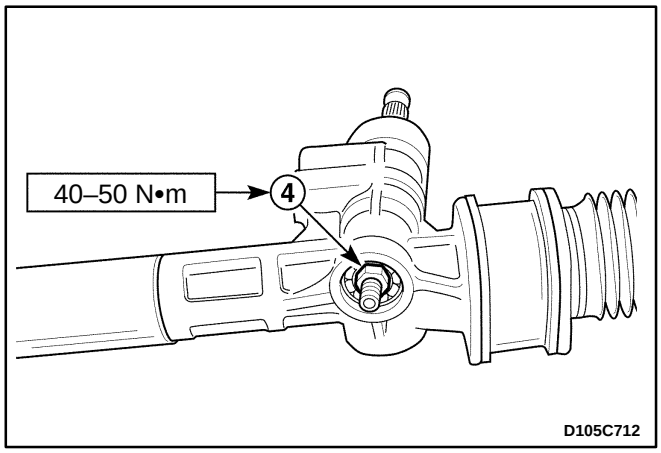


4. Inspect the bearings and the seal for damage.
   - Inspect the pinion shaft seal for leaks and wear (1).
   - Inspect the needle bearing for wear (2).
   - Inspect the pinion bearing for wear (3).
5. The faulty parts must be replaced.



Assembly Procedrue

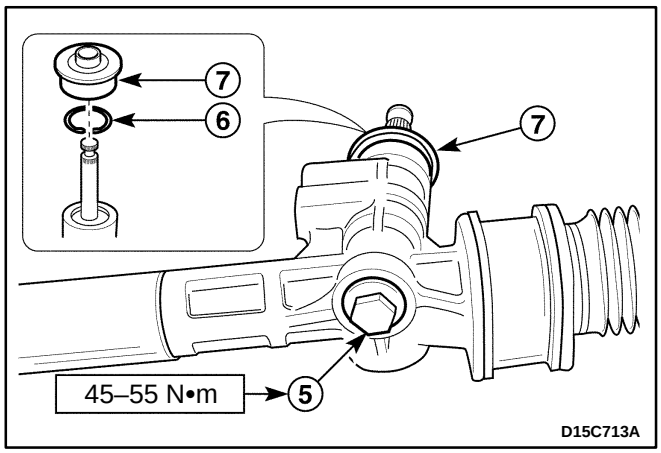
1. Install the steering pinion gear.
   - Install the retaining ring (1).
   - Install the needle bearing (2).
   - Install the pinion shaft seal using a drift (3).



2. Install the steering pinion locknut (4).

   Tighten

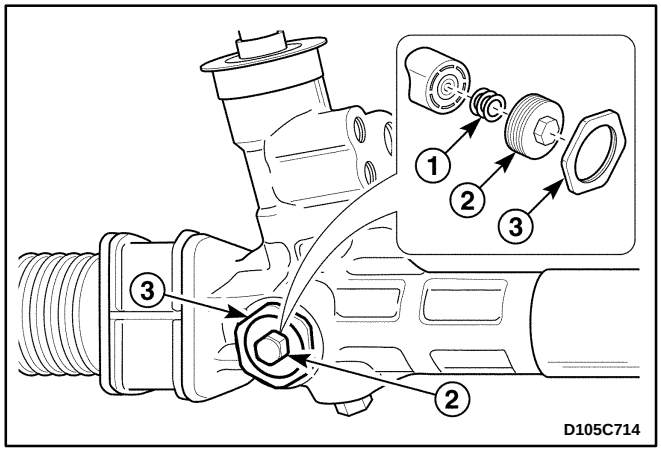
   Tighten the pinion locknut to 40–50 N•m (30–36 lb-ft).



3. Install the dust cap (5).

   Tighten

   Tighten the dust cap to 45–55 N•m (33–41 lb-ft).
4. Install the retaining ring (6).
5. Install the plastic dust cap (7).



6. Install the rack bearing.
   - Install the adjuster spring (1).
   - Tighten the adjuster plug (2).
   - Tighten the plug locknut (3).
7. Install the rack and pinion steering assembly to the vehicle. Refer to “ Rack and Pinion Assembly ” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Application			Description
Power Steering Fluid			Power Steering Fluid DEXRON®-II or DEXRON®-III
Capacity			1.0 L (1.056 qt)
Type			Rack and Pinion
Overall Gear Ratio			15.7 : 1
Power Steering Angle	144, 155 Tire	Inside	39.5° ± 2°
		Outside	33.5° ± 2°
	175 Tire	Inside	34.9° ± 2°
		Outside	30.5° ± 2°
Grease		Rack	POLYUREAS
		Ball Joint	SYNTHETICS OILS & LI SOAPS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Power Steering Gear Bracket Bolt	50–55	36–41	–
Power Steering Gear Pinion Nut	40–50	30–36	–
Power Steering Gear Pinion Dust Cover	45–55	33–41	–
Power Steering Gear Pressure Line Fitting	25–35	18–25	–
Power Steering Oil Pressure Pipe Fitting (Gear Side)	21–35	16–25	–
Power Steering Gear Ajuster Plug	Refer to “DIAGNOSIS” in this section.		

SECTION 6D

MANUAL STEERING GEAR

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.

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DESCRIPTION AND OPERATION

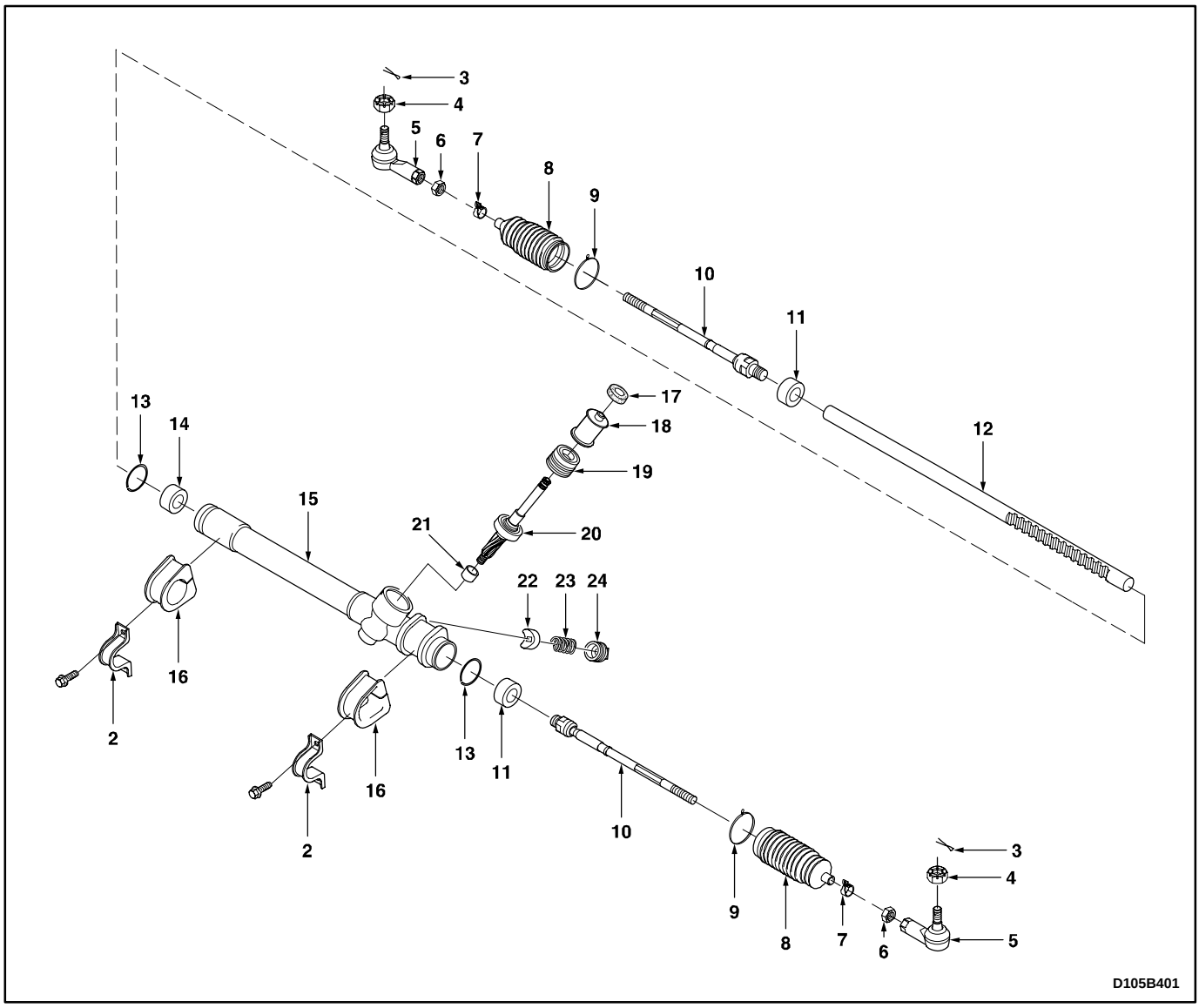
MANUAL RACK AND PINION

The manual rack and pinion steering system consists of two main components: the rack and the pinion. The motion of the pinion is transferred through the pinion teeth that mesh with the teeth on the rack, which moves the rack. The force is then transmitted through the arms on the struts, which turn the wheels.

COMPONENT LOCATOR

MANUAL RACK AND PINION STEERING GEAR

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



1. Manual Steering Gear
2. Steering Gear Bracket
3. Cotter Pin
4. Castellated Nut
5. Tie Rod End
6. Tie Rod End Lock Nut
7. Rack and Pinion Boot Clamp
8. Rack and Pinion Boot
9. Rack and Pinion Boot Wire Clamp
10. Tie Rod
11. Shock Damper Ring
12. Steering Rack Gear
13. Bulkhead Retainer
14. Bulkhead Bushing
15. Steering Gear Housing
16. Steering Gear Bracket Bushing
17. Packing
18. Dust Cover
19. Pinion Plug
20. Steering Pinion Gear
21. Roller Bearing
22. Rack Bearing
23. Adjuster Spring
24. Adjuster Plug

DIAGNOSTIC INFORMATION AND PROCEDURES

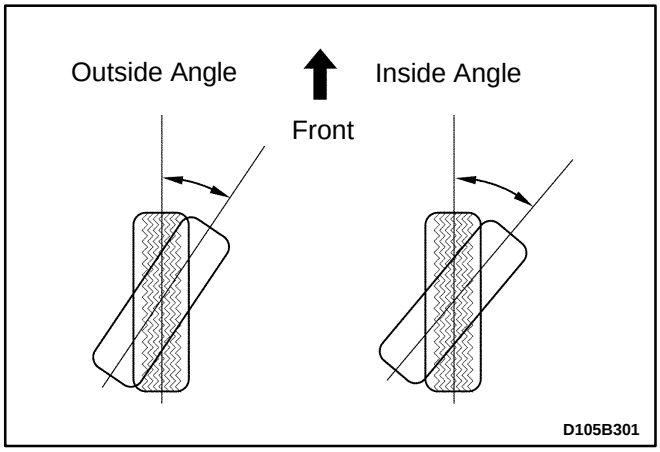
MANUAL RACK AND PINION STEERING GEAR

Condition	Probable Cause	Correction
Excessive Play or Looseness in the Steering System	● Poor adjustment of steering gear.	● Perform straight–ahead check.
	● Improperly installed tie rods.	● Tighten the tie rods.
Rattling Noise in the Steering Gear	● Improper and insufficient lubrication.	● Lubricate the rack and pinion assembly.
	● Improperly installed steering gear mounting.	● Tighten the steering gear mounting bolts.
	● Improperly installed tie rods.	● Tighten the tie rods.

STRAIGHT-AHEAD CHECK

After all the necessary operations on the steering gear are completed, check the exact straight-ahead position of the steering in each case.

With the vehicle on the floor, place the steering wheel in the straight-ahead position. Mark the centerline of both tires on the floor. Turn the steering wheel all the way to the right and mark the new centerline of both tires on the floor.



Application	Tire	Specified Valve
Inside Angle	145, 155	37.5 – 41.5°
	175	32.9 – 36.9°
Outside Angle	145, 155	31.5 – 35.5°
	175	28.5 – 32.5°

Straight Ahead Check Table

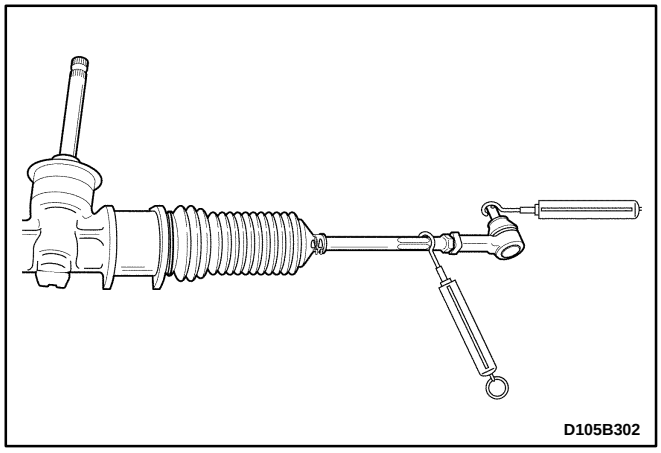
Step	Action	Value(s)	Yes	No
1	Place the steering wheel in the straight-ahead position. Is the wheel in the correct position?	–	Go to *Step 2*	–
2	Is the steering wheel off center by more than 5 degrees?	–	Go to *Step 4*	Go to *Step 5*
3	The pinion is displaced on the rack. The steering pinion position must be corrected. Is the repair complete?	–	Go to *Step 2*	–
4	Remove steering wheel and center on the spindle splines. Is the repair complete?	–	Go to *Step 2*	–
5	Turn the steering wheel all the way to the right. Measure the inner and the outer angles of the tire centerline compared to the straight-ahead centerline. Do the angles match the value specified?	Refer to “Straight–Ahead Check” in this section	System OK	Go to *Step 6*
6	The rack assembly was not assembled correctly. Repair as needed. Is the repair complete?	–	Go to *Step 5*	–

STEERING WHEEL RESTORATION

1. Turn the steering wheel fast to the right and left and turn it slowly as the same way.
2. Check if the steering wheel restoration for the wheel turning to right and the one to the left are same.
3. Turn the steering wheel to 90° about 1–2 seconds and loosen the steering wheel during the low speed driving.
4. If the steering wheel restores above 70%, the steering wheel restoration is OK.
5. If the restoration is poor, check the tire pressure, steering gear preload, and steering gear operation. And repair the fault.

CHECK THE TURNING RESISTANCE OF THE TIE ROD END OR TIE ROD

1. Turn the ball joint of the tie rod end or the tie rod about 10 times.
2. Use a spring balance to check the turning resistance of each ball joint.

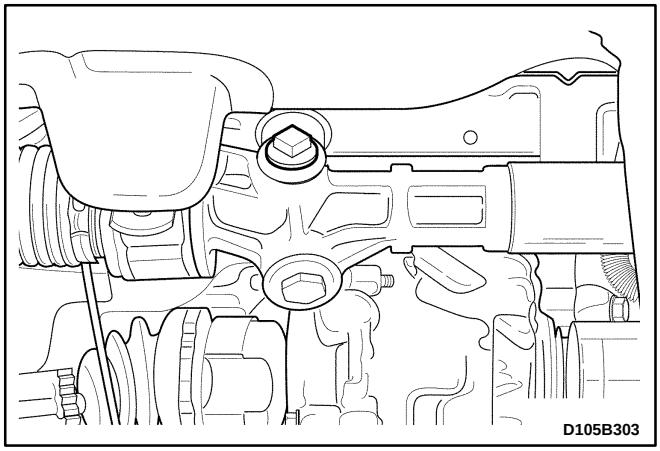


Application	Specified Value
Tie Rod End Ball Joint	0.49 – 3.43 N•m (4.5 – 30 lb-in.)
Tie Rod Ball Joint	0.49 – 3.43 N•m (4.5 – 30 lb-in.)

3. If the values exceed the specified values, replace the tie rod end or the tie rod.
4. But, If the ball joint of the tie rod end or the tie rod falls down of itself, replace it.

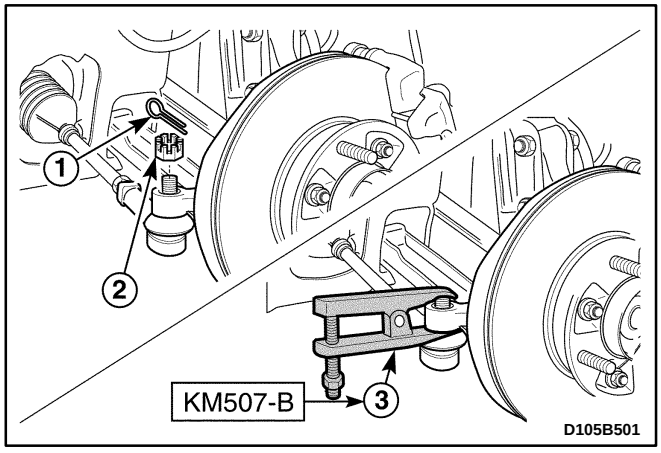
ADJUST THE FREE LOAD OF THE STEERING GEAR

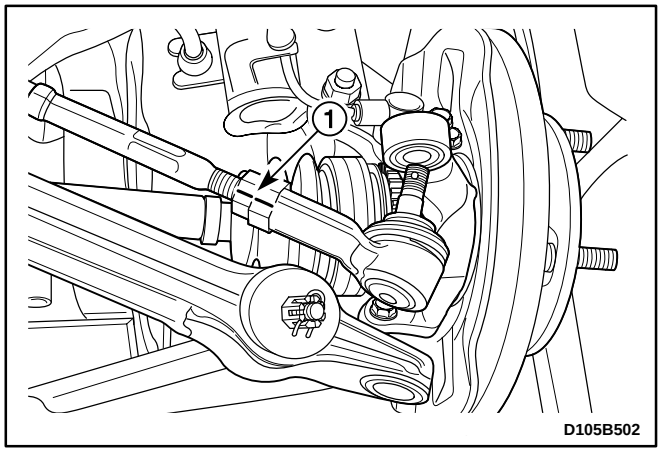
1. Place the steering wheel in the straight–ahead position.
2. Raise and suitably support the vehicle.
3. Check the torque of the adjuster plug.
4 When the measured torque is below the specification value or the measured torque is over the specification value, adjust the tightening torque.
   - Place the rack gear in the straight–ahead position.
   - Tighten the adjust plug to 95 N•m (70 lb-ft).
   - Turn the steering wheel all the way to the right and the left about 5 times repeatedly.
   - Place the rack gear in the straight–ahead position.
   - Loosen the adjust plug.
   - Tighten the adjust plug to 8 N•m (71 lb-in.).
   - Set the torque in the 0.8–1.3 N•m (8–12 lb-in.) by loosening the adjust plug to 0° – 90°.

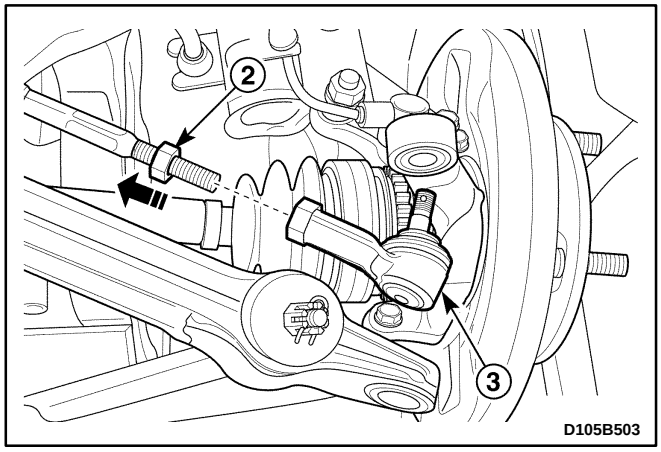


REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE







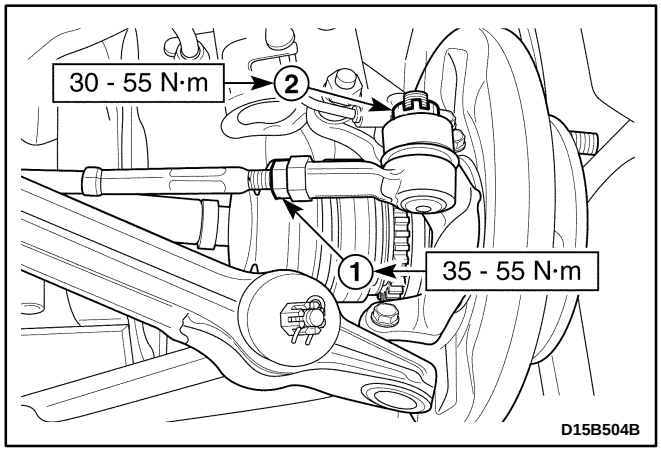
TIE ROD END

Tools Required

KM–507–B Ball Joint Remover

Removal Procedure

1. Remove the wheel. Refer to *Section 2E, Tires and wheels.*
2. Disconnect the tie rod and from the steering knuckle.
   - Remove the cotter pin (1).
   - Remove the castellated nut (2).
   - Use a ball joint remover KM–507–B, separate the tie rod end (3).
3. Remove the tie rod end.
   - Mark the tie rod, tie rod end lock nut and tie rod end (1).
   - Loosen the tie rod end lock nut anticlockwise (2).
   - Loosen the tie rod end (3).



Installation Procedure

1. Install the tie rod end.
2. Install the tie rod lock nut (1).

Tighten

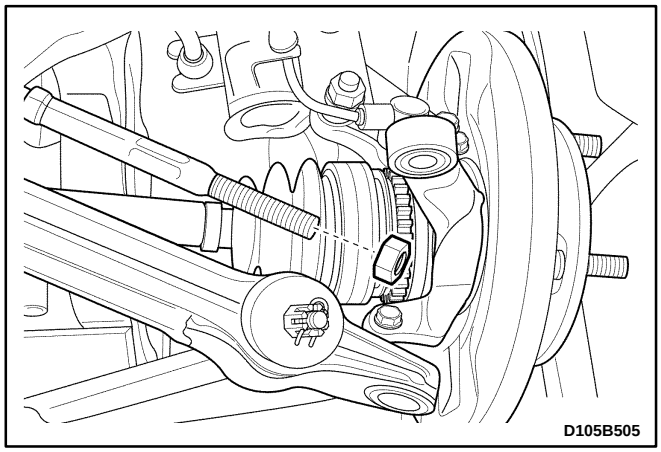
Tighten the tie rod end lock nut to 35–55 N•m (25–41 lb-ft).

3. Connect the tie rod end to the knuckle.
4. Install the tie rod end castellated nut (2).

Tighten

Tighten the castellated nut to 30–55 N•m (21–41 lb-ft).

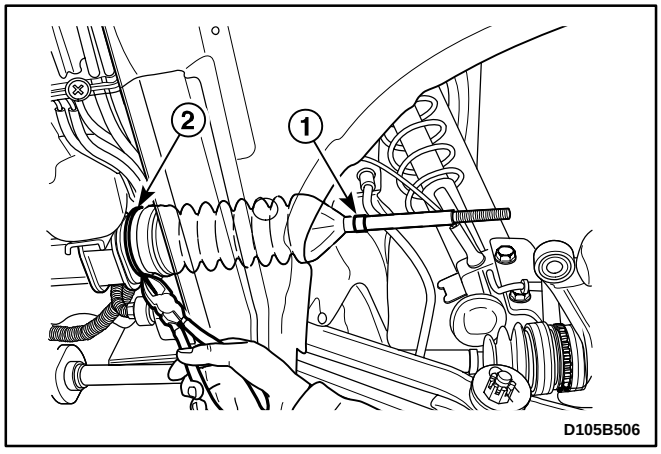
5. Install the split pin.
6. Install the wheel. Refer to *Section 2E, Tires and Wheels.*
7. Make the toe–in adjustment by turning the tie rod adjuster. Refer to *Section 2B, Wheel Alignment.*



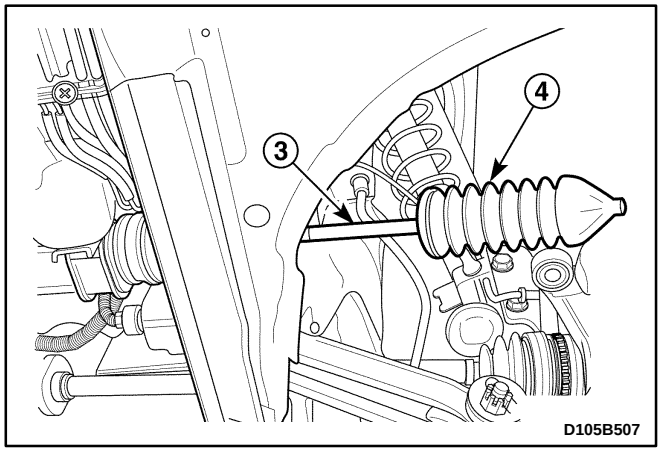
RACK AND PINON BOOT

Removal Procedure

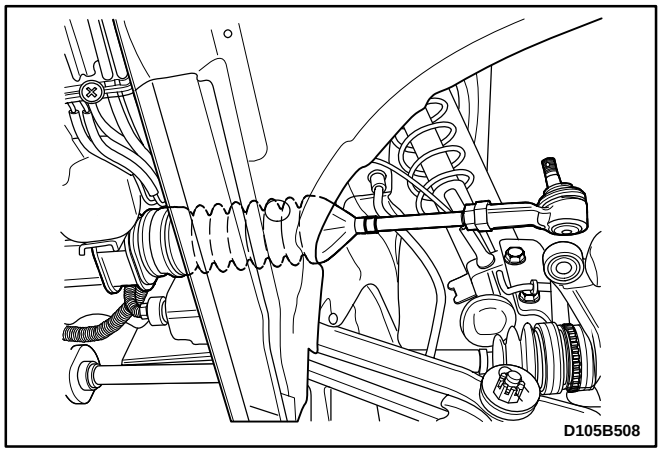
1. Remove the tie rod end. Refer to “Tie Rod End” in this section.
2. Remove the tie rod end lock nut.



3. Remove the rack and pinion boot.
   - Remove the boot clamp (1).
   - Cut off the boot wire clamp (2).

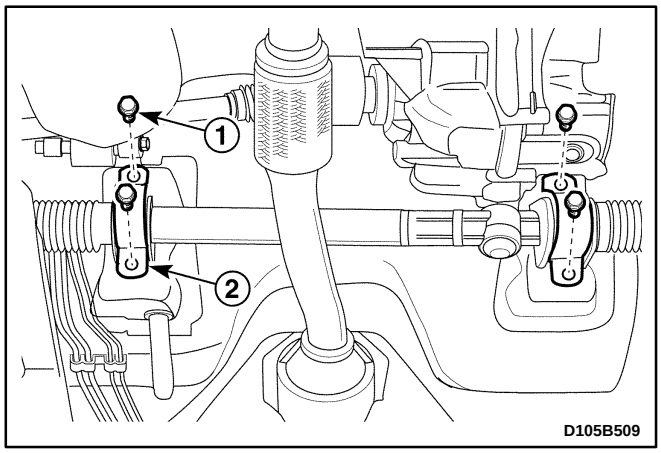


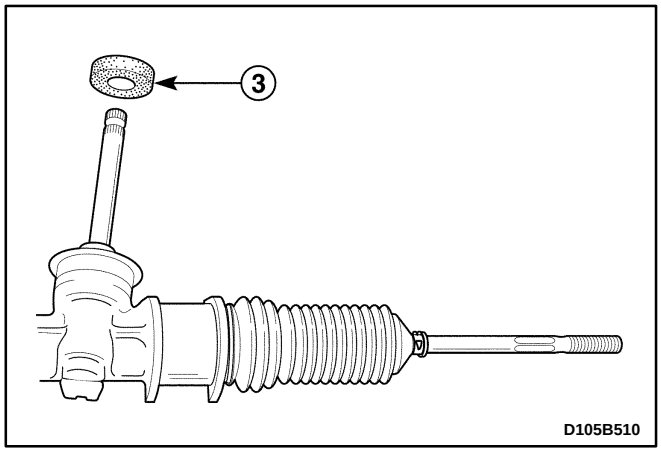
- Coat the greases on the tie rod to ease removal (3).
- Remove the boot (4).



Installation Procedure

1. Install the rack and pinion boot with the clamp and the wire clamp.
2. Install the tie rod end nut.
3. Install the tie rod end. Refer to “Tie Rod End” in this section.



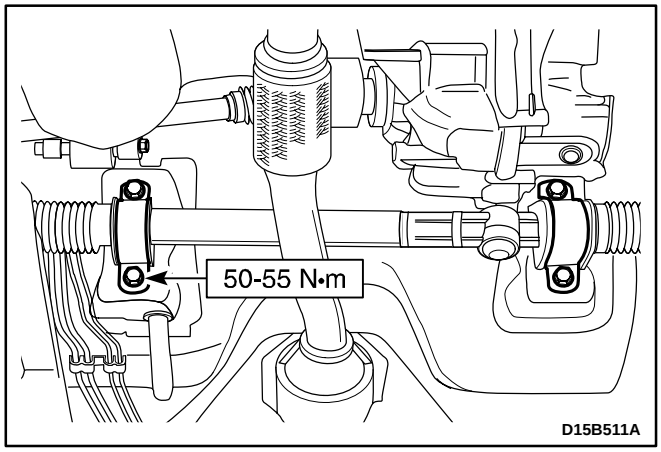


RACK AND PINION STEERING GEAR ASSEMBLY

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

Removal Procedure

1. Remove the intermediate shaft lower pinch bolt. Refer to *Section 6E, Steering Wheel and Column.*
2. Remove the wheels. Refer to *Section 2E, Tires and Wheels.*
3. Disconnect the tie rod end from the steering knuckle. Refer to “Tie Rod End” in this section.
4. Remove the front exhaust pipe nuts. Refer to *Section 1G, Engine Exhaust.*
5. Remove the steering gear assembly from the vehicle.
   - Remove the steering gear bracket bolts (1).
   - Remove the steering gear bracket (2).
   - Remove the steering gear assembly.
   - Remove the packing (3).



Installation Procedure

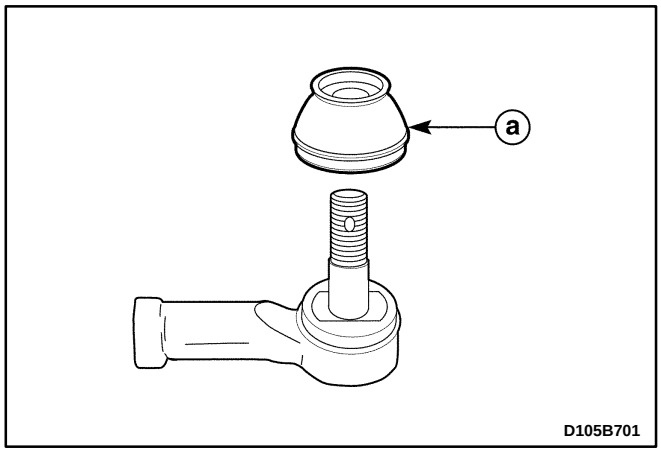
1. Install the mounting to the steering gear assembly.
2. Install the steering gear assembly.
3. Install the steering gear bracket with the bolts.

Tighten

Tighten the steering gear bracket bolts to 50–55 N•m (36–41 lb-ft).

4. Install the front exhaust pipe nuts. Refer to *Section 1G, Engine Exhaust.*
5. Connect the tie rod end to the steering knuckle. Refer to “Tie Rod End” in this section.
6. Install the wheels. Refer to *Section 2E, Tires and Wheels.*
7. Install the intermediate shaft lower pinch bolt. Refer to *Section 6E, Steering Wheel and Column.*

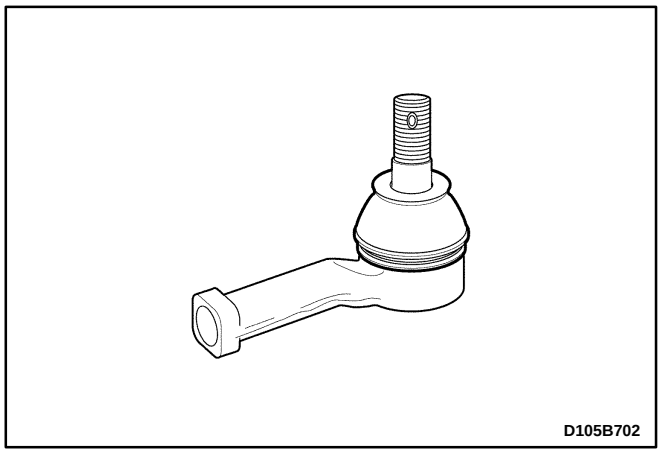
UNIT REPAIR



TIE ROD END BOOT

Disassembly Procedure

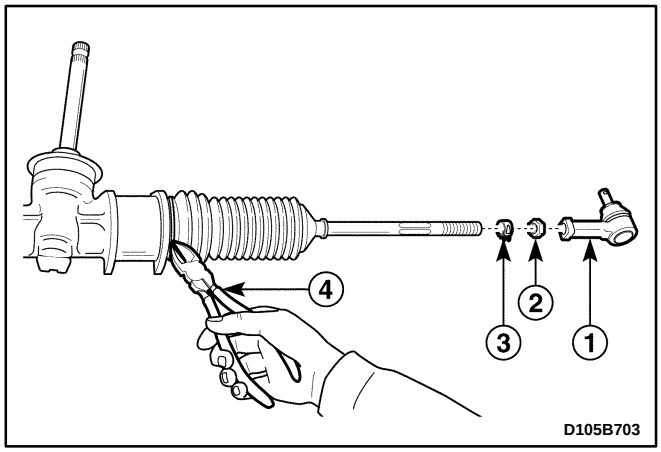
1. Remove the tie rod end. Refer to “Tie Rod End” in this section.
2. Remove the tie rod end boot.
   a. Tie rod end boot.



Assembly procedure

Important : Coat the grease inside of the boot.

1. Install the boot to the tie rod end.
2. Install the tie rod end wire clamp.
3. Install the tie rod end. Refer to “Tie Rod End” in this section.

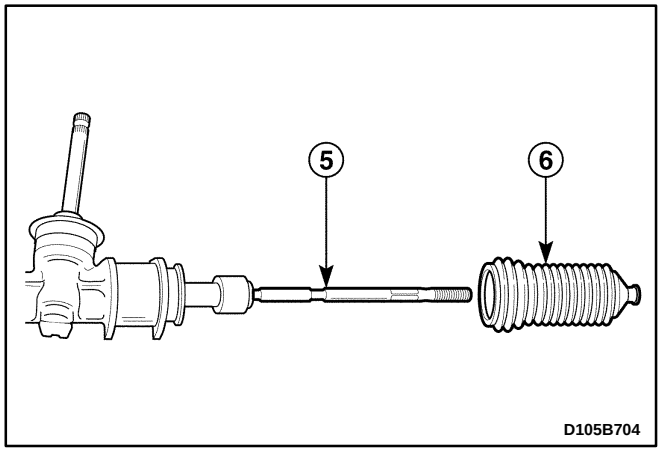


RACK AND PINION

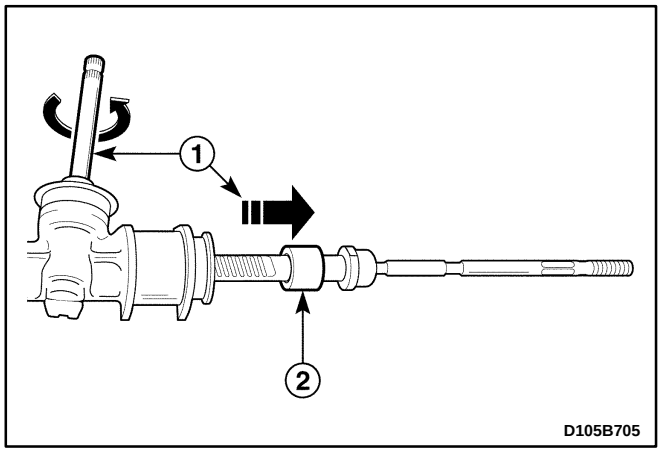
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Disassembly Procedure

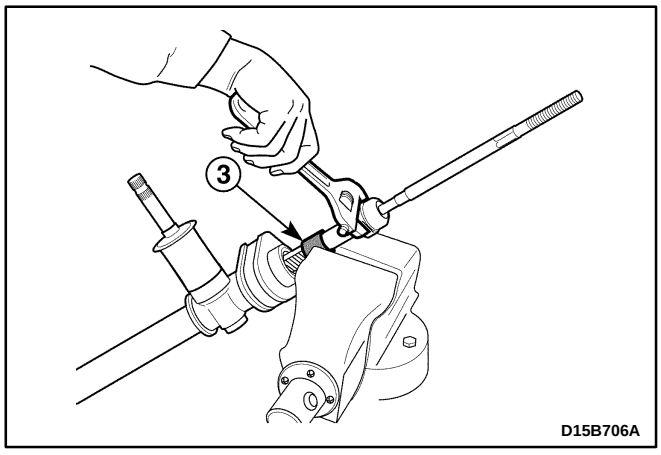
1. Remove the rack and pinion steering assembly from the vehicle. Refer to “Rock and Pinion Assembly” in this section.
2. Remove the rack and pinion boot.
   - Remove the tie rod end. Refer to “Tie Rod End” in this section (1).
   - Remove the tie rod lock nut (2).
   - Remove the rack and pinion boot clamp (3).
   - Cut off the rack and pinion boot wire (4).



- Coat the greases on the tie rod (5).
- Remove the rack and pinion boot (6).



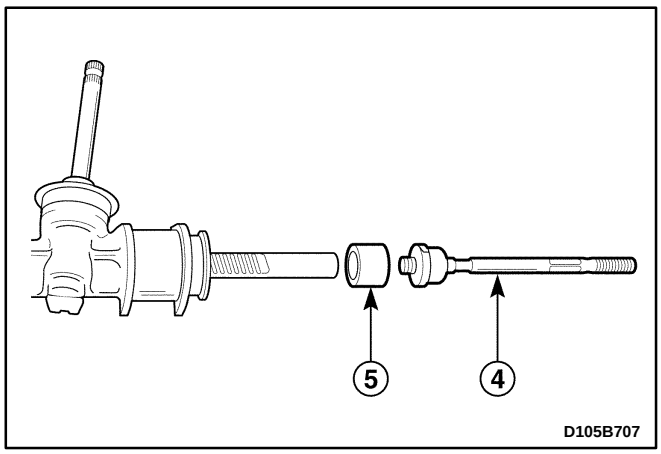
3. Remove the tie rod
   - Pull the rack gear perfectly from the steering gear housing by turning the pinion gear (1).
   - Disconnect the shock damper ring from the tie rod ball joint (2).



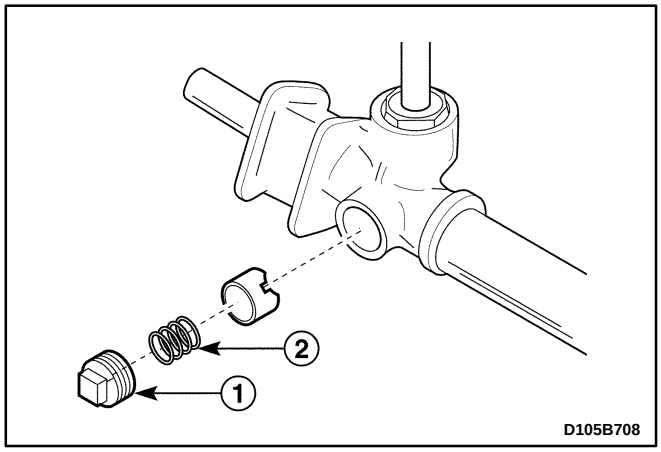
- Vise the rack gear (3).

Important: Clothe the rack gear with a cloth before vising the rack gear.

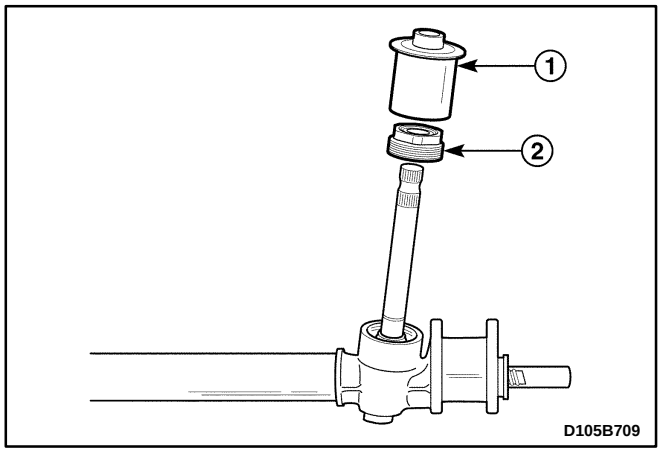
Notice: Do not vise the rack gear over two teeth face.



- Remove the tie rod (4).
- Remove the shock damper ring (5).

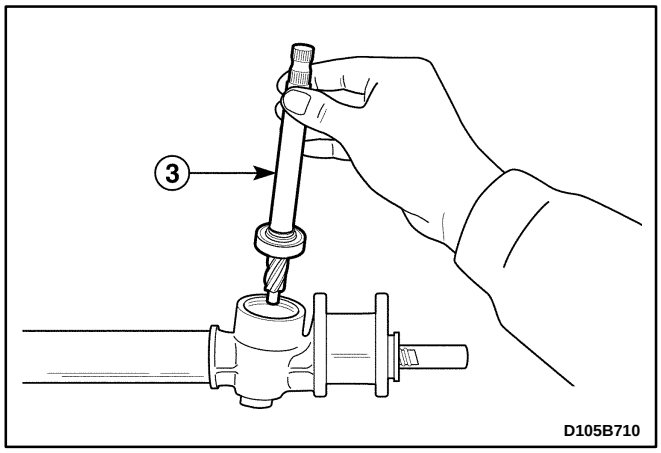


4. Remove the rack bearing.
   - Remove the adjuster plug (1).
   - Remove the adjuster spring (2).

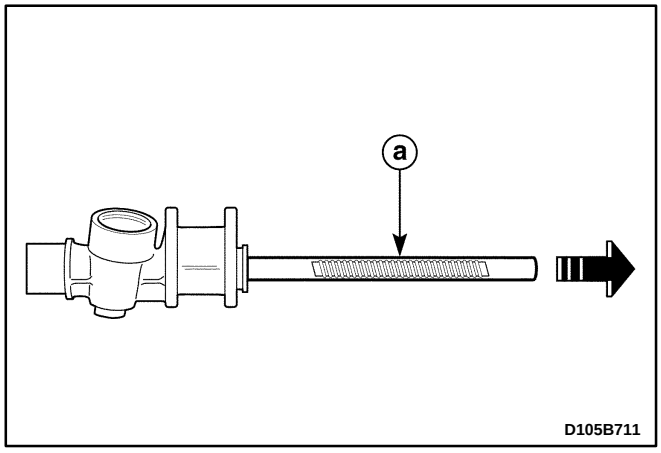


5. Remove the pinion and bearing assembly.
   - Remove the dust cover (1).
   - Remove the pinion plug (2).

Important: Do not reuse the removed pinion plug.

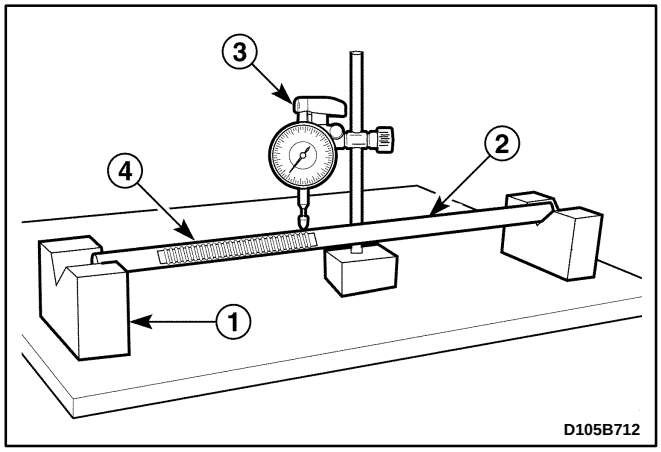


   - Remove the pinion and bearing assembly (3).



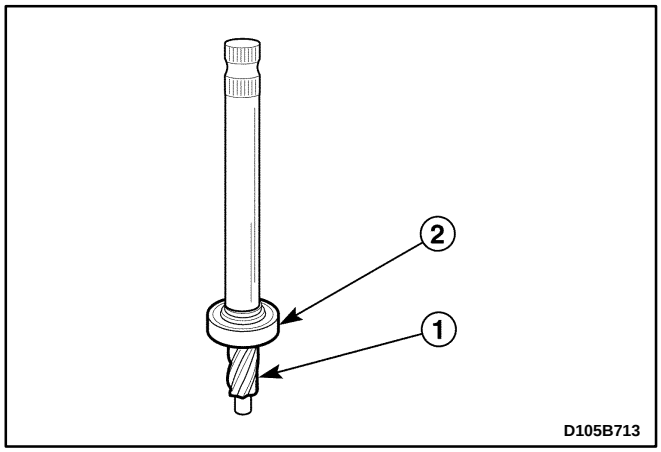
6. Remove the rack gear toward the driver side of the steering gear.
   a. Rack gear.

Notice: Remove the rack gear toward the driver side of the steering gear to prevent the bulk head in the steering gear housing from damaging in installing and removing the rack gear.

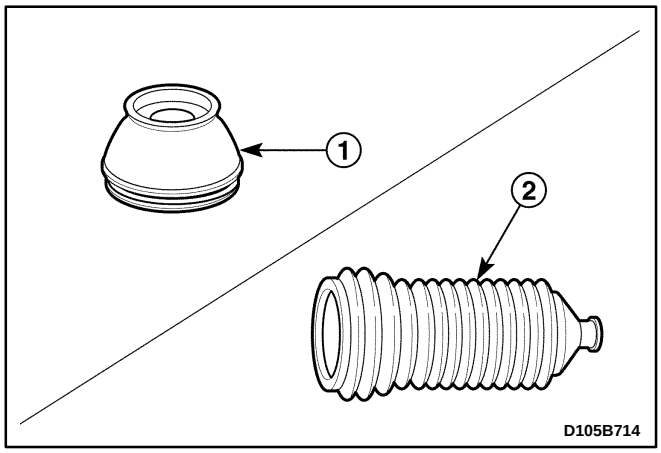


Inspection Procedure

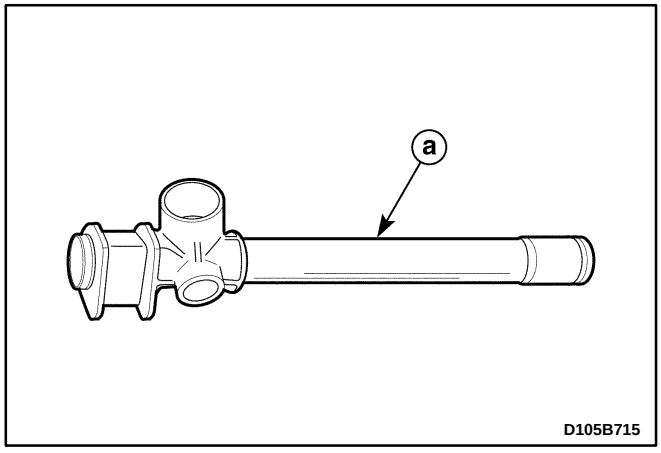
1. Inspect the rack gear deformation and damage.
   - Set the V–block on the plate (1).
   - Set the rack gear on the V–block (2).
   - Check the rack gear for deformation using a dial gauge (3).
   - Inspect the rack gear for wear and damage (4).



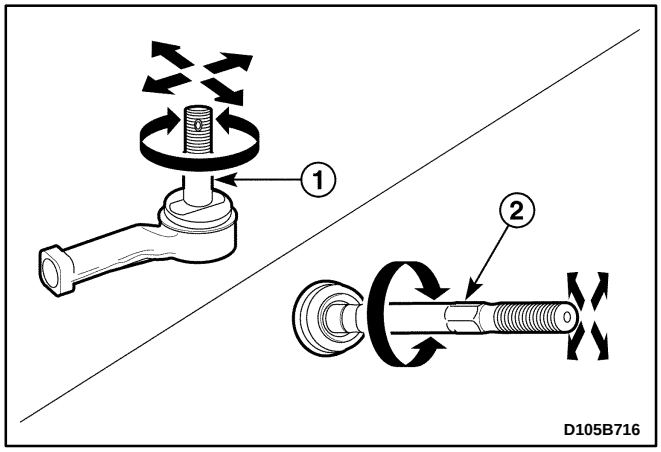
2. Inspect the pinion and bearing assembly damage.
   - Inspect the pinion gear for wear and damage (1).
   - Inspect the bearing for loose and operation (2).



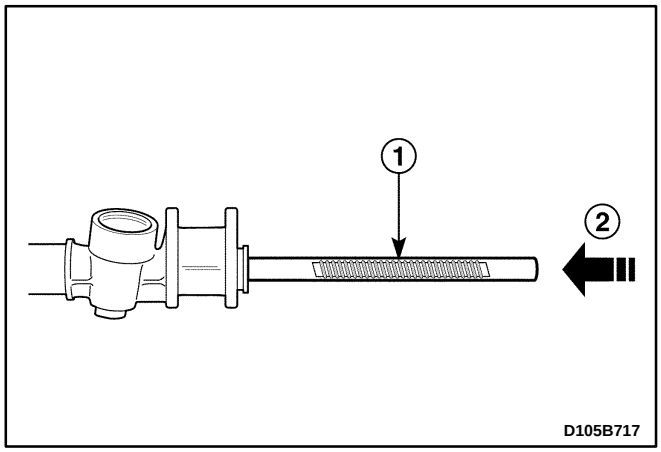
3. Inspect the tie rod end boot and the rack and pinion boot for damage.
   - Inspect the tie rod end boot for crack and wear (1).
   - Inspect the rack and pinion boot for crack and wear (2).



4. Inspect the steering gear housing for crack, deformation and wear.
   a. Steering gear housing.



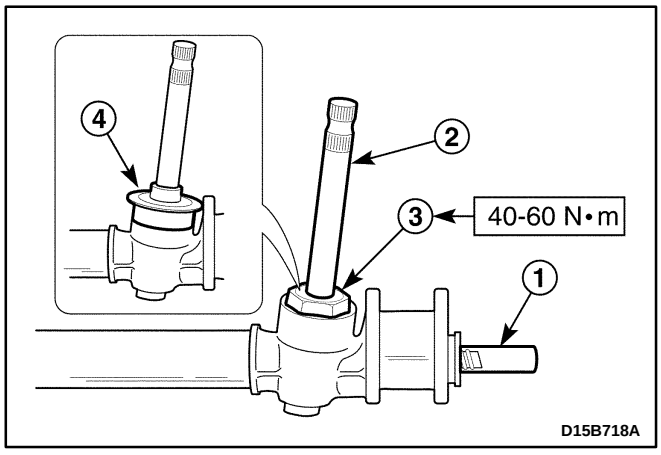
5. Inspect the tie rod end ball joint and tie rod ball joint for damage.
   - Inspect the tie rod end ball joint for operation (1).
   - Inspect the tie rod ball joint for operation and tie rod deformation (2).
6. After inspecting the parts, replace the defected parts.



Assembly Procedure

Important: Coat the all turn, contact and rub surface with grease.

1. Clean the all parts removed.
2. Install the rack gear.
   - Coat the rack gear with grease (1).
   - Insert the rack gear carefully (2).

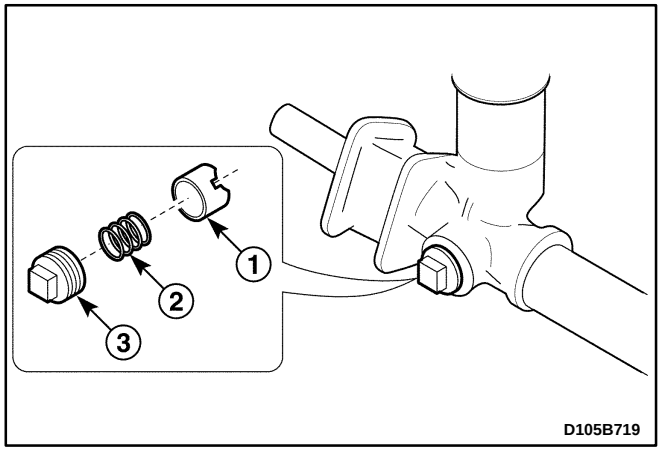


3. Install the pinion and bearing assembly.
   - Set the rack in balance (1).
   - Coat the pinion and bearing assembly and steering gear housing surface with grease.
   - Install the pinion and bearing assembly (2).
   - Coat the pinion plug with Loctitte.
   - Install the pinion plug (3).

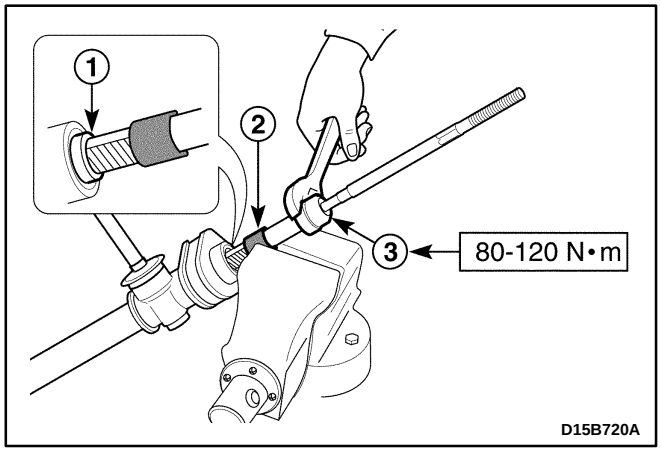
Tighten

Tighten the pinion plug to 40–60 N•m (30–44 lb-ft).

- Install the dust cover (4).



4. Install the rack bearing.
   - Coat the rack bearing with grease.
   - Install the rack bearing (1).
   - Install the adjuster spring (2).
   - Tighten the adjuster plug softly (3).



5. Install the tie rod.
   - Install the shock damper ring to the rack gear (1).
   - Vise the rack gear (2).

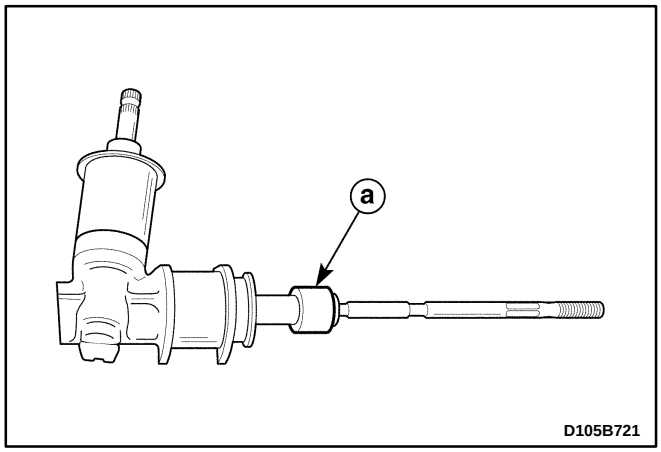
Important : Clothe the rack gear with a cloth before vising the rack gear.

Notice: Do not vise the rack gear above two teeth face.

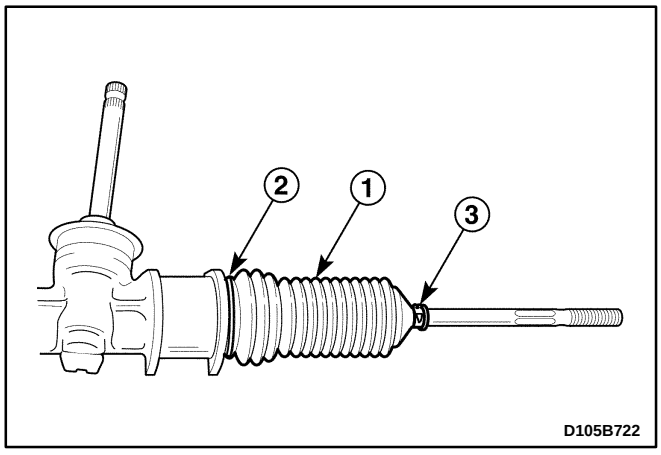
   - Coat the teeth face of the tie rod with Loctitte.
   - Install the tie rod (3).

Tighten

Tighten the tie rod to 80–120 N•m (59–89 lb-ft).



6. Install the shock damper ring to the tie rod ball joint.
   a. Tie rod ball joint.
   - Coat the tie rod ball joint with grease.



7. Install the rack and pinion boot.
   - Install the rack and pinion boot (1).
   - Install the rack and pinion boot wire clamp (2).
   - Install the rack and pinion boot clamp (3).
8. Install the tie rod end. Refer to “Tie Rod End” in this sections.
9. Install the rack and pinion steering gear assembly to the vehicle. Refer to “Rack and Pinion Steering Gear Assembly” in this section.
10. Adjust the free load of the steering gear. Refer to “Diagnosis” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

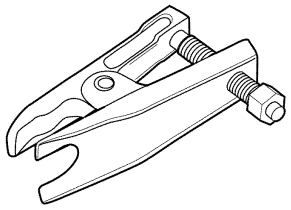
Application			Description
Type			Rack and Pinion
Overall Gear Ratio			21 : 1
Steering Angle	145,155 Tire	Inside	39.5° ± 2°
		Outside	33.5° ± 2°
	175 Tire	Inside	34.9° ± 2°
		Outside	30.5° ± 2°
Lubricant	Rack Gear		POLYUREAS
	Ball Joint		SYNTHETICS OILS & LI SOAPS
Locktite Type			DAC SPEC ADHESIVE SEALANT #520414

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Tie Rod End Castellated Nut	30 – 55	21 – 41	–
Tie Rod End Lock Nut	35 – 55	25 – 41	–
Steering Gear Bracket Bolts	50 – 55	36 – 41	–
Tie Rod–to–Rack Gear	80 – 120	59 – 89	–
Pinion Plug	40 – 60	30 – 44	–
Pinion Preload	Refer to “Diagnosis” in this section.		

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D105B101	**KM–507–B Ball Joint Remover**

SECTION 6E

STEERING WHEEL AND COLUMN

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.

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DESCRIPTION AND OPERATION

STEERING WHEEL AND COLUMN

In addition to the steering function, the steering column provides safety and security.

Caution: To ensure energy-absorbing action, it is important to use only the specified screws, bolts, and nuts, tightened to the specified torque.

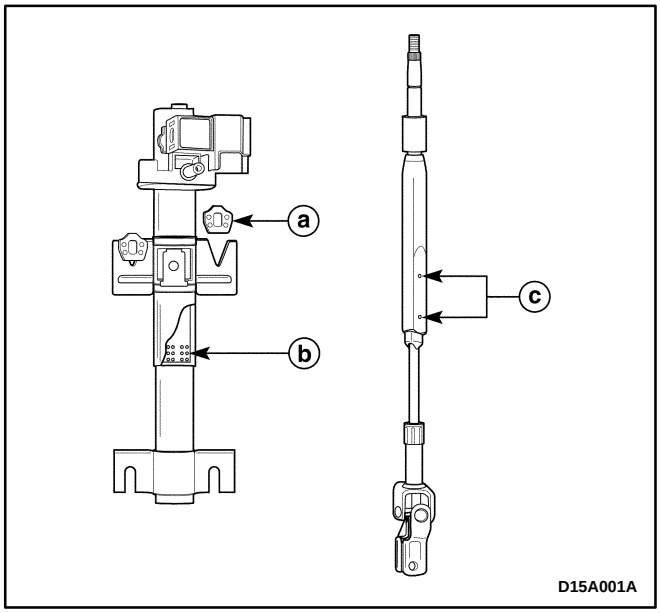
The energy-absorbing column is designed to compress in a front-end collision to lessen the chance of driver injury.

The ignition switch and the lock are mounted on the column, allowing the ignition and steering operations to be locked to inhibit theft of the car.

The column levers trigger the turn signals, the headlight beams, and the windshield washer and wipers.

Notice: Apply a thin coat of lithium grease to all friction points when reassembling to ensure proper operation.

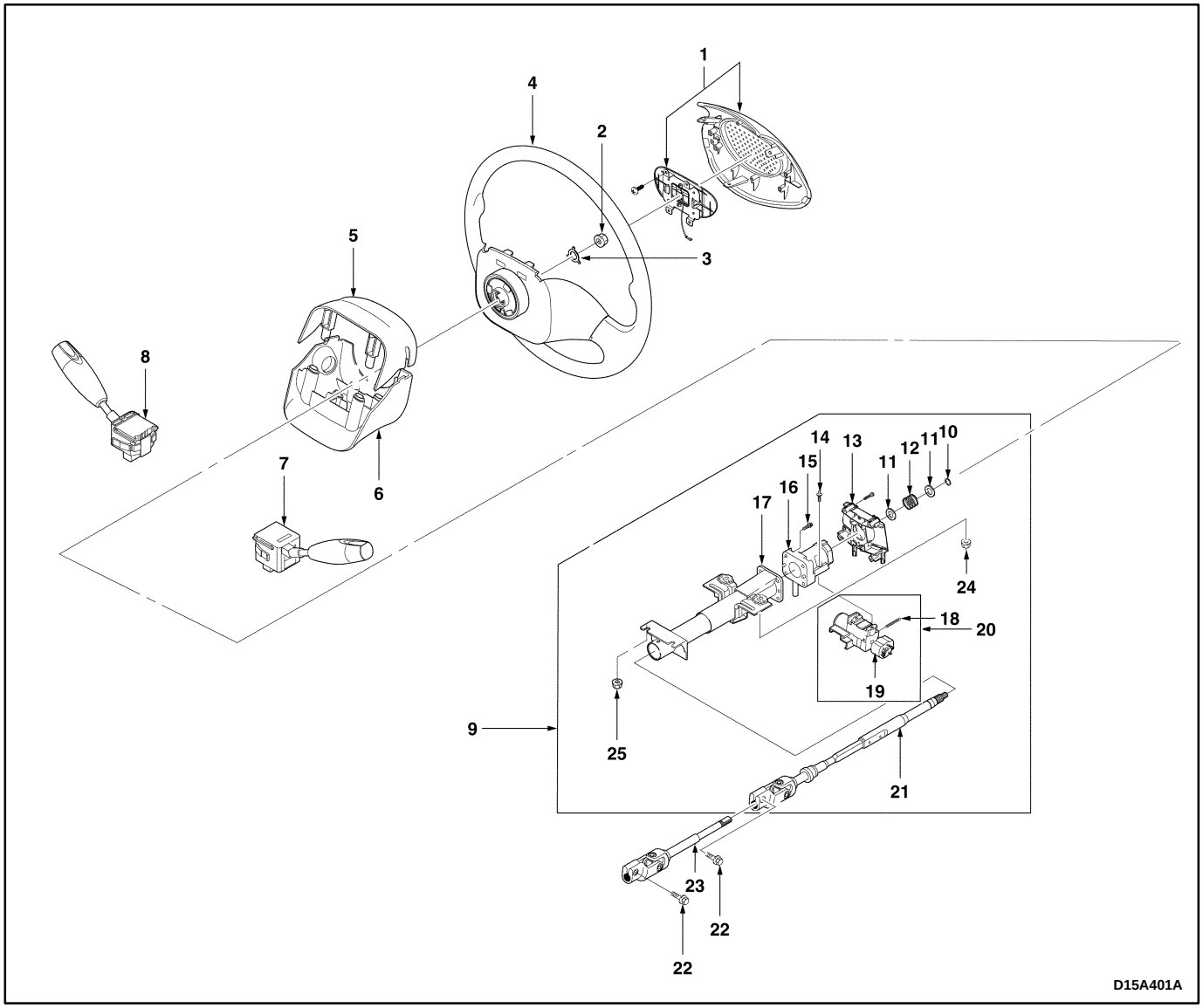
The column may be easily disassembled and assembled.



- Safety Device
  A. Steering Column Upper Bracket.
  B. Steering Column.
  C. Steering Column Shaft.

COMPONENT LOCATOR

STEERING WHEEL AND COLUMN



1. Horn Cover (Airbag Module)
2. Steering Wheel Nut
3. Locking Plate
4. Steering Wheel
5. Steering Column Upper Cover
6. Steering Column Lower Cover
7. Turn Signal Switch
8. Windshield Wiper Switch
9. Steering Column Assembly
10. Retaining Ring
11. Washer
12. Spring
13. Switch Housing
14. Bolt
15. Support Bolt
16. Steering Column Housing
17. Steering Column Jacket
18. Ignition Switch Retaining Screw
19. Ignition Switch
20. Steering Lock Housing Assembly
21. Steering Column Shaft
22. Pinch Bolt
23. Intermediate Shaft
24. Steering Column Upper Nut
25. Steering Column Lower Nut

DIAGNOSTIC INFORMATION AND PROCEDURES

STEERING COLUMN DIAGNOSIS

Lock System

Condition	Probable Cause	Correction
Lock System Will Not Unlock	• Damaged lock cylinder.	• Replace the lock cylinder.
	• The lack of free movement for the ignition switch.	• Lubricate the ignition switch.
	• Improper binding or damaged steering column housing.	• Remove the steering shaft and clear the steering column housing. • Replace the steering column housing as needed.
Lock System Will Not Lock	• Damaged lock cylinder.	• Replace the lock cylinder.
	• The lack of free movement for the ignition switch.	• Lubricate the ignition switch.
	• Improper binding or damaged steering column housing.	• Remove the steering shaft and clear the steering column housing. • Replace the steering column housing as needed.
High Lock Effort	• Damaged lock cylinder.	• Replace the lock cylinder.
	• The lack of free movement for the ignition switch.	• Lubricate the ignition switch.
	• Extreme misalignment of the housing to the cover.	• Realign the cover on the housing. • Replace the cover as needed.
Key Cannot Be Removed in the B Position	• The ignition switch to be set incorrectly.	• Reset the ignition switch.
	• Damaged lock cylinder.	• Replace the lock cylinder.

Column

Condition	Probable Cause	Correction
Noise in the Column	• Improperly installed intermediate shaft–to–column joints.	• Tighten the coupling pinch bolts. • Replace the intermediate shaft as needed.
	• Column misalignment.	• Replace the alignment spacer.
	• The lack of lubrication for the joint.	• Lubricate the joint.
	• The lack of lubrication for the steering shaft.	• Lubricate the steering shaft bearing.
	• Improperly seated shaft lock snap ring.	• Adjust the shaft lock snap ring. • Replace the shaft lock snap ring as needed.
	• Improperly installed intermediate shaft pinch bolt.	• Tighten the pinch bolt.
High Steering Shaft Effort	• Column misalignment.	• Replace the alignment spacer.
	• A damaged bearing.	• Replace the steering column housing.
	• The lack of free movement for the steering shaft universal joint.	• Lubricate the steering shaft universal joint. • Replace the steering column shaft as needed.

Column (Cont'd)

Condition	Probable Cause	Correction
Lash in the Steering Column	• Improperly installed steering column bracket mounting nuts.	• Tighten the steering column bracket mounting nuts.
	• Loose steering column housing–to–steering column jacket support bolts.	• Tighten the support bolts.
Loose Steering Wheel	• The bearing to be seated incorrectly in the housing.	• Correctly seat the bearing. • Replace the column housing as needed.
	• Loose steering column housing support bolts.	• Tighten the steering column housing support bolts.

Turn Signal / Dimmer Switch

Condition	Probable Cause	Correction
Turn Signal Will Not Stay in the Turn Position	• An improperly installed turn signal switch.	• Remove and inspect the turn signal switch. • Reinstall the switch.
	• The broken or missing components for the cancelling mechanism.	• Replace the turn signal switch.
	• Foreign material in the turn signal switch housing.	• Remove any foreign material.
Turn Signal Will Not Cancel	• Broken or missing components for the cancelling mechanism.	• Replace the turn signal switch.
Turn Signal/Dimmer Switch Difficult to Operate	• Improperly installed turn signal/dimmer switch and turn signal/dimmer switch lever.	• Remove and inspect the turn signal/dimmer switch and signal/dimmer switch lever. • Reinstall the signal/dimmer switch and signal/dimmer switch lever.
	• Foreign material in the signal/dimmer switch housing.	• Remove any foreign material.
Turn Signal Will Not Indicate Lane Change	• A broken lane change pressure pad or a broken spring hanger.	• Replace the turn signal switch.
	• The improper functioning of the lane change spring.	• Replace the turn signal switch.
	• Improperly installed turn signal switch.	• Replace the turn signal switch.
No Turn Signal Lamps	• An inoperative turn signal flasher.	• Replace the blinker unit.
	• A faulty turn signal switch.	• Replace the turn signal switch.
	• Improperly connected chassis–to–column connector.	• Reconnect the chassis–to–column connector.
Turn Indicator Lamps On, But Not Flashing	• An inoperative blinker unit.	• Replace the blinker unit.
Front or Rear Turn Signal Lamps Not Flashing	• An inoperative blinker unit.	• Replace the blinker unit.
Turn Signal Lamps Flash Very Slowly	• An inoperative blinker unit.	• Replace the blinker unit.

Ignition Switch

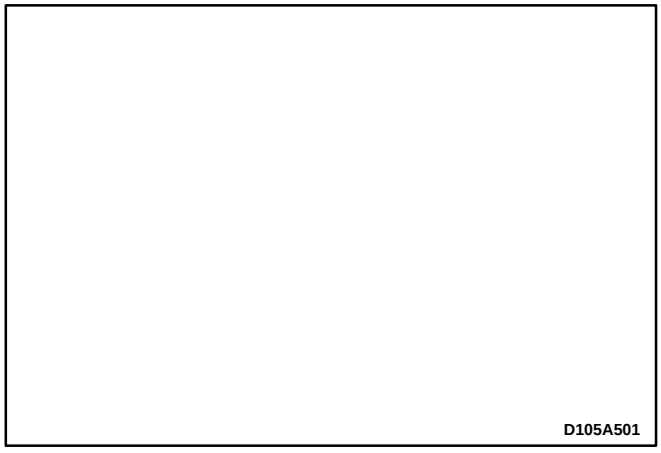
Condition	Probable Cause	Correction
Electrical System Will Not Function	● Damaged ignition switch.	● Replace the ignition switch.
	● Improperly installed ignition switch.	● Remove and inspect the ignition switch. ● Reinstall the ignition switch.
	● Improperly installed ignition switch electrical connector.	● Reconnect the ignition switch electrical connector. ● Replace the ignition switch electrical connector.
Ignition Switch Will Not Turn	● Damaged ignition switch.	● Replace the ignition switch.
	● Improperly installed ignition switch.	● Remove and inspect the ignition switch. ● Reinstall the ignition switch.

Wiper Switch Lever

Condition	Probable Cause	Correction
Switch Inoperative : No I, Low, High, Int or Wash	● Damaged wiper switch.	● Replace the wiper switch.
	● Improperly installed wiper switch.	● Remove and inspect the wiper switch. ● Reinstall the wiper switch.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE


D105A501

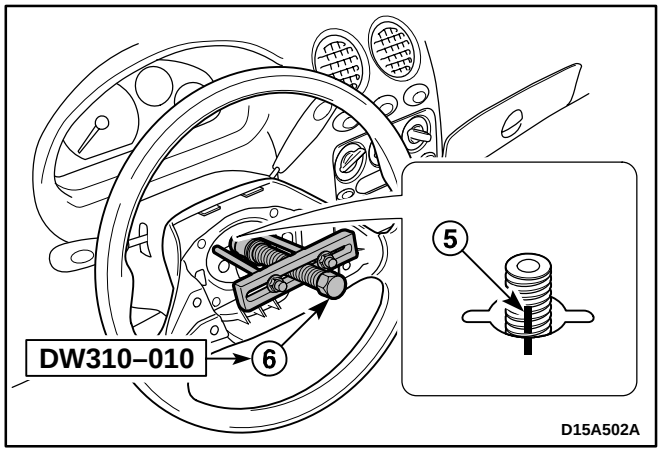
STEERING WHEEL
(Left–Hand Drive Shown, Right–Hand Drive Similar)
Tools Required

DW310–010, Steering Wheel Puller

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the SIR module. Refer to *Section 8B, Supplemental Inflatable Restraints.* (For vehicle with SIR)
3. Remove the steering wheel.
4. Remove the steering wheel horn cover (For vehicle without SIR) (1).
   - Straighten the bending locking plate (2).
   - Remove the nut (3).
   - Remove the locking plate (4).
   - In order to install the steering wheel correctly, match–mark the steering column shaft to the steering wheel (5).
   - Remove the steering wheel using the steering wheel puller DW310–010 (6).

Important: Be careful not to hit the top of steering column shaft with hammer during repair work.



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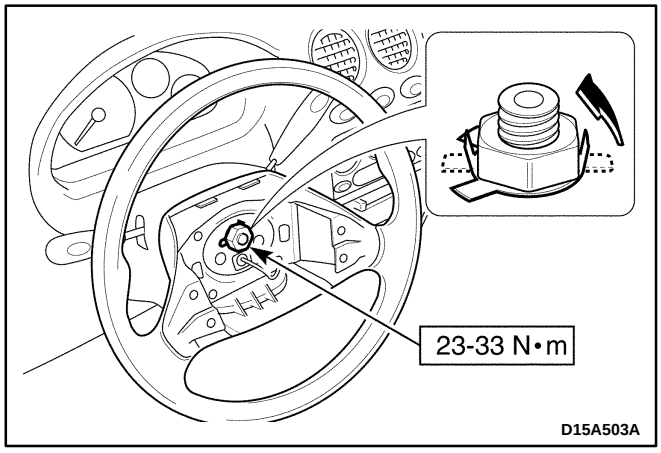


D15A503A

Installation Procedure

1. Install the SIR module. Refer to *Section 8B, Supplemental Inflatable Restraints* (For vehicle with SIR).

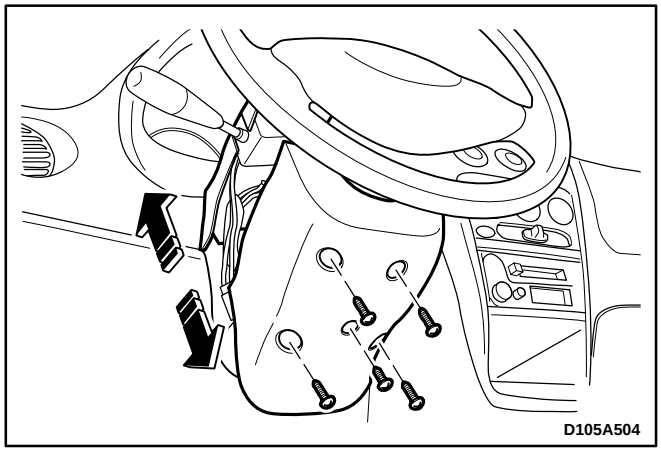
Important: Align the match marks on the steering wheel and the steering column shaft.

2. Install the steering wheel with the nut and the locking plate.

Tighten

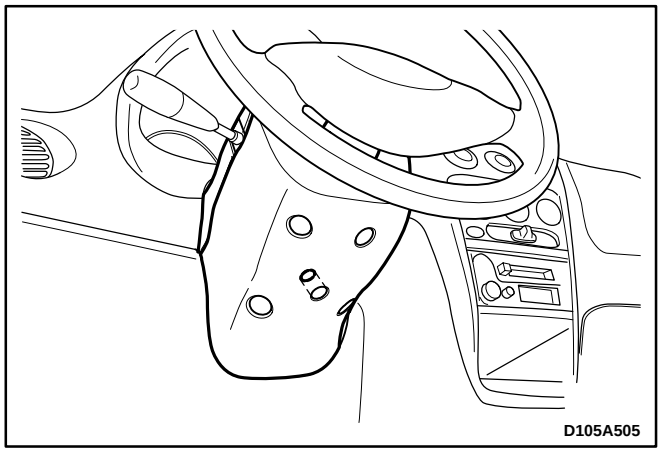
Tighten the steering wheel nut to 23–33 N•m (17–24 lb-ft).

3. Bend the tabs to secure the locking plate.
4. Install the steering wheel horn cover (For vehicle without SIR).
5. Connect the negative battery cable.


D105A504

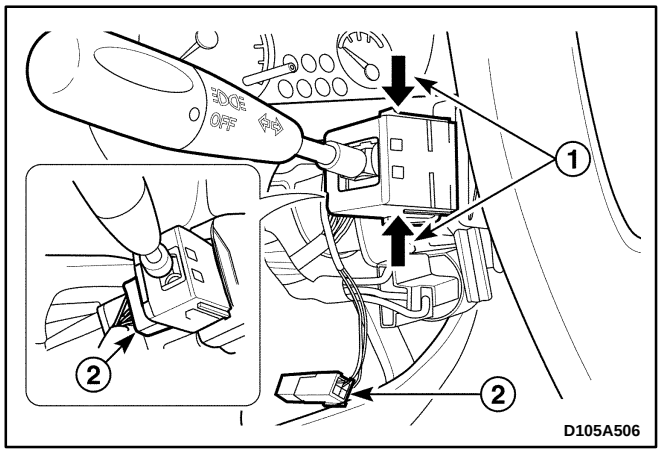
STEERING COLUMN COVER
(Left–Hand Drive Shown, Right–Hand Drive Similar)
Removal Procedure

1. Remove the screws.
2. Remove the steering column lower and upper cover.


D105A505

Installation Procedure

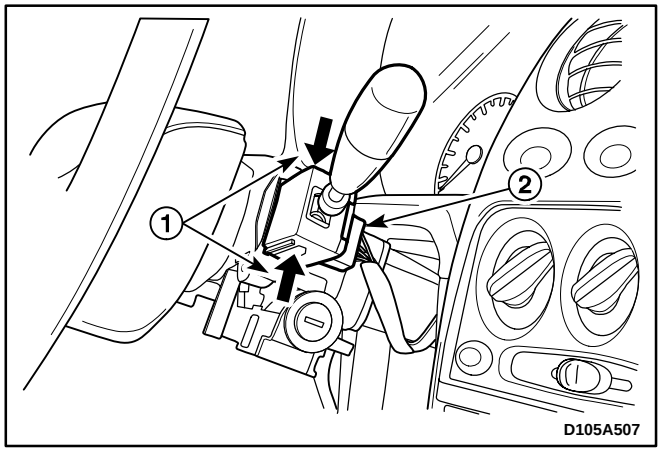
1. Install the steering column lower and upper cover with the screws.



D105A506

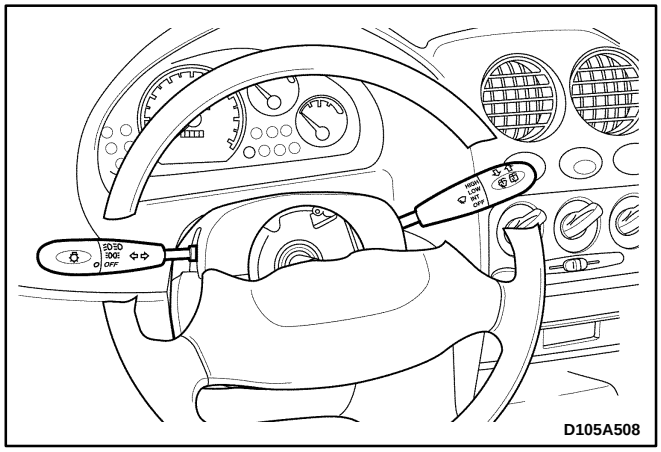
TURN SIGNAL SWITCH AND LEVER/ WIPER SWITCH AND LEVER
(Left–Hand Drive Shown, Right–Hand Drive Similar)
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the steering column cover. Refer to “Steering Column Cover” in this section.
3. Remove the turn signal switch.
   - Disconnect the turn signal switch by pushing the locking from the switch housing (1).
   - Disconnect the connector (2).



D105A507

4. Remove the wiper switch.
   - Disconnect the wiper switch by pushing the locking from the switch housing (1).
   - Disconnect the connector (2).



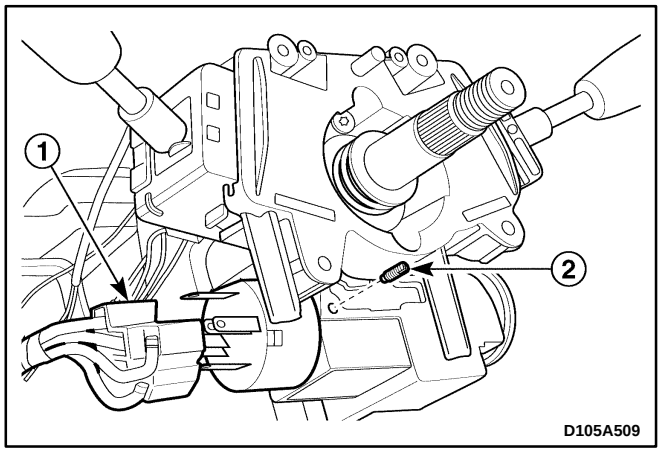
Installation Procedure

1. Install the wiper switch.
2. Install the turn signal switch.
3. Install the steering column cover. Refer to “Steering Column Cover” in this section.
4. Connect the negative battery cable.

IGNITION SWITCH

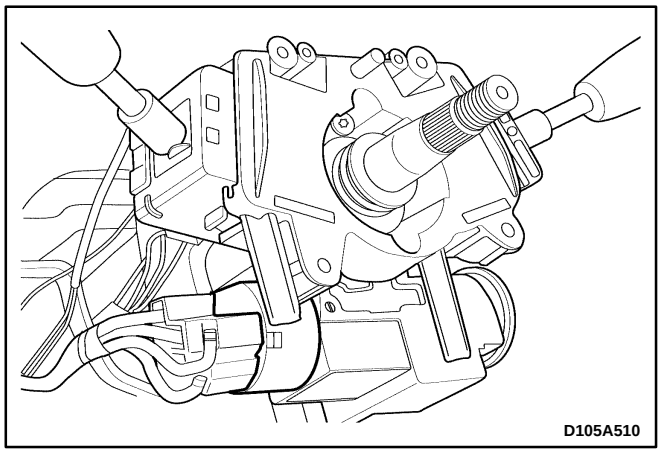
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the steering wheel. Refer to “Steering Wheel” in this section.
3. Remove the ignition switch.
   - Disconnect the electrical connector (1).
   - Remove the screw (2).



Installation Procedure

1. Connect the electrical connector.
2. Install the ignition switch with the screw.
3, Install the steering wheel. Refer to “Steering Wheel” in this section.
4. Connect the negative battery cable.

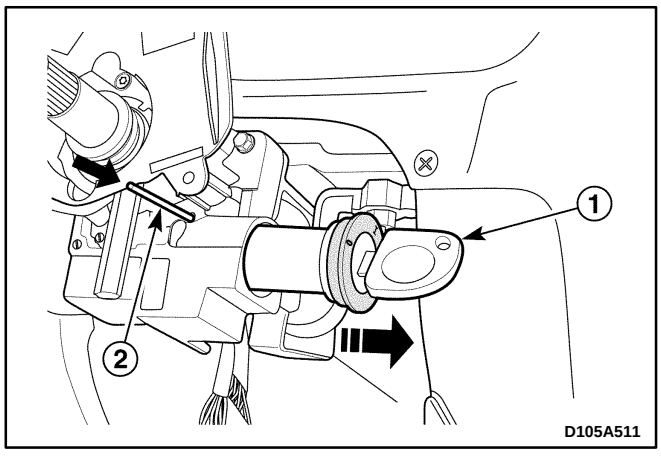


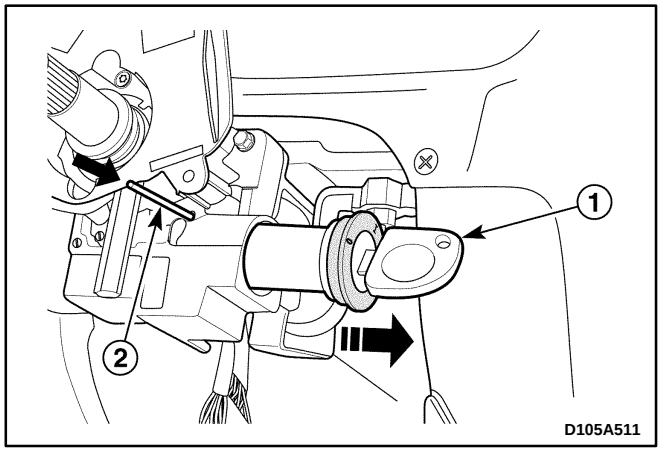
IGNITION LOCK CYLINDER WITH IMMOBILIZER

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

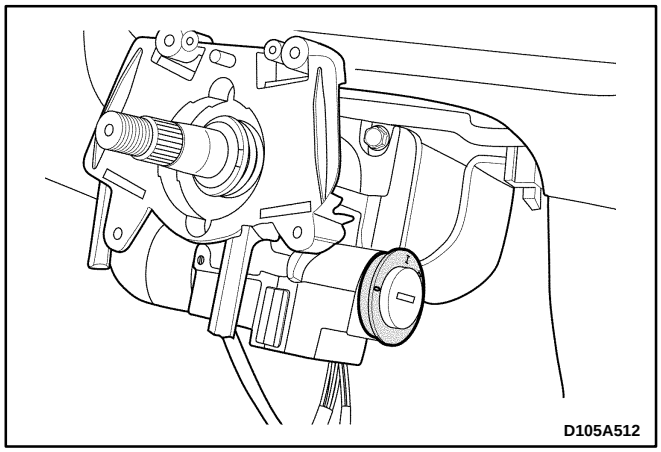
Removal Procedure

1. Remove the steering wheel. Refer to “Steering Wheel” in this section.
2. Disconnect the electrical connector for the immobilizer detection coil.
3. Remove the lock cylinder.
   - With the key in the ignition, turn to the position designated I (1).





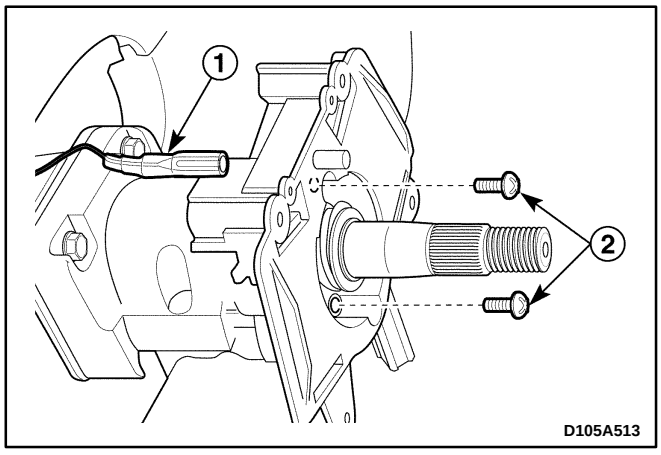
- Remove the lock cylinder by pressing down the detent spring with a 2.5MM allen wrench, or other suitable tool, and pulling the lock cylinder out of the switch cylinder housing (2).



Installation Procedure

Important: To install the ignition lock cylinder the ignition position should be designated I.

1. Install the ignition lock cylinder.
2. Connect the electrical connector for the immobilizer detection coil.
3. Install the steering wheel. Refer to “Steering Wheel” in this section.

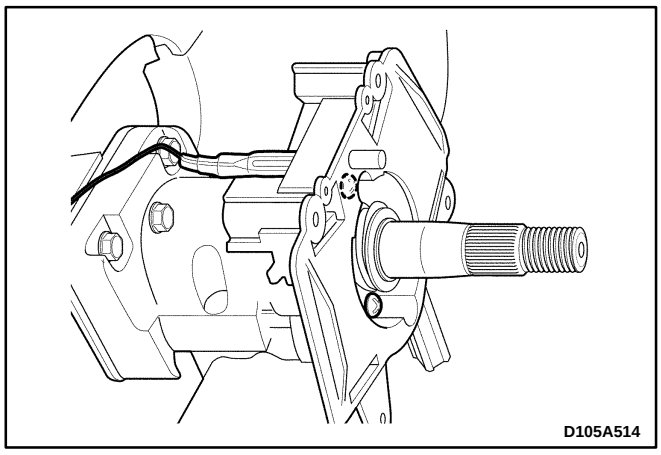


SWITCH HOUSING

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

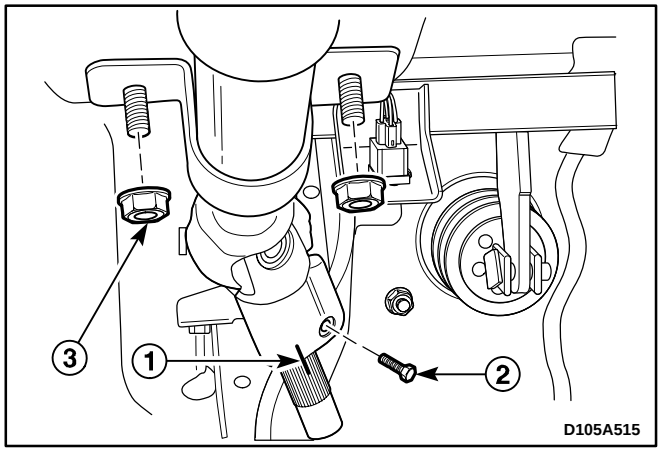
Removal Procedure

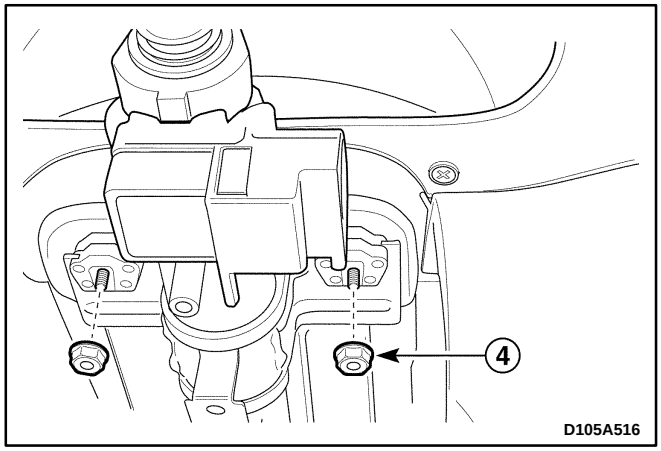
1. Remove the steering wheel. Refer to “Steering Wheel” in this section.
2. Remove the turn signal switch and windshield wiper switch. Refer to “Turn Signal Switch and Lever/Wiper Switch and Lever” in this section.
3. Remove the switch housing.
   - Disconnect the horn electrical connector (1).
   - Remove the screws retaining the switch housing (2).

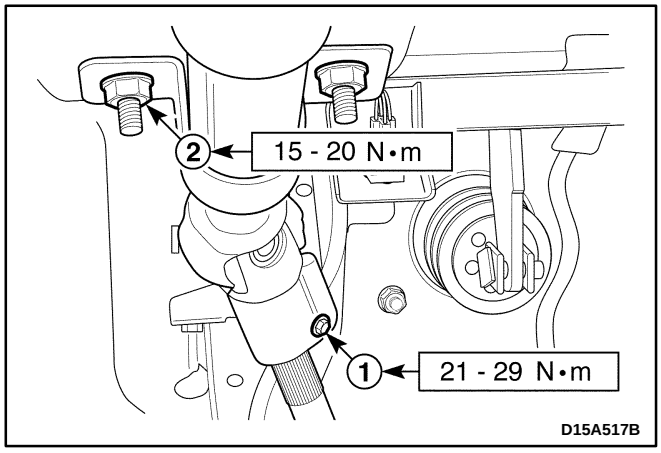


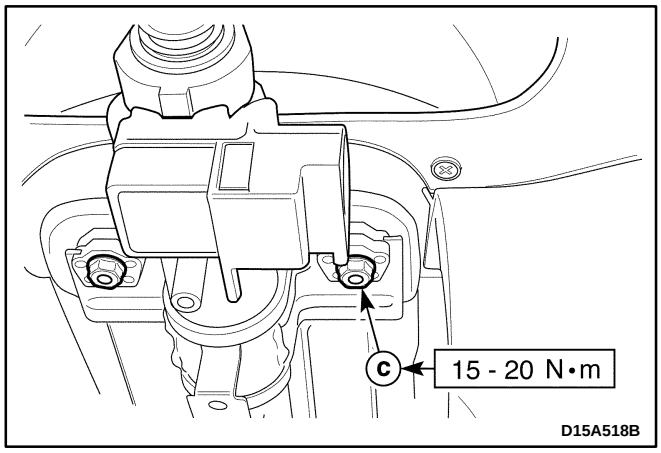
Installation Procedure

1. Install the switch housing with the screws.
2. Connect the horn electrical connector.
3. Install the turn signal switch and windshield wiper switch. Refer to “Turn Signal Switch and Lever/Wiper switch and Lever” in this section.
4. Install the steering wheel. Refer to “Steering Wheel” in this section.









STEERING COLUMN

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

Removal Procedure

1. Remove the steering wheel. Refer to “Steering Wheel” in this section.

Caution: Disconnect the negative battery cable and let the vehicle sit for 1 minute to deactivate the air-bag (For vehicle with SIR)

2. Remove the turn signal switch and wiper switch. Refer to “Turn Signal Switch and Lever/Wiper Switch and Lever in this section.
3. Remove the switch housing. Refer to “Switch Housing” in this section.
4. Remove the ignition switch. Refer to “Ignition Switch” in this section.
5. Remove the ignition lock cylinder. Refer to “Ignition Lock Cylinder” in this section.
6. Remove the steering column.
   - Match–mark on the intermediate shaft and the steering column shaft (1).
   - Remove the intermediate shaft upper pinch bolt (2).
   - Remove the steering column lower nuts (3).
   - Remove the steering column upper nuts (4).

Installation Procedure

Important: Align the match–mark on the intermediate shaft and the steering column shaft.

1. Install the steering column.
   - Install the intermediate shaft upper pinch bolt (1).

Tighten

Tighten the pinch bolt to 21–29 N•m (16–22 lb-ft).

- Install the steering column lower nuts (2).

Tighten

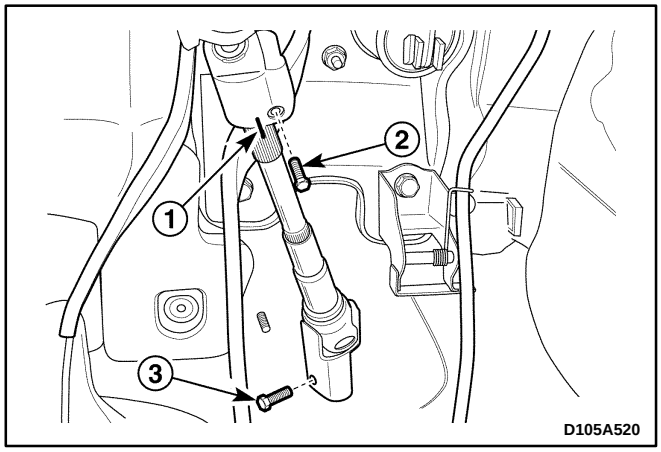
Tighten the nuts to 15–20 N•m (11–15 lb-ft).

- Install the steering column upper nuts (3).

Tighten

Tighten the nuts to 15–20 N•m (11–15 lb-ft).

2. Install the ignition lock cylinder. Refer to “Ignition Lock Cylinder” in this section.
3. Install the ignition switch. Refer to “Ignition Switch” in this section.
4. Install the switch housing. Refer to “Switch Housing” in this section.
5. Install the turn signal switch and wiper switch. Refer to “Turn Signal Switch and Lever/Wiper Switch and Lever” in this section.
6. Install the steering wheel. Refer to “Steering Wheel” in this section.

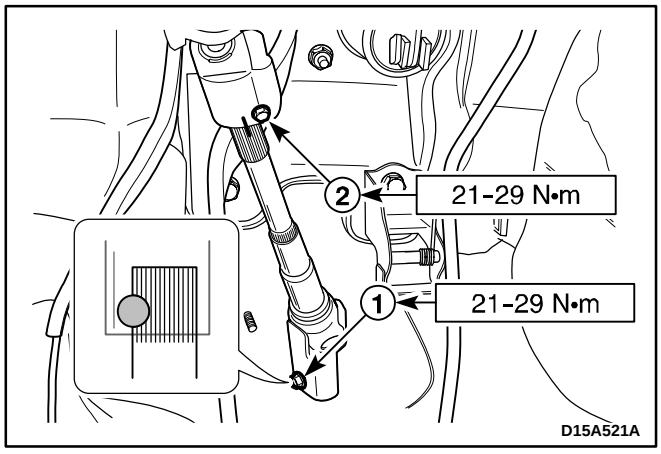


INTERMEDIATE SHAFT COVER AND INTERMEDIATE SHAFT

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

Removal Procedure

1. Remove the intermediate shaft.
   - In order to install the intermediate shaft correctly, match–mark the intermediate shaft to the steering column. (1).
   - Remove the intermediate shaft upper pinch bolt (2).
   - Remove the intermediate shaft lower pinch bolt (3).



Installation Procedure

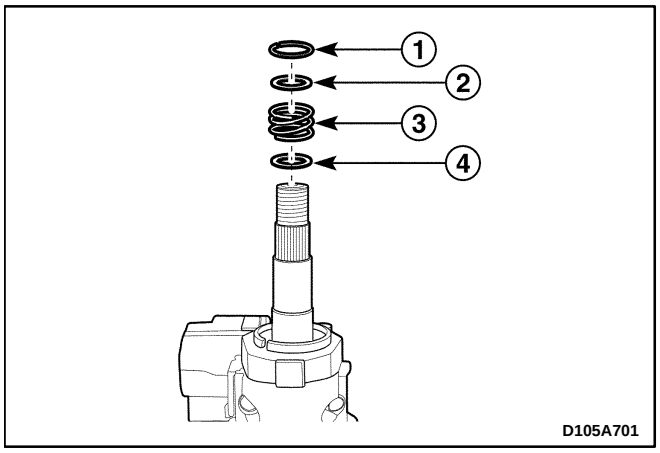
1. Install the intermediate shaft with the bolts.

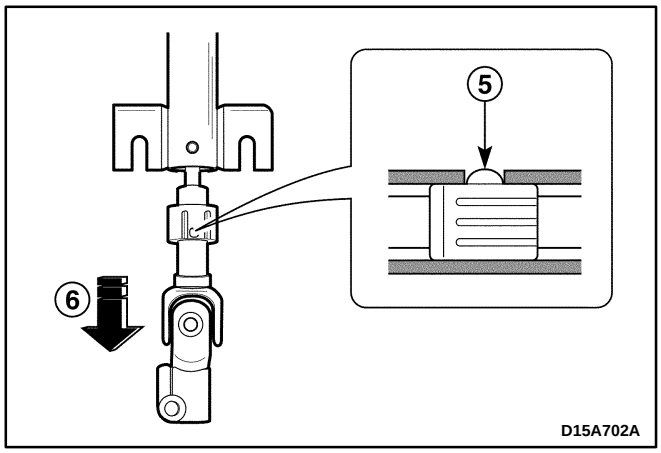
Tighten

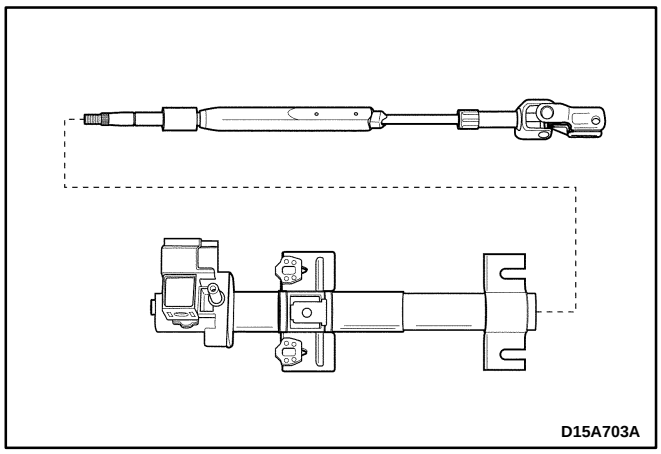
- Tighten the intermediate shaft lower pinch bolt to 21–29 N•m (16–22 lb-ft) (1).
- Tighten the intermediate shaft upper pinch bolt to 21–29 N•m (16–22 lb-ft) (2).

Notice: Check the lower pinch bolt position correctly.

UNIT REPAIR







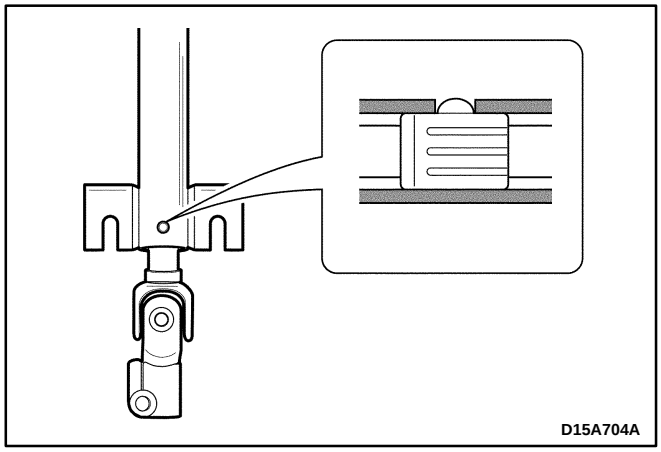
STANDARD STEERING COLUMN

Disassembly Procedure

1. Remove the steering column from the vehicle. Refer to “Steering Column” in this section.

Caution: Be careful not to impact on the steering column shaft. Plastic sleeve may be broken that is installed to secure the driver at the accident.

2. Remove the steering column shaft from the steering column.
   - Remove the retaining ring (1).
   - Remove the washer (2).
   - Remove the spring (3).
   - Remove the washer (4).
   - Remove the locking of the alignment spacer (5).
   - Push strongly the steering column shaft downward (6).



Assembly Procedure

Important: Position the alignment spacer on the lower column shaft to install the spacer in the steering column jacket easily.

1. Install the steering column shaft to the steering column.
   - Position the locking of the alignment spacer on the groove of the steering column.
   - Install the washer.
   - Install the spring.
   - Install the washer.
   - Install the retaining ring.
2. Install the steering column to the vehicle. Refer to “Steering Wheel” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

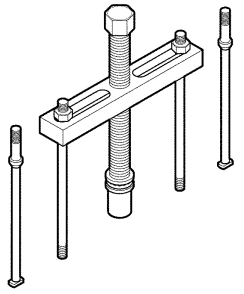
Application			Unit	Description
Steering Wheel	Diameter	With Airbag	mm (in.)	380 (14.96)
		Without Airbag	mm (in.)	370 (14.57)
	Free Play (Engine Stop)		mm (in.)	0 ± 20 (0 ± 0.79)

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Steering Wheel Nut	23 – 33	17 – 24	–
Steering Column Upper Nuts	15 – 20	11 – 15	–
Steering Column Lower Nuts	15 – 20	11 – 15	–
Intermediate Shaft Upper Pinch Bolt	21 – 29	16 – 22	–
Intermediate Shaft Lower Pinch Bolt	21 – 29	16 – 22	–

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D105A101	**DW310–010** **Steering Wheel Puller**

SECTION 7A

HEATING AND VENTILATION SYSTEM

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.

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DESCRIPTION AND SYSTEM OPERATION

HEATING AND VENTILATION SYSTEMS

The base heater system is designed to provide heating, ventilation, windshield defrosting, and side window defogging.

The heater and fan assembly blower regulates the airflow from the air inlet for further processing and distribution.

The heater core transfers the heat from the engine coolant to the inlet air.

The temperature door regulates the amount of the air that passes through the heater core. The temperature door also controls the temperature of the air by controlling the mix of the heated air and the ambient air.

The mode door regulates the flow and the distribution of the processed air to the heater ducts and to the defroster ducts.

This console-mounted heating and ventilation panel contains the following:

Three Rotary Control Knobs

1. The Rotary Temperature Control Knob
   - Actuates by cable.
   - Raises the temperature of the air entering the vehicle by rotation toward the right, or the red portion of the knob.
2. The Rotary Blower Control Knob
   - Turns on to operate the blower motor at four speeds.
   - Turns ✿ to stop the blower.
   - Operates completely independently both from the mode control that regulates the defroster door and from the temperature control knob.
   - Changes the fan speed in any mode and at any temperature setting.
3. The Rotary Mode Control Knob:
   - Actuates by cable.
   - Regulates the air distribution between the windshield, the instrument panel, and the floor vents.

Push Knobs

1. The Rear Window Defogger Push Knob
   - Controls the rear window defogger.
   - Turns ON the rear window defogger when the push knob is pressed and the indicator lamp is illuminated.
2. The A/C Push Knob (if the vehicle is equipped with air conditioning)
   - Controls the A/C.
   - Turns the A/C ON when the push knob is down. However, if the blower control knob is OFF, the A/C system is OFF, regardless of the position of the A/C knob.

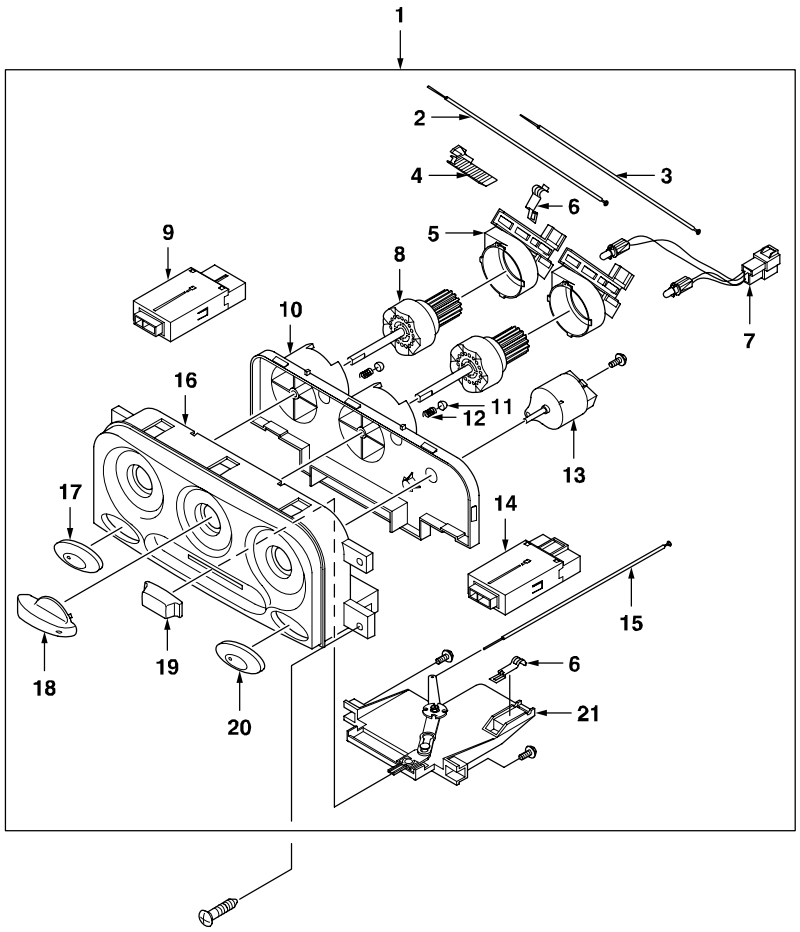
One Lever

1. The Fresh Air Control Lever
   - Operates by cable.
   - Switches between recirculating passenger compartment air and bringing outside air into the passenger compartment.
   - Draws in outside air when the lever is moved to the left.
   - Recirculates inside air when the lever is moved to the right.

COMPONENT LOCATOR

CONTROL ASSEMBLY

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



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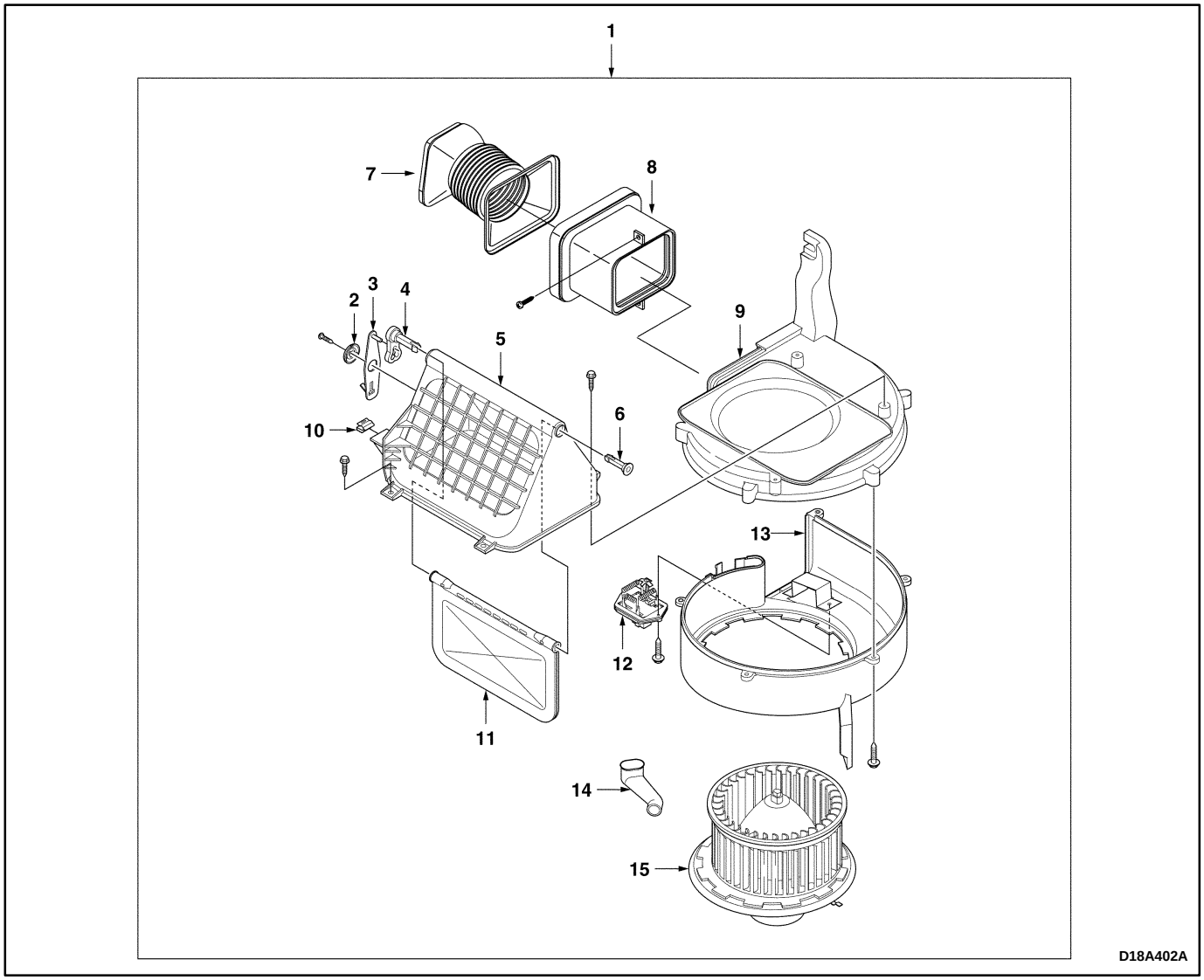
1. HVAC Control Assembly
2. Temperature Control Cable
3. Mode Select Cable
4. Rack
5. Bracket
6. Cable Clamp
7. Bulb Socket Assembly
8. Pinion Assembly
9. A/C Switch
10. Housing
11. Detent Cap
12. Detent Spring
13. Blower Switch
14. Rear Defogger Switch
15. Recirculating/Fresh Air Door Cable
16. Panel
17. A/C Push Knob
18. Rotary Knob
19. Recirculating Knob
20. Rear Defogger Push Knob
21. Recirculation

BLOWER MODULE ASSEMBLY

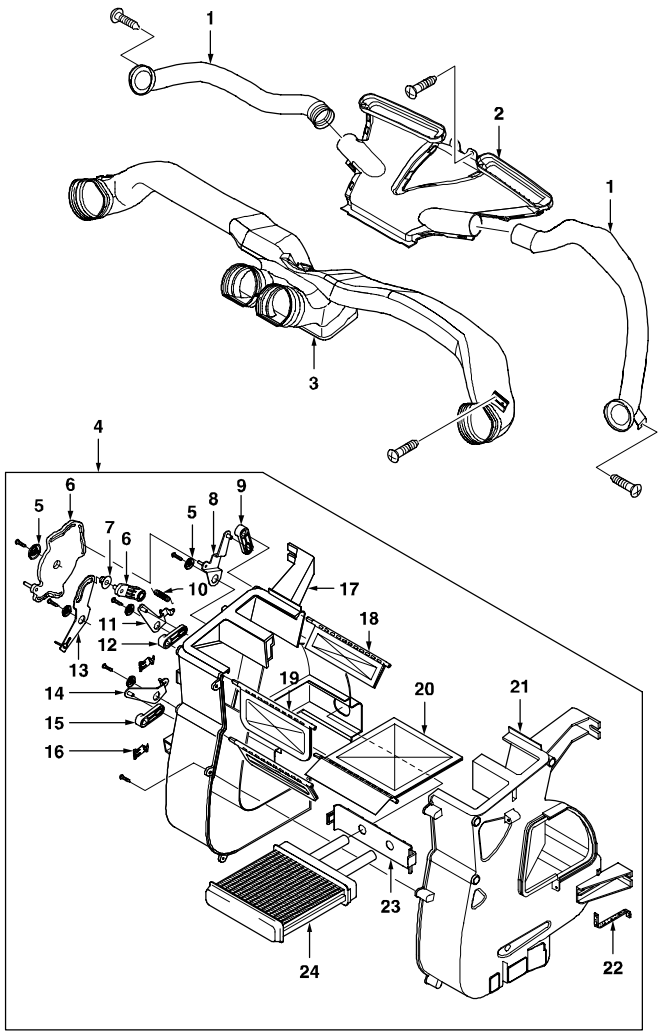
(Left–Hand Drive Shown, Right–Hand Drive Similar)



1. Blower Module Assembly
2. Plastic Washer
3. Blower Link
4. Blower Lever
5. Air Intake Case
6. Valve Retainer
7. Heater Duct Assembly
8. Blower Connector Duct
9. Orifice Case
10. Cable Clamp
11. Blower Valve
12. Blower Resistor
13. Lower Case
14. Cooling Hose
15. Blower Motor

AIR DISTRIBUTOR AND HEATER MODULE ASSEMBLY

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



D108A403

1. Defroster Duct Hose
2. Defroster Duct
3. Ventilation Duct
4. Heater Module Assembly
5. Plastic Washer
6. Temperature Control Lever
7. Temperature Control Lever Bearing
8. Defroster Link
9. Defroster Lever
10. Spring
11. Ventilation Link
12. Ventilation Lever
13. Temperature Control Link
14. Heater Link
15. Heater Lever
16. Cable Link
17. Left Heater Case
18. Defroster Valve
19. Ventilation Valve
20. Temperature Control Valve
21. Right Heater Case
22. Case Seal
23. Heater Core Cover
24. Heater Core

DIAGNOSTIC INFORMATION AND PROCEDURES

HEATER SYSTEM

INSUFFICIENT HEATING OR DEFROSTING

Caution: The cooling system is pressurized when hot. Injury can result from removing the surge tank cap before the engine is sufficiently cool.

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	Check the coolant level. Is the coolant level correct?	–	Go to *Step 4*	Go to *Step 3*
3	Add coolant as needed. Is the repair complete?	–	System OK	Go to *Step 4*
4	Check the timing belt for tension or damage. Is the timing belt OK?	–	Go to *Step 6*	Go to *Step 5*
5	Correct any problem with the drive belts. Is the repair complete?	–	System OK	Go to *Step 6*
6	Check the coolant hoses for leaks or kinks. Are the coolant hoses OK?	–	Go to *Step 8*	Go to *Step* 7
7	Repair any problem with the coolant hoses. Is the repair complete?	–	System OK	Go to *Step 8*
8	Check the surge tank cap. Refer to *Section 1D, Engine Cooling.* Is the surge tank cap OK?	–	Go to *Step 10*	Go to *Step* 9
9	Repair or replace the surge tank cap as needed. Is the repair complete?	–	System OK	Go to *Step 10*
10	1. Set the A/C switch OFF on vehicles equipped with air conditioning. 2. Set the blower motor switch on 4. 3. Set the heater control to full hot. 4. Turn the ignition ON. 5. Check for airflow from the heater outlet. Is there heavy airflow from the heater outlet?	–	Go to *Step 11*	Go to *Step 25*
11	Check for a change in the airflow at various blower speeds. Does the blower speed increase as the switch is turned from 1 to 4?	–	Go to *Step 12*	Go to ‘‘Blower Electrical’’
12	1. Set the A/C switch to OFF, on vehicles equipped with air conditioning. 2. Set the temperature lever to full hot. 3. Set the blower motor switch on 4. 4. With the engine sufficiently cool, remove the surge tank cap. 5. Start the vehicle and idle the engine. 6. Watch for the flow of the coolant. Is the coolant flow visible?	–	Go to *Step 14*	Go to *Step 13*

Insufficient Heating or Defrosting (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Check for a ● Restriction in the cooling system. ● Failed water pump impeller. ● Faulty thermostat. 2. Make repairs to the cooling system, as needed. Are the repairs complete?	–	System OK	–
14	1. Check the vehicle for cold air leaks at the ● Dash. ● Heater cases. ● Vents. 2. Check under the seat for obstructions. 3. Repair any leaks or obstructions. Are the repairs complete?	–	System OK	–
15	1. Turn the ignition OFF. 2. Turn the temperature control knob to full cold, then rapidly to full hot. 3. Listen for the sound of the temperature door slam just before reaching the end of the travel range of the control knob. Did the door slam?	–	Go to *Step 17*	Go to *Step 16*
16	1. Check the temperature door ● Travel. ● Cables. ● Linkage. 2. Verify the accuracy of the temperature controls at full hot. 3. Verify the accuracy of the temperature controls at full cold. Is the repair complete?	–	System OK	–
17	1. Set the temperature door to full hot. 2. Start the vehicle. 3. Check the temperature of the heater inlet hose and the heater outlet hose by feel. Is the heater inlet hose hot and the heater outlet hose warm?	–	Go to *Step 18*	Go to *Step 21*
18	Check the thermostat. Refer to *Section 1D, Engine Cooling.* Is the thermostat installed and seated properly?	–	Go to *Step 19*	Go to *Step 20*
19	Replace the thermostat. Refer to *Section 1D, Engine Cooling.* Is the repair complete?	–	System OK	–
20	Reinstall the thermostat. Is the repair complete?	–	System OK	–
21	Inspect the heater hoses for proper installation. Are heater hoses reversed?	–	Go to *Step 22*	Go to *Step 23*
22	Reinstall the heater hoses properly. Is the repair complete?	–	System OK	–

Insufficient Heating or Defrosting (Cont'd)

Step	Action	Value(s)	Yes	No
23	1. Back flush the heater core. 2. Drain the cooling system. 3. Replace the coolant. 4. Warm the engine to an average operating temperature. 5. Feel the heater inlet hose and the heater outlet hose. Is the heater inlet hose hot and the heater outlet hose warm?	–	System OK	Go to *Step 24*
24	Replace the heater core. Is the repair complete?	–	System OK	–
25	Recheck the system using the "Control Settings/Correct Results" tests. Refer to ''Improper Air Delivery or No Mode Shift" in this section. Is the repair complete?	–	System OK	Go to *Step 26*
26	Check for airflow from the defroster or the vent outlets. Is there high airflow from the defroster or the vent outlets?	–	Go to *Step 27*	Go to *Step 28*
27	Adjust the heater door at the floor and the vent door to get the proper airflow. Is the repair complete?	–	System OK	–
28	Switch the mode knob to defrost. Is the defroster airflow OK?	–	Go to *Step 29*	Go to *Step 30*
29	1. Remove the heater outlet and check for obstructions. 2. Remove any obstructions in the heater outlet. Is the repair complete?	–	System OK	–
30	Check for airflow change at various blower speeds. Does the blower speed increase as the control is turned from 1 to 4?	–	Go to *Step 31*	Go to ''Blower Electrical''
31	Check for obstructions in the system at the blower inlet. Are there any obstructions?	–	Go to *Step 32*	Go to *Step 33*
32	Remove the obstructions in the system at the blower inlet. Is the repair complete?	–	System OK	–
33	1. Set the blower on 4. 2. Rotate the temperature control from full hot to full cold. 3. Listen for an airflow change. Does the airflow change?	–	Go to *Step 34*	Go to *Step 35*

Insufficient Heating or Defrosting (Cont'd)

Step	Action	Value(s)	Yes	No
34	1. Check the temperature door ● Travel. ● Cables. ● Linkage. ● Control. 2. Verify the accuracy of the temperature controls at full hot. Is the repair complete?	–	System OK	–
35	1. Check the system for any obstruction between the blower and the system outlets. 2. Remove any obstruction. Is the repair complete?	–	System OK	–

BLOWER ELECTRICAL

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified.	–	Go to *Step* 2	System OK
2	Check the blower. Does the blower run at any speed?	–	System OK	Go to *Step 3*
3	1. Disconnect the power connector from the blower motor under the dashboard on the passenger side of the vehicle. 2. Use an ohmmeter check the resistance between the 1 terminal of the blower motor connector and each step with the blower switch place each position. Does the ohmmeter show the specified value of the each position?	Refer to "Specifications" in this section.	Go to *Step* 4	Go to *Step* 5
4	Replace the blower motor. Is the repair complete?	–	System OK	Go to *Step* 7
5	Check the fuse Ef6. Is the fuse blown?	–	Go to *Step 6*	Go to *Step 7*
6	1. Turn the ignition ON. 2. Use a short detector to locate a possible short. ● From the fuse Ef6 to the blower switch. ● From the blower swtich to the blower resistor. ● From the blower resistor to the blower motor. 3. Repair any short. 4. Replace any blown fuse. Is the repair complete?	–	System OK	–
7	1. Turn the ignition ON. 2. Disconnect the power connector from the blower motor. 3. Use a test lamp to locate a possible short. ● From the terminal 2 of the motor connector to the terminal 3 of the motor switch connector. ● From the terminal 2 of the motor connector to the terminal 4 of the motor switch connector. ● From the terminal 2 of the motor connector to the terminal 5 of the motor switch connector. ● From the terminal 2 of the motor connector to the terminal 6 of the motor switch connector. Does the test lamp light ON?	–	Go to *Step 9*	Go to *Step 8*
8	Replace the blower resistor. Is the repair complete?	–	System OK	Go to *Step 10*
9	Replace the blower motor switch. Is the repair complete?	–	System OK	–
10	1. Check the ground of the blower motor. 2. Repair the ground of the blower motor. Is the repair complete?	–	System OK	–

IMPROPER AIR DELIVERY OR NO MODE SHIFT

This procedure provides a test of all functions of the heater/defroster unit.

1. Warm up the vehicle.
2. Keep the engine running.
3. Perform the tests outlined in the table below and look for the results indicated.

CONTROL SETTINGS			CORRECT RESULTS				
MODE KNOB	**TEMP. CONTROL**	**BLOWER MOTOR SWITCH**	**BLOWER SPEED**	**POWER VENT OUTLET**	**FLOOR OUTLET**	**DEFROST OUTLET**	**SIDE WINDOW OUTLET**
Vent	Cold	Off	Off	No Airflow	No Airflow	No Airflow	No Airflow
Vent	Cold	4	High	Ambient Airflow	No Airflow	No Airflow	No Airflow
Floor	Cold to Hot	4	High	No Airflow	Cold to Hot Airflow	Minimum Cold to Hot Airflow	Minimum Cold to Hot Airflow
Defroster	Cold to Hot	4	High	No Airflow	Minimum Cold to Hot Airflow	Cold to Hot Airflow	Minimum Cold to Hot Airflow

If any of these settings does not produce the correct results, perform the following diagnostic procedure.

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	Examine the affected door in the unit for proper cable attachment. ● Check the cable connection to the door. ● Check that the cable sheath is properly retained. Is the cable connected properly?	–	Go to *Step 4*	Go to *Step 3*
3	Repair as necessary. Is the repair complete?	–	System OK	–
4	1. Disconnect the cable at the door. 2. Check the range of the door travel and the effort required to move it. Does the door move freely through its entire range of travel so that it can close at both ends of the range?	–	Go to *Step 5*	Go to *Step 3*
5	Check the travel of the Bowden cable by turning the control knob. Is the cable travel OK?	–	Go to *Step 6*	Go to *Step 7*
6	1. Reinstall the cable. 2. Recheck the system using the "Control Settings/Correct Results" tests in this procedure. Does the system perform properly?	–	System OK	Go to *Step 9*
7	1. Check the cable attachment at the control. 2. Check for a broken control. Is there a problem with the cable attachment or the control?	–	Go to *Step 8*	Go to *Step 9*

Improper Air Delivery or No Mode Shift (Cont'd)

Step	Action	Value(s)	Yes	No
8	Repair the cable attachment or control as necessary. Is the repair complete?	–	System OK	Go to *Step 9*
9	Recheck the system using the "Control Settings/Correct Results" tests in this procedure. Is the repair complete?	–	System OK	Go to *Step 10*
10	Check for airflow from the defroster or the vent outlets. Is there high airflow from the defroster or the vent outlets?	–	Go to *Step 11*	Go to *Step 12*
11	Adjust the heater door at the floor and the vent door to get the proper airflow. Is the repair complete?	–	System OK	–
12	Switch the mode knob to defrost. Is the defroster airflow OK?	–	Go to *Step 13*	Go to *Step 14*
13	1. Remove the heater outlet. 2. Check the heater outlet for obstructions. 3. Remove any obstructions in the heater outlet. Is the repair complete?	–	System OK	–
14	Check the blower speeds for change in the airflow. Does the blower speed increase as the control is turned from 1 to 4?	–	Go to *Step 15*	Go to "Blower Electrical"
15	1. Check for obstructions in the system at the blower inlet. 2. Remove any obstructions at the blower inlet. Is the repair complete?	–	System OK	Go to *Step 16*
16	1. Set the blower on 4. 2. Rotate the temperature control from full hot to full cold. 3. Listen for an airflow change. Did the airflow change?	–	Go to *Step 17*	Go to *Step 18*
17	1. Check the temperature door adjustment, the cables, the linkage, and the control. 2. Adjust the temperature control to full hot. Is the repair complete?	–	System OK	–
18	1. Check the system for any obstruction between the blower and the system outlets. 2. Remove any obstruction between the blower and the system outlets. Is the repair complete?	–	System OK	–

TOO MUCH HEAT

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	Set the mode switch to the floor position. Is there too much heat when the mode switch is in the floor position?	–	Go to *Step 3*	Go to *Step 9*
3	Check for defroster bleed. Is there objectionable defroster bleed?	–	Go to *Step 4*	Go to *Step 5*
4	1. Check the door travel, the cables, the controls, and the linkage for the heater and the defroster. 2. Adjust or repair, as required. Is the repair complete?	–	System OK	–
5	1. In vehicles equipped with A/C, set the A/C switch OFF. 2. In all vehicles, set the blower speed to 4. 3. Set the temperature to full hot. 4. Turn the ignition switch to ON. 5. Check for airflow from the floor outlets. 6. Check the floor outlet attachment. Is the airflow high?	–	Go to *Step 7*	Go to *Step 8*
6	Check for a change in the airflow at different blower speeds. Does the airflow change as the setting for the blower-speed switch is changed?	–	System OK	Go to "Blower Electrical"
7	1. Check the temperature door travel, the cables, and the linkage. 2. Adjust to full cold. 3. Check for full hot. Is the repair complete?	–	System OK	–
8	Adjust or repair the floor/defroster and/or the vent/floor mode. Is the repair complete?	–	System OK	–
9	Set the mode switch to the vent position. In the vent position, is the problem objectionable bleed?	–	Go to *Step 10*	Go to *Step 15*
10	1. Check the system case for leaks. 2. Check the floor outlet attachment. Are any problems found?	–	Go to *Step 11*	Go to *Step 12*
11	Repair the system case or the floor outlet attachment as required. Is the repair complete?	–	System OK	Go to *Step 12*
12	1. Turn the ignition switch OFF. 2. Turn the temperature control knob to full hot, then rapidly to full cold. Do you hear the door slam just before you reached the end of the control travel?	–	Go to *Step 13*	Go to *Step 14*
13	Adjust the vent door to vent more. Is the repair complete?	–	System OK	–

Too Much Heat (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Check the temperature door travel, the cables, and the linkage. 2. Verify that the temperature door goes to full cold. 3. Check the temperature door for full hot. Is the temperature door travel correct?	–	System OK	–
15	1. Check for hot air leaks from the engine compartment to the blower inlet. 2. Repair as needed. Is the repair complete?	–	System OK	–

CONTROLS

Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	Is excessive effort required to move a control?	–	Go to *Step 5*	Go to *Step 3*
3	Does a door move too easily on a high-blower setting?	–	Go to *Step 4*	System OK
4	1. Replace the Bowden cable with a longer cable. 2. Add a loop to the cable routing to increase the effort required to move a control. 3. Check for instrument panel interference with the new cable routing. Does the control operate properly?	–	System OK	Go to *Step* 5
5	Check the cables for improper routing, kinks, wiring interference, or other instrument panel interference. Is any cable problem found?	–	Go to *Step 6*	Go to *Step 7*
6	Repair as needed. Is the repair complete?	–	System OK	–
7	1. Remove the cable from any door that binds on the cable. 2. Cycle the door manually. 3. Check for door binding. Is there any door binding?	–	Go to *Step 8*	Go to *Step 11*
8	Check the door seal for proper installation. Is the door seal OK?	–	Go to *Step 9*	Go to *Step 10*
9	1. Check a binding door for shaft alignment, a bent shaft or a bent door, or a warped case. 2. Repair, as needed. Is the repair complete?	–	System OK	–
10	Repair the door seal, as needed. Is the repair complete?	–	System OK	–
11	Check for control binding. Does the control bind?	–	Go to *Step 13*	Go to *Step 12*
12	1. Reinstall the cable to the door. 2. Check the cable-to-dash components clearances. 3. Repair any interference. Is the repair complete?	–	System OK	–
13	1. Remove the cable from the control. 2. Check the control for binding. Does the control bind?	–	Go to *Step 14*	Go to *Step 15*
14	Replace the control. Is the repair complete?	–	System OK	–
15	Replace the cable. Is the repair complete?	–	System OK	–

BLOWER NOISE

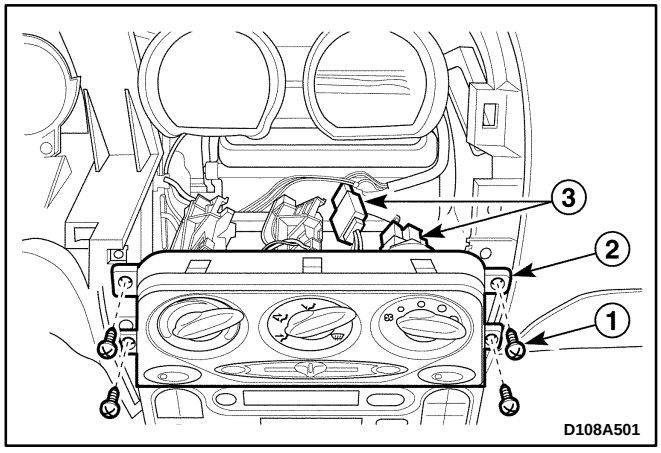
Step	Action	Value(s)	Yes	No
1	Verify the customer's complaint. Are the customer's concerns verified?	–	Go to *Step 2*	System OK
2	1. Sit inside the vehicle. 2. Close the doors and windows. 3. Turn the ignition ON. 4. Set the blower speed to 4. 5. Set the temperature to full cold. 6. Cycle through the blower speeds, the modes, and the temperature settings in order to find the noise. Is the blower noise constant at high blower speeds or certain modes, but absent at lower speeds or in other modes?	–	Go to *Step 11*	Go to *Step 3*
3	Check for vibrations from the blower motor and fan assembly at each blower speed by feeling the blower motor housing. Did you find excessive vibration?	–	Go to *Step 6*	Go to *Step 4*
4	1. Remove the blower motor and fan assembly. Refer to ''Blower Motor" in this section. 2. Check for foreign material at the opening of the blower inlet. Did you find any foreign material at the blower inlet?	–	Go to *Step 5*	Go to *Step 6*
5	Remove all foreign material. Is the repair complete?	–	System OK	Go to *Step* 6
6	1. Examine the blower fan for wear spots, cracked blades, a cracked hub, a loose fan retaining nut, or bad alignment. 2. Examine the blower case for wear spots. Did you find any problem?	–	Go to *Step 7*	Go to *Step 9*
7	Lubricate the motor. Is the repair complete?	–	System OK	Go to *Step 8*
8	Replace the motor and fan assembly. Is the repair complete?	–	System OK	Go to *Step 9*
9	If the noise is a click/tick or whine, replace the motor. Is the repair complete?	–	System OK	Go to *Step 10*
10	Reinstall the original motor. Is the problem still present?	–	Go to *Step 11*	System OK
11	1. Set the blower speed on 4. 2. Check full-hot to full-cold temperature positions in the defrost, floor, and vent modes. Is the noise present in the defrost mode only?	–	Go to *Step 12*	Go to *Step 13*
12	1. Check the ducts for obstructions or foreign materials. 2. Remove any obstructions or foreign materials. 3. Check floor/defroster door seals. 4. Repair or replace, as needed. Is the repair complete?	–	System OK	–
13	Is the noise present in the floor mode only?	–	Go to *Step 12*	Go to *Step 14*

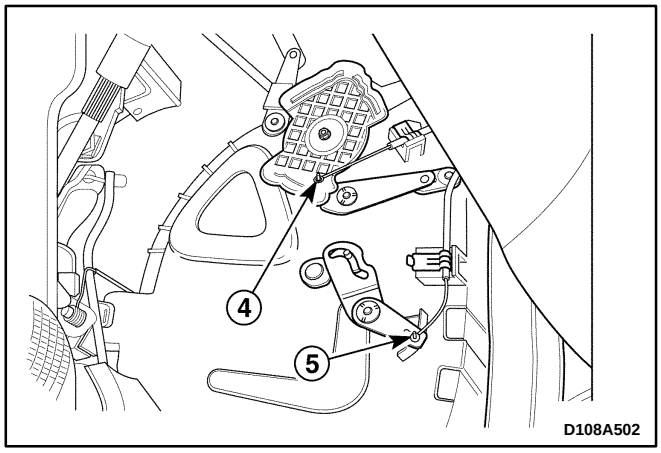
Blower Noise (Cont'd)

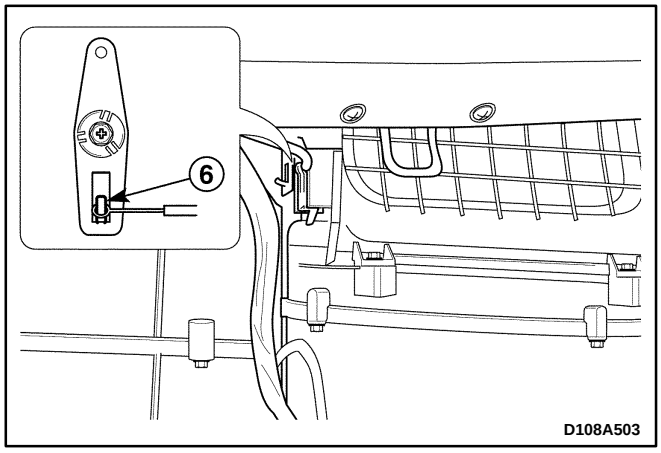
Step	Action	Value(s)	Yes	No
14	Is the noise present in the vent mode only?	–	Go to *Step 15*	Go to *Step 16*
15	1. Check the ducts for obstructions or foreign materials. 2. Remove any obstructions or foreign materials. 3. Check the vent door seals. 4. Repair or replace as needed. Is the repair complete?	–	System OK	–
16	Is the noise present in all modes, but not all temperature positions?	–	Go to *Step 17*	Go to *Step 18*
17	1. Check the temperature door seals. 2. Repair or replace, as needed. Is the repair complete?	–	System OK	–
18	1. Check the system for obstructions or foreign materials between the fan and the temperature door. 2. Repair or replace, as needed. Is the repair complete?	–	System OK	Go to *Step 2*

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE





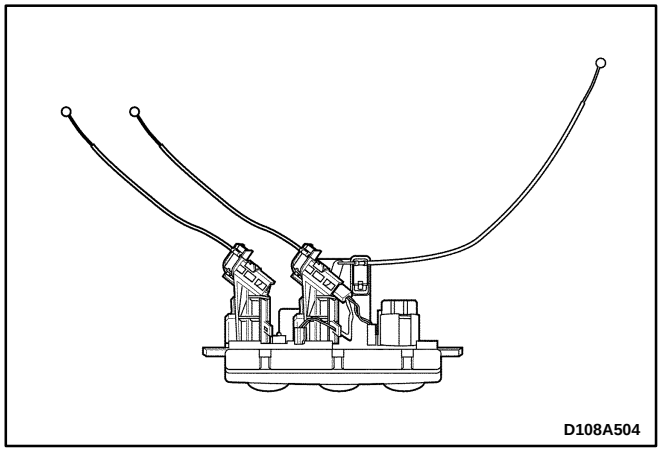


CONTROL ASSEMBLY AND CONTROL CABLES

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

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster housing trim panel. Refer to *Section 9E, Instrumentation/Driver information*.
3. Remove the control assembly.
   - Remove the control assembly retaining screws (1).
   - Separate the control assembly from the instrument panel (2).
   - Disconnect the electrical connectors (3).
   - Disconnect the mode control cable from the heater module (4).
   - Disconnect the temperature control cable from the heater module (5).
   - Remove the glove box from the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.
   - Disconnect the recirculating/fresh air door cable from the blower module (6).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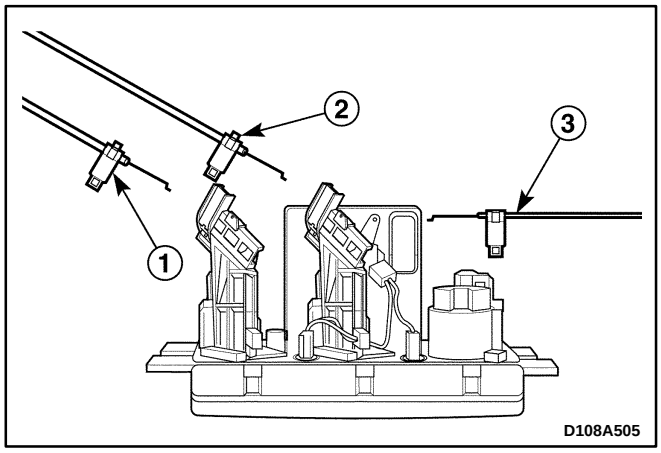

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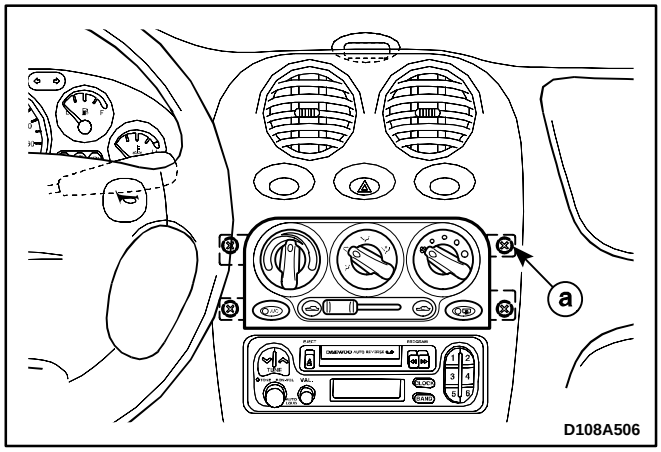

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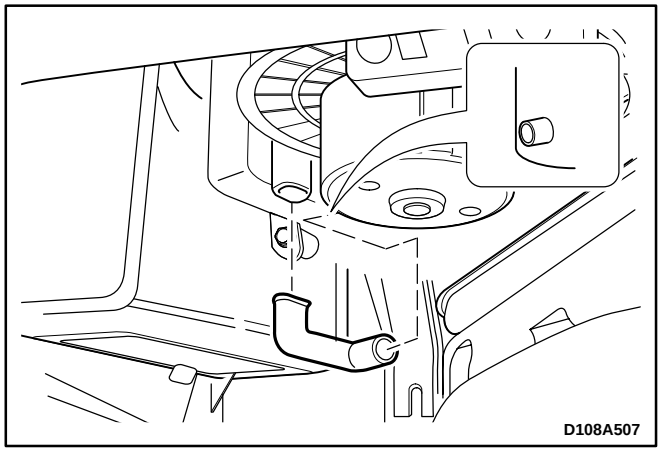
4. Disconnect the control cables from the control assembly.
   - Disconnect the temperature control cable (1).
   - Disconnect the mode control cable (2).
   - Disconnect the recirculating/fresh air door cable (3).

Installation Procedure

1. Connect the control cables to the control assembly.
2. Connect the recirculating/fresh air door cable to the blower module.
3. Install the glove box to the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.
4. Connect the temperature control cable and the mode control cable to the heater module.
5. Connect the electrical connectors.
6. Install the control assembly with the screws.
7. Install the instrument cluster housing trim panel. Refer to *Section 9E, Instrumentation/Driver Information*.
8. Connect the negative battery cable.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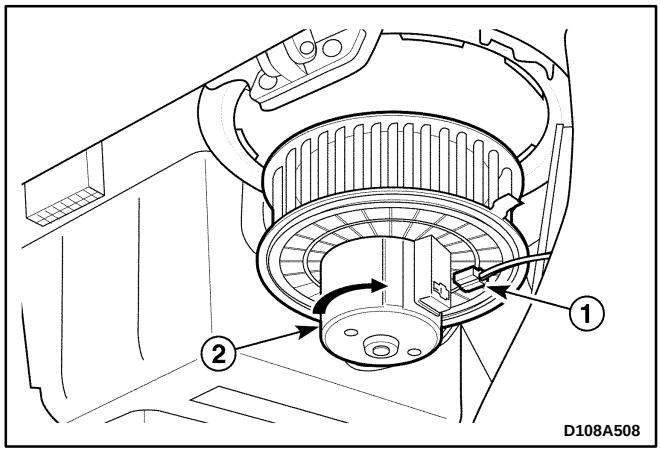
BLOWER MOTOR AND COOLING HOSE

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

Removal Procedure

1. Remove the blower motor cooling hose.



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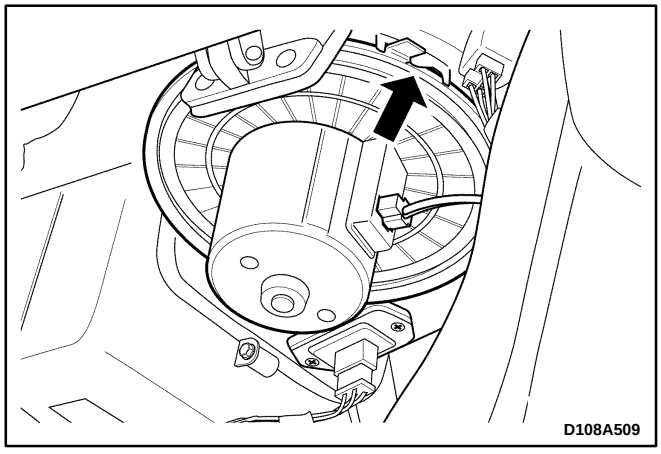
2. Remove the blower motor.
   - Disconnect the motor electrical connector (1).
   - Turn the blower motor (2).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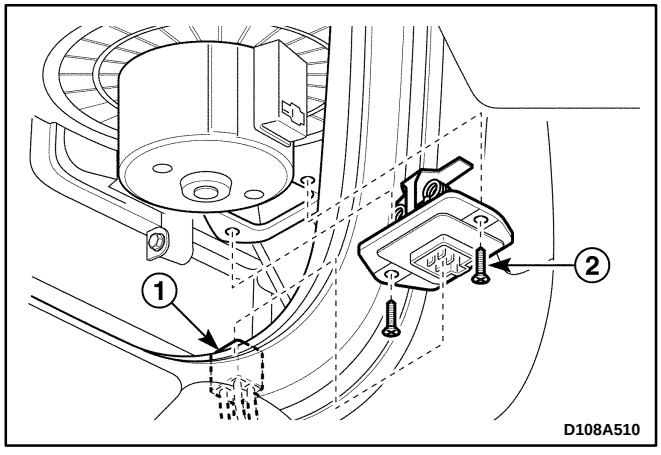
Installation Procedure

1. Install the blower motor by turning the motor clockwise.
2. Connect the motor electrical connector.
3. Install the blower motor cooling hose.



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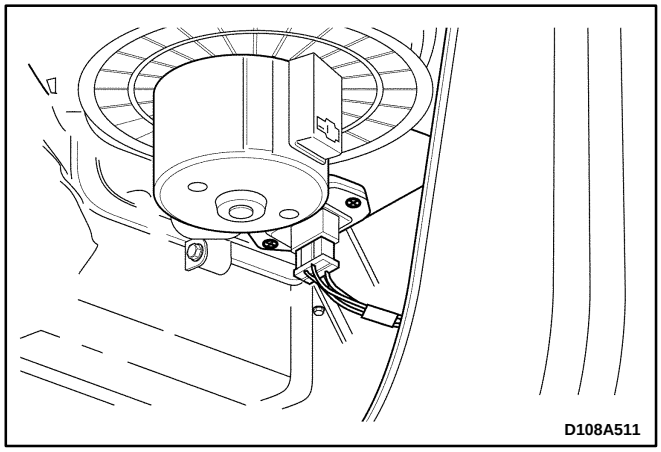
BLOWER RESISTOR

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

Removal Procedure

1. Remove the blower resistor.
   - Disconnect the blower resistor connector (1).
   - Remove the screws (2).



Installation Procedure

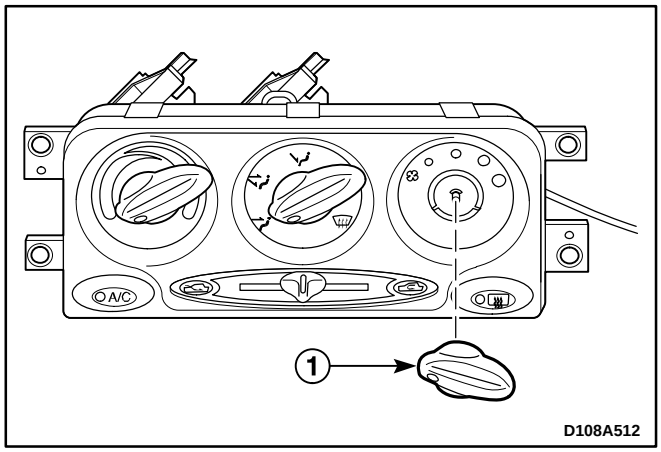
1. Install the blower resistor with the retaining screws.
2. Connect the blower resistor connector.

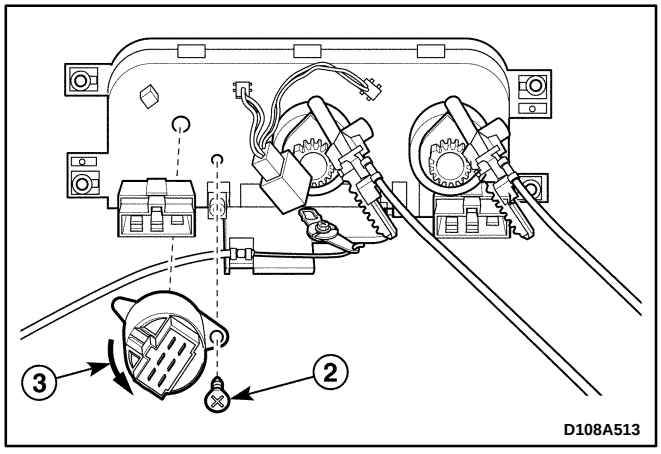
BLOWER MOTOR SWITCH

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

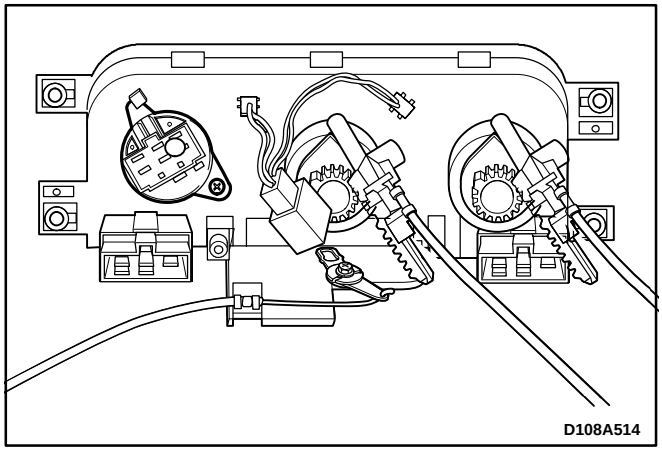
Removal Procedure

1. Remove the control assembly. Refer to “Control Assembly and Control Cables” in this section.
2. Remove the blower motor switch.
   - Remove the switch knob (1).



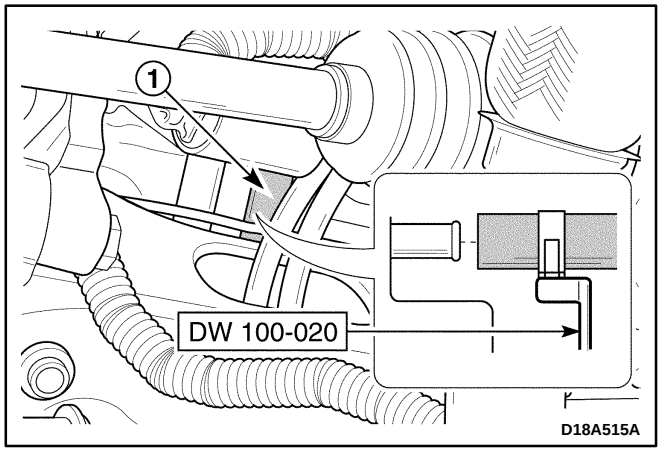


   - Remove the blower motor switch retaining screw (2).
   - Turn the blower motor switch anticlockwise (3).



Installation Procedure

1. Install the blower motor switch with the screw.
2. Install the switch knob.
3. Install the control assembly. Refer to “Control Assembly and Control Cables” in this section.



HEATER HOSES

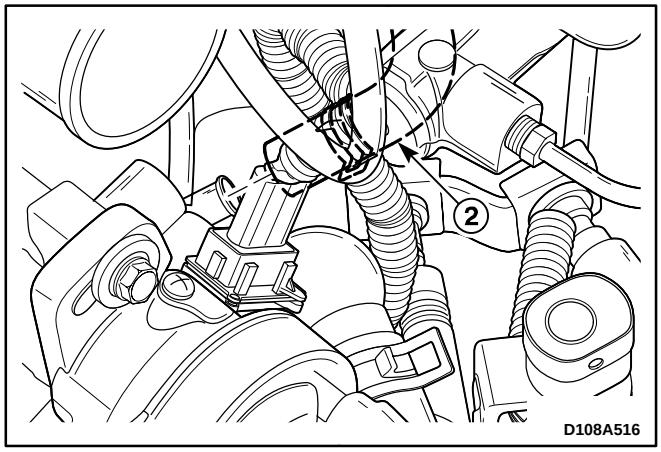
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Tool Required

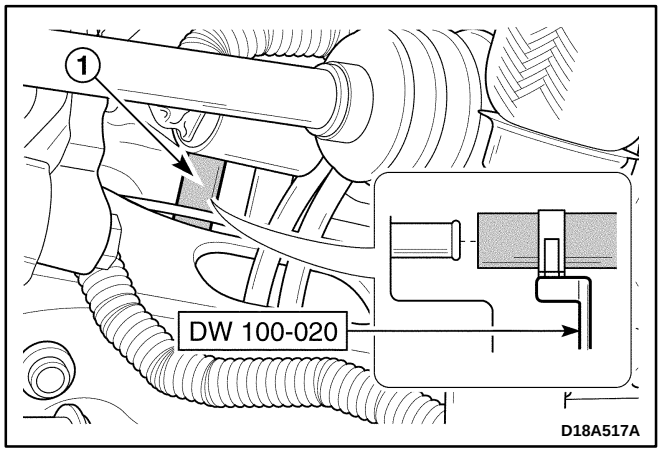
DW100–020 Hose Remover/Installer.

Removal Procedure

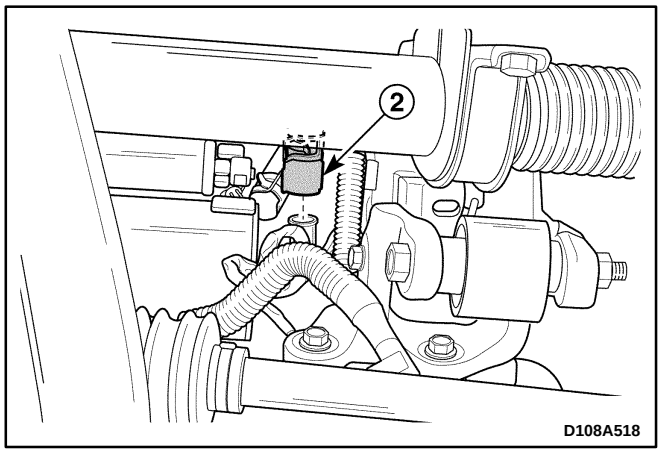
1. Disconnect the negative battery cable.
2. Drain the coolant.
3. Remove the heater inlet hoses.
   - Remove the air cleaner housing.
   - Raise and suitably support the vehicle.
   - Disconnect the hose from the heater module using a hose remover DW100–020 (1).



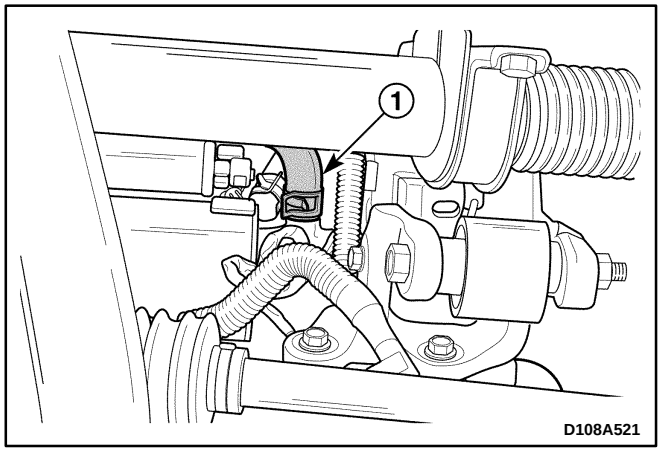
   - Lower the vehicle.
   - Disconnect the hose from the thermostat (2).



4. Remove the heater outlet hoses.
   - Raise and suitably support the vehicle.
   - Disconnect the hose from the heater module using a hose remover DW100–020 (1).
   - Disconnect the B^+ terminal from the starter. Refer to *Section 1E, Engine Electrical*.

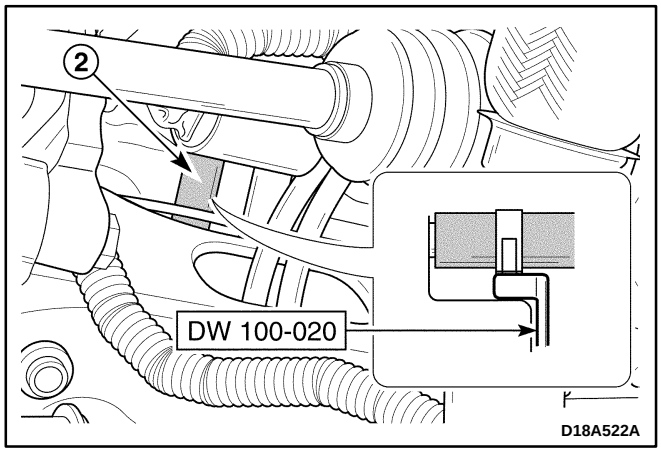


   - Disconnect the heater hose from the engine (2).

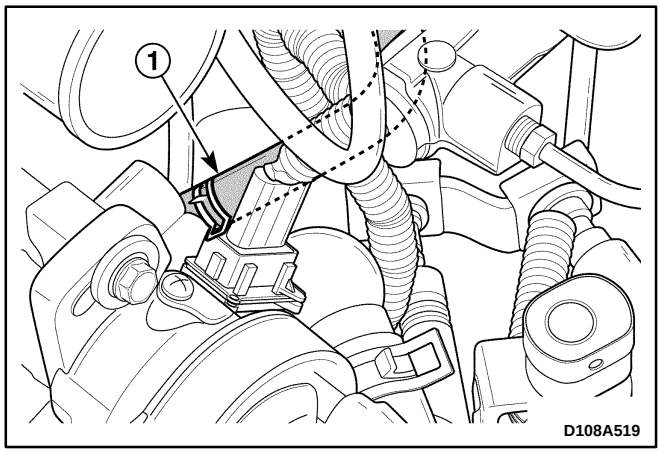


Installation Procedure

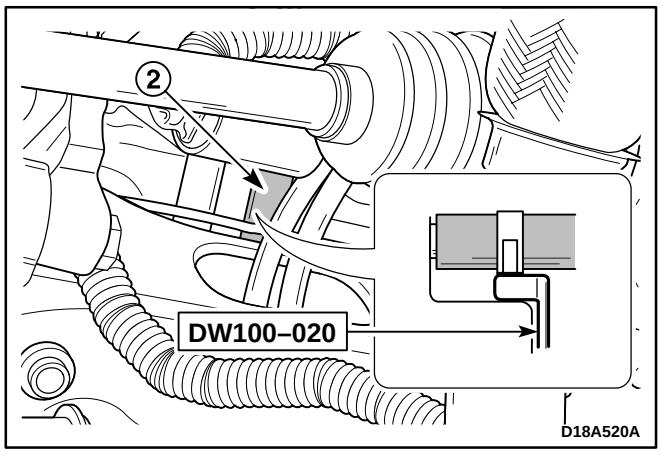
1. Install the heater outlet hoses.
   - Connect the heater hose to the engine (1).
   - Connect the B^+ terminal to the starter. Refer to *Section 1E, Engine Electrical*.



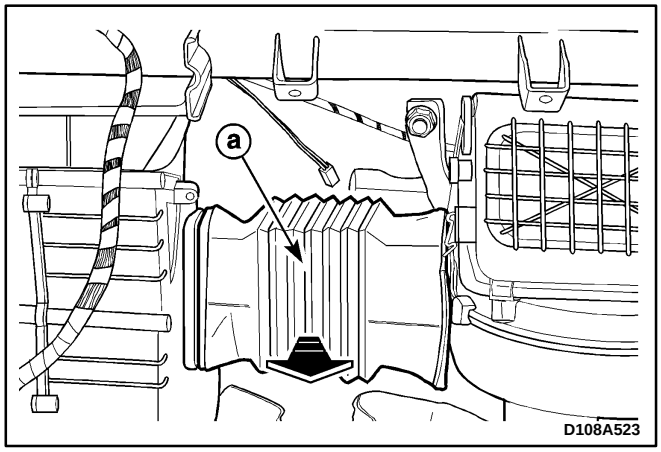
   - Connect the hose to the heater module using a hose installer DW100–020 (2).
   - Lower the vehicle.

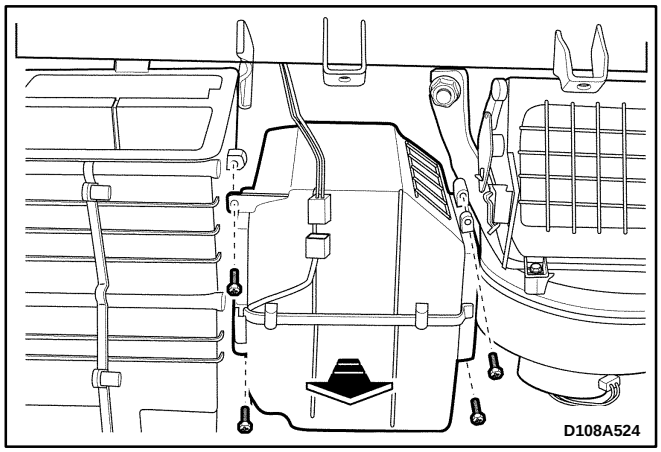


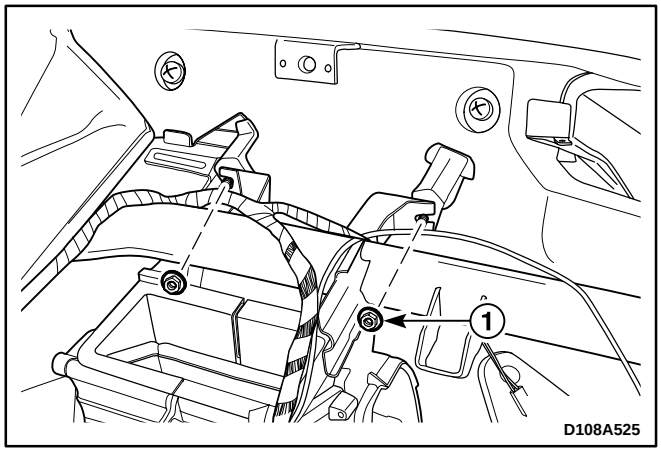
2. Install the heater inlet hoses.
   - Connect the hose to the thermostat (1).
   - Raise and suitably support the vehicle.

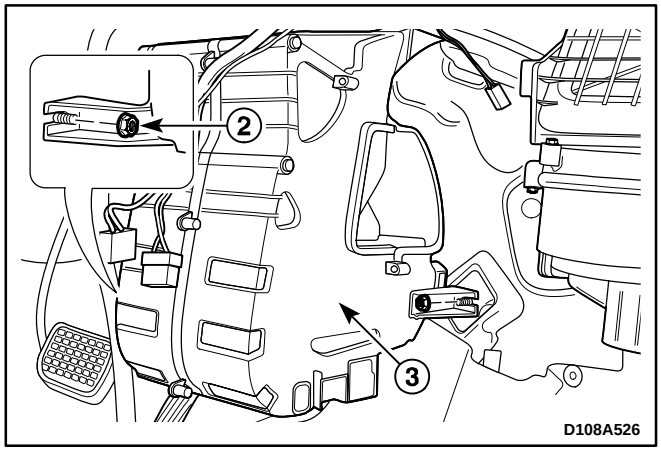


   - Connect the hose to the heater module using a hose installer DW100–020 (2).
   - Lower the vehicle.
   - Install the air cleaner housing.
3. Refill the coolant. Refer to *Section 1D, Engine Cooling*.
4. Connect the negative battery cable.







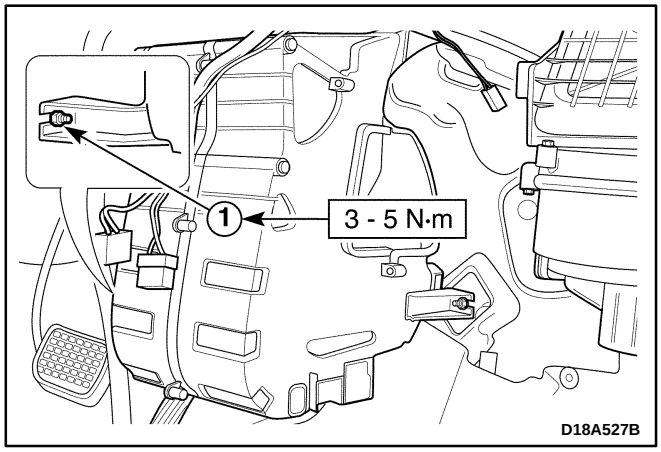


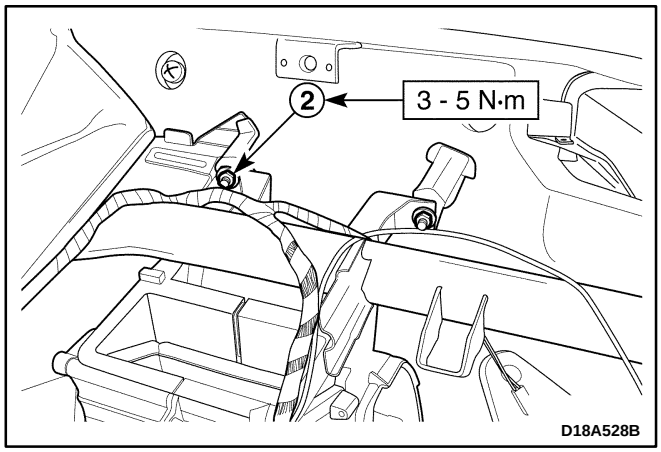
HEATER MODULE

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

Removal Procedure

1. Disconnect the heater hoses from the heater module. Refer to “Heater Hoses” in this section.
2. Remove the instrument panel and the lower tie bar center. Refer to *Section 9E, Instrumentation/Driver Information*.
3. Remove the heater module–to–blower module connection tube on the vehicle not equipped with A/C.
   a. Heater module–to–blower module connection tube.
4. Remove the evaporator on the vehicle equipped with A/C. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
5. Remove the heater module.
   - Remove the upper nuts (1).
   - Remove the lower nuts (2).
   - Remove the heater module (3).





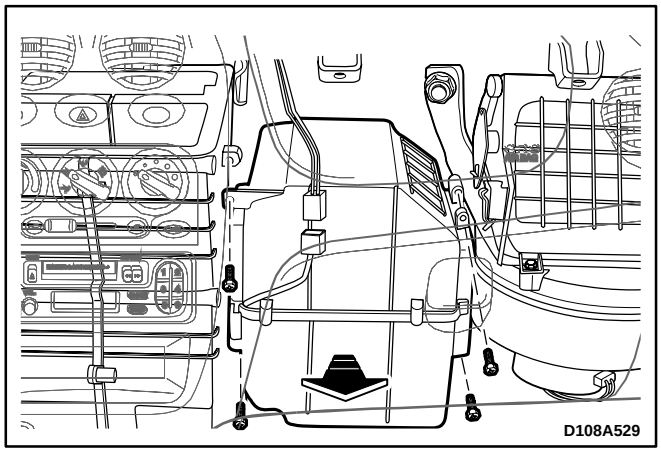
Installation Procedure

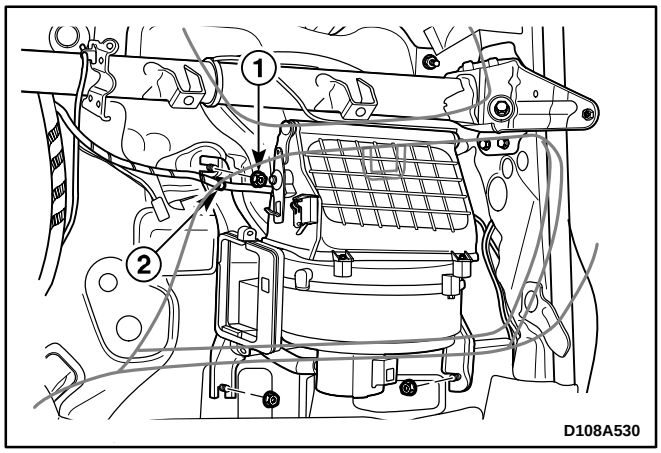
1. Install the heater module with the nuts.

   #### Tighten

   Tighten the heater module lower nuts to 3–5 N•m (27–44 lb-in) (1).

   Tighten the heater module upper nuts to 3–5 N•m (27–44 lb-in) (2).
2. Install the evaporator on the vehicle equipped with A/C. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
3. Install the heater module–to–blower module connection tube on the vehicle not equipped with A/C with the screw.
4. Install the instrument panel and the lower tie bar. Refer to *Section 9E, Instrumentation/Driver Information*.
5. Connect the heater hoses to the heater module. Refer to “Heater Hoses” in this section.



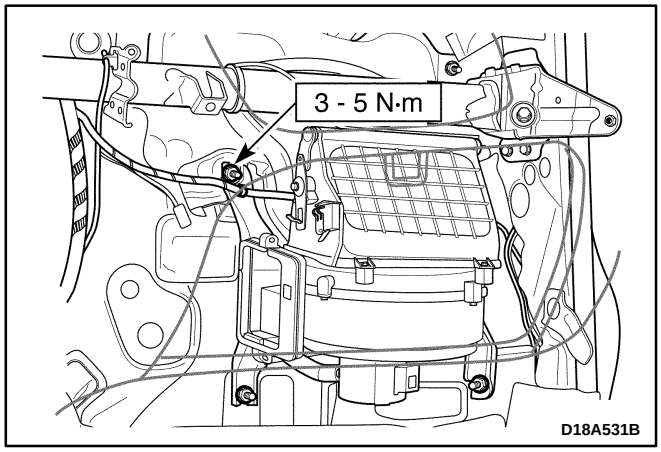


BLOWER MODULE

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

Removal Procedure

1. Remove the glove box from the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.
2. Remove the heater module–to–blower module connection tube on the vehicle not equipped with A/C. Refer to “Heater Module” in this section.
3. Remove the evaporator on the vehicle equipped with A/C. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
4. Remove the blower resistor. Refer to “Blower Resistor” in this section.
5. Disconnect the blower motor connector. Refer to “Blower Motor and Cooling Hose” in this section.
6. Remove the blower module.
   - Remove the nuts (1).
   - Disconnect the wiring harness (2).

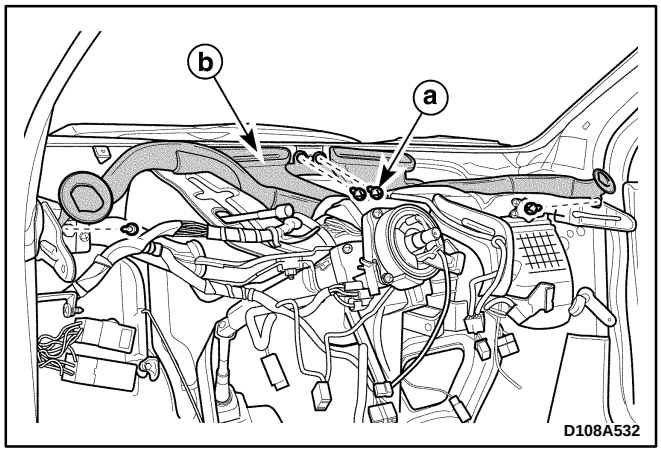


Installation Procedure

1. Install the blower module with the nuts.

   Tighten

   Tighten the blower module retaining nuts to 3–5 N•m (27–44 lb-in).
2. Connect the wiring harness.
3. Connect the blower motor connector. Refer to “Blower Motor and Cooling Hose” in this section.
4. Install the blower resistor. Refer to “Blower Resistor” in this section.
5. Install the evaporator on the vehicle equipped with A/C. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System*.
6. Install the heater module–to–blower module connection tube on the vehicle not equipped with A/C. Refer to “Heater Module” in this section.
7. Install the glove box to the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.

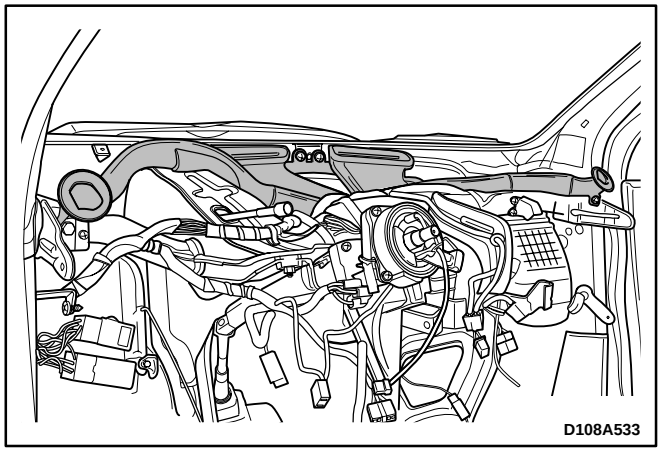


DEFROSTER DUCT AND HOSES

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

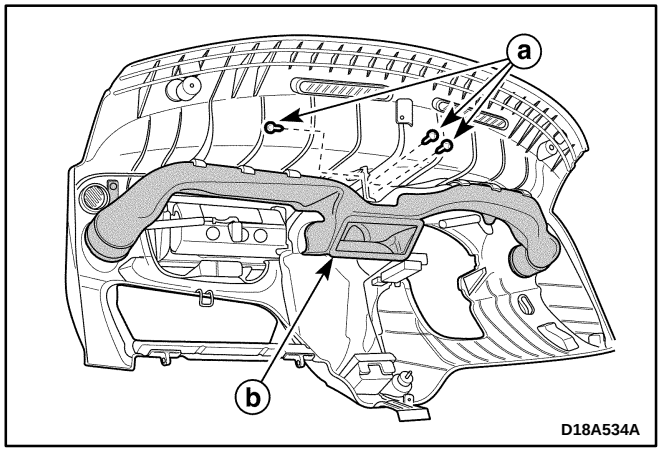
Removal Procedure

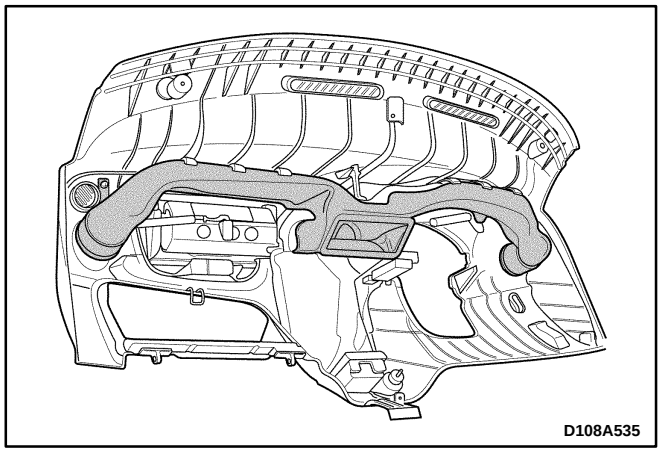
1. Remove the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.
2. Remove the defroster duct and hoses retaining screws.
   a. Retaining screw.
3. Remove the defroster duct and hoses.
   b. Defroster duct and hoses.



Installation Procedure

1. Install the defroster duct and hoses with the screws.
2. Install the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.





VENTILATION DUCT

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

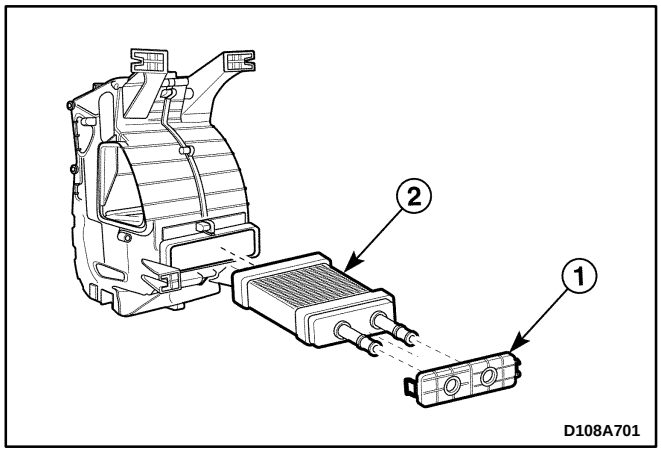
Removal Procedure

1. Remove the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.
2. Remove the ventilation duct retaining screws.
   a. Retaining screw.
3. Remove the ventilation duct.
   b. Ventilation duct.

Installation Procedure

1. Install the ventilation duct with the screws.
2. Install the instrument panel. Refer to *Section 9E, Instrumentation/Driver Information*.

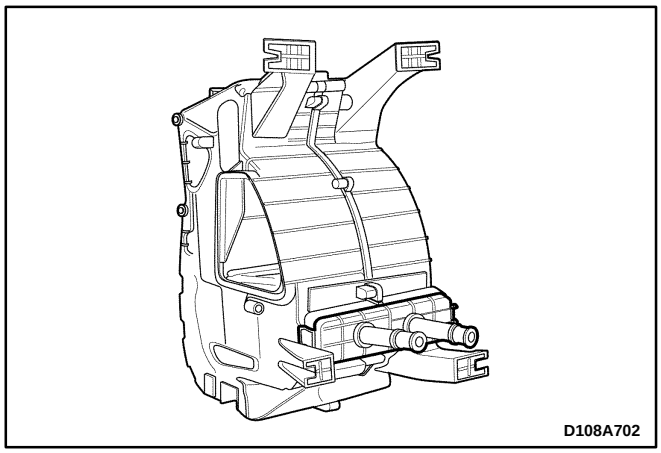
UNIT REPAIR



HEATER CORE

Disassembly Procedure

1. Remove the heater module. Refer to “Heater Module” in this section.
2. Remove the heater core.
   - Remove the heater core cover (1).
   - Remove the heater core (2).



Assembly Procedure

1. Install the heater core to the heater module.
2. Install the heater core cover.
3. Install the heater module. Refer to “Heater Module” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

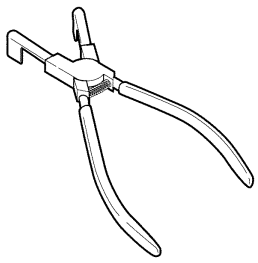
Application		Unit	Description
Maximum Heating Capacity		cal/h	7,300
Blower Motor Resistance	1 st	Ω	2.25 – 2.75
	2 nd	Ω	1.08 – 1.32
	3 rd	Ω	0.36 – 0.44
	4 th	Ω	–

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Heater Module Nuts	3 – 5	–	27 – 44
Blower Module Nuts	3 – 5	–	27 – 44

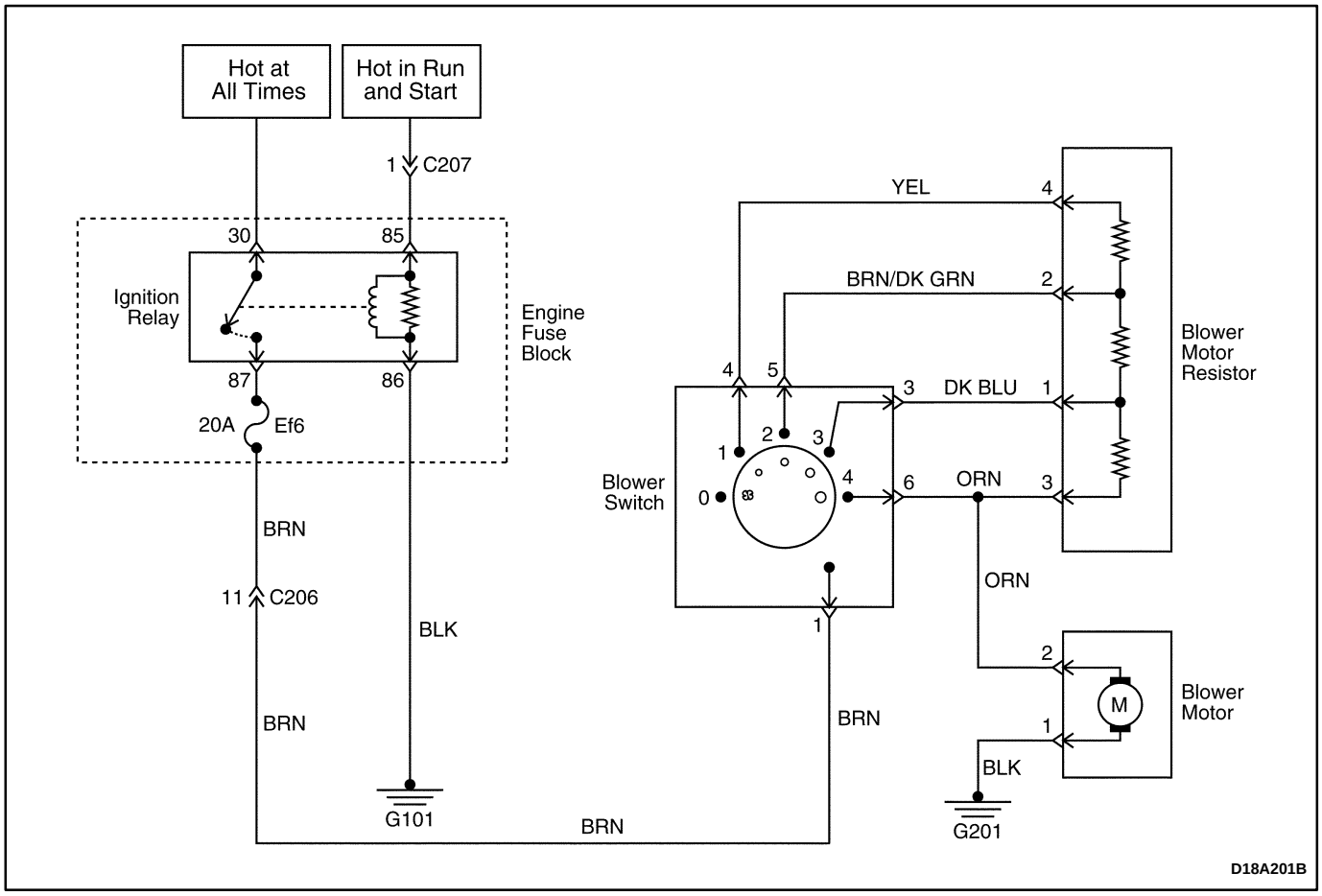
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D102B119	**DW 100–020** **Spring Clamp Remover/Installer**

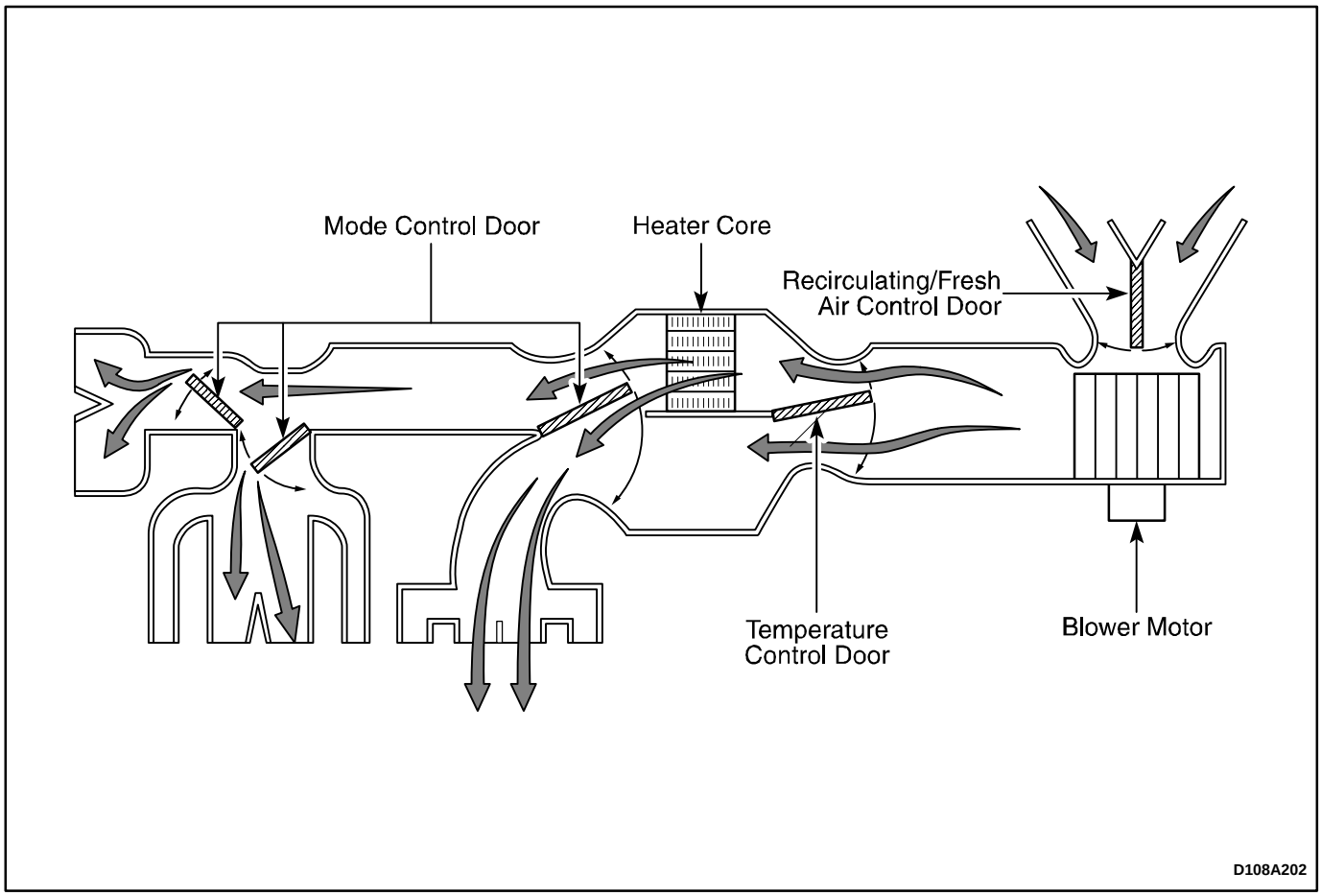
SCHEMATIC AND ROUTING DIAGRAMS

NON–A/C DIAGRAMS



AIR FLOW THROUGH DUCTS (NON–A/C)

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



SECTION 7B

MANUAL CONTROL HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM

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.

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DESCRIPTION AND OPERATION

SYSTEM COMPONENTS –FUNCTIONAL

Compressor

All compressors are belt–driven from the engine crankshaft through the compressor clutch pulley. The compressor pulley rotates without driving the compressor shaft until on electromagnetic clutch coils energized. When voltage is applied to energize the clutch coil, the clutch plate and hub assembly are drawn toward the pulley. The magnetic force locks the clutch plate and pulley together as one unit to drive the compressor shaft.

Condenser Core

The condenser assembly in front of the radiator consists of coils which carry the refrigerant and cooling fins that provide the rapid transfer of heat. The air passing through the condenser cools the high–pressure refrigerant vapor and cause it to condense into a liquid.

Expansion Valve

The expansion valve is located on the passenger compartment side of the dash panel. The expansion valve can fail in three different positions: open, closed, or restricted. An expansion valve that fails in the open position will result in a noisy A/C compressor or no cooling. The cause can be a broken spring, a broken ball, or excessive moisture in the A/C system. If the spring or the ball is found to be detective, replace the expansion valve. If excessive moisture is found in the A/C system, recycle the refrigerant. An expansion valve that fails in the closed position will result in low suction pressure and no cooling. This may be caused by a failed power done or excessive moisture in the A/C system. If the power dome on the expansion valve is found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system, recycle the refrigerant.

A restricted expansion valve will result in low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be cause, recycle the refrigerant, replace the expansion valve, and replace the receiver/dryer.

Evaporator Core

The evaporator is device which cools and dehumidifies the air before it enters the vehicle. High–pressure liquid refrigerant flows through the expansion tube (orifice) and becomes a low–pressure gas in the evaporator. The heat in the air passing through the evaporator core is transferred to the cooler surface of the core, which cools the air. As the process of heat transfer from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

Receiver–Dryer

The sealed receiver–dryer assembly is connected to the evaporator outlet pipe. It acts as a refrigerant storing container, receiving liquid and some vapor and refrigerant oil from the evaporator.

At the bottom the receiver–dryer is the desiccant, which acts as a drying agent for the moisture that may have entered the system. The receiver–dryer is serviceable only as an assembly.

Dual Cut Switch

The dual cut switch controls compressor operation when the cycling refrigerant pressure is dropped or surged.

Evaporator Thermistor

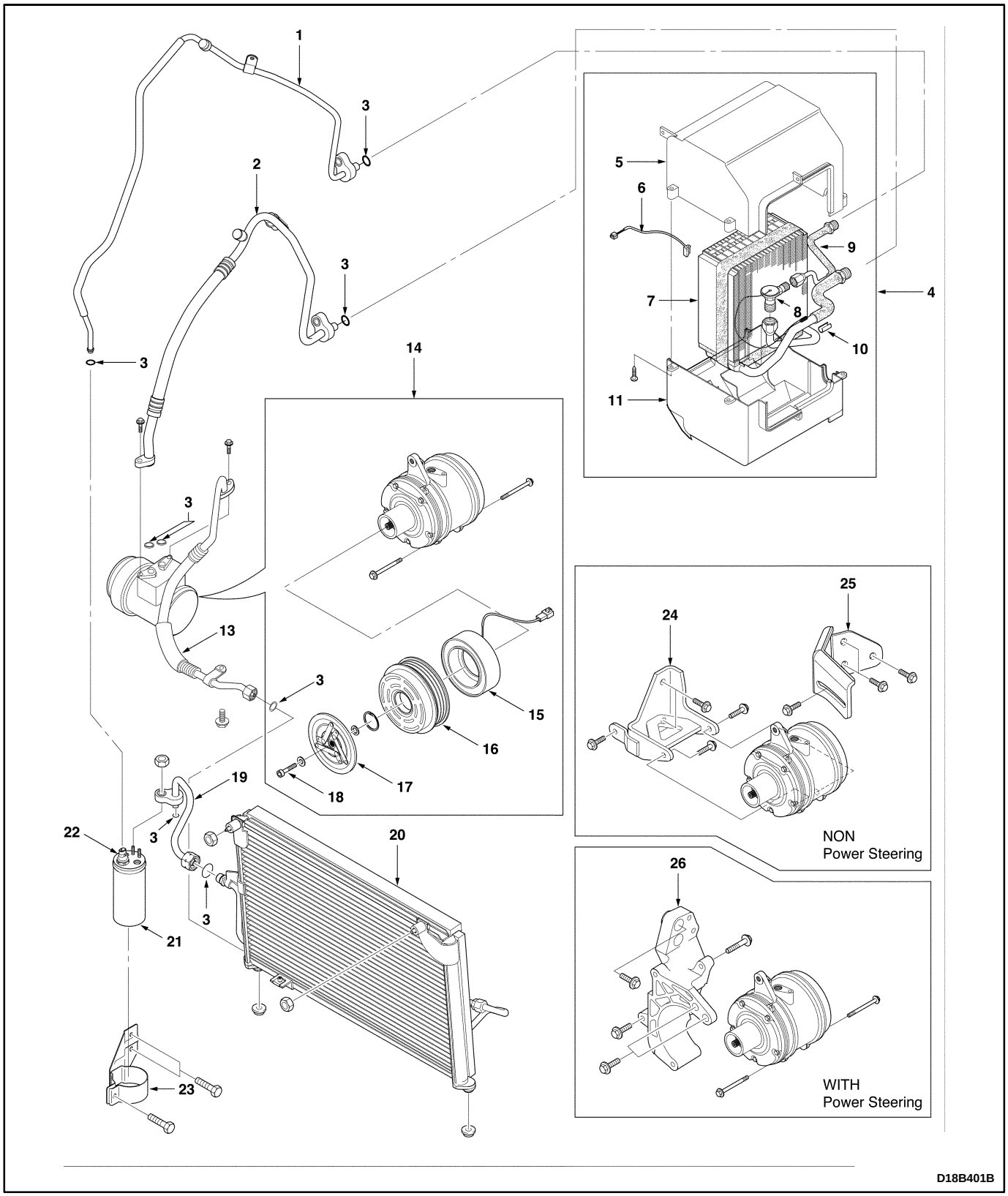
A semiconductor which resistance is noticeably changed as the change of temperature. When the refrigerant temperature of the evaporator drops to 0°C (32°F) and below, the evaporator cores get stuck with frost or ice, reducing the airflow, lowering the cooling capacity. The thermistor is a sensor which is used to prevent from frosting or icing.

The thermistor is installed on the evaporator.

COMPONENT LOCATOR

A/C SYSTEM

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



1. High Pressure Pipe (Receiver Dryer → Evaporator)
2. Low Pressure Hose (Evaporator → Compressor)
3. O–ring
4. Evaporator Module
5. Evaporator Upper Case
6. thermistor
7. Evaporator Core
8. Expansion Valve
9. Evaporator Inlet Pipe
10. Plate
11. Evaporator Lower Case
12. O–ring
13. High Pressure Pipe (Compressor → Condenser)
14. Compressor
15. Compressor Magnetic Clutch
16. Compressor Pulley
17. Compressor Clutch Drive
18. Shaft Bolt
19. High Pressure Pipe (Condenser → Receiver–Dryer)
20. Condenser
21. Receiver–Dryer
22. Dual Cut Switch
23. Receiver–Dryer Bracket
24. Compressor Bracket
25. Compressor Stay
26. A/C & Power Steering Bracket

DIAGNOSTIC INFORMATION AND PROCEDURES

GENERAL DIAGNOSIS

TESTING THE REFRIGERANT SYSTEM

If you suspect a problem in the refrigerant system, check for the following conditions:

1. Check the outer surfaces of the radiator and the condenser cores to be sure that the airflow is not blocked by dirt, leaves, or other foreign material. Check between the condenser and the radiator, as well as all outer surfaces.
2. Check for restrictions or kinks in the condenser core, the hoses, and the tubes.
3. Check the operation of the blower fan.
4. Check all the air ducts for leaks or restrictions. A low airflow rate may indicate a restricted evaporator core.
5. Check for slippage of the compressor clutch.
6. Check the drive belt tension.

INSUFFICIENT COOLING “QUICK CHECK” PROCEDURE

Perform the following “hand-feel” procedure to get a quick idea of whether the air conditioning (A/C) system has the proper charge of Refrigerant-134a.

1. Warm up the engine. Run the engine at idle.
2. Open the hood and all the doors.
3. Turn the A/C switch ON.
4. Set the temperature control to the full cold position.
5. Set the blower speed switch on 4.
6. “Hand-feel” the temperature of the evaporator outlet pipe. The pipe should be cold.
7. Check for other problems. Refer to “Testing the Refrigerant System” in this section.
8. Leak check the system. Refer to “Leak Testing the Refrigerant System” in this section. If you find a leak, discharge the system and repair the leak as required. After completing the repair, evacuate and charge the system.
9. If there is no leak, refer to “Insufficient Cooling Diagnosis” in this section.

PRESSURE-TEMPERATURE RELATIONSHIP OF R-134A

TEMPERATURE °C (°F)*	PRESSURE kPa (psig)*	TEMPERATURE °C (°F)*	PRESSURE kPa (psig)*
–8.89 (16)	105.70 (15.33)	37.78 (100)	856.84 (124.27)
–7.78 (18)	114.87 (16.66)	38.89 (102)	886.56 (128.58)
–6.67 (20)	124.32 (18.03)	40.00 (104)	916.35 (132.98)
–5.56 (22)	134.11 (19.45)	41.11 (106)	947.92 (137.48)
–4.44 (24)	144.24 (20.92)	42.22 (108)	979.64 (142.08)
–3.33 (26)	154.65 (22.43)	43.33 (110)	1012.11 (146.79)
–2.22 (28)	165.48 (24.00)	44.44 (112)	1045.21 (151.59)
–1.11 (30)	176.65 (25.62)	45.56 (114)	1079.14 (156.51)
0.00 (32)	188.16 (27.29)	46.67 (116)	1113.75 (161.53)
1.11 (34)	200.02 (29.01)	47.78 (118)	1149.12 (166.66)
2.22 (36)	212.30 (30.79)	48.89 (120)	1185.18 (171.89)
3.33 (38)	224.98 (32.63)	50.00 (122)	1222.07 (177.24)
4.44 (40)	238.08 (34.53)	51.11 (124)	1259.72 (182.70)
7.22 (45)	272.49 (39.52)	52.22 (126)	1298.12 (188.27)
10.00 (50)	309.58 (44.90)	53.33 (128)	1337.35 (193.96)
12.77 (55)	349.51 (50.69)	54.44 (130)	1377.35 (199.76)
15.56 (60)	392.33 (56.90)	57.22 (135)	1480.91 (214.78)
18.33 (65)	438.18 (63.55)	60.00 (140)	1589.57 (230.54)
21.11 (70)	487.27 (70.67)	62.78 (145)	1703.62 (247.08)
23.89 (75)	539.67 (78.27)	65.56 (150)	1823.04 (264.40)
26.67 (80)	609.38 (88.38)	68.33 (155)	1948.04 (282.53)
29.44 (85)	655.09 (95.01)	71.11 (160)	2078.77 (301.49)
32.22 (90)	718.39 (104.19)	73.89 (165)	2215.29 (321.29)
35.00 (95)	785.61 (113.94)	76.67 (170)	2357.81 (341.96)

* All values rounded to two decimal places.

EVAPORATOR RANGE: From –6.67 to 7.22°C (20 to 45°F), the temperatures represent the gas temperatures inside the coil and not on the coil surfaces. Add 1.67 to 5.56°C (3 to 10°F) the temperature for coil and air-off temperatures.

CONDENSER RANGE: From 110 to 160°F, temperatures are not ambient. Add 19.4 to 22.2°C (35 to 40°F) for proper heat transfer, then refer to the pressure chart.

Example: 32°C (90°F) ambient temperature
+ 22°C (40°F)
54°C (130°F)

Condenser temperature = 1379 kPa (200 psig)
Based on 48.3 km/h (30 mph) air flow.

LEAK TESTING THE REFRIGERANT SYSTEM

Test for leaks whenever you suspect a refrigerant leak in the system. You should also test for leaks whenever you perform a service operation which results in disturbing the lines or the connections. Leaks are commonly found at the refrigerant fittings or at the connections. Leaks are commonly caused by the following problems:

- Improper torque.
- Damaged O-ring seals.
- Dirt or lint on the O-ring seals.

Liquid Leak Detectors

Use a liquid leak detector solution on locations such as fittings. Apply the solution to the area in question with the swab that is supplied with the solution. Look for bubbles to appear. This will indicate the existence and location of any leak.

For areas where this is not practical, such as sections of the evaporator and the condenser, an electronic leak detector is more useful.

Electronic Leak Detectors

Follow the manufacturer's instructions for calibration, operation, and maintenance of an electronic leak detector. Battery condition is especially important to the accuracy of a portable model. Set the detector to R-134a before beginning the test.

Important: Electronic leak detectors are sensitive to windshield washing solutions, solvents and cleaners, and certain vehicle adhesives.

Surfaces must be clean to prevent false readings. Make sure that all surfaces are dry to prevent damage to the detector.

General Testing Instructions

- Follow the entire path of the refrigerant system.
- Completely circle each joint at 25 to 50 mm (1 to 2 inches) per second.
- Hold the probe tip within 6 mm (1/4 inch) of the surface.
- Do not block the air intake.

The audible tone changes from 1 to 2 clicks per second into a solid alarm if there is a leak. Adjust the balance control to maintain 1 to 2 clicks per second.

Test all of the following areas, even after one leak has been confirmed:

- Evaporator inlet and outlet.
- Receiver-drier inlet and outlet.
- Condenser inlet and outlet.
- Brazed and welded areas.
- Damaged areas.
- Hose couplings.
- Compressor rear head.
- All fittings and joints.

Testing Service Ports/Access Valves

The sealing cap is the primary seal for the service ports. This cap contains a special leak-free O-ring. Make sure that this cap is not missing or loose. Always use the correct cap.

Testing the Evaporator Core

Leaks in the evaporator core are difficult to find. Test the evaporator core using the following procedure:

1. Run the blower fan at speed setting 4 for at least 15 minutes.
2. Turn the blower to the OFF position.
3. Wait for 10 minutes.
4. Remove the blower motor resistor. Refer to "Blower Motor Resistor" in this section.
5. Insert the leak detector probe as close as possible to the evaporator core. The detector will indicate a leak with a solid alarm.
6. Use a flashlight to search for refrigerant oil in the core surface.

Testing the Compressor Shaft Seal

1. Blow shop air behind and in front of the compressor clutch/pulley for at least 15 seconds.
2. Wait 1 to 2 minutes.
3. Probe the area in front of the pulley. If the detector emits a solid alarm, there is a leak.

AIR CONDITIONING SYSTEM DIAGNOSIS

INSUFFICIENT COOLING DIAGNOSIS

Step	Action	Value(s)	Yes	No
1	Can you verify the customer complaint?	–	Go to *Step 2*	System OK
2	1. Check the fuses Ef14, Ef19, and Ef12. 2. Check the blower fan operation. 3. Check the engine cooling fan operation. 4. Check the A/C compressor belt. 5. Check the A/C condenser for restricted air flow. 6. Check the slippage of the compressor clutch. 7. Repair or replace any components as needed. 8. Check the A/C system operation. Is the A/C system operation normal?	–	System OK	Go to *Step 3*
3	1. Turn the ignition switch OFF. 2. Connect the high and the low pressure gauges. Are both pressures within the value specified?	Low Side Pressure: 200 kPa (29 Psi) High Side Pressure: 1,500 kPa (217.5 Psi)	Go to *Step 8*	Go to *Step 6*
4	Are both pressures above the specified value?		Go to *Step 5*	–
5	Are both pressures within the specified value?		Go to *Step 8*	–
6	Are both pressure below the specified value?		Go to *Step 7*	Go to *Step 4*
7	1. Add the refrigerant R–134a. 2. Check the A/C system for leaks. 3. Repair any refrigerant leaks as needed. 4. Recover, evacuate, and recharge the A/C system. Are both pressure within the specified value?		Go to *Step 8*	–
8	1. Start the engine and allow it to run at idle. 2. Set the A/C controls to following positions. ● The A/C switch to the ON position. ● The fresh air control switch to fresh air. ● The blower motor to 4. ● The temperature to full cold. Does the A/C compressor clutch engage?	–	Go to *Step 9*	Go to *Step 11*
9	1. Check for a knocking noise from the A/C compressor. 2. Cycle the A/C compressor ON and OFF in order to verify the source of the noise. Do you hear a loud knocking noise?	–	Go to *Step 10*	Go to *Step 14*
10	1. Recover the A/C system refrigerant. 2. Replace the A/C compressor. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. Is the repair complete?	–	Go to *Step 14*	–
11	1. Turn the ignition switch OFF. 2. Disconnect the A/C compressor clutch coil connector. 3. Connect a jumper wire from ground to one A/C compressor clutch coil terminal. 4. Connect a fused jumper wire from the positive battery terminal to the other A/C compressor clutch coil terminal. Does the A/C clutch engage?	–	Go to *Step 12*	Go to *Step 13*

Insufficient Cooling Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
12	Repair the electrical circuit to the A/C compressor clutch coil. Does the A/C clutch engage?	–	Go to *Step 20*	Go to *Step 13*
13	Replace the A/C compressor clutch coil. Does the A/C clutch engage?	–	Go to *Step 9*	Go to *Step 10*
14	**Important:** Perform this test under garage conditions; 21-32°C (70-90°F) and no sun load. Follow this test carefully for accurate results. 1. Close all of the windows and the doors of the vehicle. 2. Set the A/C controls to the following positions: ● The A/C switch to the ON position. ● The fresh air control switch to fresh air. ● The blower motor to 4. ● The temperature to full cold. 3. Start the engine and follow it to run at idle for 5 minutes. 4. Feel the evaporator inlet and outlet pipes. Is there a noticeable difference in the temperature of the evaporator inlet and outlet pipes?	–	Go to *Step 16*	Go to *Step 15*
15	1. Recover the A/C system refrigerant. 2. Replace the expansion valve as needed. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. 5. Note the discharge air temperature with the A/C ON. Is the discharge temperature normal?	–	Go to *Step16*	Go to *Step 18*
16	Feel the liquid pipe between the condenser and the expansion valve. Is the pipe cold?	–	Go to *Step 19*	Go to *Step 17*
17	1. Remove the restriction of the high pressure side. 2. Check the A/C system for leaks. Is the repair complete?	–	System OK	–
18	1. Recover the A/C system refrigerant. 2. Evacuate and recharge the A/C system. 3. Check the A/C system for leaks. Is the repair complete?	–	System OK	–
19	1. Run the engine at 3,000 rpm. 2. Close all of the windows and doors of the vehicle. 3. Set the A/C controls to the following positions: ● The A/C switch to the ON position. ● The fresh air control switch to fresh air. ● The blower motor to 4. ● The temperature to full cold. 4. Turn the A/C switch ON and OFF every 20 seconds for 3 minutes. Are the A/C compressor high and the low side pressures within the specified value of each other?	Low Side Pressure: 200 kPa (29 psi) High Side Pressure: 1,500 kPa (217.5 psi)	System OK	Go to *Step 22*

Insufficient Cooling Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Turn the ignition switch OFF. 2. Turn the A/C switch to the OFF position. 3. Attempt to turn the clutch driver (not the pulley). Can you turn the clutch driver freely by hand?	–	Go to *Step 23*	Go to *Step 21*
21	1. Recover the A/C system refrigerant. 2. Replace the A/C compressor. 3. Evacuate and recharge the A/C system. Is the repair complete?	–	System OK	–
22	1. Add the refrigerant R–134a. Does the cooling performance improve?	–	System OK	Go to *Step 23*
23	1. Recover the A/C system refrigerant. 2. Replace the compressor. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. Is the repair complete?	–	System OK	–

SYMPTOM DIAGNOSIS

PRESSURE TEST CHART (R-134A SYSTEM)

Condition	Related Symptons	Probable Cause	Correction
Discharge (high) Pressure Abnormally High	● After stopping the compressor, the pressure drops quickly, then falls gradually.	● There is air in the system.	● Recover, evacuate and recharge the system with the specified amount of refrigerant.
	● The condenser is excessively hot.	● There is excessive refrigerant in the system.	● Recover, evacuate and recharge the system with the specified amount of refrigerant.
	● Reduced or no air flow through the condenser.	● The condenser or the radiator fins are clogged.	● Clean the condenser or the radiator fins.
		● The condenser or the radiator fan is not working properly.	● Check the voltage and the fan rpm. ● Check the fan direction.
	● Line to the condenser is excessively hot.	● Restricted flow of refrigerant in the system	● Locate and repair the restriction.
Discharge Pressure Abnormally Low	● The condenser is not hot.	● Insufficient refrigerant in the system.	● Check the system for a leak. ● Charge the system.
	● High and low pressures are balanced soon after stopping the compressor. Low side pressure is higher than normal.	● Faulty compressor.	● Repair or replace the compressor.
	● The outlet of the expansion valve is not frosted, low pressure gauge indicates vacuum.	● Faulty expansion valve.	● Replace the expansion valve.
		● Moisture in the system.	● Recover, evacuate, and recharge the system.
Suction (low) Pressure Abnormally Low	● Condenser is not hot.	● Insufficient refrigerant in the system.	● Repair the leaks. Recover, evacuate, and recharge the system.
	● The expansion valve is not frosted and the low pressure line is not cold. Low pressure gauge indicates a vacuum.	● Frozen expansion valve.	● Replace the expansion valve.
		● Faulty expansion valve.	
	● Discharge temperature is low and the air flow from the vents is restricted.	● The evaporator is frozen.	● Clear the restricted evaporator case drain.
	● The expansion valve is frosted.	● The expansion valve is clogged.	● Clean or replace the expansion valve.
	● The receiver/dryer outlet is cool and the inlet is warm.	● The receiver/dryer is clogged.	● Replace the receiver/dryer.

Pressure Test Chart (R-134a System) (Cont'd)

Condition	Related Symptons	Probable Cause	Correction
Suction Pressure Abnormally High	• Low pressure hose and check joint are cooler than the temperature around the evaporator.	• The expansion valve is opened for too long.	• Replace the expansion valve.
	• Suction pressure is lowered when the condenser is cooled by water.	• There is excessive refrigerant in the system.	• Recover, evacuate, and recharge the system.
Suction and Discharge Pressure Abnormally High	• Reduced airflow through the condenser.	• The condenser or the radiator fins are clogged.	• Clean the condenser and the radiator.
		• The radiator cooling fans are not working properly.	• Check the voltage and the radiator cooling fan rpm. • Check the fan direction.
	• Condenser is excessively hot.	• There is excessive refrigerant in the system.	• Recover, evacuate, and recharge the system.
Suction and Discharge Pressure Abnormally Low	• Low pressure hose and metal end areas are cooler than the evaporator.	• Clogged or kinked low pressure hose.	• Repair or replace the low pressure hose.
	• Temperature around the expansion valve is low compared to that around the receiver/drier.	• The high pressure line is clogged.	• Repair or replace the high pressure line.
Refrigerant Leaks	• The compressor clutch is dirty.	• The compressor shaft seal is leaking.	• Repair or replace the compressor.
	• The compressor bolts are dirty.	• Leaking around a compressor housing bolt.	• Tighten the bolt(s) or replace the compressor.
	• The compressor gasket is wet with oil.	• The compressor gasket is leaking.	• Repair or replace the compressor.
	–	• Poor tightening in the system.	• Retighten the connection (coupling, bolt etc.)
	–	• O–ring is faulty.	• Replace the O–ring.

REPAIR INSTRUCTIONS ON-VEHICLE SERVICE

GENERAL A/C SYSTEM SERVICE PROCEDURES

O-RING REPLACEMENT

Important: Even though O-rings may look identical, it is extremely important that only recommended service replacement air conditioning O-rings be used, or excessive leakage of refrigerant may occur.

Important: Always slip the O-ring onto the flange tube to ensure proper locating and sealing.

Install new DAEWOO-approved service replacement air conditioning O-rings whenever a joint or a fitting is disassembled, except when the O-rings are provided on new components.

When replacing O-rings on an air conditioning component or a joint connection, the fitting design should be identified to ensure installation of the correct air conditioning service replacement O-ring.

Before installation, verify that both O-rings and fittings have not been nicked or deformed. Deformed or nicked parts must be replaced. Failure to use the proper service replacement parts and procedures may result in excessive refrigerant leakage.

HANDLING REFRIGERANT

Caution: Always work in a well-ventilated area and avoid breathing any refrigerant fumes. If you have difficulty breathing, seek medical attention immediately. If refrigerant comes in contact with any part of your body, flush the exposed area with water. If a rash or pain develops, seek medical attention.

Air conditioning systems contain refrigerant. This is a chemical mixture which requires special handling procedures to avoid personal injury.

Always wear goggles and wrap a clean cloth around the fittings, the valves and the connections when performing work that involves opening the refrigerant system. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.

All refrigerant drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and the safety plug from damage. It is good practice to replace the cap after each use of the drum.

If it is necessary to transport or carry any container of refrigerant in a vehicle, do not carry it in the passenger compartment.

HANDLING OF REFRIGERANT LINES AND FITTINGS

Notice: Using too low or too high torque when tightening a fitting can result in loose joints or deformed joint parts. Both conditions can result in refrigerant leakage.

- Keep all metal tubing lines free of dents or kinks. Any line restrictions will cause the loss of system capacity.
- Never bend a flexible hose line to a radius of less than four times the diameter of the hose.
- Never allow a flexible hose line to come near the exhaust manifold.
- Inspect flexible hose lines regularly for leaks or brittleness.
- Replace flexible hose lines with new lines if you find signs of deterioration or leaking.
- Discharge the refrigeration system of all refrigerant before disconnecting any fitting in the refrigeration system.
- Proceed very cautiously regardless of the gauge readings.
- Open the fittings very slowly.
- Keep your face and your hands away from the fitting so that you will not be injured if there happens to be liquid refrigerant in the line.
- If you notice pressure when you loosen a fitting, allow the pressure to bleed off as described under “Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System” in this section.
- Cap or tape any refrigerant line immediately after it is opened. This will prevent the entrance of moisture and dirt, which can cause internal compressor wear or plugged lines in the condenser, the evaporator core, the expansion valve or the compressor inlet screens.

Important: Use two proper wrenches to connect the O-ring fittings.

- Back up the opposing fitting to prevent distortion of the connecting lines or the components.
- Back up both the swaged fitting on the flexible hose connections and the coupling to which it is attached with two wrenches to prevent turning the fitting and damaging the ground seat.
- Keep the O-rings and the seats in perfect condition. A burr or a piece of dirt may cause a refrigerant leak.
- Dip new O-rings in clean PAG refrigerant oil before installation.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation and life of the air conditioning system is dependent upon the chemical stability of the refrigeration system. When foreign materials, such as dirt, air, or moisture, contaminate the refrigeration system, they will change the stability of the refrigerant and the PAG compressor oil. They will also affect the pressure-temperature relationship, reduce efficient operation, and can possibly cause interior corrosion and abnormal wear of moving parts.

Observe the following practices to ensure chemical stability in the system:

- Wipe away dirt or oil at and near any connection before opening that connection. This will reduce the chance of dirt entering the system.
- Cap, plug, or tape both sides of a connection as soon as possible after opening the connection. This will prevent the entry of dirt, foreign material, and moisture.
- Keep all tools clean and dry, including the manifold gauge set and all replacement parts.
- Use a clean and dry transfer device and container to add PAG refrigerant oil. This will ensure that the oil remains as moisture-free as possible. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System” in this section.
- Have everything you need ready to allow you to perform all operations quickly when opening an A/C system. Do not leave the A/C system open any longer than necessary.
- Evacuate and recharge any A/C system that has been opened. Refer to “Discharging, Adding Oil, Evacuating and Charging Procedures for A/C System” in this section for the instructions to perform this procedure properly.

All service parts are dehydrated and sealed before shipping. They should remain sealed until just before making connections. All the parts should be at room temperature before uncapping. This prevents condensation of moisture from the air from entering the system. Reseal all parts as soon as possible if the caps have been removed but the connections cannot be made promptly.

DISCHARGING, ADDING OIL, EVACUATING, AND CHARGING PROCEDURES FOR A/C SYSTEMS

Caution: Use only refillable refrigerant tanks that are authorized for the charging station being used. The use of other tanks may cause personal injury or void the warranty. Refer to the manufacturer’s instructions for the charging station.

Caution: To avoid personal injury, always wear goggles and gloves when performing work that involves opening the refrigeration system.

A charging station discharges, evacuates, and recharges an air conditioning system with one hook-up. Filtering during the recovery cycle together with filtering during the evacuation cycle ensures a supply of clean, dry refrigerant for A/C system charging.

Notice:

- Never use the R-134a charging station on a system charged with R-12. The refrigerants and the oils are not compatible and must never be mixed in even the smallest amount. Mixing refrigerant residue will damage the equipment.
- Never use adapters which convert from one size fitting to another. This will allow contamination which may cause system failure.

Charging Station Setup and Maintenance

Refer to the manufacturer’s instructions for all initial setup procedures and all maintenance procedures. There are many charging stations available. All perform the various tasks required to discharge the system and recover refrigerant, evacuate the system, add a measured amount of oil, and recharge an air conditioning system with a measured amount of refrigerant.

Control Panel Functions

A charging station will have controls and indicators to allow the operator to control and monitor the operation in progress. Refer to the manufacturer’s instructions for details. These can be expected to include:

1. Main Power Switch: The main power switch supplies electrical power to the control panel.
2. Display: The display shows the time programmed for vacuum and the weight of the refrigerant programmed for recharging. Refer to the manufacturer’s instructions for detailed programming information.
3. Low Side Manifold Gauge: This gauge shows the system’s low side pressure.
4. High Side Manifold Gauge: This gauge shows the system’s high side pressure.
5. Controls: This will contain the controls that control various operating functions.
6. Low Side Valve: This valve connects the low side of the A/C system to the unit.
7. Moisture Indicator: This indicator shows if the refrigerant is wet or dry.
8. High Side Valve: This valve connects the high side of the A/C system to the unit.

Refrigerant Recovery

Important: Use only a refrigerant tank that is designed for the charging station in use. The unit's overfill limitation mechanism is calibrated specifically for use with this tank. The tank's valves are also specifically for this unit.

1. Attach the high side hose with the quick disconnect coupler to the high side fitting of the vehicle's A/C system.
2. Open the coupler valve after attachment.
3. Attach the low side hose with the quick disconnect coupler to the low side fitting of the vehicle's A/C system.
4. Open the coupler valve after attachment.
5. Check the high side and the low side gauges on the unit's control panel in order to ensure that the A/C system has pressure. If there is no pressure, there is no refrigerant in the system to recover.

Important: If there is no refrigerant in the system, do not continue with the recovery operation. This will draw air into the recovery tank.

6. Open both the high side and the low side valves.
7. Open the gas and the liquid valves on the tank.
8. Drain any oil that may be in the oil separator.
9. Close the oil drain valve.
10. Plug the unit into the proper voltage outlet.
11. Turn on the main power switch.

Notice: Never reuse refrigerant oil. Damage to the A/C system may result. Dispose of the refrigerant oil properly.

12. Begin the recovery process. Refer to the manufacturer's instructions for the charging station in use.

Important: Some A/C system PAG lubricating oil may be removed with the refrigerant during recovery. The amount of oil removed varies. A charging station separates the oil from the refrigerant and allows a means of determining how much oil was removed. Replace the same amount of oil when you recharge the system. Refer to the manufacturer's instructions for the charging station in use.

13. Wait 5 minutes. Check the control panel low side gauge. If the A/C has maintained vacuum, the recovery is complete.
14. There is more refrigerant in the system if the low side gauge pressure rises above zero. Recover the additional refrigerant. Repeat this step until the system maintains vacuum for two minutes.

Important: If the control indicator shows that the refrigerant tank is full during the recovery process and the unit shuts off, install an empty unit tank to store the refrigerant needed for steps later in the procedure. Do not use any other type of tank.

Evacuation

The unit tank must contain a sufficient amount of R-134a refrigerant for charging. Check the amount of refrigerant in the tank. If there is less than 3.6 kg (8 pounds) of refrigerant, add new refrigerant to the tank. Refer to the manufacturer's instructions for adding refrigerant.

1. Verify that the high side and the low side hoses are connected to the A/C system. Open both the high side and the low side valves on the unit's control panel.
2. Open both the gas and the liquid valves on the tank.

Important: Refer to the manufacturer's instructions for the charging station in use. It is necessary to evacuate the system before recharging it with new or recycled refrigerant.

3. Start the vacuum pump and begin the evacuation process. Non-condensable gases (mostly air) are automatically vented from the tank during the recycling process. You may hear the pressure being released.
4. Check for leaks in the system. Refer to the manufacturer's instructions for the charging station in use.

Important:

- Change the vacuum pump oil frequently. Refer to the manufacturer's instructions for the charging station in use.

A/C System Oil Charge Replenishing

Any oil removed from the A/C system during the recovery process must be replenished at this time.

1. Use the correct graduated bottle of polyalkaline glycol (PAG) oil for the R-134a system.

Important:

- Keep the oil bottles tightly capped at all times to protect the oil from moisture and contamination.
- Never open the oil injection valve while there is positive pressure in the A/C system. This will result in oil blow-back through the bottle vent. You must have A/C system vacuum for this operation.
- Never let the oil level drop below the pick-up tube while charging or replenishing the system. This will allow air into the A/C system.

2. Refer to the manufacturer's instructions for the charging station in use. Add the proper amount of PAG oil to the system.
3. Close the valve when the required oil charge has been pulled into the system.

Charging

Important: Evacuate the air conditioning system before charging.

1. Close the low side valve on the control panel.
2. Open the high side valve on the control panel.

3. Refer to the manufacturer's instructions for the charging station in use.
   - Enter the amount of refrigerant needed to charge the A/C. Be sure that you are using the correct system of measurement (kg, lb).
   - Begin the charging process.

Successful Transfer Complete

1. Close the high side valve on the unit's control panel. Both valves should be closed.
2. Start the vehicle and the A/C system.
3. Let the engine run until the readings on the high side and low side gauges stabilize.
4. Compare the readings to the system specifications.
5. Check the evaporator outlet temperature to ensure that the A/C system is operating within the system specifications.
6. Keep the A/C running.
7. Close the high side coupler valve.
8. Disconnect the high side hose from the vehicle.
9. Open the high side and low side valves on the control panel.
10. The system will quickly draw in refrigerant from both hoses through the low side hose.
11. Close the low side coupler valve.
12. Disconnect the low side hose from the vehicle.

Unsuccessful Transfer

Sometimes the total charge does not transfer into the A/C system. There are two reasons why this may occur.

1. The pressure in the unit's tank and the pressure in the A/C system are roughly equal. This will cause the transfer to proceed too slowly. Refer to the manufacturer's instructions for the charging station in use.
2. There was not enough refrigerant in the unit's tank to transfer the full charge. It is necessary to recover the partial charge of refrigerant from the vehicle and evacuate and charge the A/C system again. Refer to the manufacturer's instructions for the charging station in use.

SERVICEABLE COMPONENTS

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

CONTROL ASSEMBLY AND CONTROL CABLES

To remove the control assembly and control cables, refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

BLOWER MOTOR AND COOLING HOSE

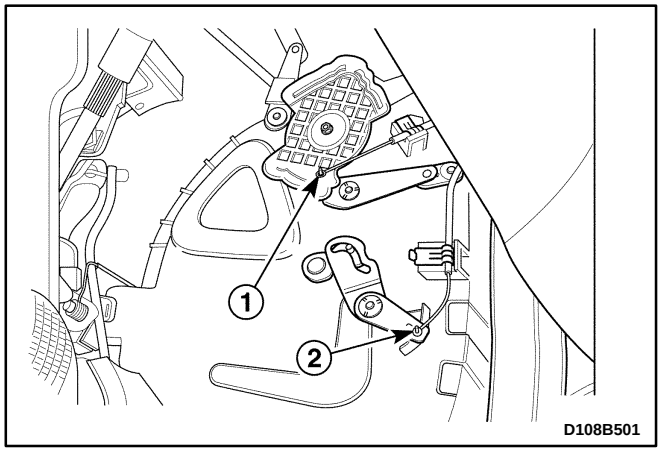
To remove the blower motor and cooling hose, refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

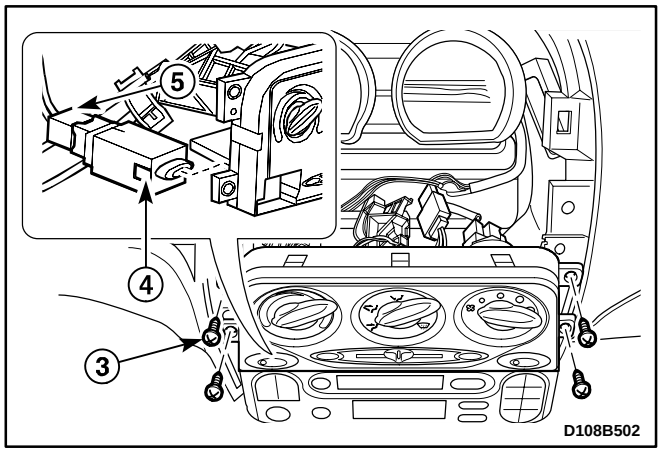
BLOWER RESISTOR

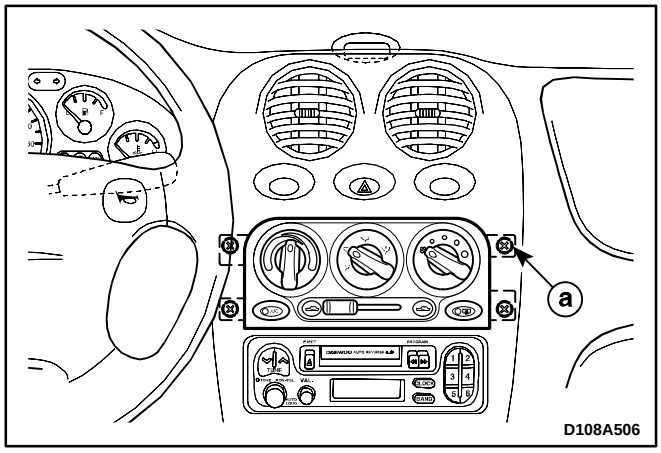
To remove the blower resistor, refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*

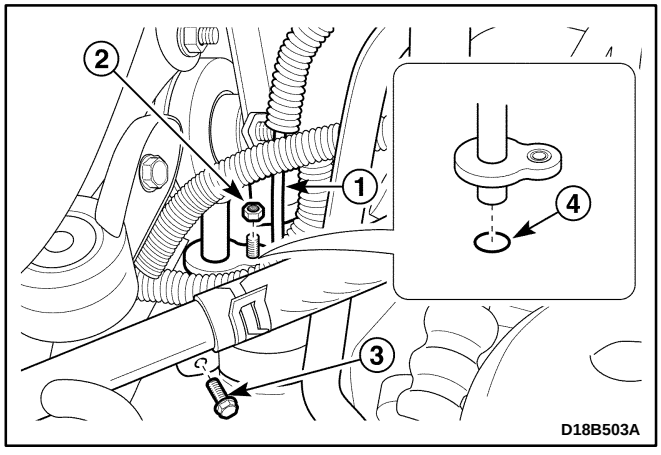
BLOWER MOTOR SWITCH

To remove the blower motor switch, refer to *Section 7A, Heating and Ventilation System (Without Air Conditioning).*









A/C PUSH KNOB

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

Removal Procedure

1. Remove the instrument cluster housing trim panel. Refer to *Section 9E, Instrumentation/Driver Information.*
2. Remove the A/C push knob.
   - Disconnect the temperature control cable from the heater module (1).
   - Disconnect the mode control cable from the heater module (2).
   - Remove the control assembly retaining screws (3).
   - Pull out the control assembly.
   - Remove the A/C push knob by pushing the knob lock (4).
   - Disconnect the A/C push knob electrical connector (5).

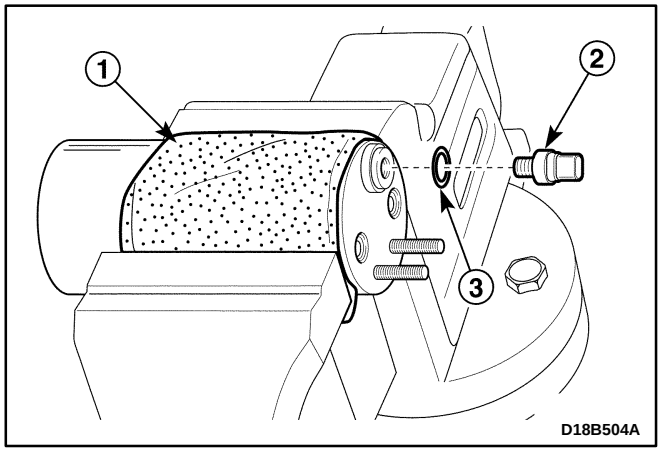
Installation Procedure

1. Install the A/C push knob to the control assembly.
2. Connect the A/C push knob electrical connector.
3. Install the control assembly with the screws.
4. Connect the mode control cable to the heater module.
5. Connect the temperature control cable to the heater module.
6. Install the instrument cluster housing trim panel. Refer to *Section 9E, Instrumentation / Driver Information.*

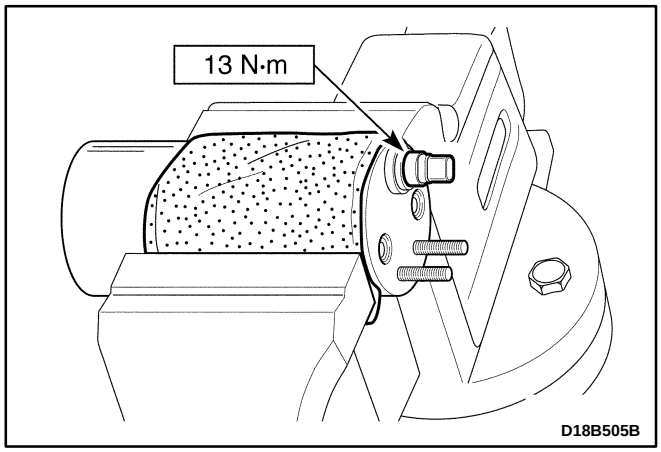
RECEIVER DRYER AND DUAL CUT SWITCH

Removal Procedure

1. Recover the refrigerant. Refer to “Discharging, Adding Oil, Evaculating, and Charging Procedures for A/C System” in this section.
2. Remove the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
3. Remove the receiver dryer.
   - Disconnect the dual cut switch connector (1).
   - Remove the receiver dryer flange nuts (2).
   - Remove the bracket bolt (3).
   - Discard the O–ring (4).

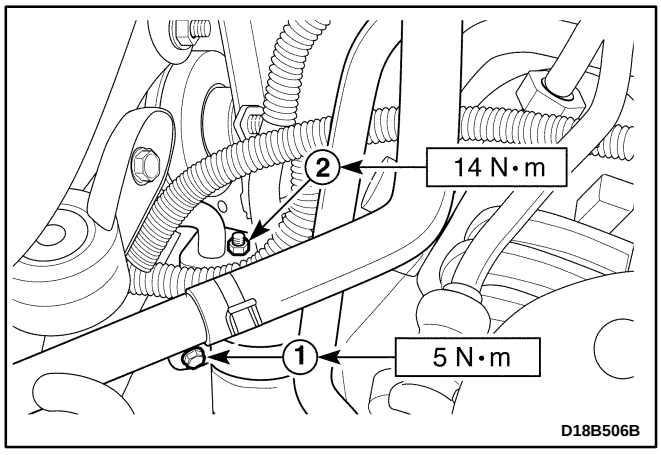


4. Remove the dual cut switch.
   - With the receiver dryer clothed, vise the receiver dryer (1).
   - Remove the dual cut switch (2).
   - Discard the O–ring (3).



Installation Procedure

1. Install the new O–ring.
2. Install the dual cut switch.
   Tighten the dual cut switch to 13 N•m (115 lb-in).



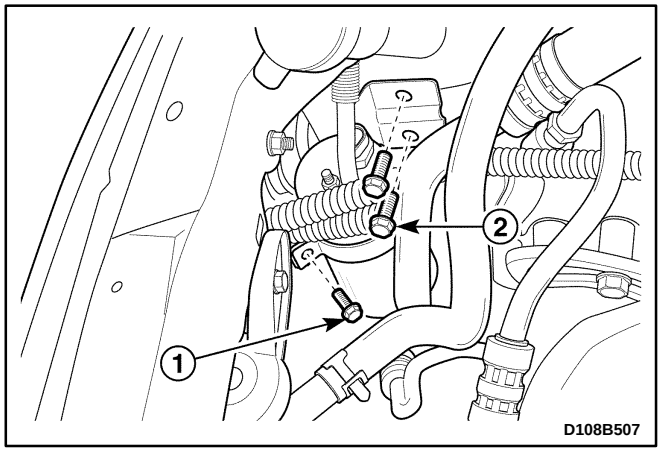
3. Install the receiver dryer.
   - Install the new O–rings.
   - Install the bracket bolt (1).

   ### Tighten

   Tighten the bracket bolt to 5 N•m (44 lb-in).
   - Install the receiver dryer flange nuts (2).

   ### Tighten

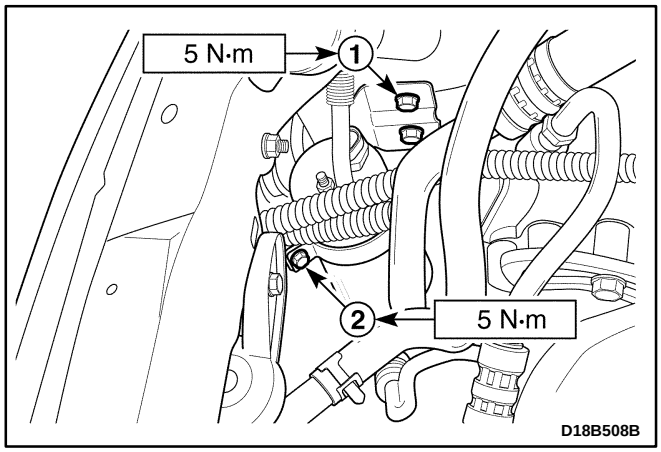
   Tighten the receiver dryer flange nut to 14 N•m (10.5 lb-ft).
   - Connect the dual cut switch connector.
4. Install the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
5. Evacuate and recharge the system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.



RECEIVER DRYER BRACKET

Removal Procedure

1. Remove the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
2. Remove the receiver dryer bracket.
   - Remove the receiver dryer bracket bolt (1).
   - Remove the receiver dryer bracket–to–body bolts (2).



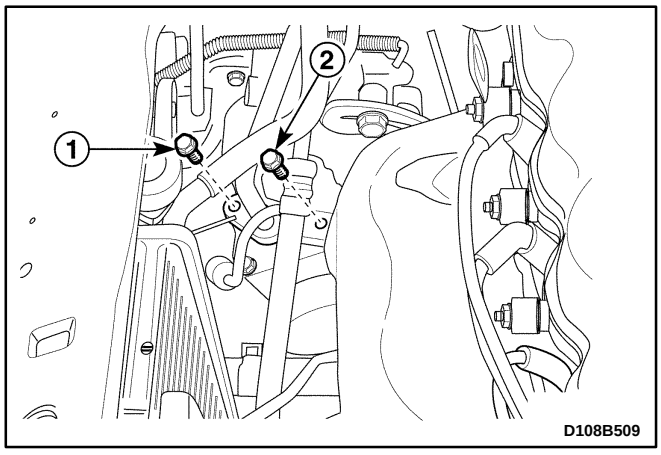
Installation Procedure

1. Install the receiver dry bracket with the bolts.

Tighten

- Tighten the receiver dryer bracket–to–body bolts to 5 N•m (44 lb-in) (1).
- Tighten the receiver dryer bracket bolt to 5 N•m (44 lb-in) (2).

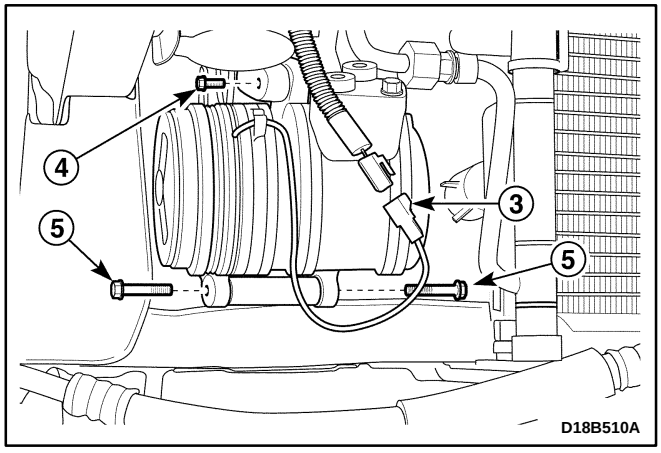
2. Install the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*

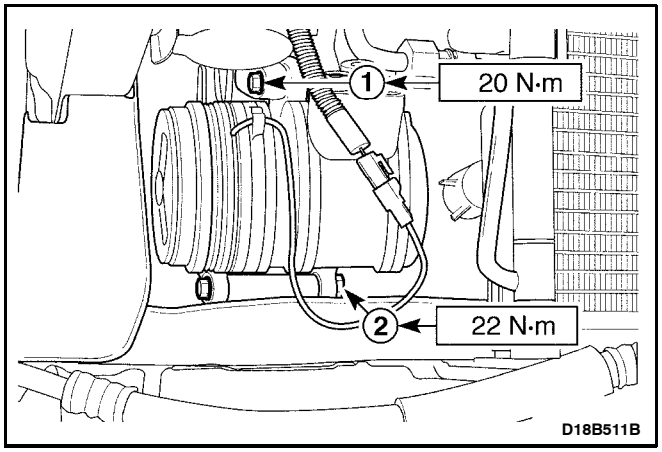


COMPRESSOR

Removal Procedure

1. Remove the receiver dryer. Refer to “Receiver Dryer and Dual Cut Switch” in this section.
2. Remove the A/C belt. Refer to *Section 6B, Power Steering Pump.*
3. Remove the compressor.
   - Discharge and recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Provedures for A/C System” in this section.
   - Remove the bolt securing the low pressure pipe line to the compressor (1).
   - Remove the bolt securing the high pressure pipe line to the compressor (2).
   - Disconnect the electrical connector (3).
   - Remove the upper bolt mounting the compressor–to–bracket (4).
   - Remove the lower bolts mounting the compressor–to–bracket (5).





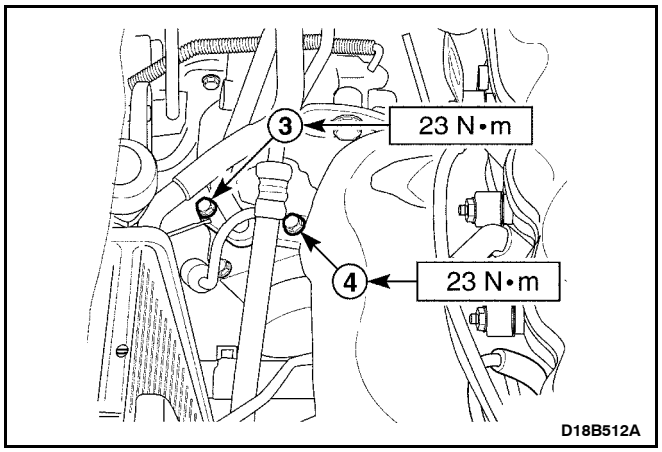
Installation Procedure

1. Install the compressor with the mounting bolts.

Tighten

- Tighten the compressor–to–bracket upper bolt to 20 N•m (15 lb-ft) (1).
- Tighten the compressor–to–bracket lower bolts to 22 N•m (16 lb-ft) (2).

2. Connect the electrical connector.



3. Install the A/C high pressure pipe line to the compressor with the bolt.

Tighten

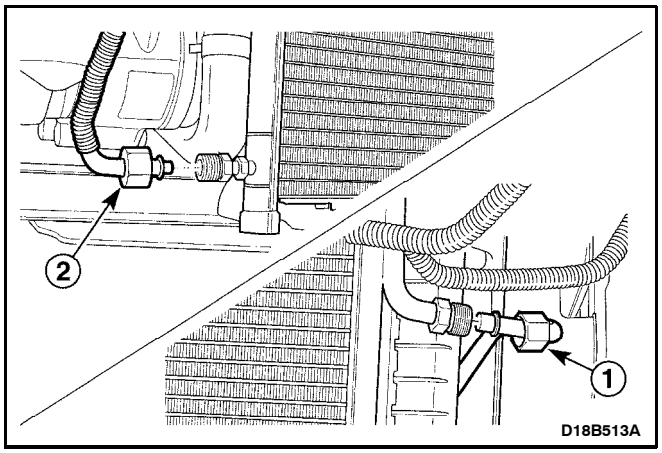
Tighten the A/C high pressure pipe line bolt to 23 N•m (17 lb-ft) (3).

4. Install the A/C low pressure pipe line to the compressor with the bolt.

Tighten

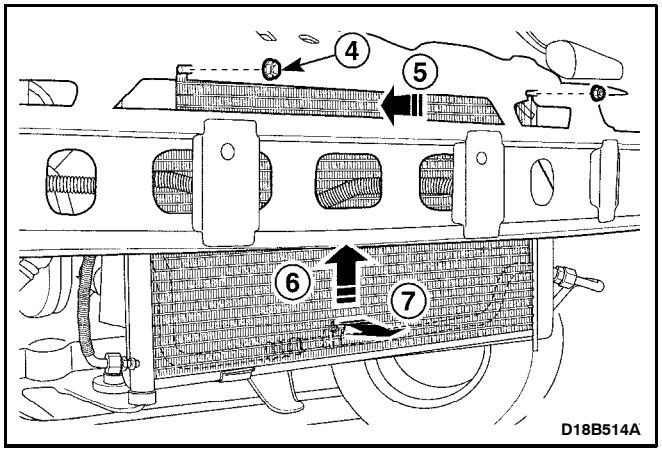
Tighten the A/C low pressure pipe line bolt to 23 N•m (17 lb-ft) (4).

5. Evacuate and charge the system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedure for A/C System” in this section.
6. Install the A/C belt. Refer to *Section 6B, Power Steering Pump*.
7. Install the receiver dryer. Refer to “Receiver Dryer and Dual Cut Switch” in this section.

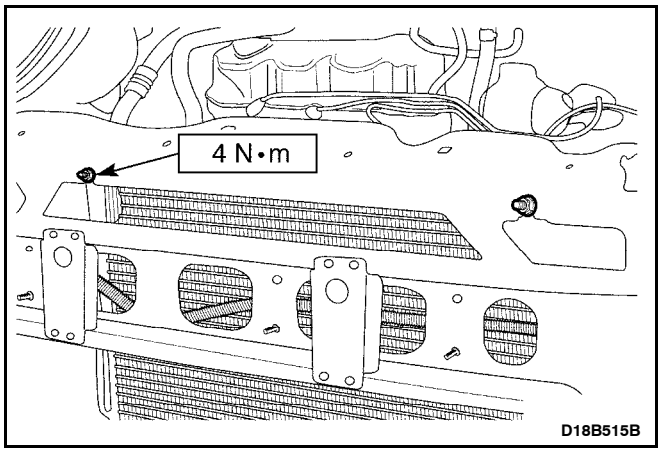


CONDENSER

1. Disconnect the negative battery cable.
2. Remove the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
3. Discharge and recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C system” in this section.
4. Remove the condenser.
   - Loosen the condenser pipe–to–compressor pipe fitting (1).
   - Loosen the condenser pipe–to–receiver dryer pipe fitting (2).



- Remove the condenser mounting nuts (3).
- Push the top of the condenser (4).
- Take off the condenser from the lower bracket by lifting the condenser (5).
- Remove the condenser (6).



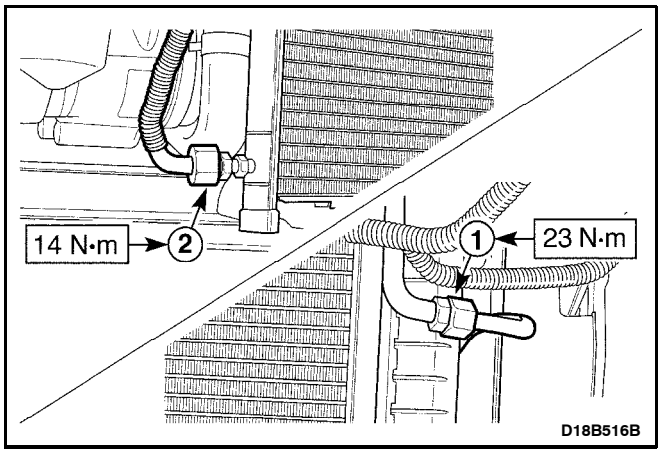
Installation Procedure

Important: Discard the removed O–rings.

1. Install the condenser with the nuts.

Tighten

Tighten the condenser mounting nuts to 4 N•m (36 lb-in).

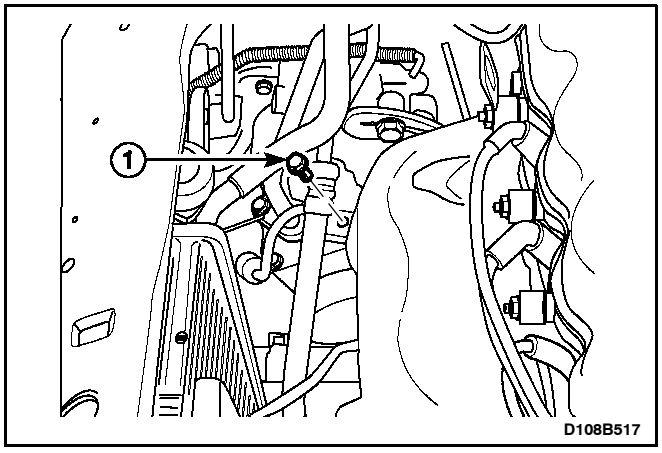


2. Tighten the fittings and the bolt.

Tighten

- Tighten the condenser pipe–to–compressor pipe fitting to 23 N•m (17 lb-ft) (1).
- Tighten the condenser pipe–to–receiver dryer pipe fitting to 14 N•m (10.5 lb-ft) (2).

3. Evacuate and recharge the system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
4. Install the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
5. Connect the negative battery cable.

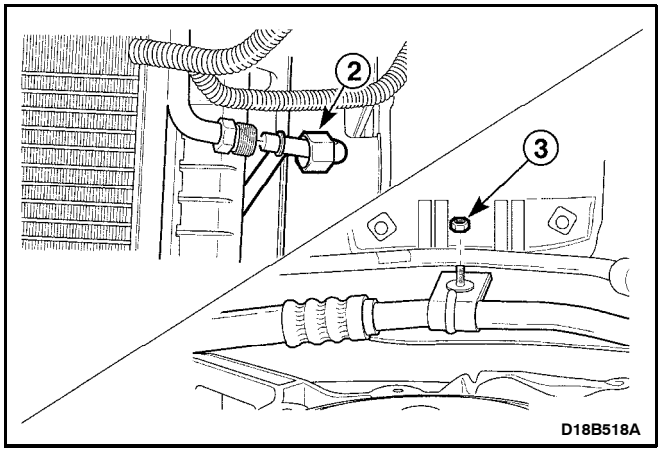


A/C HIGH PRESSURE PIPE LINE

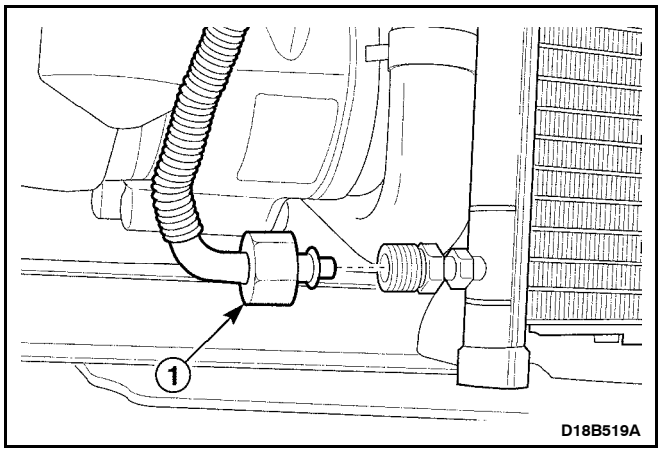
(Left-Hand Drive Shown, Right-Hand Drive Similar)

Removal Procedure

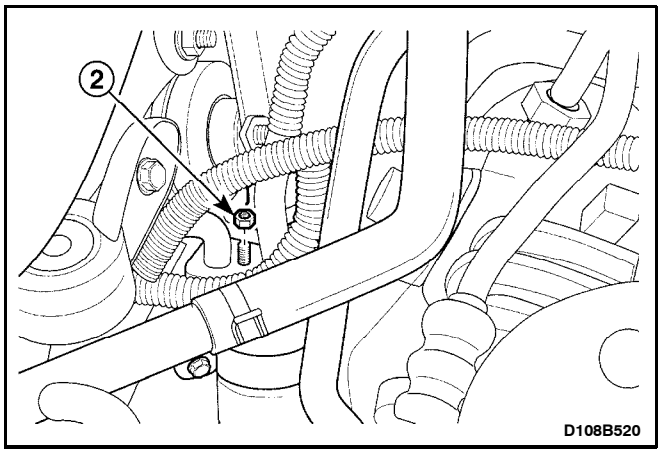
1. Disconnect the negative battery cable.
2. Remove the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
3. Discharge and recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
4. Remove the A/C high pressure pipe line between the compressor and the condenser.
   - Remove the bolt securing the high pressure pipe line to the compressor (1).



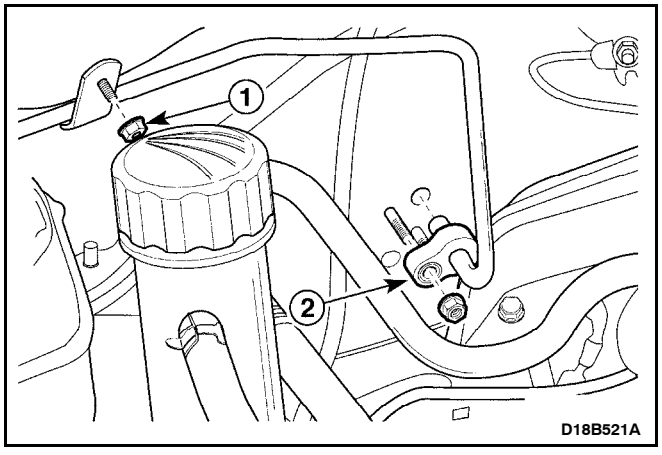
- Loosen the fitting securing the high pressure pipe line to the condenser pipe line (2).
- Remove the clamp nut (3).



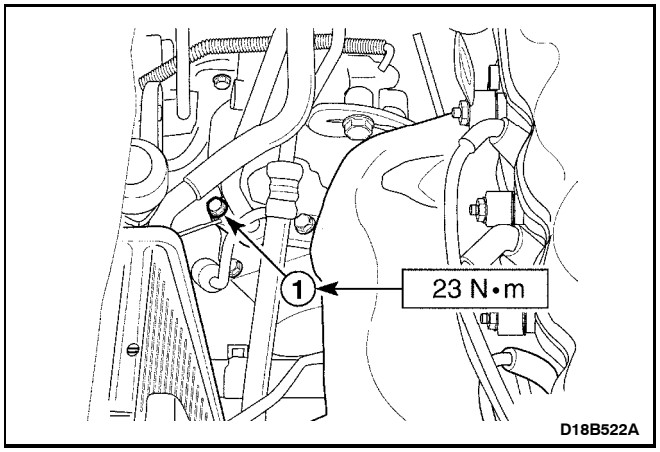
5. Remove the A/C high pressure pipe line between the condenser and the receiver dryer.
   - Loosen the fitting securing the receiver dryer to the condenser (1).

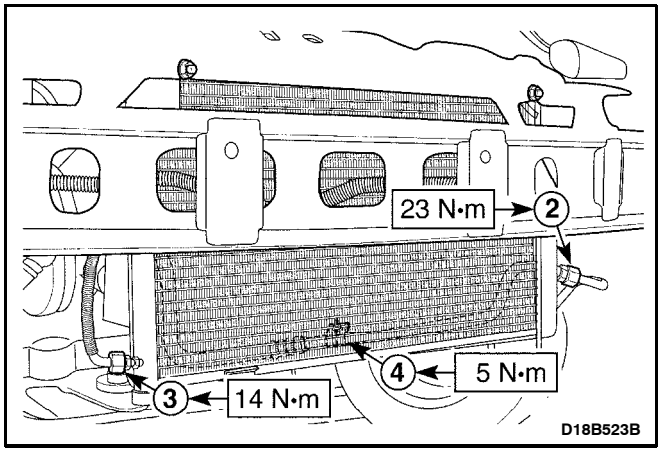


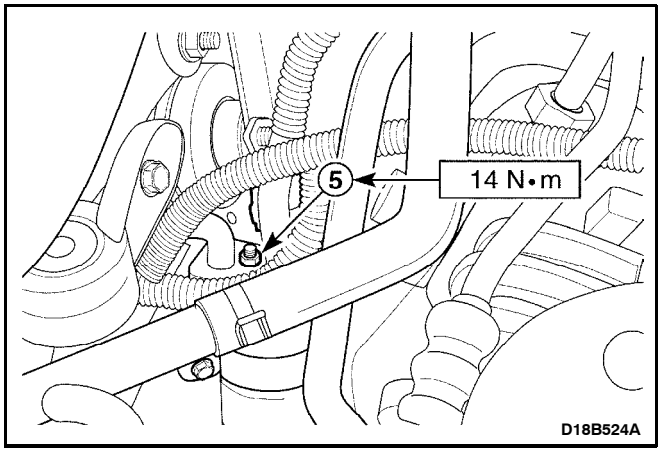
- Remove the receiver dryer flange nuts (2).

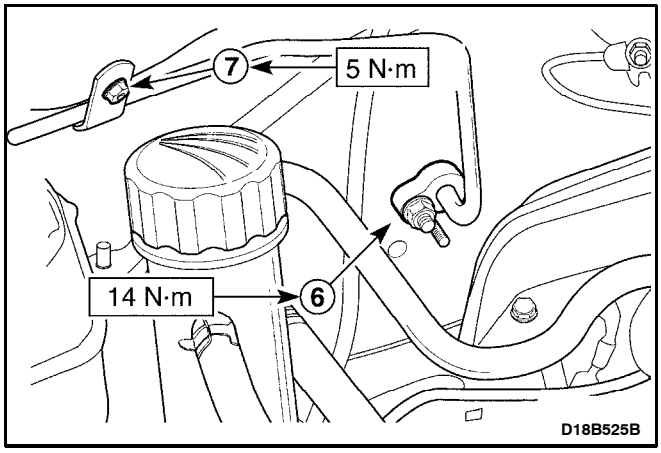


6. Remove the A/C high pressure pipe line between the receiver dryer and the evaporator.
   - Remove the purge control valve. Refer to *Section 1F, Engine Controls.*
   - Remove the bracket nut (1).
   - Loosen the fitting (2).









Installation Procedure

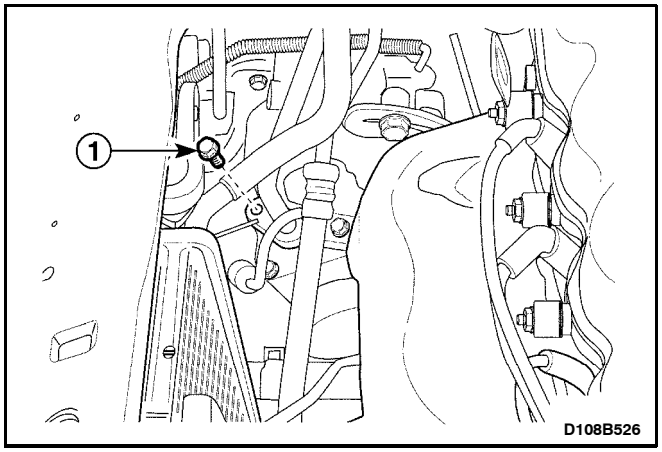
Important: Discard the removed O–rings.

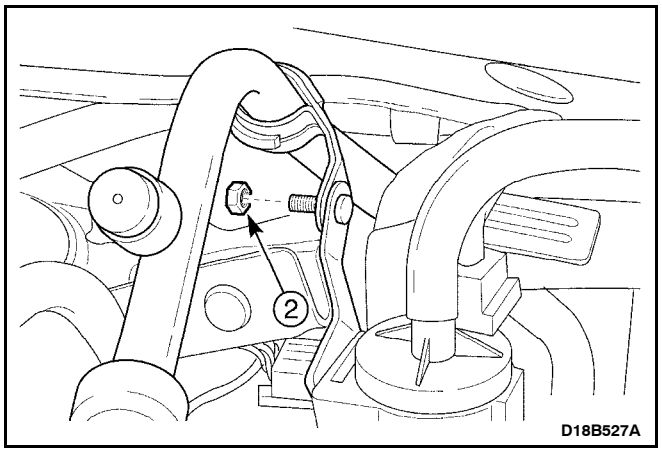
1. Install the high pressure pipe lines with the bolts, the nuts, and the fittings.

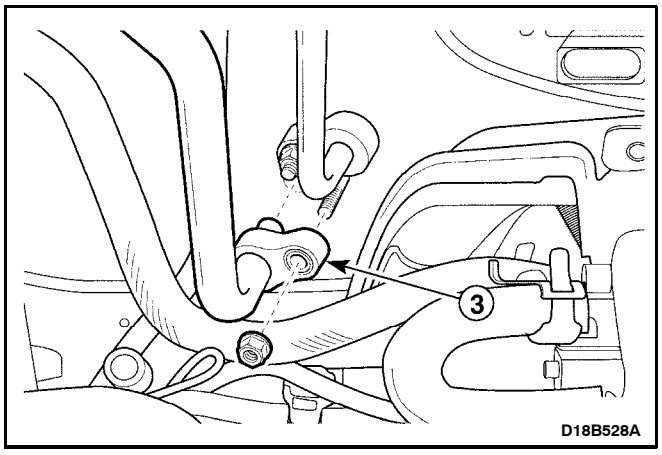
Tighten

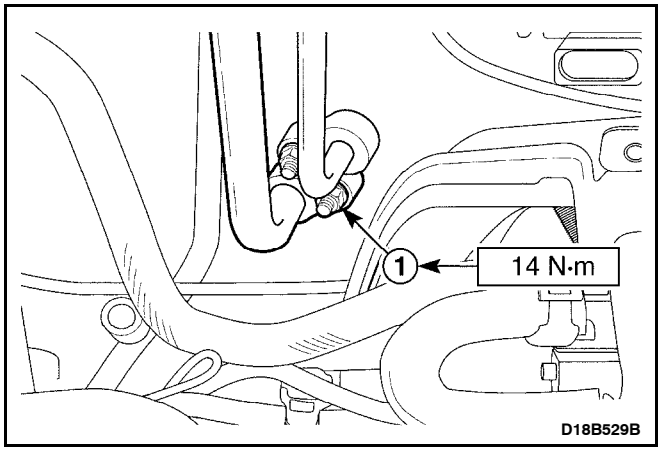
- Tighten the bolt securing the high pressure pipe line to the compressor to 23 N•m (17 lb-ft) (1).
- Tighten the fitting securing the high pressure pipe line to the condenser pipe line to 23 N•m (17 lb-ft) (2).
- Tighten the fitting securing the high pressure pipe line to the receiver dryer to 14 N•m (10.5 lb-ft) (3).
- Tighten the bracket nut to 5 N•m (44 lb-in) (4).
- Tighten the receiver dryer flange nuts to 14 N•m (10.5 lb-ft) (5).
- Tighten the nut securing the high pressure pipe line to the evaporator to 14 N•m (10.5 lb-ft) (6).
- Tighten the bracket nut to 5 N•m (44 lb-in) (7).

2. Install the purge control valve. Refer to *Section 1F, Engine controls.*
3. Evacuate and recharge the system. Refer to “Discharging, Adding Oil, Evaculating, and Charging Procedures for A/C System” in this section.
4. Install the front bumper fascia. Refer to *Section 9O, Bumpers and Fascias.*
5. Connect the negative battery cable.









A/C LOW PRESSURE PIPE LINE

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

Removal Procedure

1. Disconnect the negative battery cable.
2. Discharge and recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
3. Remove the A/C low pressure pipe line.
   - Remove the bolt securing the A/C low pressure pipe line at the compressor (1).
   - Remove the bracket nut from shut bar (2).
   - Remove the purge control valve. Refer to *Section 1F, Engine Controls.*
   - Loosen the nut securing the A/C low pressure pipe line at the evaporator (3).

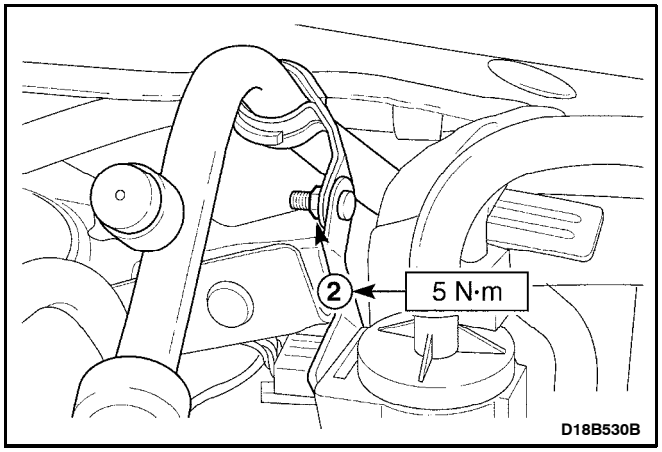
Installation Procedure

Important: Discard the removed O-rings.

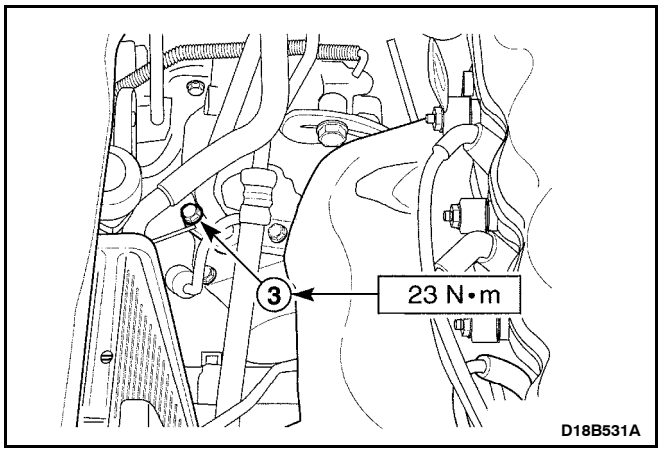
1. Install the A/C low pressure pipe line.

Tighten

- Tighten the nut securing the A/C low pressure pipe line at the evaporator to 14 N•m (10.5 lb-ft) (1).

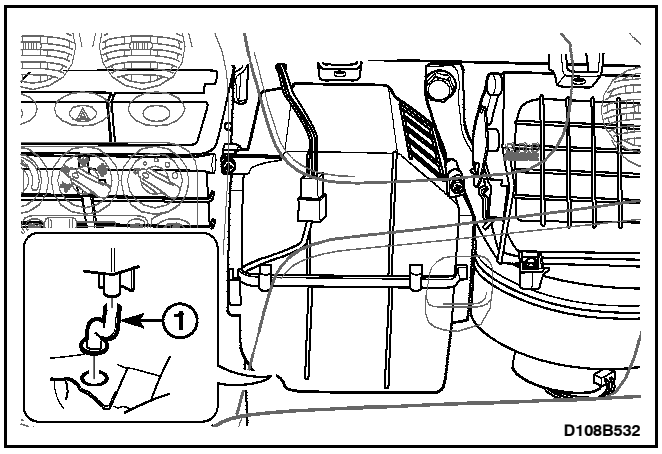


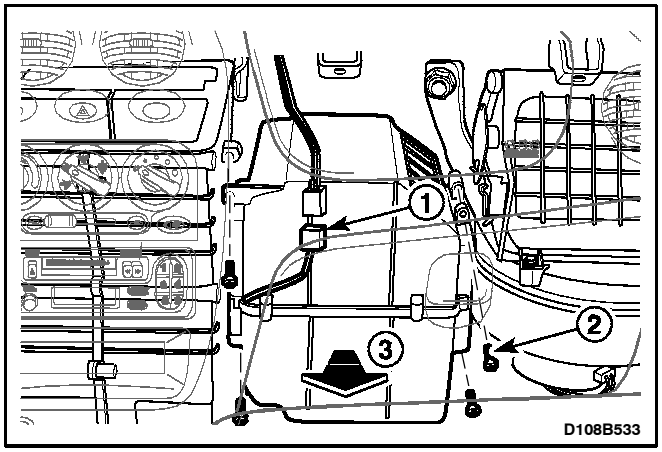
- Tighten the bracket nut to 5 N•m (44 lb-in) (2).



- Tighten the bolt securing the A/C low pressure pipe line at the compressor to 23 N•m (17 lb-ft) (3).

2. Evacuate and recharge the system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedure for A/C System” in this section.
3. Connect the negative battery cable.



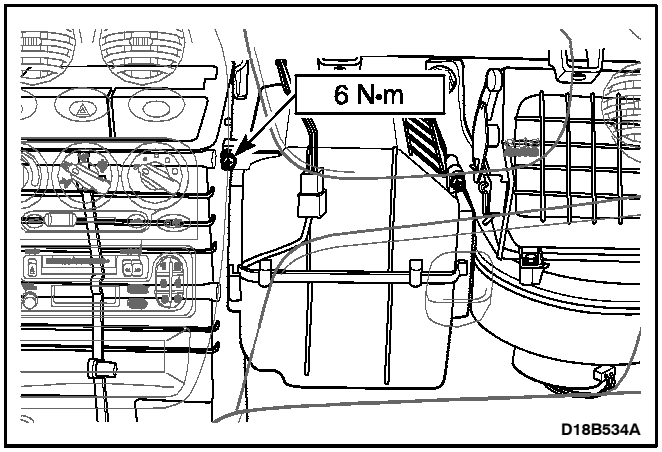


EVAPORATOR UNIT AND DRAIN HOSE

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

Removal Procedure

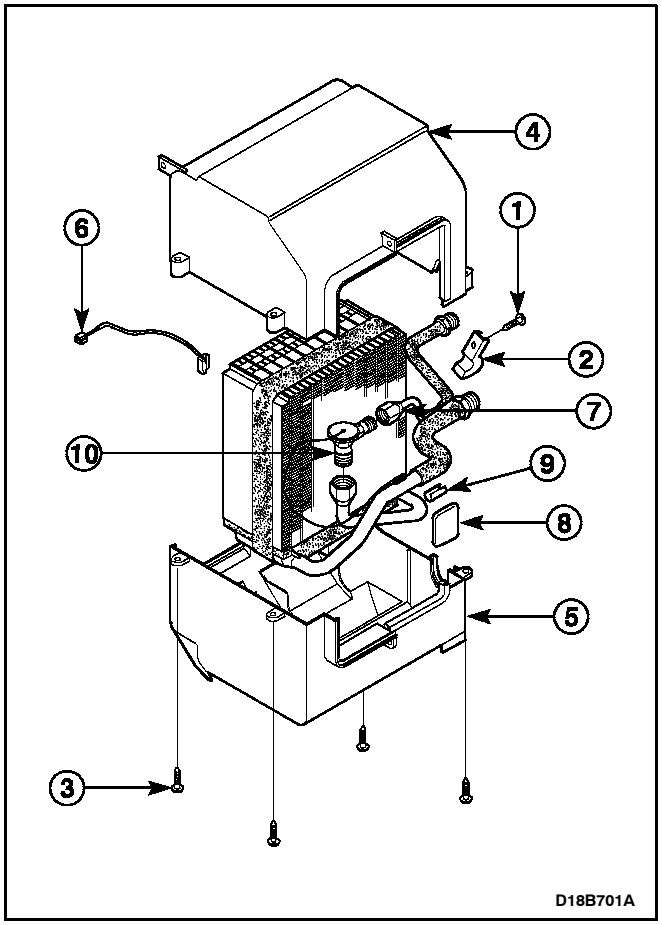
1. Disconnect the negative battery cable.
2. Discharge and recover the refrigerant. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
3. Loosen the high pressure pipe line (receiver dryer → evaporator) nut and the low pressure pipe line (evaporator → compressor) nut.
4. Remove the glove box. Refer to *Section 9E, Instrumentation/Driver information.*
5. Remove the evaporator unit.
   - Remove the drain hose (1).
   - Disconnect the thermistor connector (2).
   - Remove the screws (3).
   - Remove the evaporator backward slowly (4).



Installation Procedure

1. Install the evaporator evaporator with the screws.
2. Connect the thermistor connector.
3. Install the drain hose.
4. Install the glove box. Refer to *Section 9E, Instrumentation / Driver Information.*
5. Tighten the high pressure pipe line (receiver dryer → evaporator) nut and the low pressure pipe line (evaporator → compressor) nut to 14 N•m (10.5 lb-ft).
6. Evacuate and recharge the system. Refer to “Discharging, Adding Oil, Evacuating, and Charging Procedures for A/C System” in this section.
7. Connect the negative battery cable.

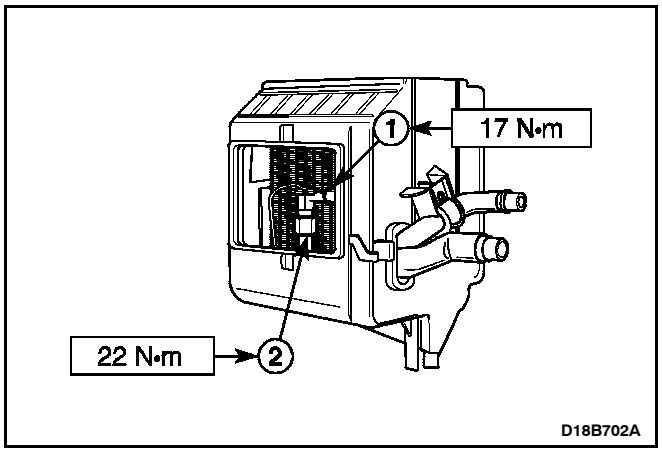
UNIT REPAIR



EVAPORATOR CORE AND EXPANSION VALVE

Disassembly Procedure

1. Remove the evaporator unit. Refer to “Evaporator Unit and Drain Hose” in this section.
2. Remove the evaporator core and expansion valve.
   - Remove the screw (1).
   - Remove the clamp (2).
   - Remove the screws securing the evaporator case cover (3).
   - Remove the upper evaporator case cover (4).
   - Remove the lower evaporator case cover (5).
   - Remove the thermistor (6).
   - Loosen the fitting and remove the high pressure pipe line (7).
   - Remove the tape (8).
   - Remove the evaporator plate seal (9).
   - Loosen the fitting and remove the expansion valve (10).



Assembly Procedure

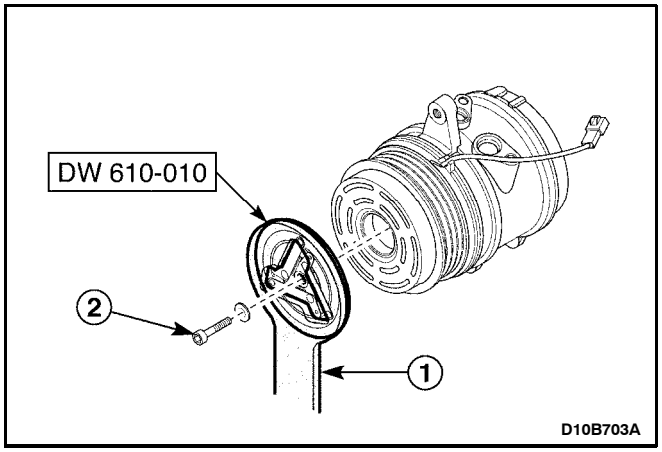
1. Install the exponsion valve with the fitting.

   Tighten

   Tighten the high pressure pipe line coupling to 17 N•m (13 lb-ft) (1).
2. Install the evaporator plate seal.
3. Install the tape.
4. Install the high pressure pipe line with the fitting.

   Tighten

   Tighten the expansion valve coupling to 22 N•m (16 lb-ft) (2).
5. Install the thermistor.
6. Install the screws securing the evaporator case cover.
7. Install the clamp and the screw.
8. Install the evaporator unit. Refer to “Evaporator Unit and Drain Hose” in this section.



COMPRESSOR OVERHAUL

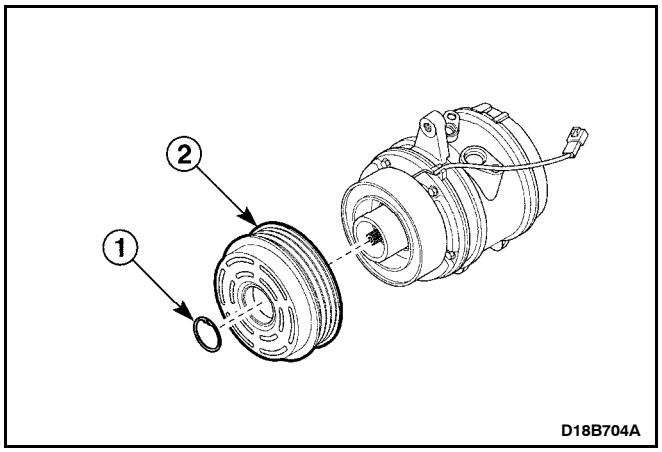
Tools Required

DW–610–010 Clutch Hub Holding Tool

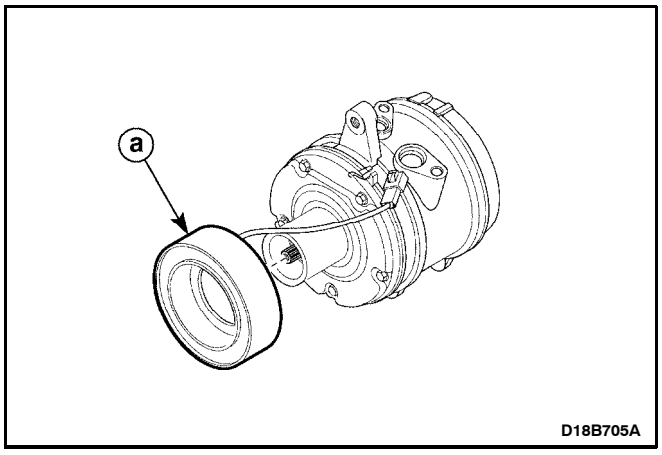
Disassembly Procedure

1.Remove the compressor. Refer to “Compressor” in this section.

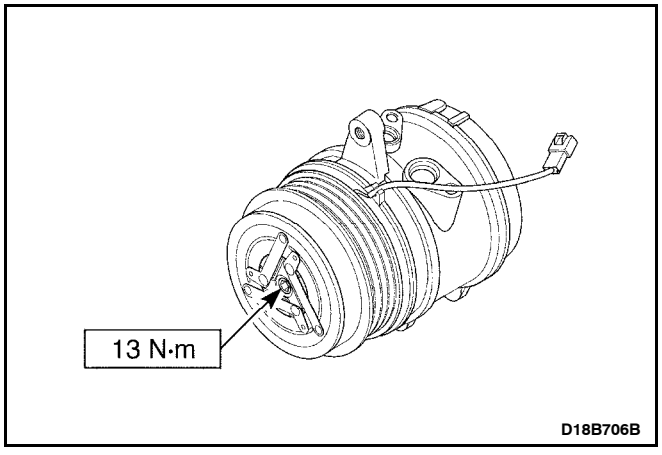
2. Remove the clutch drive plate.
   - Use the clutch hub holding tool DW–610–010 to keep the clutch drive plate (1).
   - Remove the shaft bolt (2).



3. Remove the compressor pulley.
   - Remove the snap ring using a ring pryer (1).
   - Remove the pulley (2).



4. Disconnect the wiring harness holder and remove the electromagnetic clutch.
   a. Electromagnetic clutch



Assembly Procedure

1. Connect the wiring harness holder and install the clutch coil.
2. Install the snap ring and compressor pulley.
3. Use the clutch hub holding tool DW–610–010, install the clutch drive plate with the shaft bolt.

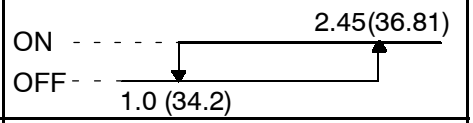
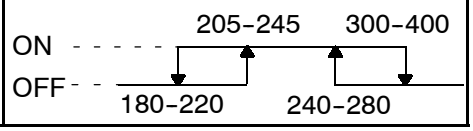
Tighten

Tighten the shaft bolt to 13 N•m (115 lb-in).

4. Install the compressor. Refer to “Compressor” in this section.

SPECIFICATIONS

GENERAL SPECIFICATIONS

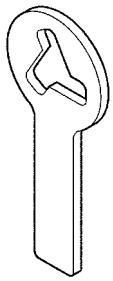
Application		Unit	Description
Compressor		-	SP-10.4PK
Receiver-Dryer		-	AL R/DRIER
Refrigerant	Type	-	R-134a System
	Capacity	g	500 (RHD : 530)
Refrigerant Oil in A/C System	Type	-	RL 244 PAG OIL
	Capacity	cc	150
A/C Cooling Capacity (Airflow rate 8.7 kg/min)		Kcal/h	5,500
Refrigerant Pressure in A/C System(Engine Idle, Fresh Air 30°C (86°F), Ambient Temperature 25°C-35°C (77°F-95°F), Temperature to Full Cold)	Low Pressure Side	kPa (psi)	200 (2.9)
	High Pressure Side	kPa (psi)	1,500 (217.5)
A/C Compressor ON/OFF Condition (Refer to *Section 1F, Engine Controls* About the A/C Compressor ON/OFF Condition According to Engine Operating Status)	Evaporator Thermistor Temperature	°C (°F)	
	Dual Cut Switch Pressure	kPa	

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Compressor Upper Bracket Bolts	20	15	-
Compressor Front Head-to-Rear Head Through-Bolt	22	16	-
High Pressure Pipe Line (Compressor → Condenser) Bolt	23	17	-
High Pressure Pipe Line (Compressor → Condenser) Fitting	23	17	-
High Pressure Pipe Line (Compressor → Condenser) Clamp Nut	5	-	44
Receiver-Dryer Flange Nut	14	10.5	-
High Pressure Pipe Line (Condenser → Receiver-Dryer) Fitting Nut	14	10.5	-
High Pressure Pipe Line (Receiver-Dryer → Evaporator) Fitting Nut	14	10.5	-
High Pressure Pipe Line(Receiver-Dryer → Evaporator) Clamp Nut	5	-	44
Low Pressure Pipe Line (Evaporator → Compressor) Fitting Nut	14	10.5	-
Low Pressure Pipe Line (Evaporator → Compressor) Clamp Nut	5	-	44
Low Pressure Pipe Line(Evaporator→Compressor) Compressor Bolt	23	17	-
Dual Cut Switch	13	-	115
Receive-Dryer Bracket-to-Body Bolts	5	-	44
Receive-Dryer Bracket Bolt	5	-	44
Expansion Valve Coupling (Receiver-Dryer → Expansion Valve)	17	13	-
Expansion Valve Coupling (Expansion Valve → Evaporator)	22	16	-
Compressor Shaft Bolt	13	-	115
Condenser Mounting Nuts	4	-	36

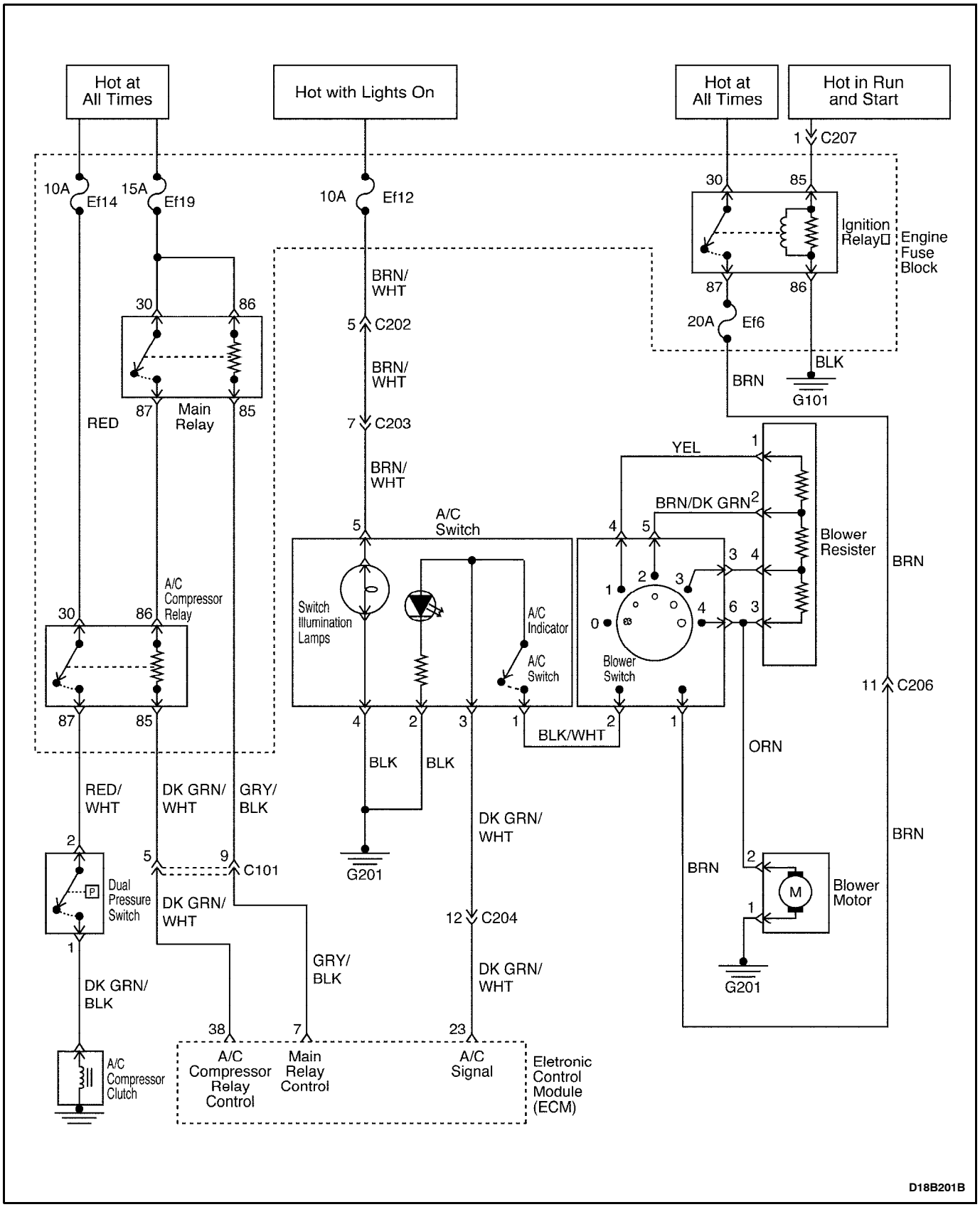
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D108B101	**DW-610-010 Clutch Hub Holding Tool**

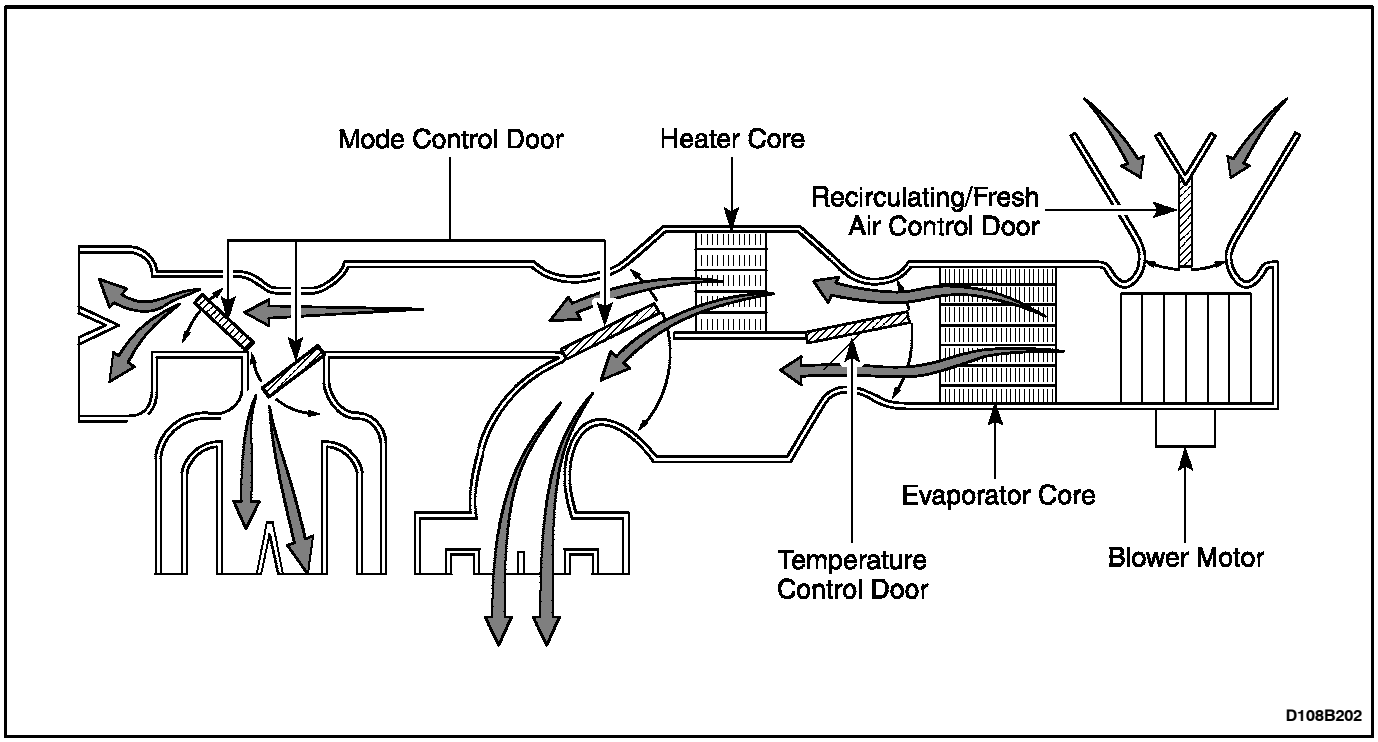
SCHEMATIC AND ROUTING DIAGRAMS

A/C DIAGRAMS



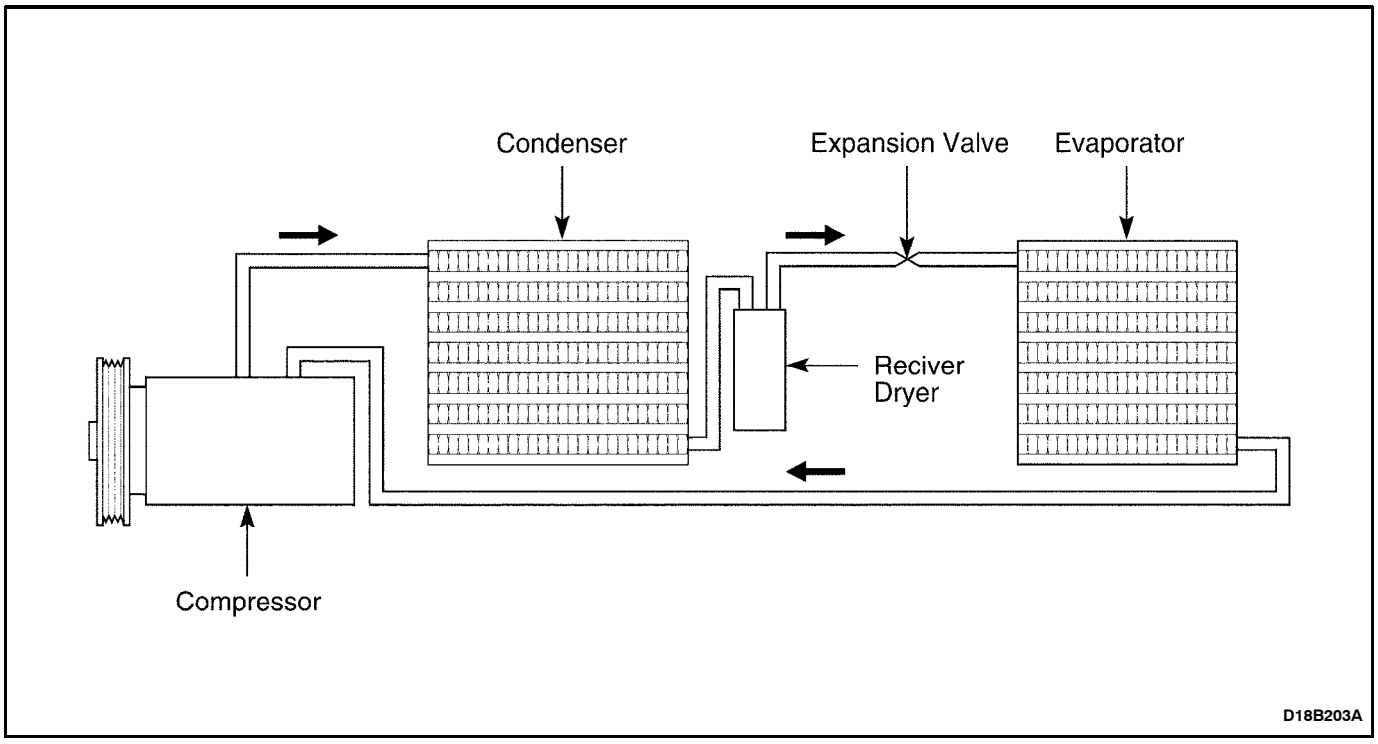
A/C AIRFLOW

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



A/C SYSTEM

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



SECTION 8A

SEAT BELTS

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.

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DESCRIPTION AND OPERATION

DRIVER SEAT BELT WARNING

The driver's safety belt incorporates a safety belt reminder light in the instrument cluster to remind the driver if the safety belt is not fastened when the ignition is turned ON.

THREE-POINT PRETENSIONER FRONT SEAT BELT (W/EUROPE ONLY)

The pretensioner front seat belt is optional. It contains a electrically-controlled pyrotechnical retractor, which reduces seat belt slack when it is activated in a head-on or angled front collision. The pretensioner front seat belt must be replaced after an accident that causes its activation.

THREE-POINT WLR FRONT SEAT BELT

The three-point web locking retractor (WLR) seat belt will limit the movement of the driver and offer better protection in an accident.

THREE-POINT ELR FRONT SEAT BELT

The three-point emergency locking retractor (ELR) front seat belt is always unlocked, allowing the passenger freedom of movement, except in emergencies (rapid deceleration, rapid acceleration, or hard cornering maneuvers).

THREE-POINT ELR REAR OUTBOARD SEAT BELT

The rear outboard seating positions use the three-point emergency locking retractor (ELR) seat belts. The three-point emergency locking retractor (ELR) seat belt is always unlocked, allowing the passenger freedom of movement, except in emergencies (rapid deceleration, rapid acceleration, or hard cornering maneuvers).

TWO-POINT LAP REAR CENTER SEAT BELT

The two-point lap rear center seat belt is a single continuous length of webbing. The webbing is routed from the anchor through a latch plate and into a single retractor.

OPERATIONAL AND FUNCTIONAL CHECKS

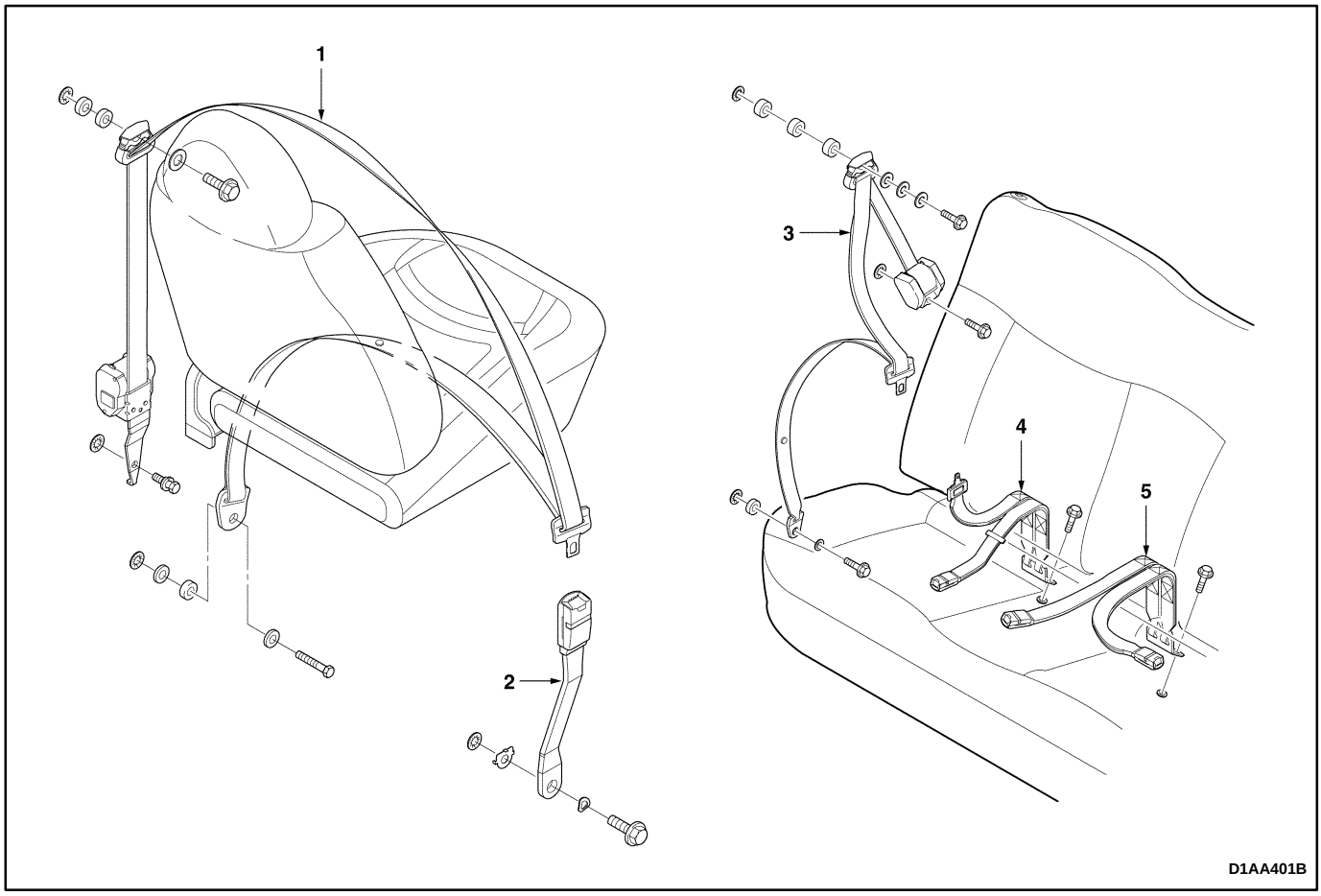
Caution:

- ***Keep sharp objects and potentially damaging objects away from the seat belts.***
- ***Avoid bending or damaging any portion of the buckle or the latch plate.***
- ***Do not bleach or dye the belt webbing. Use only mild soap and water in order to clean the belts.***
- ***When installing the seat belt anchor bolts and the screws, start the bolts and the screws by hand in order to prevent crossthreading.***
- ***Do not attempt any repairs on the retractor mechanisms or the covers. Replace any defective assemblies with new assemblies.***
- ***Replace any belts that are cut or damaged in any way.***

1. Inspect all seat belt anchor bolts and the screws in order to verify that they are secure.
2. Inspect the seat belt buckle. The buckle must lock and unlock easily.
3. After inserting the latch into the buckle, tug sharply on the belt. The buckle must remain locked.
4. Fully extend the shoulder belt portion to make sure that there is no twisting or tears in the belt.
5. Let the shoulder belt retract fully. The belt should retract easily.

COMPONENT LOCATOR

FRONT AND REAR SEAT BELT



1. Front Seat Belt
2. Front Seat Belt Buckle
3. Rear Seat Belt (Three–Point)
4. Rear Seat Belt (Two–Point) / Buckle (Three–Point)
5. Rear Seat Belt Buckle (Three–Point/Two–Point)

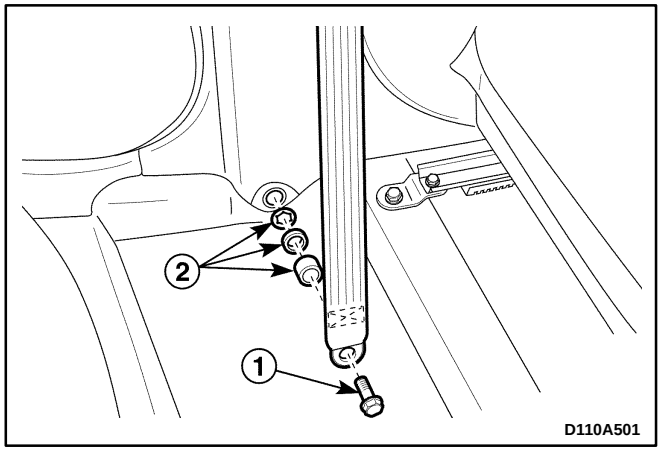
DIAGNOSTIC INFORMATION AND PROCEDURES

SEAT BELT WARNING LAMP IS INOPERATIVE

Condition	Probable Cause	Correction
Seat Belt Warning Lamp is Inoperative	● Fuse F1 is blown.	● Replace the fuse F1.
	● Seat belt warning lamp wiring harness is open circuit or a short circuit.	● Repair the wiring harness.
	● The continuity between the two terminals at the switch side of the connector is fail.	● Replace the seat belt switch.
	● The continuity between the terminal for the BLK wire and ground is fail.	● Repair the open ground.
	● The warning lamp bulb in the instrument cluster is blown.	● Replace the warning lamp bulb.

REPAIR INSTRUCTIONS

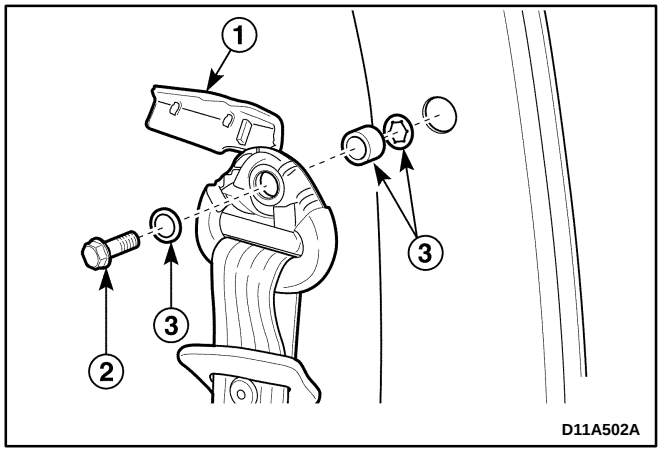
ON–VEHICLE SERVICE



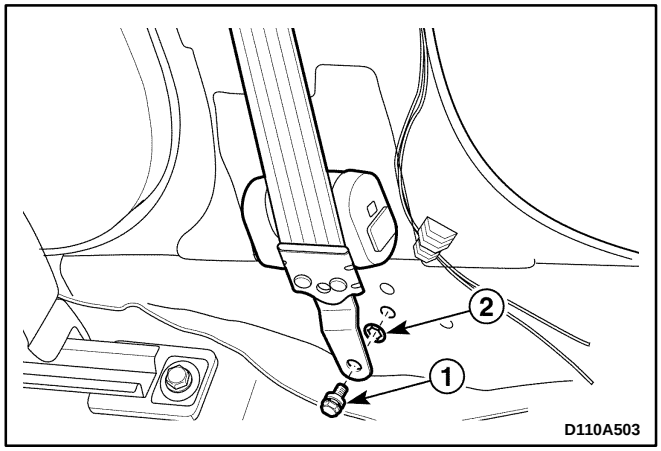
THREE–POINT WLR/ELR FRONT SEAT BELT

Removal Procedure

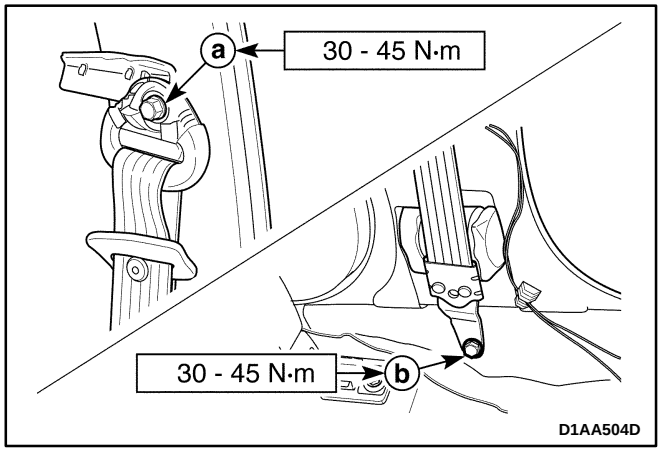
1. Slide the front seat forward and fold the seatback.
2. Remove the bolt on the lower B–pillar.
   - Remove the bolt (1).
   - Remove the spacer and the fiber washer (2).
   - Remove the plastic protector on the seat belt anchor.



3. Remove the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim.*
4. Remove the bolt on the upper B–pillar.
   - Using a flathead screwdriver, open the bolt cap (1).
   - Remove the bolt (2).
   - Remove the spacer and the fiber washer (3).



5. Remove the seat belt retractor bolt.
   - Remove the floor carpet to be seen the retractor.
   - Remove the bolt (1).
   - Remove the fiber washer (2).
   - Remove the seat belt retractor.



Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install in the reverse order of removal.
2. Install the bolt on the upper B–pillar.

Tighten

Tighten the seat belt upper bolt to 30–45 N•m (22–33 lb-ft).

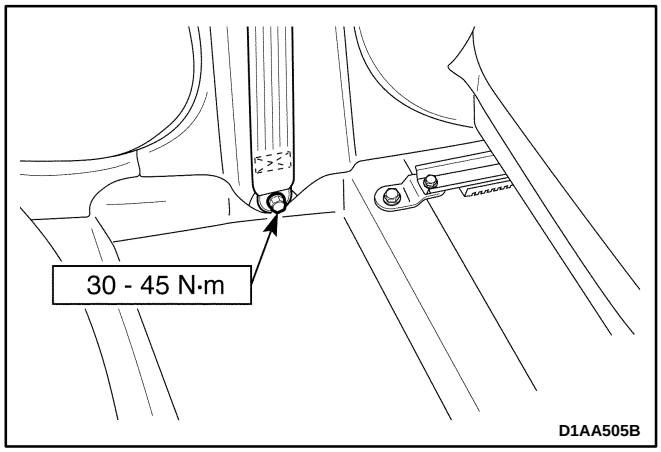
a. Seat belt upper bolt.

3. Install the seat belt retractor with the bolt.

Tighten

Tighten the seat belt retractor bolt to 30–45 N•m (22–33 lb-ft).

b. Seat belt retractor bolt.



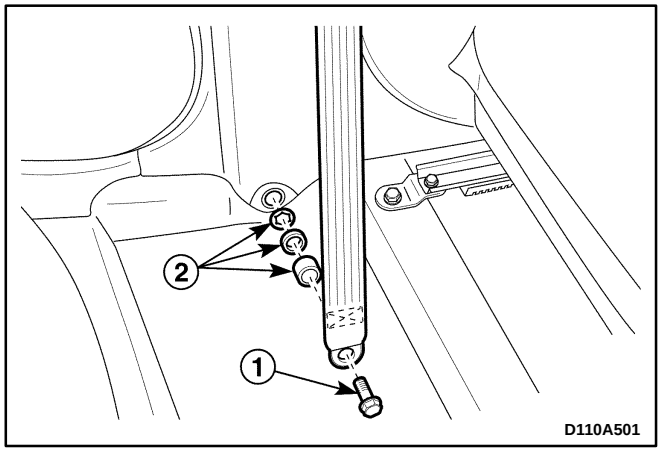
4. Install the bolt on the lower B–pillar.
   - Install the bolt.

Tighten

Tighten the lower B–pillar bolt to 30–45 N•m (22–33 lb-ft).

- Install the spacers and the spring washer.
- Install the plastic protector on the seat belt anchor.

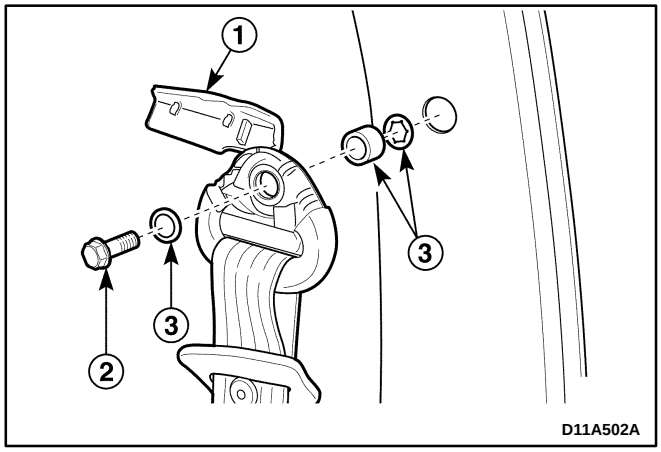
5. Relocate the seatback.



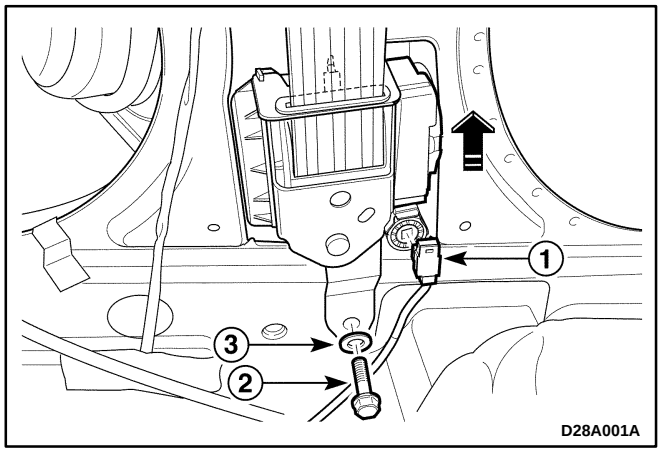
THREE–POINT PRETENSIONER FRONT SEAT BELT (W/EUROPE ONLY)

Removal Procedure

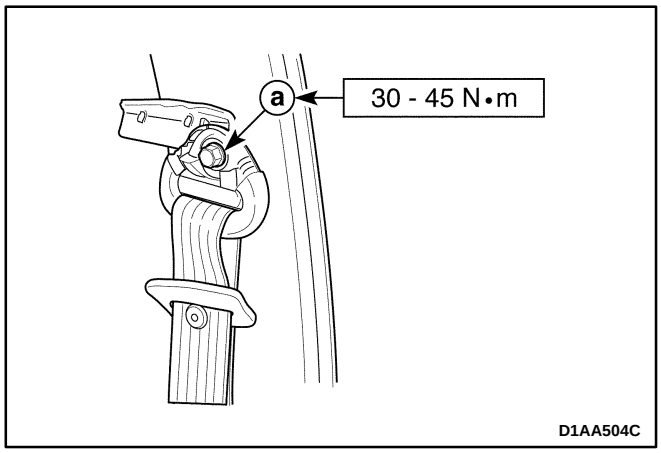
1. Slide the front seat forward and fold the seatback.
2. Remove the bolt on the lower B–pillar.
   - Remove the bolt (1).
   - Remove the spacer and the fiber washer (2).
   - Remove the plastic protector on the seat belt anchor.



3. Remove the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim*.
4. Remove the bolt on the upper B–pillar.
   - Using a flathead screwdriver, open the bolt cap (1).
   - Remove the bolt (2).
   - Remove the spacer and the fiber washer (3).



5. Remove the seat belt retractor bolts.
   - Remove the floor carpet to be seen the retractor.
   - Disconnect the pretensioner front seat belt connector (1).
   - Remove the lower retractor bolt (2).
   - Remove the fiber washer (3).
   - Remove the seat belt retractor.



Installation Procedure

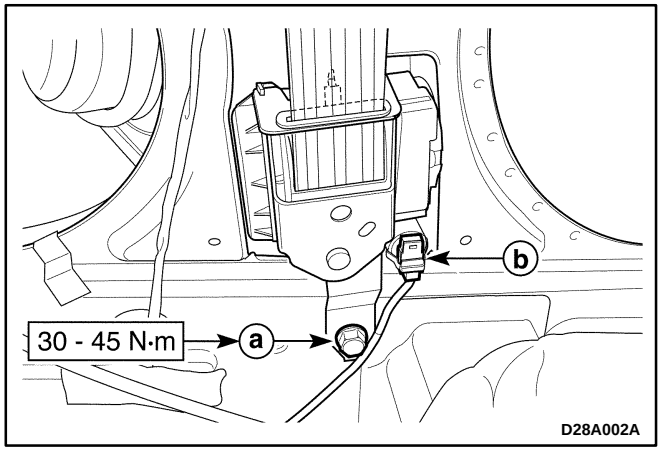
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install in the reverse order of removal.
2. Install the bolt on the upper B–pillar.

Tighten

Tighten the seat belt upper bolt to 30–45 N•m (22–33 lb-ft).

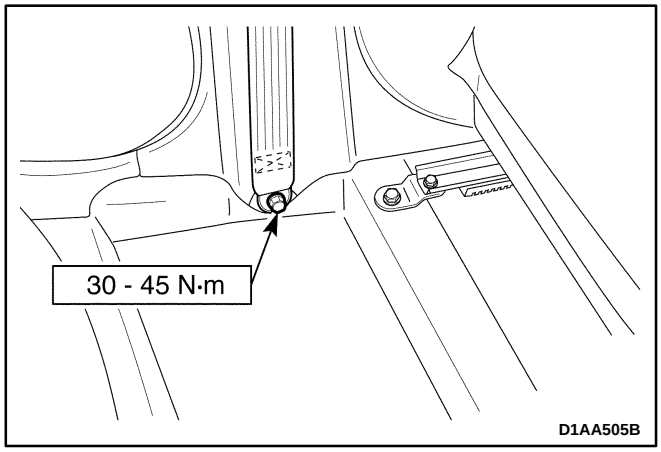
a. Seat belt upper bolt.



3. Install the seat belt retractor with the bolt.

Tighten

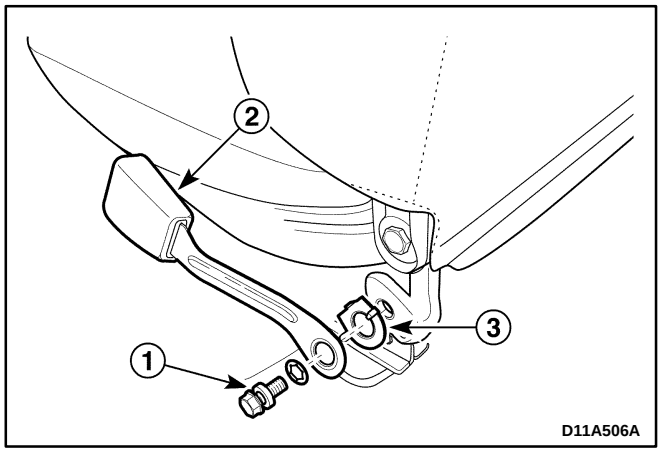
- Tighten the lower retractor bolt to 30–45 N•m (22–33 lb-ft).
  a. Lower retractor bolt.
  b. Connect the pretensioner front seat belt connector.



4. Install the bolt on the lower B–pillar.
   - Install the bolt.

   Tighten

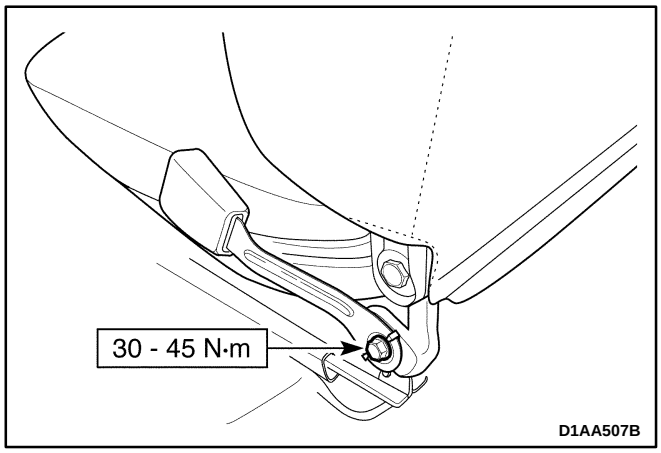
   Tighten the lower B–pillar bolt to 30–45 N•m (22–33 lb-ft).
   - Install the spacers and the fiber washer.
   - Install the plastic protector on the seat belt anchor.
5. Relocate the seatback.



FRONT SEAT BELT BUCKLE

Removal Procedure

1. Remove the front seat belt buckle
   - Remove the bolt (1).
   - Remove the buckle (2).
   - Remove the patch (3).
   - Before removing the driver seat belt buckle, disconnect the reminder light connector.

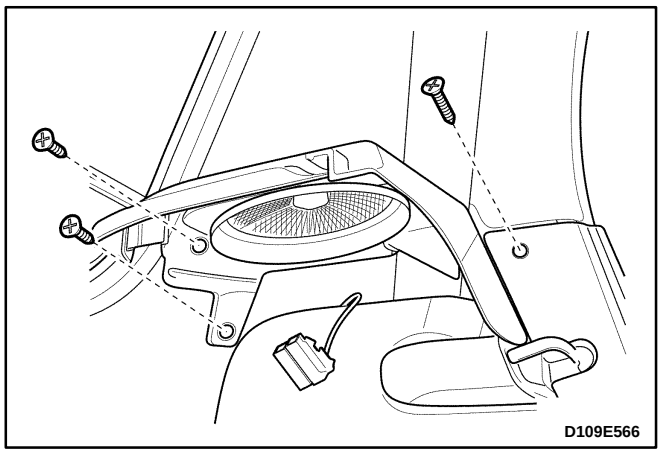


Installation Procedure

1. Install the front seat belt buckle.
   - Connect the reminder light connector.
   - Install the patch.
   - Install the buckle.
   - Install the bolt.

   Tighten

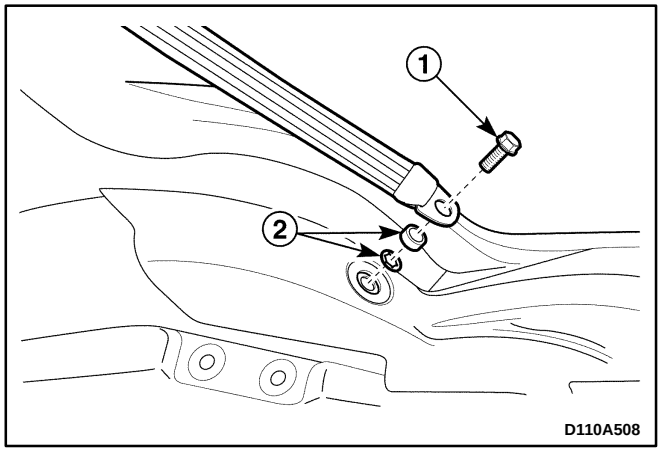
   Tighten the seat belt buckle bolt to 30–45 N•m (22–33 lb-ft).



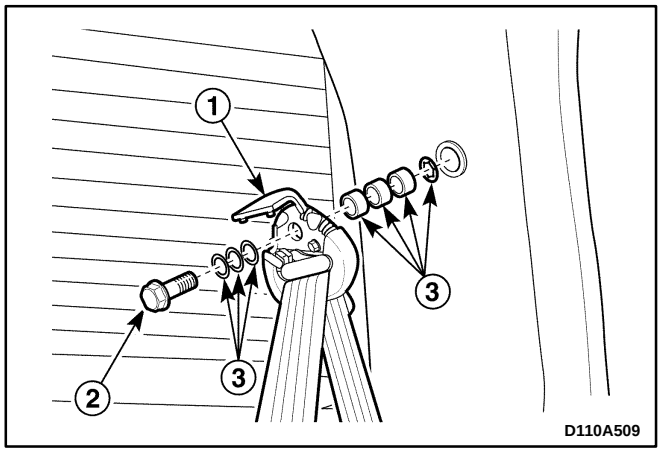
THREE–POINT ELR REAR OUTBOARD SEAT BELT

Removal Procedure

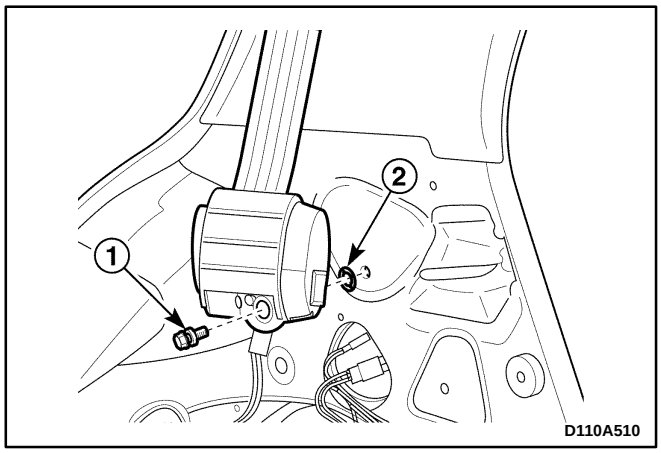
1. Remove the rear seat cushion and the rear seatback.
2. Pry off the rear interior trim panel. Refer to *Section 9G, Interior Trim.*
   - Pry off the backshelf trim panel.
   - Pry off the luggage compartment side load trim panel.



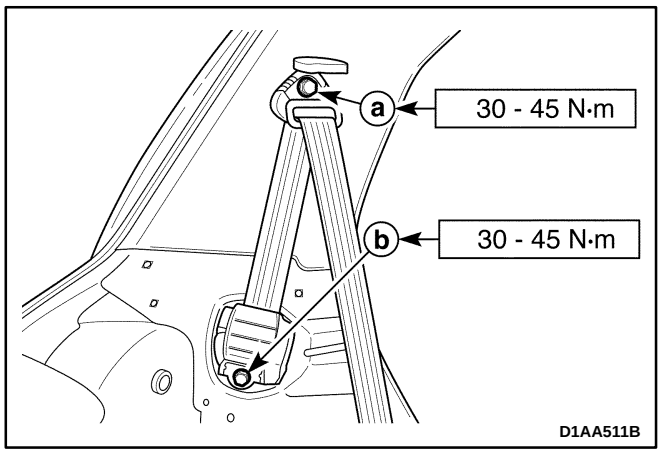
3. Remove the bolt on the floor.
   - Remove the bolt (1).
   - Remove the spacer and the fiber washer (2).
   - Remove the plastic protector on the seat belt anchor.



4. Pry off the luggage compartment trim panel.
   Refer to section *9G, Interior Trim.*
5. Remover the bolt on the C–pillar trim panel (1).
   - Open the bolt cap using a flathead screw driver.
   - Remove the bolt (2).
   - Remove the plastic washers, the spacers and the fiber washer (3).



6. Remove the seat belt retractor bolt.
   - Remove the bolt (1).
   - Remove the fiber washer (2).
   - Remove the rear seat belt.

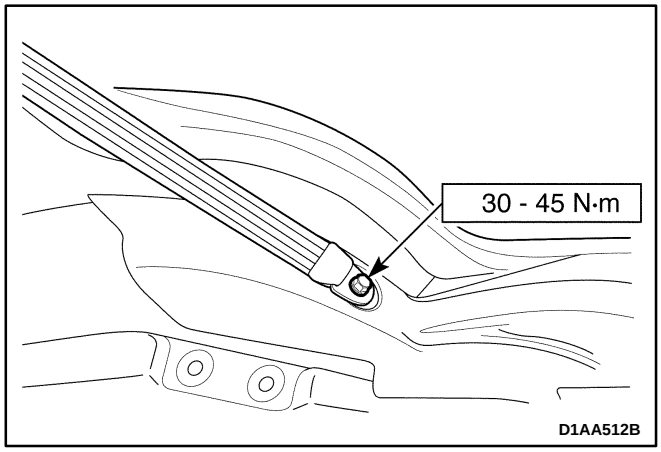


Installation Procedure

1. Install in the reverse order of removal.
2. Install the seat belt retractor bolt and the upper bolt.

Tighten

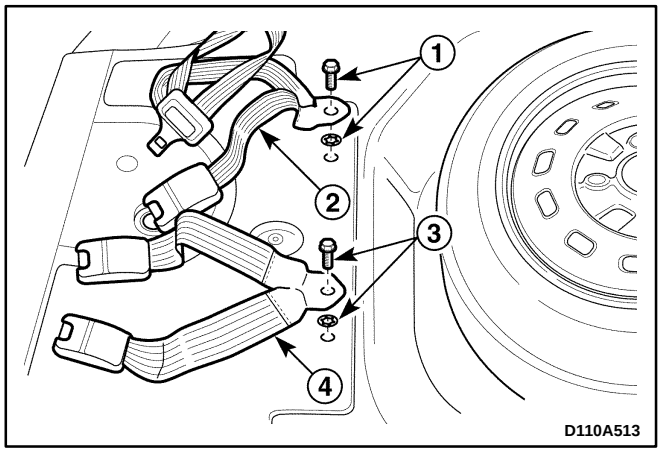
- Tighten the seat belt upper bolt to 30–45 N•m (22–33 lb-ft).
  a. Seat belt upper bolt.
- Tighten the seat belt retractor bolt to 30–45 N•m (22–33 lb-ft).
  b. Retractor bolt.



3. Install the bolt on the floor.

Tighten

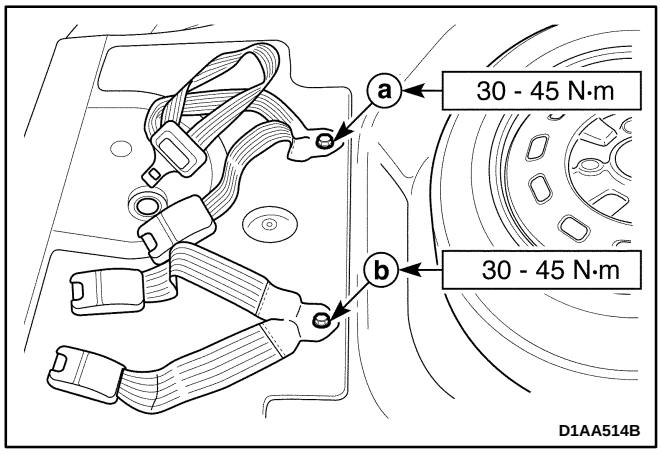
Tighten the bolt on the floor to 30–45 N•m (22–33 lb-ft).



TWO–POINT LAB REAR CENTER SEAT BELT

Removal Procedure

1. Remove the rear seat cushion.
2. Remove the two–point rear seat belt and the buckle.
   - Remove the bolt and the fiber washer (1).
   - Remove the seat belt (two–point) and the buckle (three–point) (2).
   - Remove the bolt and the fiber washer (3).
   - Remove the buckle (two–point and three–point) (4).



Installation Procedure

1. Install in the reverse order of removal.
2. Install the three–point rear seat belt buckle with the bolt.

Tighten

Tighten the three–point rear seat belt buckle bolt and the two–point rear seat belt bolt to 30–45 N•m (22–33 lb-ft).

a. Two–point rear seat belt and three–point rear seat belt buckle bolt.

3. Install the two–point rear seat belt with the bolt.

Tighten

Tighten the two–point and three–point rear seat belt buckle bolt to 30–45 N•m (22–33 lb-ft).

b. Two–point and three–point rear seat belt buckle bolt.

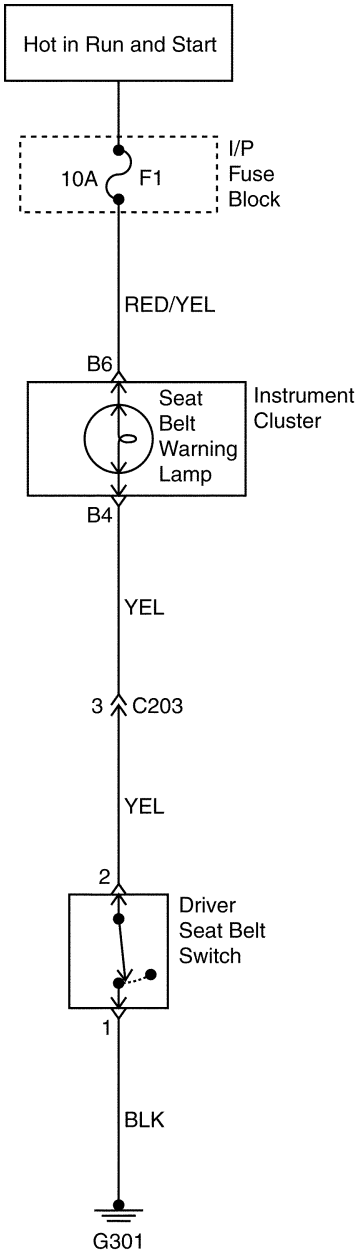
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Seat Belt Upper Bolt	30 – 45	22 – 33	–
Seat Belt Lower Bolt	30 – 45	22 – 33	–
Seat Belt Retractor Bolt	30 – 45	22 – 33	–
Seat Belt Buckle Bolt	30 – 45	22 – 33	–
Rear Seat Belt Buckle Bolt	30 – 45	22 – 33	–

SCHEMATIC AND ROUTING DIAGRAMS

DRIVER SEAT BELT WARNING



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SECTION 8B

SUPPLEMENTAL INFLATABLE RESTRAINTS (SIR)

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.

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DESCRIPTION AND OPERATION

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

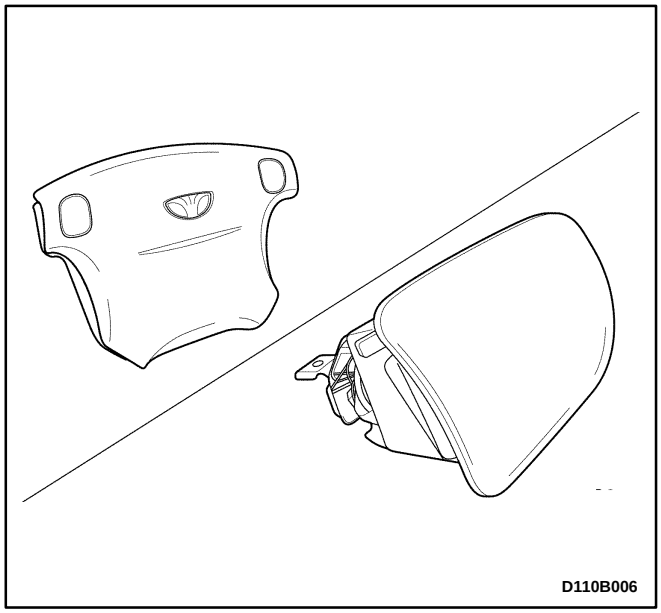
AIRBAG MODULE

Driver Airbag Module

Caution: Tampering with the driver side airbag module creates the risk of an injury from an unexpected deployment. Therefore, the driver side airbag module should never be disassembled.

The driver airbag module is under the center pad on the steering wheel.

The driver airbag module contains an ignitor charge and a gas generator to inflate the folded airbag.



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Passenger Airbag Module

Caution: Tampering with the passenger side airbag module creates the risk of an injury from an unexpected deployment. Therefore, the passenger side airbag module should never be disassembled.

The passenger airbag module is on the passenger side of the instrument panel.

The passenger airbag module contains an ignitor charge and a gas generator to inflate the folded airbag.

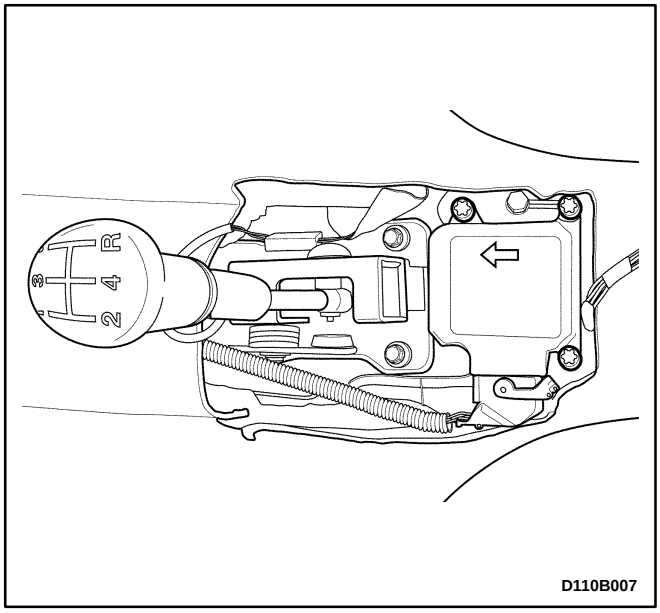
SENSING AND DIAGNOSTIC MODULE (SDM)

The SDM

- Has no user-serviceable parts.
- Is under the front console assembly.
- Continuously monitors the system components.
- Records any faults which are discovered.
- Illuminates a warning lamp that alerts the driver to any faults.
- Allows the fault codes to be retrieved with a scan tool.

The SDM controls the deployment of the airbag system through the use of the

- Arming sensor.
- Capacitor.
- Crash sensor, or accelerometer.



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Arming Sensor

The arming sensor is safety device made up of a dual-contact, electro-mechanical switch that:

- Acts independently of the electronic components.
- Keeps the firing circuits for the airbags unarmed under normal driving conditions.
- Allows the airbags to deploy under the required conditions.

Capacitor

The capacitor provides reserve power.

Crash Sensor

The crash sensor, or accelerometer, electronically represents the acceleration or deceleration of the vehicle during a frontal impact. In this electronic representation, the electrical signal is proportional to the acceleration or deceleration of the vehicle.

SIR WARNING LAMP

The supplemental inflatable restraints (SIR) system includes a self-diagnostic function.

If there is a failure of the sensing and diagnostic module or the external circuits, the SIR warning lamp in the instrument cluster turns ON.

As a system check, the SIR warning lamp also turns ON when the ignition is first switched to the ON position.

Correct Functioning

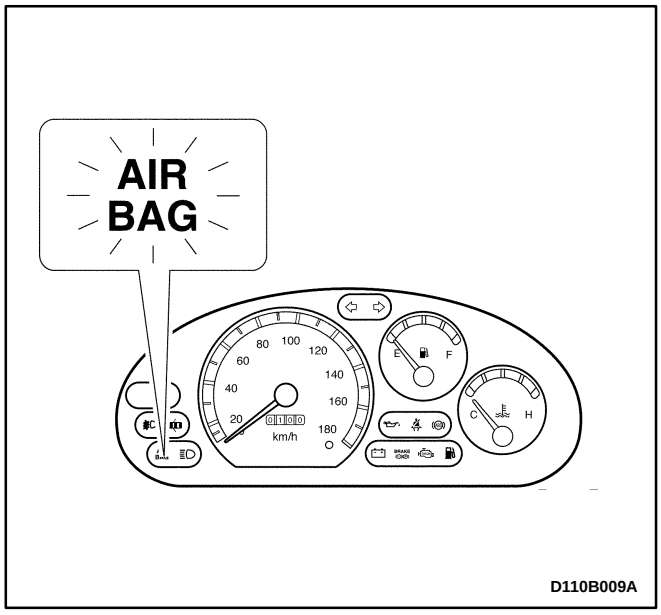
The system is working properly if:

- The SIR warning lamp turns OFF after approximately four seconds.

Faulty Functioning

The system is not working properly, meaning one of the SIR components or the wiring connector is faulty, if:

- The SIR warning lamp fails to turn ON when the ignition is first switched ON.
- The SIR warning lamp remains ON.



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CLOCK SPRING

The clock spring:

- Is on the steering column.
- Contains a coil that is the electrical contact between the steering column wiring harness and the driver side airbag module.
- Is part of the circuit for the horn.

Notice: Turning the steering wheel more than three and one-quarter turns may damage the clock spring.

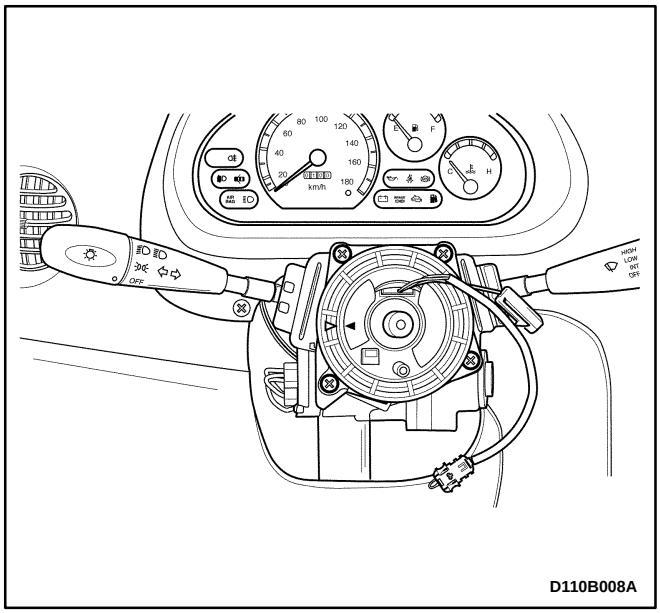
Turning the steering wheel:

- In one direction tightens the coil.
- In the opposite direction loosens the coil.
- More than three and one-quarter turns may damage the clock spring.

Caution: Disassembling the clock spring can cause injury and vehicle damage.

The clock spring should never be disassembled.

The clock spring must be replaced if the airbags have been deployed.



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WIRING HARNESS/CONNECTORS

The connector for the sensing and diagnostic module (SDM) has a built-in shorting bar that will turn ON the warning lamp if there is a poor connection at the SDM.

As an anti-deployment mechanism, additional shorting bars are in the

- Connector for the clock spring at the lower steering column.
- Passenger airbag module connector.
- SDM connector.

When these connectors are separated, the shorting bars will short circuit any current which is applied, preventing the current from reaching the airbag modules.

SIR SYSTEM

The supplemental inflatable restraints (SIR) system is a safety device used in conjunction with the seat belts.

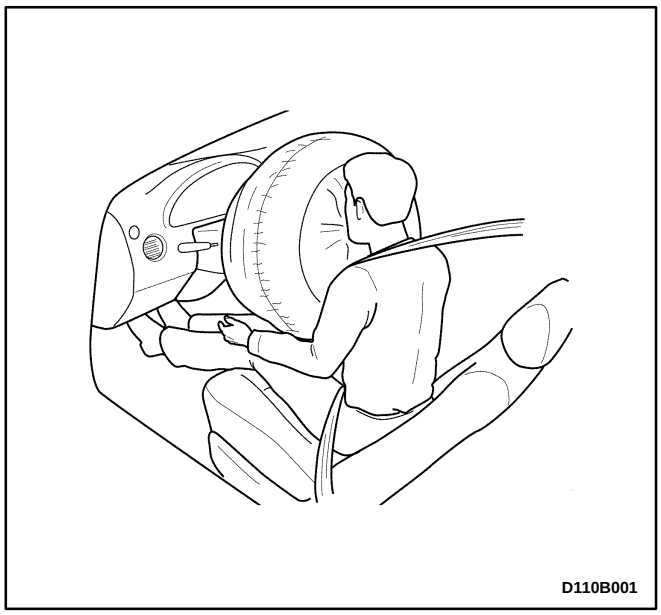
The airbag does not replace the function of the seat belt. The driver and the passengers must always fasten their seat belts and adjust them for a proper fit.

The SIR is designed to protect the driver and the front seat passenger in the event of a significant frontal impact to the vehicle. The airbags deploy if the force is applied from a direction within 30 degrees of the vehicle's centerline and above 25 km/h (15 mph) speed.

The SIR consists of a

- Driver airbag module.
- Passenger airbag module.

- Sensing and diagnostic module.
- Steering column clock spring.
- Wiring harness.
- SIR malfunction warning lamp.



GENERAL PRECAUTIONS

The supplemental inflatable restraints (SIR) warning lamp must illuminate when the ignition is switched ON, and then turn OFF after approximately 4 seconds.

There is a fault in the airbag system if

- The warning lamp does not turn OFF.
- The warning lamp illuminates while the vehicle is in operation.

If the warning lamp indicates there is a fault in the airbag system, assume that the SIR system may not be functional.

Caution: Failure to follow all service procedures in the correct sequence can cause the airbag system to deploy unexpectedly and possibly cause a serious injury.

Only trained personnel at franchised Daewoo dealers and authorized Daewoo service dealerships may service the airbag system.

Never attempt to disassemble, repair, or reuse the

- Airbag modules.
- Clock spring.
- Sensing and diagnostic module.
- Wiring harness.

When making SIR repairs,

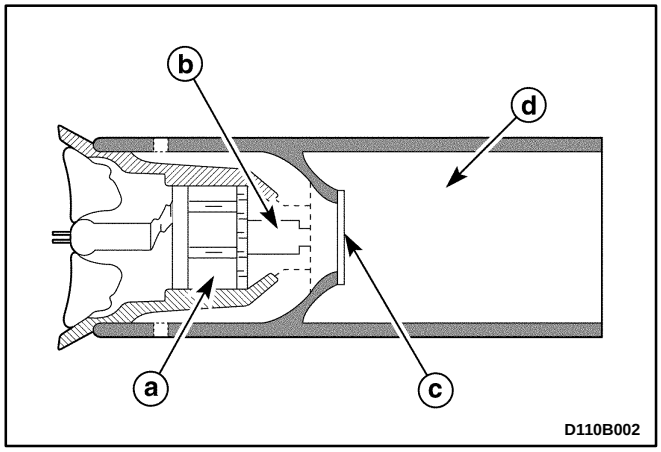
- Inspect any SIR part before it is installed.
- Use only new parts.
- Do not install used SIR parts from other vehicles.
- Do not install any part that has been dropped or that has dents, cracks, or other defects.

AIRBAG DEPLOYMENT CONDITION

Airbag is designed to deploy under 30° left/right angle barrier and above 25 km/h (15 mph) speed.

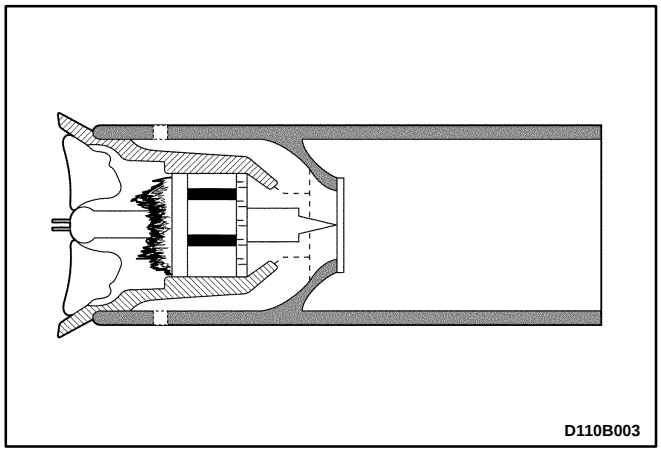
Concrete Barrier Deployment Condition

In case of the 0° frontal concrete battier, airbag may deploy above 25 km/h (15 mph) speed.

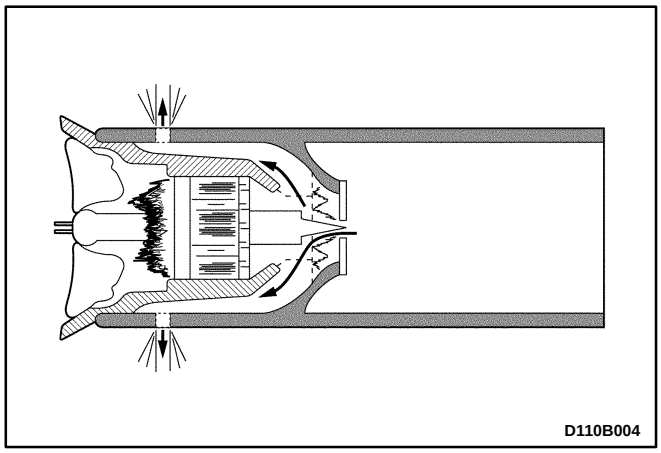


AIRBAG DEPLOYMENT PROCEDURE

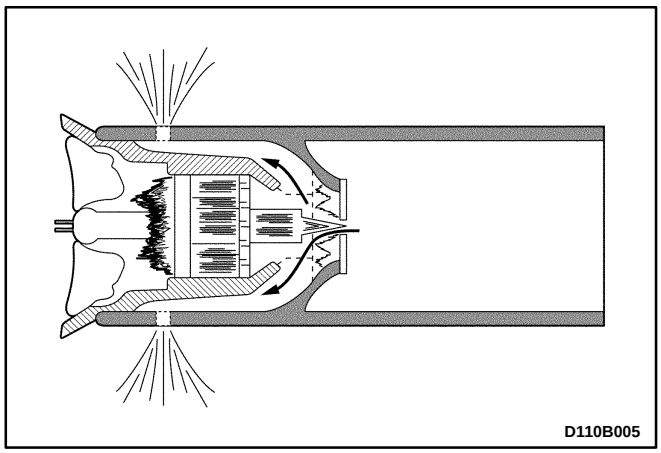
1. Non–Deployment condition
   a. Initiator
   b. Piston
   c. Safety disc
   d. Compressed Ar gas



2. When crashing, firing current flows from the SDM to the initiator.
3. Initiator is burning and the inside pressure is increasing and the piston hits the safety disc.



4. Safety disc is broken and the compressed Ar gas is spouted out.

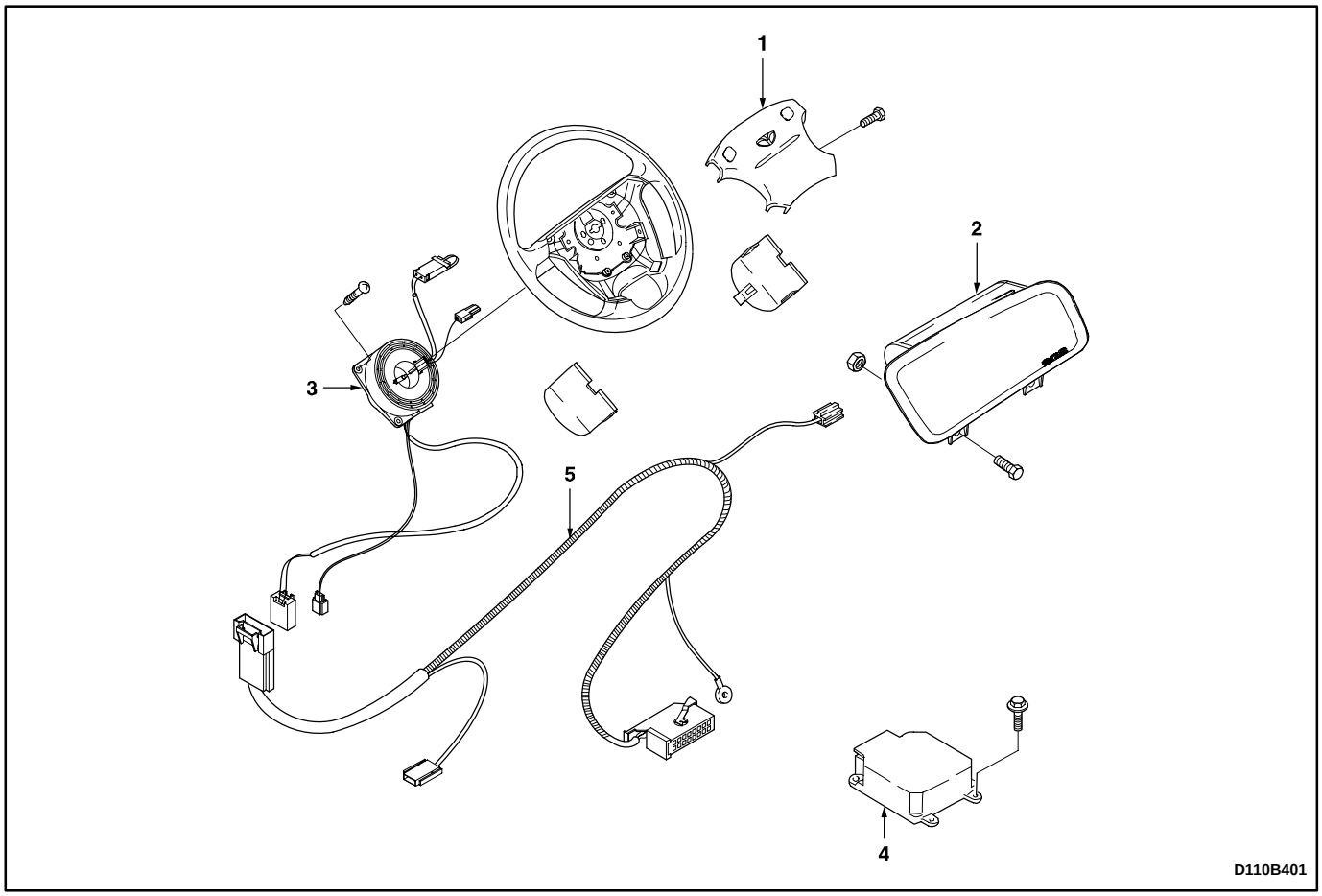


5. Compressed Ar gas and the burned initiator are carbureted. And the airbag is deployed.

COMPONENT LOCATOR

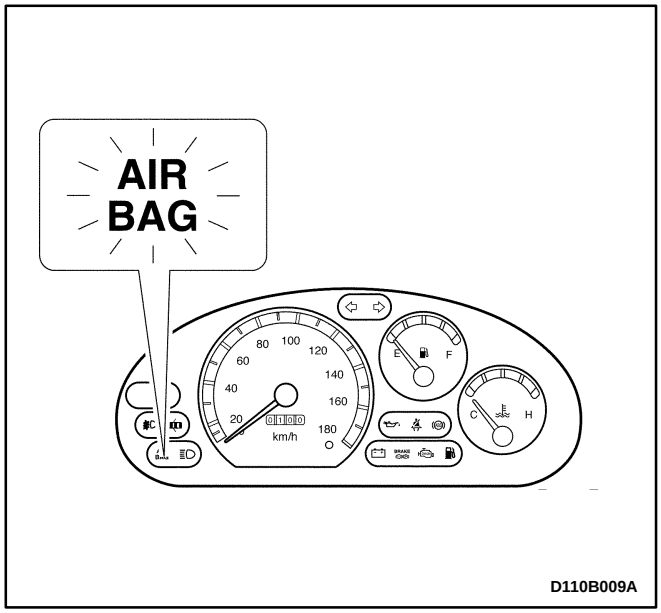
SIR COMPONENT

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



1. Driver Airbag Module
2. Passenger Airbag Module
3. Clock Spring
4. Sensing and Diagnostic Module (SDM)
5. Wiring Harness

DIAGNOSTIC INFORMATION AND PROCEDURES



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BULB CHECK

As soon as the operating voltage is applied to the sensing and diagnostic module (SDM) ignition input, the SDM activates the warning lamp for a bulb check.

The SDM turns the lamp ON for 4 seconds, and then the SDM turns the lamp OFF.

During the bulb check, the SDM is not ready to detect a crash or deploy the supplemental inflatable restraints.

FAULT INDICATION

The sensing and diagnostic module records the system's faults in two categories:

- Current faults and the fault code appears "Axx" on the scan tool display.
- Historic faults, which are those that were detected in the past, but are no longer active. And the fault code appears "Sxx" on the scan tool display.

The warning lamp:

- Indicates a fault as soon as it occurs.
- Stays ON, even if a fault is no longer active.

A scan tool connected to the data link connector (DLC):

- Reveals the fault codes.
- Receives serial data transmission through the terminal J (13) of the DLC.
- Receives ground through the terminal A (4) of the DLC.

CLEARING FAULT CODES

When the sensing and diagnostic module (SDM) receives the CODE ERASE command from the scan tool, the SDM:

- Clears the entire fault memory.
- Turns OFF the warning lamp.
- Resets for fault detection.

External Fault

Service personnel can reset the SDM and turn OFF the warning lamp if the fault is an external fault.

Internal Fault

An internal fault of the SDM or a CRASH RECORDED fault code cannot be reset.

In the case of an internal fault of the SDM or a CRASH RECORDED fault code, the SDM must be replaced.

Voltage-Low Fault

The SDM will turn OFF the VOLTAGE LOW fault as soon as the voltage recovers.

MICROPROCESSOR – INDEPENDENT LAMP ACTIVATION

If the sensing and diagnostic module (SDM) electrical connector is not properly attached, the SDM cannot function and cannot control the warning lamp.

If this fault is present, the warning lamp will operate independently from the SDM through the use of shorting bars that are built into the SDM connector.

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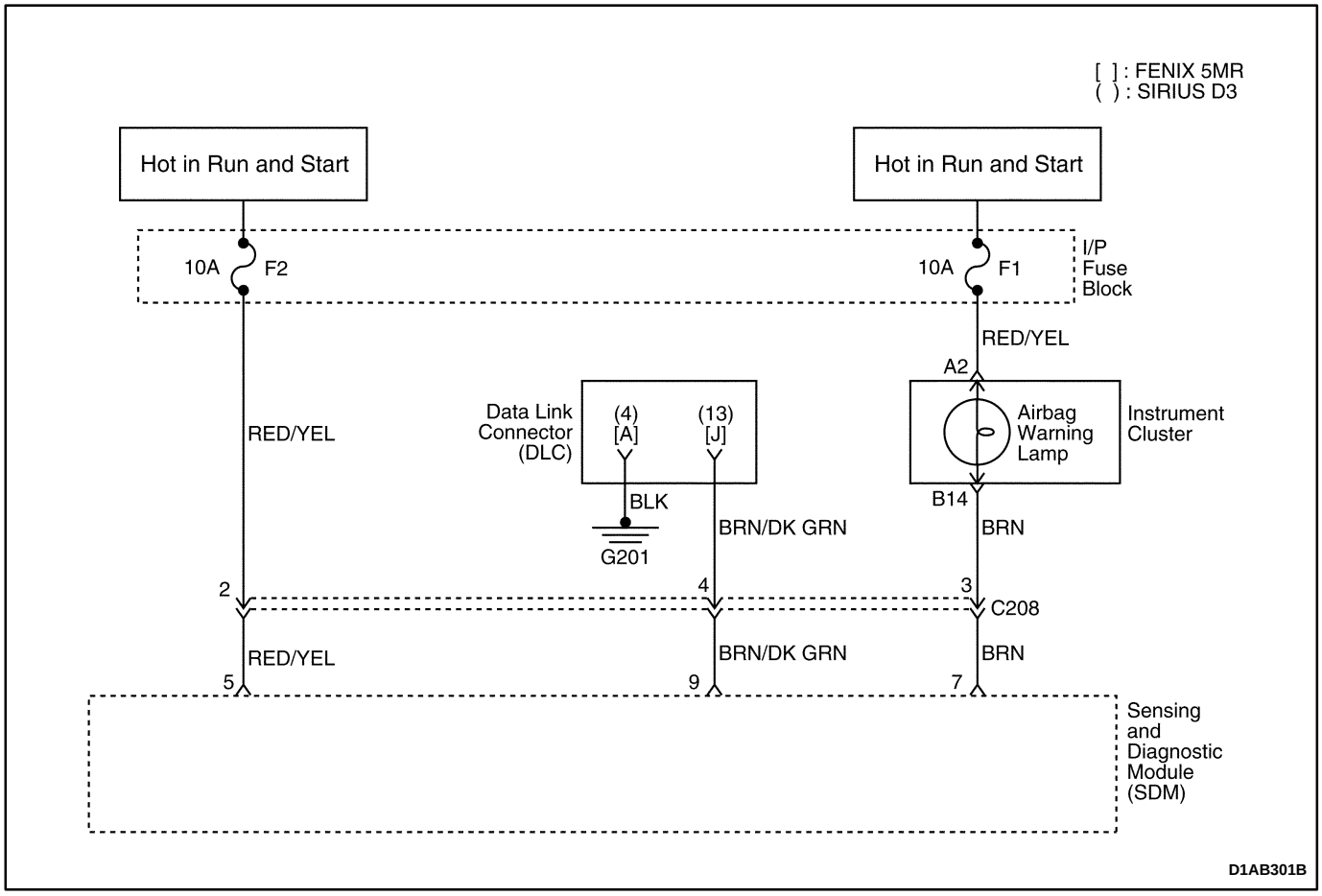
SYSTEM CHECK



Caution: Use only the scan tool to check the airbag modules and the sensing and diagnostic module (SDM). Never measure the resistance of an airbag module with an ohmmeter. An ohmmeter's battery can deploy the airbag and cause injury.

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Do not attempt to repair the supplemental inflatable restraints (SIR) wiring harness. An SIR repair can create a high-resistance connection which can keep the airbags from deploying when needed, resulting in injury.

Circuit Description

When the ignition switch is turned ON, the SDM is able to send serial data from the terminal 9 of the SDM to the terminal J (13) of the assembly line diagnostic link.

Diagnostic System Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition ON. 2. Check the warning lamp. Does the warning lamp turn off after 4 seconds?	–	System OK	Go to *Step 2*
2	1. Connect the scan tool cable to the DLC. 2. Connect the scan tool power cable to the cigar lighter socket. 3. Select the airbag main menu on the scan tool. 4. Select "Fail Code View & Clear " from the displayed menu of the diagnostic test codes (DTC). Are there any active fault codes?	–	Go to the DTC table for the fault indicated	Go to *Step 3*

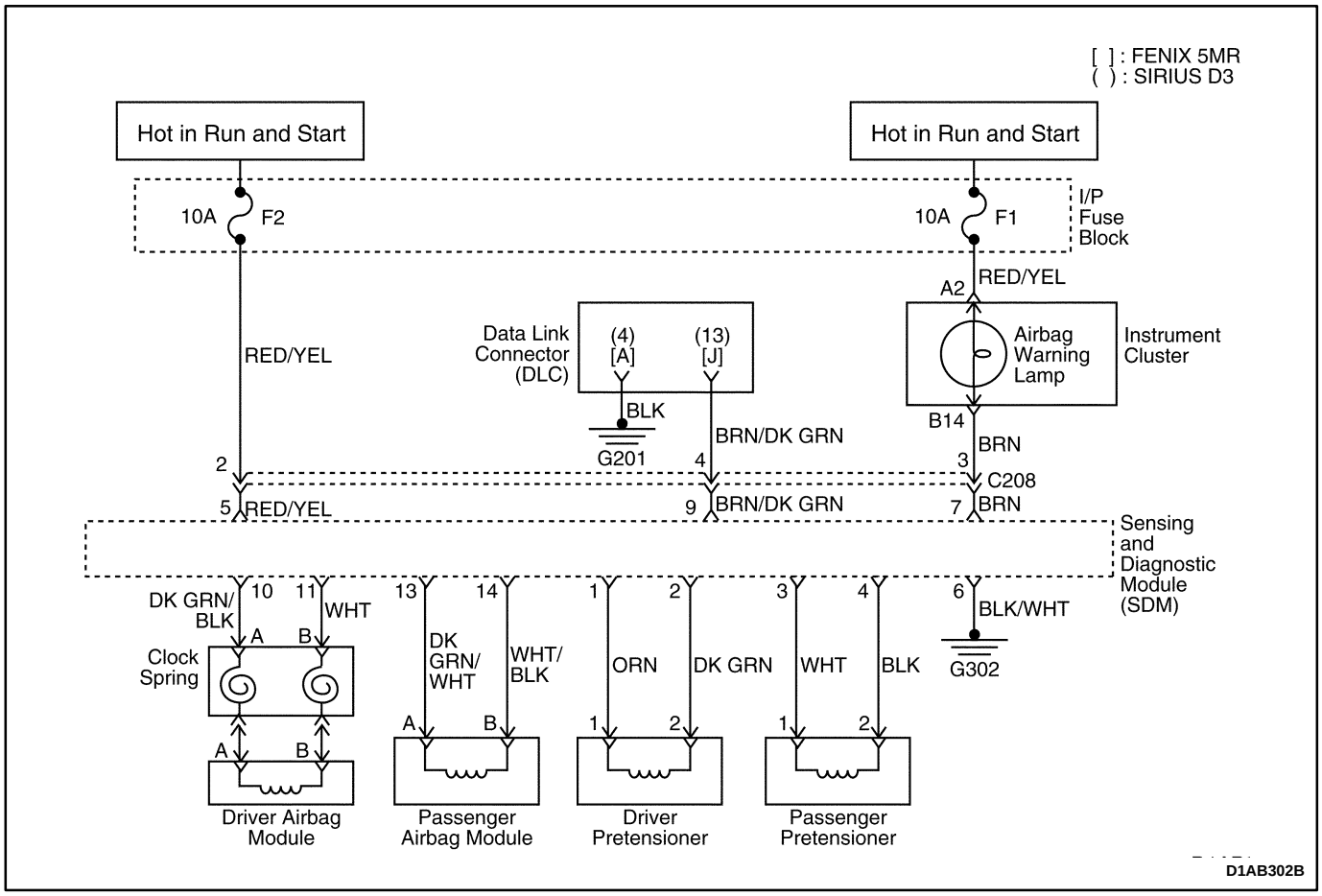
Diagnostic System Check (Cont'd)

Step	Action	Value(s)	Yes	No
3	1. Check fuse F2. Is the fuse F2 blown?	–	Go to *Step 4*	Go to *Step 5*
4	1. Replace fuse F2. Is the repair complete?	–	System OK	–
5	1. Disconnect the electrical connector C208. 2. Check for a short to ground between fuse F2 and terminal 2 of connector C208. Is wiring harness shorted to ground?	–	Go to *Step 6*	Go to *Step 7*
6	Repair a short to ground between fuse F2 and terminal 2 of connector C208. Is the repair complete?	–	System OK	–
7	1. Disconnect the SDM electrical connector. 2. Check for a short to ground between terminal 2 and terminal 5 of SDM connector. Is wiring harness shorted to ground?	–	Go to *Step 15*	Go to *Step 8*
8	Use an ohmmeter to check for continuity between terminal A (4) of the DLC and ground G201. Does the ohmmeter show the specified value?	≈0 Ω	Go to *Step 9*	Go to *Step 10*
9	Repair the open DLC ground circuit. Is the repair complete?	–	System OK	–
10	1. Turn the ignition ON. 2. Check the voltage at the cigar lighter positive terminal. Does the voltmeter show the specified value?	11–14V	Go to *Step 12*	Go to *Step 11*
11	Repair the power supply for the cigar lighter socket. Is the repair complete?	–	System OK	–
12	Check for a short to ground of open circuit between terminal J (13) of the DLC and terminal 4 of connector 208. Is wiring harness shorted to ground or open?	–	Go to *Step 13*	Go to *Step 14*
13	Repair a short to ground or open circuit between terminal J (13) of the DLC and terminal 4 of connector C208. Is the repair complete?	–	System OK	–
14	Check for a short to ground or open between terminal 4 of connector C208 and terminal 9 of the SDM connector. Is wiring harness shorted to ground or open?	–	Go to *Step 15*	Go to *Step 16*
15	Replace the SDM waring harness. Is the repair complete?	–	System OK	–
16	Replace the SDM. Is the repair complete?	–	System OK	–

FAULT CODES

Fault Codes	Fault Contents
01	Driver Firing Circuit, Resistance Too High
02	Driver Firing Circuit, Resistance Too Low
03	Driver Firing Circuit, Short to Ground
04	Driver Firing Circuit, Short to Battery Ground
05	Passenger Firing Circuit, Resistance Too High
06	Passenger Firing Circuit, Resistance Too Low
07	Passenger Firing Circuit, Short to Ground
08	Passenger Firing Circuit, Short to Battery Voltage
09	Driver Pretensioner Circuit, Resistance Too High
10	Driver Pretensioner Circuit, Resistance Too Low
11	Driver Pretensioner Circuit, Short to Ground
12	Driver Pretensioner Circuit, Short to Battery Voltage
13	Passenger Pretensioner Circuit, Resistance Too High
14	Passenger Pretensioner Circuit, Resistance Too Low
15	Passenger Pretensioner Circuit, Short to Ground
16	Passenger Pretensioner Circuit, Short to Battery Voltage
17	Connection Between Driver Firing Circuit and Passenger Firing Circuit
18	Connection Between Driver Firing Circuit and Driver Pretensioner Circuit
19	Connection Between Driver Firing Circuit and Passenger Pretensioner Circuit
20	Connection Between Passenger Firing Circuit and Driver Pretensioner Circuit
21	Connection Between Passenger Firing Circuit and Passenger Pretensioner Circuit
22	Connection Between Driver Pretensioner Circuit and Passenger Pretensioner Circuit
23	Ignition Input Circuit, Voltage Too High
24	Ignition Input Circuit, Voltage Too Low
25	Warning Lamp Failure
31	SDM Internal Fault
32	SDM Crash Recorded

BLANK



DIAGNOSTIC TROUBLE CODE (DTC) 01
DRIVER FIRING CIRCUIT, RESISTANCE TOO HIGH

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver airbag module firing circuit. The SDM allows a very small amount of current to flow through the driver airbag module firing circuit. The SDM monitors the circuit resistance during this check.

DTC 01 Will Set When

- The combined resistance of the driver airbag module, the harness wiring, and the connector contacts is above a specified value, as with an open circuit.

Test Description

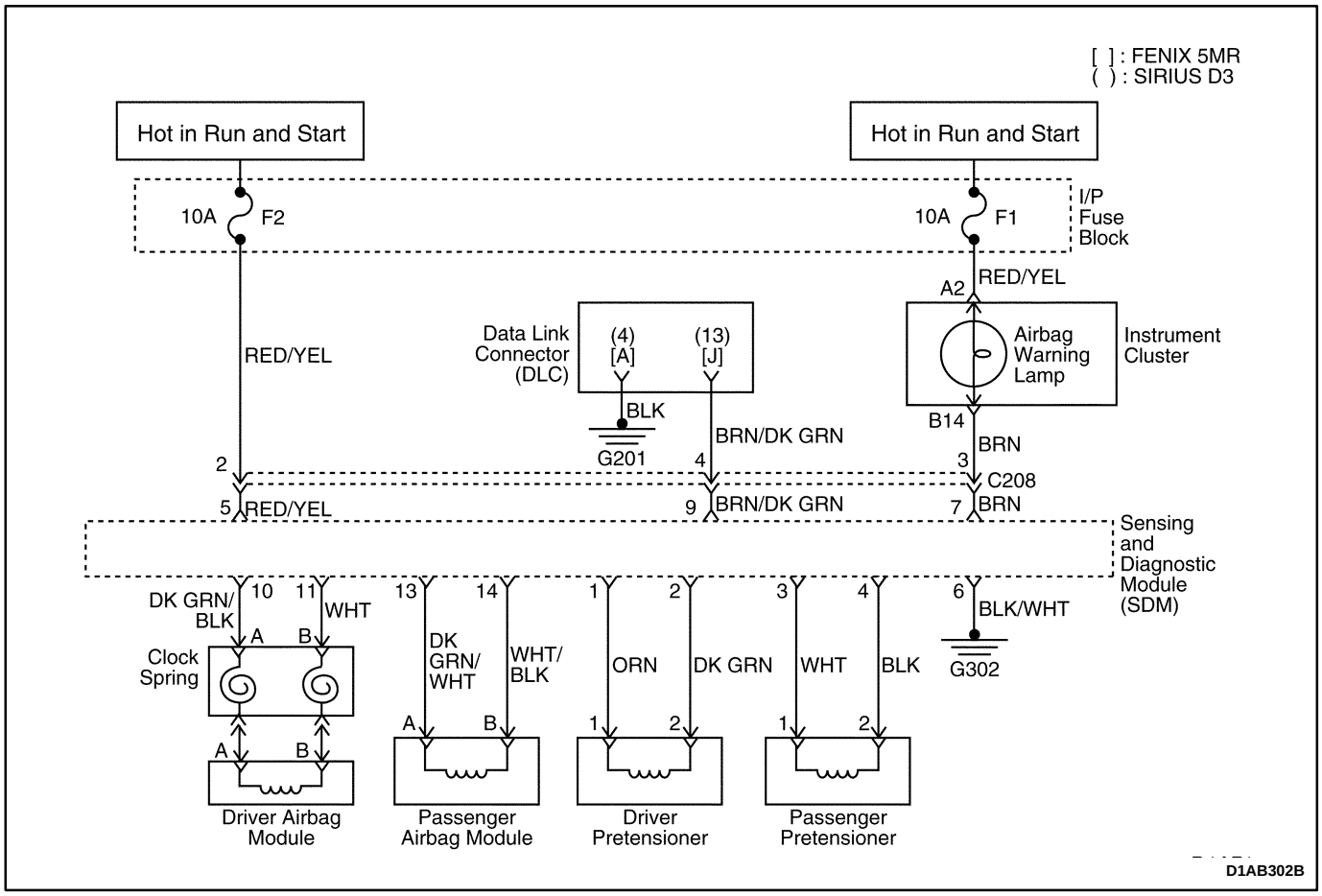
Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module with an ohmmeter. An ohmmeter's battery can deploy the airbag and cause injury.

Caution: Do not attempt to repair the supplemental inflatable restraints (SIR) wiring harness. A repair can create a high-resistance connection which can keep the airbags from deploying when needed, resulting in injury.

DTC 01 – Driver Firing Circuit, Resistance Too High

Step	Action	Value(s)	Yes	No
1	Examine the wiring and the connector at the driver airbag module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the driver airbag module connector. 2. Reinstall the driver airbag module in the steering wheel. 3. Reconnect the negative battery terminal. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Remove the driver airbag module. 2. Place the driver airbag module in a secure position with the decorative surface facing upward. 3. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver airbag module. 4. Connect an ohmmeter to the terminals of the wiring harness connector for the driver airbag module. ● Refer to "Diagnostic Illustration 3" in this section. Does the ohmmeter indicate the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 01 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver airbag module. 2. Reconnect the negative battery terminal. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Disconnect the clock spring wiring harness connector at the lower steering column. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the clock spring. 2. Connect an ohmmeter to the terminals at the SDM side of the clock spring connector. ● Refer to "Diagnostic Illustration 4" in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 7*	Go to *Step 8*
7	1. Replace the clock spring. 2. Reconnect the negative battery terminal. Is the repair complete?	–	Go to *Diagnostic System Check*	–
8	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 02
DRIVER FIRING CIRCUIT, RESISTANCE TOO LOW

Short Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver airbag module firing circuit. The SDM allows a very small amount of current to flow through the airbag module firing circuit. The SDM monitors the circuit resistance during this check.

DTC 02 Will Set When

- The combined resistance of the driver airbag module, the harness wiring, and the connector contacts is below a specified value, as with a short circuit between the wires to the driver airbag module.

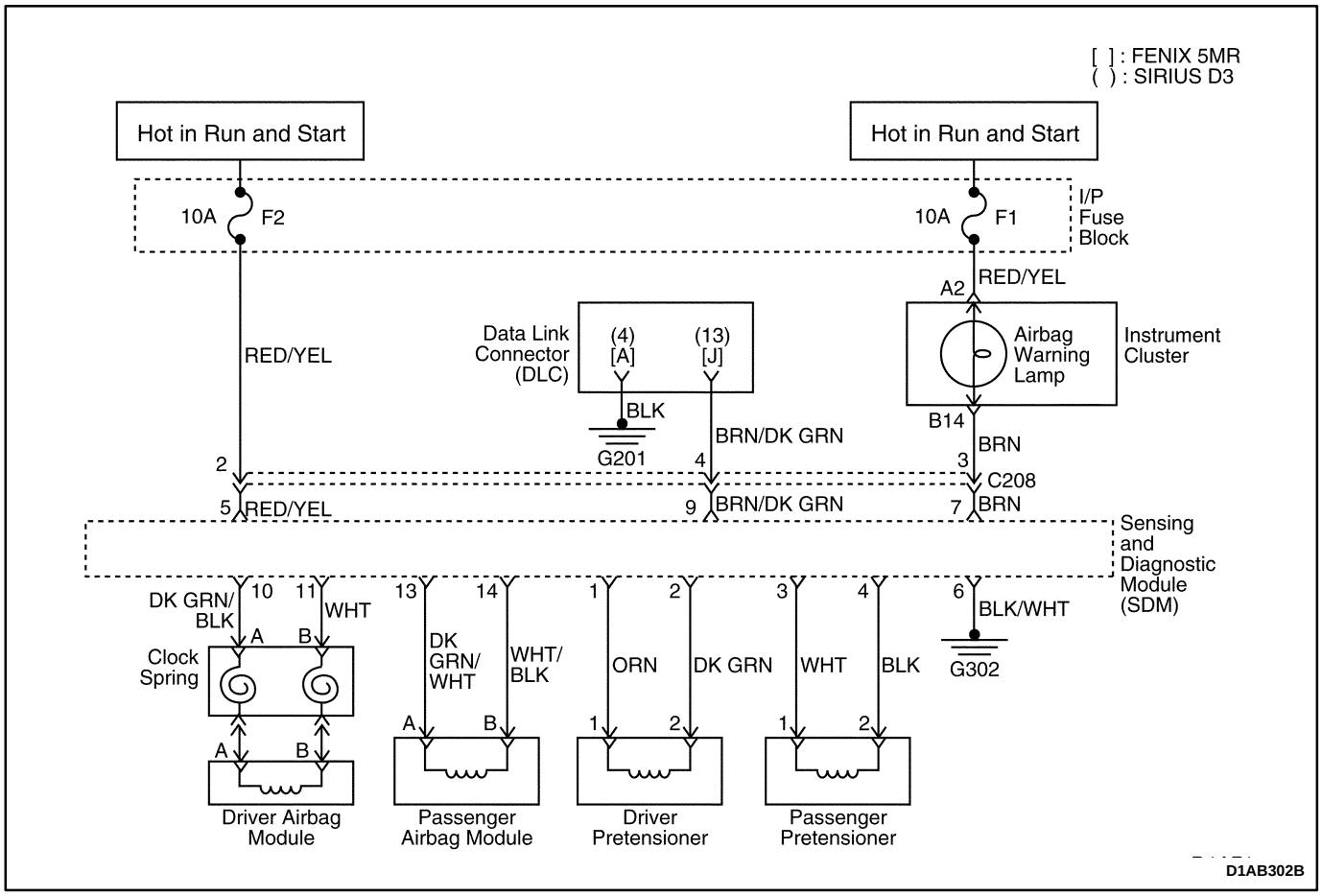
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module with an ohmmeter. An ohmmeter's battery can deploy the airbag and cause injury.

DTC 02 – Driver Firing Circuit, Resistance Too Low

Step	Action	Value(s)	Yes	No
1	1. Remove the driver airbag module. 2. Store the driver airbag module with the decorative side facing upward. 3. Connect an ohmmeter to the terminals of the wiring harness connector for the driver airbag module. ● Refer to "Diagnostic Illustration 3" in this section. Does the ohmmeter show the specified value?	∞	Go to *Step 2*	Go to *Step 4*
2	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 02 still show as a current fault?	–	Go to *Step 3*	System OK
3	1. Replace the driver airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
4	1. Disconnect the clock spring wiring harness connector at the lower steering column. 2. Connect an ohmmeter to the terminals at the SDM side of the clock spring connector. ● Refer to "Diagnostic Illustration 4" in this section. Does the ohmmeter show the specified value?	∞	Go to *Step 5*	Go to *Step 6*
5	1. Replace the clock spring. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 03
DRIVER FIRING CIRCUIT, SHORT TO GROUND

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver airbag module firing circuit. The SDM allows a very small amount of current to flow through the driver airbag module firing circuit. The SDM monitors the voltage during this check.

DTC 03 Will Set When

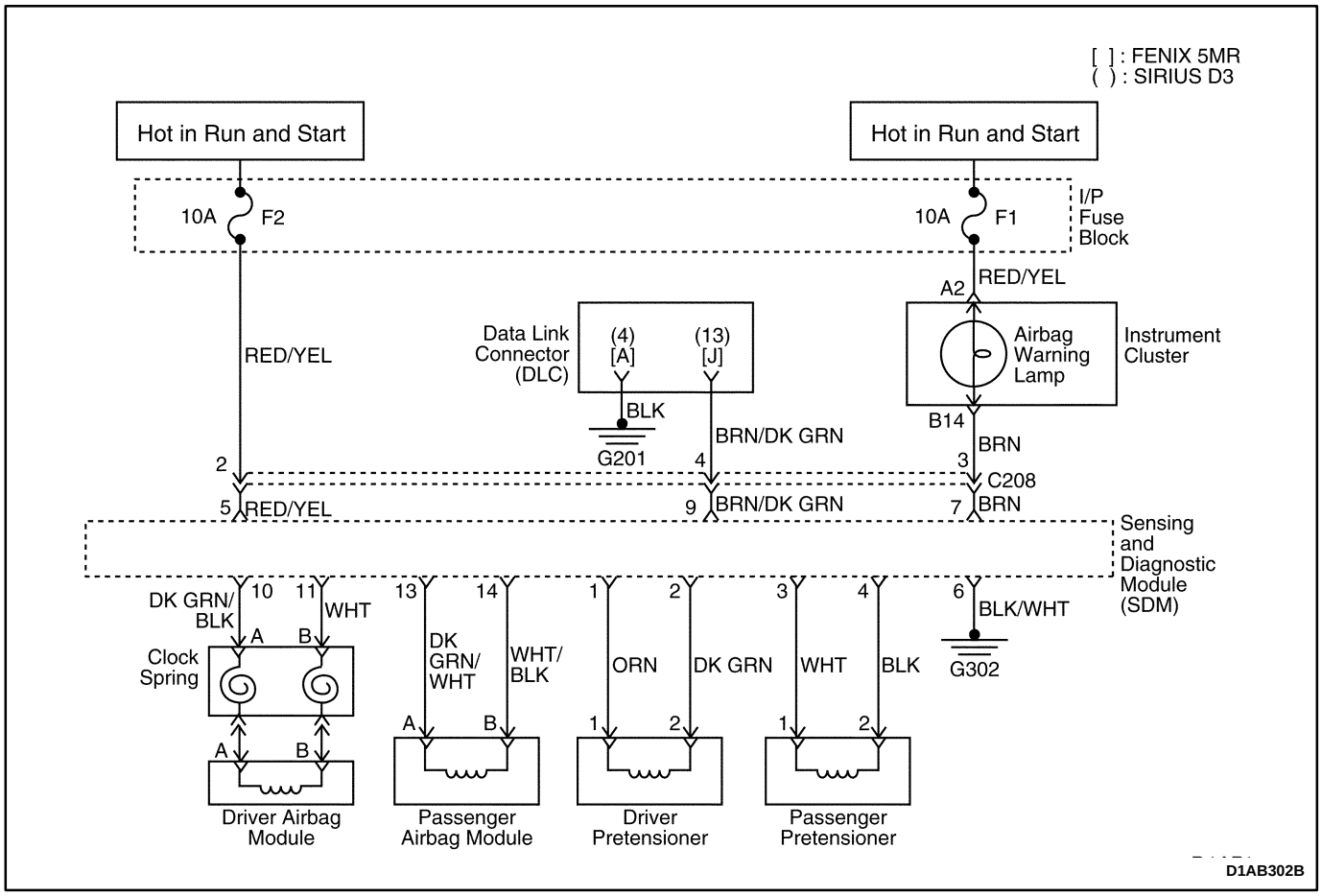
- The firing circuit is shorted to ground.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 03 – Driver Firing Circuit, Short To Ground

Step	Action	Value(s)	Yes	No
1	Visually inspect the supplemental inflatable restraints (SIR) wiring harness for damage. Is there any visible damage to the SIR harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Remove the driver airbag module. 2. Place the driver airbag module in a secure position with the decorative surface facing upward. 3. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver airbag module. 4. Use an ohmmeter to check the continuity between ground and one of the terminals on the wiring harness connector for the driver airbag module. ● Refer to "Diagnostic Illustration 5" in this section. Is the resistance less than the specified value?	∞	Go to *Step 6*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. ● Refer to the "Diagnostic System Check" in this section. Does the code 03 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Disconnect the clock spring wiring harness connector at the lower steering column. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the clock spring. 2. Using an ohmmeter, check for continuity between ground and one of the terminals on the SDM side of the clock spring connector. Is the resistance less than the specified value?	∞	Go to *Step 2*	Go to *Step 7*
7	1. Replace the clock spring. 2. Reconnect the negative battery terminal. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 04
DRIVER FIRING CIRCUIT, SHORT TO BATTERY VOLTAGE

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver airbag module firing circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors voltage during this check.

DTC 04 Will Set When

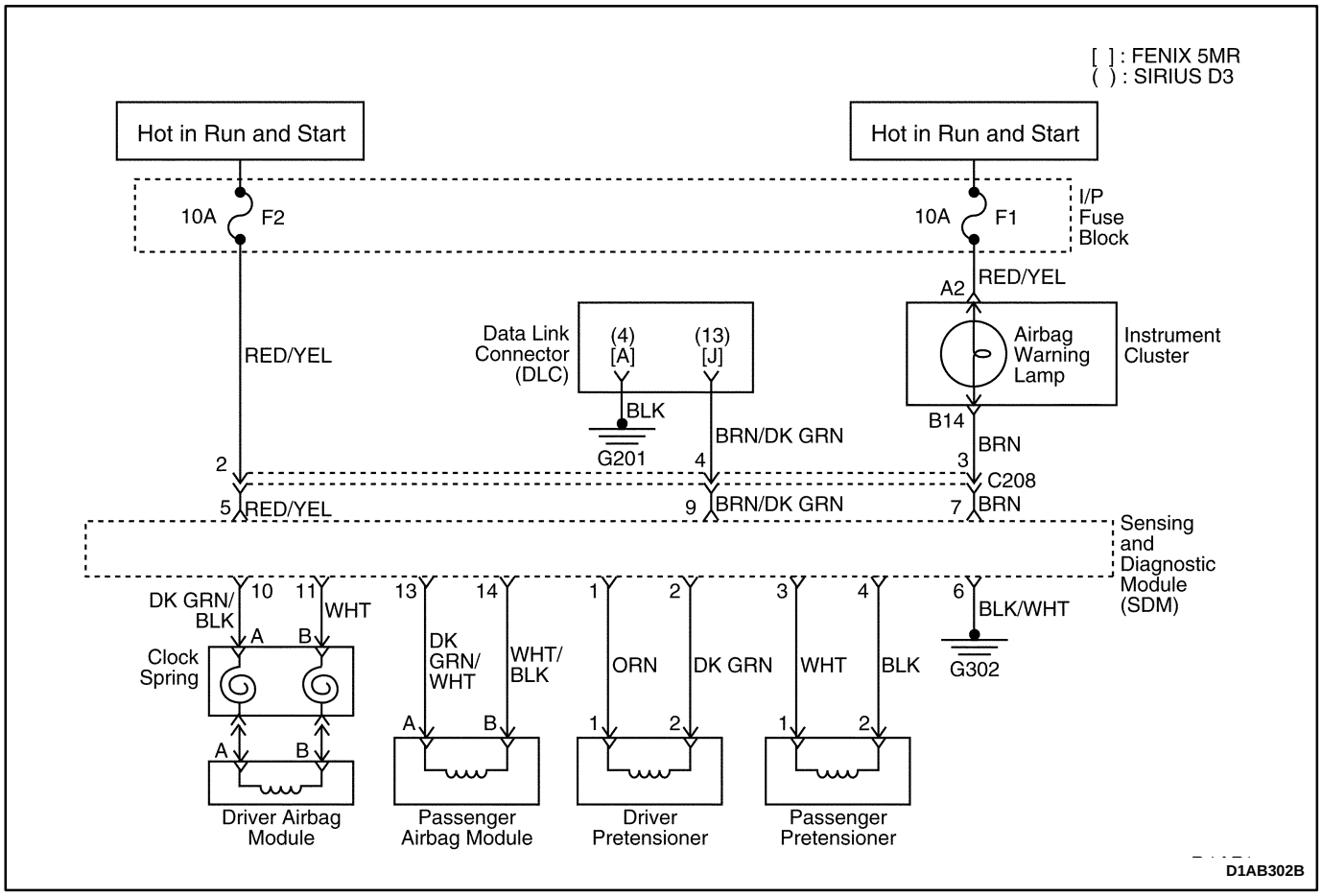
- The firing circuit is shorted to voltage.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 04 – Driver Firing Circuit, Short To Battery Voltage

Step	Action	Value(s)	Yes	No
1	Visually inspect the supplemental inflatable restraints (SIR) harness for damage. Is there any visible damage to the SIR harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is your repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Remove the driver airbag module. 2. Place the driver airbag module in a secure position with the decorative surface facing upward. 3. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver airbag module. 4. Use a multimeter to check the voltage at one of the terminals on the wiring harness connector for the driver airbag module. ● Refer to ‘‘Diagnostic Illustration 6’’ in this section. Is the voltage greater than the specified value?	0 v	Go to *Step 6*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 04 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Disconnect the clock spring wiring harness at the lower steering column. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the clock spring connector. 2. Using a multimeter, check the voltage at one of the terminals on the SDM side of the clock spring connector. ● Refer to ‘‘Diagnostic Illustration 7’’ in this section. Did the voltmeter indicate the specified value?	0 v	Go to *Step 7*	Go to *Step 2*
7	1. Replace the clock spring. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 05
PASSENGER FIRING CIRCUIT, RESISTANCE TOO HIGH

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger airbag firing circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 05 Will Set When

- The combined resistance of the passenger airbag module, the harness wiring, and the connector contacts is above a specified value, as in an open circuit.

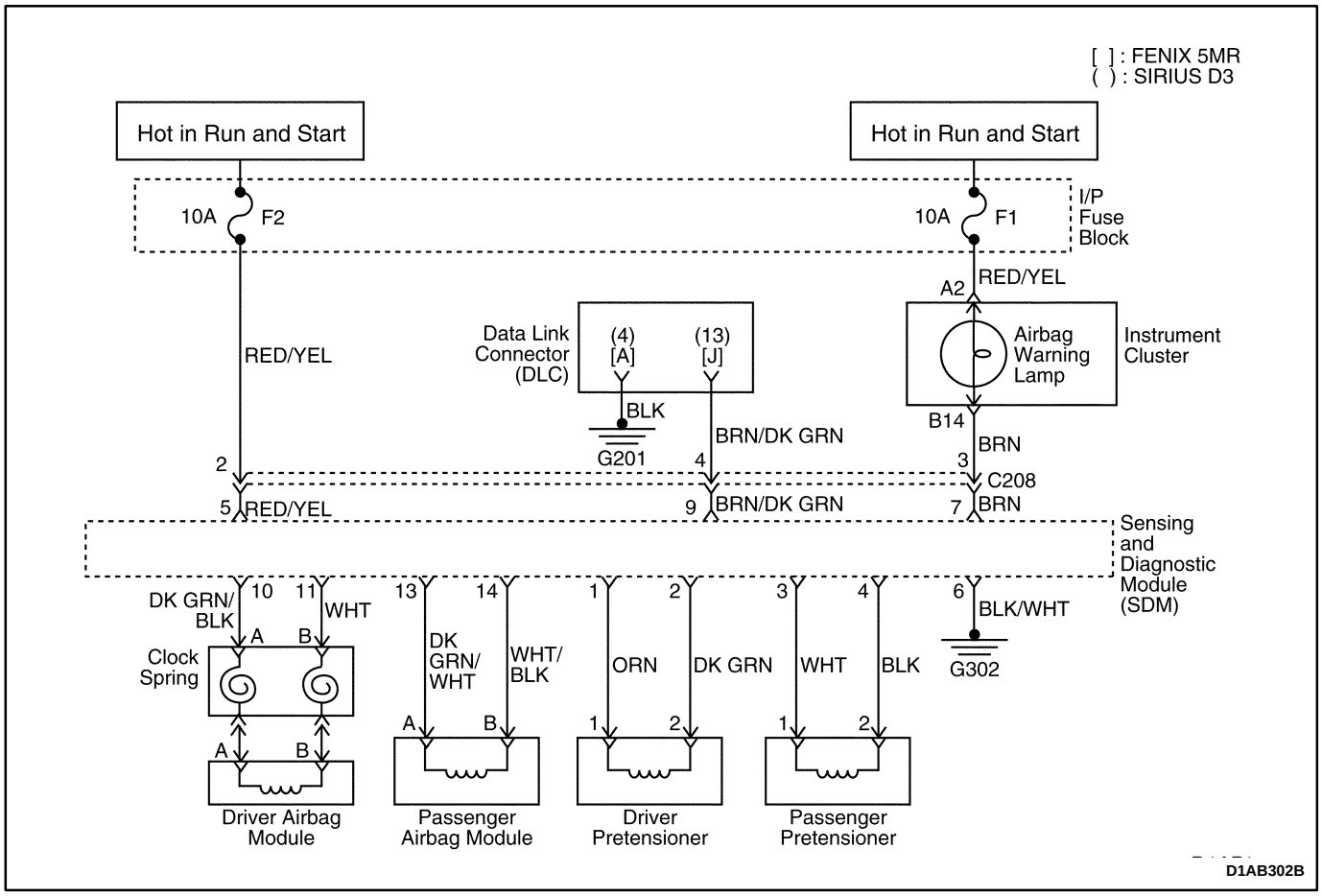
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 05 – Passenger Firing Circuit, Resistance Too High

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the passenger side airbag module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the passenger side airbag module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the passenger side airbag module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger airbag module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the passenger side airbag module. ● Refer to "Diagnostic Illustration 8" in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 05 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger side airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 06
PASSENGER FIRING CIRCUIT, RESISTANCE TOO LOW

Short Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger airbag firing circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 06 Will Set When

- The combined resistance of the passenger airbag module, the harness wiring, and the connector contacts is below a specified value, as in a short circuit between the wires to the passenger airbag module.

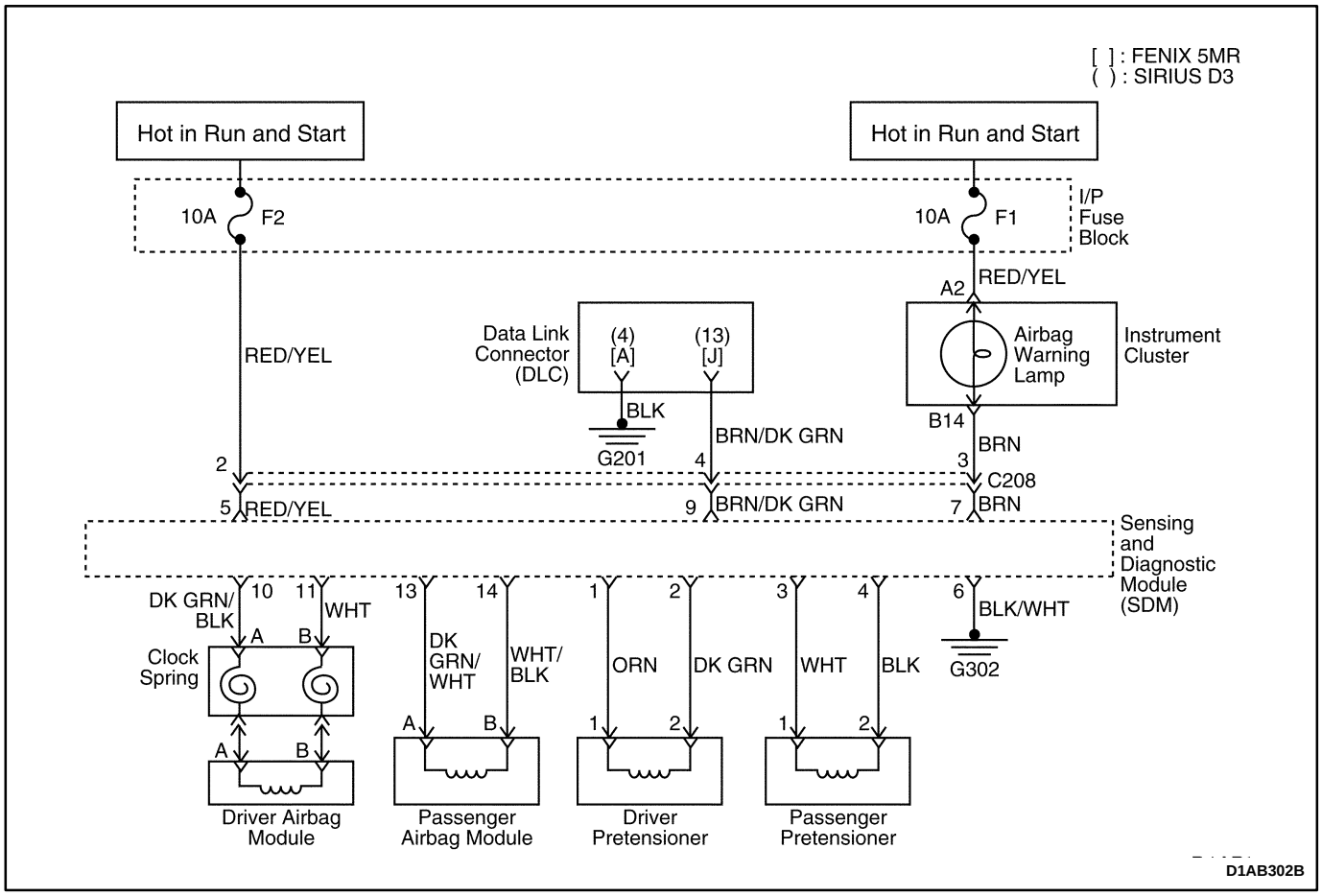
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module side of the connector is not working properly, the meter's battery could deploy the airbag and cause injury.

DTC 06 – Passenger Firing Circuit, Resistance Too Low

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Connect an ohmmeter to the terminals of the wiring harness connector for the passenger airbag module on the SDM side of the connector. ● Refer to ‘‘Diagnostic Illustration 8’’ in this section. Does the ohmmeter show the specified value?	∞	Go to *Step 2*	Go to *Step 4*
2	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 06 still show as a current fault?	–	Go to *Step 3*	System OK
3	1. Replace the passenger airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
4	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 07
PASSENGER FIRING CIRCUIT, SHORT TO GROUND

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger airbag firing circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the voltage during this check.

DTC 07 Will Set When

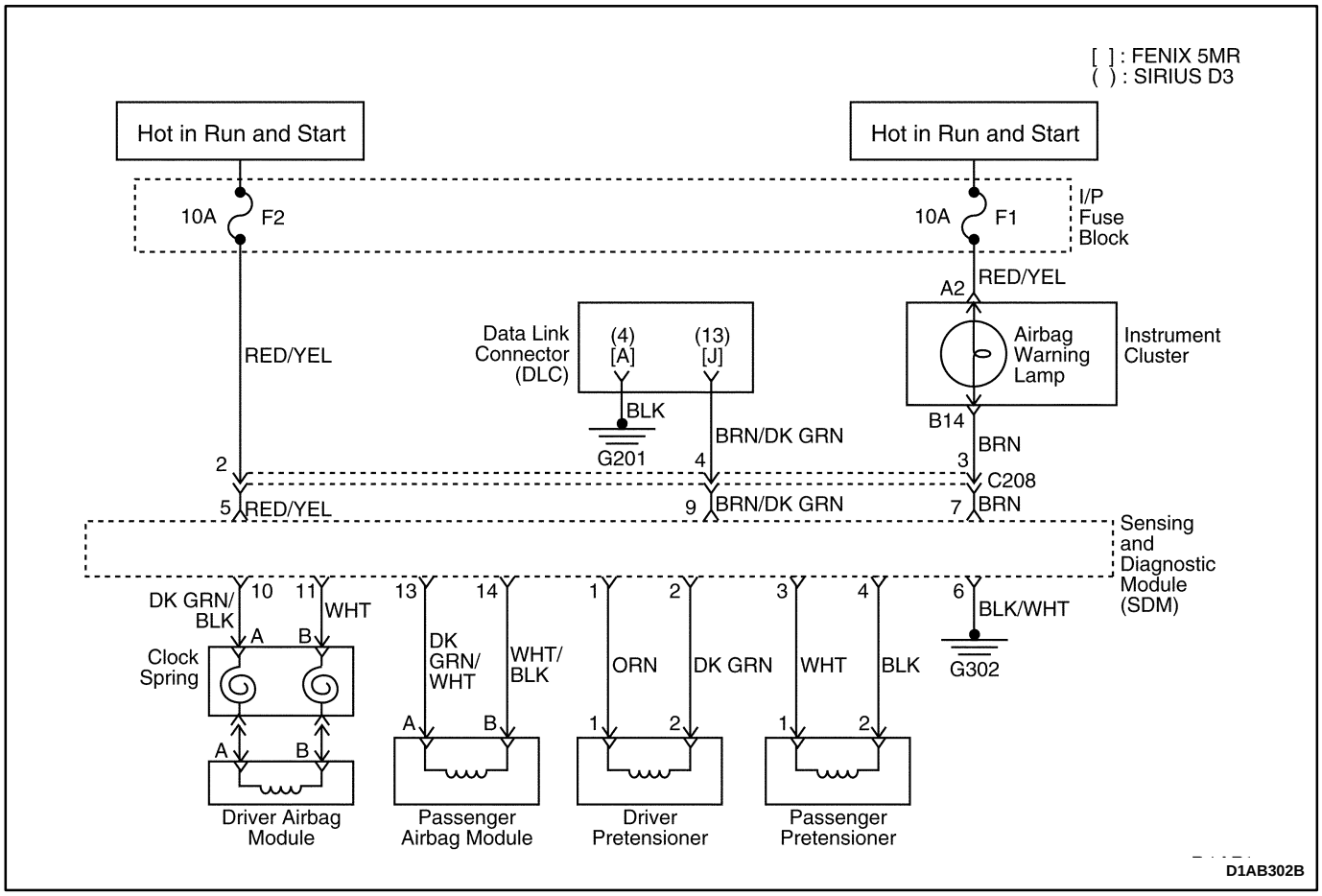
- The firing circuit is shorted to ground.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 07 Passenger Firing Circuit, Short To Ground

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Visually inspect the supplemental inflatable restraints (SIR) wiring harness. Is there any visible damage to the SIR harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector from the passenger airbag module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger side airbag module. 3. Use an ohmmeter to check the continuity between ground and one of the terminals at the SDM side of the wiring harness connector for the passenger side airbag module. ● Refer to ‘‘Diagnostic Illustration 9’’ in this section. Is the resistance less than the specified value?	∞	Go to *Step 2*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 07 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger side airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 08
PASSENGER FIRING CIRCUIT, SHORT TO BATTERY VOLTAGE

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger airbag firing circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the voltage during this check.

DTC 08 Will Set When

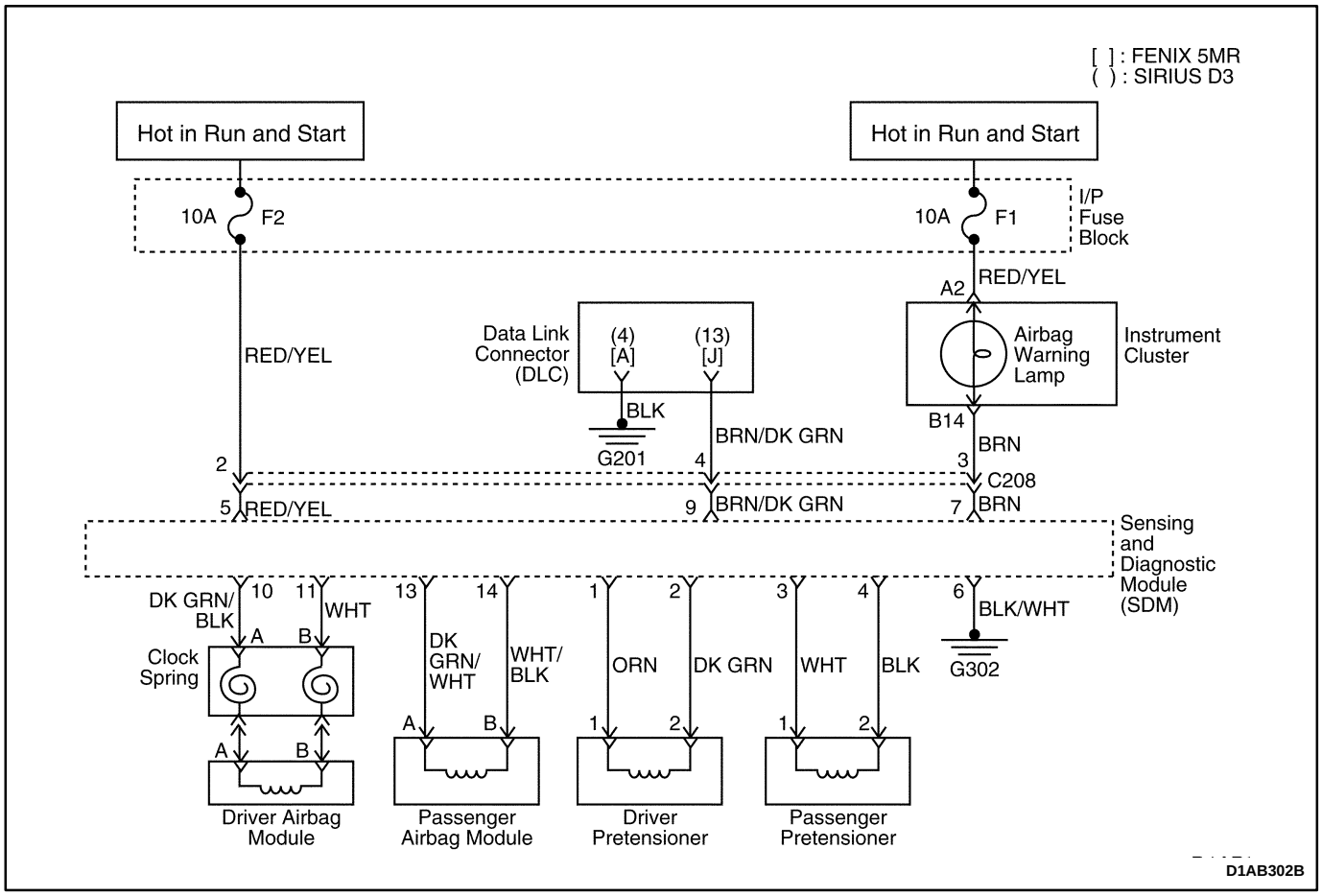
- The firing circuit is shorted to the voltage.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies the reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 08 – Passenger Firing Circuit, Short To Battery Voltage

Step	Action	Value(s)	Yes	No
1	1. Disconnect the battery negative cable. 2. Wait 1 minute for the SDM capacitor to discharge. ● The capacitor supplies reserve power to deploy the passenger side airbag even if the battery has been disconnected. 3. Visually inspect the supplemental inflatable restraints (SIR) wiring harness. Is there any visible damage to the SIR wiring harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the passenger airbag module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger airbag module. 3. Use a multimeter to check the voltage at one of the terminals on the SDM side of the SIR wiring harness connector for the passenger airbag module. ● Refer to ‘‘Diagnostic Illustration 10’’ in this section. Is the voltage greater than the specified value?	0 v	Go to *Step 2*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4.Do the diagnostic system check. Does the code 08 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger side airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 09
DRIVER PRETENSIONER CIRCUIT, RESISTANCE TOO HIGH

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 09 Will Set When

- The combined resistance of the driver pretensioner module, the harness wiring, and the connector contacts is above a specified value, as in an open circuit.

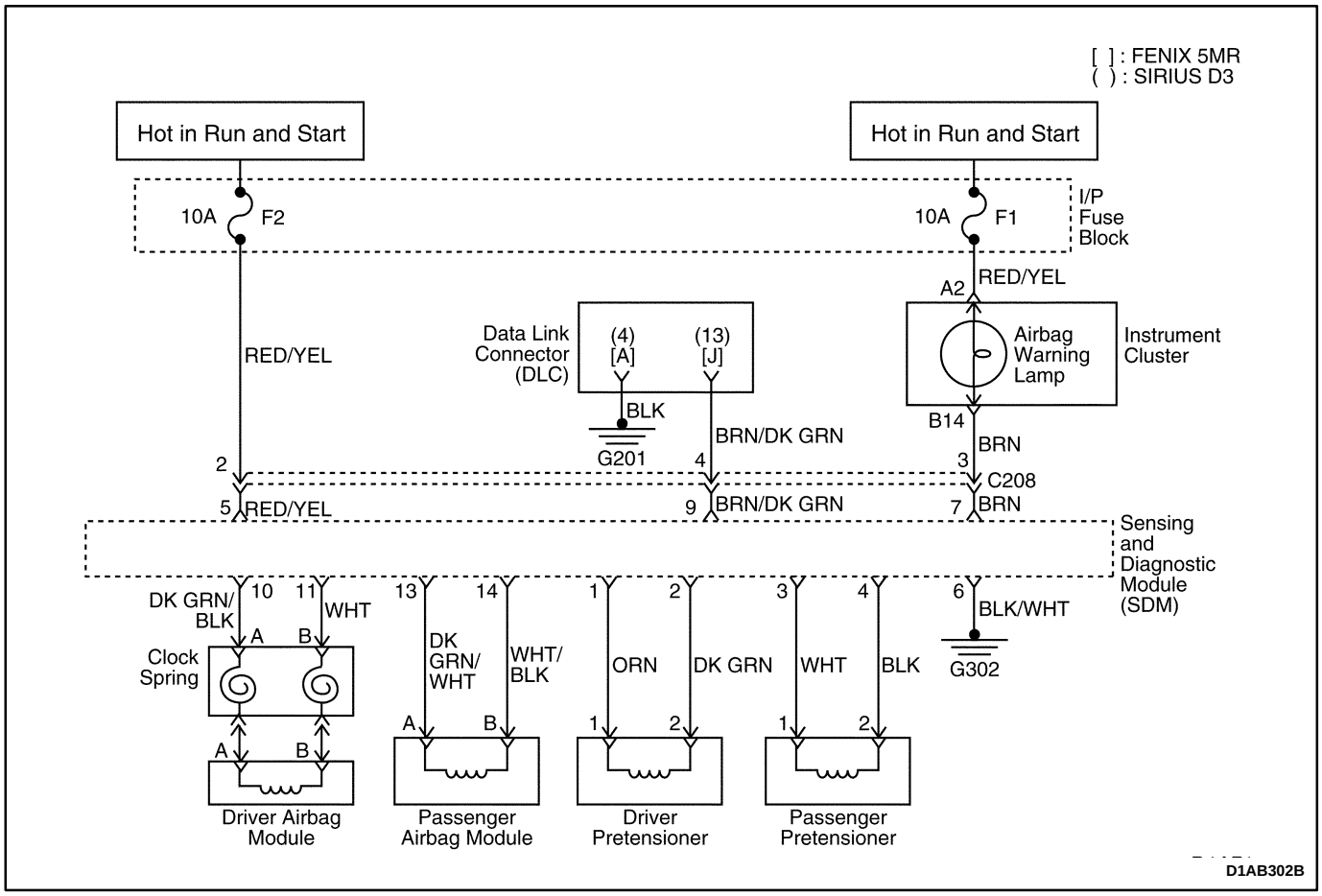
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 09 – Driver Pretensioner Circuit, Resistance Too High

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the driver seat belt pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the driver seat belt pretensioner module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the driver seat belt pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver seat belt pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the driver seat belt pretensioner module. ● Refer to ‘‘Diagnostic Illustration 16’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 09 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 10
DRIVER PRETENSIONER CIRCUIT, RESISTANCE TOO LOW

Short Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver pretensioner circuit. The SDM allows a very small amount of current to flow through the pretensioner circuit. The SDM monitors the circuit resistance during this check.

DTC 10 Will Set When

- The combined resistance of the driver pretensioner the harness wiring, and the connector contacts is below a specified value, as with a short circuit between the wires to the driver airbag module.

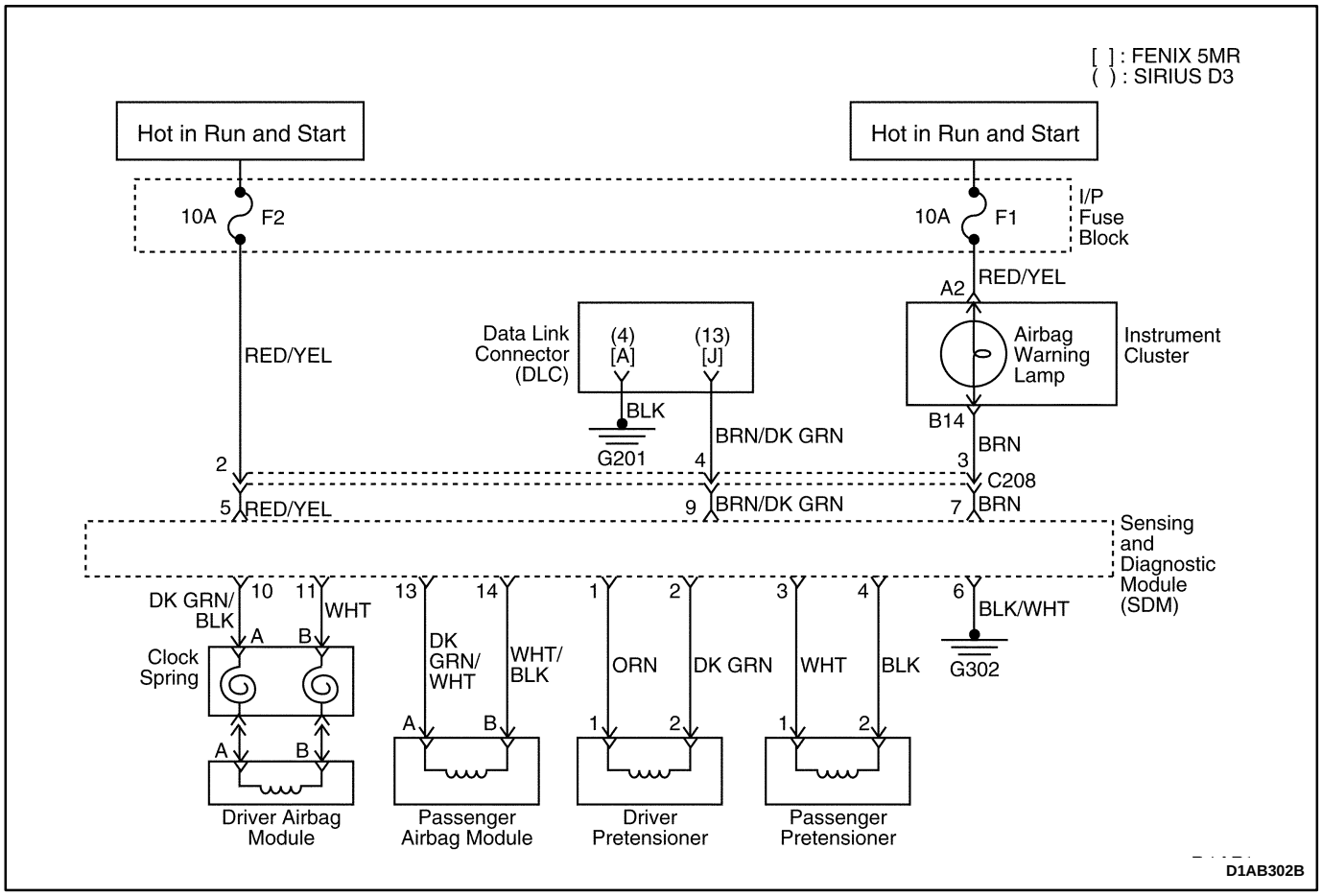
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module with an ohmmeter. An ohmmeter's battery can deploy the airbag and cause injury.

DTC 10 – Driver Pretensioner Circuit, Resistance Too Low

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Connect an ohmmeter to the terminals of the wiring harness connector for the driver seat belt pretensioner module on the SDM side of the connector. ● Refer to ‘‘Diagnostic Illustration 16’’ in this section. Does the ohmmeter show the specified value?	∞	Go to *Step 2*	Go to *Step 4*
2	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 10 still show as a current fault?	–	Go to *Step 3*	System OK
3	1. Replace the driver seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
4	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 11
DRIVER PRETENSIONER CIRCUIT, SHORT TO GROUND

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver pretensioner circuit. The SDM allows a very small amount of current to flow through the driver pretensioner circuit. The SDM monitors the voltage during this check.

DTC 11 Will Set When

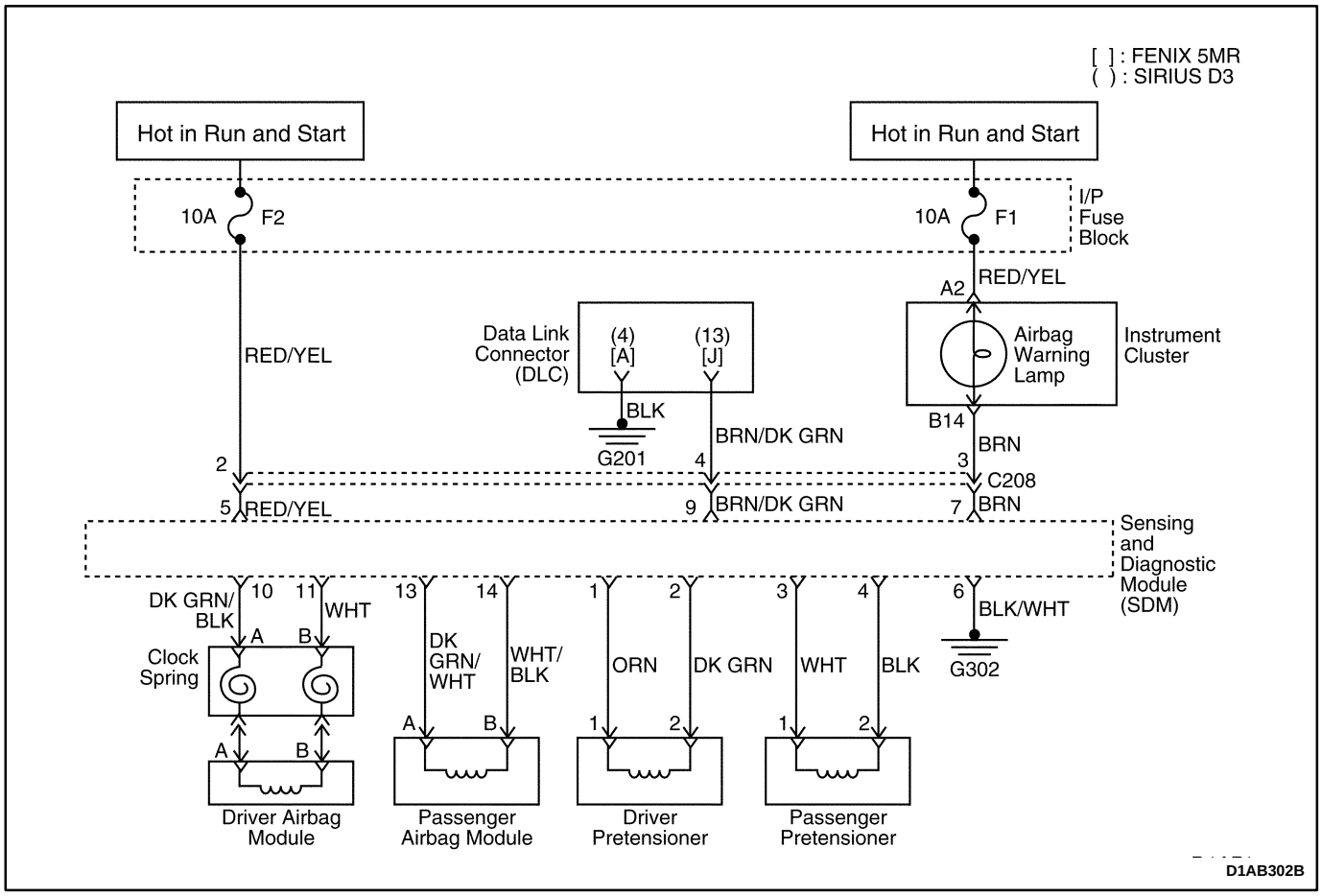
- The firing circuit is shorted to ground.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 11 Driver Pretensioner Circuit, Short To Ground

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Visually inspect the supplemental inflatable restraints (SIR) wiring harness. Is there any visible damage to the SIR harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector from the driver seat belt pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver seat belt pretensioner module. 3. Use an ohmmeter to check the continuity between ground and one of the terminals at the SDM side of the wiring harness connector for the driver seat belt pretensioner module. ● Refer to ‘‘Diagnostic Illustration 17’’ in this section. Is the resistance less than the specified value?	∞	Go to *Step 2*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 11 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 12
DRIVER PRETENSIONER CIRCUIT, SHORT TO BATTERY VOLTAGE

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors voltage during this check.

DTC 12 Will Set When

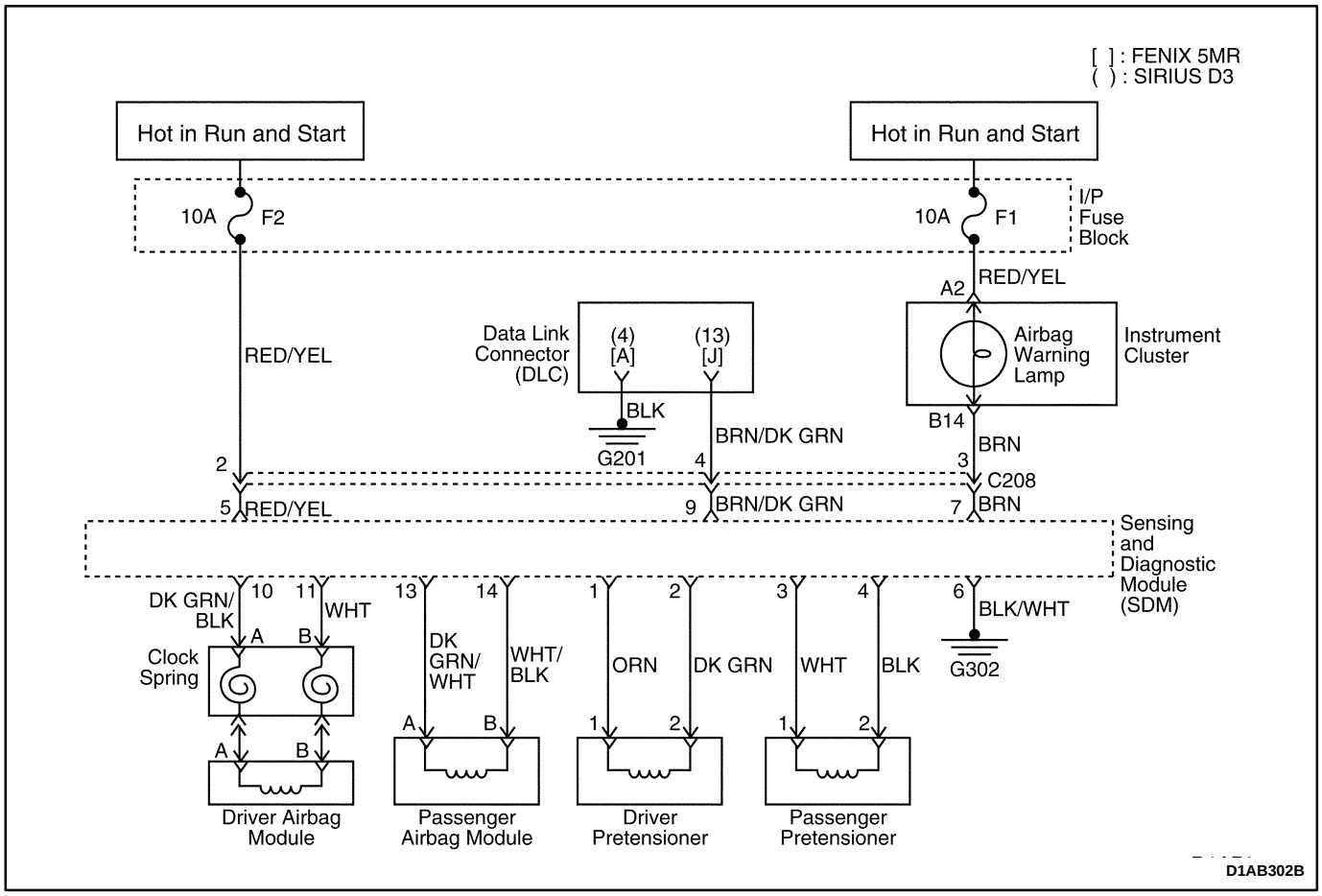
- The firing circuit is shorted to voltage.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 12 – Driver Pretensioner Circuit, Short To Battery Voltage

Step	Action	Value(s)	Yes	No
1	1. Disconnect the battery negative cable. 2. Wait 1 minute for the SDM capacitor to discharge. ● The capacitor supplies reserve power to deploy the driver seat belt pretensioner even if the battery has been disconnected. 3. Visually inspect the supplemental inflatable restraints (SIR) wiring harness. Is there any visible damage to the SIR wiring harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the driver seat belt pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver seat belt pretensioner module. 3. Use a multimeter to check the voltage at one of the terminals on the SDM side of the SIR wiring harness connector for the driver seat belt pretensioner module. ● Refer to ‘‘Diagnostic Illustration 18’’ in this section. Is the voltage greater than the specified value?	0 v	Go to *Step 2*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4.Do the diagnostic system check. Does the code 12 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 13
PASSENGER PRETENSIONER CIRCUIT, RESISTANCE TOO HIGH

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 13 Will Set When

- The combined resistance of the passenger pretensioner module, the harness wiring, and the connector contacts is above a specified value, as in an open circuit.

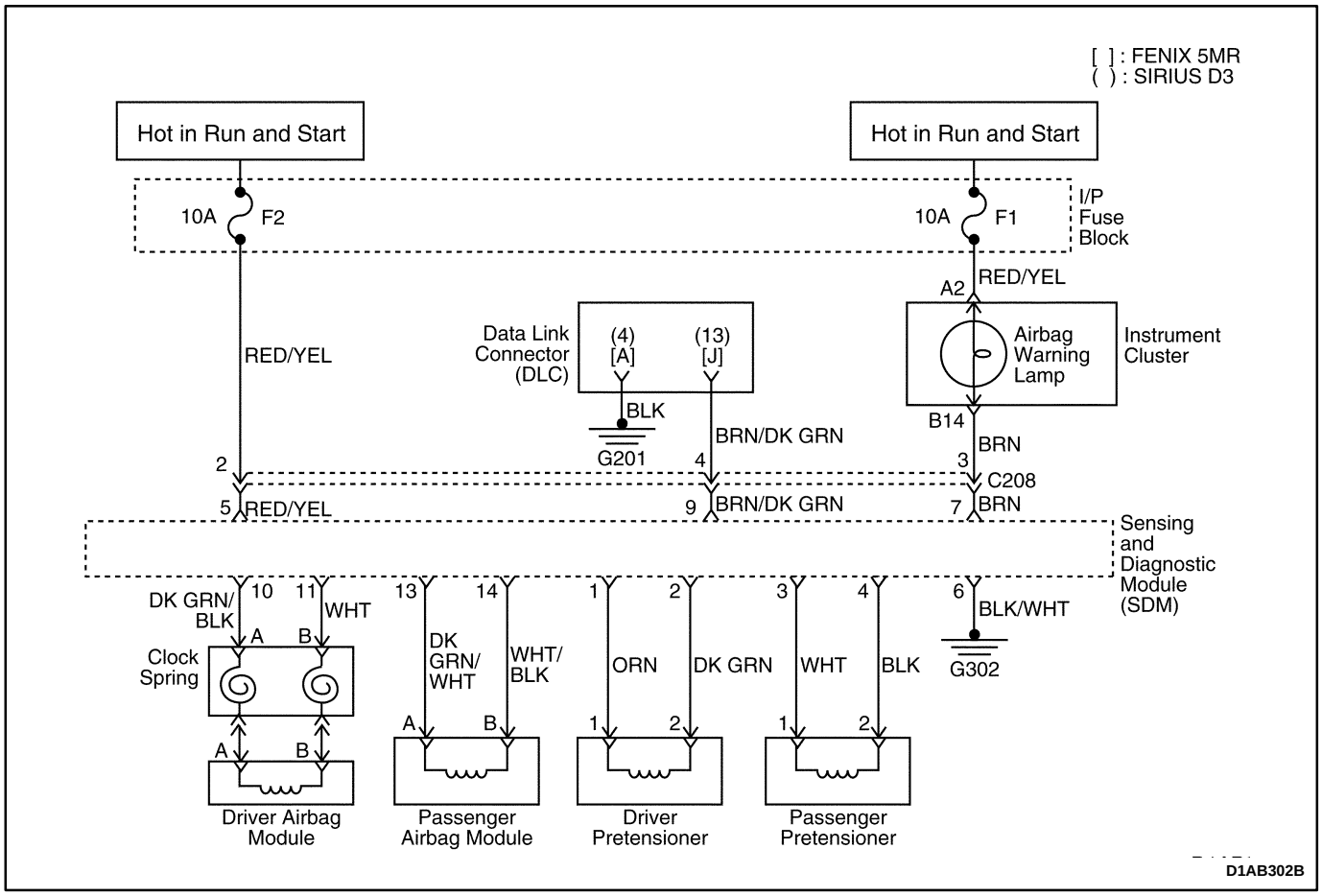
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 13 – Passenger Pretensioner Circuit, Resistance Too High

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the passenger seat belt pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the passenger seat belt pretensioner module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the passenger seat belt pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger seat belt pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the passenger seat belt pretensioner module. ● Refer to ‘‘Diagnostic Illustration 19’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 13 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 14
PASSENGER PRETENSIONER CIRCUIT, RESISTANCE TOO LOW

Short Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 14 Will Set When

- The combined resistance of the passenger pretensioner module, the harness wiring, and the connector contacts is below a specified value, as in a short circuit between the wires to the passenger airbag module.

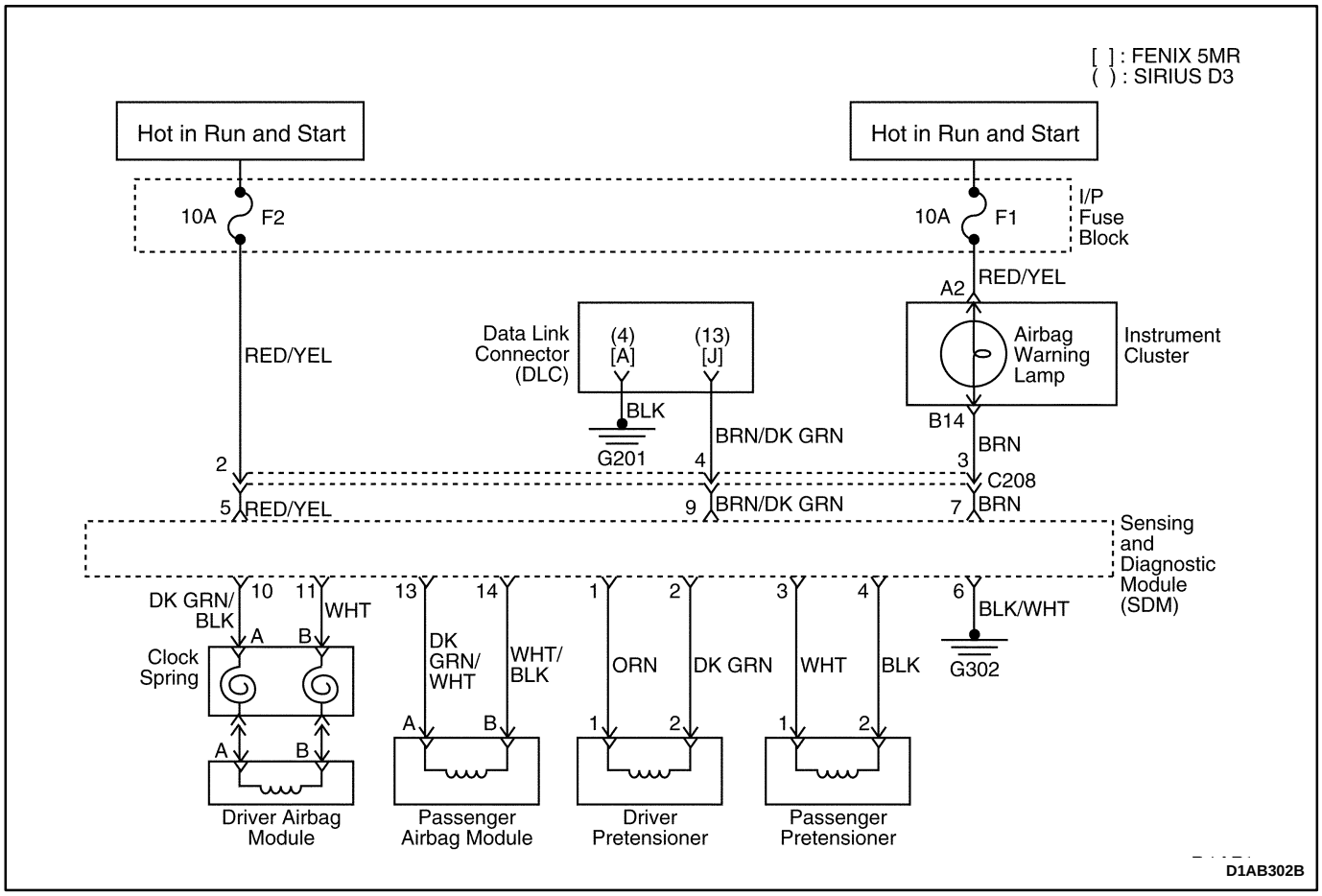
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module side of the connector is not working properly, the meter's battery could deploy the airbag and cause injury.

DTC 14 – Passenger Pretensioner Circuit, Resistance Too Low

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Connect an ohmmeter to the terminals of the wiring harness connector for the passenger seat belt pretensioner module on the SDM side of the connector. ● Refer to ‘‘Diagnostic Illustration 19’’ in this section. Does the ohmmeter show the specified value?	∞	Go to *Step 2*	Go to *Step 4*
2	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 14 still show as a current fault?	–	Go to *Step 3*	System OK
3	1. Replace the passenger seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
4	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 15
PASSENGER PRETENSIONER CIRCUIT, SHORT TO GROUND

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the voltage during this check.

DTC 15 Will Set When

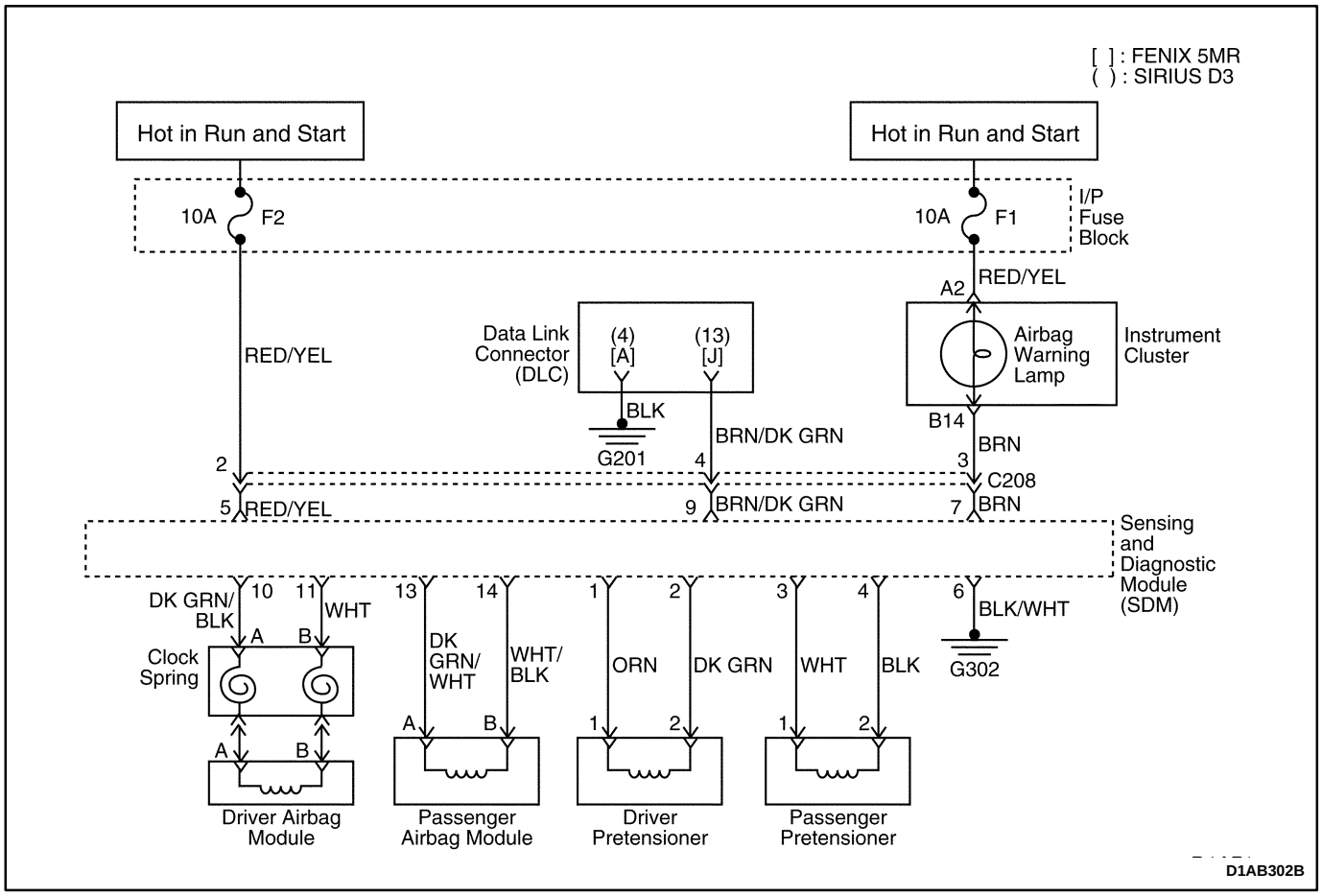
- The firing circuit is shorted to ground.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 15 Passenger Pretensioner Circuit, Short To Ground

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Visually inspect the supplemental inflatable restraints (SIR) wiring harness. Is there any visible damage to the SIR harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector from the passenger seat belt pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger seat belt pretensioner module. 3. Use an ohmmeter to check the continuity between ground and one of the terminals at the SDM side of the wiring harness connector for the passenger seat belt pretensioner module. ● Refer to ‘‘Diagnostic Illustration 20’’ in this section. Is the resistance less than the specified value?	∞	Go to *Step 2*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4. Do the diagnostic system check. Does the code 15 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 16
PASSENGER PRETENSIONER CIRCUIT, SHORT TO BATTERY VOLTAGE

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the voltage during this check.

DTC 16 Will Set When

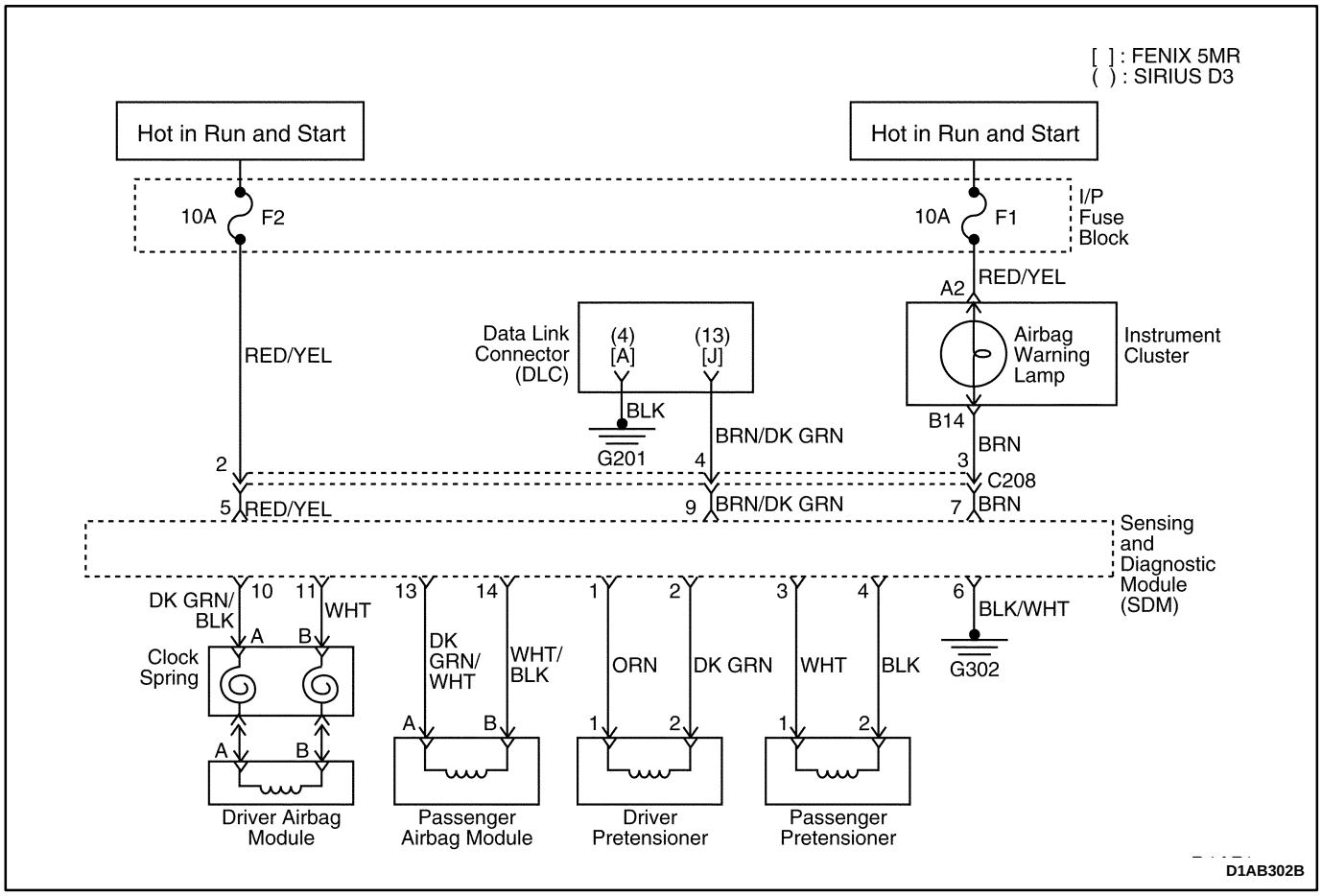
- The firing circuit is shorted to the voltage.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies the reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 16 – Passenger Pretensioner Circuit, Short To Battery Voltage

Step	Action	Value(s)	Yes	No
1	1. Disconnect the battery negative cable. 2. Wait 1 minute for the SDM capacitor to discharge. ● The capacitor supplies reserve power to deploy the passenger seat belt pretensioner even if the battery has been disconnected. 3. Visually inspect the supplemental inflatable restraints (SIR) wiring harness. Is there any visible damage to the SIR wiring harness?	–	Go to *Step 2*	Go to *Step 3*
2	1. Replace the SIR wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the passenger seat belt pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger seat belt pretensioner module. 3. Use a multimeter to check the voltage at one of the terminals on the SDM side of the SIR wiring harness connector for the passenger seat belt pretensioner module. ● Refer to ‘‘Diagnostic Illustration 21’’ in this section. Is the voltage greater than the specified value?	0 v	Go to *Step 2*	Go to *Step 4*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool to CODE ERASE. 4.Do the diagnostic system check. Does the code 16 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger seat belt pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 18 CONNECTION BETWEEN DRIVER FIRING CIRCUIT AND DRIVER PRETENSIONER CIRCUIT

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver airbag and the driver pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 18 Will Set When

- Connection between the driver firing circuit and the driver pretensioner circuit or the SDM internal connection problem may exist.

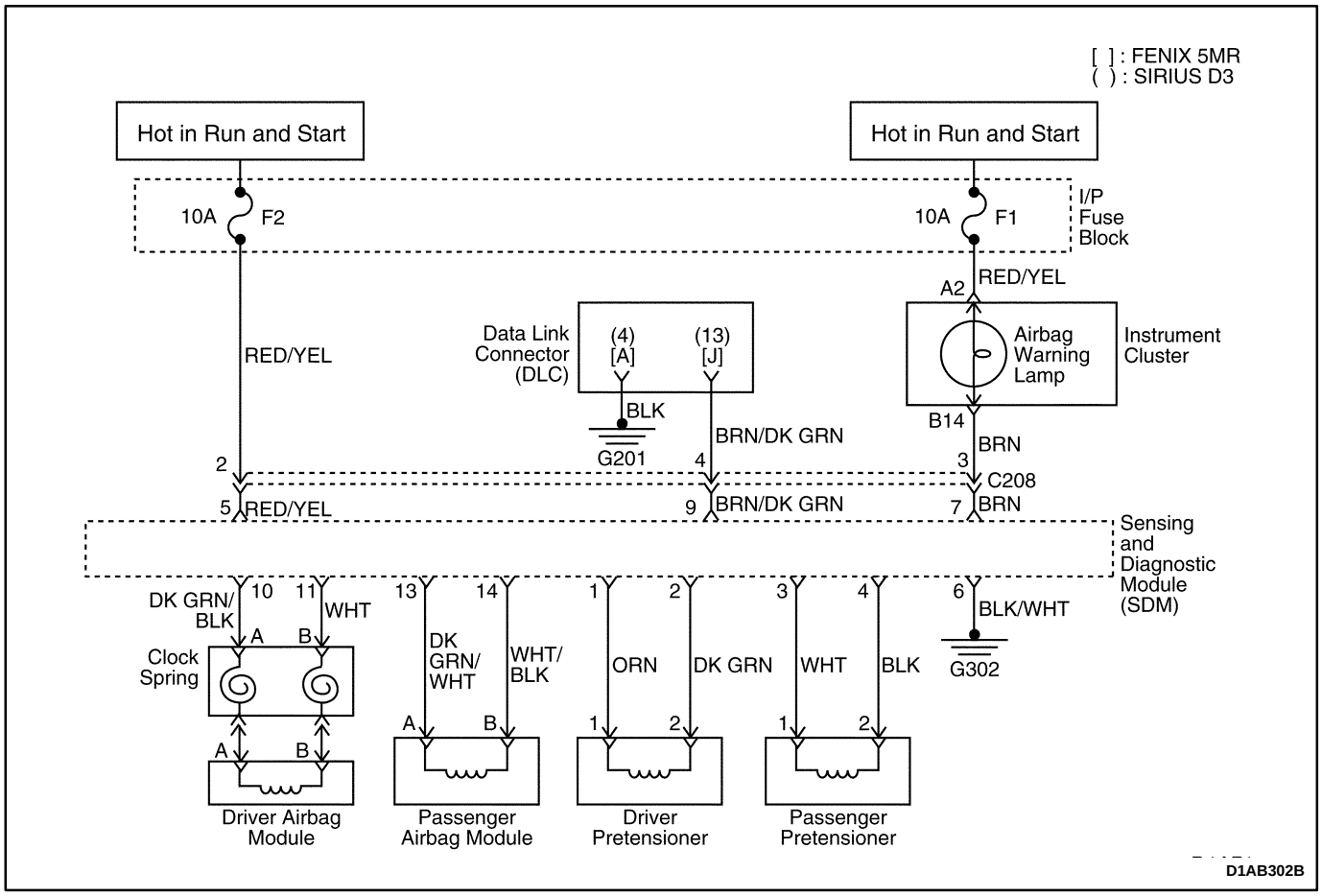
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 18 – Connection Between Driver Firing Circuit and Driver Pretensioner Circuit

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the driver side airbag module and the driver pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the driver side airbag module and the driver pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the driver side airbag module and the driver pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver airbag module and the driver pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the driver pretensioner module. ● Refer to ‘‘Diagnostic Illustration 16’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 18 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 19 CONNECTION BETWEEN DRIVER FIRING CIRCUIT AND PASSENGER PRETENSIONER CIRCUIT

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver airbag and the passenger pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 19 Will Set When

- Connection between the drive firing circuit and the passenger pretensioner circuit or SDM internal connection problem may exist.

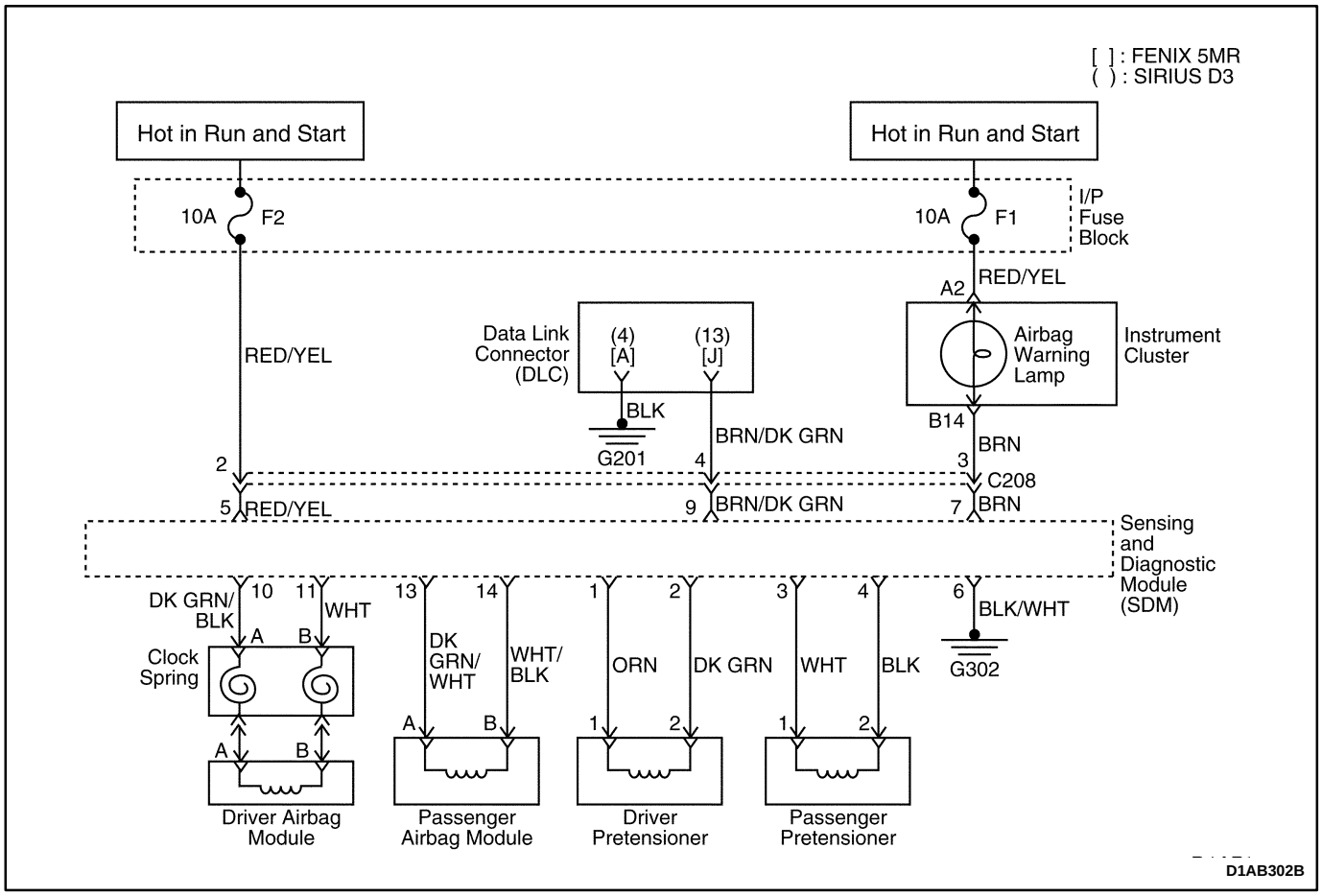
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 19 – Connection Between Driver Firing Circuit and Passenger Pretensioner Circuit

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the driver side airbag module and the passenger pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the driver side airbag module and the passenger pretensioner module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the driver side airbag module and the passenger pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver airbag module and the passenger pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the passenger pretensioner module. ● Refer to ‘‘Diagnostic Illustration 19’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 19 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 20 CONNECTION BETWEEN PASSENGER FIRING CIRCUIT AND DRIVER PRETENSIONER CIRCUIT

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger airbag and the driver pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 20 Will Set When

- Connection between the passenger firing circuit and the driver pretensioner circuit or SDM internal connection problem may exist.

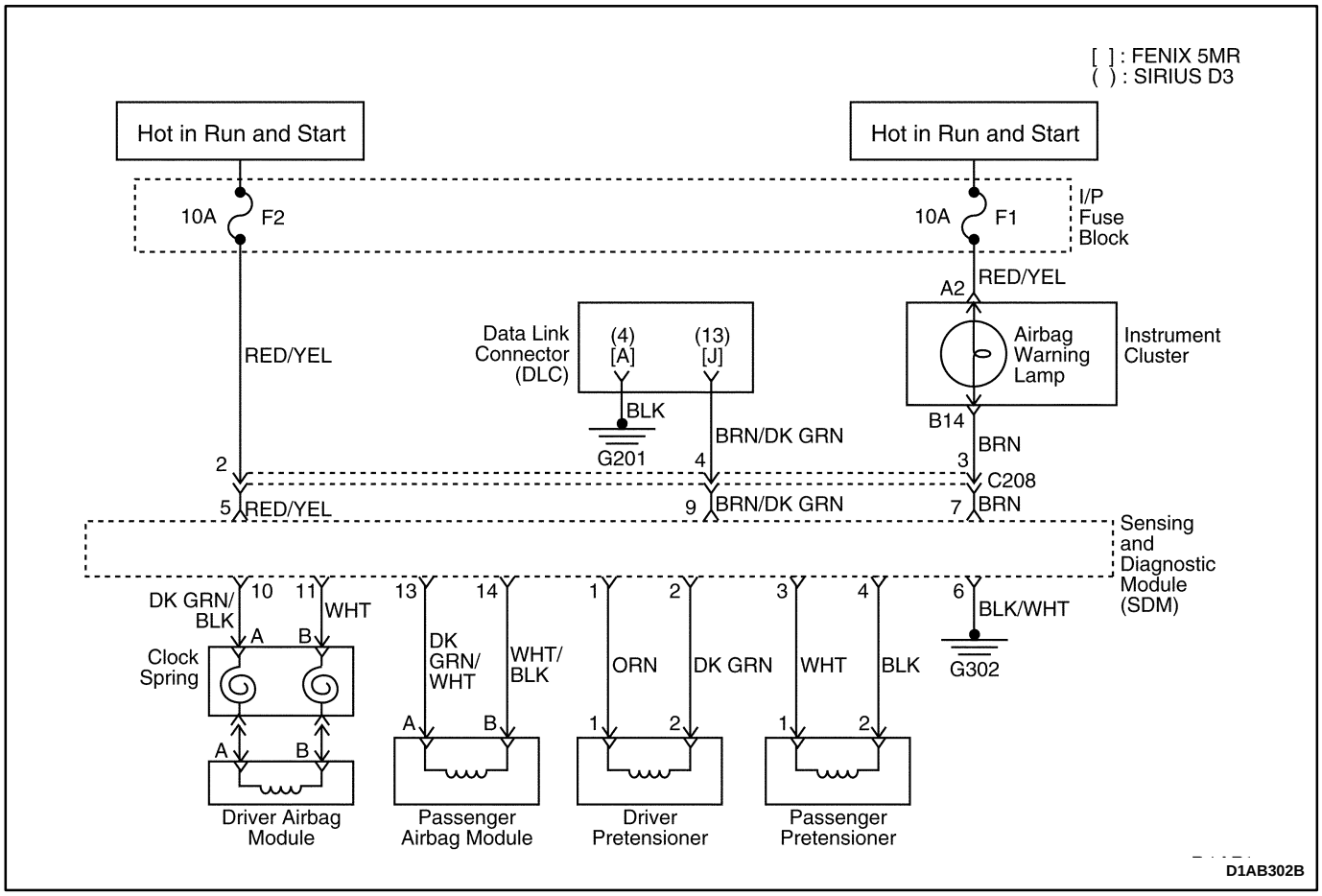
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 20 – Connection Between Passenger Firing Circuit and Driver Pretensioner Circuit

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the passenger side airbag module and the driver pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the passenger side airbag module and the driver pretensioner module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the passenger side airbag module and the driver pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger airbag module and the driver pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the driver pretensioner module. ● Refer to ‘‘Diagnostic Illustration 16’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 20 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the driver pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 21 CONNECTION BETWEEN PASSENGER FIRING CIRCUIT AND PASSENGER PRETENSIONER CIRCUIT

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the passenger airbag and the passenger circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 21 Will Set When

- Connection between the passenger firing circuit and the passenger pretensioner circuit or SDM internal connection problem may exist.

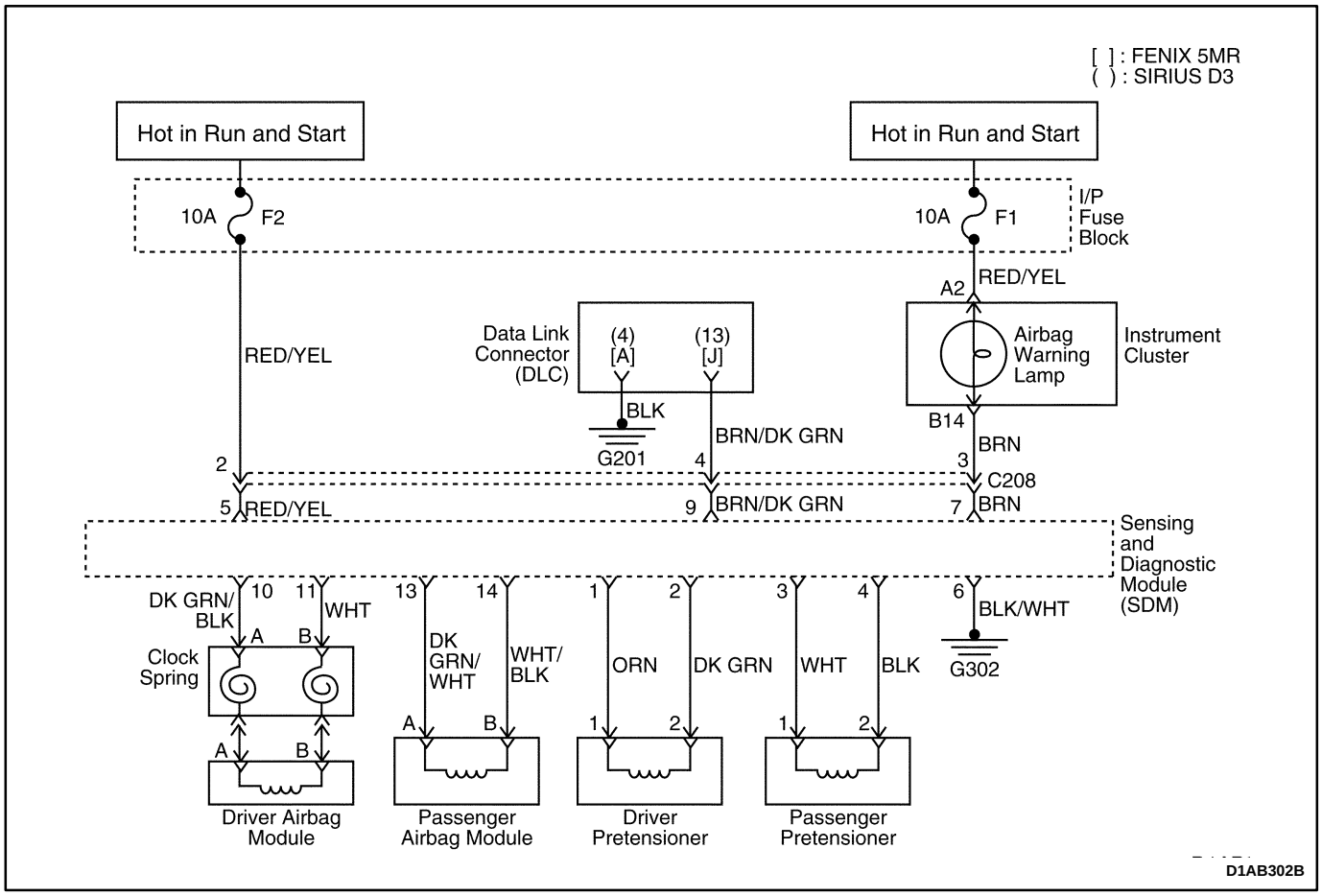
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 21 – Connection Between Passenger Firing Circuit and Passenger Pretensioner Circuit

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the passenger side airbag module and the passenger pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the passenger side airbag module and the passenger pretensioner module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the passenger side airbag module and the passenger pretensioner module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the passenger airbag module and the passenger pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the passenger pretensioner module. ● Refer to ‘‘Diagnostic Illustration 19’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 6*
4	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 21 still show as a current fault?	–	Go to *Step 5*	System OK
5	1. Replace the passenger pretensioner module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 22
CONNECTION BETWEEN DRIVER PRETENSIONER CIRCUIT AND PASSENGER PRETENSIONER CIRCUIT

Open Circuit

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the driver pretensioner and the passenger pretensioner circuit. The SDM allows a very small amount of current to flow through the circuit. The SDM monitors the circuit resistance during this check.

DTC 22 Will Set When

- Connection between the driver pretensioner circuit and the passenger pretensioner circuit or SDM internal connection problem may exist.

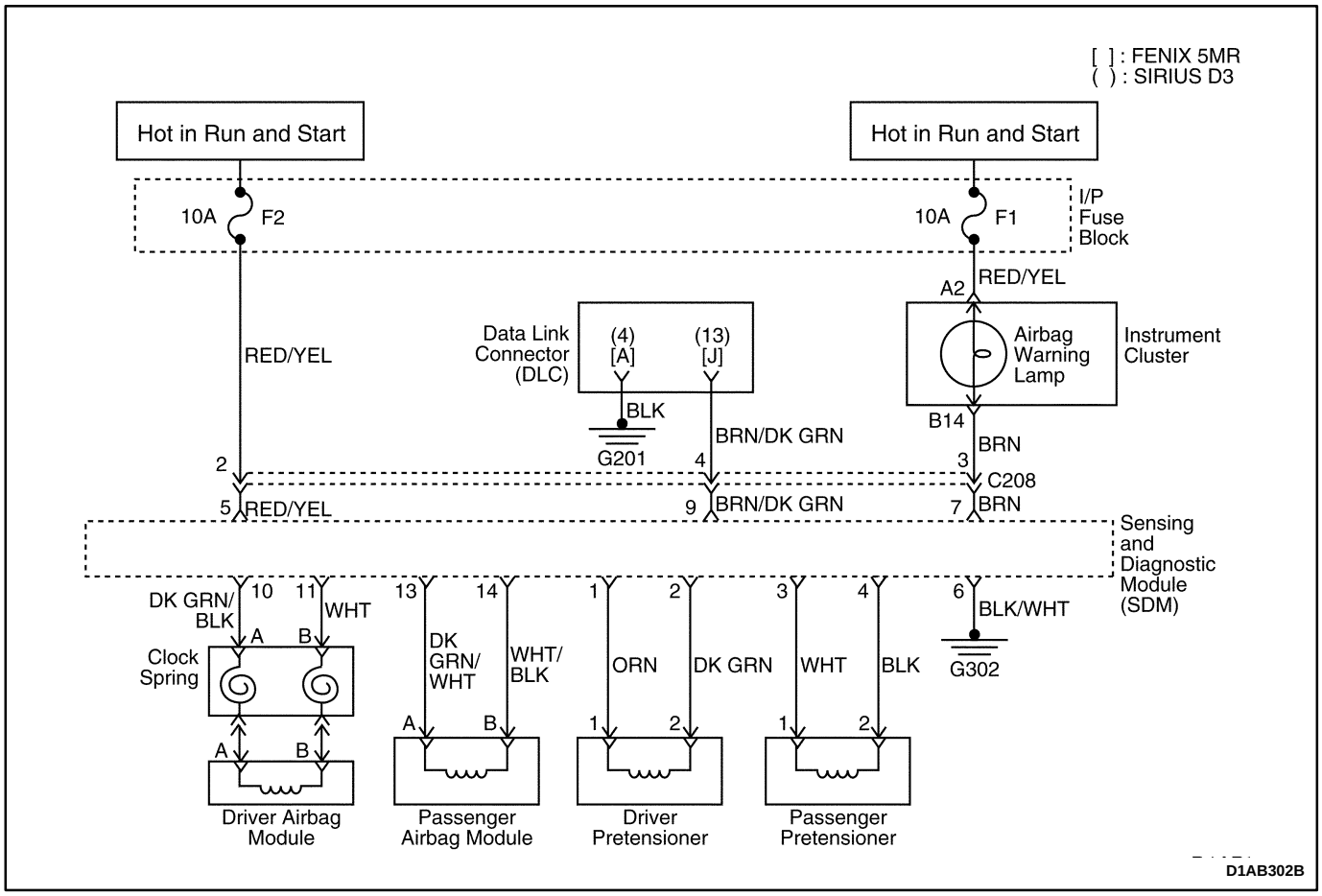
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: Never measure the resistance of an airbag module. If the anti-deployment shorting bar on the module-side of the connector is not working properly, the meter's battery can deploy the airbag and cause injury.

DTC 22 – Connection Between Driver Pretensioner Circuit and Passenger Pretensioner Circuit

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Wait 1 minute for the SDM capacitor to discharge. 3. Examine the wiring and the connector at the driver pretensioner module and the passenger pretensioner module. Is the connector disconnected?	–	Go to *Step 2*	Go to *Step 3*
2	1. Reconnect the driver pretensioner module and the passenger pretensioner module connector. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the electrical connector for the driver pretensioner module and the passenger passenger module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver pretensioner module and the passenger pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the driver pretensioner module. ● Refer to ‘‘Diagnostic Illustration 16’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 4*	Go to *Step 7*
4	1. Disconnect the electrical connector for the driver pretensioner module and the passenger passenger module. 2. Disconnect the electrical connector at the SDM. ● The shorting bar at the disconnected SDM connector will create a complete circuit between the wires from the driver pretensioner module and the passenger pretensioner module. 3. Connect an ohmmeter to the terminals on the SDM side of the wiring harness connector for the passenger pretensioner module. ● Refer to ‘‘Diagnostic Illustration 19’’ in this section. Does the ohmmeter show the specified value?	≈ 0 Ω	Go to *Step 5*	Go to *Step 7*
5	1. Replace the SDM. 2. Reconnect the negative battery cable. 3. Set the scan tool for CODE ERASE. 4. Do the diagnostic system check. Does the code 22 still show as a current fault?	–	Go to *Step 6*	System OK
6	1. Replace the passenger side airbag module. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–
7	1. Replace the supplemental inflatable restraints (SIR) wiring harness. 2. Reconnect the negative battery cable. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 23
IGNITION INPUT CIRCUIT, VOLTAGE TOO HIGH

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After completing the internal tests, the SDM will check its voltage supply. If the voltage supply is too high or too low, the SDM may not receive the proper information when it attempts to use a known current to test the airbag module circuits.

DTC 23 Will Set When

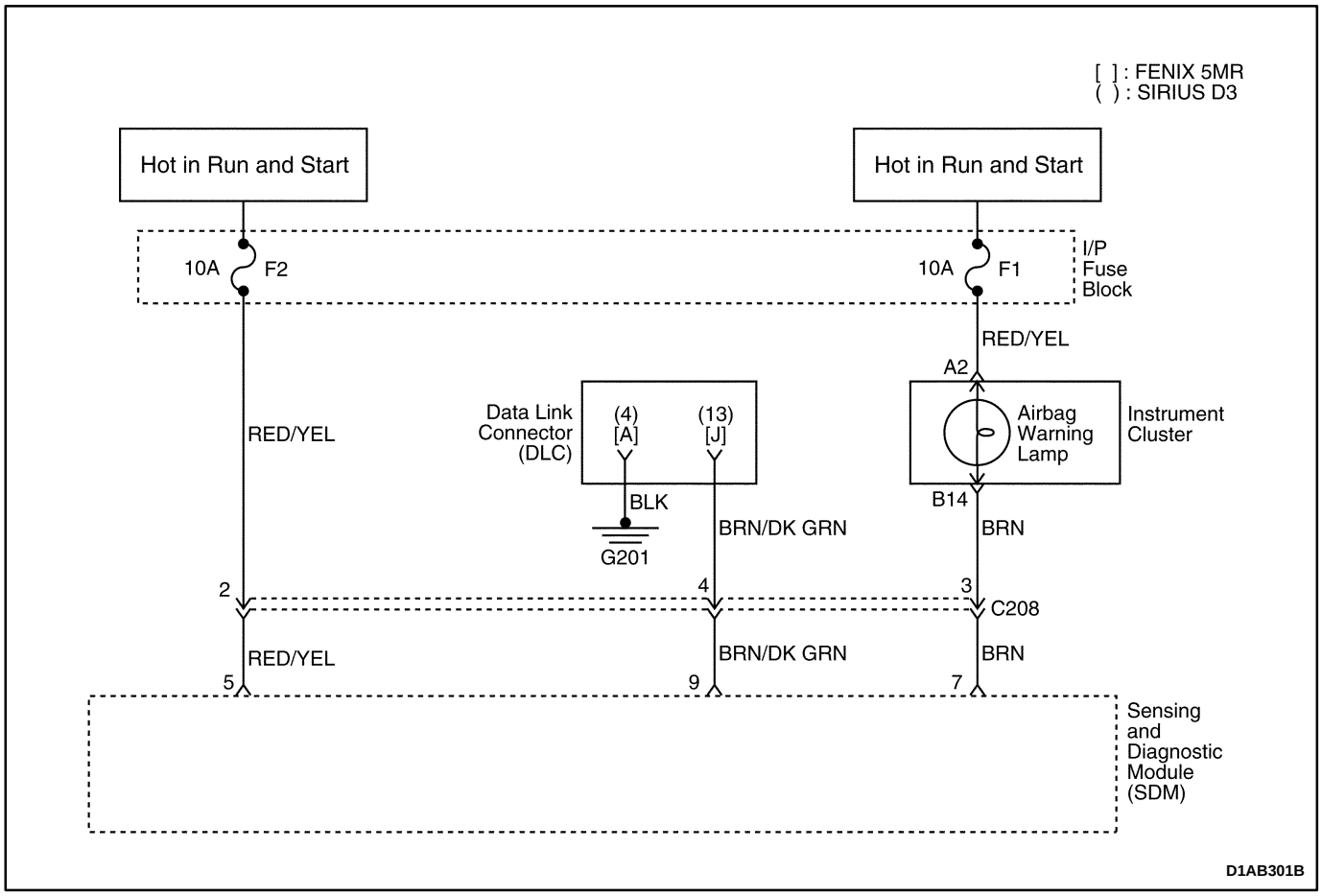
- The SDM receives voltage higher than a specified value.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 23 – Ignition Input Circuit, Voltage Too High

Step	Action	Value(s)	Yes	No
1	Check the vehicle's charging system. Refer to *Section 1E, Engine Electrical.* Is the charging system OK?	–	Go to *Step 3*	Go to *Step 2*
2	Repair the charging system. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Disconnect the negative battery cable. 2. Replace the SDM. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 24
IGNITION INPUT CIRCUIT, VOLTAGE TOO LOW

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After completing the internal tests, the SDM will check its voltage supply. If the voltage supply is too high or too low, the SDM may not receive the proper information when it attempts to use a known current to test the airbag module circuits.

DTC 24 Will Set When

- The SDM receives the voltage lower than a specified value.

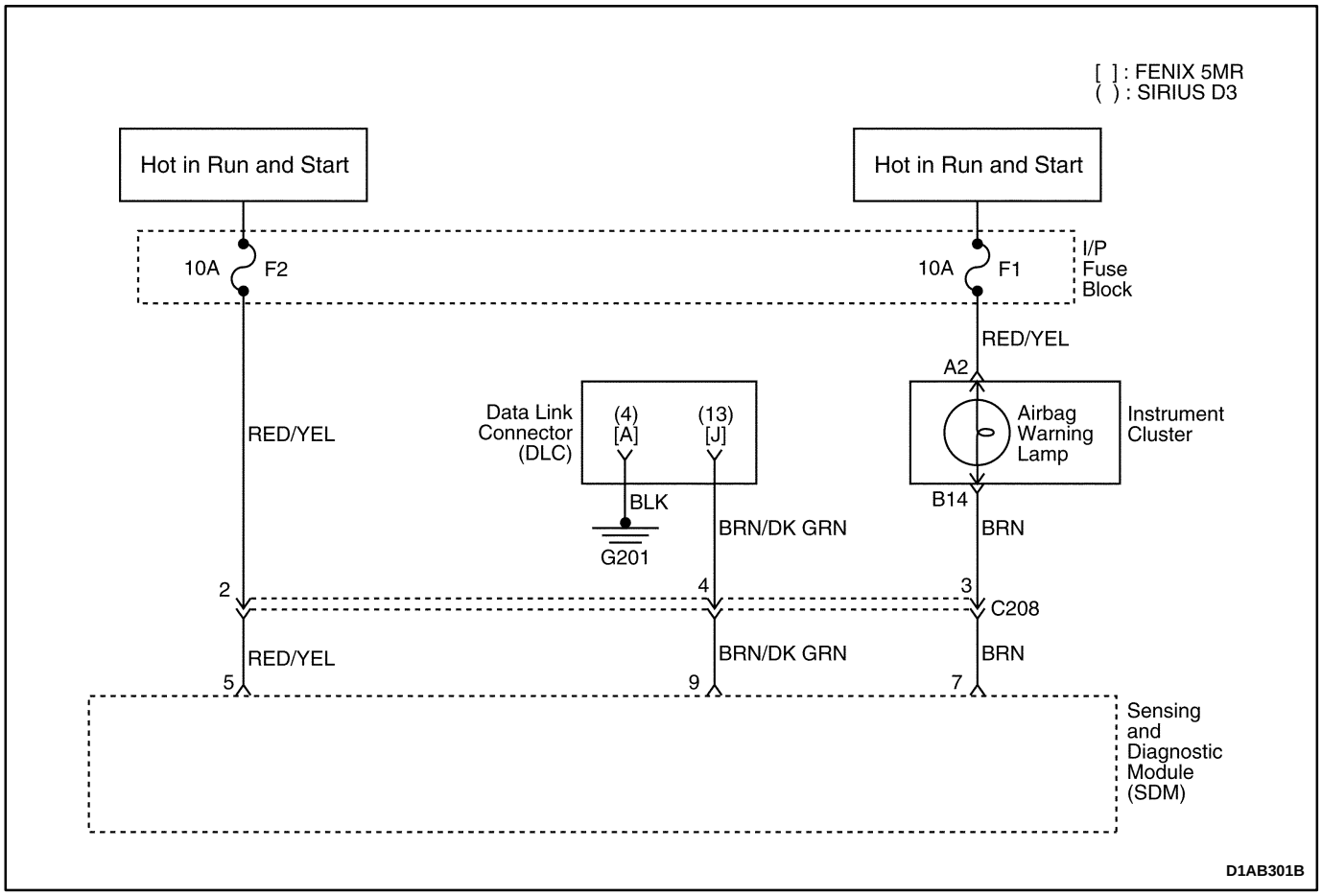
Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: As a safety precaution, disconnect the connector for the passenger airbag module. Unintentional deployment of the airbags can cause injury.

DTC 24 – Ignition Input Circuit, Voltage Too Low

Step	Action	Value(s)	Yes	No
1	Check the fuse F2. Is the fuse blown?	–	Go to *Step 2*	Go to *Step 3*
2	1. Check for a short circuit. 2. Repair if needed. 3. Replace the fuse. Is the repair complete?	–	Go to *Diagnostic System Check*	–
3	1. Turn the ignition ON. 2. Using a multimeter, check the voltage at the fuse F2. Is the battery voltage available at the fuse F2?	11–14 v	Go to *Step 5*	Go to *Step 4*
4	Repair the power supply to the fuse F2. Is the repair complete?	–	Go to *Diagnostic System Check*	–
5	1. Disconnect the negative battery cable. 2. Wait one minute before proceeding. 3. Disconnect the connector at the SDM. 4. Reconnect the battery. 5. Turn the ignition key ON. 6. Measure the voltage at the terminal 5 of the SDM Connector. ● Refer to ‘‘Diagnostic Illustration 11’’ in this section. Is the voltage equal to the specified value?	11–14 v	Go to *Step 6*	Go to *Step 7*
6	1. Replace the SDM. 2. Reconnect the electrical connectors. Is the repair complete?	–	Go to *Diagnostic System Check*	–
7	1. Disconnect the connector C208. ● The connector C208 is the connector between the instrument harness and the supplemental inflatable restraints (SIR) harness. 2. Turn the ignition ON. 3. Using a multimeter, check the voltage on the instrument harness side at the terminal 2 of the connector C208. ● Refer to ‘‘Diagnostic Illustration 12’’ in this section. Is the voltage equal to the specified value?	11–14 v	Go to *Step 8*	Go to *Step 9*
8	1. Replace the SIR wiring harness. 2. Reconnect the battery. Is the repair complete?	–	Go to *Diagnostic System Check*	–
9	Repair the open circuit between the fuse F2 and the connector C208. Is the repair complete?	–	Go to *Diagnostic System Check*	–



DIAGNOSTIC TROUBLE CODE (DTC) 25
WARNING LAMP FAILURE

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

After passing these tests, the SDM will check the warning lamp circuit. The SDM constantly measures the voltage at the warning lamp output in order to determine if the lamp is ON or OFF at the correct time.

DTC 25 Will Set When

- The lamp is ON when it should be OFF.
- The lamp is OFF when it should be ON.

Diagnostic Aids

When the warning lamp operates correctly, the warning lamp turns ON for approximately four seconds after the ignition is first switched ON, and then The warning lamp turns OFF.

When the warning lamp operates incorrectly, the warning lamp continues to blink four times per second, demonstrating that the SDM is faulty and must be replaced.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

Caution: If the short is in the supplemental inflatable restraints (SIR) wiring harness, do not attempt to repair it. The repair might create a high-resistance connection which can keep the airbags from deploying when needed, resulting in injury. Replace the SIR wiring harness if it is damaged.

DTC 25 – Warning Lamp Failure

Step	Action	Value(s)	Yes	No
1	Turn the ignition ON. Is the warning lamp constantly ON?	–	Go to *Step 2*	Go to *Step 9*
2	Make sure the SDM connector is attached correctly. Does the warning lamp turn OFF?	–	Go to *Diagnostic System Check*	Go to *Step 3*
3	1. Check for indications of the diagnostic trouble code (DTC) other than the code 25. 2. Go to the appropriate DTC charts and repair each additional problem. 3. Do the diagnostic system check. Does the scan tool still indicate the code 25?	–	Go to *Step 4*	System OK
4	Check for a short to ground between the SDM and the warning lamp using the following method: 1. Turn the ignition OFF. 2. Disconnect the connector C208. 3. Connect one ohmmeter lead to ground. 4. Touch the other ohmmeter lead to the terminal 3 of the connector C208 on the instrument harness side. ● Refer to ‘‘Diagnostic Illustration 14’’ in this section. Does the ohmmeter indicate the specified value?	∞	Go to *Step 6*	Go to *Step 5*
5	Repair the short to ground in the instrument harness. Is the repair complete?	–	Go to *Diagnostic System Check*	–
6	1. The connector C208 remains disconnected. 2. One lead of the ohmmeter remains connected to ground. 3. Move the ohmmeter lead at the connector C208 to the SDM side of the connector. ● Refer to ‘‘Diagnostic Illustration 13’’ in this section. Does the ohmmeter indicate the specified value?	∞	Go to *Step 7*	Go to *Step 8*
7	Replace the SDM. Is the repair complete?	–	Go to *Diagnostic System Check*	–
8	1. Disconnect the negative battery cable. 2. Replace the SIR wiring harness. 3. Do the diagnostic system check. Does the code 25 still show?	–	Go to *Step 5*	System OK
9	Check the fuse F1. Is the fuse F1 blown?	–	Go to *Step 10*	Go to *Step 11*
10	1. With the connector C208 temporarily disconnected, check for a short to ground between the fuse F1 and the warning lamp. 2. Make a repair, if needed. 3. Replace the fuse F1. Is the repair complete?	–	Go to *Diagnostic System Check*	–

DTC 25 – Warning Lamp Failure (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Turn the ignition ON. 2. Using a multimeter, check the voltage at the fuse F1. Does the multimeter show the specified value?	11–14 v	Go to *Step 13*	Go to *Step 12*
12	Repair the open power supply circuit for the fuse F1. Is the repair complete?	–	Go to *Diagnostic System Check*	–
13	1. Disconnect the connector C208. 2. Turn the ignition ON. 3. Using a multimeter, check the voltage on the instrument harness side of the terminal 3 of the connector C208. Does the multimeter show the specified value?	11–14 v	Go to *Step 15*	Go to *Step 14*
14	1. Check the warning lamp bulb. 2. Replace the warning lamp bulb, if needed. 3. If the bulb is good, repair the open circuit between the fuse F1 and the terminal 3 of the connector C208. Is the repair complete?	–	Go to *Diagnostic System Check*	–
15	1. Disconnect the negative battery terminal. 2. Wait at least 1 minute before proceeding. 3. Replace the SIR wiring harness. Is the repair complete?	–	System OK	–

DIAGNOSTIC TROUBLE CODE (DTC) 31
SDM INTERNAL FAULT

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose malfunctions within itself.

DTC 31 Will Set When

- The SDM does not pass the internal tests.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 31 – SDM Internal Fault

Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Replace the SDM. Is the repair complete?	–	Go to *Diagnostic System Check*	–

DIAGNOSTIC TROUBLE CODE (DTC) 32
SDM CRASH RECORDED

Circuit Description

When the ignition switch is turned ON, the sensing and diagnostic module (SDM) will perform tests to diagnose any malfunctions within itself.

DTC 32 Will Set When

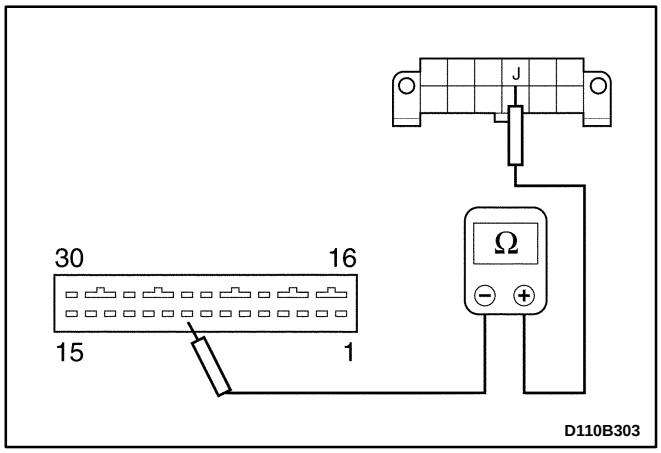
- The SDM has previously detected a crash.

Test Description

Caution: Before testing, disconnect the negative battery cable. Wait 1 minute for the SDM capacitor to discharge. The capacitor supplies reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.

DTC 32 – SDM Crash Recorded

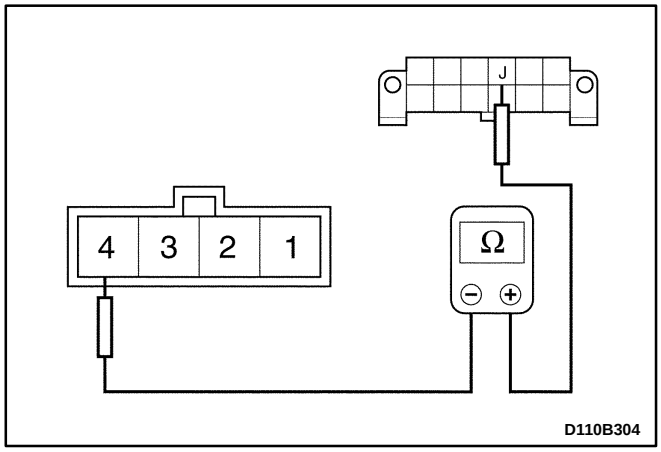
Step	Action	Value(s)	Yes	No
1	1. Disconnect the negative battery cable. 2. Replace the SDM. Is the repair complete?	–	Go to *Diagnostic System Check*	–



Caution: Do not use these illustrations to troubleshoot without consulting the diagnostic trouble code (DTC) charts. The DTC charts give additional safety precautions and detailed instructions for each test. Failure to follow the proper precautions can result in injury from unintended airbag deployment.

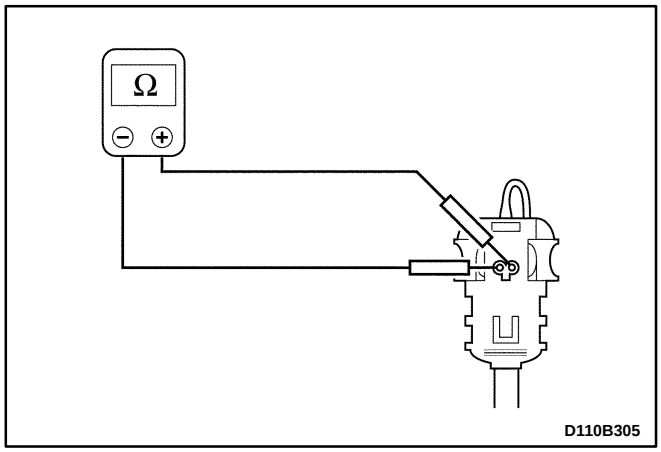
DIAGNOSTIC ILLUSTRATION 1

Checking the continuity between the terminal 9 of the sensing and diagnostic module and the terminal J (13) of the assembly line diagnostic link.



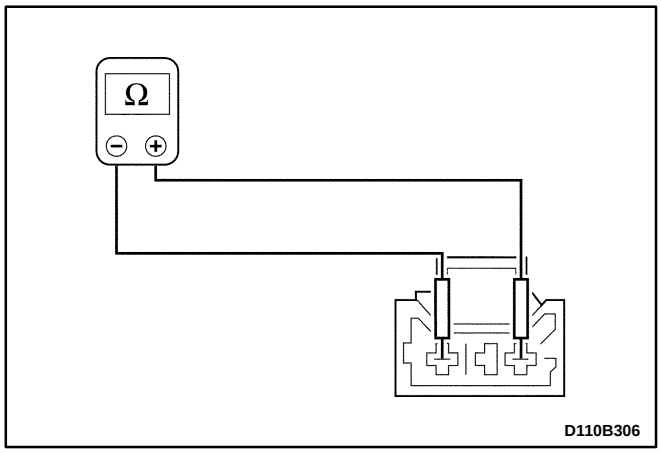
DIAGNOSTIC ILLUSTRATION 2

Checking the continuity on the instrument harness side between the terminal J (13) of the assembly line diagnostic link and the terminal 4 of the connector C208.



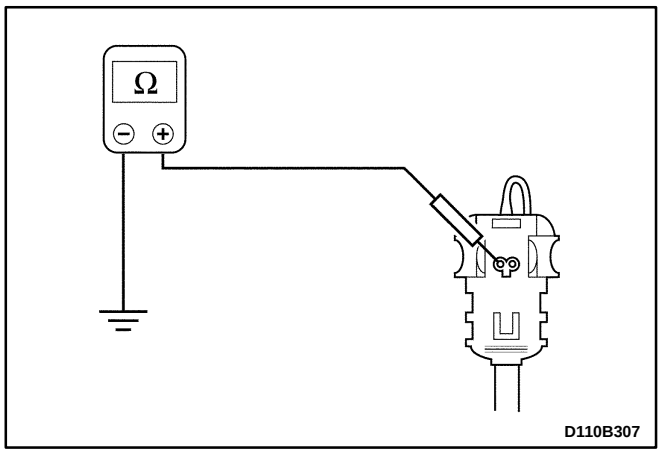
DIAGNOSTIC ILLUSTRATION 3

Measuring the wiring harness for the continuity of the driver side airbag module circuit.



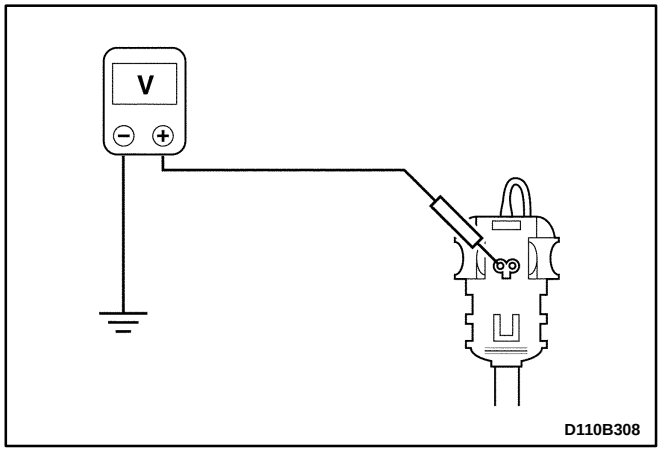
DIAGNOSTIC ILLUSTRATION 4

Checking the continuity of the driver airbag circuit on the sensing and diagnostic module (SDM) side of the clock spring connector.



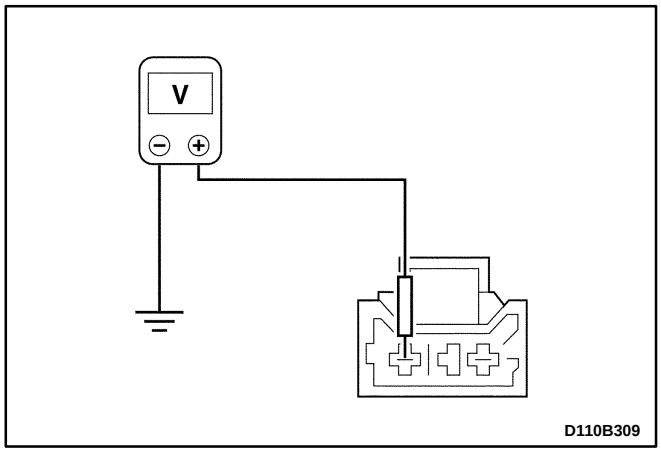
DIAGNOSTIC ILLUSTRATION 5

Checking the driver airbag circuit for a short to ground with the sensing and diagnostic module disconnected.



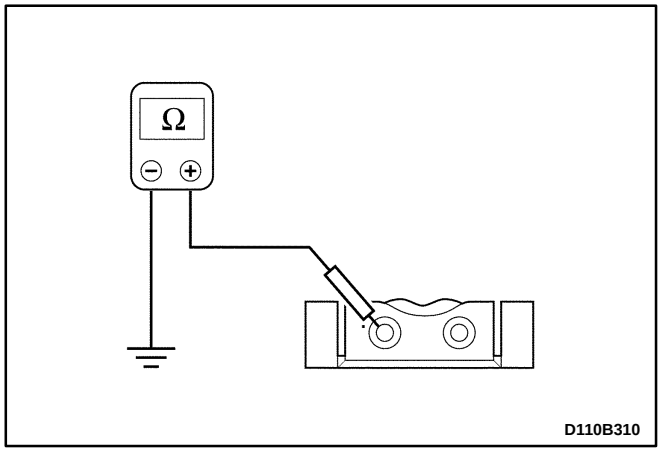
DIAGNOSTIC ILLUSTRATION 6

Checking the driver airbag circuit for a short to voltage.



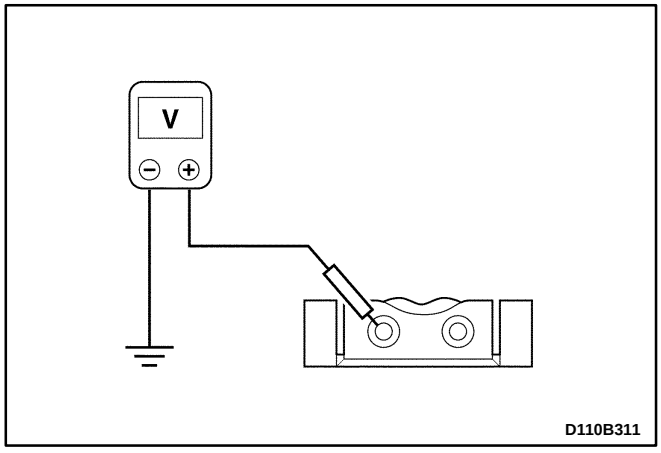
DIAGNOSTIC ILLUSTRATION 7

Checking the clock spring connector for a short to voltage on the sensing and diagnostic module side.



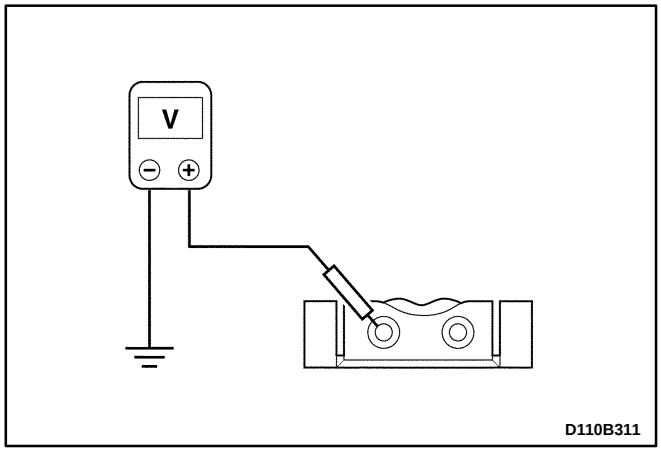
DIAGNOSTIC ILLUSTRATION 8

Checking the passenger airbag circuit continuity on the sensing and diagnostic module side of the connector.



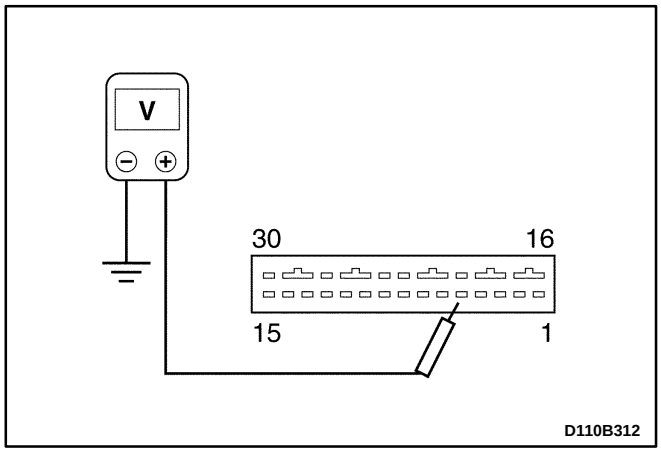
DIAGNOSTIC ILLUSTRATION 9

Checking the passenger airbag circuit for a short to ground.



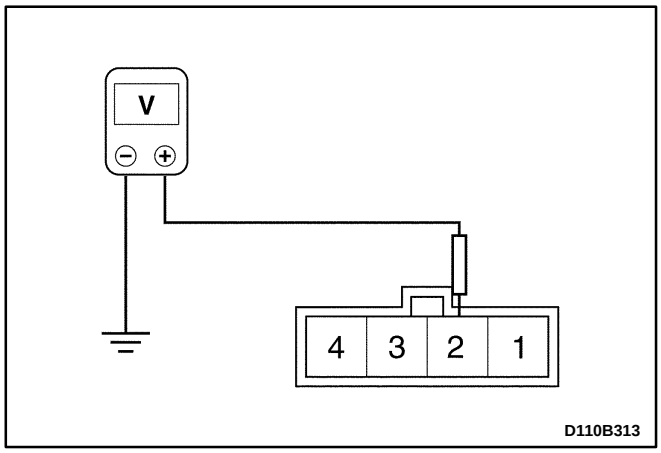
DIAGNOSTIC ILLUSTRATION 10

Checking the passenger airbag circuit for a short to voltage.



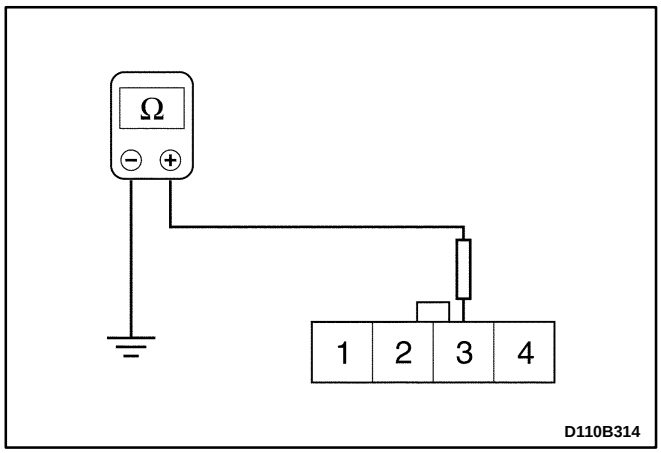
DIAGNOSTIC ILLUSTRATION 11

Checking the sensing and diagnostic module voltage supply at the terminal 5.



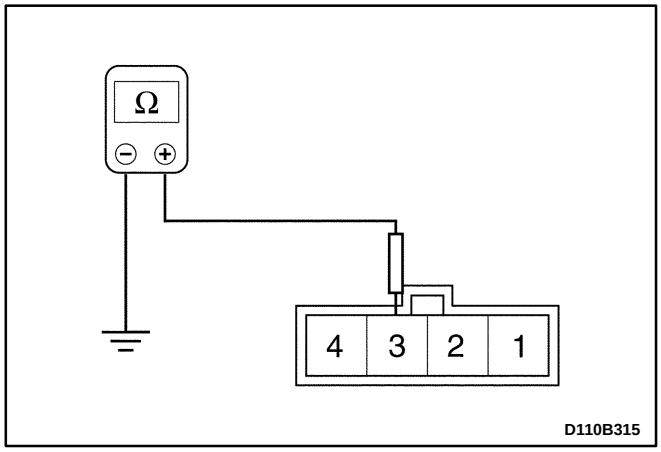
DIAGNOSTIC ILLUSTRATION 12

Checking the voltage supply on the instrument harness side at the terminal 2 of the connector C208.



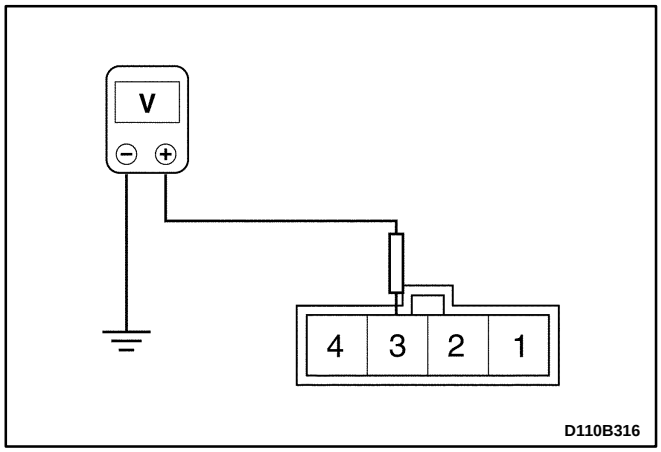
DIAGNOSTIC ILLUSTRATION 13

Checking for a short to ground on the sensing and diagnostic module side of the supplemental inflatable restraints harness at the terminal 3 of the connector C208.



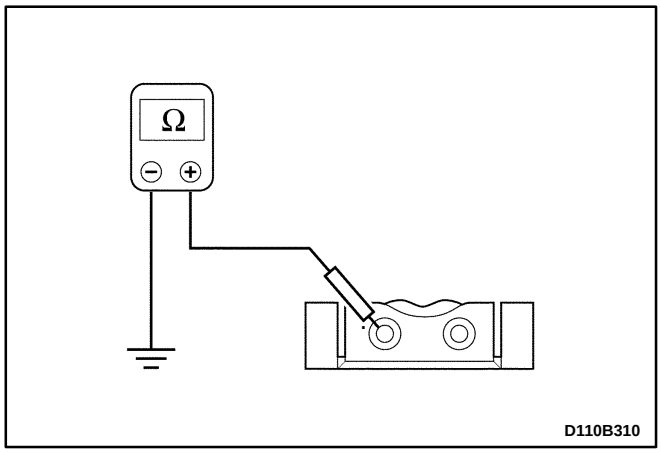
DIAGNOSTIC ILLUSTRATION 14

Checking for a short to ground in the instrument harness on the instrument harness side at the terminal 3 of the connector C208.



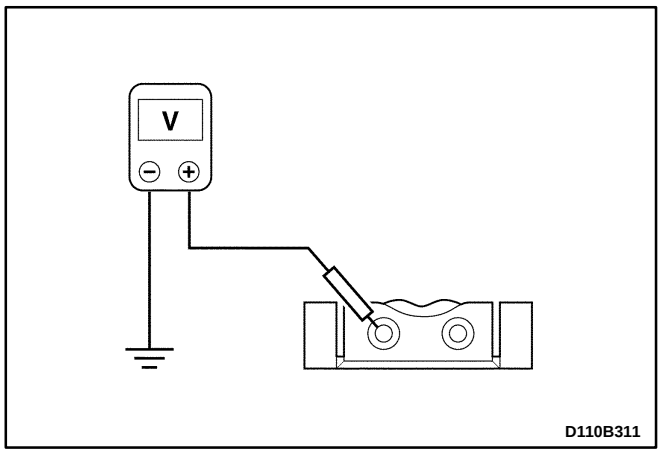
DIAGNOSTIC ILLUSTRATION 15

Checking the voltage of the warning lamp circuit on the instrument harness side at the terminal 3 of the connector C208.



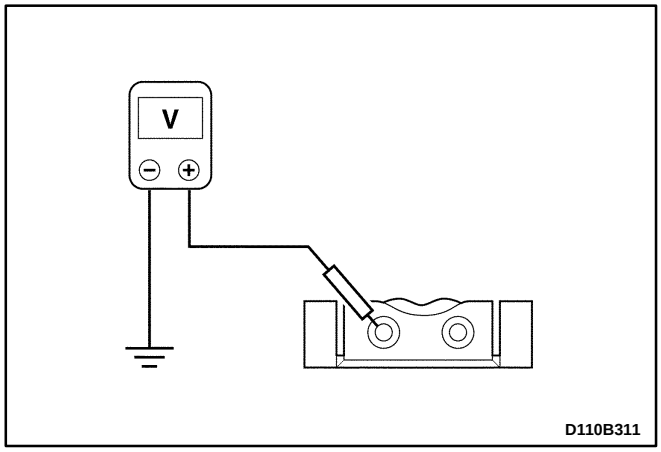
DIAGNOSTIC ILLUSTRATION 16

Checking the driver seat belt pretensioner circuit continuity on the sensing and driagnostic module side of the connector.



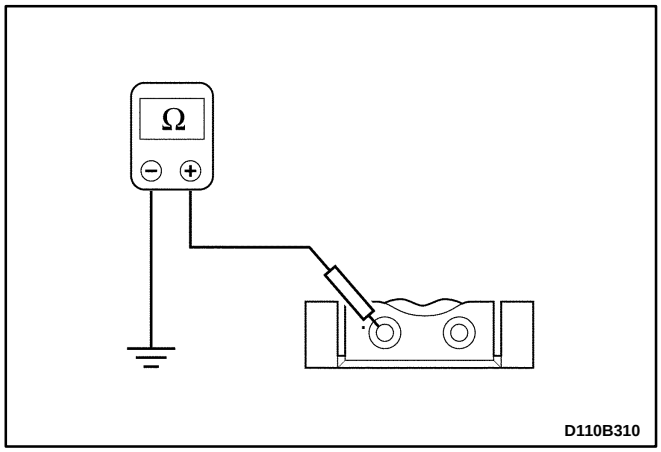
DIAGNOSTIC ILLUSTRATION 17

Checking the driver seat belt pretensioner circuit for a short to ground.



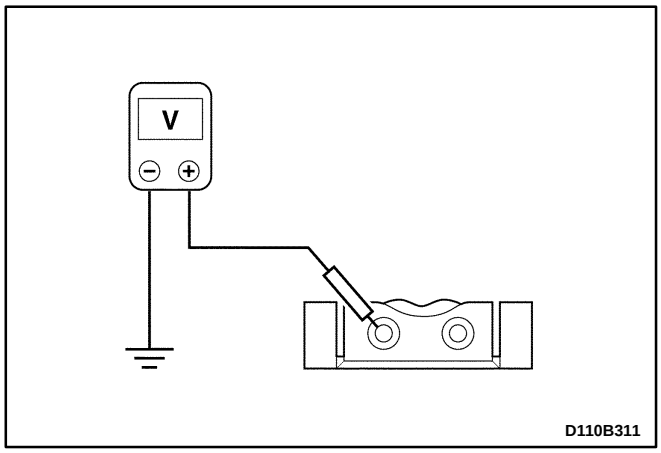
DIAGNOSTIC ILLUSTRATION 18

Checking the driver seat belt pretensioner circuit for a short to voltage.



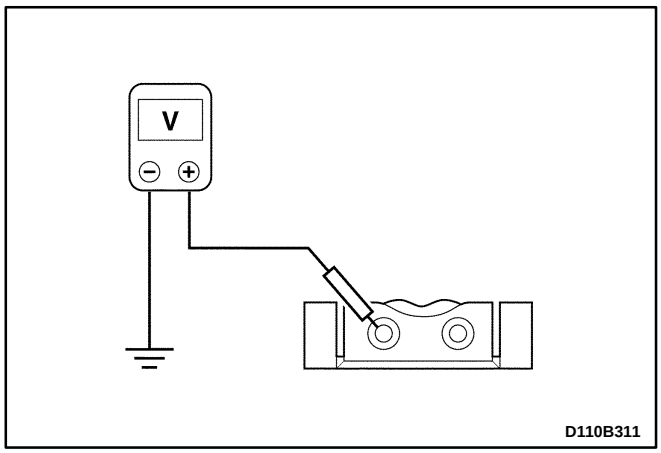
DIAGNOSTIC ILLUSTRATION 19

Checking the passenger seat belt pretensioner circuit continuity on the sensing and driagnostic module side of the connector.



DIAGNOSTIC ILLUSTRATION 20

Checking the passenger seat belt pretensioner circuit for a short to ground.

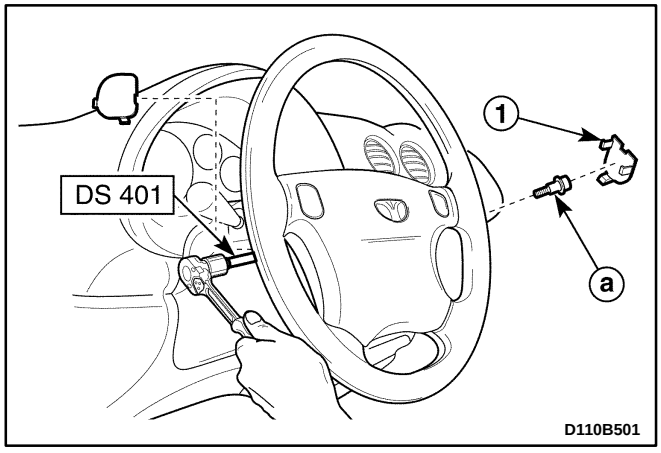


DIAGNOSTIC ILLUSTRATION 21

Checking the passenger seat belt pretensioner circuit for a short to voltage.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



DRIVER AIRBAG MODULE

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

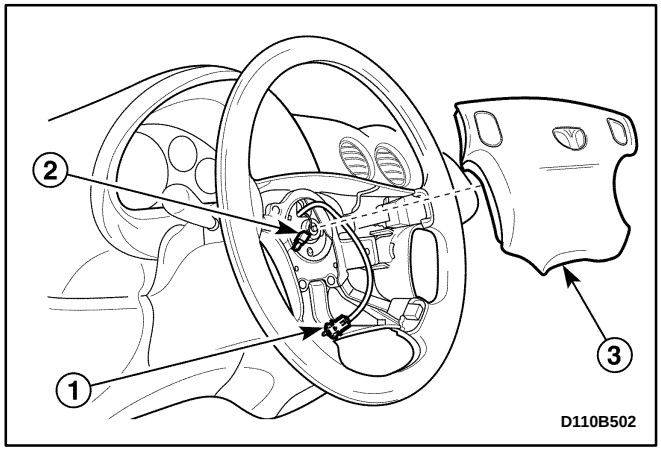
Tool Required

DS 401 Torx Bolt Wrench

Removal Procedure

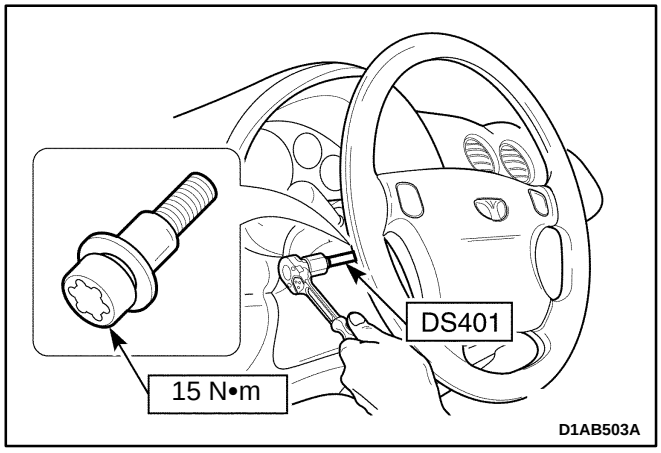
1. Disconnect the negative battery cable.
2. Position the steering wheel straight ahead.
3. Remove the driver airbag module mounting bolts.
   - Remove the airbag module bolt cover (1).
   - Remove the airbag module torx bolt using a torx bolt wrench DS 401.
     a. Airbag module torx bolt.

Caution: When handling an airbag module, always keep the top of the unit facing upward. This leaves room for the module to expand if the module unexpectedly deploys. Without room for expansion, a module suddenly propelled toward a person or object can cause injury or vehicle damage.



4.Remove the driver airbag module.

- Disconnect the driver airbag module connector (1).
- Disconnect the horn terminal connector (2).
- Remove the driver airbag module (3).



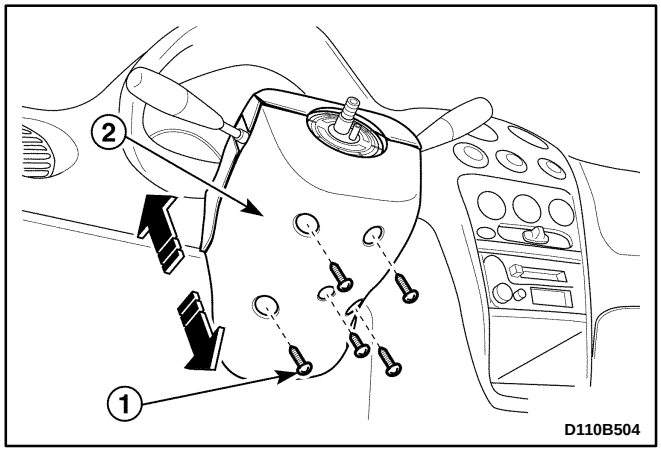
Installation Procedure

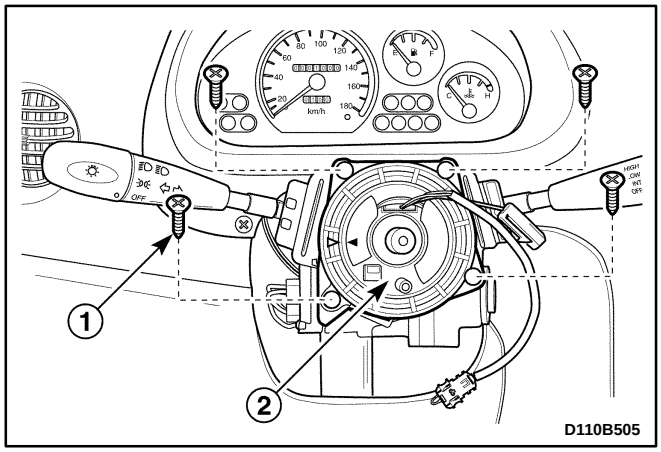
Caution: When removing an airbag module or handling a new airbag module, always keep the top of the unit facing upward. This leaves room for the module to expand if the module unexpectedly deploys. Without room for expansion, a module suddenly propelled toward a person or object can cause injury or vehicle damage.

1. Install the driver airbag module.
2. Connect the connectors to the horn terminal and the driver airbag module.
3. Install the driver airbag module torx bolt using a torx bolt wrench DS 401.

   Tighten

   Tighten the torx bolt to 15 N•m (11 lb-ft)
4. Connect the negative battery cable.



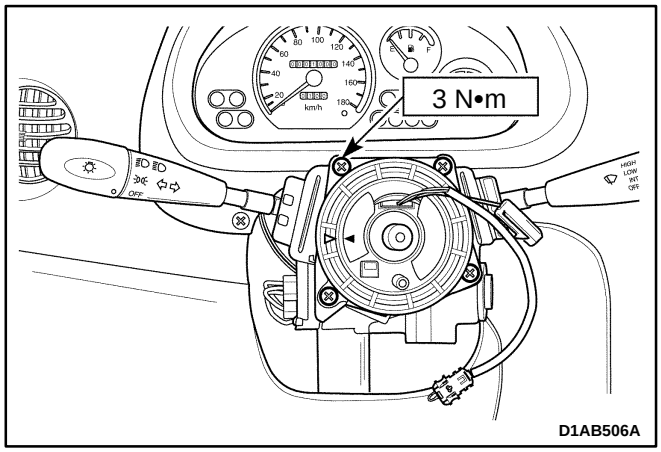


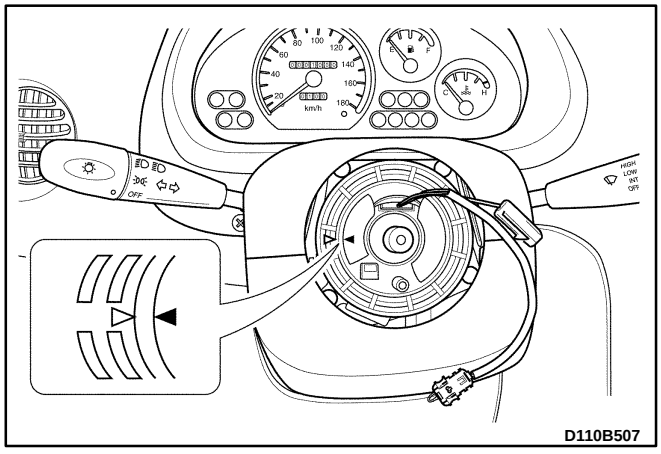
CLOCK SPRING

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

Removal Procedure

1. Disconnect the negative battery cable. Wait 1 minute until the capacitor inside the sensing and diagnostic module has discharged.
2. Remove the driver airbag module. Refer to “Driver Airbag Module” in this section.
3. Remove the steering wheel. Refer to *Section 6E, Steering Wheel and Column.*
4. Remove the lower/upper steering column cover.
   - Remove the screws (1).
   - Remove the lower/upper steering column cover(2).
5. Disconnect the clock spring and the horn terminal connector.
6. Disconnect the clock spring and the horn terminal connector which are banded on the steering column.
7. Remove the clock spring.
   - Remove the screws (1).
   - Remove the clock spring (2).





Installation Procedure

Caution: If the clock spring is not properly aligned, the steering wheel may not be able to rotate completely during a turn. Restricted turning ability can cause the vehicle to crash. Improper alignment of the clock spring also may make the supplemental inflatable restraints (SIR) system inoperative, preventing the airbags from deploying during a crash. Both of these outcomes can result in injury.

Notice: Turning the clock spring more than three turns clockwise or more than three turns counterclockwise can damage the spring.

1. Turn the front wheels straight ahead.
2. Install the clock spring with the screws.

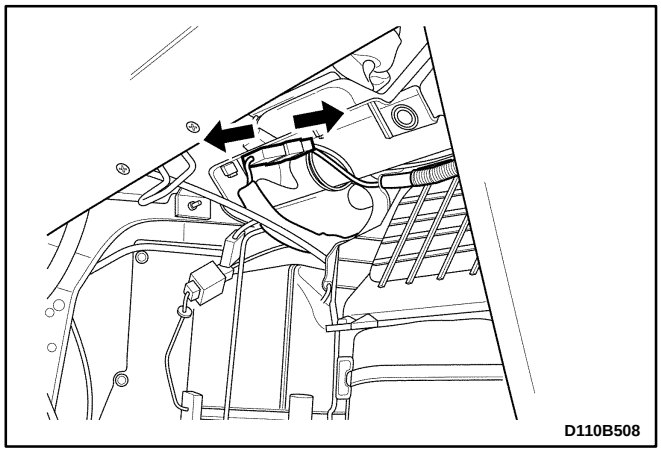
Tighten

Tighten the clock spring mounting screws to 3 N•m (27 lb-in)

Important: The clock spring may come packed in material used to prevent damage to the spring during shipping or storage. Avoid installing any of the packing material with the clock spring.

3. Turn the label of the clock spring clockwise to lock.
4. Turn the label of the clock spring counterclockwise approximately three turns to the neutral positions with the front wheels ahead.

5. Properly align the pointed marks (▷◀) on the components of the clock spring.
6. Connect the electrical connectors on the lower spring steering column.
7. Install the lower/upper steering column cover.
8. Install the steering wheel. Refer to *Section 6E, Steering Wheel and Column.*
9. Connect the driver airbag module and the horn connectors.
10. Install the driver airbag module. Refer to “Driver airbag module” in this section.
11. Connect the negative battery cable.



PASSENGER AIRBAG MODULE

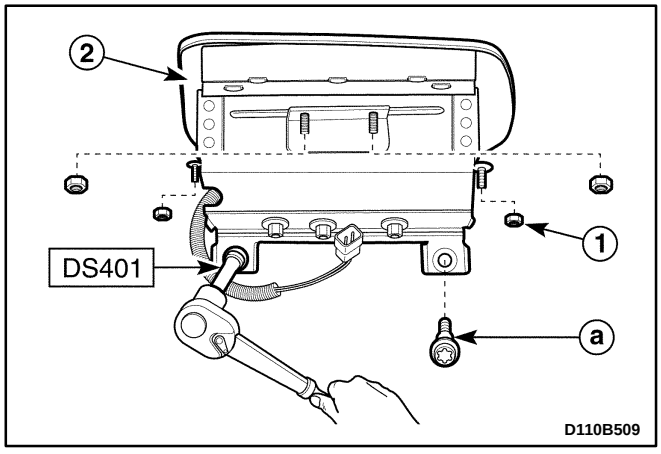
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Tool Required

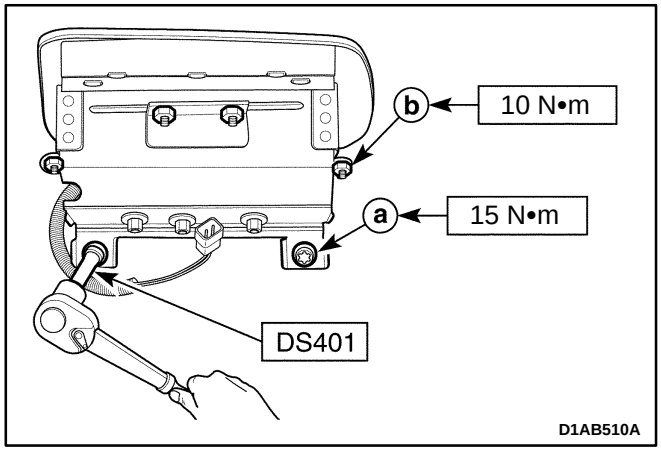
DS 401 Torx Bolt Wrench.

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the glove box. Refer to *Section 9E, Instrument/Driver Information.*
3. Disconnect the passenger airbag module connector.



4. Remove the passenger airbag module.
   - Remove the nuts (1).
   - Remove the airbag module torx bolts using a torx bolt wrench DS 401.
     a. Passenger airbag module torx bolt.
   - Remove the passenger airbag module (2).



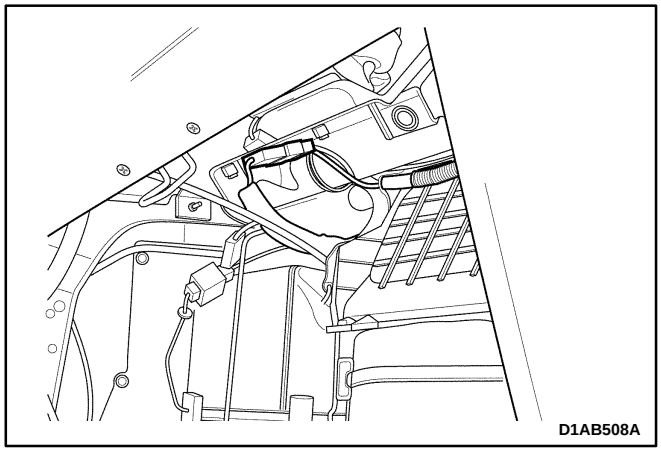
Installation Procedure

1. Install the passenger airbag module.
2. Install the passenger airbag module mounting torx bolts and the nuts using a torx bolt wrench DS 401.

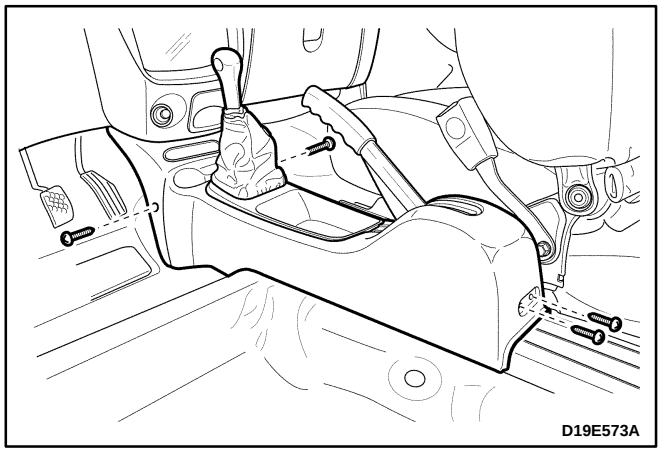
Tighten

- Tighten the passenger airbag module torx bolts to 15 N•m (11 lb-ft).
  a. Passenger airbag module torx bolt.
- Tighten the passenger airbag module nuts to 10 N•m (89 lb-in).
  b. Passenger airbag module nut.

Notice : Do not reuse the removed torx bolts. Replace the torx bolts with the new ones.



3. Connect the passenger airbag module connector.
4. Install the glove box. Refer to *Section 9E, Instrument/ Driver Information.*
5. Connect the negative battery cable.



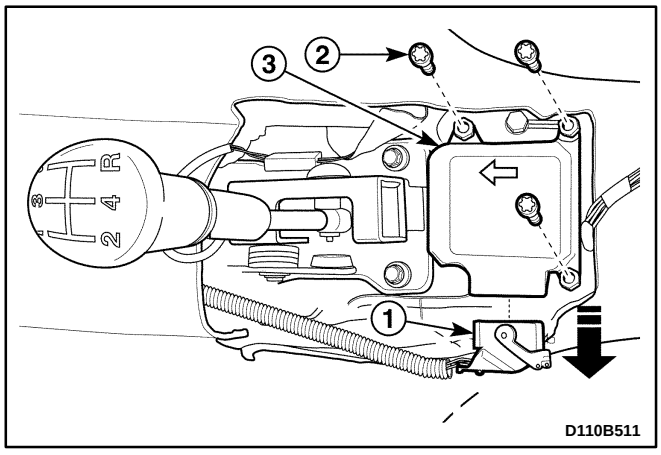
SENSING AND DIAGNOSTIC MODULE (SDM)

Tool Required

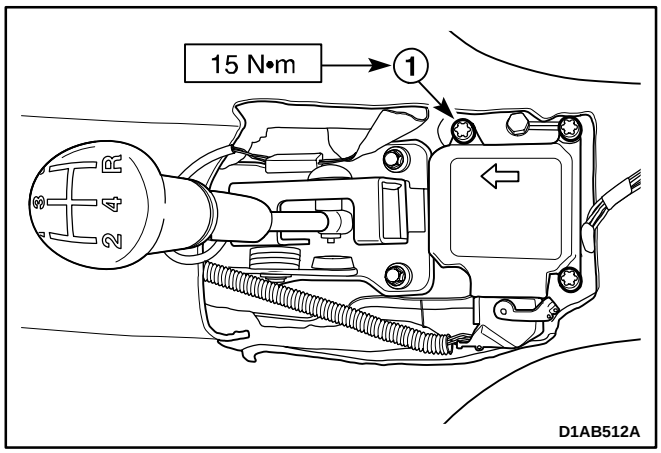
DS 401 Torx Bolt Wrench.

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the floor console. Refer to *Section 9G, Interior Trim.*



3. Remove the SDM.
   - Disconnect the SDM electrical connector (1).
   - Remove the torx bolts using a torx bolt wrench DS 401 (2).
   - Remove the SDM (3).



Installation Procedure

Notice: Do not install an SDM that has been dropped or has water damage, dents, cracks, or other visible defects. Attempted use of a defective SDM can result in vehicle damage.

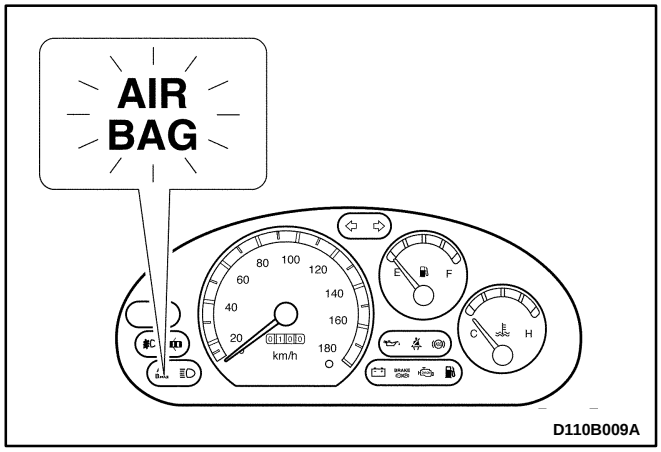
1. Install the SDM with the mounting torx bolts so that the arrow on the SDM label points toward the front of the vehicle.

Notice : Ground the wiring harness to the mounting torx bolt (1).

Tighten

Tighten the SDM mounting torx bolts to 15 N•m (11 lb-ft).

2. Connect the SDM electrical connector.



3. Install the floor console. Refer to *Section 9G, Interior Trim.*
4. Connect the negative battery cable.
5. Check for proper operation of the system.
   - Turn the ignition ON while watching the supplemental inflatable restraints warning lamp.
   - The warning lamp should turn ON for about 4 seconds, and then turn OFF.

AIRBAG MODULE DEPLOYMENT (IN VEHICLE)

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

Deploy the airbags before disposing of them. This includes those in a whole vehicle being scrapped.

If the vehicle is still within the warranty period, contact the Daewoo regional service manager for approval or special instructions before deploying the airbag modules.

Caution: Before deploying the airbags, remove all loose objects from the airbags expansion area.

Caution: Deploy the airbags with the vehicle doors closed and the side windows open.

Caution: Deploy the airbags only in an evacuated area. Service personnel who must be present during the deployment should be at least 10 meters (33 feet) in front of the vehicle.

Caution: Do not connect the voltage source until after having completed all other preparations for the deployment of the airbags.

Caution: Allow a deployed airbag module to cool for at least 30 minutes before handling.

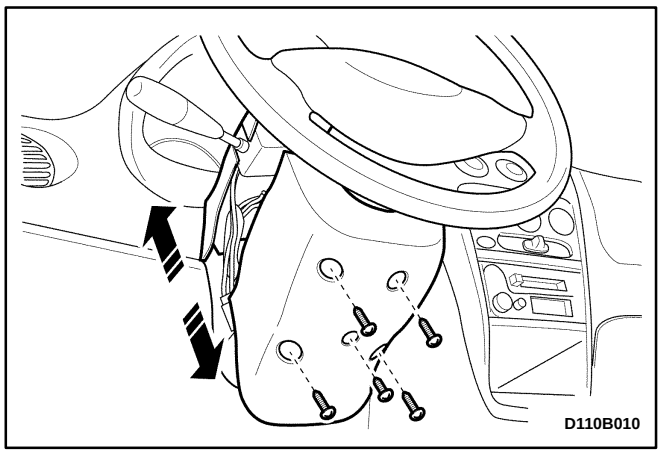
Caution: Wear the gloves and the eye protectors during the disposal process.

Caution: If the deployment fails, disconnect the voltage source and wait 5 minutes before approaching the vehicle.

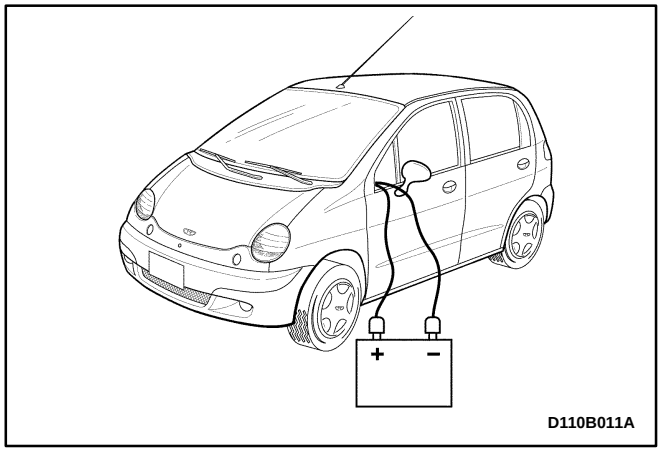
Deployment Procedure

1. Disconnect both battery cables and place the battery at least 10 meters (32.8 feet) from the vehicle.

Caution: Wait 1 minute after disconnecting both battery cables to allow the capacitor inside the sensing and diagnostic module (SDM) to discharge before taking any other action. The capacitor supplies the reserve power to deploy the airbags, even if the battery is disconnected. Unintentional deployment of the airbags can cause injury.



2. Remove the lower cover from the steering column.
3. At the lower steering column, cut the two wires leading from the supplemental inflatable restraint (SIR) harness to the clock spring.
4. Strip 13 mm (0.5 inch) of insulation from the ends of the wires leading to the clock spring.
5. Use two additional wires, each at least 10 meters (33 feet) long, to reach from the deployment battery to the airbag module.
6. Strip 13 mm (0.5 inch) of insulation from the ends of these two additional wires.
7. Twist the two wires together at one end.



8. Place the twisted ends of the two wires near the deployment battery. Do not connect the wires to the battery at this time.
9. Using the free ends of the 10 meters (33 feet) wires leading to the clock spring, make two splices, one at each wire from the airbag module.
10. Wrap the splices with insulating tape.
11. Now that the free ends of the 10 meters (33 feet) wires are spliced to the airbag module wires, and the ends that are twisted together are near the deployment battery, clear the area.
12. Untwist the wires that are near the deployment battery.
13. Touch one wire to the positive battery terminal and touch the other wire to the negative battery terminal. The airbag will deploy.
14. Repeat the procedure for the passenger airbag, cutting the wires to the passenger airbag module instead of the wires leading to the clock spring.
15. Strip 13 mm (0.5 inch) of insulation from the ends of the wires leading to the passenger airbag module.
16. Use two additional wires, each at least 10 meters (33 feet) long, to reach from the deployment battery to the passenger airbag module.
17. Strip 13 mm (0.5 inch) of insulation from the ends of these two additional wires.
18. Twist the two wires together at one end.
19. Place the twisted ends of the two wires near the deployment battery. Do not connect the wires to the battery at this time.
20. Using the free ends of the 10 meter (33 feet) wires to the passenger airbag module, make two splices, one at each wire from the airbag module.
21. Wrap the splices with insulating tape.
22. Now that the free ends of the 10 meters (33 feet) wires are spliced to the passenger airbag module wires, and the ends that are twisted together are near the deployment battery, clear the area.
23. Untwist the wires that are near the deployment battery.
24. Touch one wire to the positive battery terminal and touch the other wire to the negative battery terminal. The passenger airbag will deploy.
25. Using the proper precautions, dispose of the deployed airbag. Refer to “Deployed Airbag Module Disposal Procedure” in this section.

AIRBAG MODULE DEPLOYMENT (OUTSIDE OF VEHICLE)

Deploy all intact airbag modules that have been

- Removed from a scrapped vehicle.
- Found to be defective.
- Found to have been damaged during transit, storage, or service.

Caution: Deploy the airbags only in an evacuated area. Service personnel who must be present during the deployment should be at least 10 meters (33 feet) in front of the vehicle.

Caution: Do not connect the voltage source until completing all other preparations for the deployment of the airbags.

Caution: Allow a deployed airbag module to cool for at least 30 minutes before removing it from the vehicle.

Caution: Wear gloves and eye protection during the disposal process.

Caution: If the deployment fails, disconnect the voltage source and wait 5 minutes before approaching the vehicle.

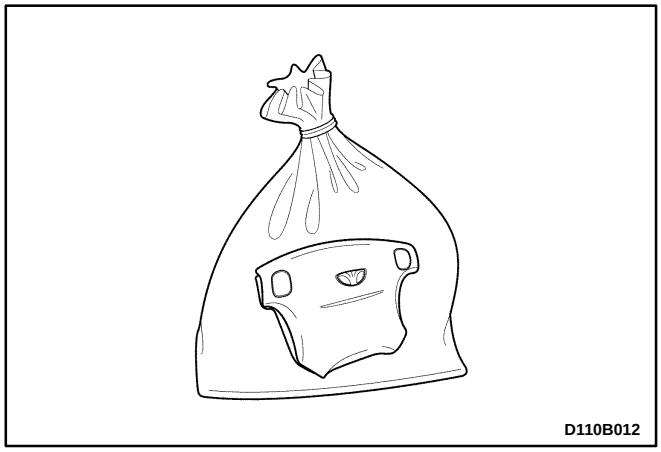
1. Position the airbag module face up, on flat ground outdoors, at least 10 meters (33 feet) from any obstacles or people.
2. Place a vehicle battery at least 10 meters (33 feet) away from the airbag module.
3. Deploy the airbag module using the deployment tool.
4. Using the proper precautions, dispose of the deployed airbag. Refer to “Deployed Airbag Module Disposal Procedure” in this section.

DEPLOYED AIRBAG MODULE DISPOSAL PROCEDURE

Caution: After an airbag module has been deployed, the surface of the airbag may contain a powdery residue. The powder lubricates the airbag as it inflates. The dust that is produced as a by-product of the deployment is unlikely to be harmful, but use the gloves and the safety glasses in order to prevent any possible irritation of the skin and the eyes.

Caution: After deployment, the metal surfaces of the airbag module will be hot. In order to avoid the risk of an injury or a fire, do not place the deployed airbag modules near any flammable objects, and allow the airbag modules to cool for 30 minutes before handling them.

Deploy an airbag before disposing of it. This includes those in a whole vehicle being scrapped.



If the vehicle is still within the warranty period, contact the Daewoo regional service manager for approval or special instructions before deploying an airbag module.

Deployed airbag modules should be disposed of in the same manner as any other scrap parts, with the addition of the following steps:

1. Place the deployed airbag in a sturdy plastic bag.
2. Seal the plastic bag securely.
3. Wash your hands and rinse them with water after handling a deployed airbag.

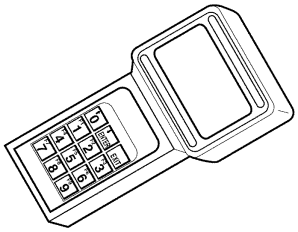
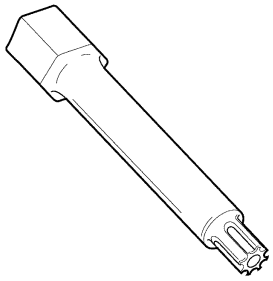
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Clock Spring Mounting Screws	3	–	27
Driver Airbag Module Mounting Bolts	15	11	–
Passenger Airbag Module Mounting Nuts	10	–	89
Passenger Airbag Module Mounting Bolts	15	11	–
Sensing and Diagnostic Module Mounting Bolts	15	11	–

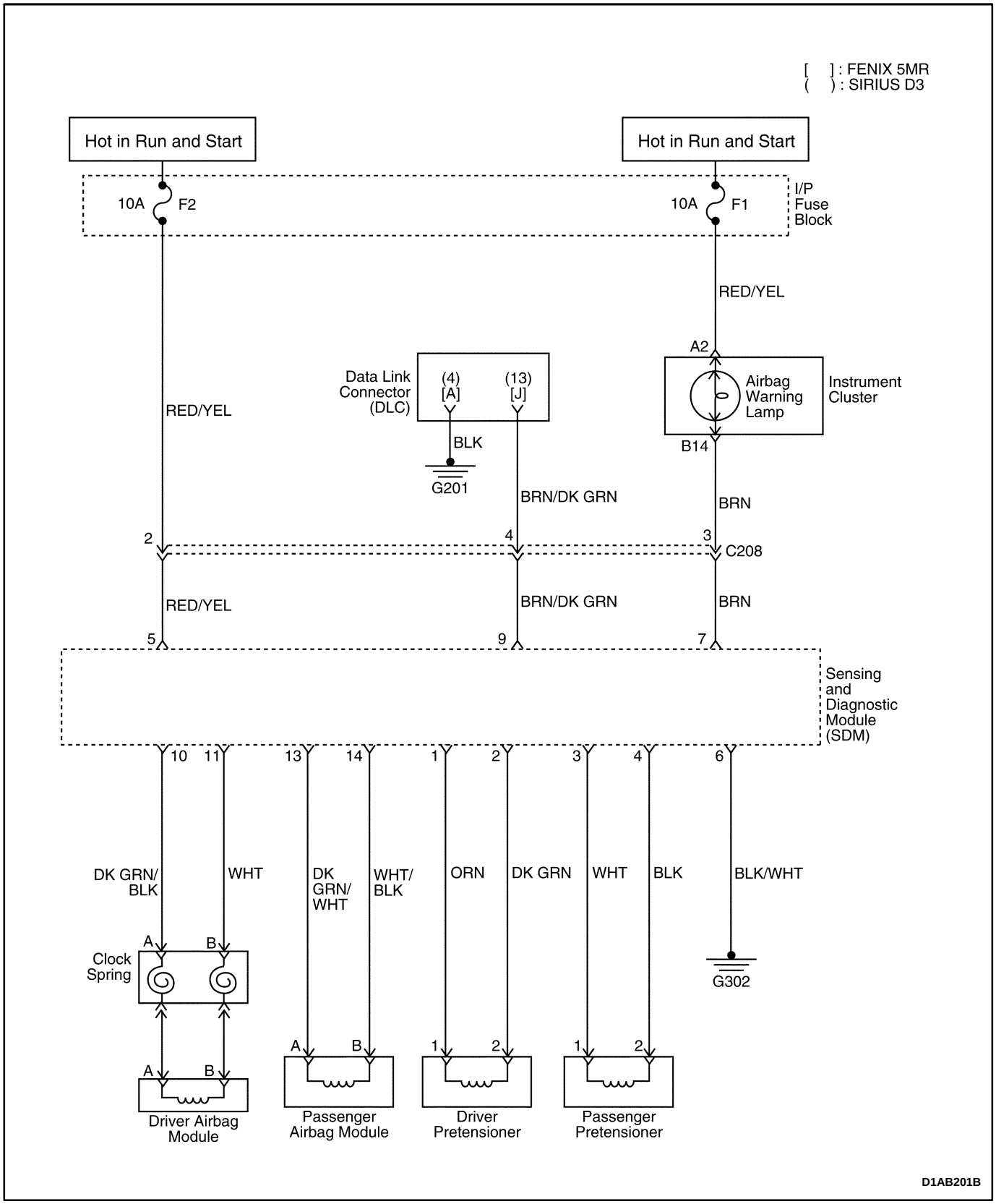
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D102F101	**Scan Tool**
 D110B101	**DS 401** **Torx Bolt Wrench**

SCHEMATIC AND ROUTING DIAGRAMS

SUPPLEMENTAL INFLATABLE RESTRAINTS (SIR) ELECTRICAL SCHEMATIC



SECTION 9A

BODY WIRING SYSTEM

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.

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- How to Check Terminal Number of Connector . 9A-4

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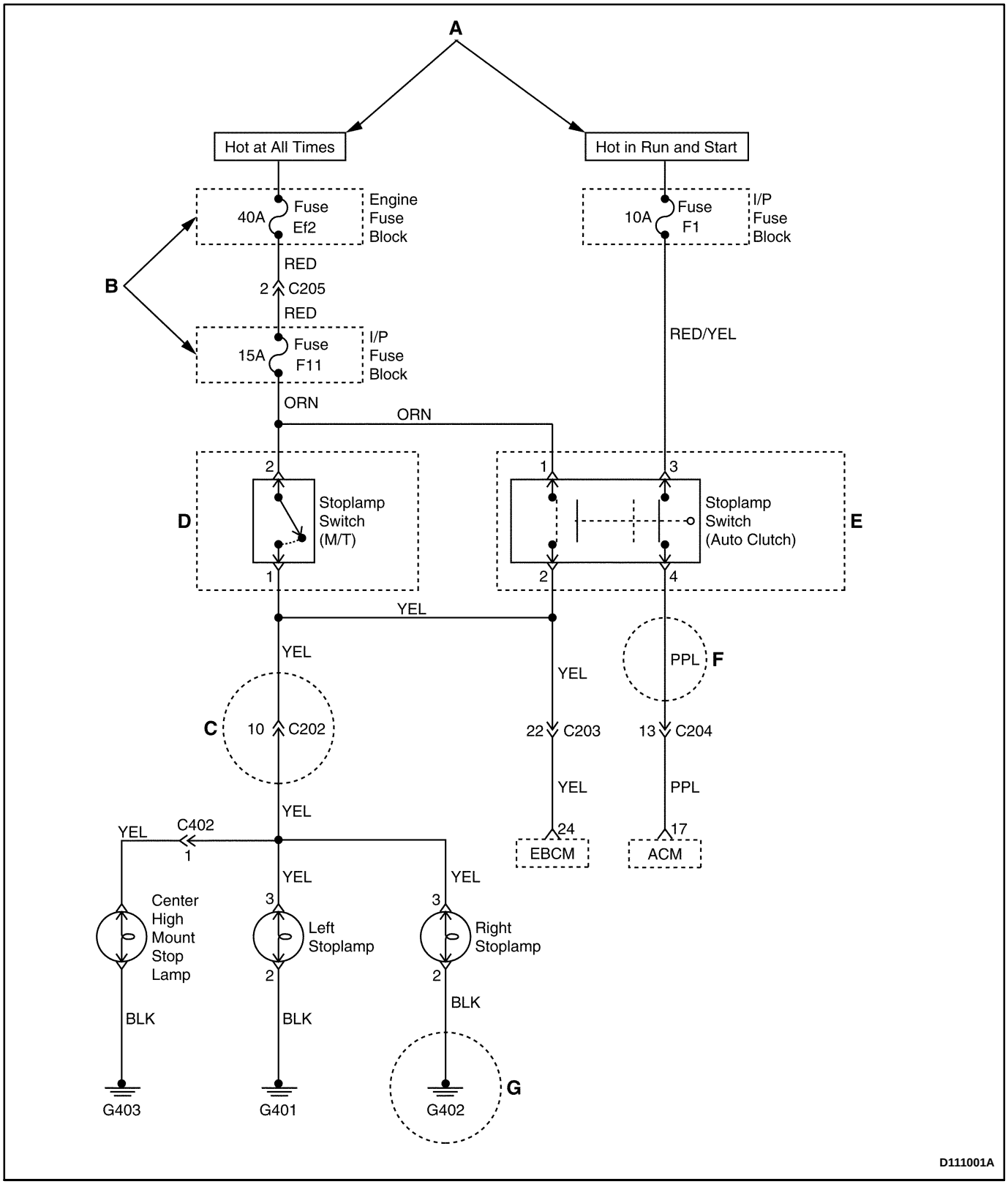
- Rear Door Harness Routing 9A-20
- Tailgate Harness Routing 9A-21

DESCRIPTION AND OPERATION

HOW TO READ ELECTRICAL WIRING DIAGRAM



Contents of Electrical Wiring Diagram

Position	Explanation
A	– The box above the fuse box: Power supply lines – Power supply lines: 30, 15, 15A, Ka, 58, 50 – Refer to “Circuit Identification Symbol” in this section for more details.
B	– Ef10 or F3: Fuse Number • Ef10: Fuse No 10 in the engine room fuse box • F3: Fuse No 3 in the passenger room fuse box – 40A: Fuse Capacity – Refer to “Relay Box Locator” and “Fuse Box Locator” in this section.
C	– Connector – Connector No C202, terminal No 10 – Refer to “How to Check Terminal Number of Connect” in this section
D	– Internal circuit of component (Relay) (Component Name, Terminal Number)
E	– Internal circuit of component (Switch) (Terminal Number)
F	– Wiring Harness Color – Refer to “Wire Color Chart” in this section
G	– Ground line. – G402: Ground Position – In case of the ground numberless, this means the body ground.

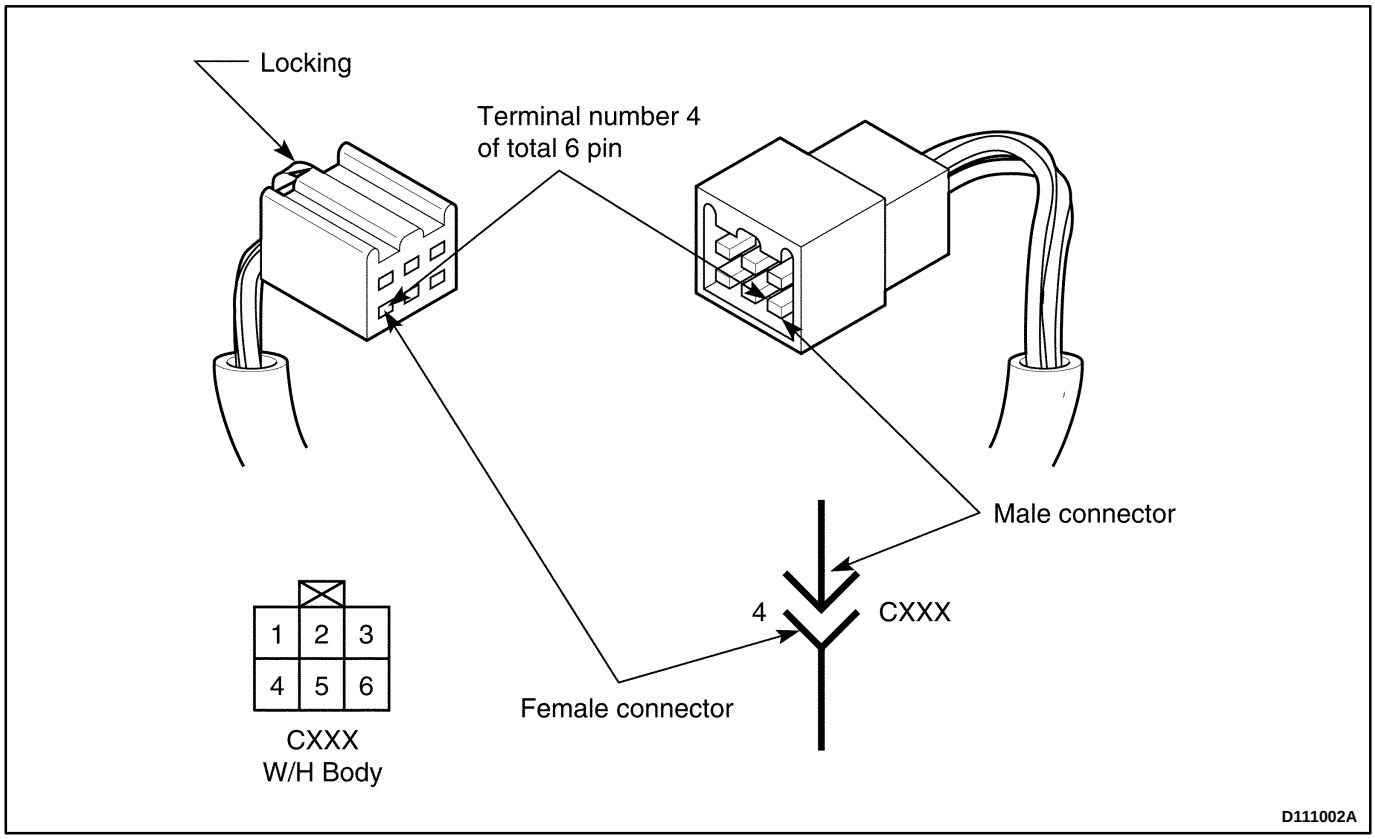
Circuit Identification Symbol

Identification Symbol	Meaning
C	Connector
Ef	Fuse in engine room fuse box
F	Fuse in passenger compartment fuse box
G	Ground

HOW TO CHECK TERMINAL NUMBER OF CONNECTOR

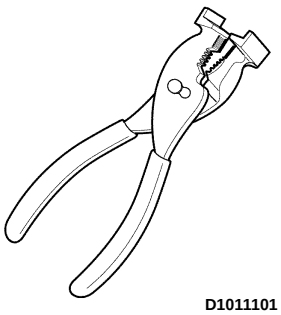
Terminal number is given based on female terminal connector.

Example: Terminal number 4 of 6 pin connection.



SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D1011101	**DW–540–010** **Relay Remover**

SCHEMATIC AND ROUTING DIAGRAMS

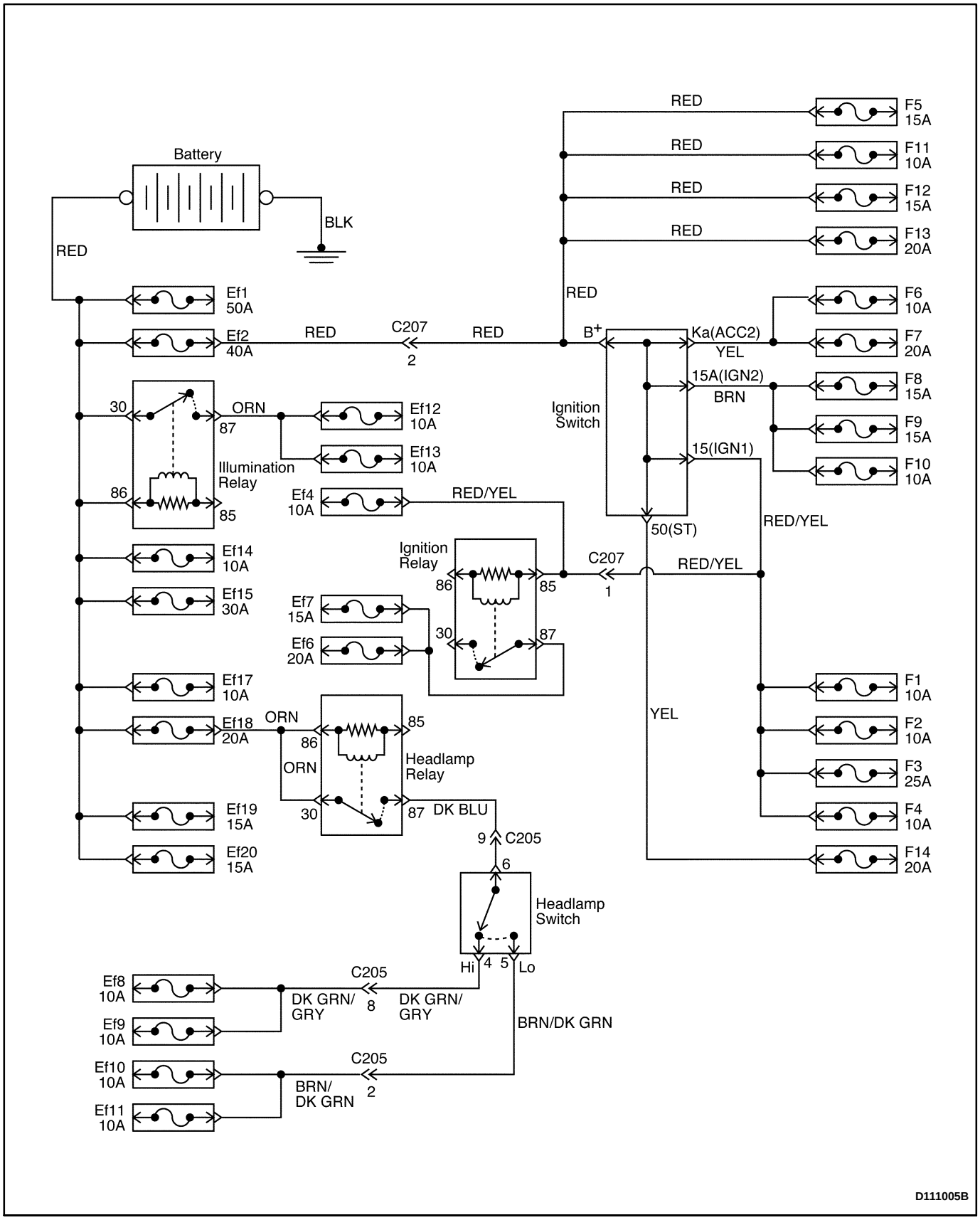
WIRE COLOR CHART

Wire Color	Abbreviation On Schematic
Green	DK GRN
Blue	DK BLU
Brown	BRN
Orange	ORN
Yellow	YEL
Grey	GRY
Red	RED
Black	BLK
White	WHT
Purple	PPL

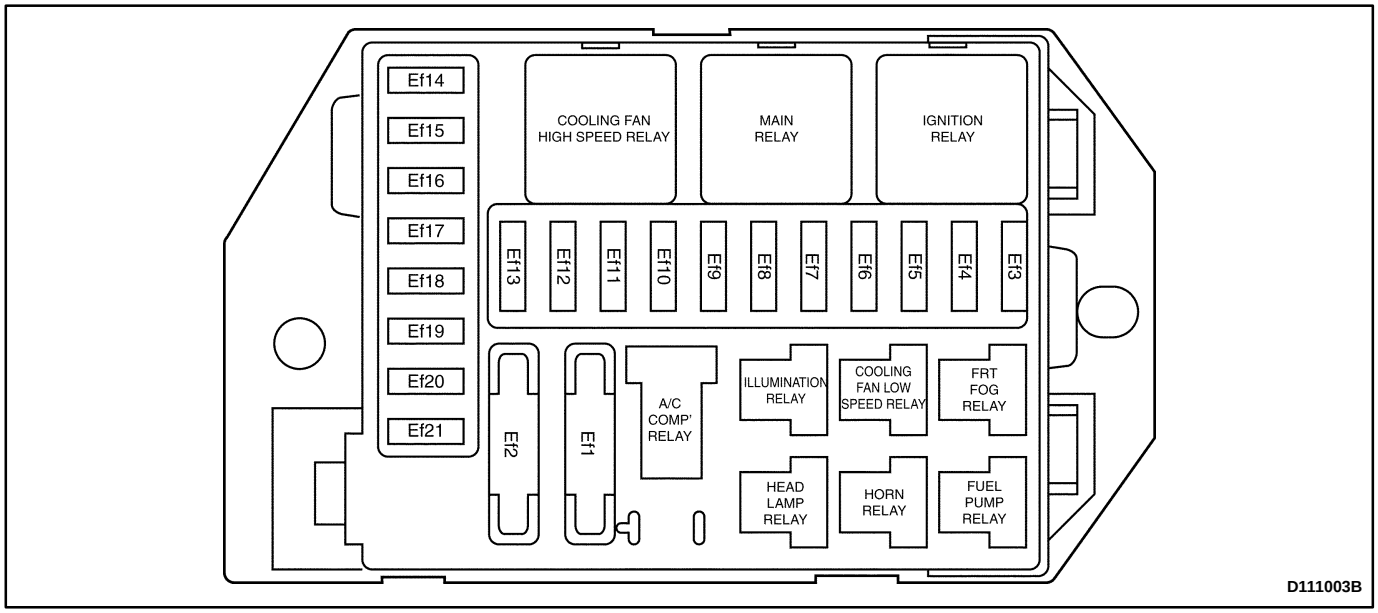
Wires With Tracers

Wire Color	Abbreviation On Schematic
Red with White Tracer	RED/WHT

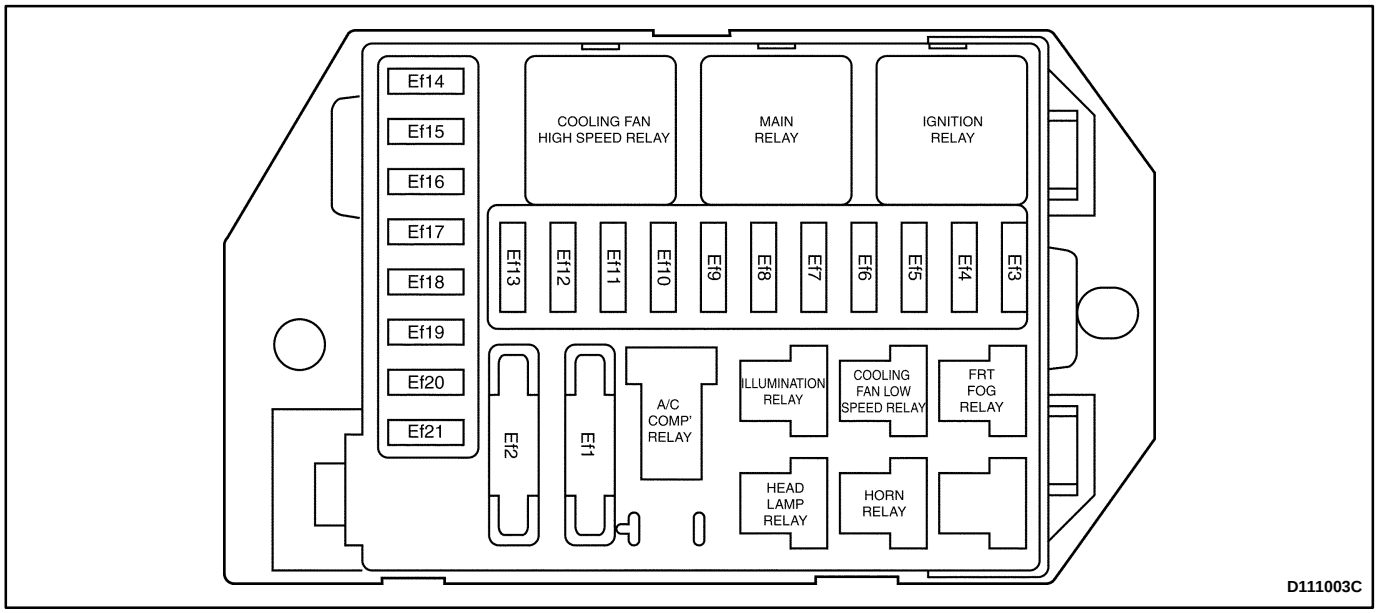
POWER DISRIBUTION SCHEMATIC



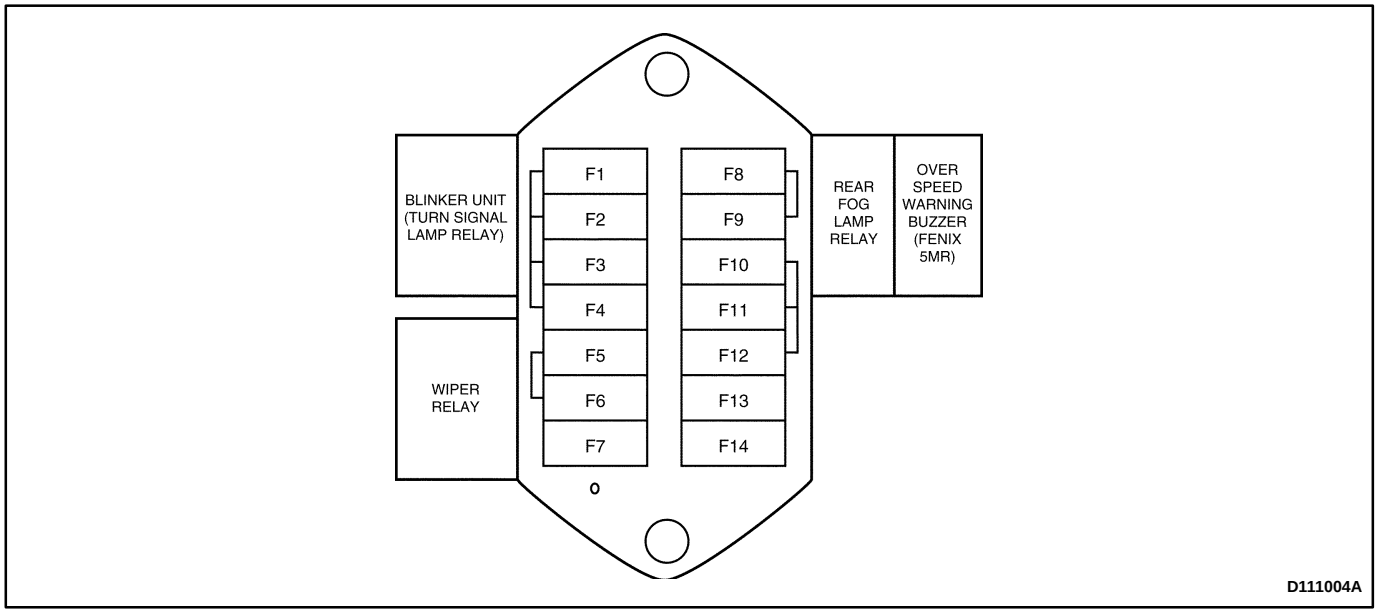
RELAY & FUSE BOX LOCATOR (ENGINE ROOM: SIRIUS D3)



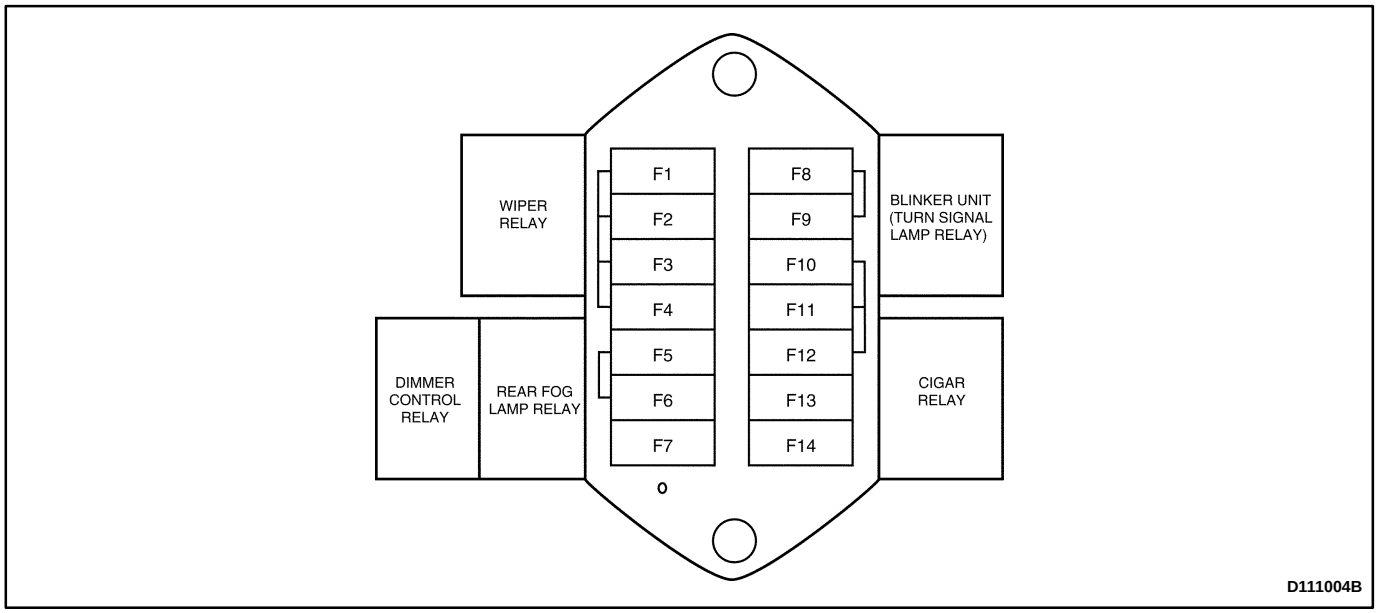
RELAY & FUSE BOX LOCATOR (ENGINE ROOM: FENIX 5MR)



FUSE BOX LOCATOR (PASSENGER COMPARTMENT: LHD)



FUSE BOX LOCATOR (PASSENGER COMPARTMENT: RHD)

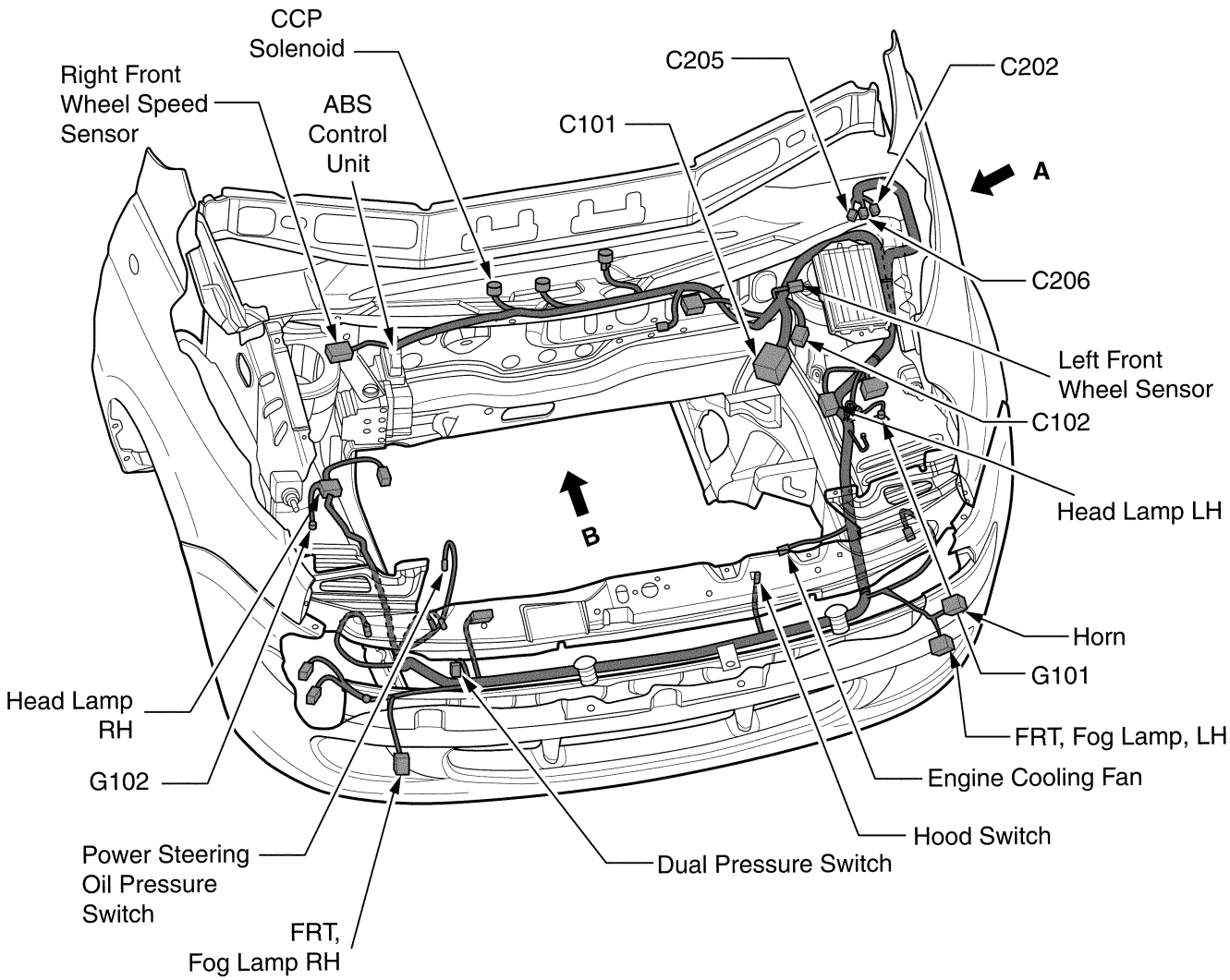


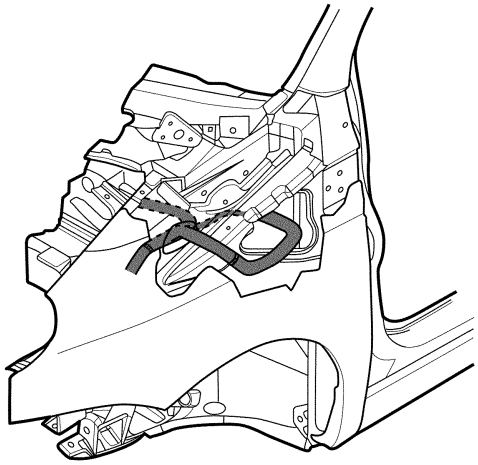
FUSE CHART

Fuse	Rating/ Source		Circuit
Ef1 (Engine Fuse)	50A	BAT	ABS
Ef2	40A	BAT	Ignition Switch, Instrument Panel Fuse Block (F5, F11 ~ F13)
Ef3	10A	BAT	Fuel cut-off Switch (Inertia Switch)
Ef4	10A	IGN 1	Fuel, EBCM, Generator, VSS, Fuel Pump Relay, Main Relay, Ignition Coil
Ef5	–	–	Not Used
Ef6	20A	BAT	Blower Motor
Ef7	15A	BAT	Rear Window Defogger
Ef8	10A	BAT	Headlamp Hi Beam, Right Side
Ef9	10A	BAT	Headlamp Hi Beam, Left Side
Ef10	10A	BAT	Headlamp Lo Beam, Right Side
Ef11	10A	BAT	Headlamp Lo Beam, Left Side
Ef12	10A	58	Tail and Illumination Lamps, Right Side
Ef13	10A	58	Tail and Illumination Lamps, Left Side
Ef14	10A	BAT	A/C Compressor
Ef15	30A	BAT	Radiator Fan
Ef16	10A	–	Spare
Ef17	10A	BAT	Horn
Ef18	20A	BAT	Headlamp Relay, Hi Beam Passing, DRL Module
Ef19	15A	BAT	ECM, Main Relay
Ef20	15A	BAT	Front Fog Lamp
Ef21	15A	–	Spare
F1 (Fuse)	10A	IGN 1	Cluster, Clock, IMMO, Anti-Theft Control Unit, DRL Relay
F2	10A	IGN 1	SDM
F3	25A	IGN 1	Hazard Switch, DRL Module
F4	10A	IGN 1	Turn Signal Lamp
F5	15A	BAT	Stop Lamp
F6	10A	ACC	Audio
F7	20A	ACC	Cigar Light
F8	15A	IGN 2	Wiper
F9	15A	IGN 2	Rear Wiper Motor, Front & Rear Washer, Backup Lamp
F10	10A	IGN 2	Auto Miror Switch
F11	10A	Ef2	IMMO, Audio, Room Lamp
F12	15A	Ef2	Hazard, Clock
F13	20A	Ef2	Anti-Theft Control Unit, Door Lock
F14	20A	ST	Starter Motor

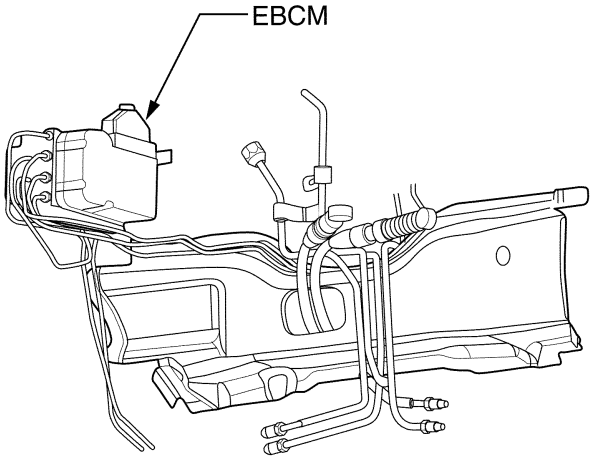
FRONT HARNESS ROUTING

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





Direction "A"

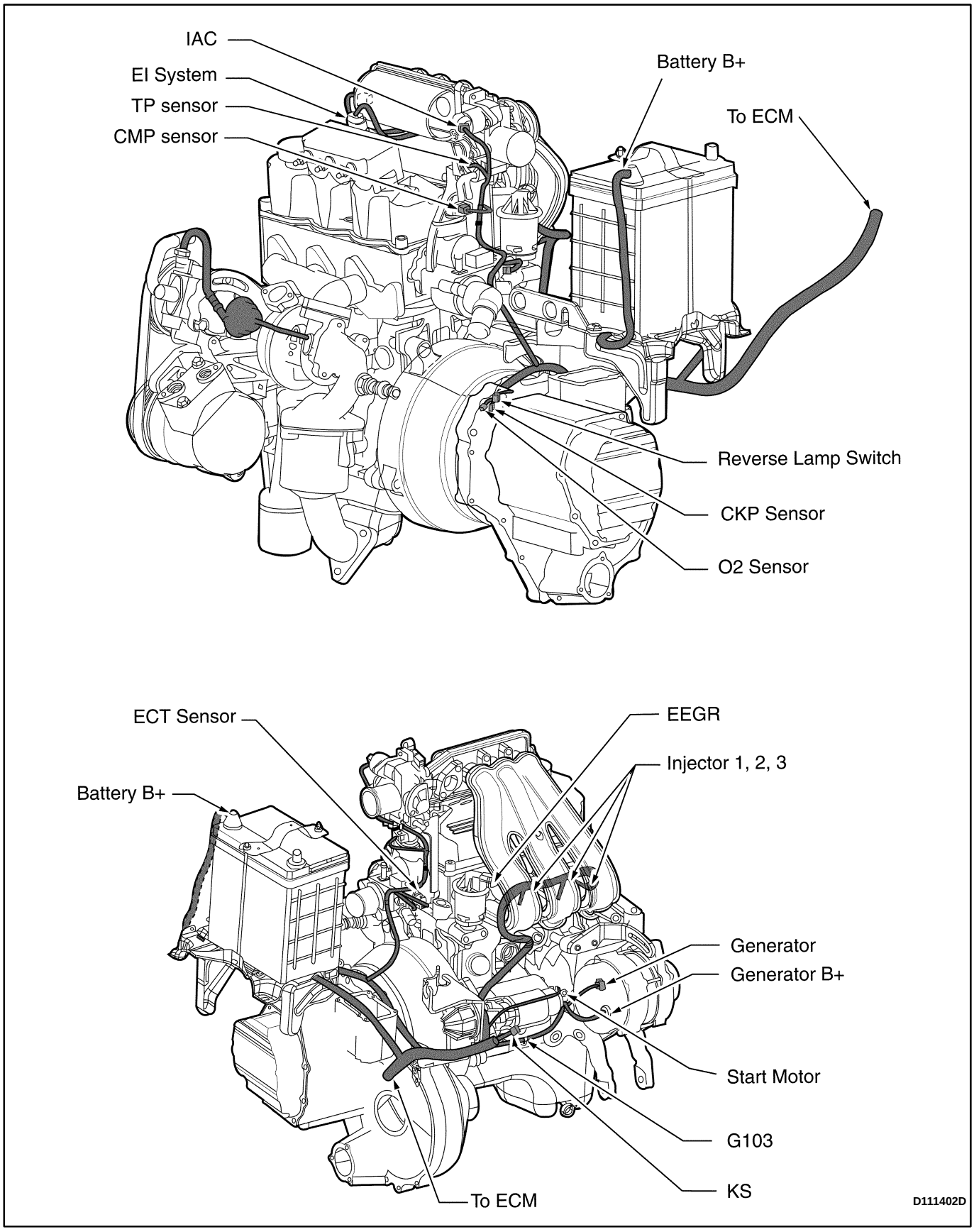


Direction "B"

D111401D

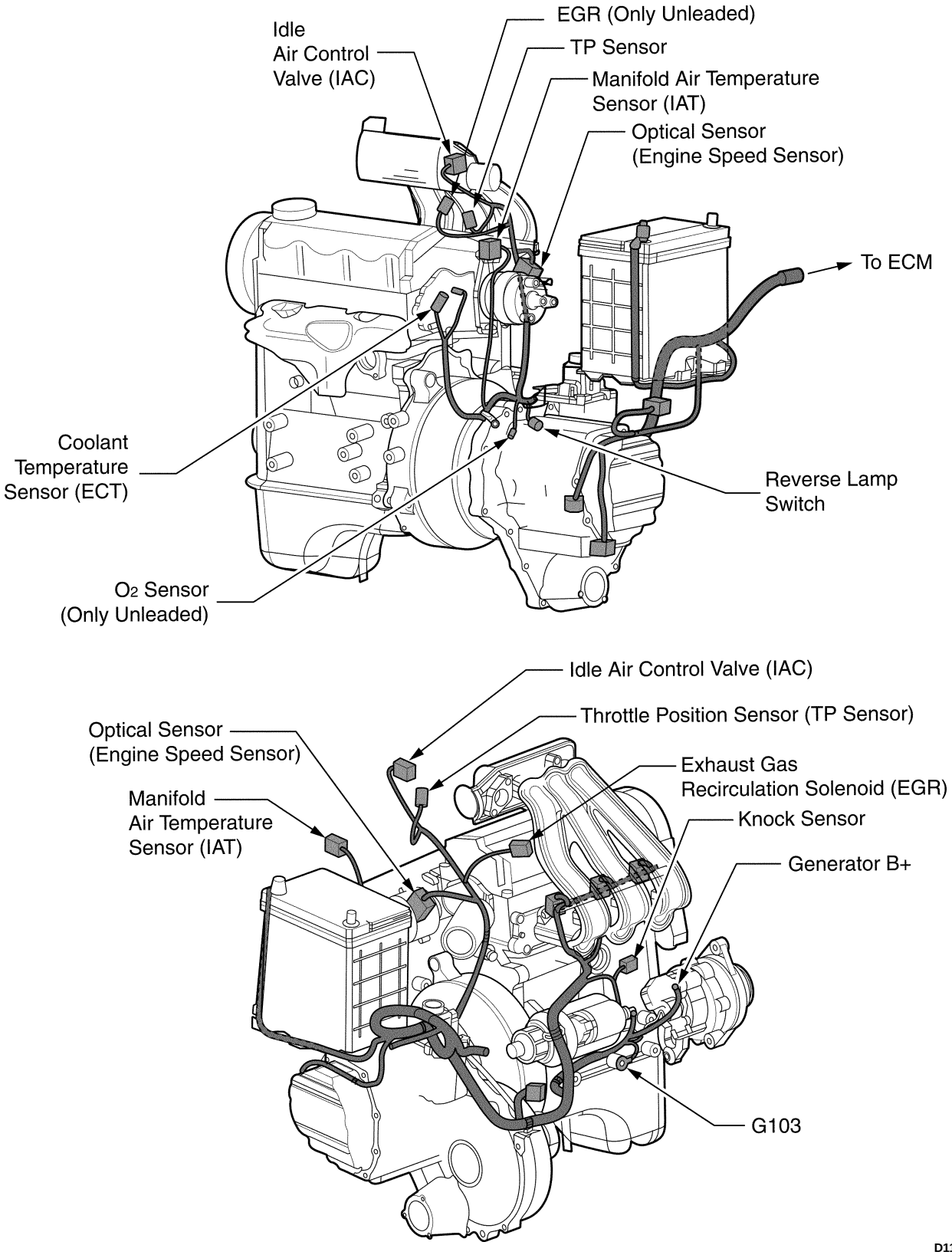
ENGINE HARNESS ROUTING (SIRIUS D3)

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



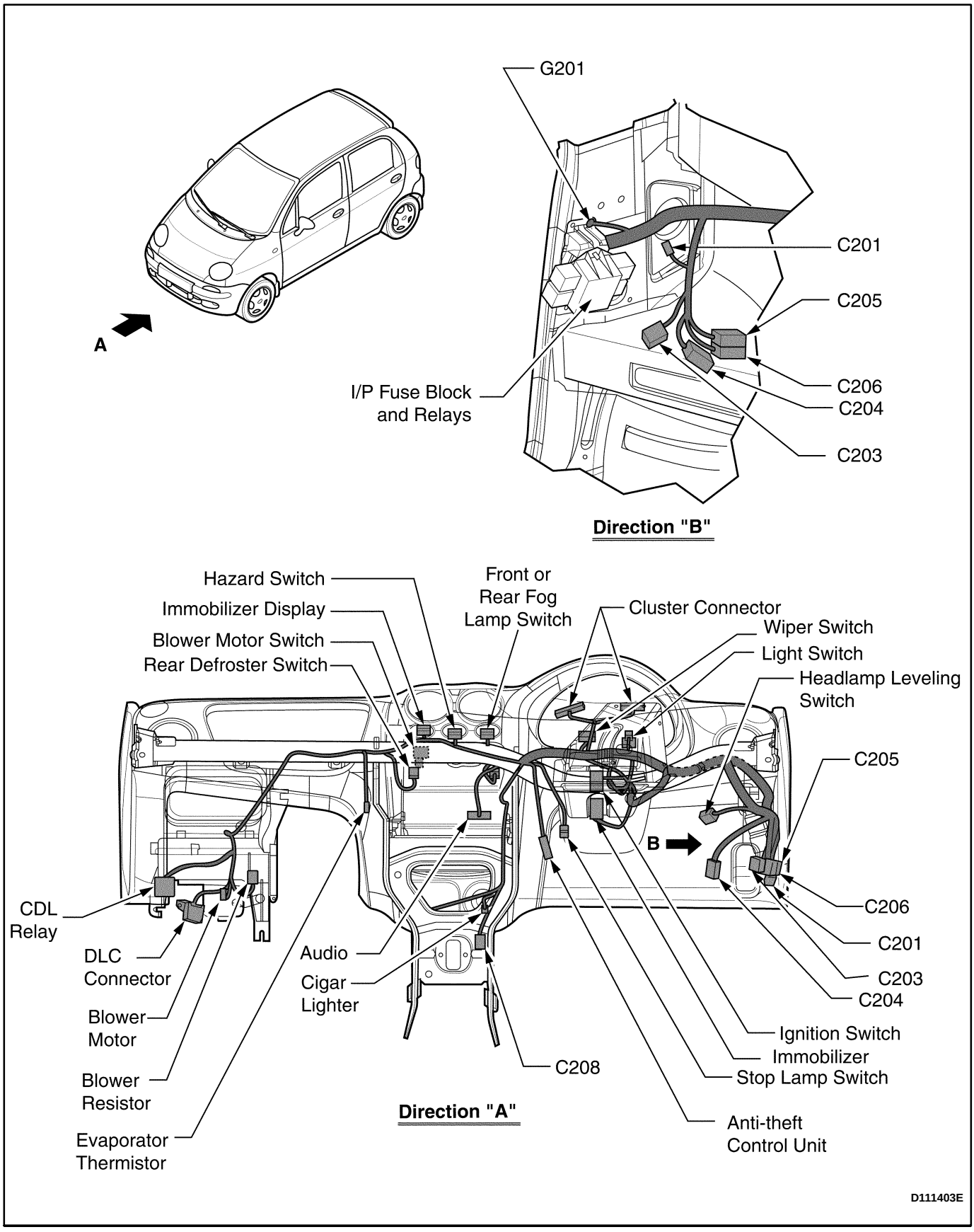
ENGINE HARNESS ROUTING (FENIX 5NR)

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



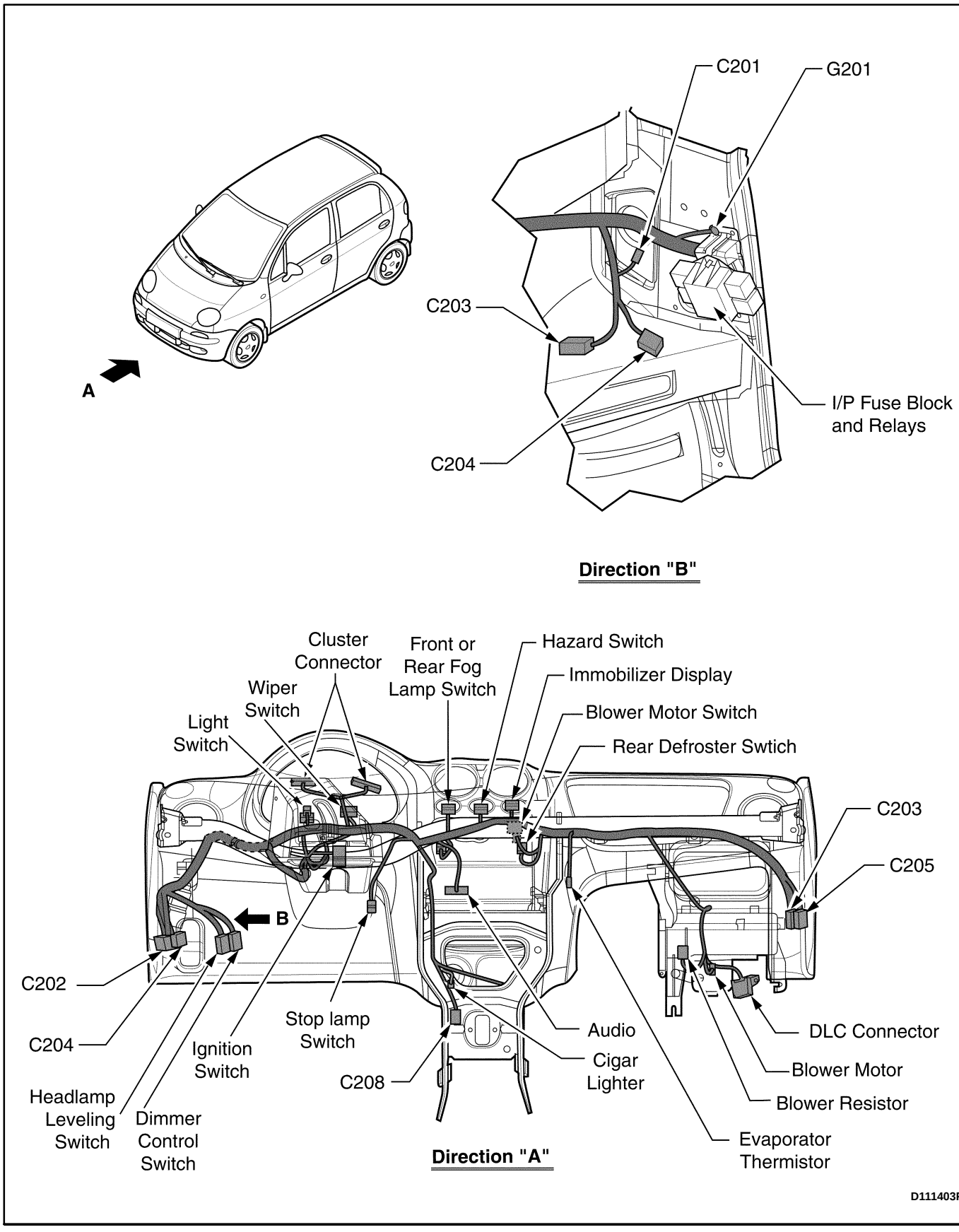
INSTRUMENT HARNESS ROUTING

(Left–Hand Drive)



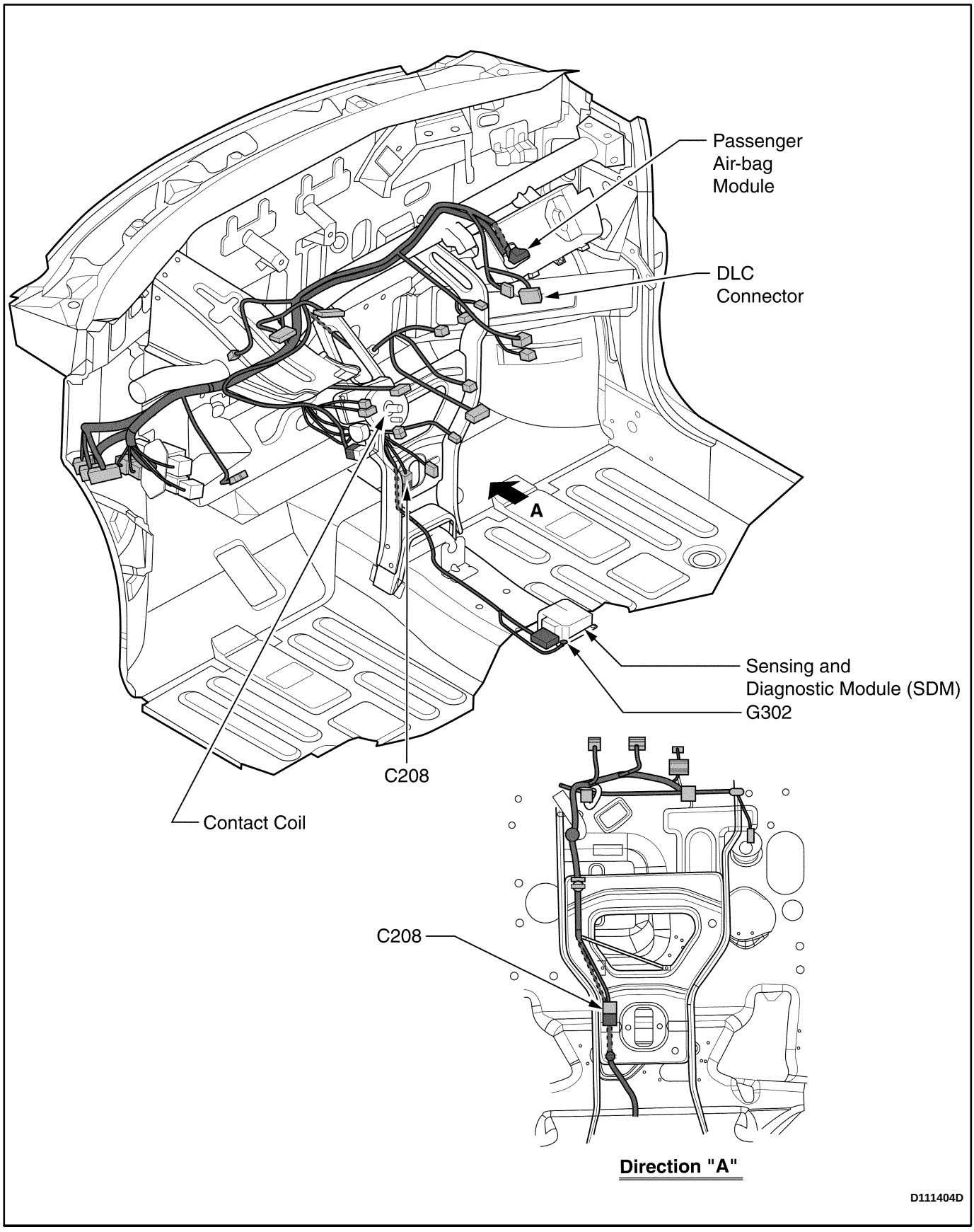
INSTRUMENT HARNESS ROUTING

(Right–Hand Drive)

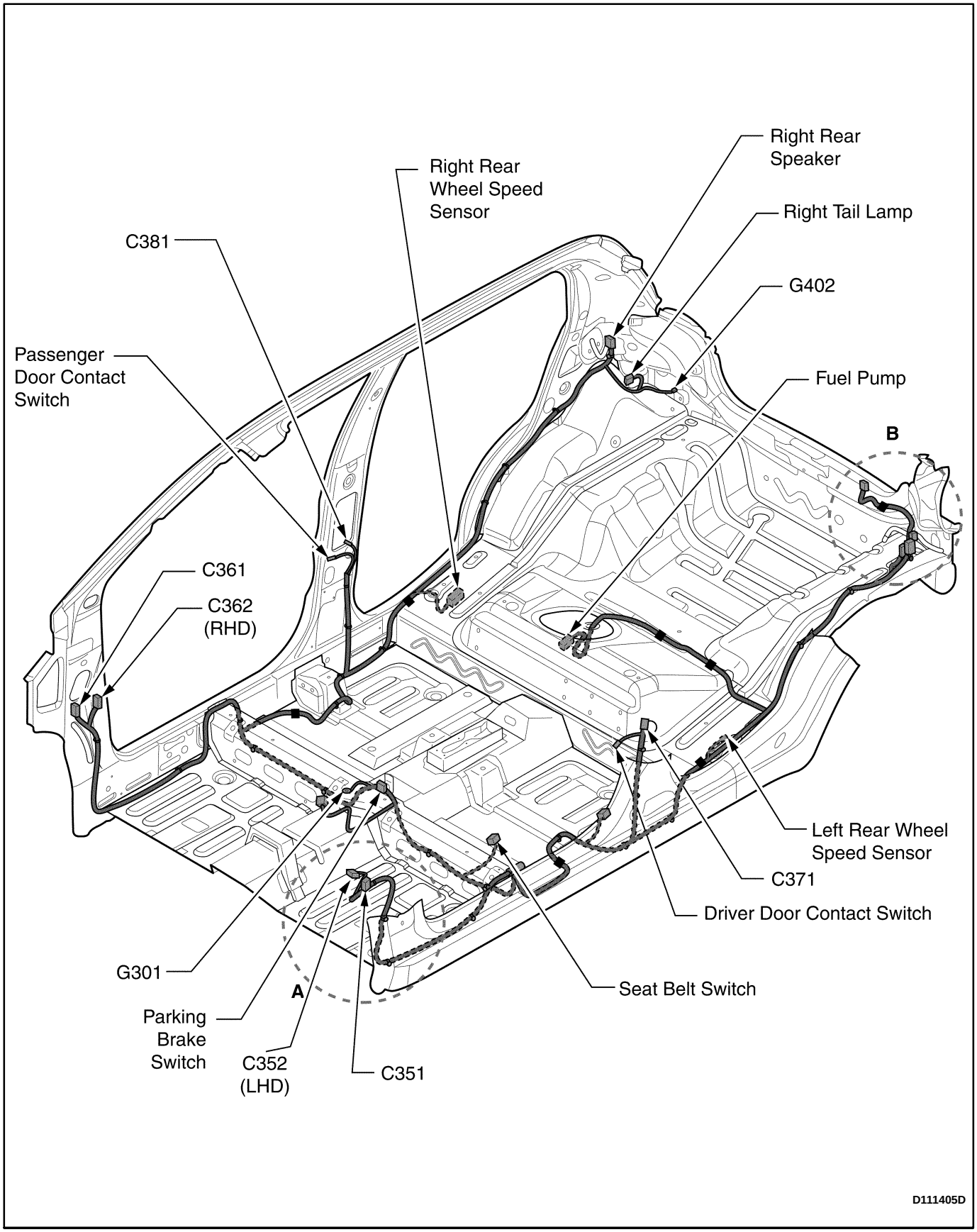


AIRBAG HARNESS ROUTING

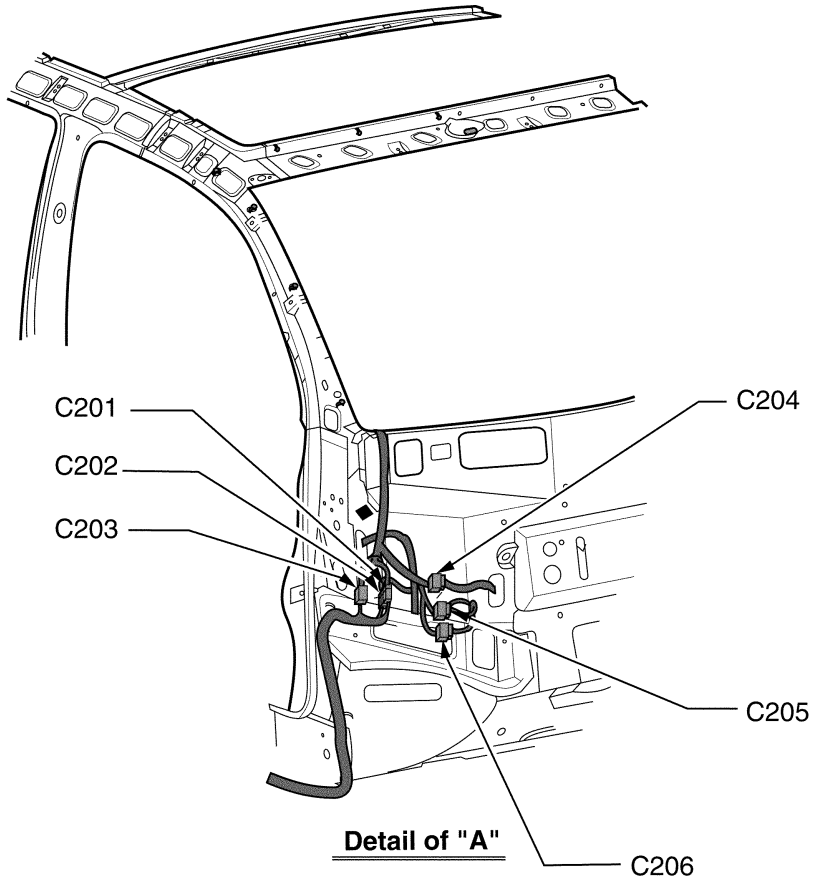
(Left–Hand Drive Shown, Right–Hand Drive Similar)



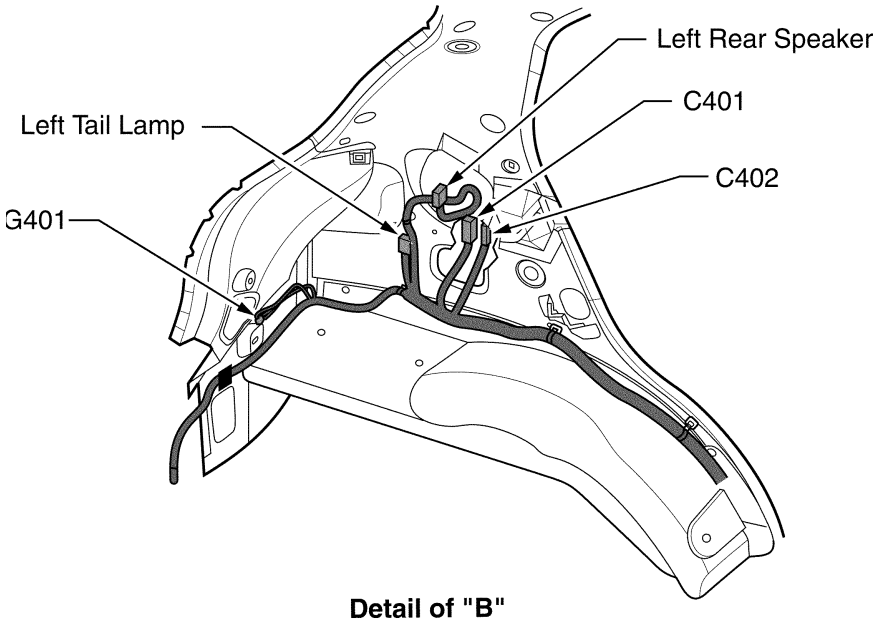
BODY HARNESS ROUTING



BODY HARNESS ROUTING (Cont'd)



Detail of "A"



Detail of "B"

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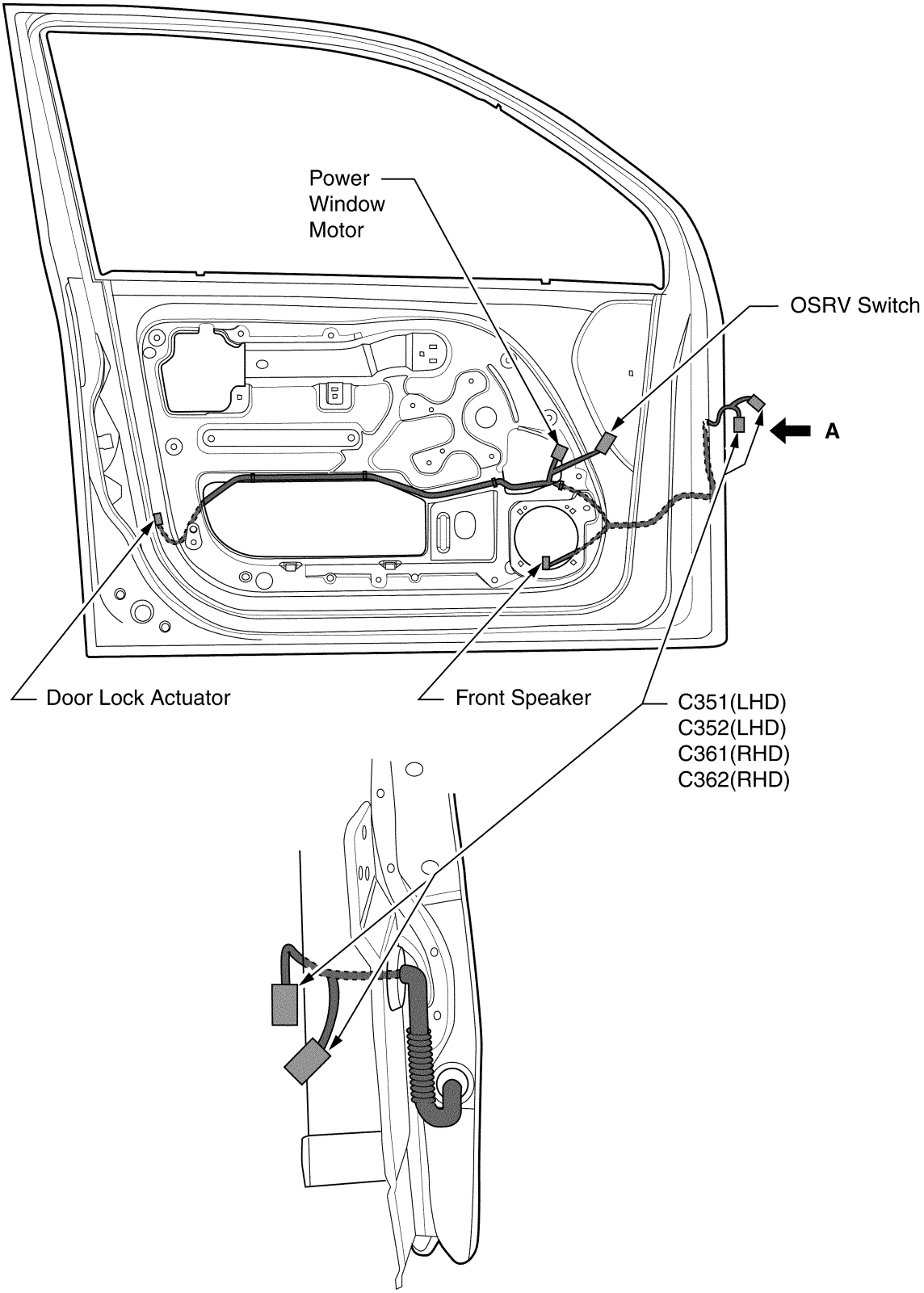
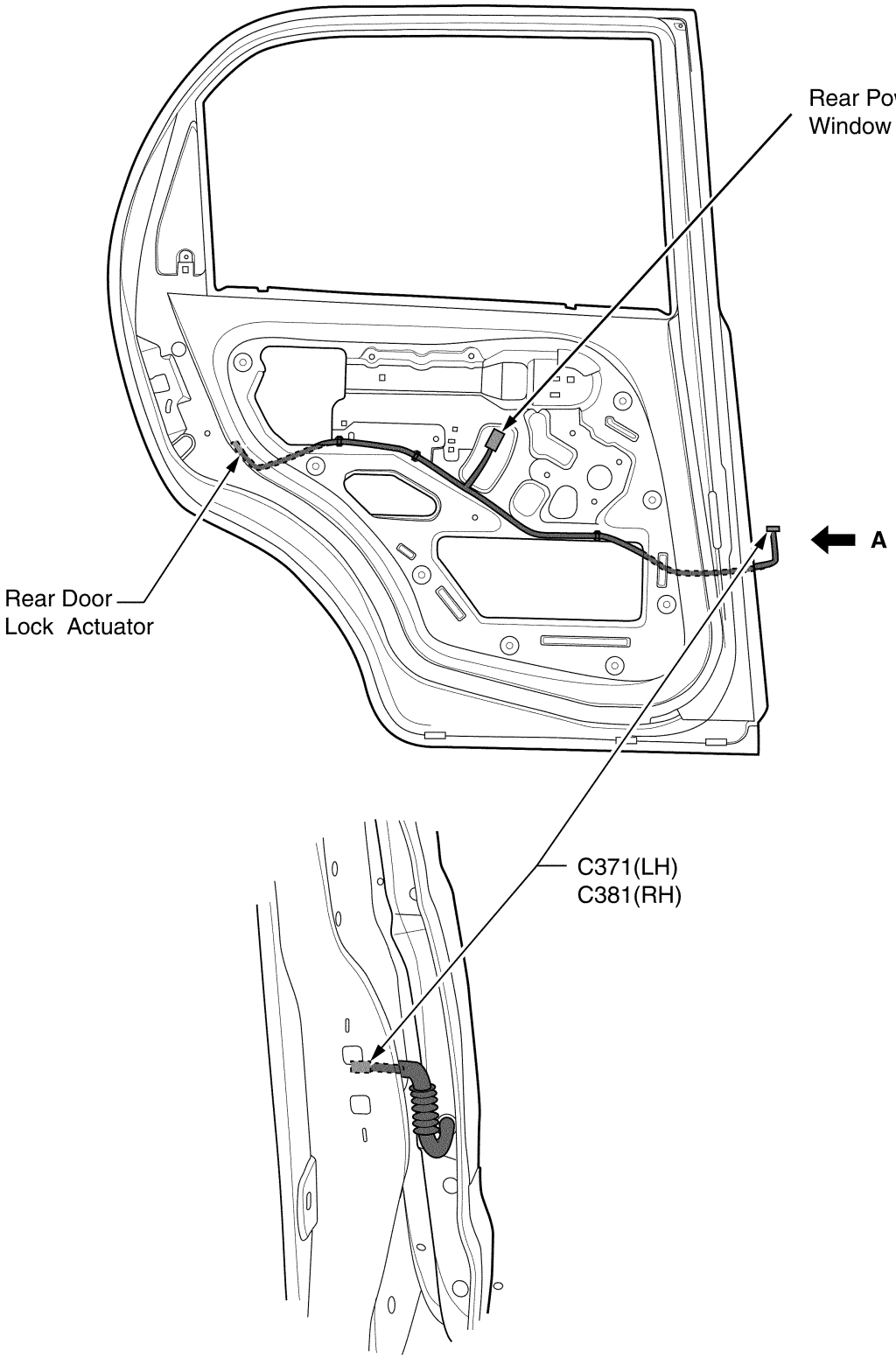
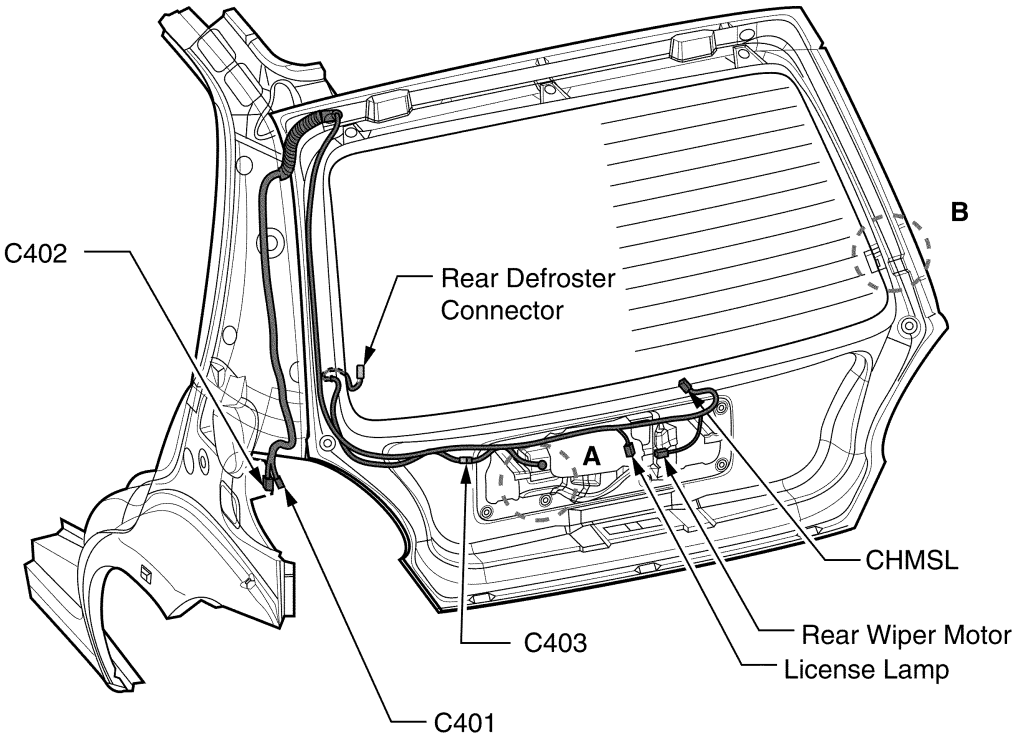
FRONT DOOR HARNESS ROUTING

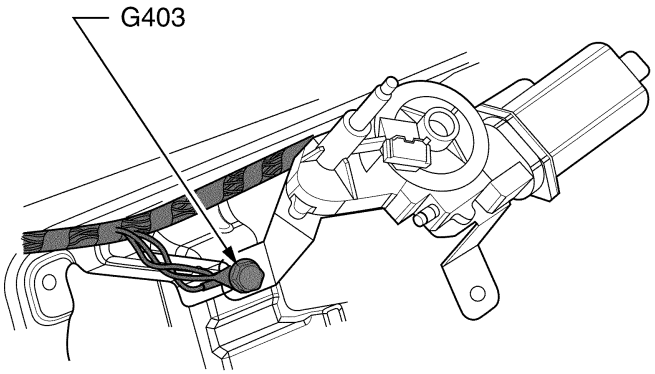


REAR DOOR HARNESS ROUTING

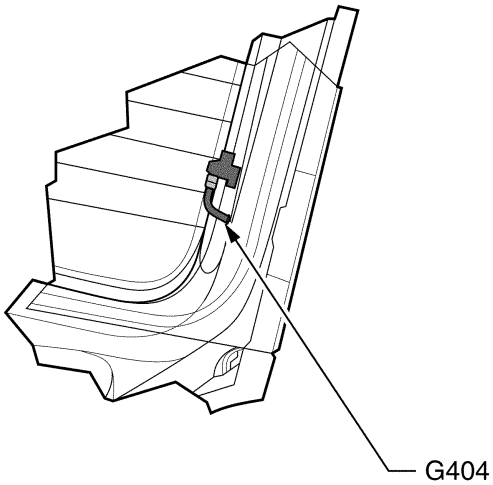


TAILGATE HARNESS ROUTING





Detail of "A"



Detail of "B"

D111409D

SECTION 9B

LIGHTING SYSTEMS

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.

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DESCRIPTION AND OPERATION

HEADLAMPS AND PARKING LAMPS

The headlamps are controlled by the multifunction lever located on the left side of the steering column. They will come on with the ignition switch in any position. Turning the headlamp switch to the first position turns on the parking lamps, the license plate lamps and the instrument panel illumination. Turning the switch to the second position turns on all of the previous lamps and the headlamps. Turning the switch to the off position turns off all the lamps.

The parking lamps can be turned on by turning the lighting switch to the first position. The parking lamps can be turned off by turning the switch to the OFF position.

Headlamp high beam and low beam are also controlled by this lever. When the headlamps are on, pushing the lever away from the driver until the switch clicks changes the lamp from low beam to high beam. An indicator lamp on the instrument cluster assembly will come on when the high beam headlamps are on. To return the headlamps to low beam, pull the lever toward the driver.

The headlamps must be aimed for proper illumination of the road. Headlamp aim should be checked whenever a new headlamp assembly is installed or service repairs to the front end area may have disturbed the headlamp assembly or its mountings.

FRONT TURN SIGNAL LAMPS

When the turn signals are activated, the side turn signal lamps flash to signal a turn. The turn signal works only when the ignition switch is on.

The turn signals are controlled by the light switch on the left side of the steering column. Moving the lever all the way up or down (past the detent) will turn on the turn signals. When the turn is completed, the lever will return to horizontal and the turn signals will stop flashing.

For changing lanes or shallow turns where the steering wheel does not turn far enough to cancel the signal, move the signal only to the first detent and hold it there. When the lever is released, it will return to horizontal and the turn signal will cancel.

REAR FOG LAMP

The rear fog lamp is incorporated in the drive side taillamp assembly and are controlled by the rear fog lamp switch on the instrument panel. The rear fog lamp can be turned on only when headlamps are on.

TAILLAMPS

The taillamps, stoplamps, backup lamp(s), rear fog lamp (if equipped with) and turn signal lamps are one assembly.

Turning on either the headlamps or the parking lamps will also turn on the taillamps. When the brake pedal is pushed, the taillamps will glow brighter to serve as stoplamps.

The center high-mounted stoplamp is located in the rear window and will come on when the brake pedal is pressed.

LICENSE PLATE LAMPS

The license plate lamps will come on when the headlamps or the parking lamps are on. The license plate lamps are mounted on the rear bumper, above the license plate.

INTERIOR COURTESY LAMP

The courtesy lamp is located on the headliner just before the front seats. The lamp switch has three positions. If the switch is in the center position, the lamp will go on whenever a door is opened and go off when it is closed. In the ON position, the lamp will stay on until it is turned off. In the OFF position, the lamp will not come on, even when a door is opened.

BACKUP LAMP(S)

The backup lamps are located in the rear combination lamps. They will come on when the transaxle is shifted into REVERSE. On a vehicle with a manual transaxle, they are activated by a reverse switch which is part of the transaxle.

DAYTIME RUNNING LAMPS (DRL) (W/Europe Only)

The daytime running lamps (DRL) work in conjunction with the exterior lamps system. When the ignition switch is turned to the ”II” position with the light switch off, parking, tail, license plate and instrument panel lights illuminate. And, when the engine is started, the headlamps (low beam) also come on.

They remain on until the ignition switch is turned off or the light switch is turned on. They revert to normal operation when the light switch is on.

The daytime running lamps (DRL) is optional.

DIAGNOSTIC INFORMATION AND PROCEDURES

HEADLAMPS

Condition	Probable Cause	Correction
Low Beam Headlamps Are Inoperative, High Beam Headlamps Are OK.	• Faulty headlamp combination switch.	• Replace the headlamp combination switch.
	• The open circuit or a short circuit between the fuse Ef10/Ef11 and the terminal 5 of the headlamp combination switch.	• Repair or Replace the wiring harness.
	• Fuse Ef10 or Ef11 is blown.	• Replace the fuse Ef10 or Ef11
	• The open circuit or a short circuit between the fuse Ef10 or Ef11 and the terminal 2 of the headlamp connector.	• Repair or Replace the wiring harness.
	• Headlamp bulb is blown.	• Replace the headlamp bulb.
	• The open grounds (G101, G102) circuit.	• Repair or replace the open ground circuit.
High Beam Headlamps Are Inoperative, Low Beam Headlamps Are OK.	• Faulty headlamp combination switch.	• Replace the headlamp combination switch.
	• The open circuit or a short circuit between the fuse Ef8/Ef9 and the terminal 4 of the headlamp combination switch.	• Repair or Replace the wiring harness.
	• Fuse Ef8 or Ef9 is blown.	• Replace the fuse Ef10 or Ef11.
	• The open circuit or a short circuit between the fuse Ef8 or Ef9 and the terminal 1 of the headlamp connector.	• Repair or Replace the wiring harness.
	• Headlamp bulb is blown.	• Replace the headlamp bulb.
	• The open grounds (G101, G102) circuit.	• Repair or Replace the open ground circuit.
High Beam and Low Beam Headlamps Are Inoperative On Both Left and Right Sides.	• The open circuit or a short circuit in the power supply circuit to the fuse Ef18.	• Repair or Replace the wiring harness.
	• Fuse Ef18 is blown.	• Replace the fuse Ef18 (20A).
	• The open circuit or a short circuit between the fuse Ef18 and the terminal 86, 30 of the headlamp relay.	• Repair or Replace the wiring harness.
	• Faulty headlamp relay.	• Replace the headlamp relay.
	• The open circuit or a short circuit between the terminal 87 of the headlamp relay and the terminal 6 of the headlamp combination switch.	• Repair or Replace the wiring harness.
	• Faulty headlamp combination switch.	• Replace the headlamp combination switch.
	• The open ground (G201) circuit.	• Repair or Replace the open ground circuit.

TURN SIGNAL LAMPS AND HAZARD LAMPS

Condition	Probable Cause	Correction
Turn Signal Lamps and Hazard Lamps Do Not Work.	● The open circuit or a short circuit between the power supply circuit and the fuse Ef2.	● Repair or Replace the wiring harness.
	● Fuse Ef2 is blown.	● Replace the fuse Ef2.
	● The open circuit or a short circuit between the fuse Ef2 and the fuse F12.	● Repair of Replace the wiring harness.
	● Fuse F12 is blown.	● Replace the fuse F12.
	● The open circuit or a short circuit between the fuse F12 and the terminal 8 of the hazard lamp switch connector.	● Repair or Replace the wiring harness.
	● Faulty hazard lamp switch.	● Replace the hazard lamp switch.
	● The open circuit or a short circuit between the terminal 7 of the hazard lamp switch connector and the terminal 49 of the turn signal lamp relay.	● Repair or Replace the wiring harness.
	● The open circuit or a short circuit between the terminal 49a of the turn signal lamp relay and the terminal 9 of the hazard lamp switch connector.	● Repair or Replace the wiring harness.
	● Faulty turn signal lamp relay.	● Replace the turn signal lamp relay.
	● The open circuit or a short circuit between the terminal 49a of the turn signal lamp relay and the terminal 2 of the turn signal lamp switch connector.	
	● Faulty turn signal lamp switch.	● Replace the turn signal lamp switch.
	● The open circuit or a short circuit between the terminal 1,3 of the turn signal switch connector and the terminal 2,5 of each turn signal lamp connectors.	● Repair or Replace the wiring harness.
	● Turn signal lamp bulb is blown.	● Replace the turn signal lamp bulb.
	● The open grounds (G101, G102, G401, G402) circuits.	● Repair or Replace the open ground circuit.
Hazard Lamps Do Not Operate, Turn Signals Are OK.	● The open circuit or a short circuit between the terminal 49a of the turn signal lamp relay and the terminal 9 of the hazard lamp switch connector.	● Repair or Replace the open circuit.
	● The open circuit or a short circuit between the terminals 5,6 of the hazard lamp switch connector and the terminals 2,5 of the turn signal lamp connectors.	● Repair or Replace the wiring harness.

STOPLAMPS AND INTERIOR COURTESY LAMP

Condition	Probable Cause	Correction
Stoplamps Do Not Work.	● Fuse F5 is blown.	● Replace the fuse F5.
	● The open circuit or a short circuit between the fuse F11 and the terminal 2 of the stoplamps switch connector (For vehicle equipped with M/T).	● Repair or Replace the wiring harness.
	● Faulty stoplamp switch.	● Replace the stoplamp switch.
	● The open circuit or a short circuit between the terminal 1 of the stoplamp switch connector and the terminal 3 of the stoplamps connector (For vehicle equipped with M/T).	● Repair or Replace the wiring harness.
	● Stoplamp bulb is blown.	● Replace the stoplamp bulb.
	● The open ground (G401, G402) circuits.	● Repair or Replace the open ground circuit.
Interior Courtesy Lamp Does Not Work.	● The open circuit or a short circuit in the power supply circuit to the fuse Ef2.	● Repair or Replace the wring harness.
	● Fuse Ef2 is blown.	● Replace the fuse Ef2.
	● The open circuit or a short circuit between the fuse Ef2 and the fuse F11.	● Repair or Replace the wiring harness.
	● Fuse F11 is blown.	● Replace the fuse F11.
	● The open circuit or a short circuit between the fuse F11 and the terminal 1 of the interior courtesy lamp connector.	● Repair or Replace the wiring connector.
	● Interior courtesy lamp bulb is blown.	● Replace the bulb.
	● Faulty interior courtesy lamp.	● Replace the interior courtesy lamp.

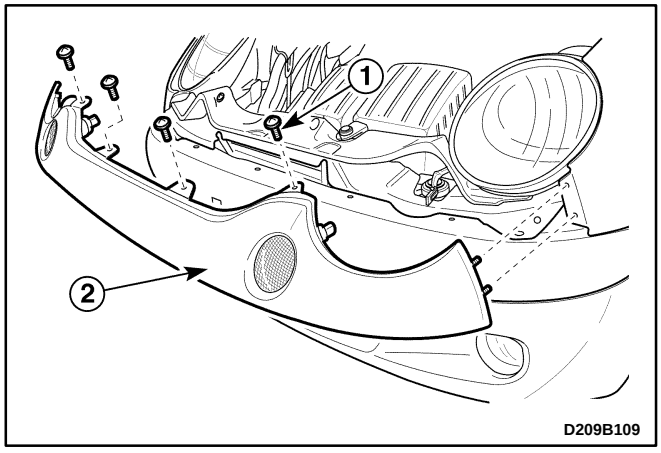
REAR FOG LAMP

Diagnostic Aids: The rear fog lamp will not operate unless the headlamps are ON. If the headlamps are not operating, repair that problem before attempting to diagnose the rear fog lamp.

Condition	Probable Cause	Correction
Rear Fog Lamp Does Not Work.	● The open circuit or a short circuit between the terminal 87 of the headlamp relay and terminal 15,30 of the rear fog lamp relay.	● Repair or Replace the wiring harness.
	● Faulty rear fog lamp relay.	● Replace the rear fog lamp relay.
	● The open circuit or a short circuit between the terminal 87 of the rear fog lamp relay and terminal 6 of the rear fog lamp connector.	● Repair or Replace the wiring harness.
	● The open circuit or a short circuit between the terminal E of the rear fog lamp relay and terminal 6 of the rear fog lamp switch.	● Repair or Replace the wiring harness.
	● Faulty rear fog lamp switch.	● Replace the rear fog lamp switch.
	● The open grounds (G201, G401) circuits.	● Repair or Replace the open ground circuit.
	● Rear fog lamp bulb is blown.	● Replace the rear fog lamp bulb.

REPAIR INSTRUCTIONS

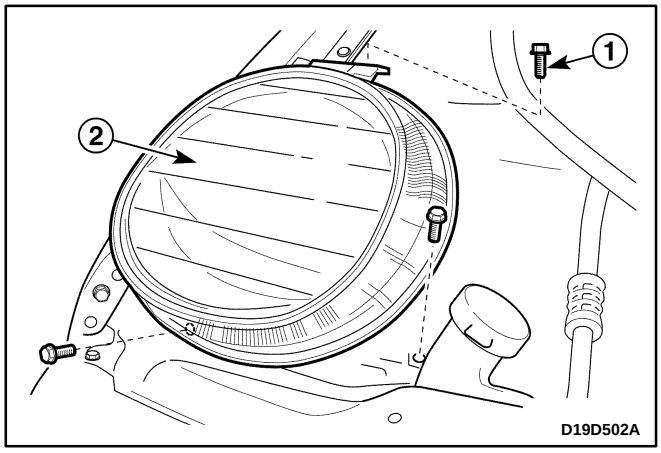
ON–VEHICLE SERVICE



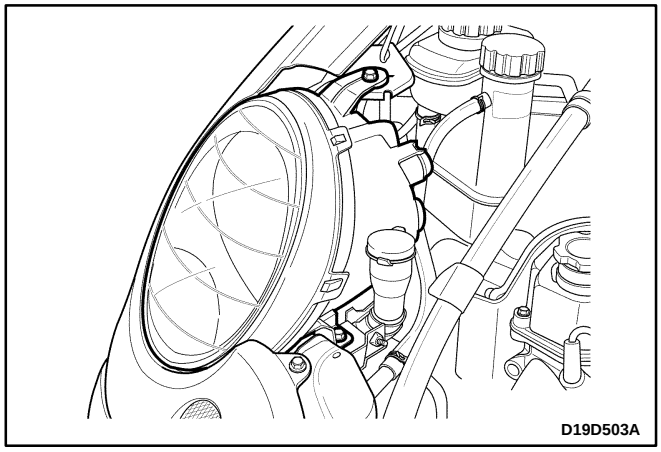
HEADLAMPS

Removal Procedure

1. Support the hood suitably.
2. Disconnect the negative battery cable.
3. Remove the front bumper spacer.
   - Remove the bolts (1).
   - Remove the front bumper spacer from the bumper fasia (2).

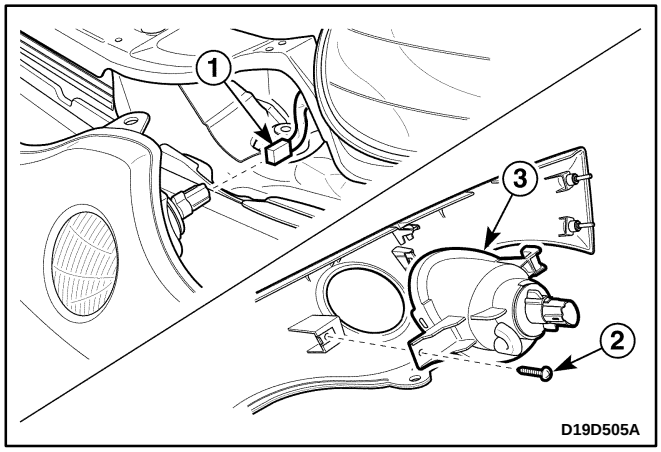


4. Remove the headlamp.
   - Remove the bolts and washer (1).
   - Disconnect the electrical connectors.
   - Remove the headlamp (2) .



Installation Procedure

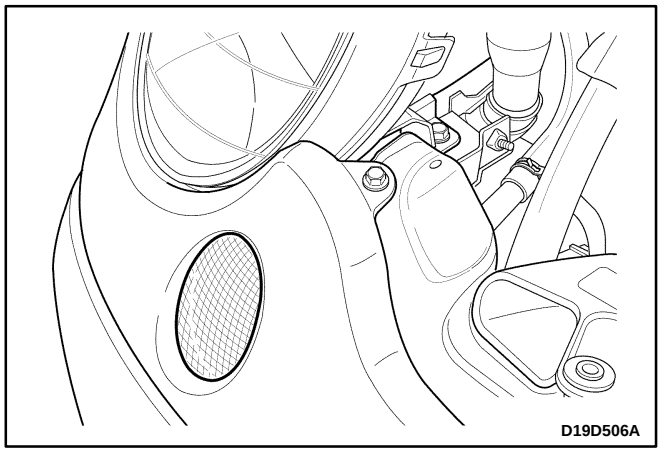
1. Install the headlamp with the bolts.
2. Connect the headlamp connector and parking lamp connector.
3. Install the front bumper spacer with the bolts.
4. Connect the negative battery cable.



TURN SIGNAL LAMPS

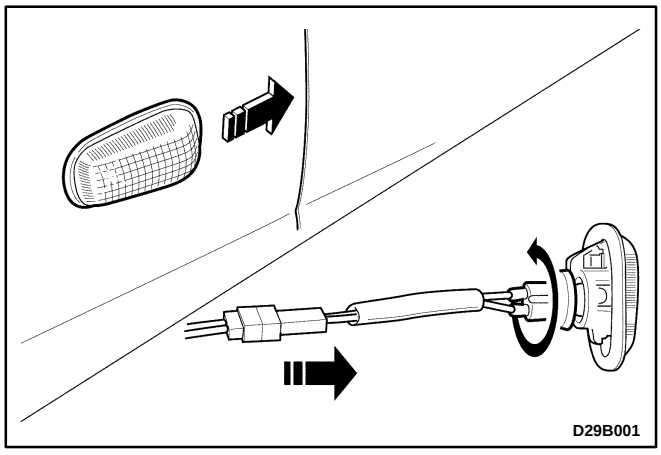
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the front bumper spacer. Refer to *Section 9M, Exterior Trim.*
3. Remove the turn signal lamps from the front bumper spacer.
   - Disconnect the electrical connector (1).
   - Remove the screw (2).
   - Remove the turn signal lamp assembly (3).



Installation Procedure

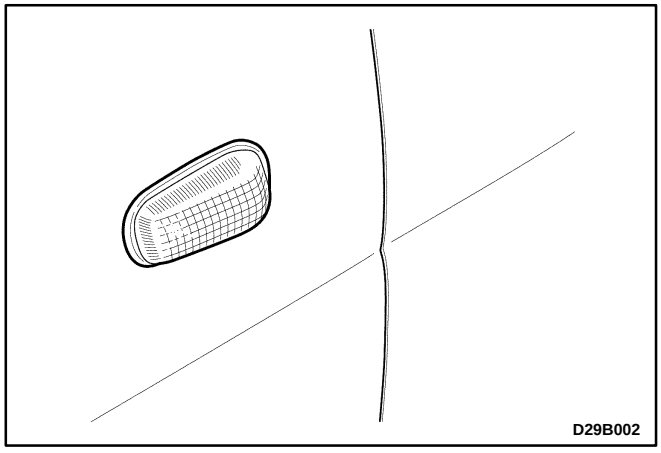
1. Connect the electrical connector.
2. Install the turn signal lamp assembly with the screw.
3. Install the front bumper spacer. Refer to *Section 9M, Exterior Trim.*
4. Connect the negative battery cable.



SIDE TURN SIGNAL LAMPS

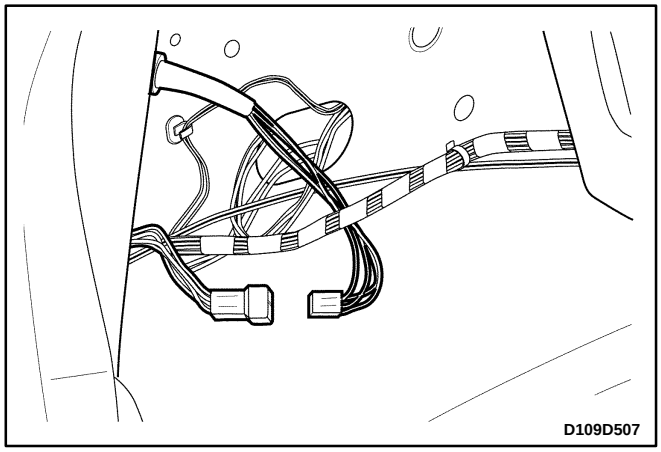
Removal Procedure

1. Disconnect the negative battery cable.
2. Slide the side turn signal lamp rearward.
3. Remove the lamp.
4. Disconnect the electrical connector.



Installation Procedure

1. Connect the electrical connector.
2. Install the side turn signal lamp.
3. Connect the negative battery cable.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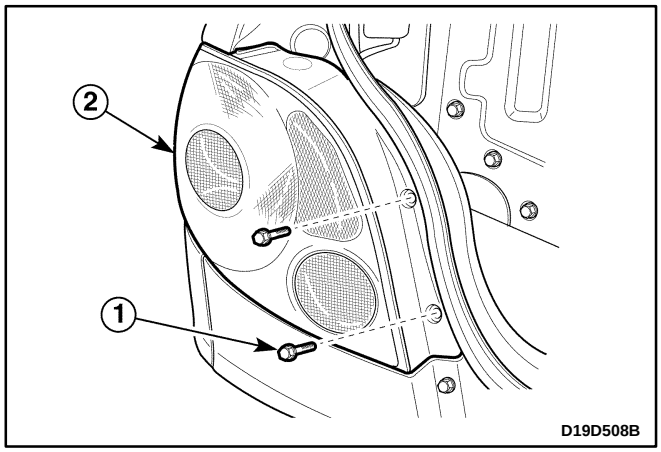
TAILLAMPS ASSEMBLY

Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Remove the luggage compartment wheelhouse trim. Refer to *Section 9G, Interior Trim.*
4. Disconnect the electrical connector.



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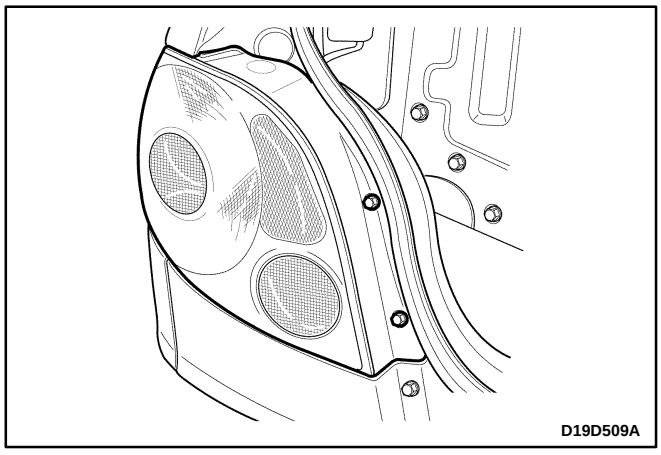
5. Remove the taillamp assembly.
   - Remove the screws (1).
   - Remove the taillamp (2).


D19D509A

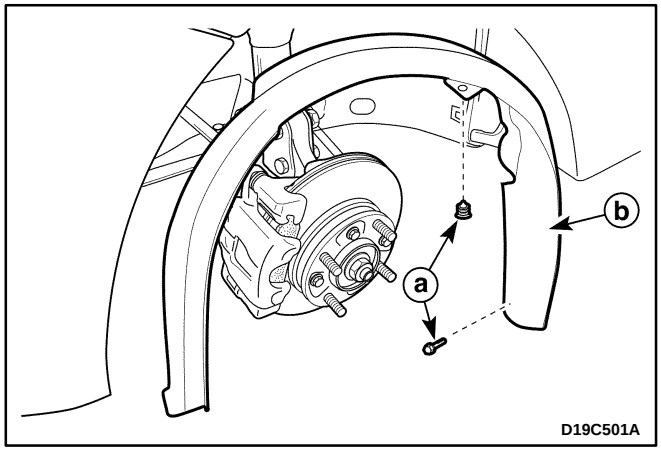
Installation Procedure

1. Install the taillamp assembly with the screws.
2. Connect the electrical connector.
3. Install the luggage compartment wheelhouse trim. Refer to *Section 9G, Interior Trim.*
4. Connect the negative battery cable.

FRONT FOG LAMP

Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the front wheels.
4. Remove the front wheel house splash shield.
   - Remove the clip and bolts.
     a. Bolt and clips.
   - Remove the wheel house splash shield.
     b. Splash shield.



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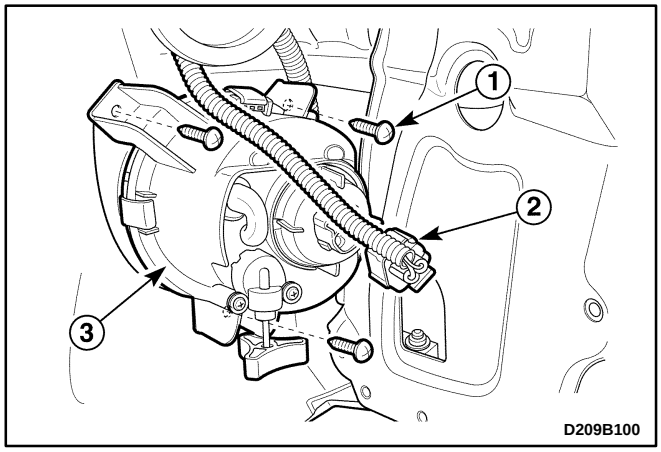
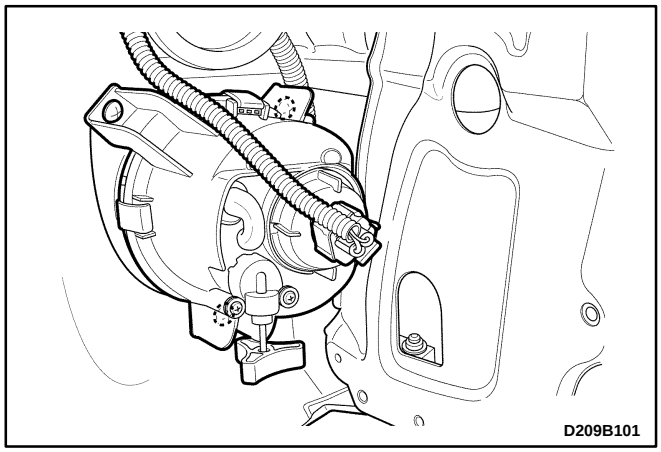
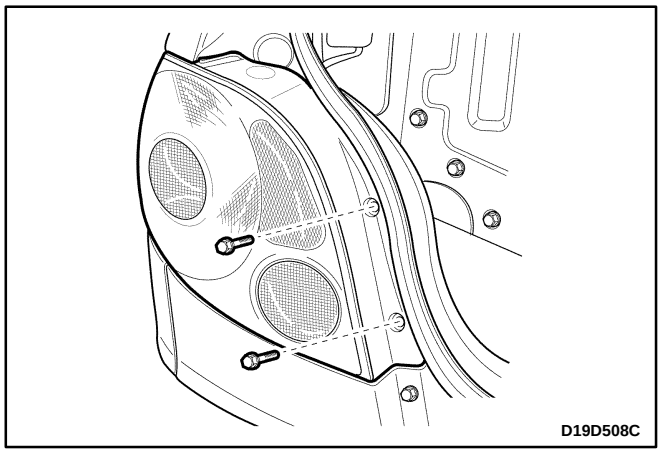


5. Remove the front fog lamp.
   - Remove the screws (1).
   - Disconnect the electrical connector (2).
   - Remove the front fog lamp (3).



Installation Procedure

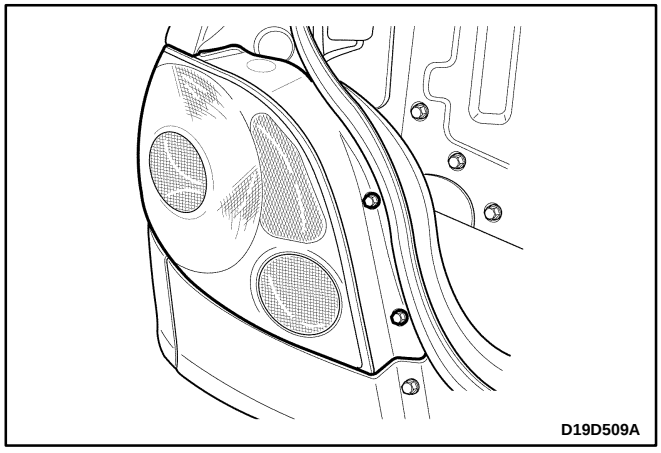
1. Install the front fog lamp with the screws.
2. Connect the front fog lamp connector.
3. Install the front wheelhouse splash shields with the clips and the bolts.
4. Install the front wheels.
5. Lower the vehicle.
6. Connect the negative battery cable.



REAR FOG/BACKUP LAMP(S)

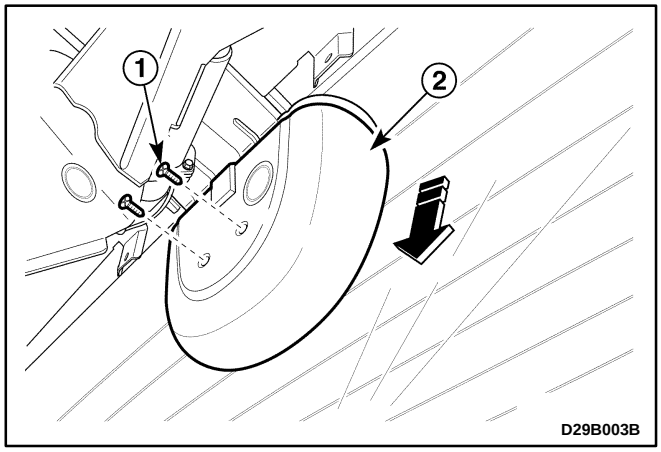
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the taillamp assembly. Refer to “Taillamps Assembly” in this section.
3. Remove the bulb(s).



Installation Procedure

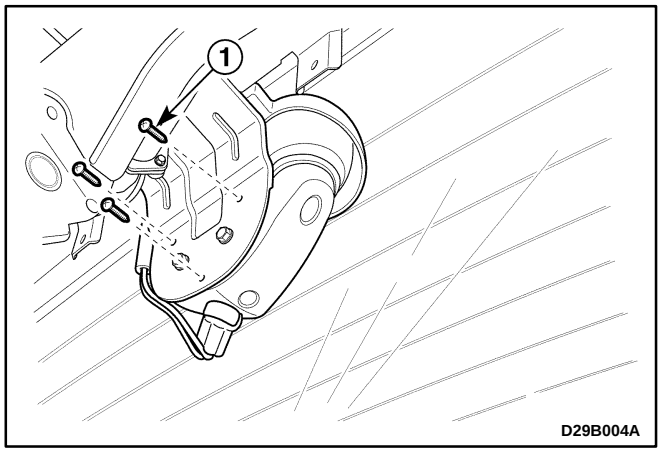
1. Install the bulb(s).
2. Install the taillamp assembly. Refer to “Taillamps Assembly” in this section.
3. Connect the negative battery cable.



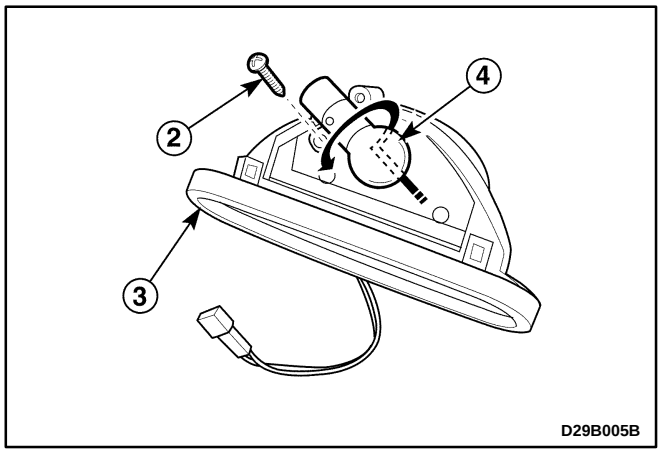
CENTER HIGH-MOUNTED STOPLAMP (CHMSL)

Removal Procedure

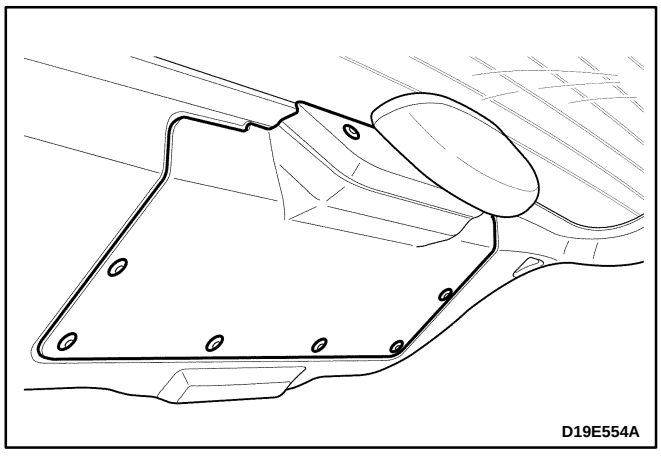
1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Pry off the tailgate trim panel. Refer to *Section 9G Interior Trim*.
4. Remove the CHMSL cover.
   - Remove the screws (1).
   - Remove the CHMSL cover (2).



5. Remove the CHMSL and bulb.
   - Remove the screws (1).

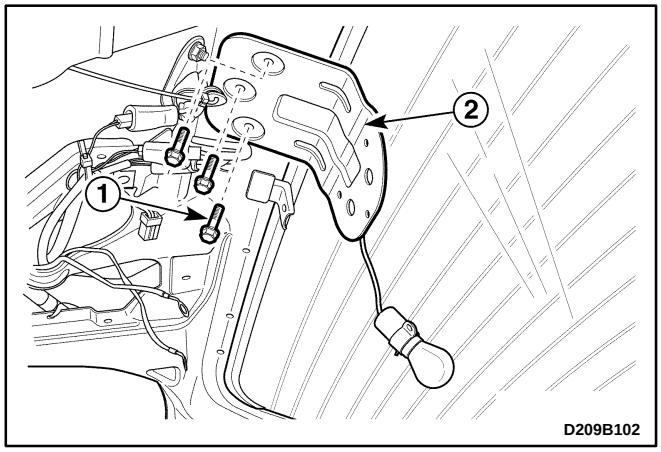


- Remove the screw from bulb socket (2).
- Remove the CHMSL (3).
- Remove the bulb (4).



Installation Procedure

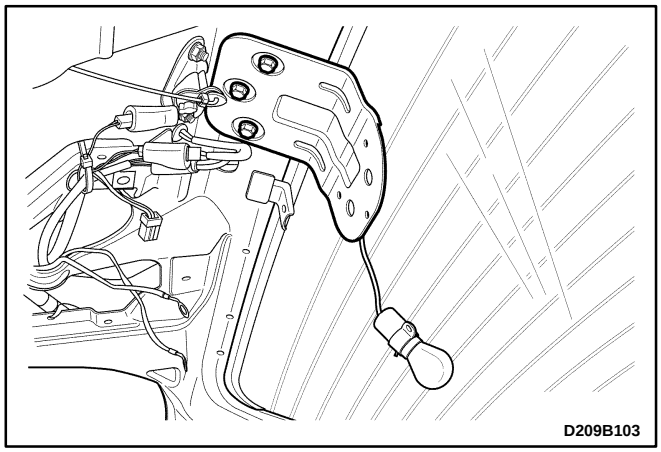
1. Install the CHMSL bulb.
2. Install the CHMSL with the screws.
3. Install the CHMSL cover with the screws.
4. Install the tailgate trim panel. Refer to *Section 9G, Interior Trim.*
5. Connect the negative battery cable.



CHMSL MOUNTING BRACKET

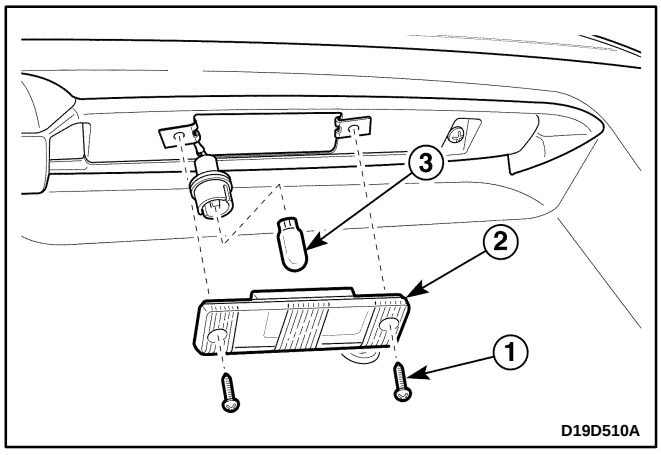
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the center high–mounted stoplamp (CHMSL). Refer to “Center High–Mounted Stoplamp” in this section.
3. Remove the rear window wiper motor assembly. Refer to *Section 9D, Wipers/Washer Systems.*
4. Remove the CHMSL mounting bracket.
   - Remove the bolts (1).
   - Remove the CHMSL mounting bracket (2).



Installation Procedure

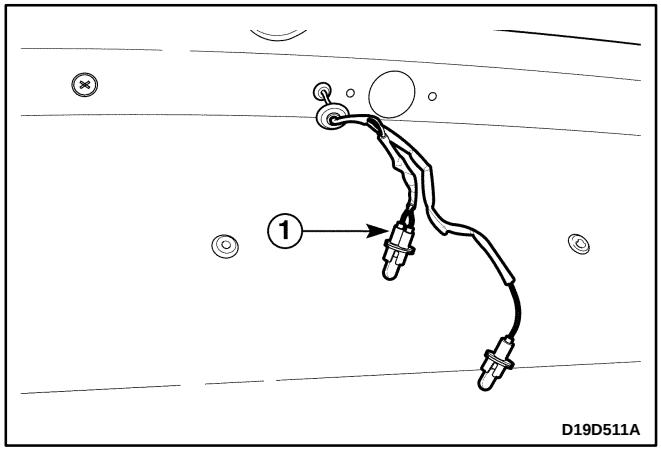
1. Install the CHMSL mounting bracket with the bolts.
2. Install the rear window wiper motor assembly. Refer to *Section 9D, Wipers/Washer Systems.*
3 .Install the CHMSL. Refer to “Center High–Mounted Stoplamp” in this section.
4. Connect the negative battery cable.



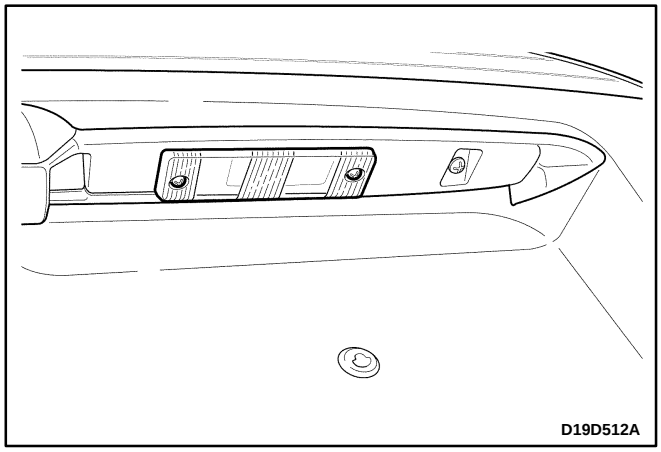
LICENSE PLATE LAMPS

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the license plate lamp from the tailgate handle.
   - Remove the screws (1).
   - Draw out the license plate lamp (2).
   - Remove the license plate lamp bulb (3).



3. Remove the rear window wiper motor assembly. Refer to *Section 9D, Wipers/Washer Systems.*
4. Disconnect the electrical connector in the tailgate.
5. Remove the tailgate handle. Refer to *Section 9M, Exterior Trim.*
6. Remove the license plate lamp socket.
   - Remove the socket (1).


D19D512A

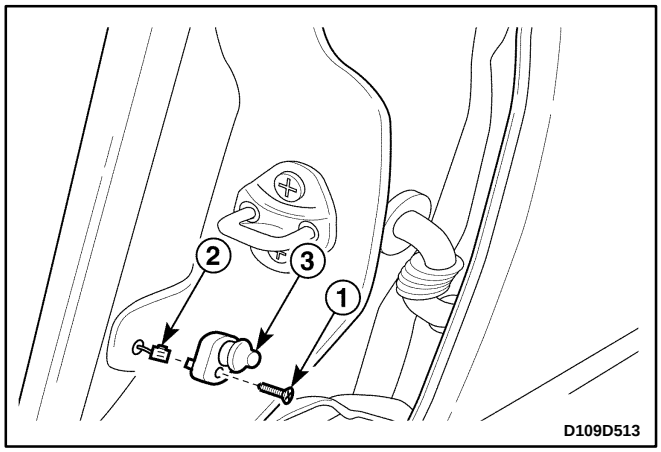
Installation Procedure

1. Install the license plate lamp socket.
2. Install the tailgate handle. Refer to *Section 9M, Exterior Trim.*
3. Connect the electrical connector.
4. Remove the rear window wiper motor assembly. Refer to *Section 9D, Wipers/Washer Systems.*
5. Install the license plate lamp bulb.
6. Install the license plate lamp with the screws.
7. Connect the negative battery cable.

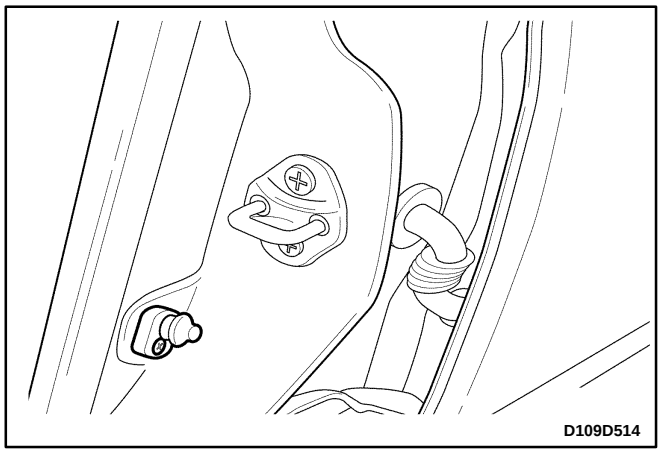
DOOR JAMB SWITCH

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the door jamb switch.
   - Remove the screw (1).
   - Disconnect the electrical connector (2).
   - Remove the door jamb switch (3).



D109D513


D109D514

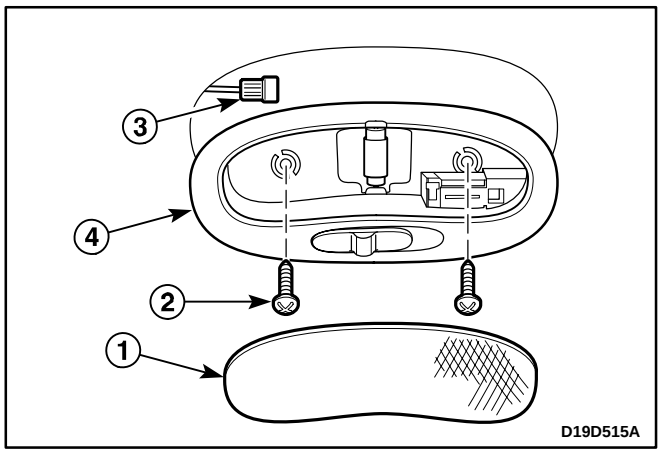
Installation Procedure

1. Install the door jamb switch with the screw.
2. Connect the electrical connector.
3. Connect the negative battery cable.

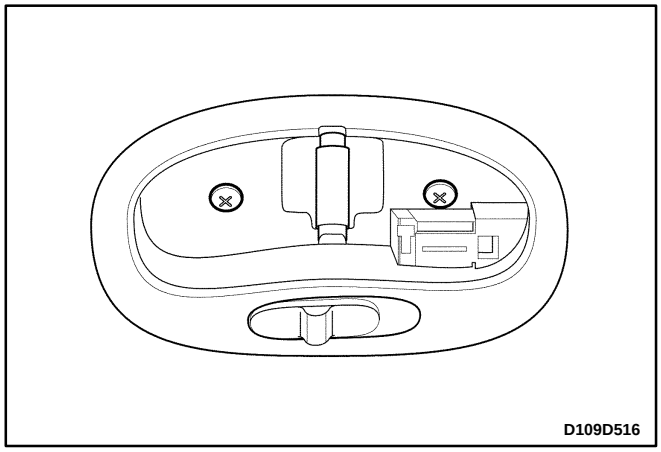
INTERIOR COURTESY LAMP

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the interior courtesy lamp.
   - Pry off the interior courtesy lamp lens (1).
   - Remove the screws (2).
   - Disconnect the electrical connector (3).
   - Remove the interior courtesy lamp (4).

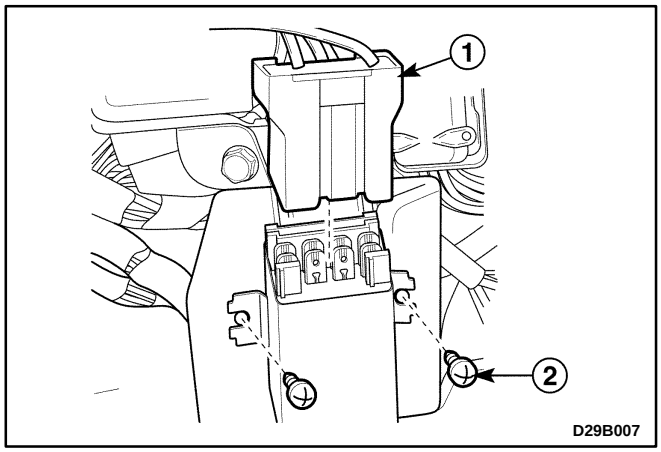


D19D515A


D109D516

Installation Procedure

1. Connect the electrical connector.
2. Install the interior courtesy lamp with the screws.
3. Install the interior courtesy lamp lens.
4. Connect the negative battery cable.

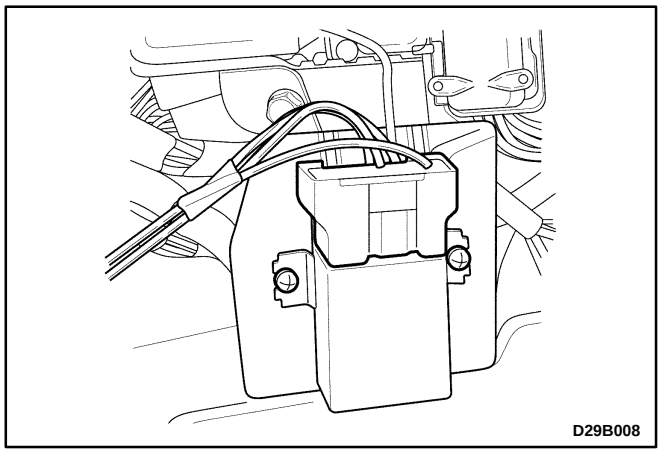


D29B007

DAYTIME RUNNING LAMP MODULE (W/Europe Only)

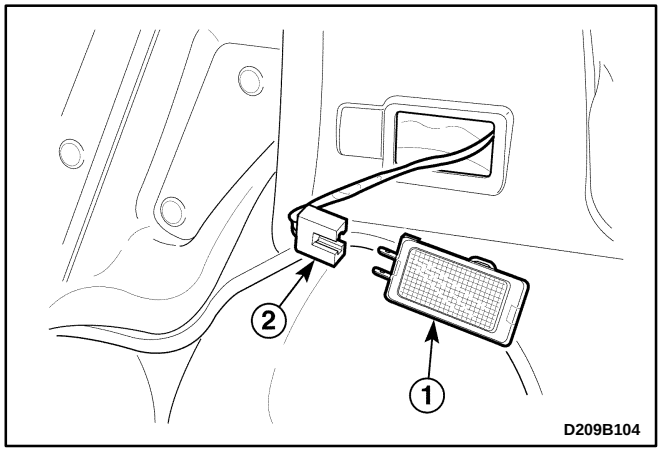
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector (1).
3. Remove the screws (2) and the daytime running lamp module.


D29B008

Installation Procedure

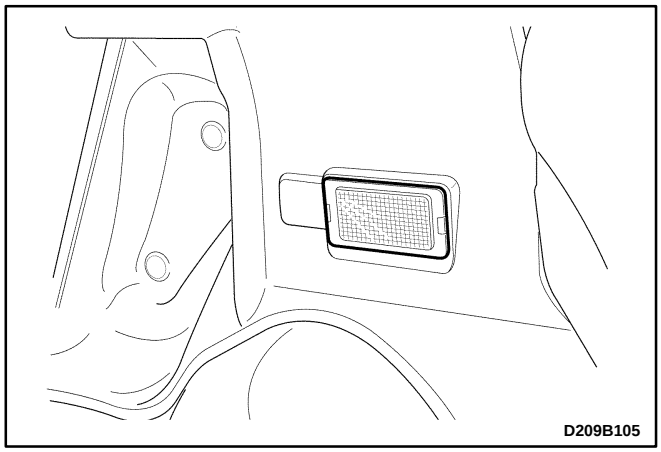
1. Install the daytime running lamp module with the bolts.
2. Connect the electrical connector.
3. Connect the negative battery cable.



LUGGAGE ROOM LAMP

Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Remove the luggage room lamp.
   - Remove the luggage room lamp (1).
   - Disconnect the electrical connector (2).



Installation Procedure

1. Connect the electrical connector.
2. Install the luggage room lamp.
3. Connect the negative battery cable.

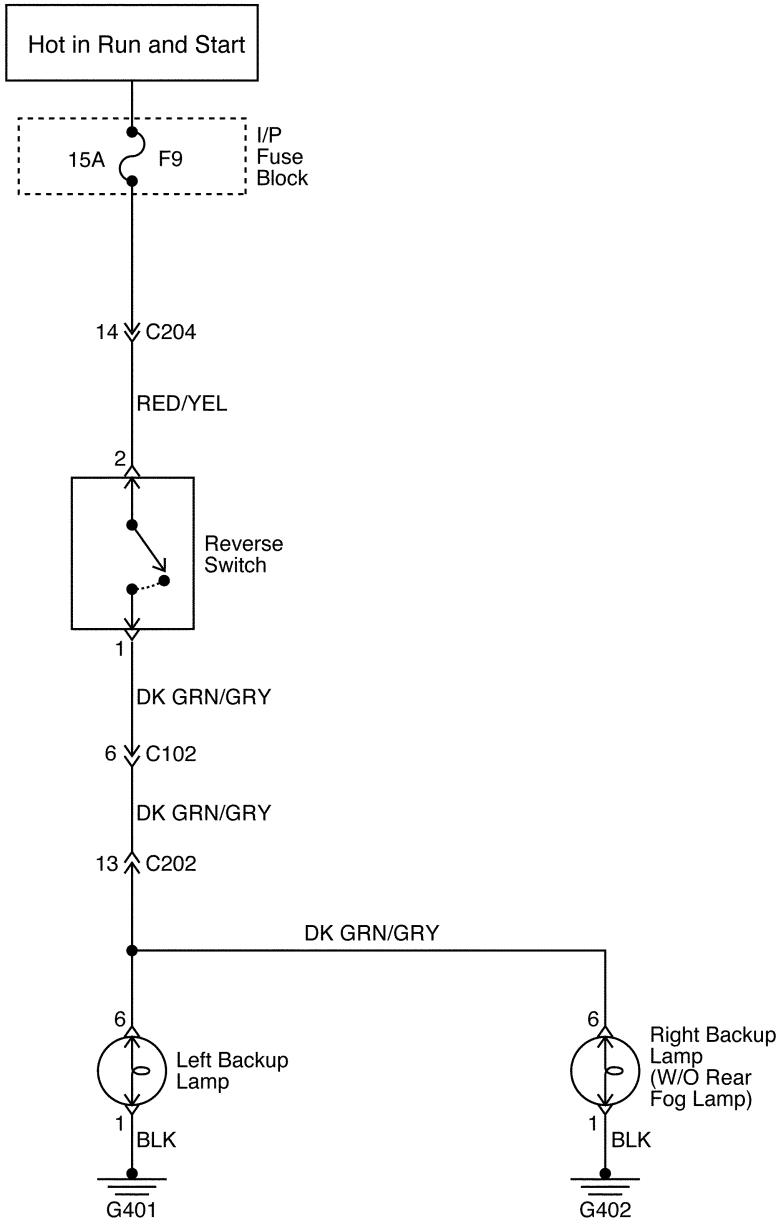
SPECIFICATIONS

BULB USAGE CHART

Bulb	Replacement Bulb Number
Backup Lamp(s)	21W
Center High Mounted Stoplamp	21W
Headlamps	Double 60/55W
Interior Courtesy Lamp	10W
License Plate Lamp	5W
Front Turn Signal Lamps	21W
Rear Fog Lamp	21W
Rear Turn Signal Lamps	21W
Side Marker Turn Signal Lamps	5W
Tail and Stoplamp	Double 5/21W, 5W
Parking Lamp	5W

SCHEMATIC AND ROUTING DIAGRAMS

BACKUP LAMP(S) CIRCUIT



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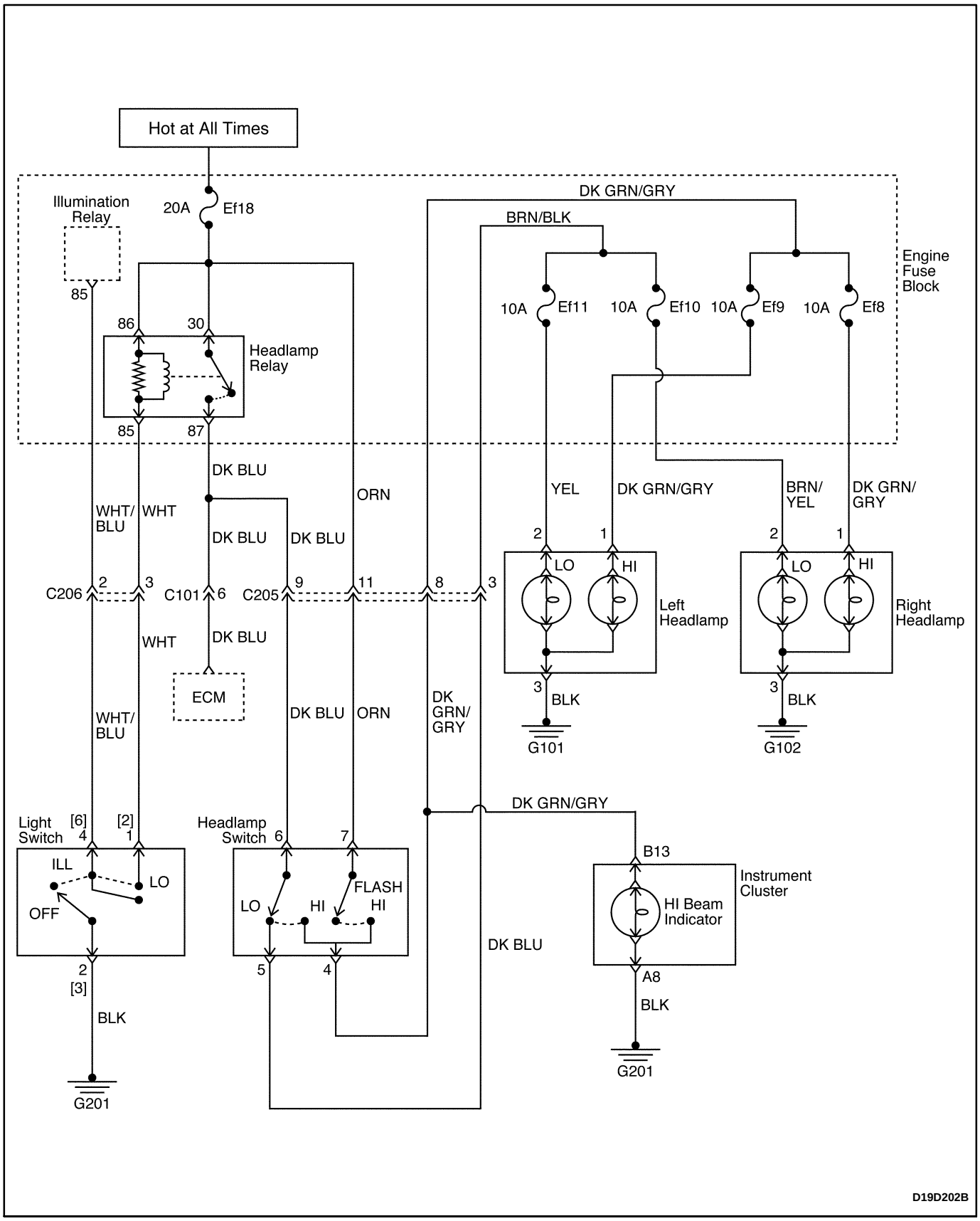
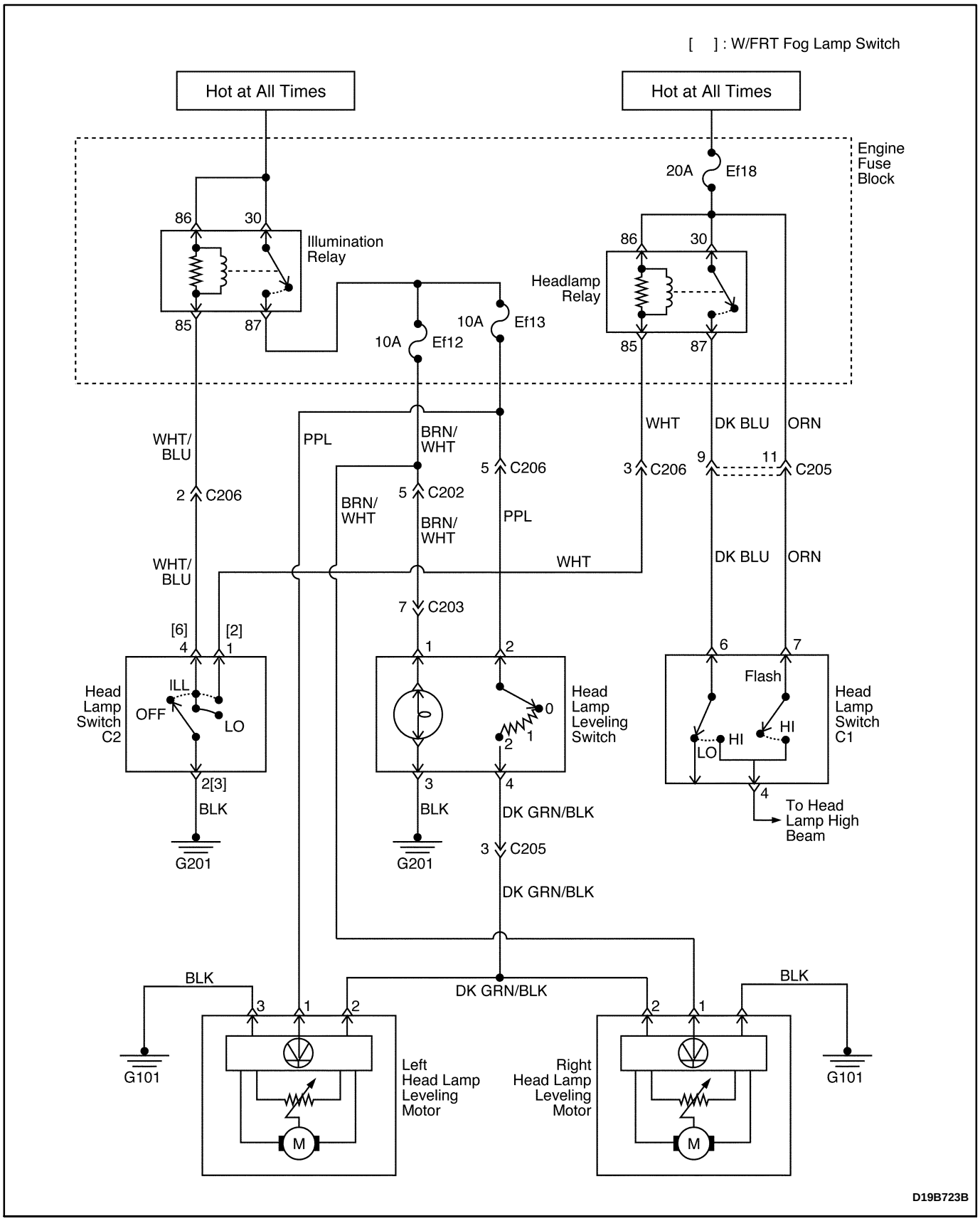
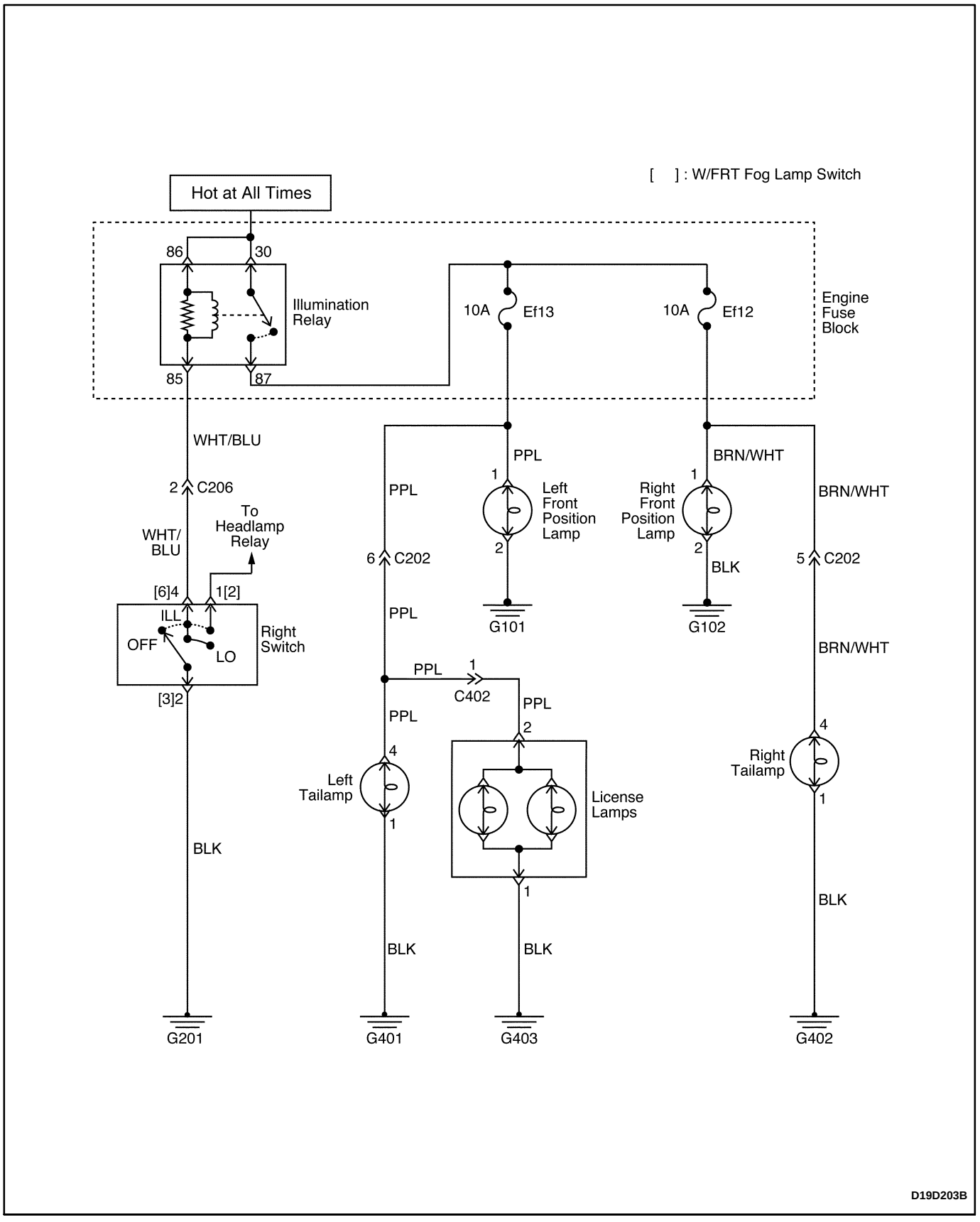
HEADLAMPS CIRCUIT



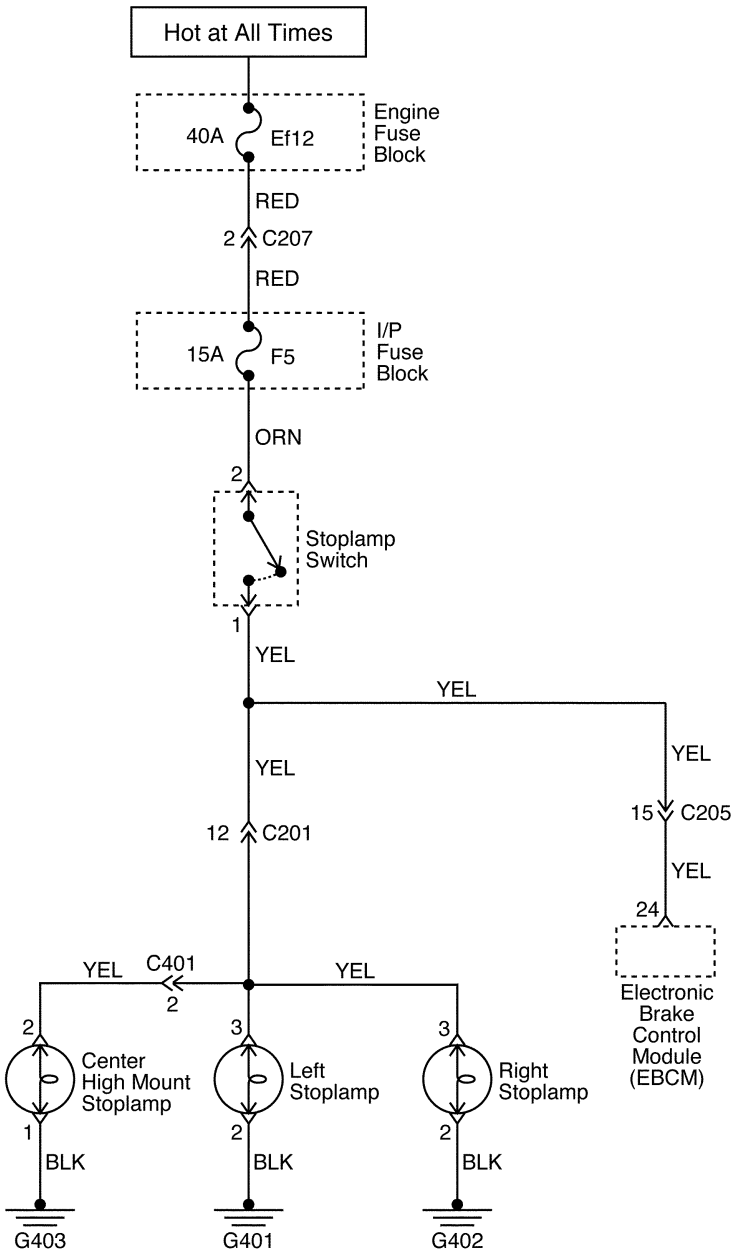
HEADLAMP LEVELING CIRCUIT



TAIL AND LICENSE PLATE LAMPS CIRCUIT

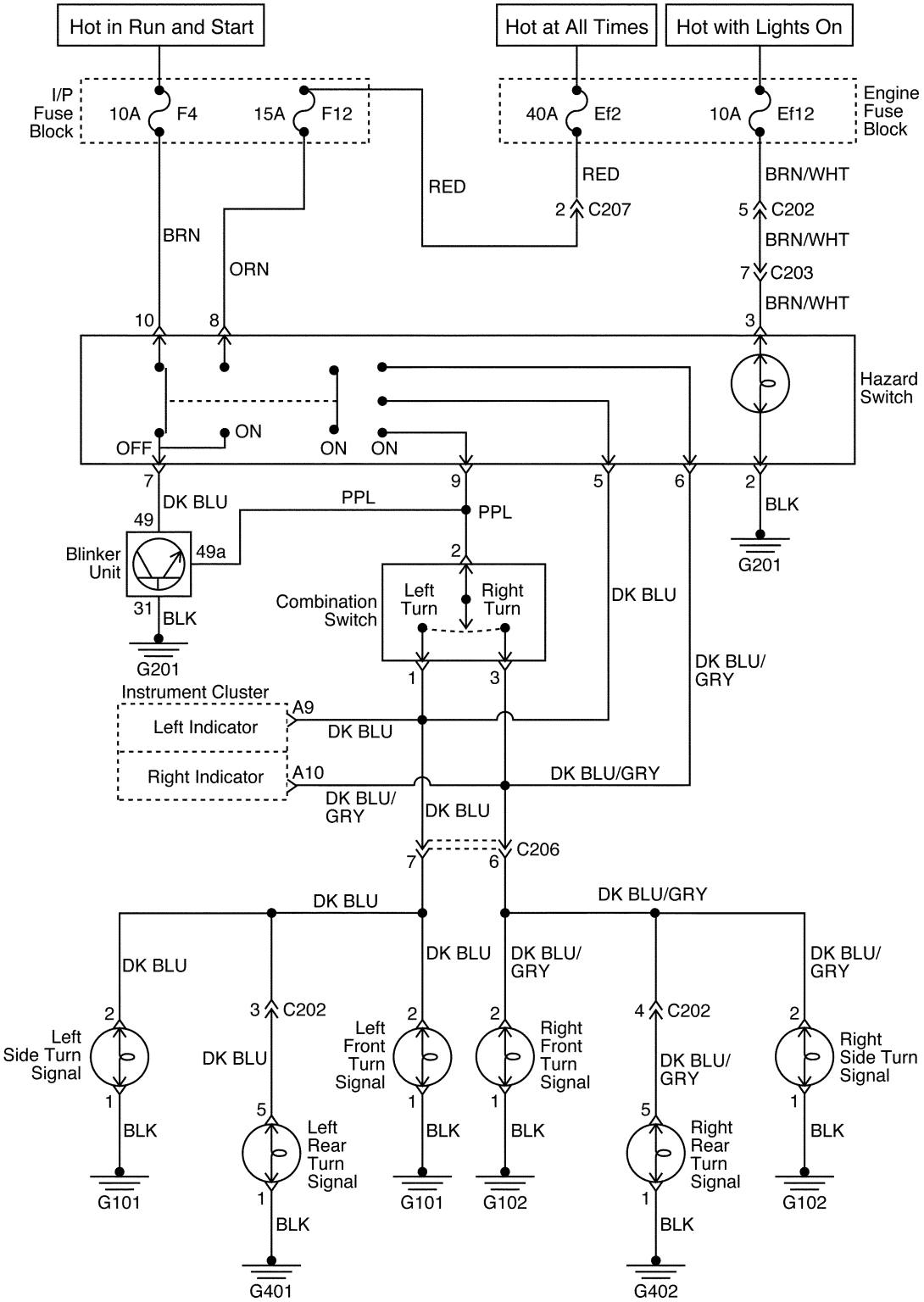


STOPLAMPS CIRCUIT

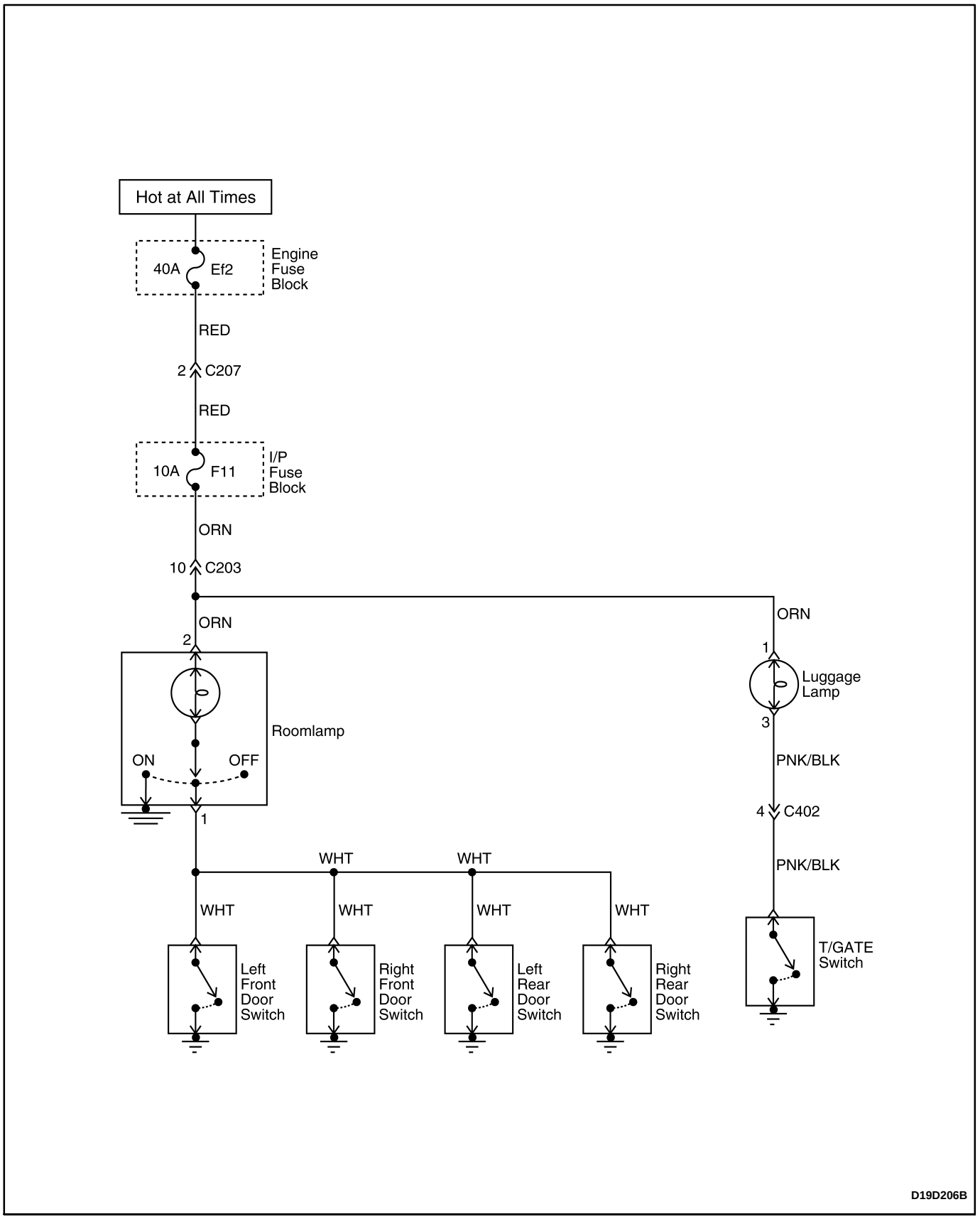


D19D204B

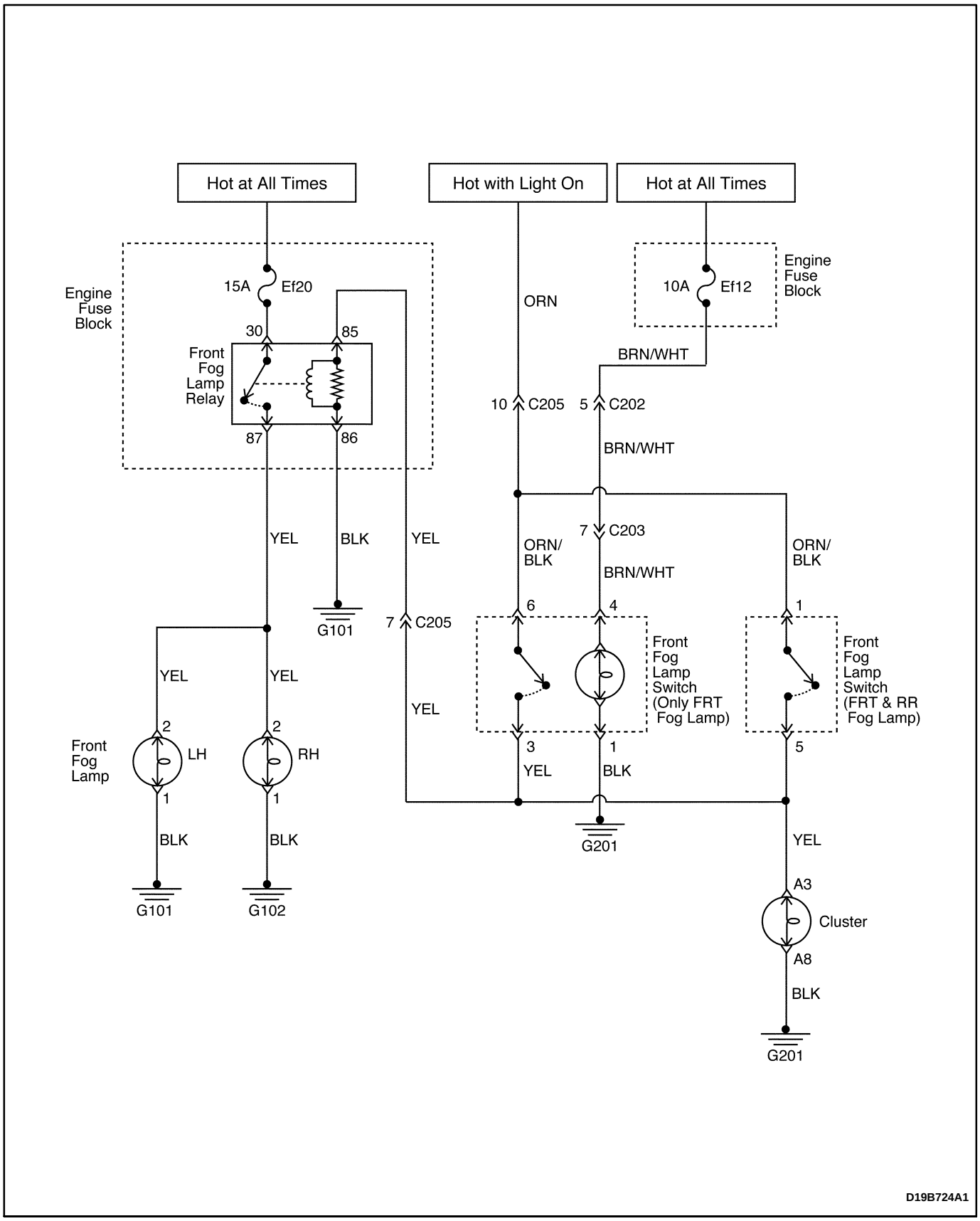
TURN AND HAZARD LAMPS CIRCUIT



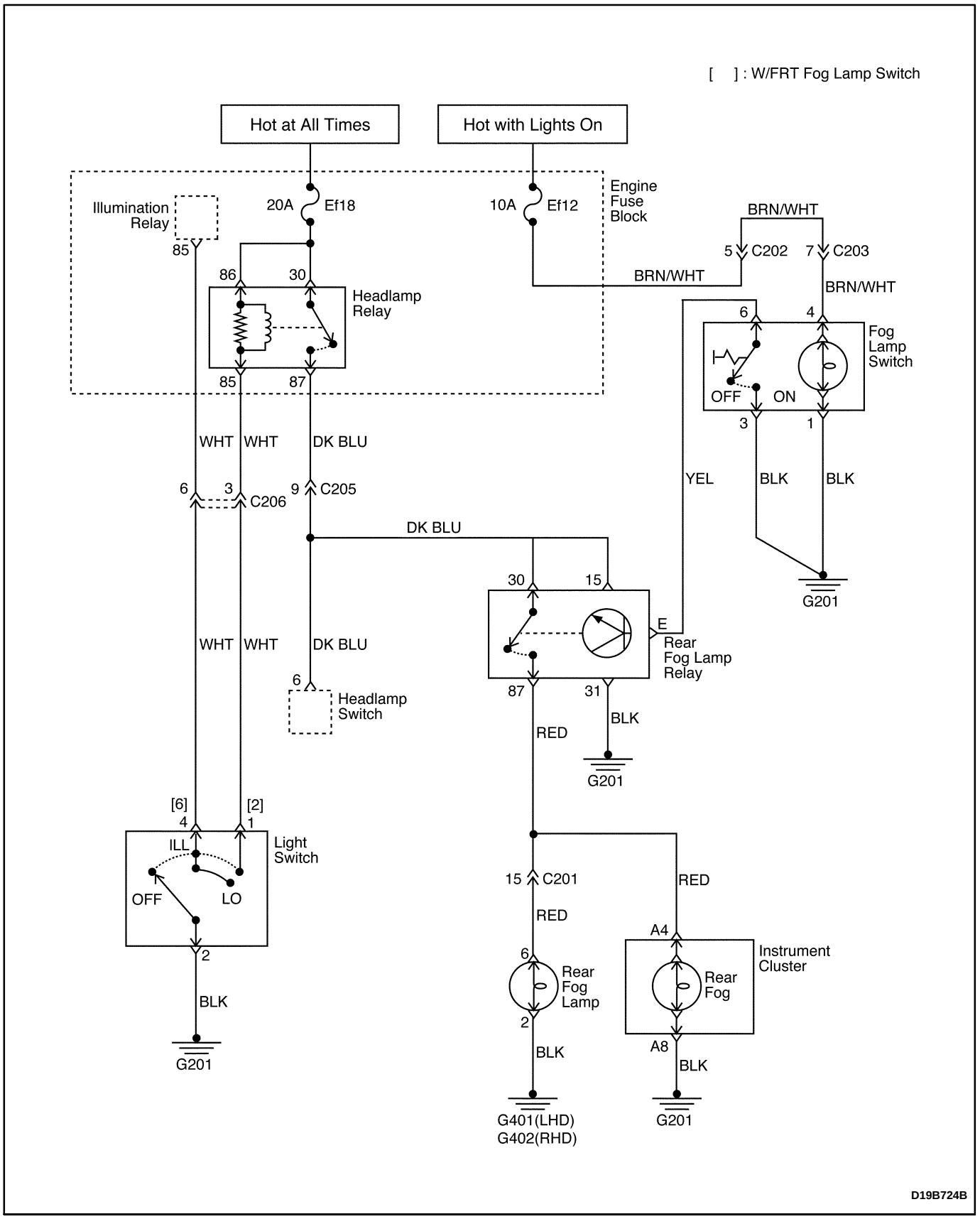
INTERIOR COURTESY LAMP CIRCUIT



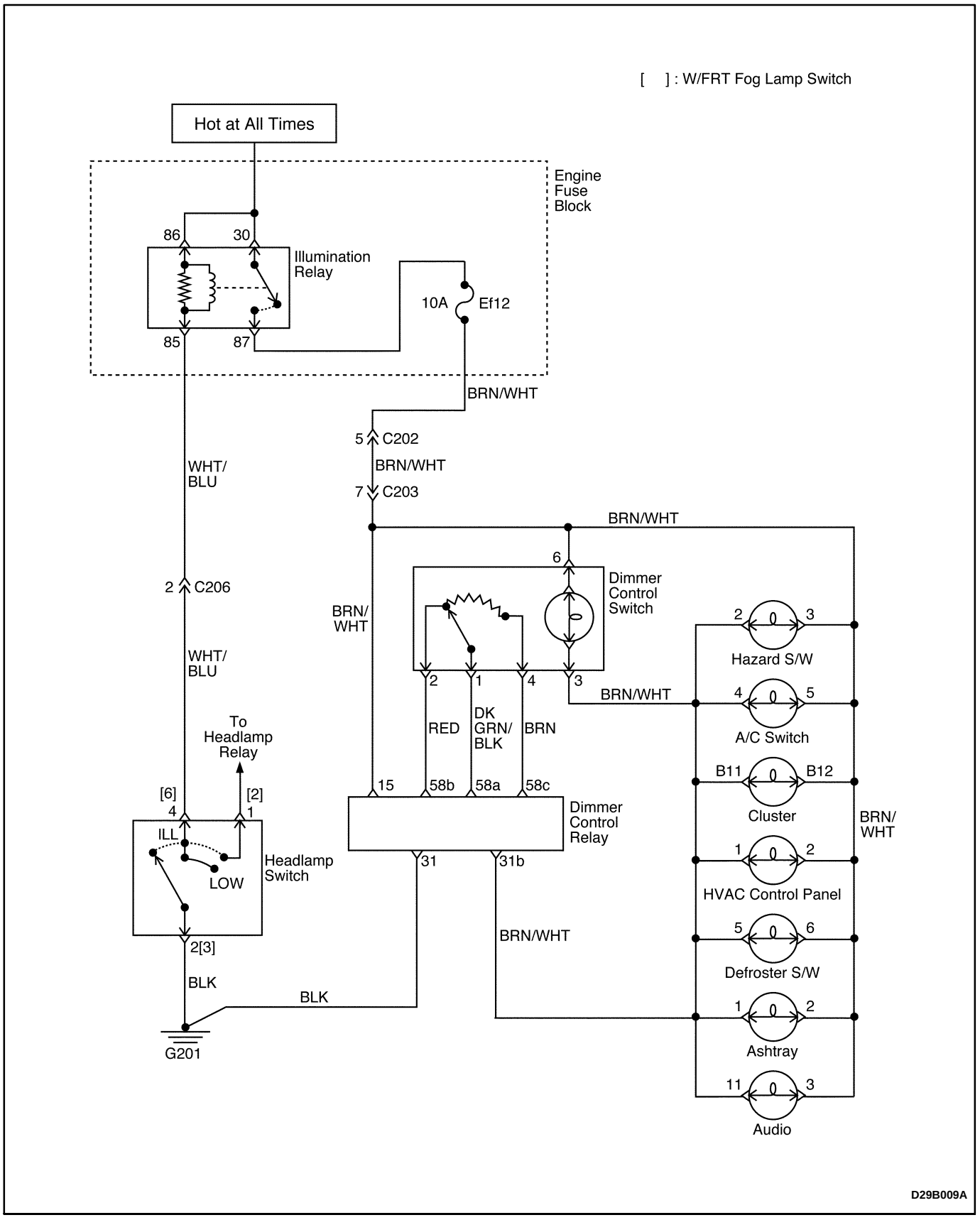
FRONT FOG LAMP CIRCUIT



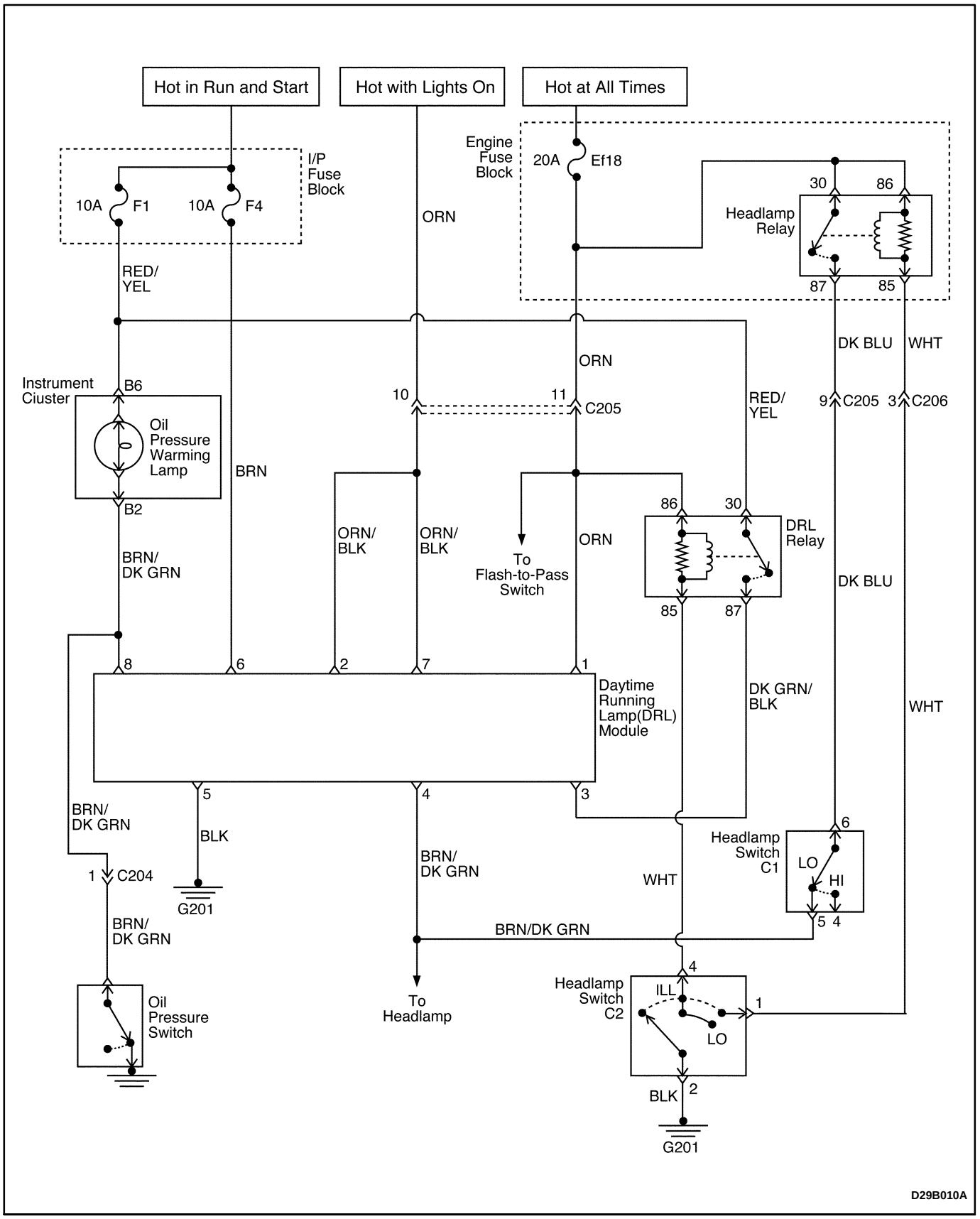
REAR FOG LAMP CIRCUIT



DIMMER CONTROL CIRCUIT (EXCEPT W/EUROPE)



DAYTIME RUNNING LAMPS CIRCUIT (W/EUROPE ONLY)



SECTION 9C

HORNS

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.

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Horn Wiring System 9C-4

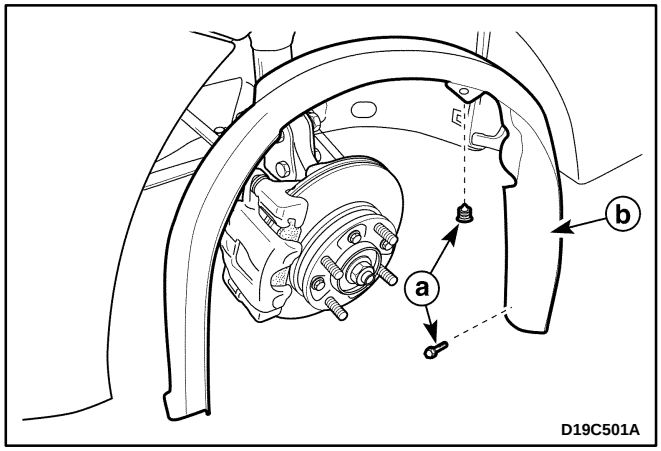
DESCRIPTION AND OPERATION

HORN

The horn is located under the hood. It is attached near the radiator at the front of the vehicle. The horn is actuated by pressing the steering wheel pad, which grounds the horn's electrical circuit.

REPAIR INSTRUCTIONS

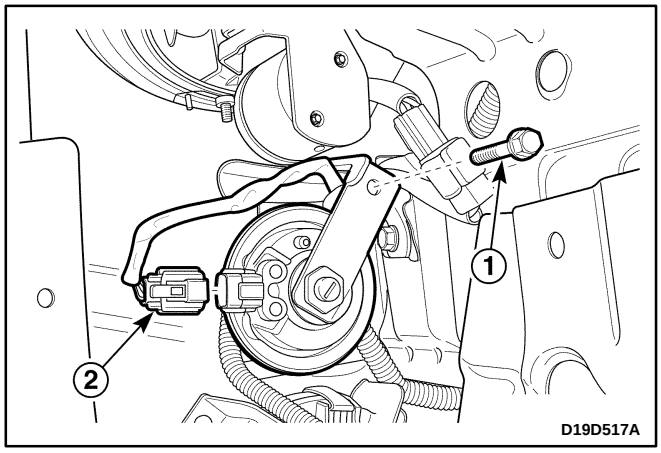
ON–VEHICLE SERVICE



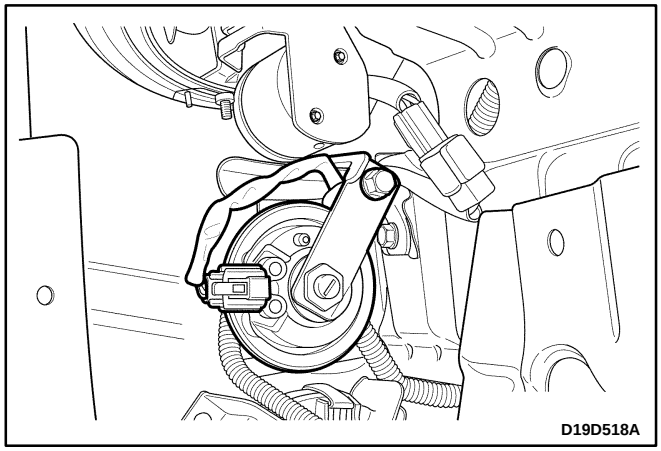
HORN

Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the front wheels.
4. Remove the front wheel house splash shield.
   - Remove the clip and bolts.
     a. Bolts and clips.
   - Remove the wheel house splash shield.
     b. Splash shield.



5 Remove the horn.
   - Remove the bolt (1).
   - Disconnect the electrical connector (2).

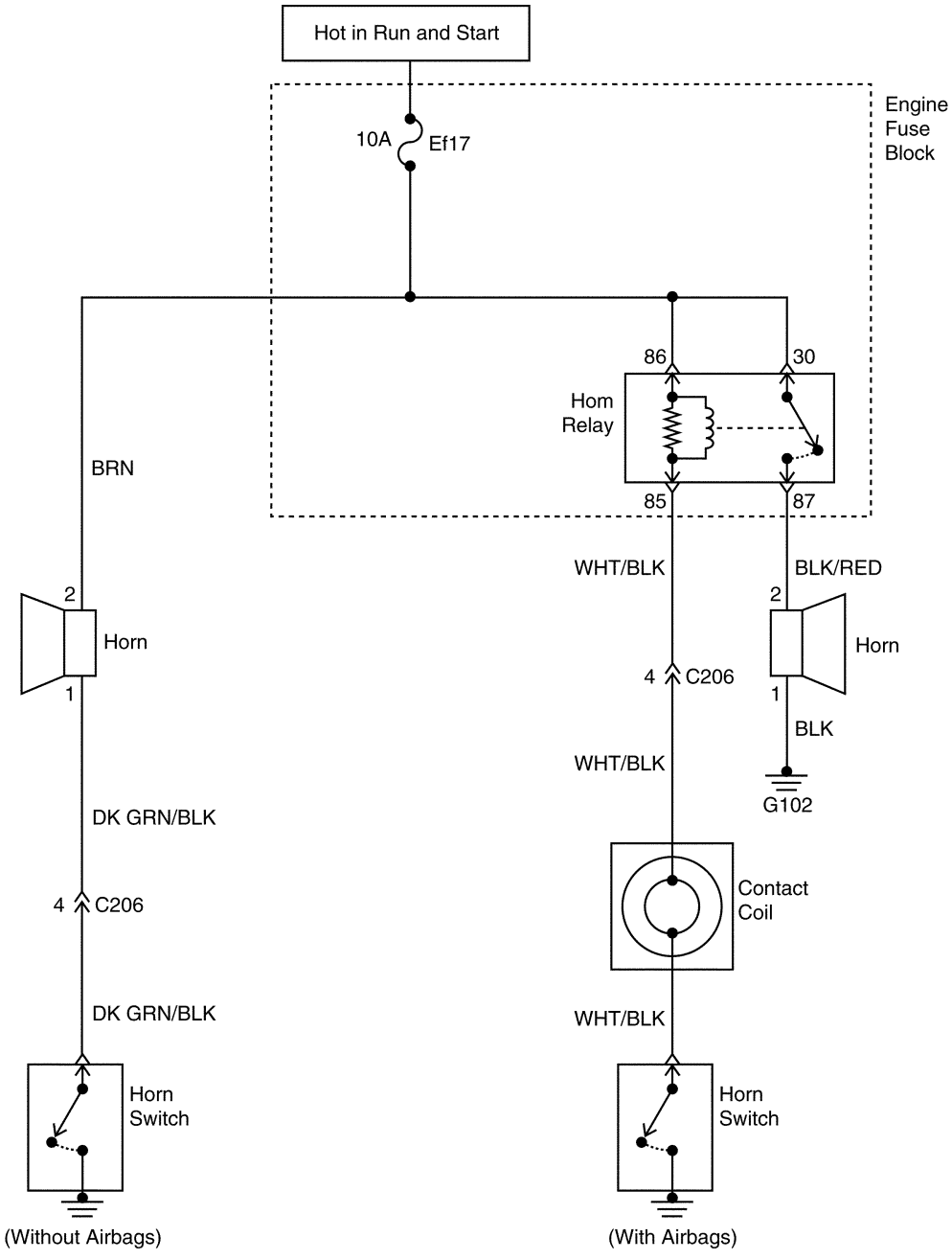


Installation Procedure

1. Install the horn with the bolt.
2. Connect the electrical connector.
3. Install the front wheel house splash shield with the clips and the bolts.
4. Install the front wheels.
5. Lower the vehicle.
6. Connect the negative battery cable.

SCHEMATIC AND ROUTING DIAGRAMS

HORN WIRING SYSTEM



SECTION 9D

WIPERS / WASHER SYSTEMS

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.

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DESCRIPTION AND OPERATION

WINDSHIELD WIPER SYSTEM

The windshield wiper system consists of a wiper motor, a linkage, a wiper arm and a blade, and a wiper/washer switch. The windshield wiper circuit incorporates a self-parking device which consists of a worm gear and a cam plate in order to keep the circuit engage temporarily when the switch is turned off. The wiper system is driven by a permanent magnet-type motor. The windshield wiper motor is mounted on the dash panel and is directly connected to the windshield wiper linkage.

The windshield wiper motor has two speeds, LOW and HIGH, and also has intermittent wiper capability. The wiper switch is an integral part of the wiper/washer switch. Windshield wiper operation is actuated through the lever on the right side of the steering column.

WINDSHIELD WASHER SYSTEM

The windshield washer system is equipped with a washer fluid reservoir, a washer fluid pump, hoses, nozzles, and a wiper/washer switch. The windshield washer reservoir is mounted inner the front right wheel well splash shield. Attached to the reservoir is a washer pump, which pumps fluid through the hoses to the two nozzles mounted on the cowl panel. The washer switch is an integral part of the wiper/washer switch. Windshield washer operation is actuated through the lever on the right side of the steering column.

REAR WIPER/WASHER SYSTEM

The rear wiper/washer system is equipped with the high grade vehicle. The rear wiper and the washer are one assembly. The rear washer is installed to the rear wiper.

The rear wiper/washer switch is same with the windshield wiper. Push the switch to one position forward and the rear wiper operate slowly. And push more the switch forward and the rear wiper/washer system operate.

DIAGNOSTIC INFORMATION AND PROCEDURES

WINDSHIELD/REAR WINDOW WIPER AND WASHER SYSTEM

Condition	Probable Cause	Correction
Windshield Wipers Do Not Work At Any Speed	● The open or a short in the power supply circuit to the fuse F8.	● Repair or replace the open a short in the power supply circuit to the fuse F8.
	● Fuse F8 is blown.	● Replace the fuse F8.
	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/washer switch connector and the wiper relay is open or short.	● Repair or Replace the wiring harness.
	● The circuit between the fuse F8 and the wiper relay is open or short.	● Repair or Replace the wiring harness.
	● Faulty wiper relay.	● Replace the wiper relay.
	● The circuit between the wiper relay and the ground G201 is the open circuit or a short circuit.	● Repair or Replace the open circuit or a short circuit between the wiper relay and the ground G201.
	● The circuit between the wiper/washer switch and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● The circuit between the fuse F8 and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● The circuit between the wiper relay and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper motor.	● Replace the wiper motor.
	● The connection of the wiper linkage and the wiper motor is poor.	● Tighten completely the nut. ● Tighten completely the ball.
	● Wiper linkage is out of order.	● Replace the wiper linkage.
Wipers Do Not Work On High Speed, Low Speed OK	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/washer switch and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper motor.	● Replace the wiper motor.
Wipers Do Not Work On Low Speed, High Speed OK	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/washer switch and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper motor.	● Replace the wiper motor.

WINDSHIELD/REAR WINDOW WIPER AND WASHER SYSTEM(Cont'd)

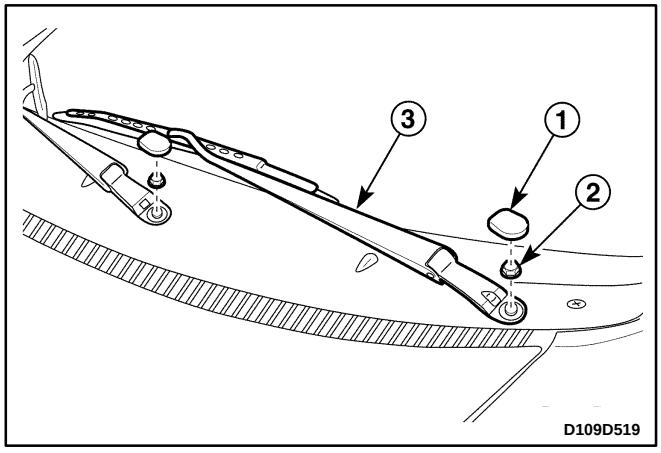
Condition	Probable Cause	Correction
Wipers Do Not On Intermittent, Other Speed OK	● The circuit between the fuse F8 and the wiper relay is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● The circuit between the fuse F8 and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/washer switch and the wiper relay is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper relay.	● Replace the wiper relay.
	● The circuit between the wiper relay and the wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Poor ground G201.	● Repair or Replace the wiring harness.
	● Faulty wiper motor.	● Replace the wiper motor.
Windshield Washer Does Not Work, Windshield Wipers OK	● The open or a short in the power supply circuit to the fuse F9.	● Repair or Replace the open or a short in the power supply circuit to the fuse F9.
	● Fuse F9 is blown.	● Replace the fuse.
	● The circuit between the fuse F9 and the wiper/washer switch is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/ washer switch and the wiper relay is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper relay.	● Replace the wiper relay.
	● The circuit between the wiper relay and ground G201 is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● The circuit between the wiper/washer switch and the windshield washer pump is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty windshield washer pump.	● Replace the windshield wash pump.
	● Poor ground G201.	● Repair or Replace the wiring harness.

WINDSHIELD/REAR WINDOW WIPER AND WASHER SYSTEM(Cont'd)

Condition	Probable Cause	Correction
Rear Wiper Does Not Work	● The open or a short in the power supply circuit to the fuse F9.	● Repair or Replace the open or a short in the power supply circuit to the fuse F8.
	● Fuse F9 is blown.	● Replace the fuse F9.
	● The circuit between the fuse F9 and the wiper/washer switch is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/washer switch and the rear window wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● The circuit between the fuse F9 and the rear window wiper motor is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty rear window wiper motor.	● Replace the rear window wiper motor.
	● Poor ground G403.	● Repair or Replace the wiring harness.
Rear Window Washer Does Not Work, Rear Window Wiper OK	● The open or a short in the power supply circuit to the fuse F9.	● Repair or Replace the open or a short in the power supply circuit to the fuse F9.
	● Fuse F9 is blown.	● Replace the fuse F9.
	● The circuit between the fuse F9 and wiper/washer switch is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty wiper/washer switch.	● Replace the wiper/washer switch.
	● The circuit between the wiper/washer switch and the windshield washer pump is the open circuit or a short circuit.	● Repair or replace the wiring harness.
	● Faulty windshield washer pump.	● Replace the windshield washer pump.
	● Poor ground G102.	● Repair or Replace the wiring harness.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

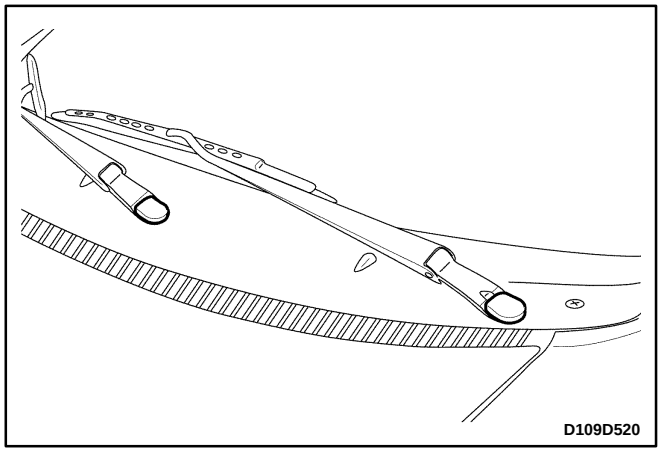


WINDSHIELD WIPER ARM

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

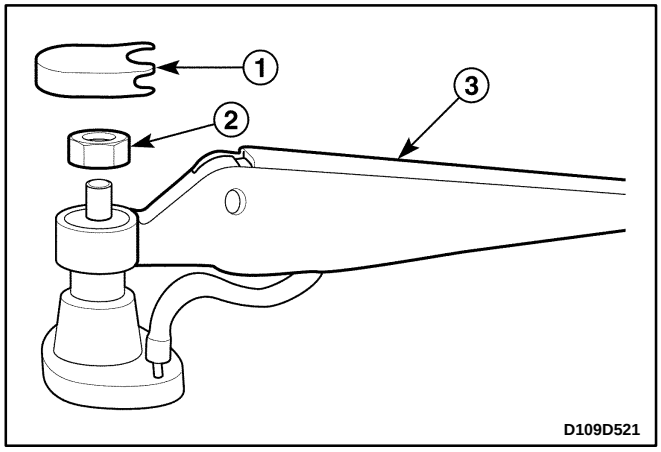
Removal Procedure

1. Remove the wiper arm.
   - Remove the cap (1).
   - Remove the nut (2).
   - Remove the wiper arm (3).



Installation Procedure

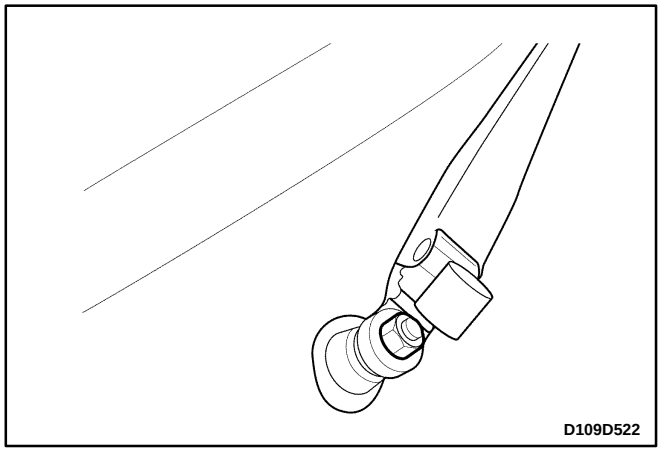
1. Install the wiper arm with the nut.
2. Install the cap.



REAR WINDOW WIPER ARM

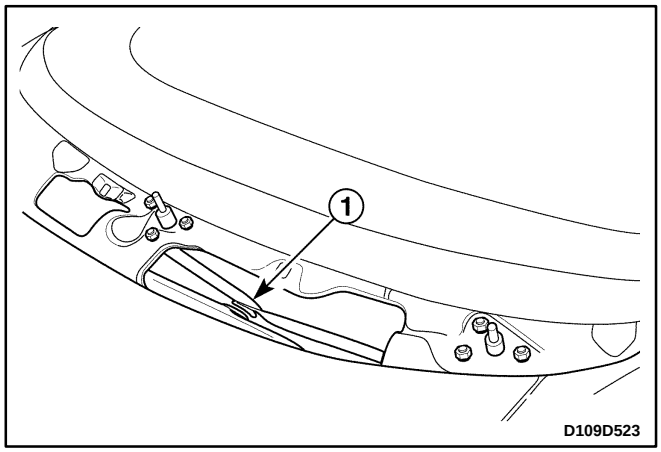
Removal Procedure

1. Remove the washer nozzle from the wiper arm. Refer to “Rear Washer Nozzle” in this section.
2. Remove the wiper blade. Refer to “Windshield Wiper Blade” in this section.
3. Remove the wiper arm.
   - Remove the cap (1).
   - Remove the nut (2).
   - Remove the wiper arm (3).



Installation Procedure

1. Install the rear wiper arm with the nut.
2. Install the cap.
3. Install the wiper blade. Refer to “Windshield Wiper Blade” in this section.
4. Install the washer nozzle to the wiper arm. Refer to “Rear Washer Nozzle” in this section.

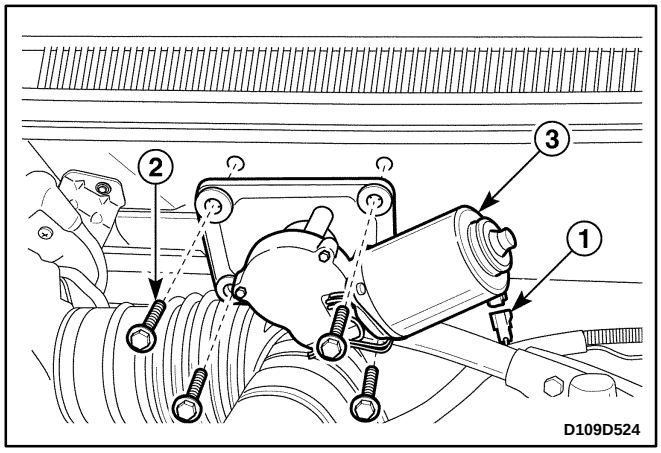


WINDSHIELD WIPER MOTOR

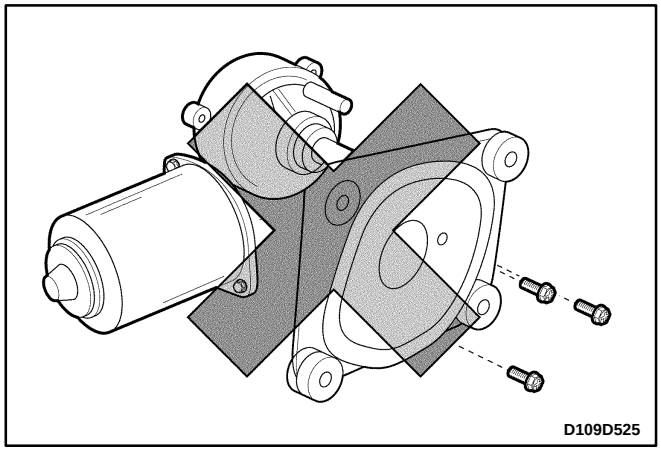
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

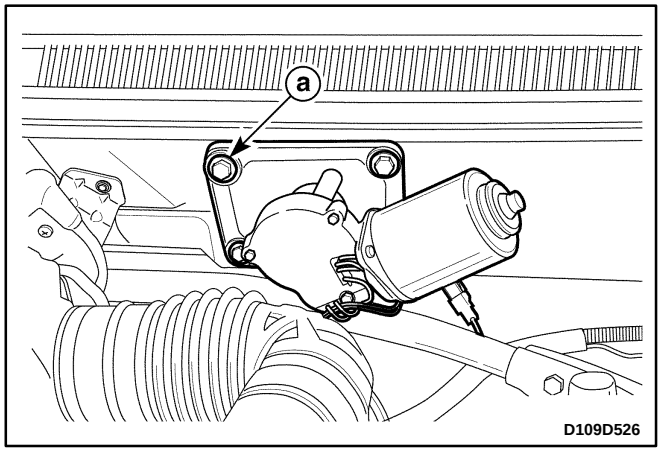
1. Disconnect the negative battery cable.
2. Remove the windshield wiper arm. Refer to “Windshield Wiper Arm” in this section.
3. Remove the cowl vent grille. Refer to *Section 9R, Body Front End.*
4. Separate the wiper motor from the wiper linkage.
   - Remove the wiper linkage ball from the wiper linkage (1).



5. Remove the wiper motor from the engine room.
   - Disconnect the electrical connector (1).
   - Remove the bolts (2).
   - Remove the wiper motor assembly (3).

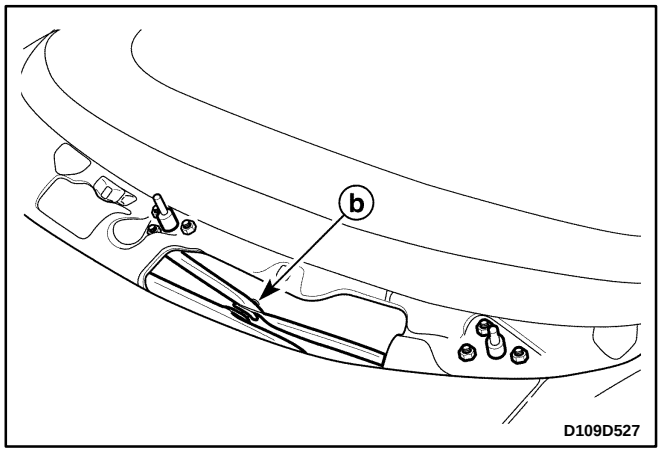


Caution: Because the wiper motor link plate is fixed, do not separate the wiper motor from the bracket.

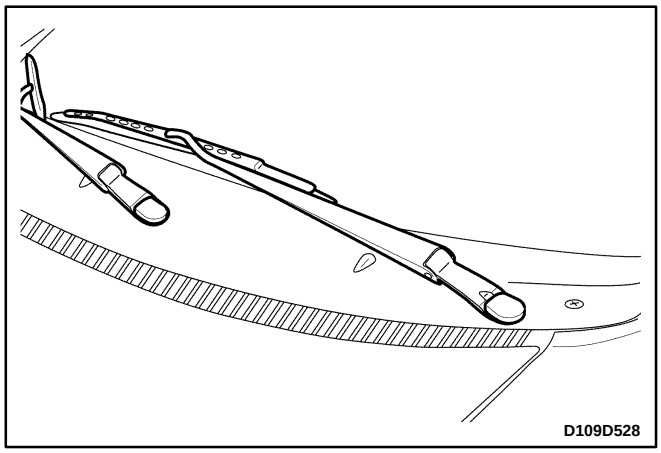


Installation Procedure

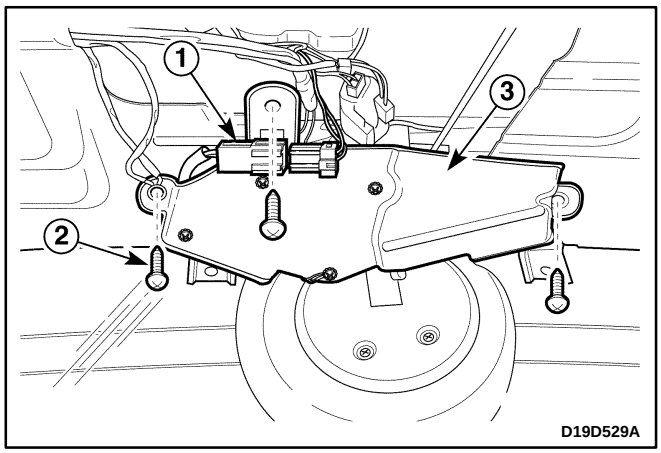
1. Install the wiper motor to the engine room with the bolts.
   a. Wiper motor assembly bolt.
2. Connect the electrical connector.



3. Install the wiper linkage to the wiper motor linkage ball.
   b. Wiper linkage ball.



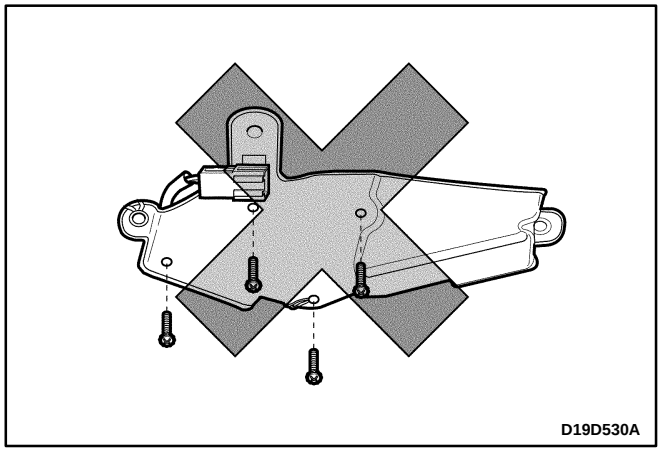
4. Install the cowl vent grille. Refer to *Section 9R, Body Front End.*
5. Install the windshield wiper arm. Refer to “Windshield Wiper Arm” in this section.
6. Connect the negative battery cable.



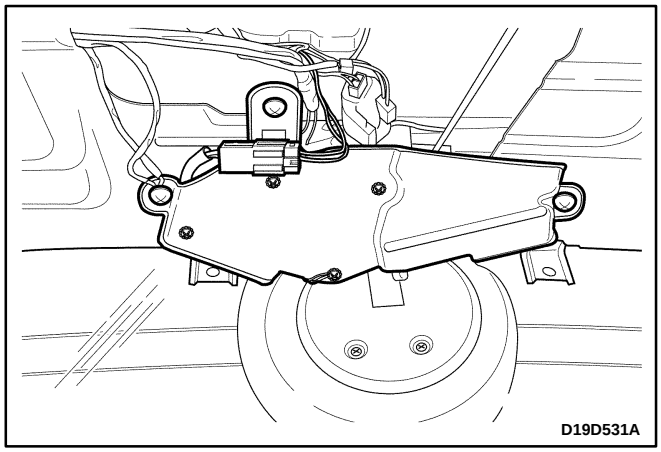
REAR WINDOW WIPER MOTOR

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the wiper arm from the tailgate. Refer to “Windshield Wiper Arm” in this section.
3. Remove the tailgate inside trim. Refer to *Section 9G, Interior Trim.*
4. Remove the rear wiper motor assembly.
   - Disconnect the electrical connector (1).
   - Remove the screws (2).
   - Remove the rear wiper motor assembly (3).


D19D530A

Caution: Because the wiper motor link plate is fixed, do not separate the wiper motor from the bracket.


D19D531A

Installation Procedure

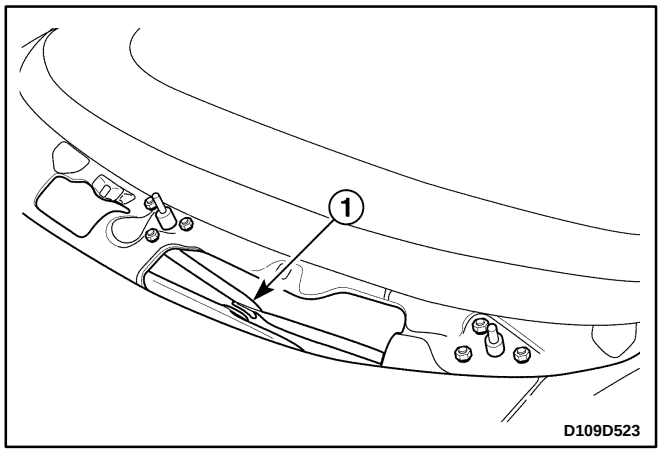
1. Install the wiper motor assembly to the tailgate with the screws.
2. Connect the electrical connector.
3. Install the tailgate inside trim. Refer to *Section 9G, Interior Trim.*
4. Install the wiper arm. Refer to “Windshield Wiper Arm” in this section.
5. Connect the negative battery cable.

WINDSHIELD WIPER LINKAGE

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

Removal Procedure

1. Remove the windshield wiper arms. Refer to ”Windshield Wiper Arm” in this section.
2. Remove the cowl vent grille. Refer to *Section 9R*, *Body Front End*.
3. Separate the wiper linkage from the wiper motor.
   - Separate the wiper linkage from the wiper motor linkage ball (1).



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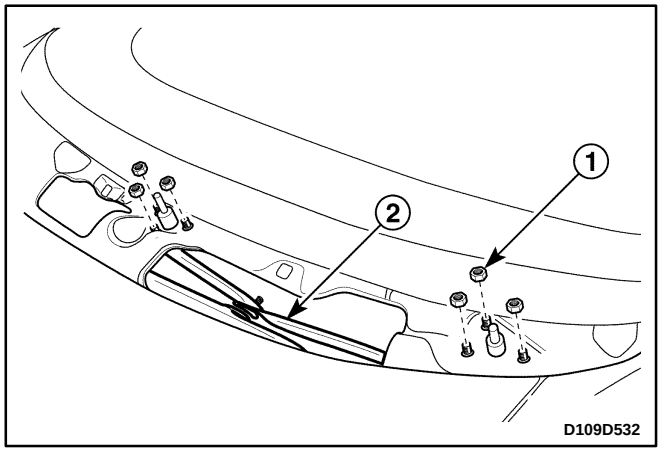
4. Remove the wiper linkage.
   - Remove the wiper linkage nuts (1).
   - Remove the wiper linkage (2).



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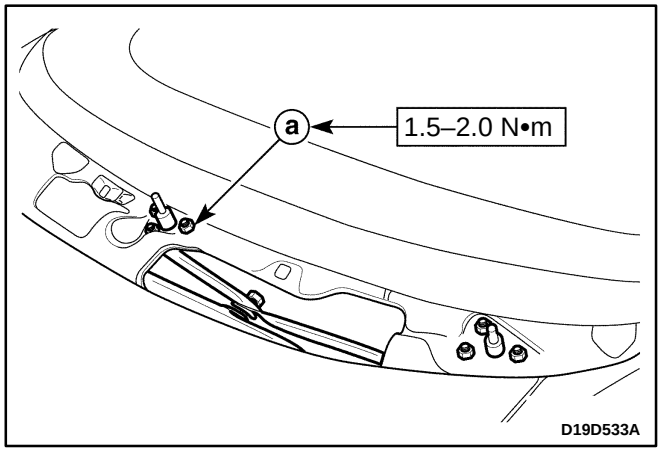


Installation Procedure

1. Install the wiper linkage with the wiper linkage nuts.

Tighten

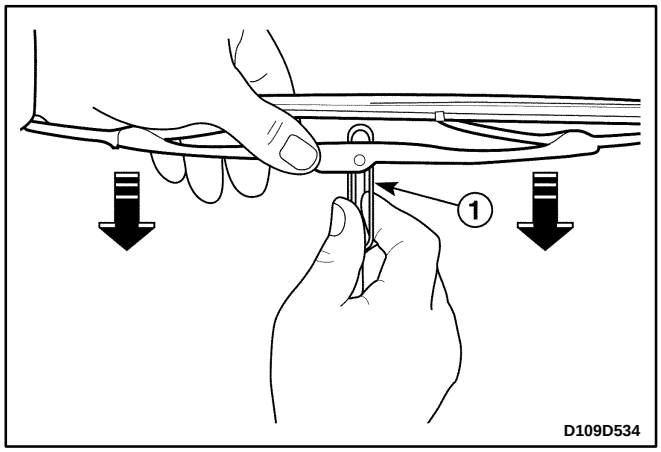
Tighten the wiper linkage nuts to 1.5–2.0 N•m (13–18 lb-in).

a. Wiper linkage nut.

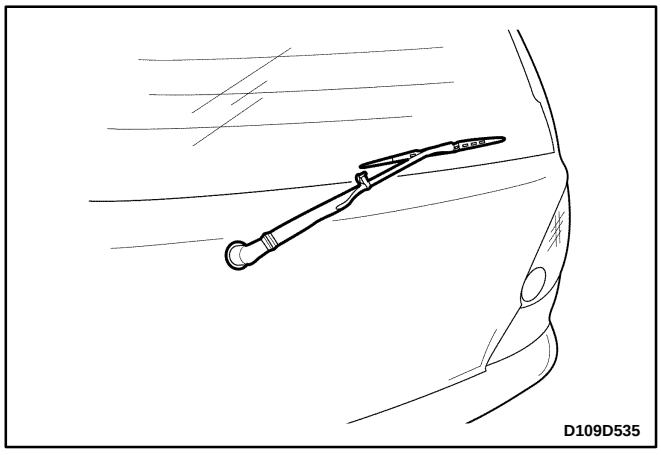
2. Install the wiper motor linkage ball.
3. Install the cowl vent grille. Refer to *Section 9R, Body Front End*.
4. Install the windshield wiper arms. Refer to ”Windshield Wiper Arm” in this section.

WINDSHIELD WIPER BLADE

Removal Procedure



1. Pull the wiper blade off the arm by pushing the wiper blade retaining clip (1).

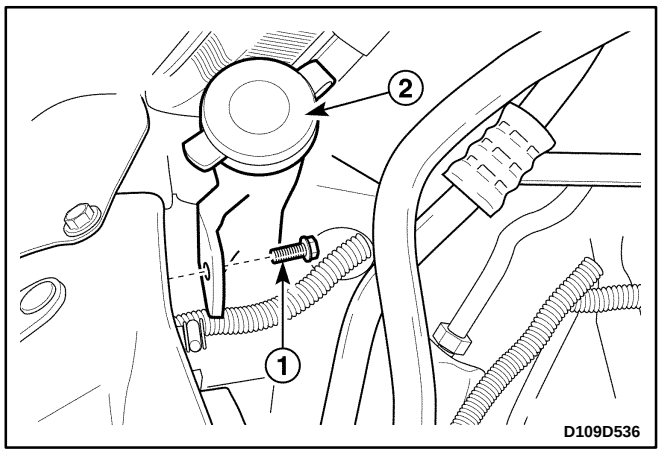


Installation Procedure

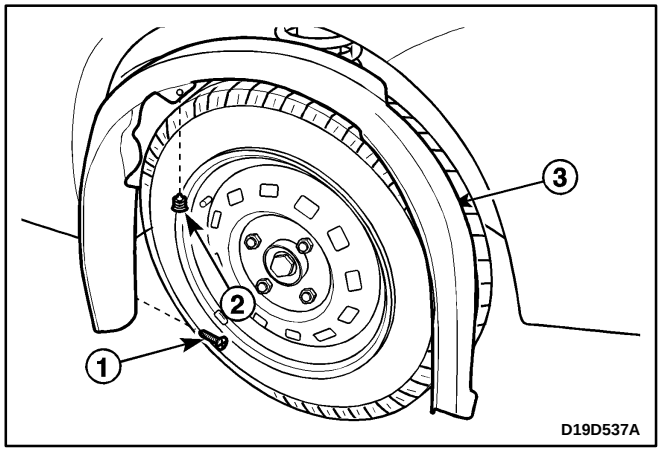
1. Install the wiper blade to the arm.

WASHER RESERVOIR

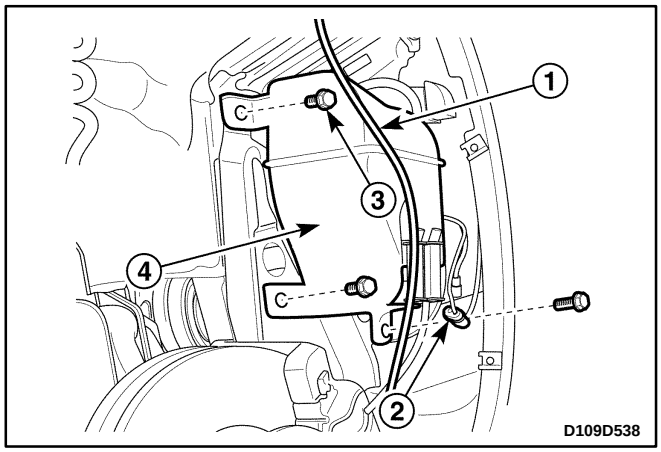
Removal Procedure



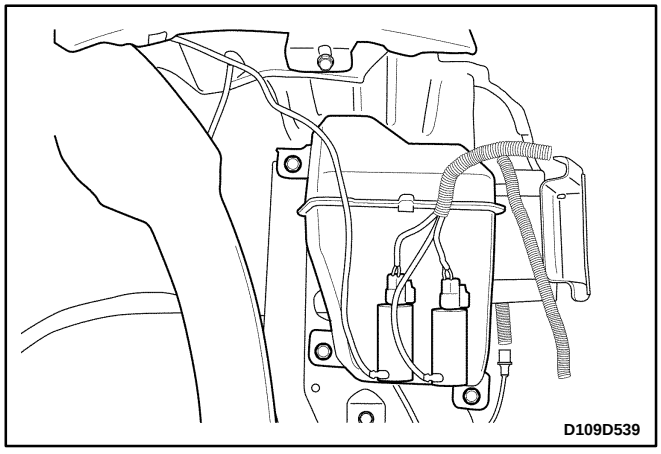
1. Disconnect the negative battery cable.
2. Remove the washer reservoir inlet.
   - Remove the bolt (1).
   - Remove the washer reservoir inlet (2).



3. Raise and suitably support the vehicle.
4. Remove the front RH wheelhouse splash shield.
   - Remove the screws (1).
   - Remove the clips (2).
   - Remove the wheelhouse splash shield (3).

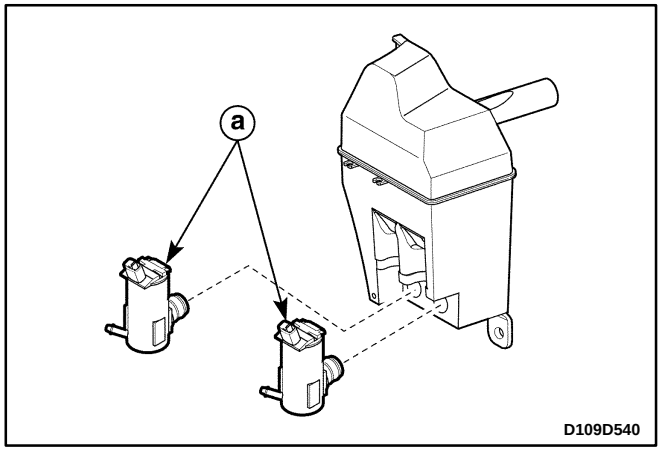


5. Remove the washer reservoir assembly.
   - Drain the washer fluid.
   - Disconnect the washer hose connector (1).
   - Disconnect the washer pump electrical connector (2).
   - Remove the bolts (3).
   - Remove the washer reservoir assembly (4).



Installation Procedure

1. Install the washer reservoir assembly with the bolts.
2. Connect the washer pump electrical connector.
3. Connect the washer hose connector.
4. Install the front RH wheelhouse splash shield with the screws and the clips.
5. Lower the vehicle.
6. Install the washer reservoir with the bolt.
7. Connect the negative battery cable.

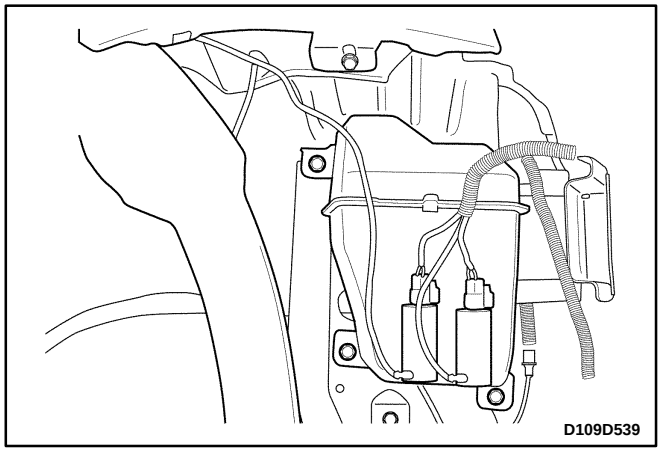


WASHER PUMP

Removal Procedure

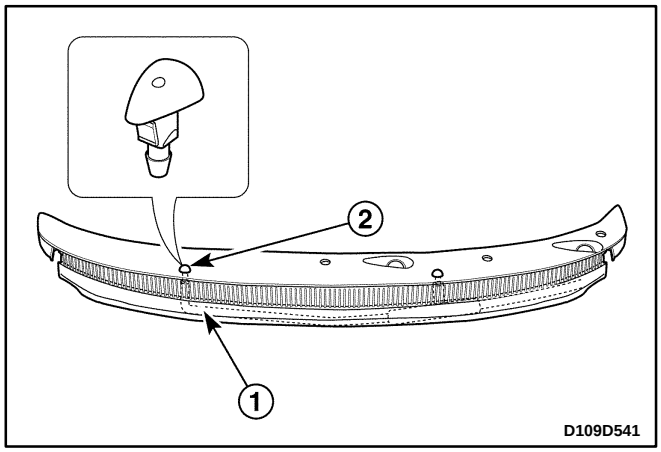
1. Disconnect the negative battery cable.
2. Remove the washer reservoir assembly. Refer to “Washer Reservoir” in this section.
3. Drain the washer fluid.
4. Remove the wiper motor from the washer reservoir assembly.

   a. Washer pump.


D109D539

Installation Procedure

1. Install the wiper motor to the washer reservoir assembly.
2. Install the washer reservoir assembly.
   Refer to “Washer Reservoir” in this section.
3. Connect the negative battery cable.
4. Fill the washer reservoir.



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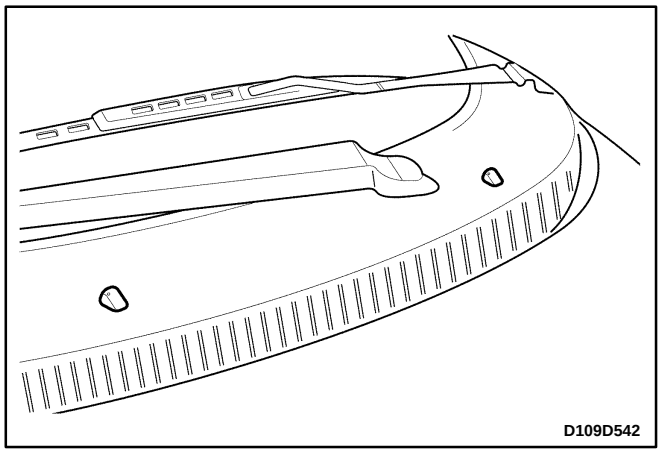
WINDSHIELD WASHER NOZZLE

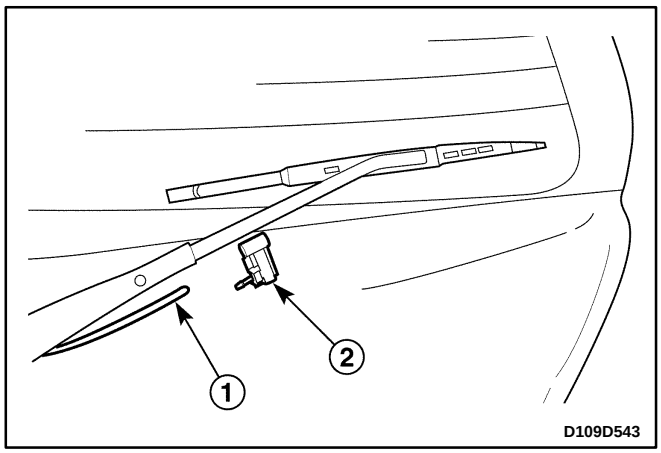
Removal Procedure

1. Remove the cowl vent grille. Refer to *Section 9R, Body Front End.*
2. Remove the washer nozzle from the cowl vent grille.
   - Disconnect the washer nozzle hose (1).
   - Remove the washer nozzle (2).


D109D542

Installation Procedure

1. Install the washer nozzle to the cowl vent grille.
2. Install the washer nozzle hose to the washer nozzle.
3. Install the cowl vent grille. Refer to *Section 9R, Body Front End.*



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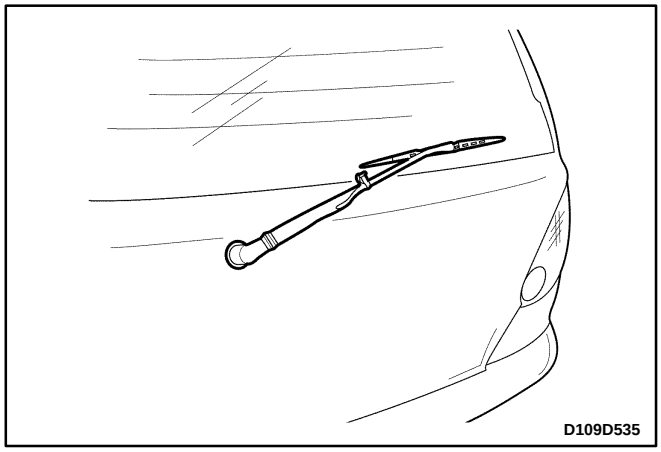
REAR WINDOW WASHER NOZZLE

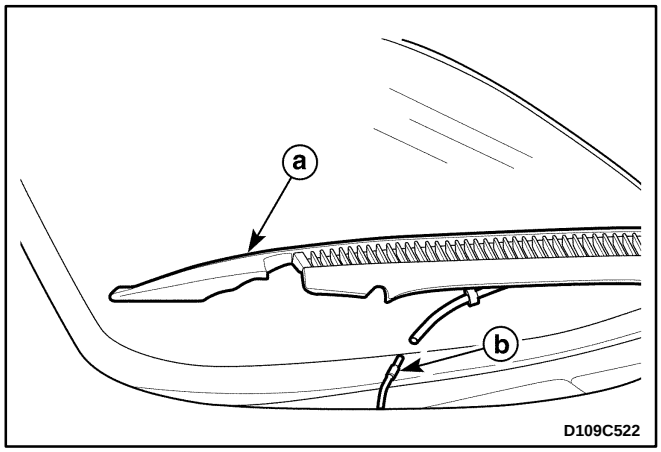
Removal Procedure

1. Remove the washer nozzle from the wiper arm.
   - Disconnect the washer nozzle hose (1).
   - Remove the washer nozzle (2).



Installation Procedure

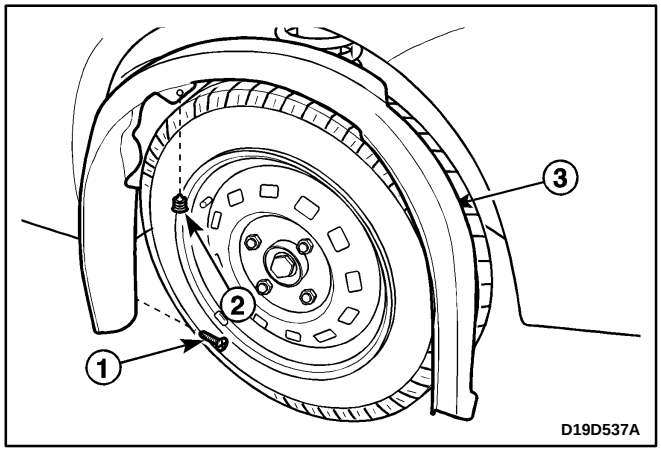
1. Install the washer nozzle to the wiper arm assembly.
   - Install the washer nozzle hose in the wiper arm return spring.
   - Fix the washer nozzle into the wiper arm.
   - Install the washer nozzle hose to the pivot cap connector.



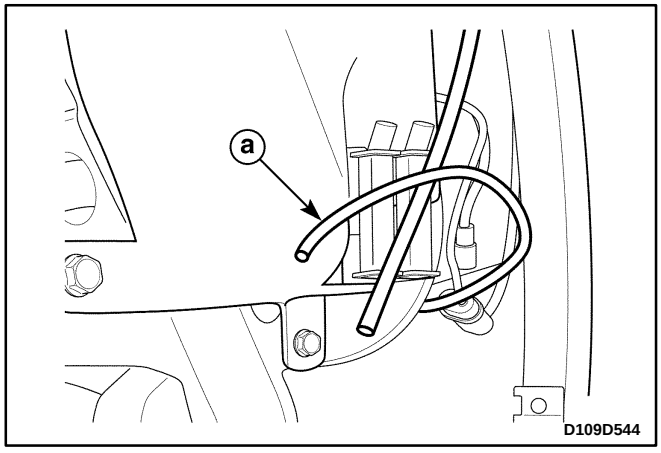
WASHER HOSE

Removal Procedure

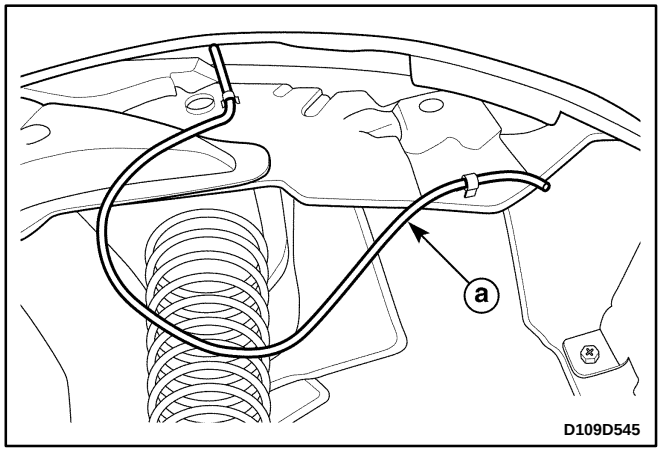
1. Remove the cowl vent grille. Refer to *Section 9R*, *Body Front End*.
   a. Cowl vent grille.
2. Disconnect the washer hose connector.
   b. Washer hose connector.



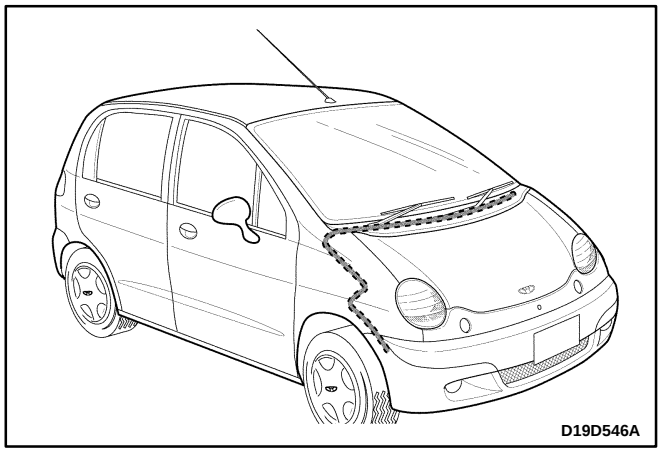
3. Raise and suitably support the vehicle.
4. Remove the front RH wheel.
5. Remove the front RH wheel house splash shield.
   - Remove the screws (1).
   - Remove the clips (2).
   - Remove the wheel house splash shield (3).



6. Disconnect the washer hose from the washer pump.
   a. Washer hose.



7. Remove the washer hose.
   a. Washer hose.



Installation Procedure

1. Connect the washer hose to the washer pump.
2. Install the front RH wheel house splash shield with the screws and the clips.
3. Install the front RH wheel.
4. Lower the vehicle.
5. Connect the washer hose connector.
6. Install the cowl vent grille. Refer to *Section 9R*, *Body Front End*.

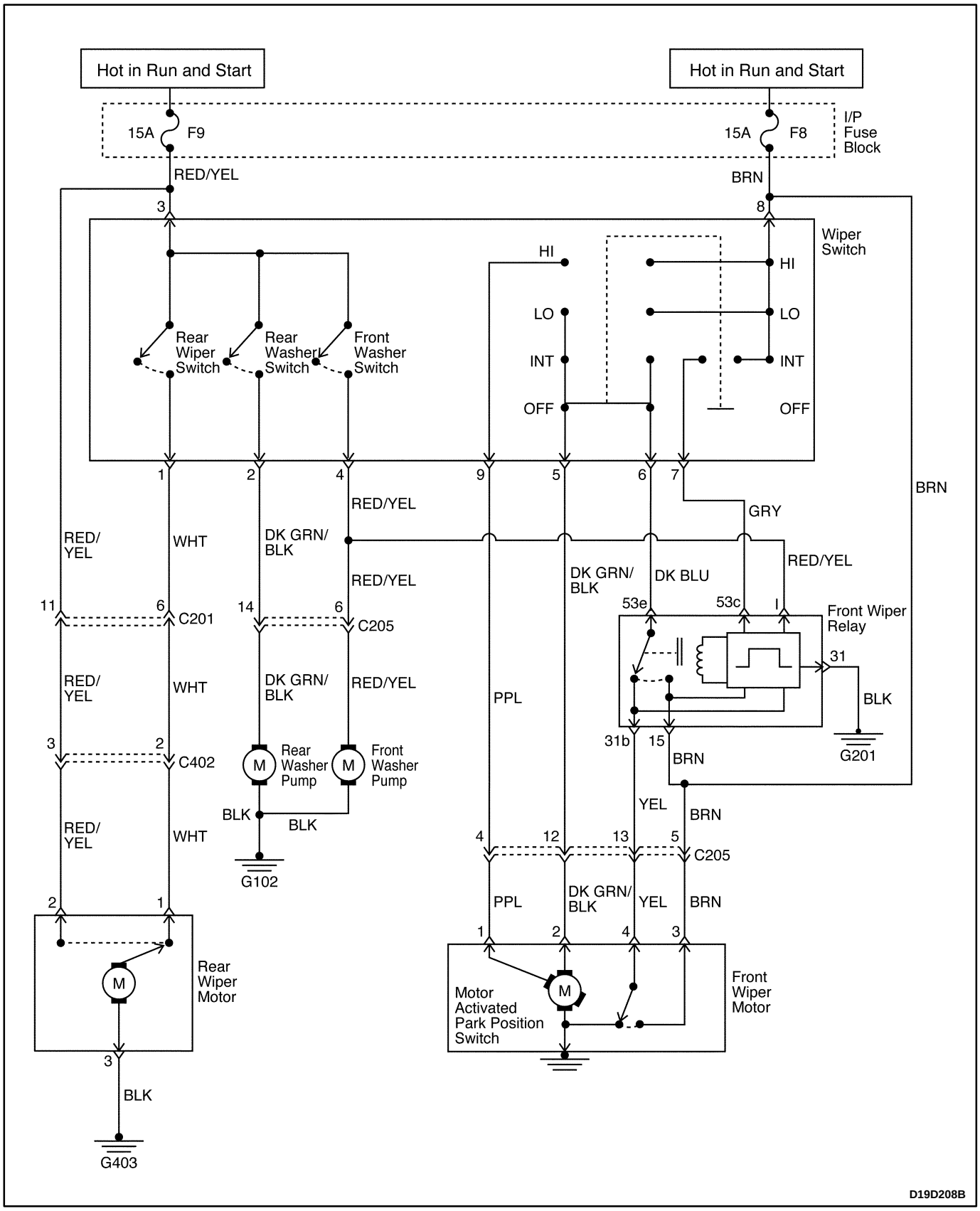
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Wiper Linkage Conclusion Nut	1.5–2.0	–	13–18

SCHEMATIC AND ROUTING DIAGRAMS

WINDSHIELD/REAR WINDOW WIPER AND WASHER SYSTEM



SECTION 9E

INSTRUMENTATION/DRIVER INFORMATION

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.

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DESCRIPTION AND OPERATION

CIGAR LIGHTER

The cigar lighter is located in the front portion of the instrument panel. To use the lighter, push it in completely. When the lighter is hot, it will release itself from contact with the heating element. The lighter and the heating element can be damaged if the lighter is not allowed to release itself fully from the heating element. Cigar lighter is not equipped with the lamp.

ASHTRAY

The ashtray is located in the lower portion of the instrument panel. In case of cleaning the ashtray up, remove the ashtray by pushing the upper button and clean it up. The ashtray lamp is optional.

INSTRUMENT PANEL VENTS

The center and the side vents in the instrument panel can be adjusted up and down and from side to side. The side vents can also be aimed toward the side windows in order to defog them.

GLOVE BOX

The glove box can be opened by pulling up on the latch handle. The glove box must be removed in order to gain access to the passenger-side airbag module.

DIGITAL CLOCK

The digital clock is located in the instrument panel, below the defroster grille. The clock is capable of a 12 – hour display.

INSTRUMENT CLUSTER

The instrument cluster is located above the steering column and in the instrument cluster trim panel. The instrument cluster contains the instruments that provide the driver with vehicle performance information. The instrument cluster contains a speedometer, an odometer, a trip odometer, a temperature gauge, a fuel gauge, and several indicator lamps. For replacement of the indicator lamp bulbs contained in the instrument cluster, refer to “Instrument Cluster Indicator Lamps Specifications” in this section.

SPEEDOMETER/ODOMETER/TRIP ODOMETER

The speedometer measures the speed of the vehicle. It consists of an instrument cluster gauge connected to the vehicle speed sensor on the transaxle output shaft.

The odometer measures the total distance the vehicle has traveled since it was manufactured. It consists of an instrument cluster gauge connected to the vehicle speed sensor on the transaxle output shaft.

The trip odometer measures the distance the vehicle has traveled since the odometer was last reset. It consists of an instrument cluster gauge connected to the vehicle speed sensor on the transaxle output shaft. The trip odometer can be reset to zero at any time so that the driver can record the distance traveled from any starting point.

FUEL GAUGE

The fuel gauge consists of an instrument cluster gauge connected to a sending unit in the fuel tank.

The fuel gauge indicates the quantity of fuel in the tank without the ignition switch position.

TEMPERATURE GAUGE

The temperature gauge consists of an instrument cluster gauge connected to a temperature sensor that is in contact with the circulating engine coolant.

The temperature gauge indicates the temperature of the coolant. Prolonged driving or idling in very hot weather may cause the pointer to move beyond the center of the gauge. The engine is overheating if the pointer moves into the red zone at the upper limit of the gauge.

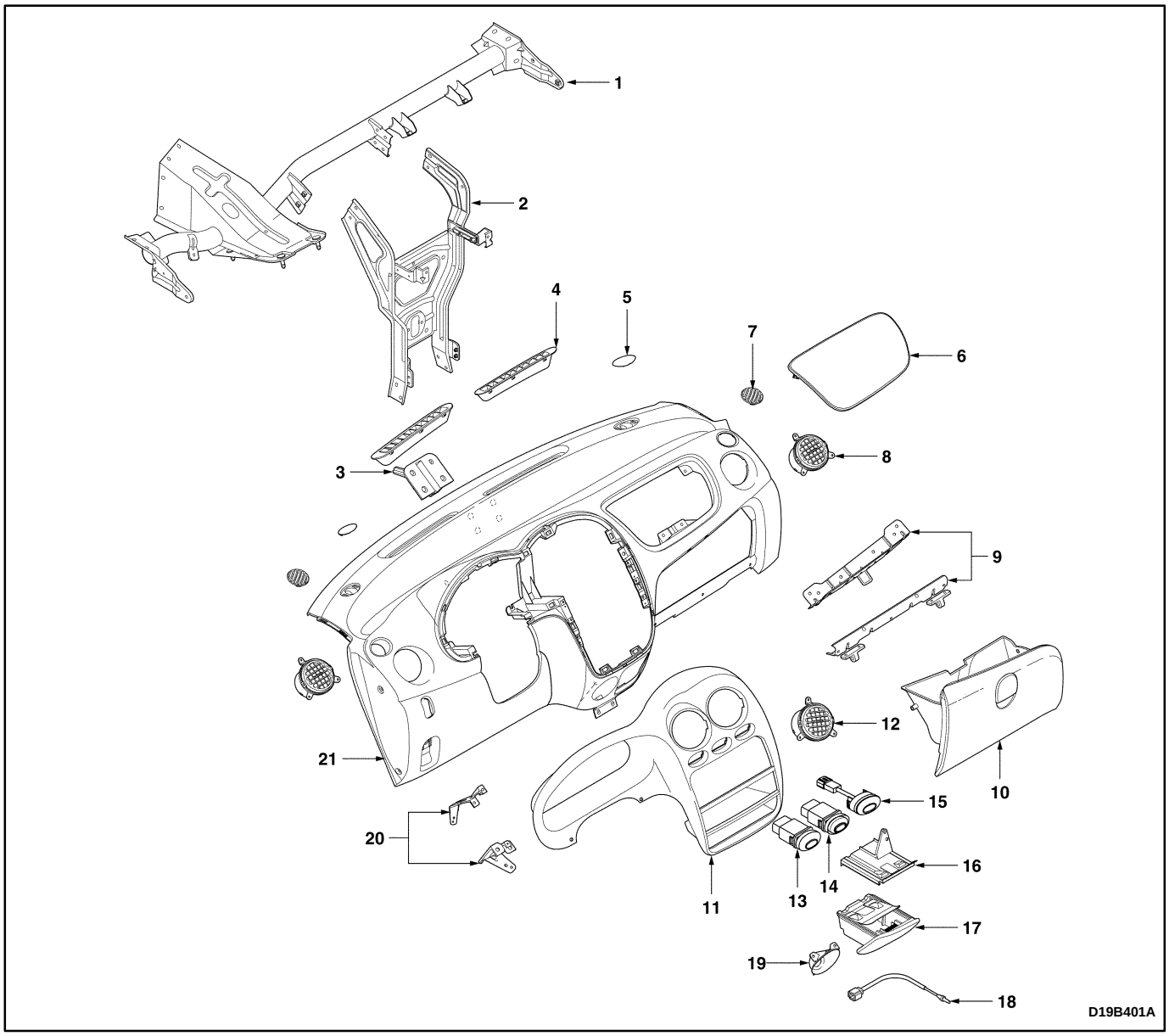
INSTRUMENT CLUSTER INDICATOR LAMPS

The instrument cluster contains indicator lamps that indicate the functioning of certain systems or the existence of potential problems with the operation of the vehicle. The indicator lamps are replaceable. For replacement of the indicator lamps contained in the instrument cluster, refer to “Instrument Cluster Indicator Lamps Specifications” in this section.

COMPONENT LOCATOR

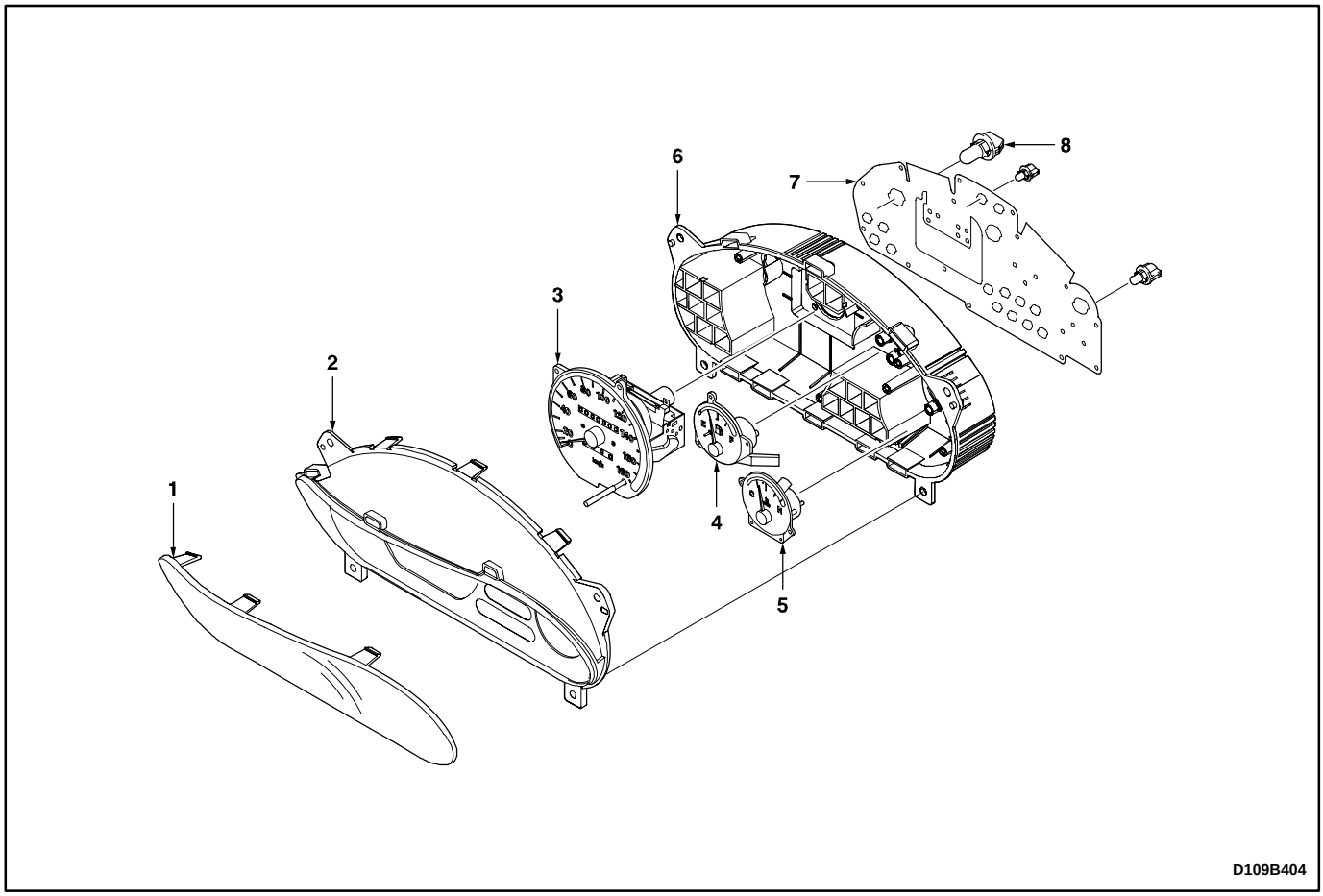
INSTRUMENT PANEL ASSEMBLY

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



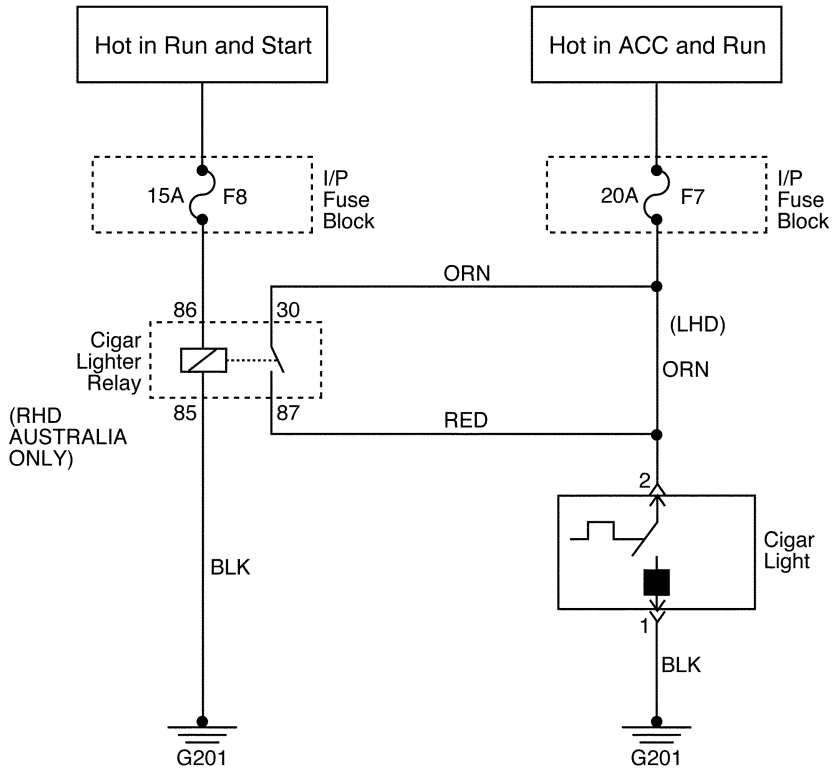
1. Tie–Bar
2. Tie–Bar Center
3. Instrument Panel Guide
4. Defroster Grille
5. Instrument Panel Upper Cap
6. Passenger's Airbag Blank Cover
7. Demister Grille
8. Side Ventilation Grille
9. Glove Box Bracket
10. Glove Box
11. Instrument Cluster Housing Molding
12. Center Ventilation Grille
13. Switch Blank Cover (Fog Lamp Switch)
14. Hazard Warning Switch
15. Immobilizer LED Indicator Switch
16. Ashtray Bracket
17. Ashtray
18. Ashtray Lamp
19. Cigar Lighter Housing
20. Instrument Cluster Bracket
21. Instrument Panel

INSTRUMENT CLUSTER



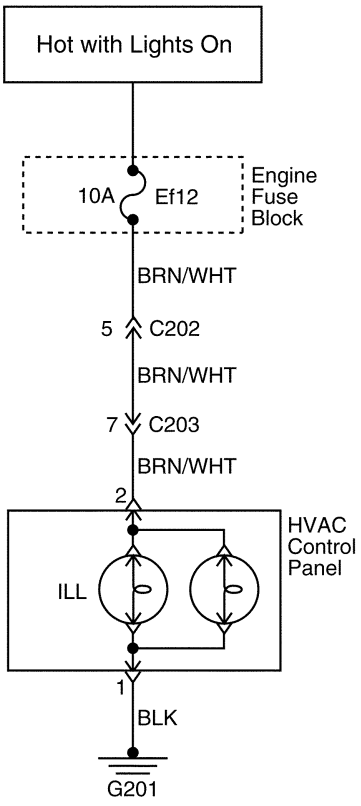
1. Instrument Cluster Lens
2. Instrument Cluster Window Plate
3. Speedometer Gauge
4. Fuel Gauge
5. Temperature Gauge
6. Instrument Cluster Case
7. Fronted Circuit Plate
8. Instrument Cluster Bulb

DIAGNOSTIC INFORMATION AND PROCEDURES



CIGAR LIGHTER

Condition	Probable Cause	Correction
Cigar Lighter Inoperative	● The open or a short in the power supply circuit to the fuse F7.	● Repair or Replace the wiring harness.
	● Fuse F7 is blown.	● Replace the fuse F7.
	● The circuit between the fuse F7 and the terminal 2 of the cigar lighter connector is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty the cigar lighter connector.	● Repair or Replace the cigar lighter connector.
	● Cigar lighter element is blown.	● Replace the cigar lighter.
	● Open ground (G201) circuit.	● Repair the open ground circuit.



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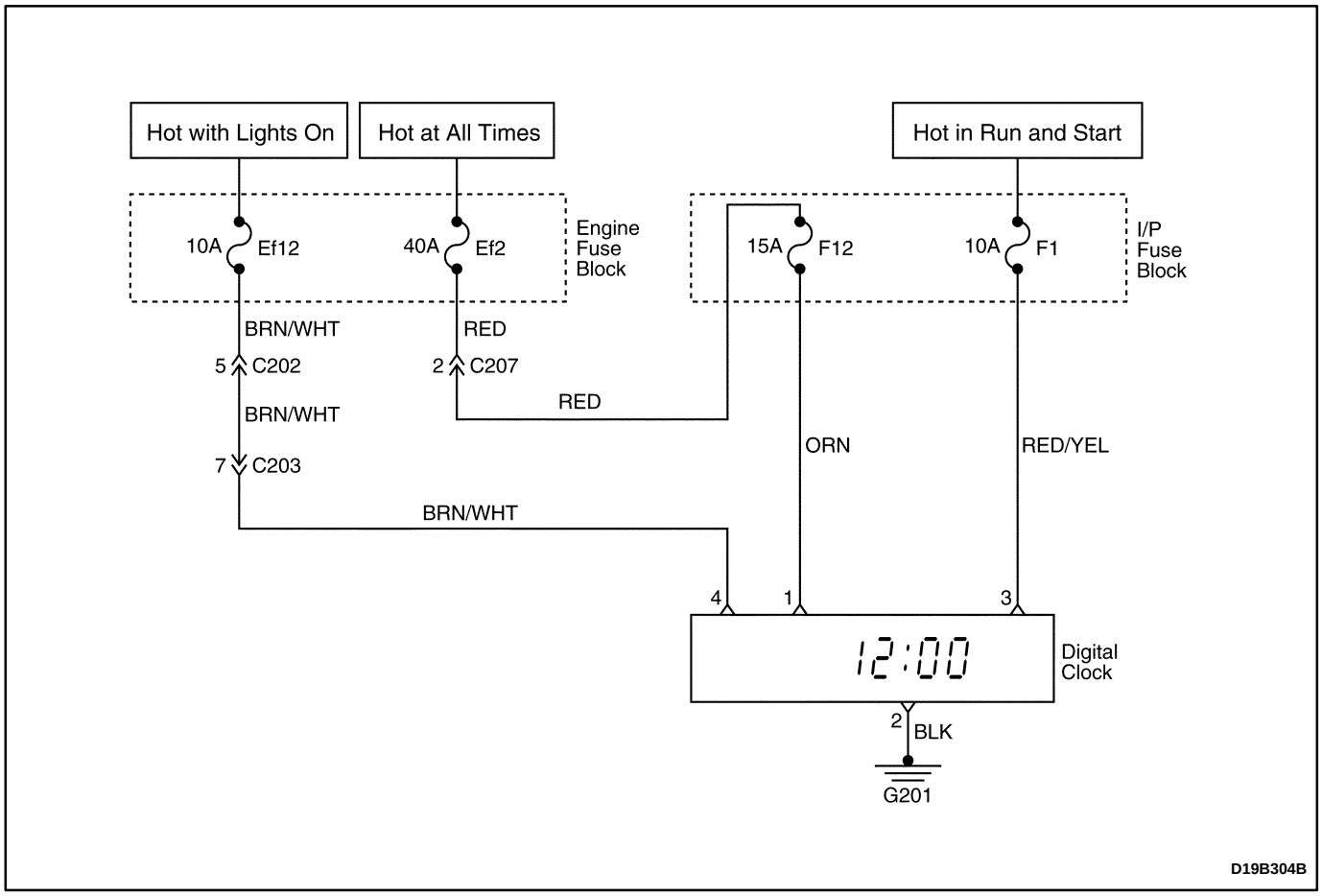
HVAC PANEL ILLUMINATION

Condition	Probable Cause	Correction
HVAC Panel Illumination Inoperative	● The open or a short in the power supply circuit to the fuse Ef12.	● Repair or Replace the wiring harness.
	● Fuse Ef12 is blown.	● Replace the fuse Ef12
	● The circuit between the fuse Ef12 and the terminal 2 of the HVAC panel illumination connector is the open circuit or a short circuit.	● Repair or Replace the wiring harness.
	● Faulty the HVAC panel illumination connector.	● Repair or Replace the instrument panel illumination connector.
	● HVAC panel illumination bulb is blown.	● Replace the bulb.
	● Open ground (G201) circuit.	● Repair the open ground circuit.

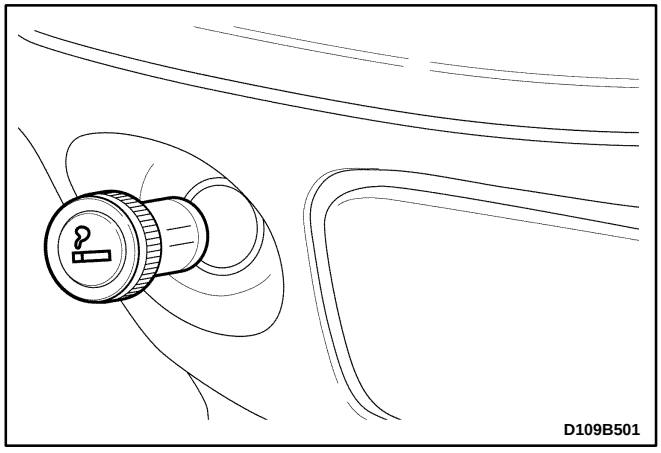


DIGITAL CLOCK

Condition	Probable Cause	Correction
Digital Clock Inoperative	• The open or a short in the power supply circuit to the fuse Ef2 regardless of the ignition position.	• Repair or Replace the power supply circuit wiring harness.
	• The open or a short in the power supply circuit to the fuse F1 with the ignition position I.	• Repair or Replace the power supply circuit wiring harness.
	• The open or a short in the power supply circuit to the fuse Ef12 with the interior courtesy lamp ON.	• Repair or Replace the power supply circuit wiring harness.
	• The circuit between the fuse Ef2 and the fuse F12 is open or short.	• Repair or Replace the wiring harness.
	• Fuse Ef2, Ef12, F1 or F12 is blown.	• Replace and fuse.
	• The circuit between the fuse F12 and the digital clock connector.	• Repair or Replace the wiring harness.
	• The circuit between the fuse F1 and the digital clock connector.	• Repair or Replace the wiring harness.
	• The circuit between the Ef12 and the digital clock connector.	• Repair or Replace the wiring harness.
	• Faulty digital clock.	• Replace the digital clock.
	• Open ground (G201) circuit.	• Repair the open ground circuit.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

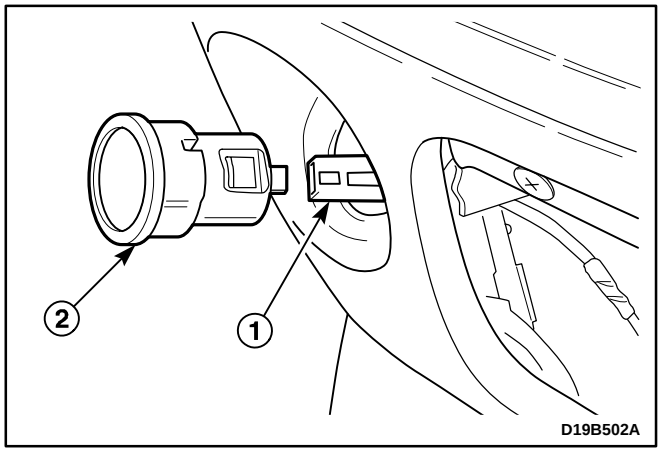


CIGAR LIGHTER

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

Removal Procedure

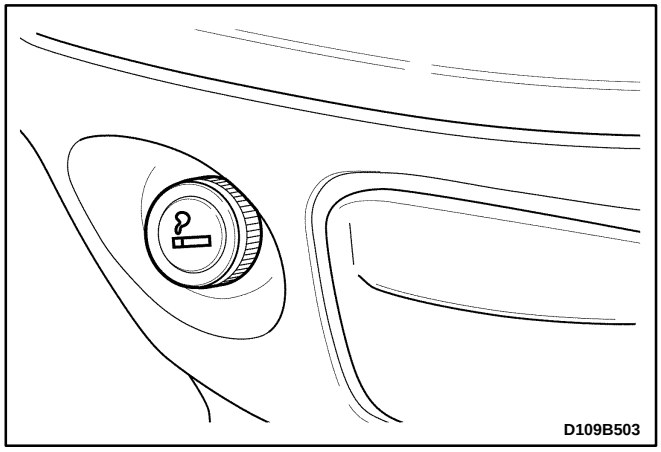
1. Disconnect the negative battery cable.
2. Remove the ashtray from the ashtray housing.
3. Remove the cigar lighter from the cigar lighter socket.



4. Remove the cigar lighter socket from the cigar lighter housing.

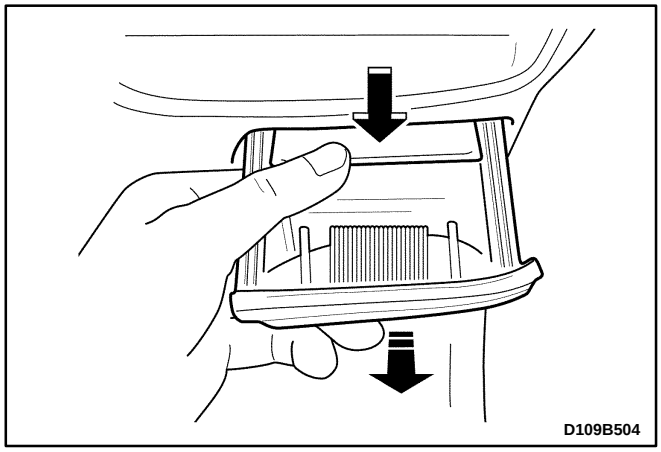
Caution: Ashtray housing edge could cause serious injury.

- Push out the socket.
- Disconnect the electrical connector (1).
- Remove the socket (2).



Installation Procedure

1. Connect the electrical connector.
2. Install the cigar lighter socket.
3. Install the cigar lighter in the cigar lighter socket.
4. Install the ashtray.
5. Connect the negative battery cable.

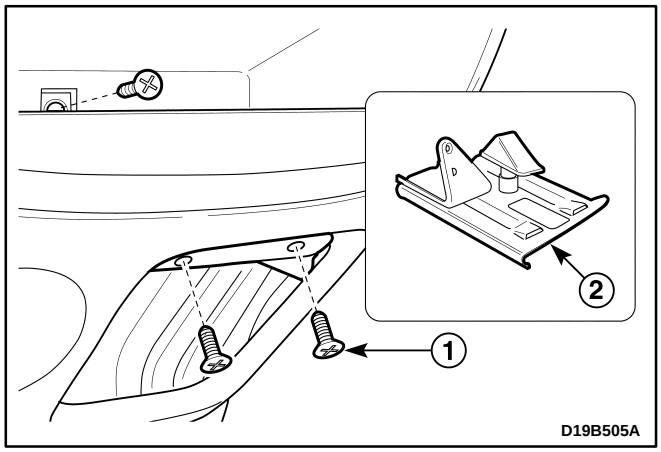


ASHTRAY

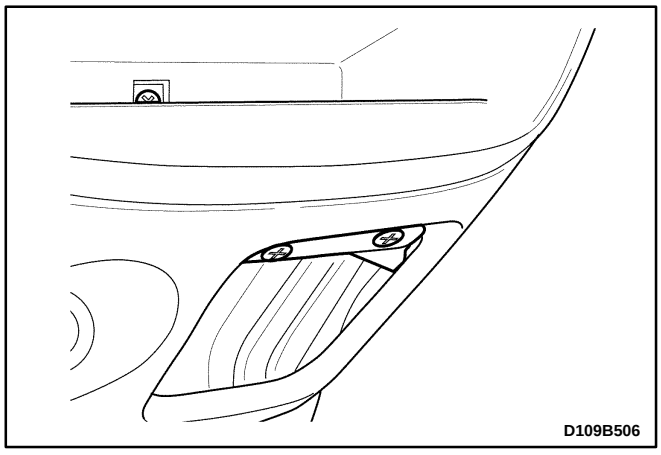
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

1. Remove the ashtray from the ashtray bracket.
   - Pull off the ashtray by pressing the upper button.

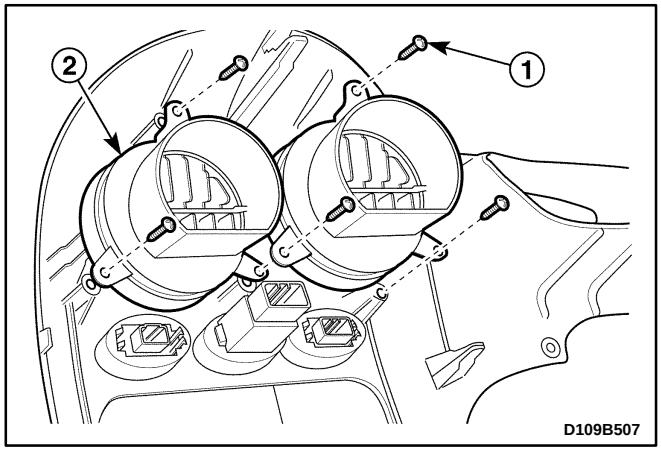


2. Remove the ashtray bracket from the instrument panel.
   - Remove the screws (1).
   - Remove the ashtray bracket (3).



Installation Procedure

1. Install the ashtray bracket with the screws.
2. Install the ashtray.

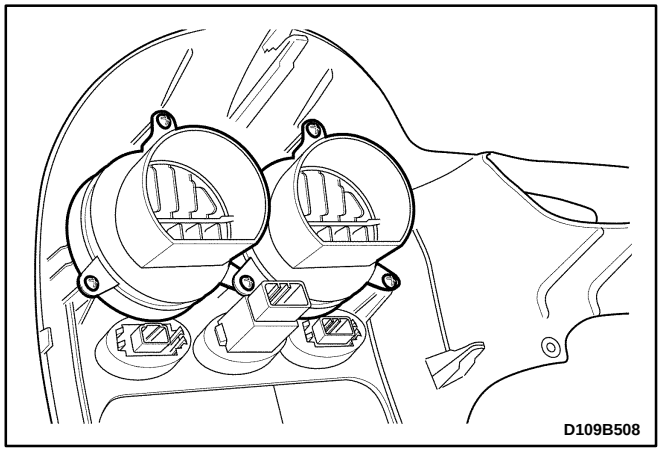


INSTRUMENT CLUSTER TRIM PANEL VENTS

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

Removal Procedure

1. Remove the instrument cluster trim panel from the instrument panel. Refer to “Instrument Cluster Trim Panel” in this section.
2. Remove the vent from the instrument cluster trim panel.
   - Remove the screws (1).
   - Remove the vents (2).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Installation Procedure

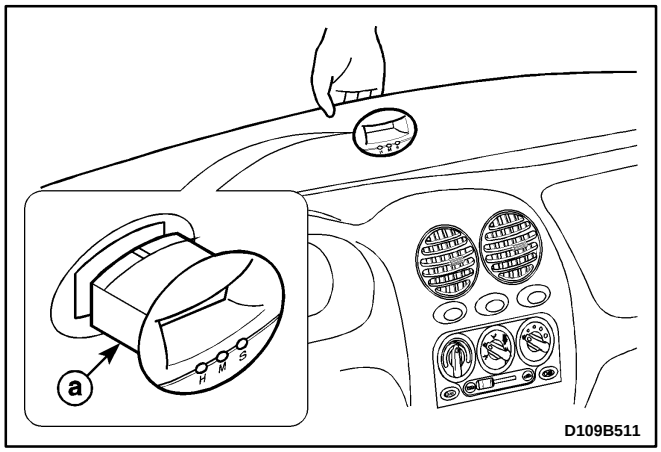
1. Install the vents to the instrument cluster trim panel with the screws.
2. Install the instrument cluster trim panel. Refer to “Instrument Cluster Trim Panel” in this section.

DIGITAL CLOCK

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

Removal Procedure

1. Disconnect the negative battery cable.
2. Pry off the defroster grille.
3. Unlock the locking of the digital clock.
   a. Digital clock.



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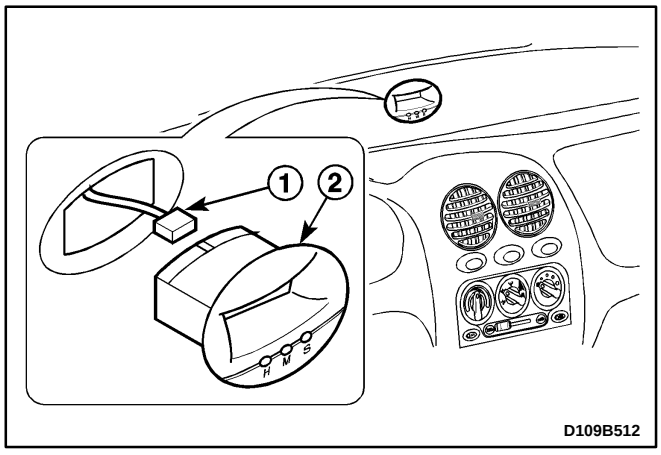
4. Remove the digital clock from the instrument panel.
   - Disconnect the electrical connector (1).
   - Remove the digital clock (2).



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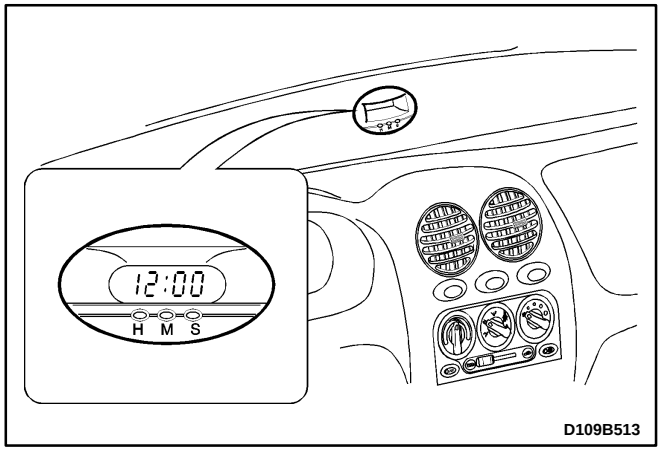
Installation Procedure

1. Connect the electrical connector.
2. Install the digital clock to the instrument panel.
3. Connect the negative battery cable.
4. Set the clock.



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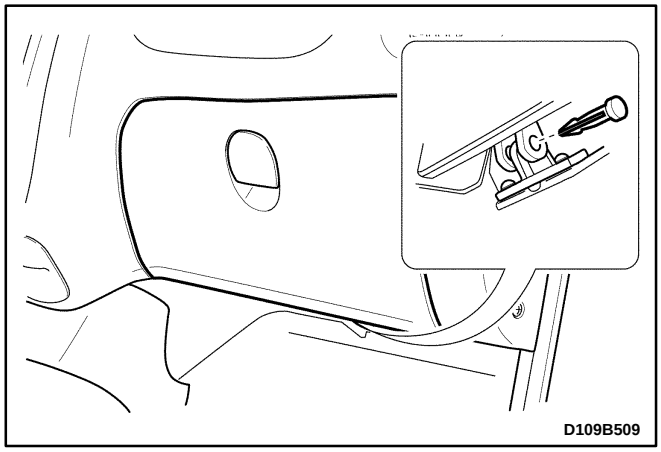
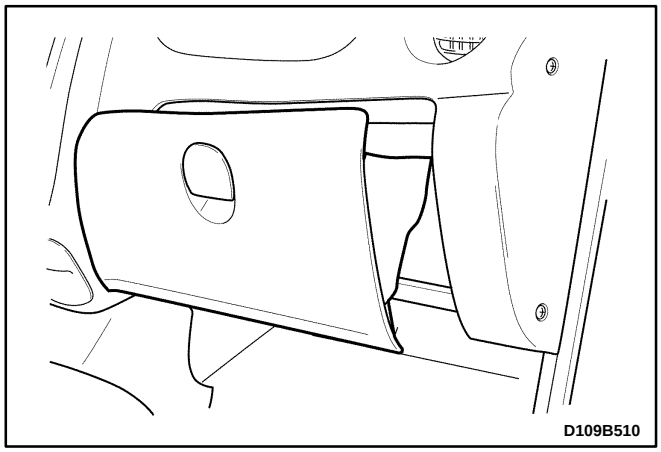


GLOVE BOX

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

Removal Procedure

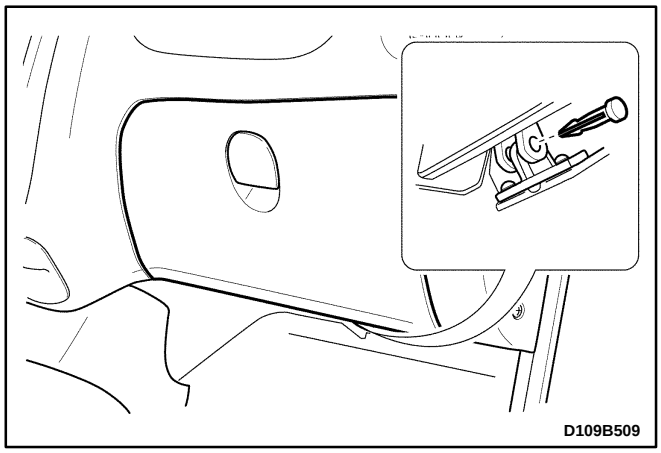
1. Remove the hinge pins at the base of the glove box.

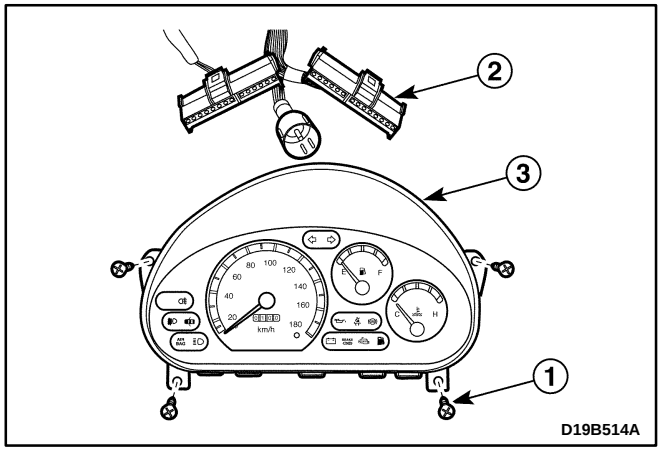


2. Remove the glove box from the instrument panel.

Installation Procedure

1. Install the glove box to the instrument panel with the hinge pins.

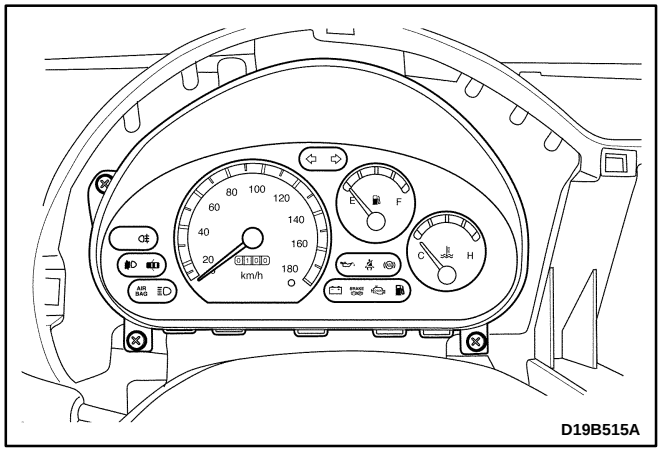




INSTRUMENT CLUSTER

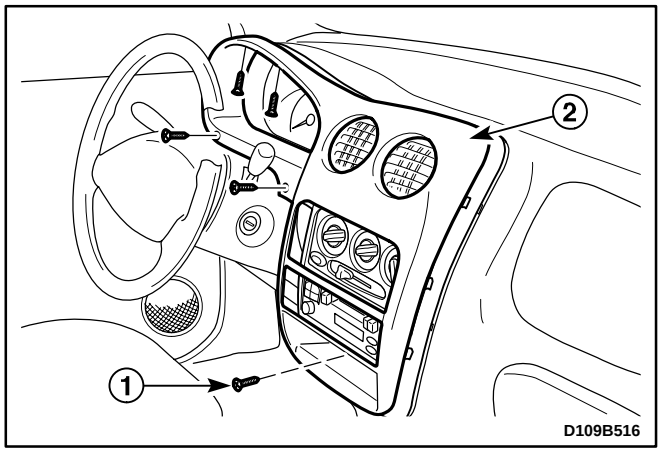
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster trim panel from the instrument panel. Refer to “Instrument Cluster Trim Panel” in this section.
3. Remove the instrument cluster assembly from the instrument panel.
   - Remove the screws (1).
   - Disconnect the electrical connector and the speedometer cable (2).
   - Remove the instrument cluster (3).



Installation Procedure

1. Connect the electrical connector and the speedometer cable.
2. Install the instrument cluster assembly to instrument panel with screws.
3. Install the instrument cluster trim panel to the instrument panel. Refer to “Instrument Cluster Trim Panel” in this section.
4. Connect the negative battery cable.



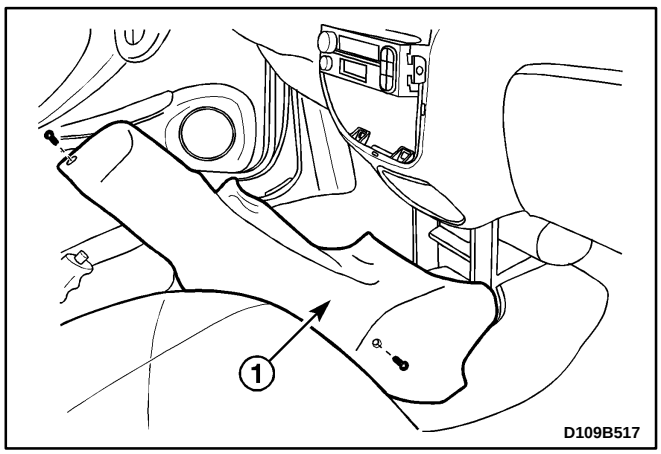
INSTRUMENT PANEL

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

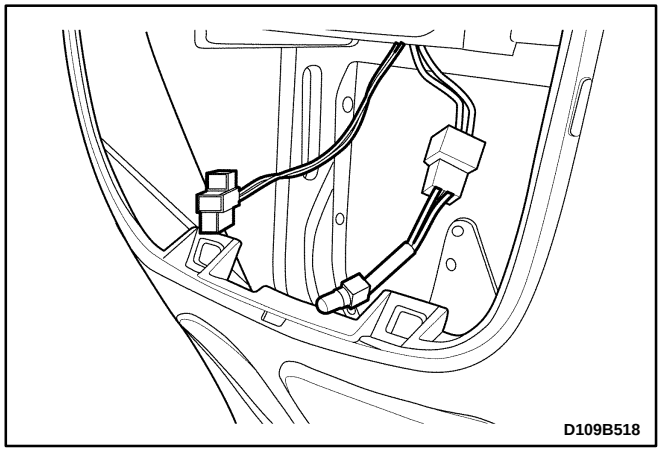
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the driver’s airbag module from the steering wheel. Refer to *Section 8B, Supplemental Inflatable Restraints (SIR)* (For the vehicle equipped with the airbag).
3. Remove the steering wheel from the steering column. Refer to *Section 6E, Steering Wheel and Column.*
4. Remove the steering column trim cover. Refer to *Section 6E, Steering Wheel and Column.*
5. Remove the signal lamp switch and the wiper switch. Refer to *Section 6E, Steering Wheel and Column.*
6. Pry off the A–pillar trim panels. Refer to *Section 9G, Interior Trim.*
7. Remove the instrument cluster trim panel from the instrument panel.
   - Remove the screws (1)
   - Using a flathead screwdriver, remove the instrument cluster trim panel (2).

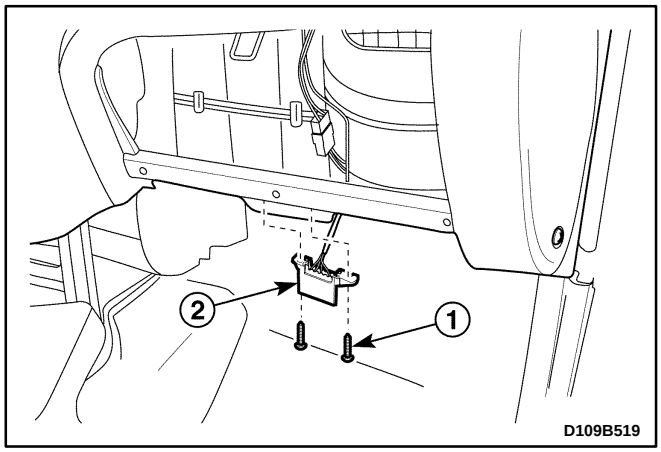
Notice: To prevent the instrument panel damage, cover the flathead screwdriver with a soft cloth.



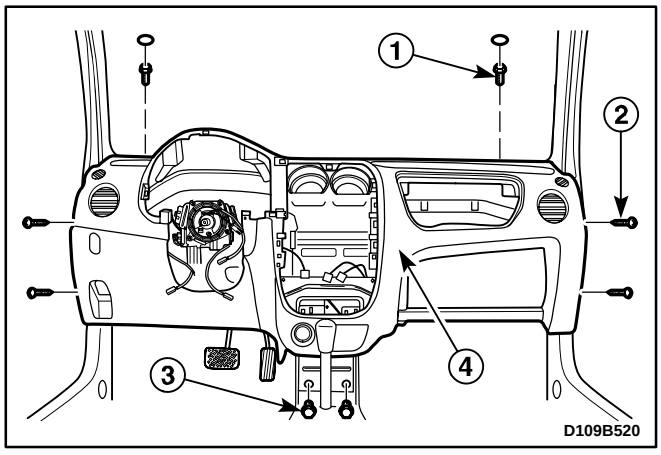
8. Remove the hood latch release lever from the instrument panel. Refer to *Section 9R, Body Front End.*
9. Remove the glove box assembly from the instrument panel. Refer to “Glove Box” in this section.
10. Remove the passenger’s airbag module from the instrument panel. Refer to *Section 8B, Supplemental Inflatable Restraints (SIR)* (For vehicle equipped with the airbag).
11. Put aside the floor console after removing the screws (1).



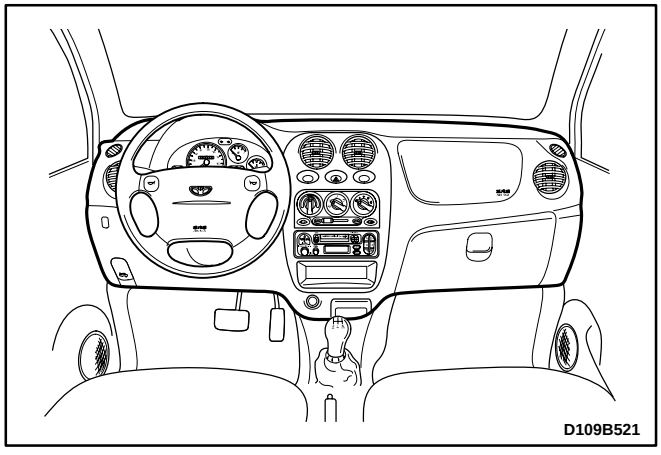
12. Remove the instrument cluster assembly. Refer to “Instrument Cluster” in this section.
13. Remove the A/C controller from the instrument. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*
14. Remove the audio system from the instrument panel. Refer to *Section 9F, Audio Systems*.
15. Disconnect the cigar lighter connector.
16. Disconnect the ashtray lamp if equipped.



17. Disconnect the ALDL connector.
    - Remove the screws (1).
    - Disconnect the ALDL connector (2).



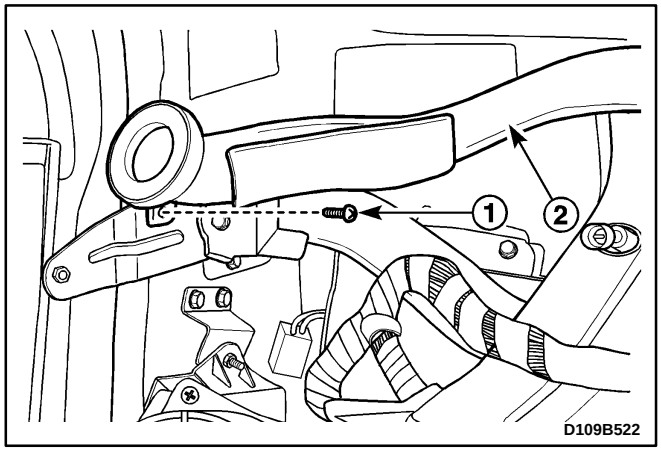
18. Remove the instrument trim panel assembly.
    - Remove the bolts after removing the caps (1).
    - Remove the screws on the side plate (2).
    - Remove the tie–bar retaining bolts on the lower panel (3).
    - Remove the instrument trim panel assembly (4).



Installation Procedure

1. Install the instrument trim panel assembly with the bolts and screws.
2. Connect the ALDL connector with the screws.
3. Connect the ashtray lamp if equipped with.
4. Connect the cigar lighter connector.
5. Install the audio system to the instrument panel. Refer to *Section 9F, Audio Systems.*
6. Install the A/C controller to the instrument panel. Refer to *Section 7B, Manual Control Heating, Ventilation, and Air Conditioning System.*

7. Install the instrument cluster assembly. Refer to “Instrument Cluster” in this section.
8. Install the floor console with the screws.
9. Install the passenger’s airbag module to the instrument panel. Refer to *Section 8B, Supplemental Inflatable Restraints (SIR)* (For vehicle equipped with the airbag).
10. Install the glove box assembly to the instrument panel. Refer to “Glove Box” in this section.
11. Install the hood latch release lever to the instrument panel. Refer to *Section 9R, Body Front End*.
12. Install the instrument cluster trim panel to the instrument cluster trim panel with the screws.
13. Install the A–pillar trim panels. Refer to *Section 9G, Interior Trim.*
14. Install the signal lamp switch and the wiper switch. Refer to *Section 6E, Steering Wheel and Column*.
15. Install the steering column trim cover. Refer to *Section 6E, Steering Wheel and Column*.
16. Install the steering wheel to the steering column.
17. Install the driver’s airbag module to the steering wheel. Refer to *Section 8B, Supplemental Inflatable Restraints (SIR)* (For vehicle equipped with the airbag).
18. Connect the negative battery cable.

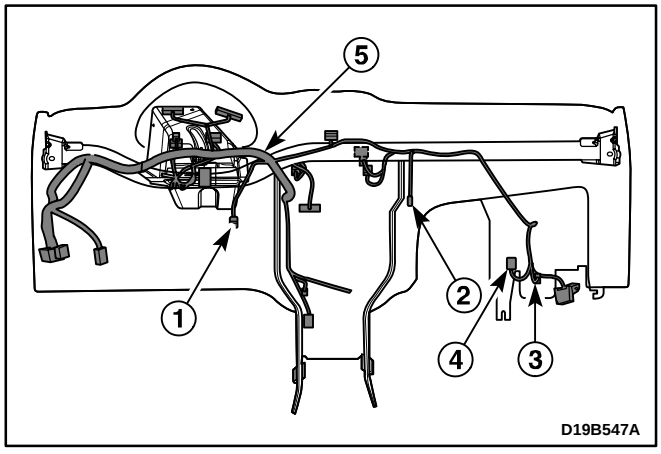


TIE–BAR

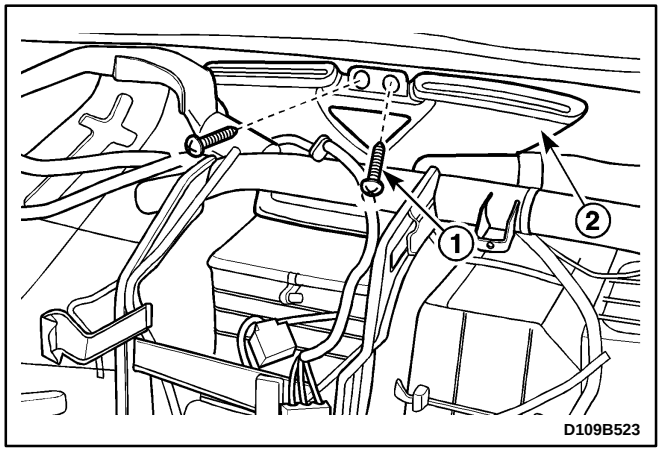
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

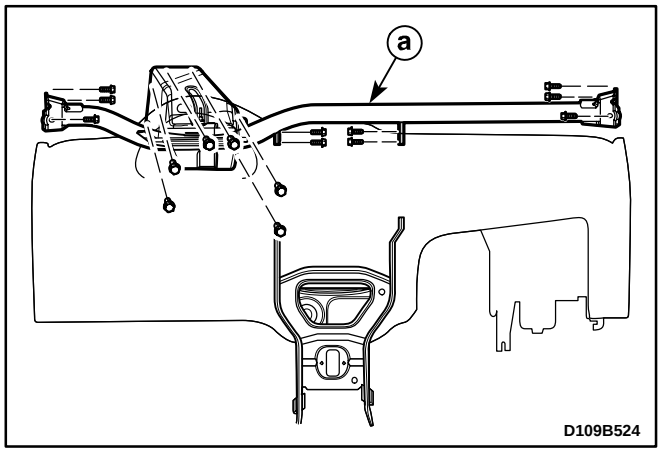
1. Disconnect the negative battery cable.
2. Remove the instrument panel assembly. Refer to “Instrument Panel” in this section.
3. Remove the defroster duct hose from the tie–bar.
   - Remove the screws (1).
   - Remove the defroster duct hose (2).



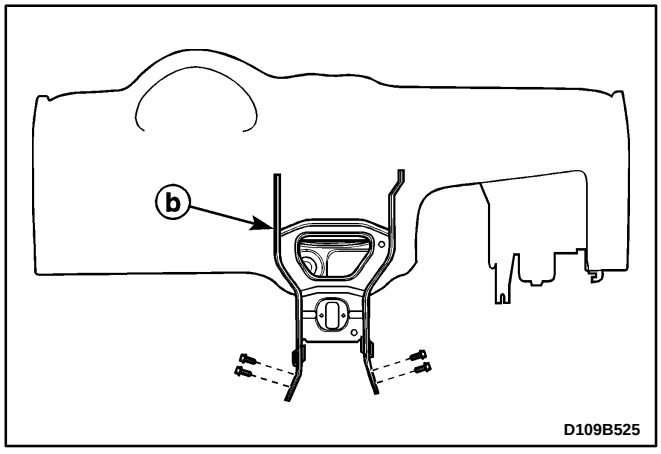
4. Remove the nuts and the steering column. Refer to *Section 6E, Steering Wheel and Column*.
5. Disconnect the electrical connectors and electrical wiring harness after removing the electrical wiring harness strips.
   - Remove the electrical wiring harness strip.
   - Disconnect the brake switch connector (1).
   - Disconnect the thermostat connector (2).
   - Disconnect the blow motor connector (3).
   - Disconnect the blow motor resistance connector (4).
   - Disconnect the electrical wiring harness (5).



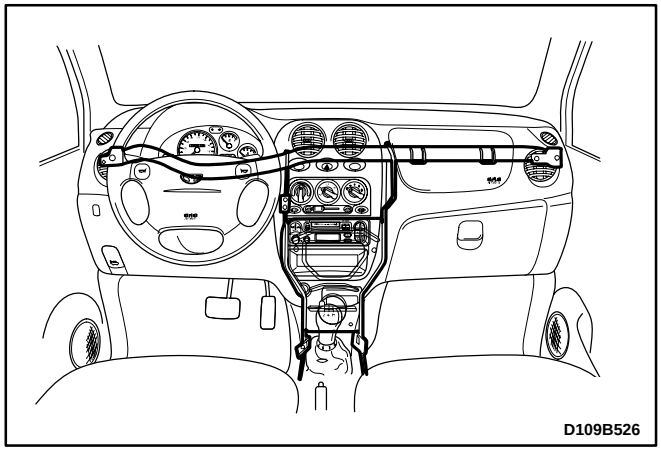
6. Remove the defroster duct from the cowl upper panel.
   - Remove the screws (1).
   - Remove the defroster duct (2).



7. Remove the bolts and the tie–bar.
   a. Tie bar.



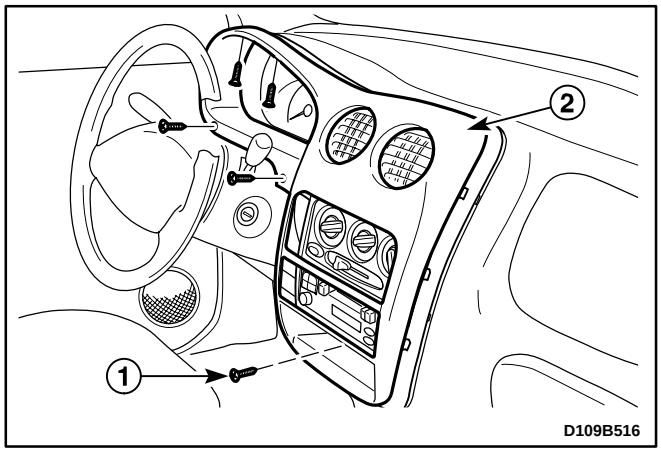
8. Remove the bolts and the tie–bar center.
   b. Tie bar center.



Installation Procedure

1. Install the tie–bar with the bolts.
2. Install the tie–bar center with the bolts.
3. Install the defroster duct to the cowl upper panel with the screws.

4. Connect the electrical wiring harness.
5. Connect the blow motor resistance connector.
6. Connect the blow motor connector.
7. Connect the thermostat connector.
8. Connect the brake switch connector.
9. Bind the electrical wiring harness strip.
10. Install the steering column with the nuts.
11. Install the defroster duct hose with the screws.
12. Install the instrument panel assembly. Refer to “Instrument Panel” in this section.
13. Connect the negative battery cable.



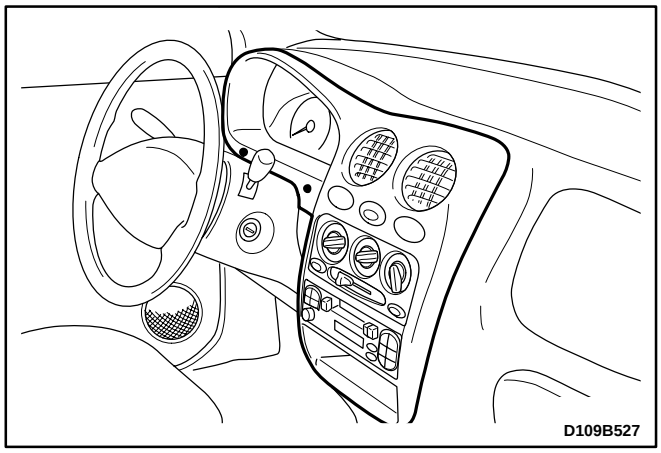
INSTRUMENT CLUSTER TRIM PANEL

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

Removal Procedure

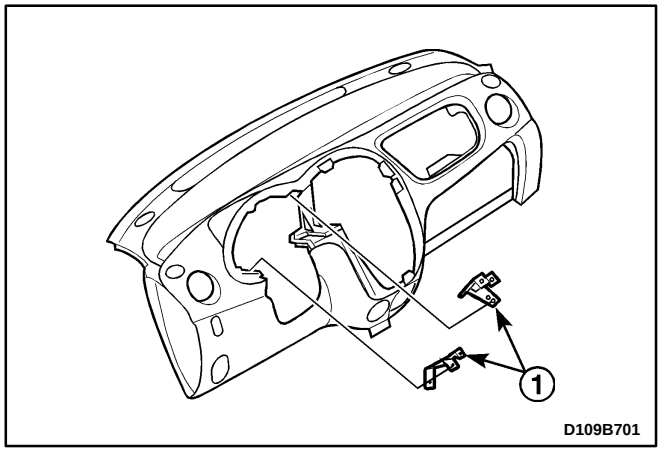
1. Remove the instrument cluster trim panel from the instrument panel.
   - Remove the screws (1).
   - Using a flathead screwdriver, remove the central console cover (2).

Notice: To prevent the instrument panel damage, cover the flathead screwdriver with a soft cloth.



Installation Procedure

1. Install the instrument cluster trim panel with the screws.

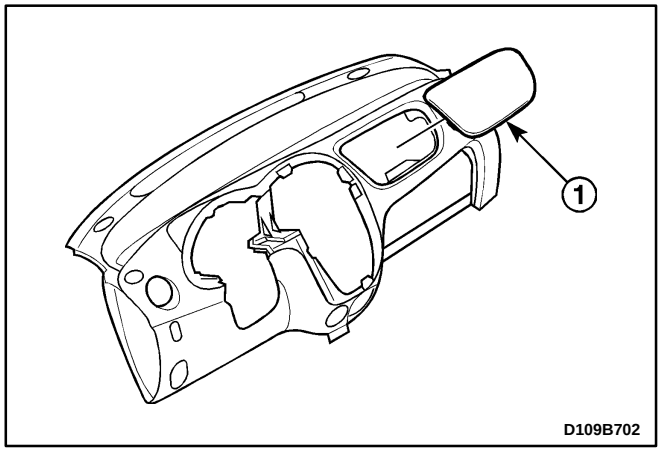


INSTRUMENT TRIM PANEL ASSEMBLY

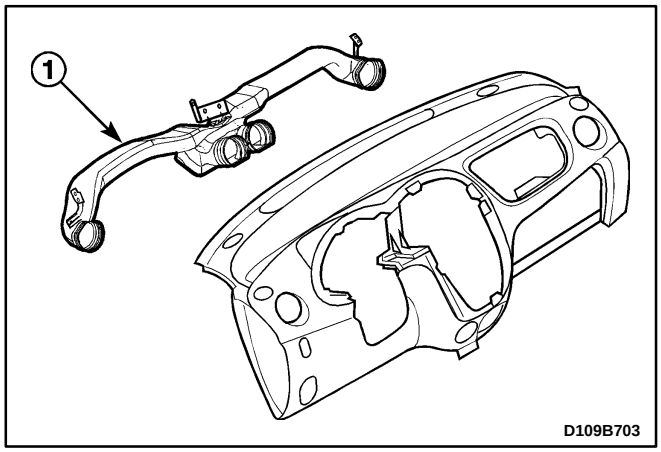
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

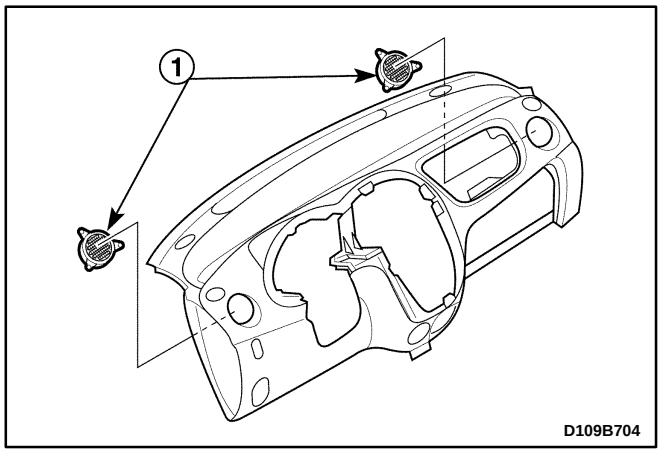
1. Disconnect the negative battery cable.
2. Remove the instrument panel assembly. Refer to “Instrument Panel” in this section.
3. Remove the instrument cluster brackets from the instrument panel.
   - Remove the screws.
   - Remove the instrument cluster brackets (1).



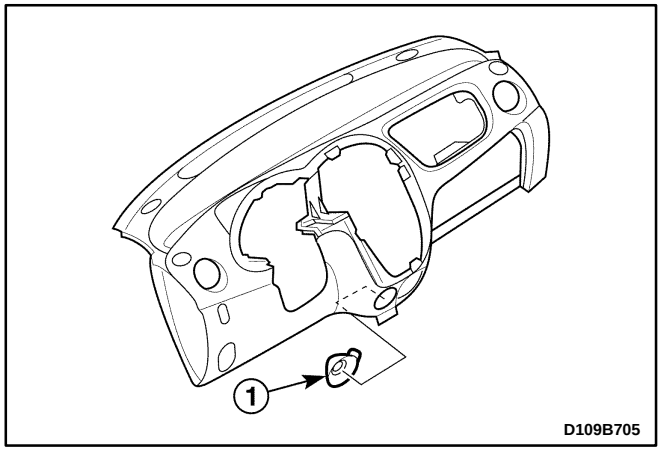
4. Remove the passenger's airbag module blank cover from the instrument panel.
   - Remove the screws.
   - Remove the passenger's airbag module blank cover (1).



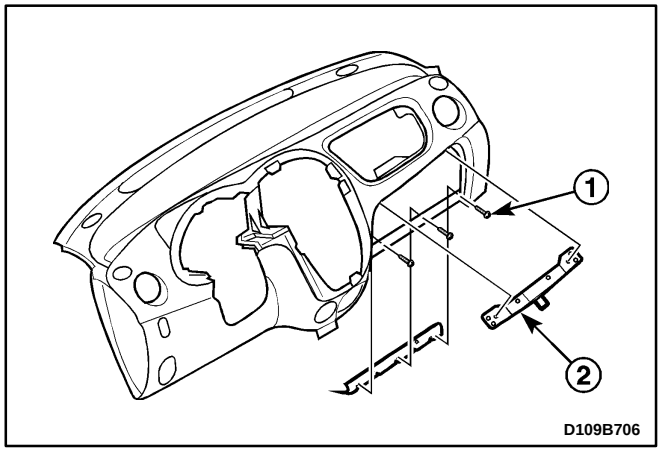
5. Remove the ventilation duct from the instrument panel.
   - Remove the screws.
   - Remove the ventilation duct (1).



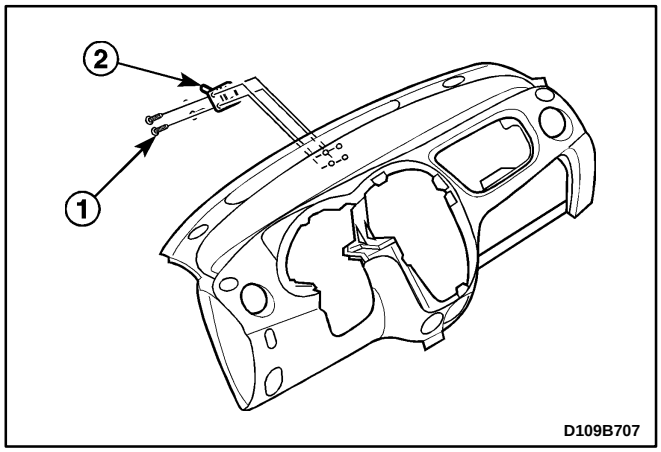
6. Remove the ventilation grilles from the instrument panel.
   - Remove the screws.
   - Remove the ventilation grilles (1).



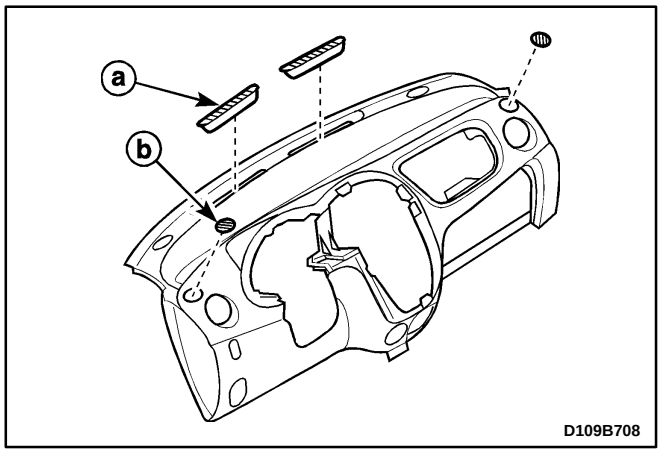
7. Remove the cigar lighter housing from the instrument panel.
   - Remove the screws.
   - Remove the cigar lighter housing (1).



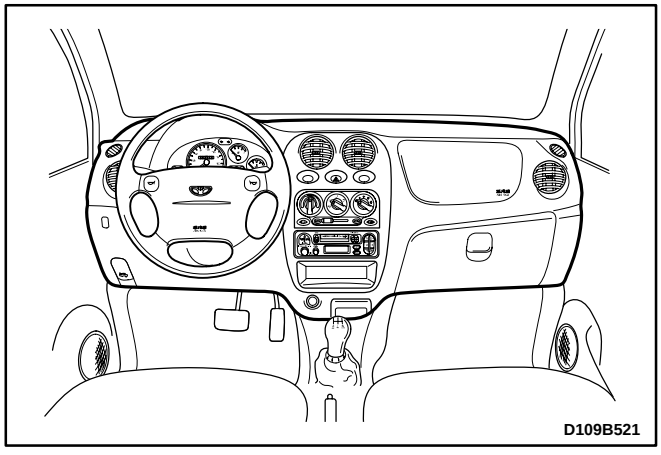
8. Remove the glove box striker and bracket from the instrument panel.
   - Remove the screws (1).
   - Remove the glove box striker and bracket (2).



9. Remove the instrument panel guide from the instrument panel.
   - Remove the screws (1).
   - Remove the instrument panel guide (2).

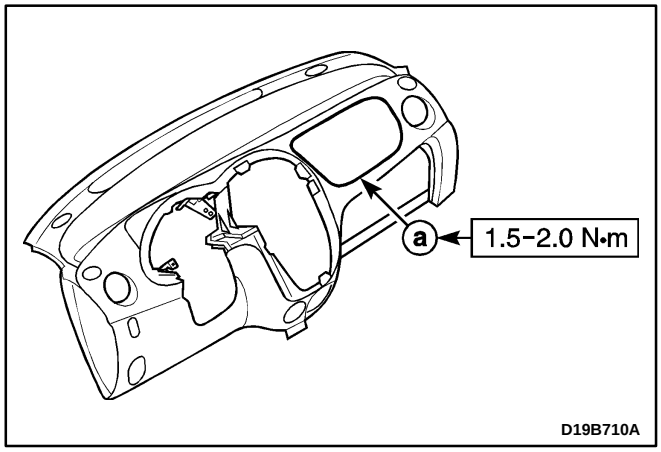


10. Remove the defroster grilles and the demister grilles from the instrument panel.
    a. Defroster grille.
    b. Demister grille.



Installation Procedure

1. Install the defroster grilles and the demister grilles to the instrument.
2. Install the instrument panel guide to the instrument panel with the screws.
3. Install the glove box striker and the bracket to the instrument panel with the screws.
4. Install the cigar lighter housing to the instrument panel with the screws.
5. Install the ventilation grilles to the instrument panel with the screws.
6. Install the ventilation duct to the instrument panel with the screws.

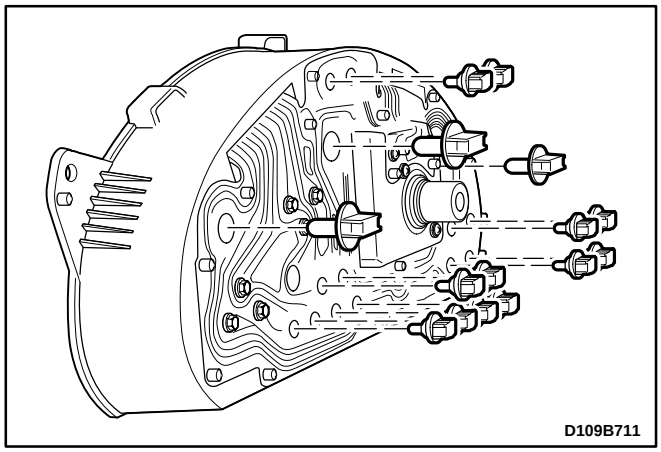


7. Install the passenger's airbag module blank cover to the instrument panel with the screws.

   Tighten

   Tighten the screws to 1.5–2 N.m (13–18 lb-in).

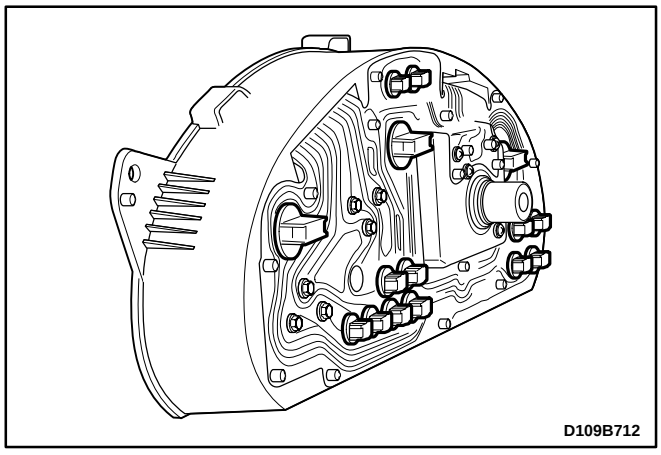
   a. Passenger's airbag module blank cover screw
8. Install the instrument cluster brackets to the instrument panel with the screws.
9. Install the instrument panel assembly. Refer to "Instrument Panel" in this section.
10. Connect the negative battery cable.



INSTRUMENT CLUSTER INDICATOR LAMPS

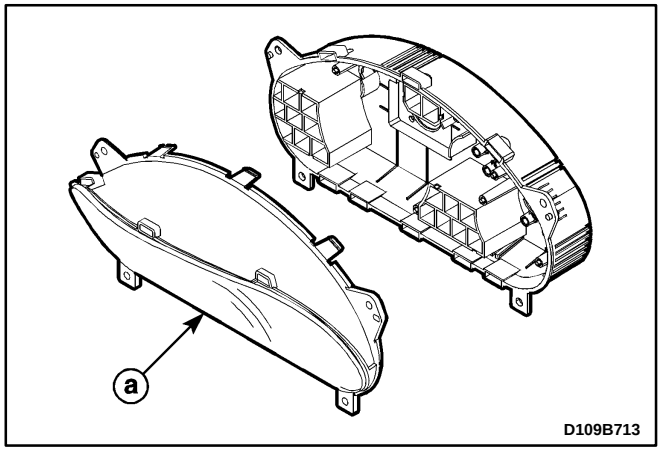
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster from the instrument panel. Refer to "Instrument Cluster" in this section.
3. Remove the indicator bulbs from the rear of the cluster.



Installation Procedure

1. Install the indicator bulb.
2. Install the instrument cluster to the instrument panel. Refer to "Instrument Cluster" in this section.
3. Connect the negative battery cable.

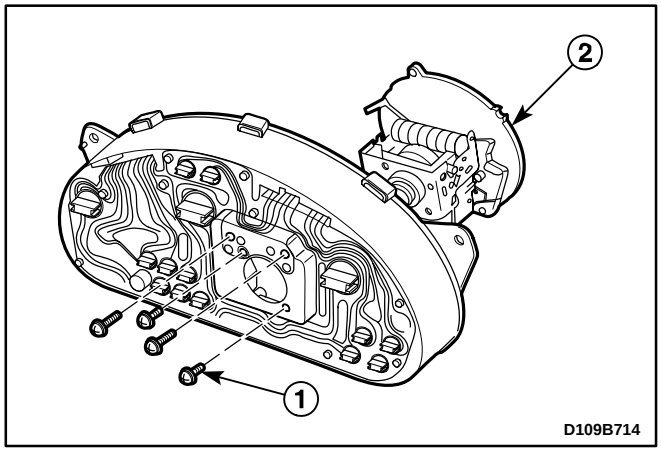


SPEEDOMETER/ODOMETER/TRIP ODOMETER

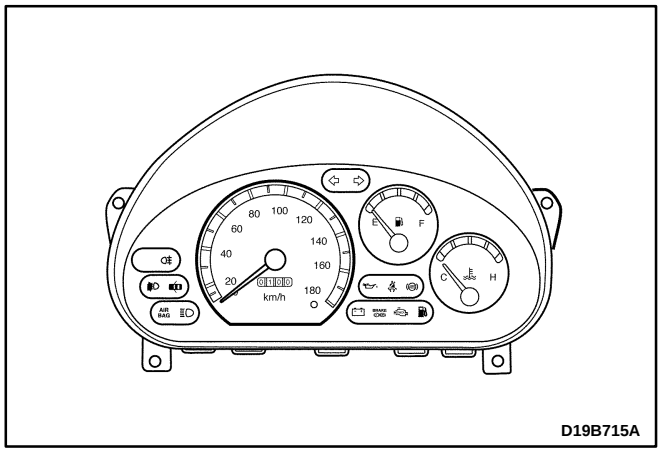
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster from the instrument panel. Refer to "Instrument Cluster" in this section.
3. Remove the instrument cluster lens and the face plate.

   a. Window plate.

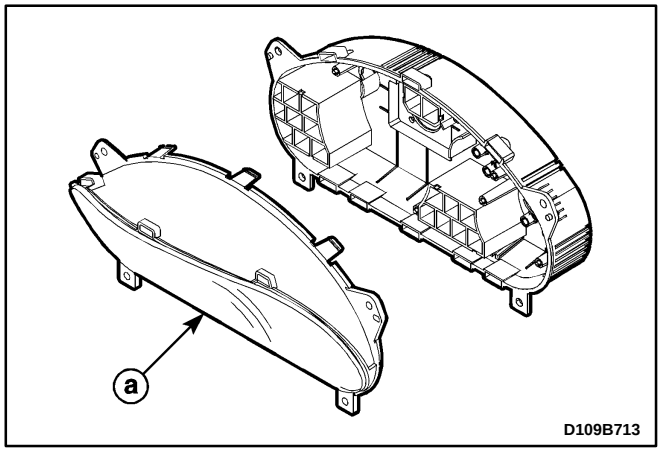


4. Remove the speedometer/odometer/trip odometer.
   - Remove the screws on the circuit plate (1).
   - Remove the speedometer/odometer/trip odometer (2).



Installation Procedure

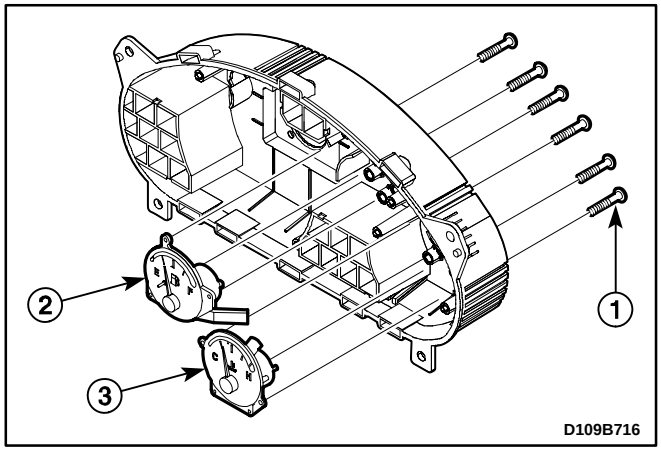
1. Install the speedometer/odometer/trip odometer with the screws.
2. Install the instrument cluster lens and the face plate.
3. Install the instrument cluster. Refer to “Instrument Cluster” in this section.
4. Connect the negative battery cable.



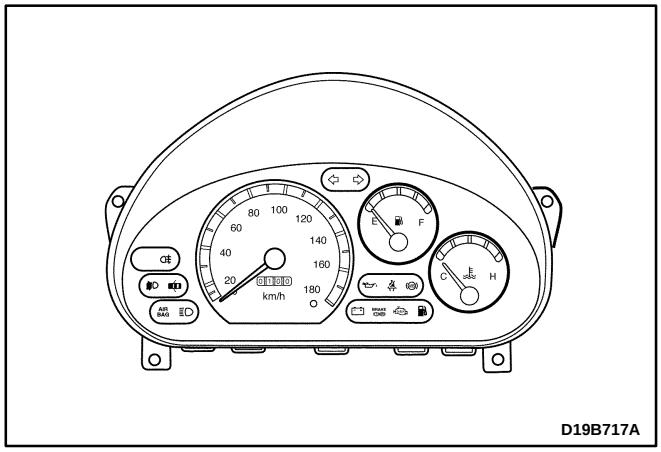
FUEL GAUGE/TEMPERATURE GAUGE

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster. Refer to “Instrument Cluster” in this section.
3. Remove the instrument cluster lens and the face plate.
   a. Window plate.



4. Remove the fuel gauge/temperature gauge from the cluster assembly.
   - Remove the screws on the circuit plate (1).
   - Remove the fuel gauge (2).
   - Remove the temperature gauge (3).



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Installation Procedure

1. Install the fuel gauge/temperature gauge to the cluster assembly with the screws.
2. Install the instrument cluster lens and the face plate.
3. Install the instrument cluster. Refer to “Instrument Cluster” in this section.
4. Connect the negative battery cable.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

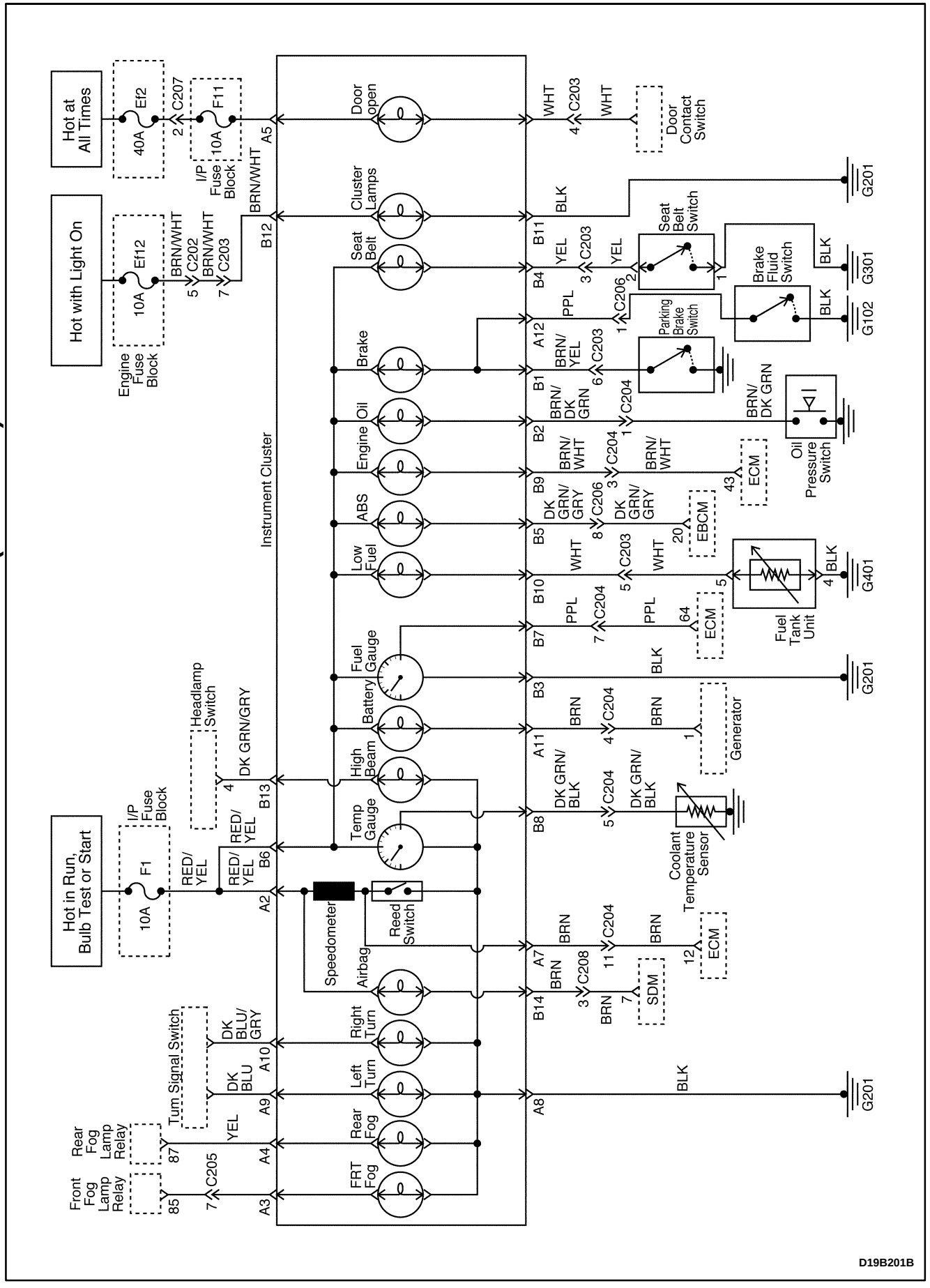
Application	N•m	Lb-Ft	Lb-In
Passenger's Airbag Module Blank Cover Screw	1.5–2	–	13–18

INSTRUMENT CLUSTER INDICATOR LAMPS SPECIFICATIONS

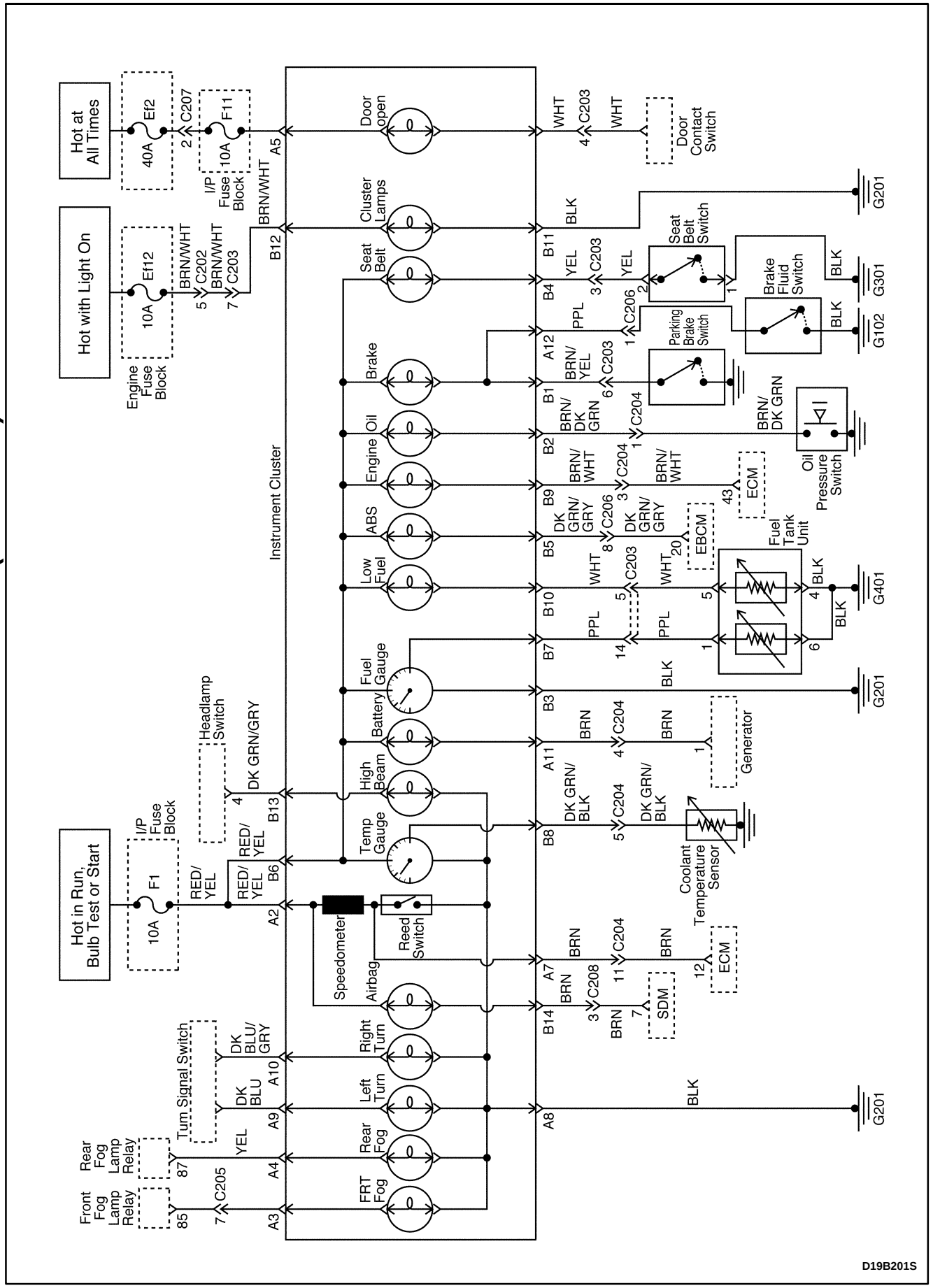
Indicator Lamp	Color	Bulb
ABS Warning	Amber	14 v 1.4 W
Airbag Warning	Red	14 v 1.4 W
Battery Charge Indicator	Red	14 v 1.4 W
Fasten Seat Belt Warning	Red	14 v 1.4 W
High Beam Indicator	Blue	14 v 1.4 W
Low Fuel Level Warning	Amber	12 v 3 W
Oil Pressure Warning	Red	14 v 1.4 W
Parking Brake Indicator and Brake Fluid Warning	Red	14 v 1.4 W
Service Engine Soon Warning	Amber	14 v 1.4 W
Turn Signal Indicators	Green	14 v 1.4 W
Instrument Cluster Illumination	Blue	12 v 3 W
Rear Fog Lamp Indicator	Amber	14 v 1.4 W

SCHEMATIC AND ROUTING DIAGRAMS

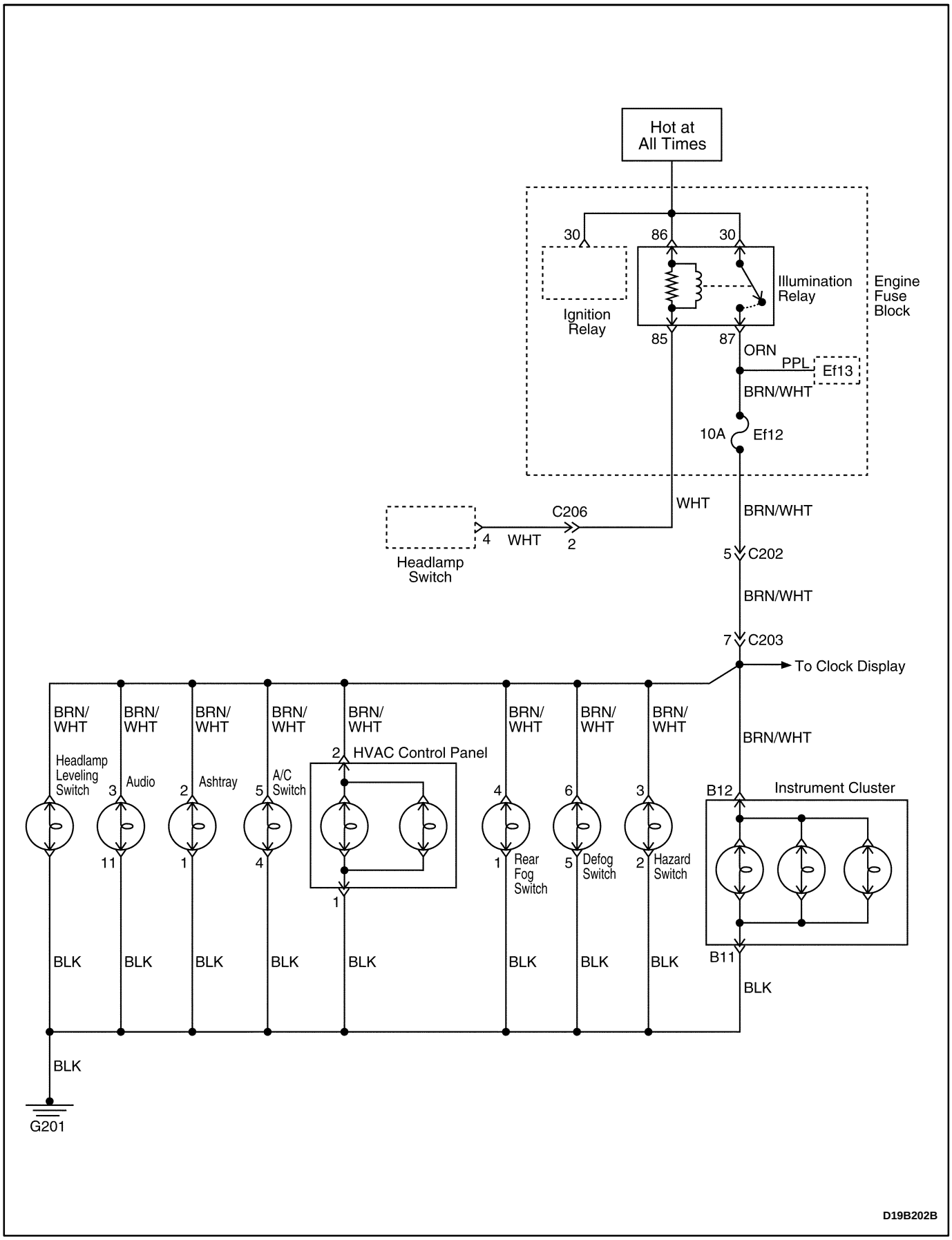
INSTRUMENT CLUSTER (SIRIUS D3)



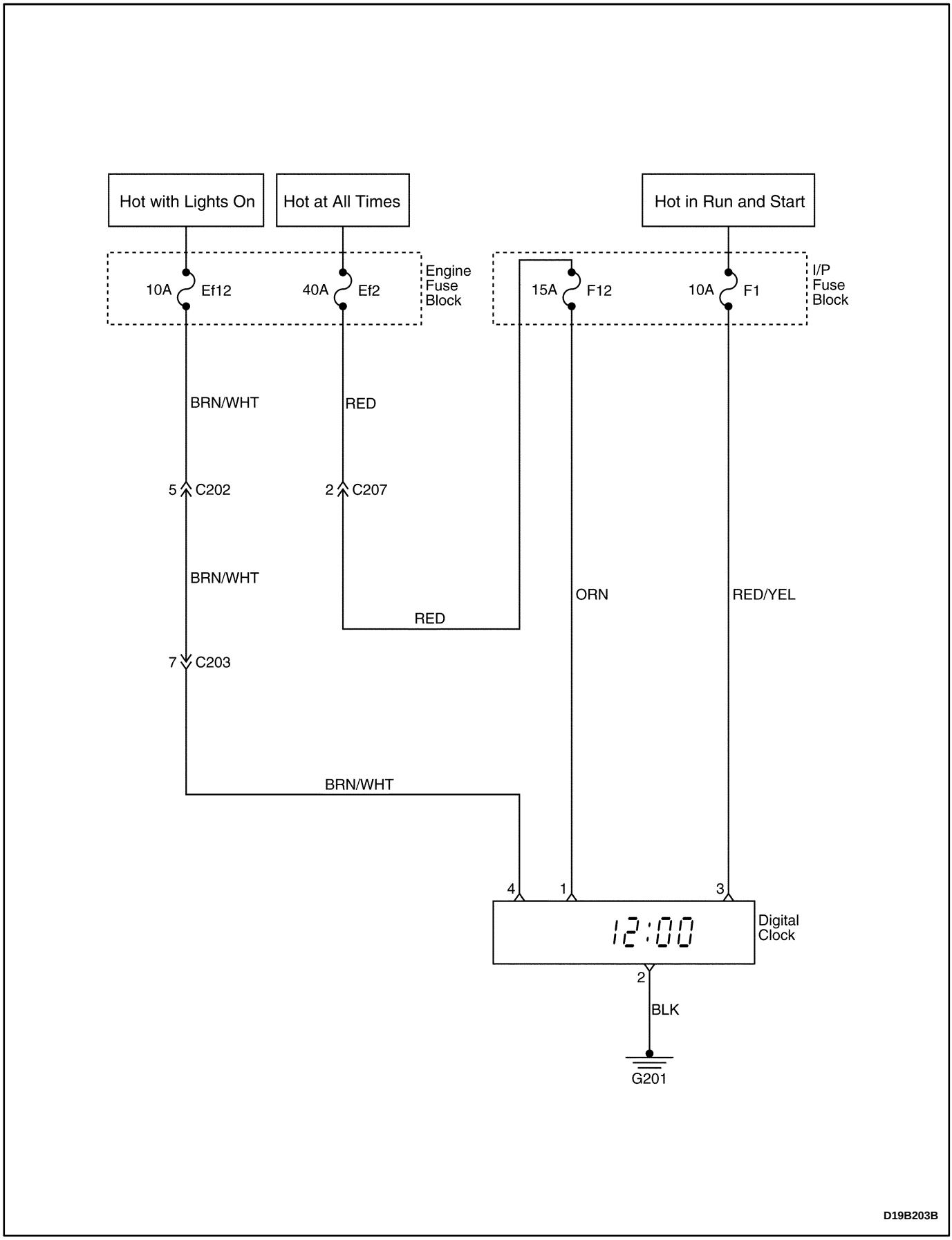
INSTRUMENT CLUSTER (FENIX 5MR)



INSTRUMENT PANEL ILLUMINATION



DIGITAL CLOCK



SECTION 9F

AUDIO SYSTEMS

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.

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DESCRIPTION AND OPERATION

STEREO CASSETTE AM/FM RADIO WITH CD CHANGER AND RDS/AUDIO SECURITY SYSTEM

The stereo digital logic cassette AM/FM radio with electronic tape ejection and the stereo digital logic cassette AM/FM radio with a CD changer located under the front seat (LH) are optional equipment.

The radio data system (RDS) uses a single button to select a specific radio station once it is set to the listener's preference.

The audio security system is activated whenever the audio system circuit is disconnected from the battery. A four-digit security code must be entered in order for the audio system to be functional once again. The security code is stamped on a card located in the vehicle (usually in the glove box). One of the following security code entering procedures can be followed.

With RDS

1. With the ignition switch in the I or II position, turn the radio ON. At this time, "CODE" will be shown on the radio display.
2. Press the P-UP button until the correct first digit is shown on the display.
3. Press the P-DN button to move over to the second digit and then press P-UP once again to enter the correct second digit.
4. Use steps two and three to enter the third and fourth digits using the same method.
5. After entering the correct four-digit security code, press the TP button. "CODE OK" will briefly appear on the radio display, and the system is ready for use.

Wrong Code

If the wrong code is entered, "ERROR 1" will appear on the display. After this, "CODE" will appear once again, and the correct security code can be entered. The time between each new coding attempt is doubled; a total of ten coding attempts can be made.

FRONT AND REAR SPEAKERS

All audio systems use four speakers: two speakers mounted in the front doors and two speakers mounted in the rear parcel side shelf.

ROOF ANTENNA

Roof antenna is located on the roof and is designed to separate the antenna pole from the antenna base. The antenna pole should be removed to prevent the painting damage before washing the vehicle. The roof antenna cannot be adjusted.

TAPE PLAYER AND CASSETTE CARE

The head and the capstan are the two parts of the tape player that should be cleaned. This service should be performed every 100 hours of cassette operation.

In order to clean the head and the capstan, use a cotton swab dipped in rubbing alcohol.

A cassette cleaning kit may also be used to clean the head and the capstan. Follow the cleaning kit instructions to clean the tape player.

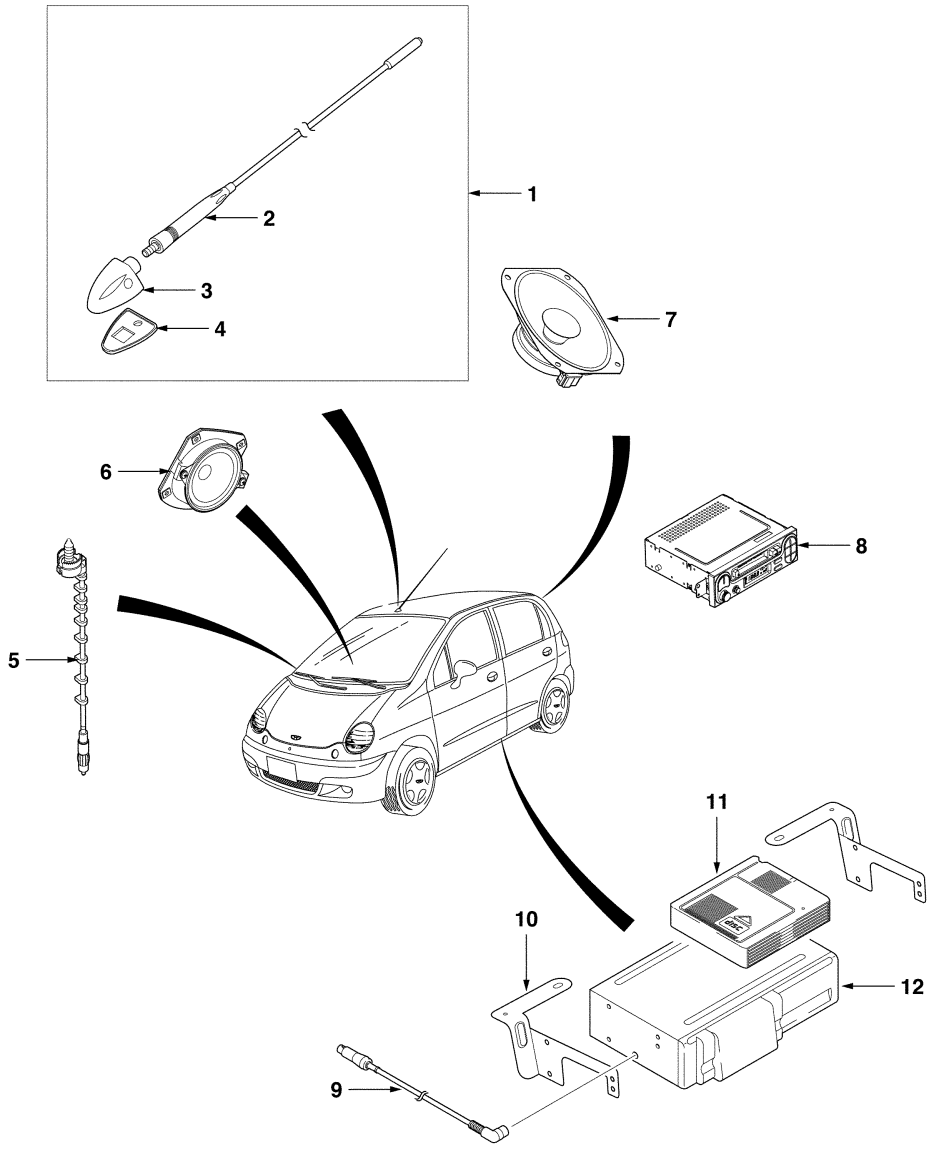
Do not touch the tape head with magnetized tools. If the head becomes magnetized, it will degrade cassettes played in the player. No service is performed on the cassettes. The cassette manufacturer handles warranties of the cassettes. Store cassettes away from extreme heat and direct sunlight.

COMPACT DISC CARE

Handle discs carefully. Store the discs in protective cases away from the sun, heat, and dust. If the surface is soiled, dampen a clean, soft cloth in a solution of mild neutral detergent and wipe the disc clean. Mini discs (about 3 inches in diameter), will not eject and should not be used.

COMPONENT LOCATOR

AUDIO SYSTEMS



1. Roof Antenna Assembly
2. Roof Antenna Pole
3. Roof Antenna Base
4. Roof Antenna Frame
5. Roof Antenna Cable
6. Front Speaker
7. Rear Speaker
8. Audio
9. CD Changer Cable
10. CD Changer Bracket
11. CD Changer Magazine
12. CD Changer

DIAGNOSTIC INFORMATION AND PROCEDURES

AUDIO SYSTEM

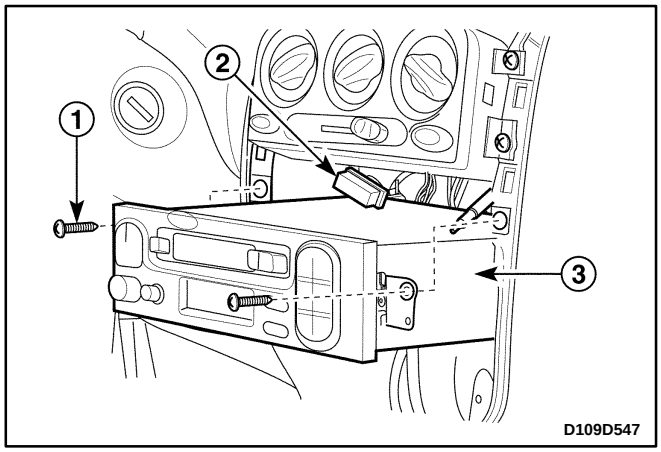
Condition	Probable Cause	Correction
Audio System Inoperative	● The power supply circuit to the fuse Ef2 is open circuit or short circuit.	● Repair or Replace the power supply wiring harness.
	● The fuse Ef2 is blown.	● Replace the fuse.
	● The circuit between the fuse Ef2 and the fuse F11 is open or short.	● Repair or Replace the wiring harness.
	● The fuse F6 or the fuse F11 is blown.	● Replace the fuse.
	● The audio system circuit to the fuse F6 or the fuse F11 is open circuit or short circuit.	● Repair or Replace the wiring harness.
	● Poor ground G201.	● Replace or Replace the wiring harness.
	● Audio system is out of order.	● Replace the audio system.
Cassette Player Inoperative, AM/FM Functions OK	● Bad–quality tape.	● Do not use a bad-quality tape.
	● The cassette player destroy a good–quality tape.	● Clean the cassette player head, the capstan, and the drive system.
	● Obstructions behind the tape door.	● Remove the obstruction using gentle force.
	● Cassette player is out of order.	● Replace the audio system.
FM Does Not Work, AM and Cassette OK	● Audio system is out of order.	● Replace the audio system.
AM Radio Does Not Work, FM and Cassette OK	● AM radio reception is poor (Using a test antenna, test the AM radio reception).	● Replace the audio system.
	● AM radio reception is good (Using a test antenna, test the AM radio reception).	● Replace the antenna cable between the audio system and the antenna.
Front Speakers Distorted or Inoperative	● Damage, rattles, or vibration of the speaker and the door area.	● Make the necessary repairs to secure the component causing the distortion.
	● The circuit between the front speaker connector and the radio connector is open circuit or short circuit.	● Repair or Replace the wiring harness.
	● The connection of the front speaker connector and the audio connector is poor.	● Confirm the connection.
	● Front speaker is out of order.	● Replace the front speaker.
	● Audio system is out of order.	● Replace the audio system.
Rear Speakers Distorted or Inoperative	● Damage, rattles, or vibration of the rear speaker and the rear parael side shelf.	● Make the necessary repairs to secure the component causing the distortion.
	● The circuit between the rear speaker connector and the radio connector is open circuit or short circuit.	● Repair or Replace the wiring harness.

AUDIO SYSTEM (Cont'd)

Condition	Probable Cause	Correction
Rear Speakers Distorted or Inoperative	● The connection of the rear speaker connector and the audio connector is poor.	● Confirm the connection.
	● Rear speaker is out of order.	● Replace the rear speaker.
	● Audio system is out of order.	● Replace the audio system.

REPAIR INSTRUCTIONS

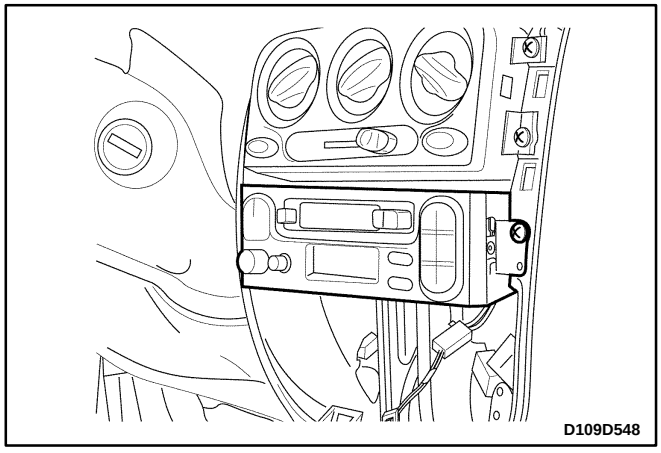
ON–VEHICLE SERVICE



AUDIO SYSTEM

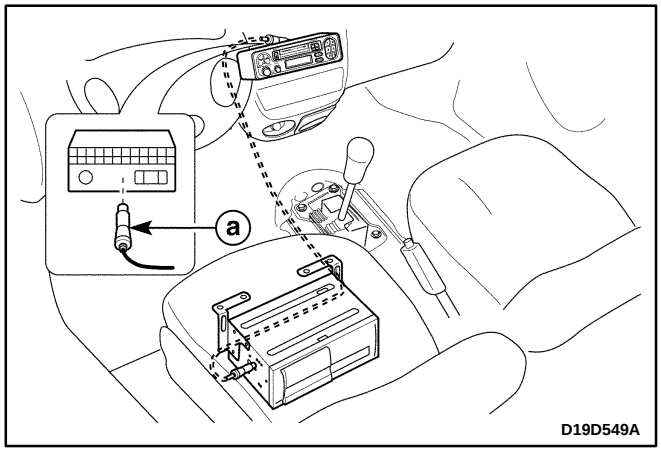
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the instrument cluster trim panel from the instrument panel. Refer to *Section 9E, Instrument/Driver Information.*
3. Remove the audio system from the instrument panel.
   - Remove the screws (1).
   - Disconnect the electrical connector and the antenna cable (2).
   - Remove the audio system (3).



Installation Procedure

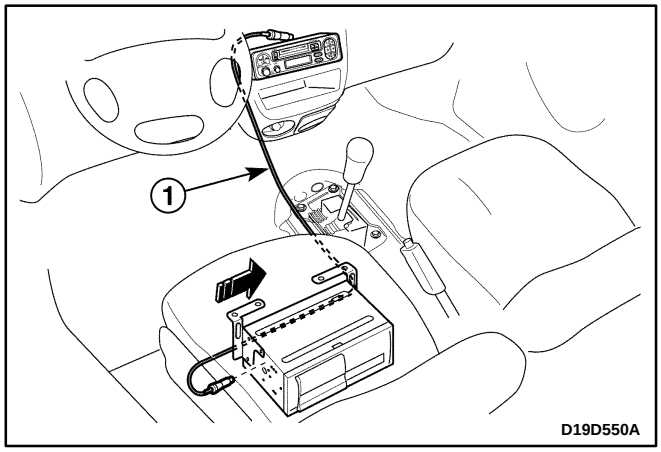
1. Connect the electrical connector and the antenna cable.
2. Install the audio system with the screws.
3. Install the instrument cluster trim panel. Refer to *Section 9E, Instrument/Driver Information.*
4. Connect the negative battery cable.



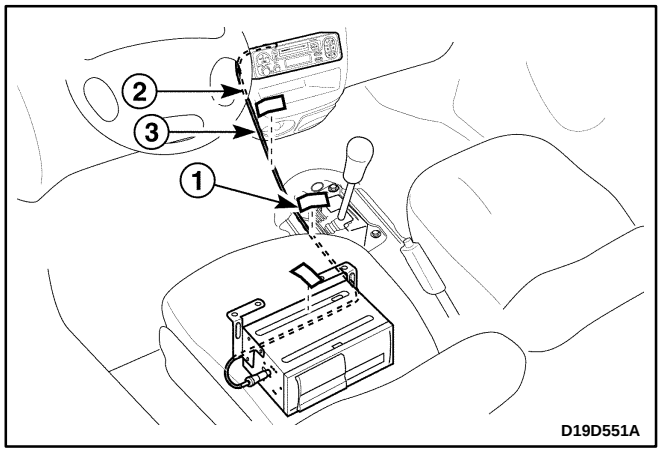
CD CHANGER

Removal Procedure

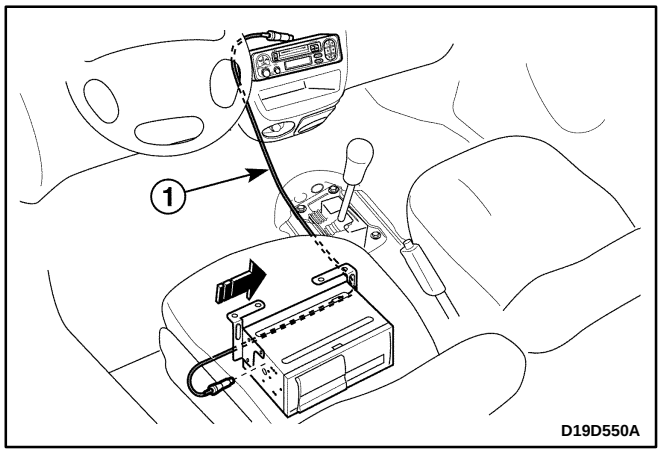
1. Disconnect the negative battery cable.
2. Remove the audio system from the instrument panel.
   Refer to “Audio System” in this section.
3. Remove the floor console. Refer to *Section 9G, Interior Trim.*
4. Disconnect the CD changer electrical connector from the audio system.
   a. CD changer electrical connector.



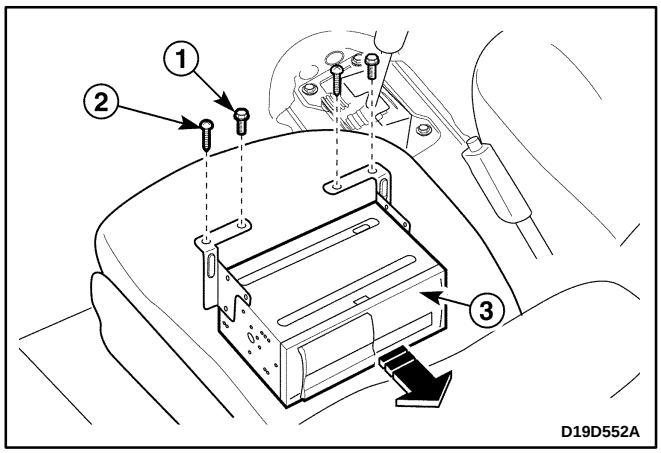
5. Disconnect the CD changer electrical connector from the CD changer (1).



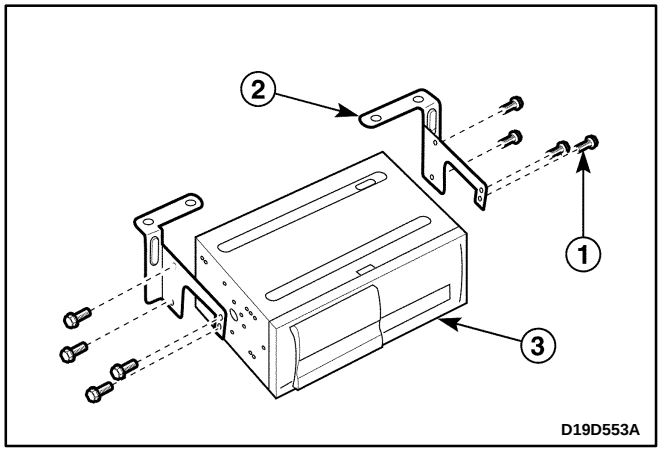
6. Remove the sponge pads and the clip.
   - Remove the sponge pads retaining the CD changer cable (1).
   - Remove the clip retaining tie-bar (2).
   - Remove the clip retaining instrument panel wiring harness (3).



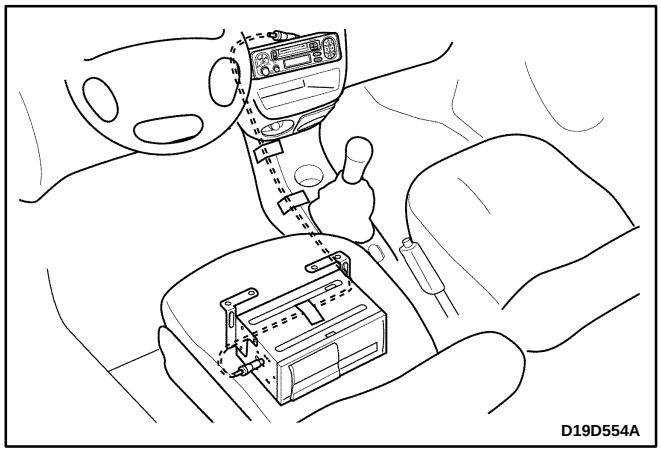
7. Remove the CD changer cable.
   - Remove the CD changer cable (1).



8. Remove the CD changer assembly.
   - Remove the CD changer bracket mounting bolts (1).
   - Remove the CD changer bracket mounting screws (2).
   - Remove the CD changer assembly (3).



9. Separate the CD changer and the CD changer bracket.
   - Remove the bolts from the CD changer bracket (1).
   - Remove the CD changer bracket (2).
   - Remove the CD changer (3).



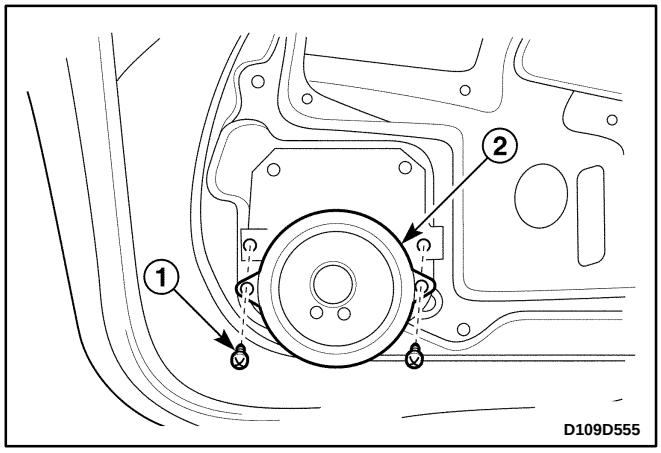
Installation Procedure

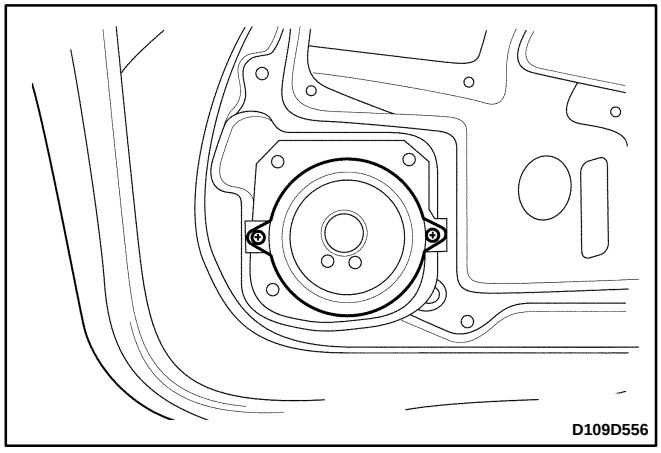
1. Install the CD changer bracket to the CD changer with the bolts.
2. Mount the CD changer assembly under the Driver's seat with the bolts and the screws.
3. Arrange the CD changer cable with the sponge pads and the clip.
4. Connect the CD changer electrical connectors.
5. Install the floor console. Refer to *Section 9G, Interior Trim*.
6. Install the Audio System to the instrument panel. Refer to "Audio System" in this section.
7. Connect the negative battery cable.

FRONT SPEAKERS

Removal Procedure

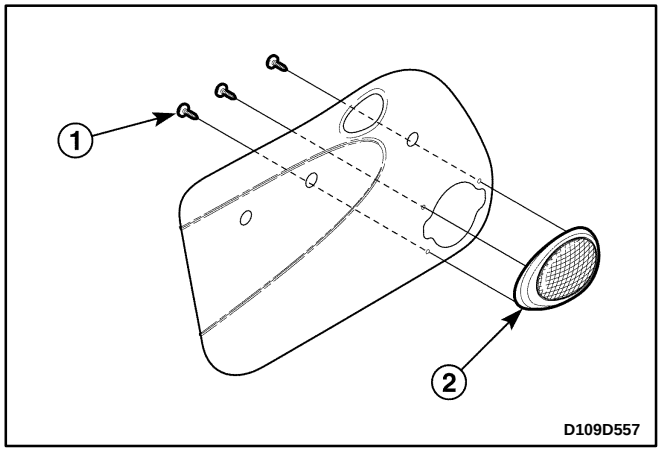
1. Disconnect the negative battery cable.
2. Remove the door seal trim. Refer to *Section 9P, Doors.*
3. Remove the speaker.
   - Remove the screws (1).
   - Disconnect the electrical connector.
   - Remove the speaker (2).





Installation Procedure

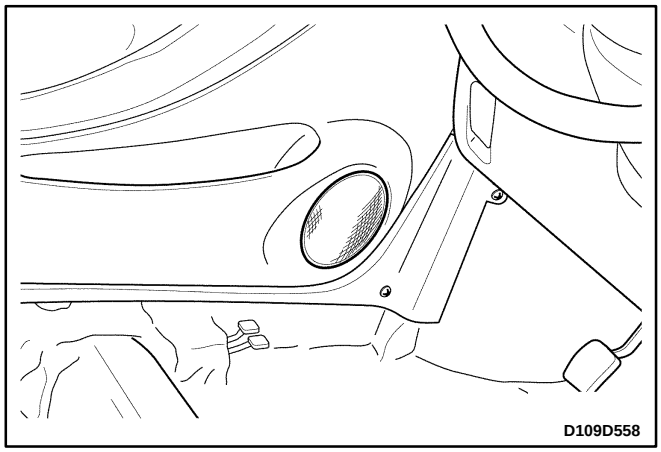
1. Connect the electrical connector.
2. Install the speaker with the screws.
3. Install the door seal trim. Refer to *Section 9P, Doors*
4. Connect the negative battery cable.



FRONT SPEAKER COVERS

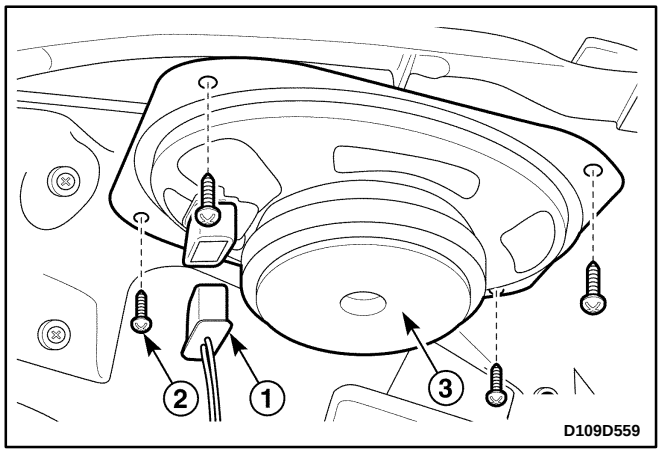
Removal Procedure

1. Remove the door trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the speaker cover from the door trim panel.
   - Remove the screws (1).
   - Remove the speaker cover (2).



Installation Procedure

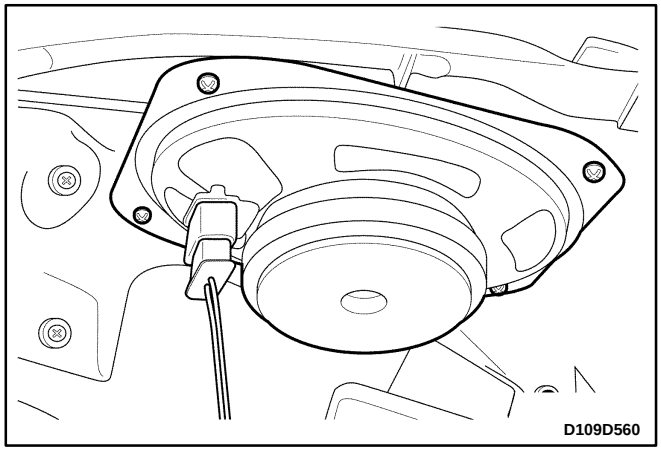
1. Install the speaker cover to the door trim panel with the screws.
2. Install the door trim panel. Refer to *Section 9G, Interior Trim.*



REAR SPEAKERS

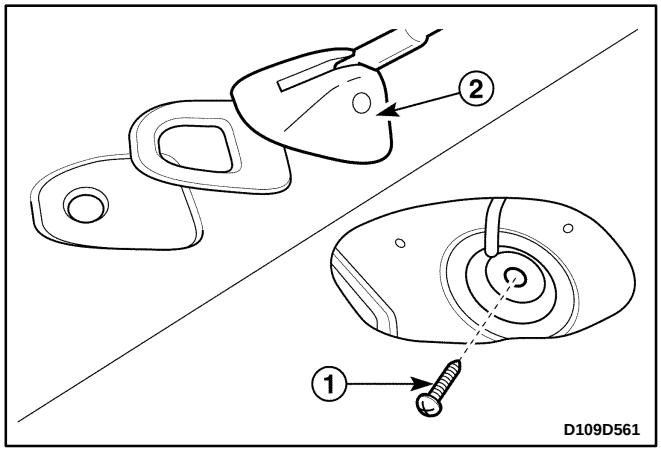
Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Remove the rear speaker from the rear parcel side shelf.
   - Disconnect the electrical connector (1).
   - Remove the screws (2).
   - Remove the rear speaker (3).



Installation Procedure

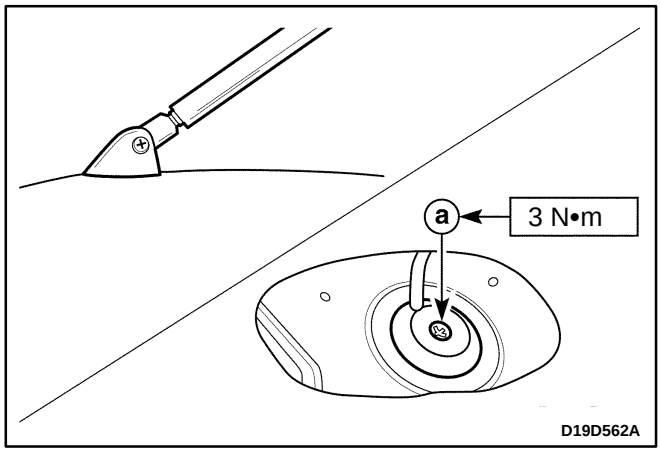
1. Install the rear speaker to the rear parcel side shelf with the screws.
2. Connect the electrical connector.
3. Connect the negative battery cable.



ROOF ANTENNA

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the interior courtesy lamp. Refer to *Section 9B, Lighting Systems.*
3. Remove the roof antenna.
   - Remove the screw from the vehicle inside (1).
   - Remove the roof antenna (2).



Installation Procedure

1. Install the roof antenna with the screw.

Tighten

Tighten the roof antenna retaining screw to 3 N•m (27 lb-in).

a. Roof antenna retaining screw.

2. Install the interior courtesy lamp. Refer to *Section 9B, Lighting Systems.*
3. Connect the negative battery cable.

SPECIFICATIONS

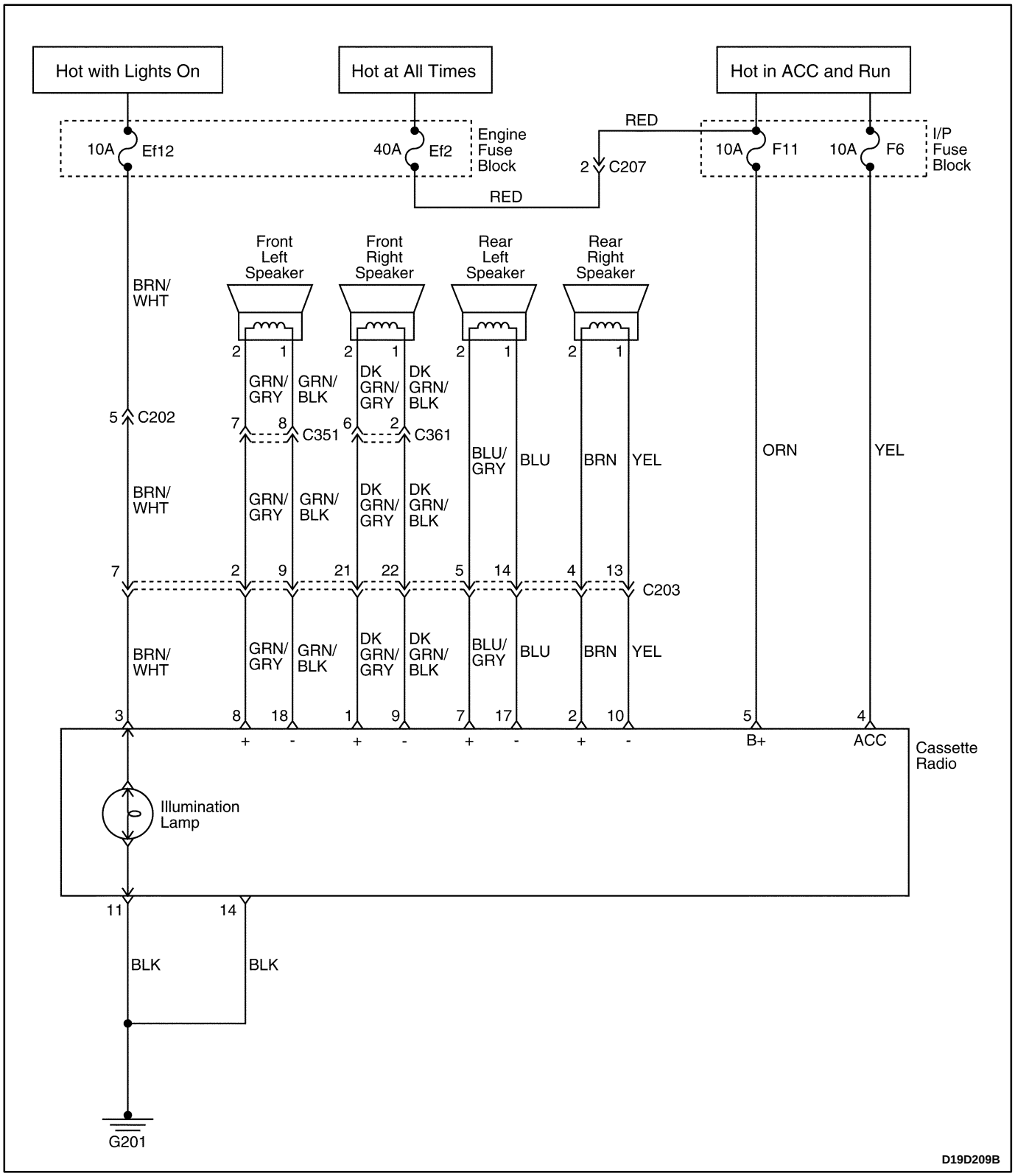
FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Roof Antenna Retaining Screw	3	–	27

SCHEMATIC AND ROUTING DIAGRAMS

AUDIO SYSTEM CIRCUIT

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



SECTION 9G

INTERIOR TRIM

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.

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DESCRIPTION AND OPERATION

INTERIOR TRIM PANELS

The interior trim panels are molded plastic and fasten with screws or plastic clips.

PRESSURE RELIEF VENT

When all the windows are closed and the ventilation system is on, the addition of outside air to the interior of the vehicle causes a positive pressure within the vehicle. In order to relieve the pressure, air is released through one pressure relief vents. The pressure relief vent is located in the luggage compartment, behind the spare wheel.

FLOOR CONSOLE

The floor console fits over the tunnel in the floor of the vehicle and extends from under the center of the instrument panel to the front seat area. The floor console contains the transaxle shift lever and a cupholder.

The sensing and diagnosis module (SDM) for the airbag system is located under the floor console.

PARKING BRAKE CABLE COVER

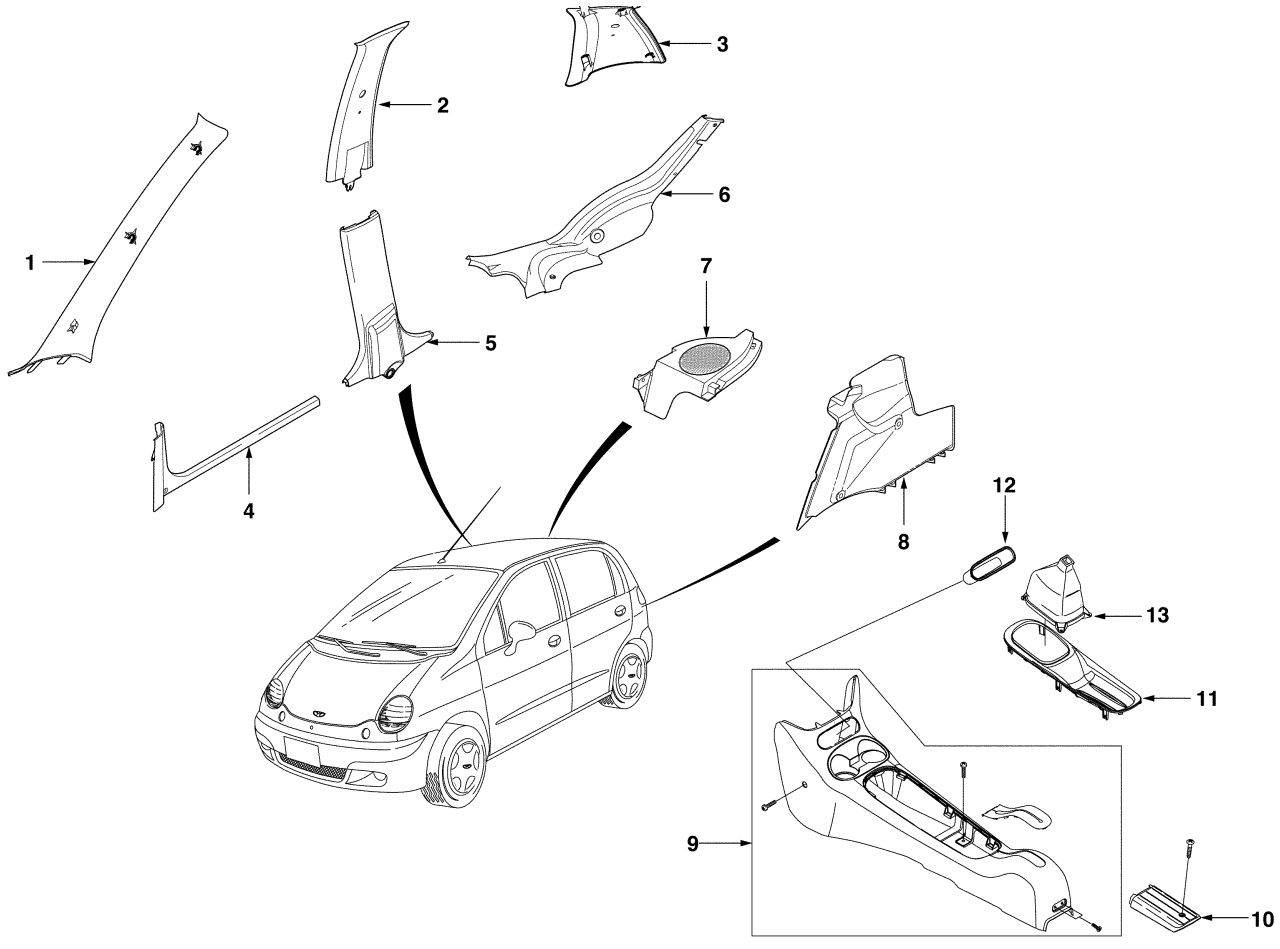
The parking brake cable cover should be removed to adjust the free play of the parking brake cable.

FLOOR CARPET

The molded one-piece floor carpet goes over both the front and the rear floor pans.

COMPONENT LOCATOR

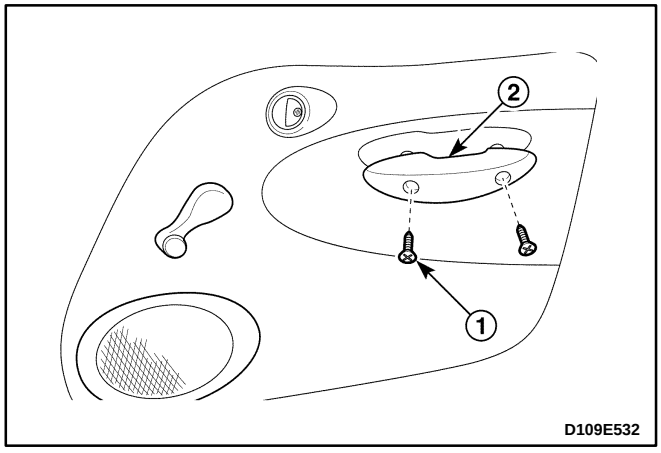
INTERIOR TRIM



1. A–Pillar Trim Panel
2. B–Pillar Upper Trim Panel
3. C–Pillar Trim Panel
4. Front Rocker Trim Panel
5. B–Pillar Lower Trim Panel
6. Rear Rocker Trim Panel
7. Rear Parcel Side Shelf
8. Wheel House Trim Panel
9. Floor Console
10. Parking Brake Cable Cover
11. Console Cover Assembly
12. Deposit Box
13. Console Boot Assembly

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



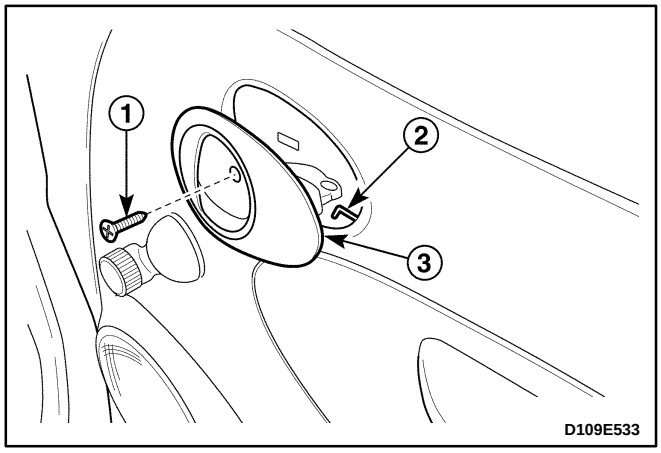
FRONT DOOR TRIM PANEL (STANDARD)

Tool Required

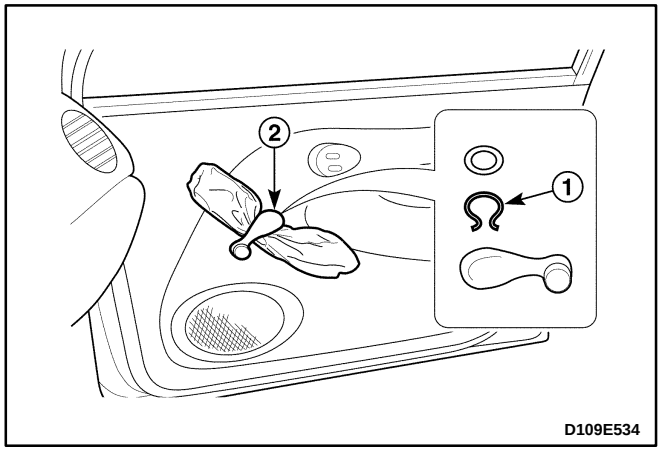
KM 475–B Trim Remover.

Removal Procedure

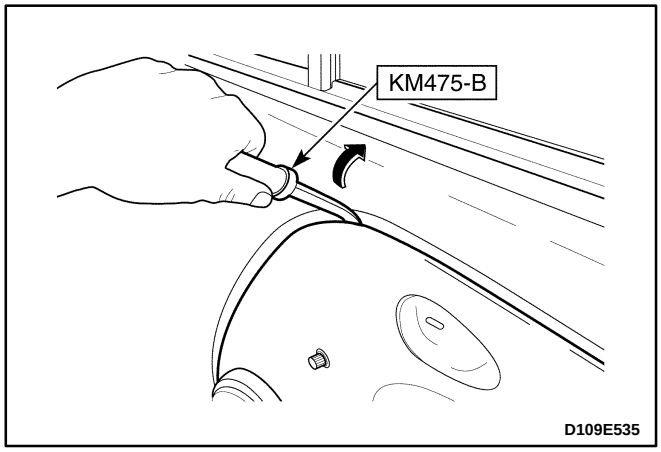
1. Remove the door pull from the front door.
   - Remove the screws (1).
   - Remove the door pull (2).



2. Remove the inside door handle.
   - Remove the screw (1).
   - Disconnect the inside door handle rod (2).
   - Pry off the inside door handle (3).

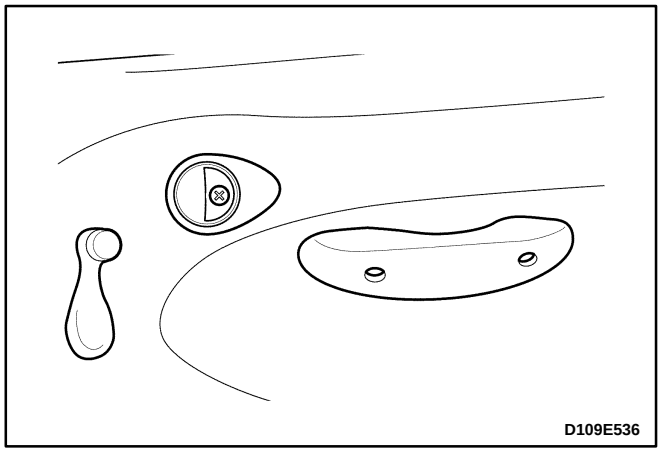


3. Remove the window regulator handle from the front door.
   - Using a cloth, pull out the clip (1).
   - Remove the regulator handle (2).



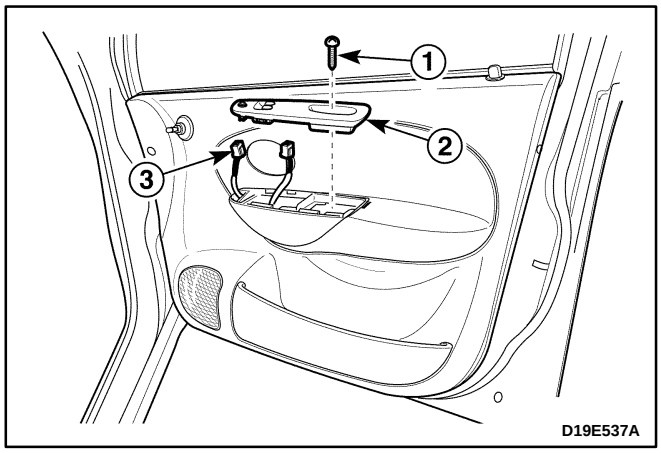
4. Pry off the trim panel using a trim remover KM 475–B.

Notice: Make sure to cover the remover with cloth to prevent the paint damage of the door.



Installation Procedure

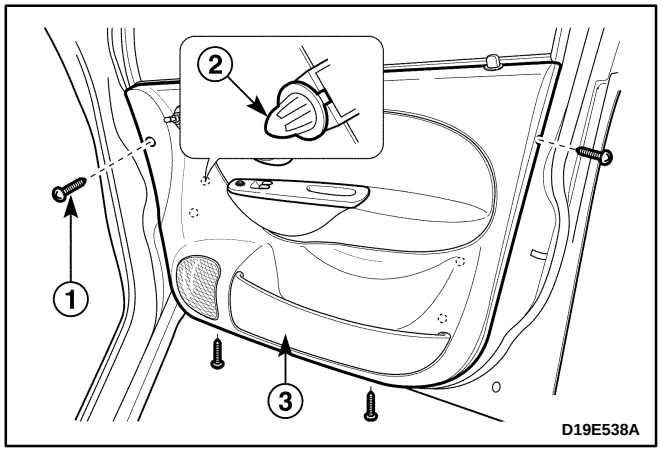
1. Install the trim panel.
2. Install the window regulator handle with the clip.
3. Install the inside door handle and the door pull with the screws.



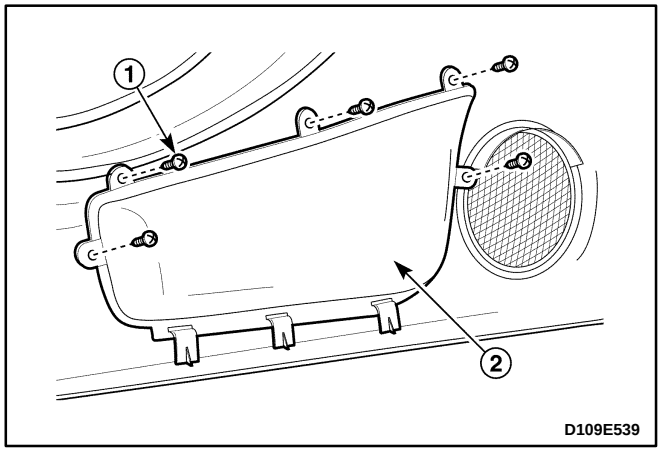
FRONT DOOR TRIM PANEL (DELUXE)

Removal Procedure

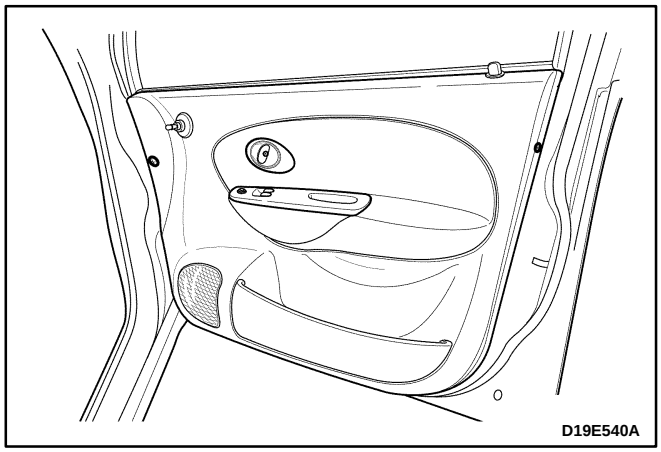
1. Remove the inside door handle. Refer to *Section 9P, Doors.*
2. Remove the power window/mirror control switch assembly from the front door.
   - Remove the screws (1).
   - Remove the power window/mirror control switch assembly (2).
   - Disconnect the electrical connectors (3).



3. Remove the trim panel.
   - Remove the screws (1).
   - Remove the clips (2).
   - Remove the trim panel (3).



4. Remove the inside channel weatherstrip. Refer to *Section 9P, Doors.*
5. Remove the map pocket from the door trim.
   - Remove the screws (1).
   - Remove the map pocket (2).



Installation Procedure

1. Install the map pocket to the door trim with the screws.
2. Install the inside channel weatherstrip. Refer to *Section 9P, Doors.*
3. Install the door trim panel with the screws and the clips.
4. Install the power window/mirror control switch assembly with the screw.
5. Install the inside door handle. Refer to *Section 9P, Doors.*

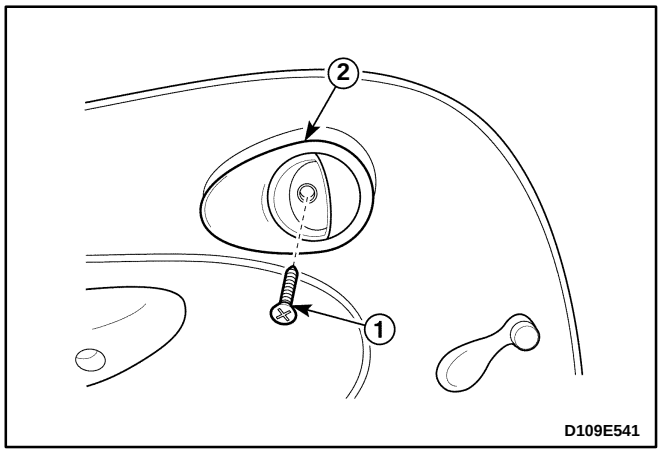
REAR DOOR TRIM PANEL (STANDARD)

Tool Required

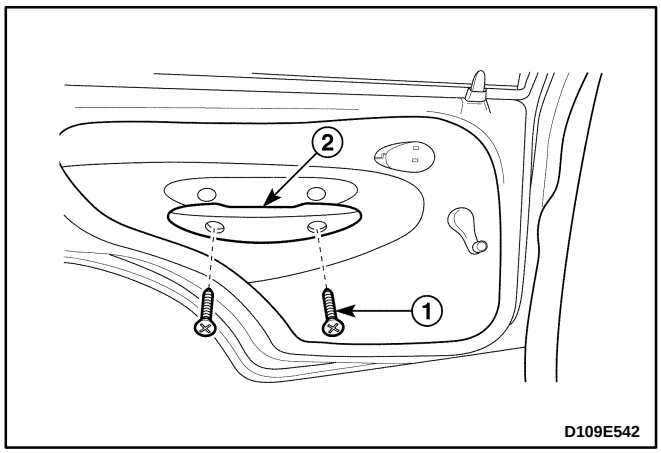
KM 475–B Trim Remover.

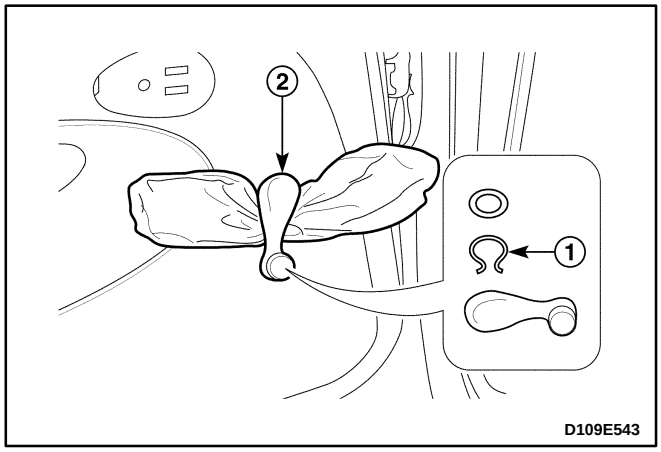
Removal Procedure

1. Remove the inside door handle.
   - Remove the screw (1).
   - Disconnect the inside door handle rod.
   - Pry off the inside door handle (2).

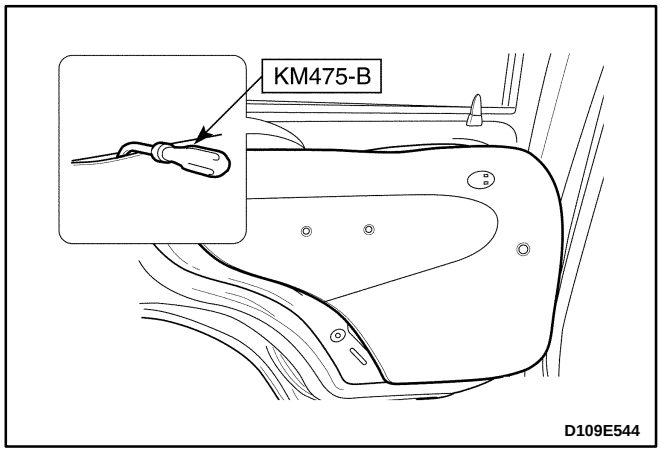


2. Remove the door pull.
   - Remove the screws (1).
   - Remove the door pull (2).



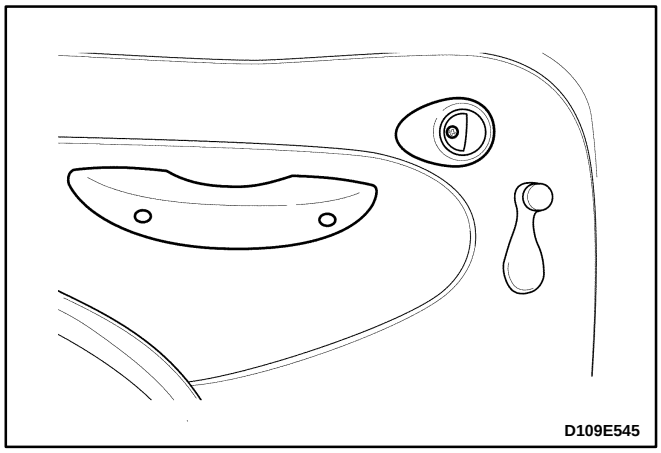


3. Remove the window regulator handle from the rear door.
   - Using a cloth, pull out the clip (1).
   - Remove the regulator handle (2).



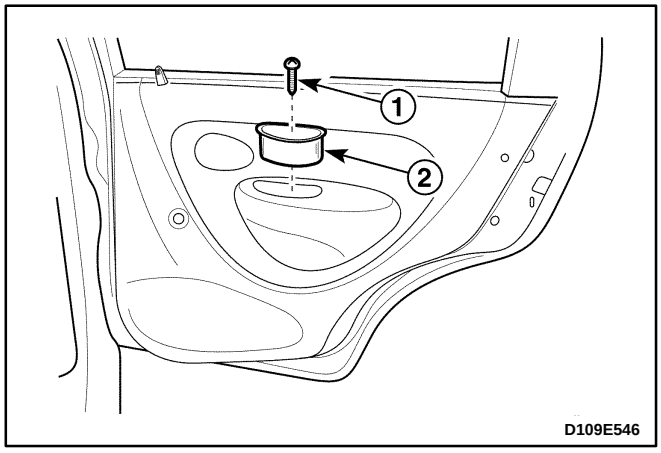
4. Pry off the trim panel using a trim remover KM 475–B.

Notice: Make sure to cover the remover with cloth to prevent the paint damage of the door.



Installation Procedure

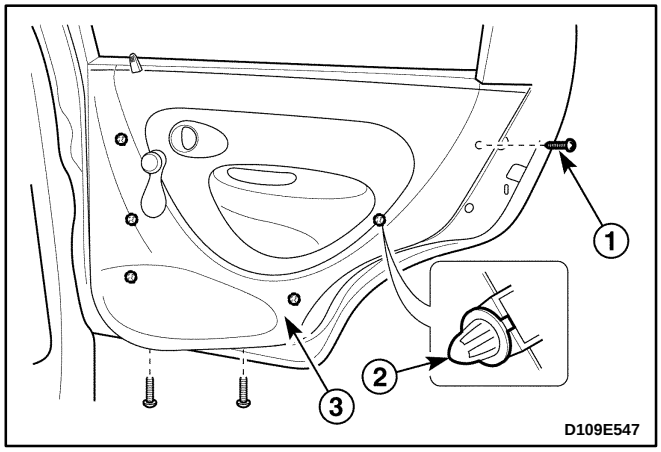
1. Install the trim panel.
2. Install the window regulator handle with the clip.
3. Install the inside door handle and the door pull with the screws.



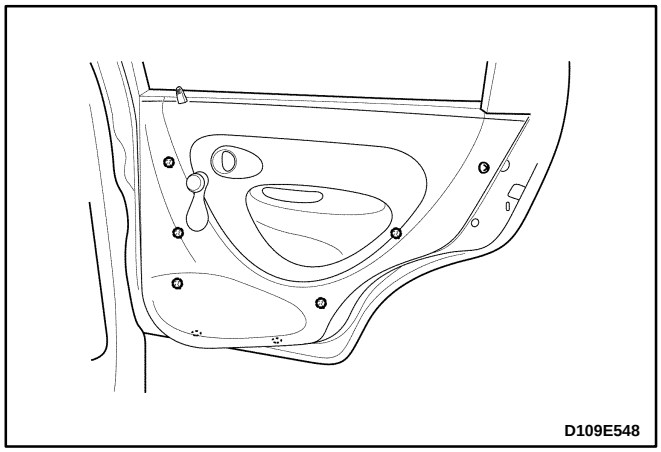
REAR DOOR TRIM PANEL (DELUXE)

Removal Procedure

1. Remove the inside door handle. Refer to *Section 9P, Doors.*
2. Remove the window regulator handle from the rear door. Refer to *Section 9P, Doors.*
3. Remove the door pull.
   - Remove the screw (1).
   - Remove the door pull (2).

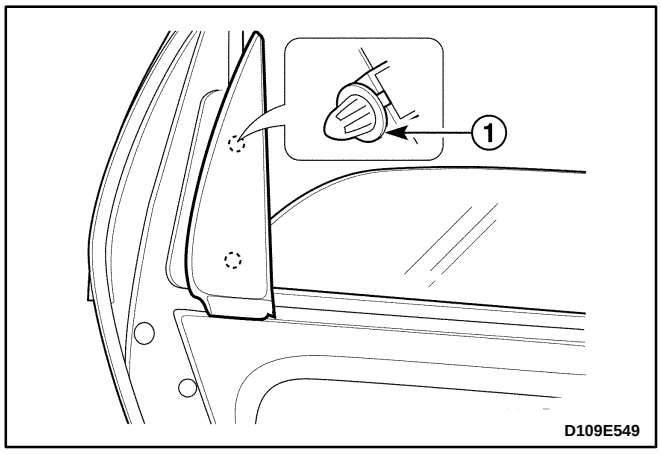


4. Remove the trim panel.
   - Remove the screws (1).
   - Remove the clips (2).
   - Remove the trim panel (3).
5. Remove the inside channel weatherstrip. Refer to *Section 9P, Doors.*



Installation Procedure

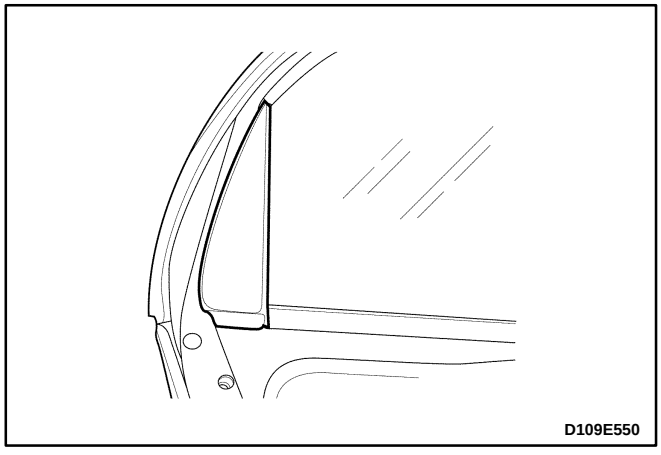
1. Install the inside channel weatherstrip. Refer to *Section 9P, Doors.*
2. Install the trim panel with the screws and the clips.
3. Install the door pull with the screw.
4. Install the window regulator handle. Refer to *Section 9P, Doors.*
5. Install the inside door handle. Refer to *Section 9P, Doors.*



REAR DOOR INTERIOR GARNISH MOLDING

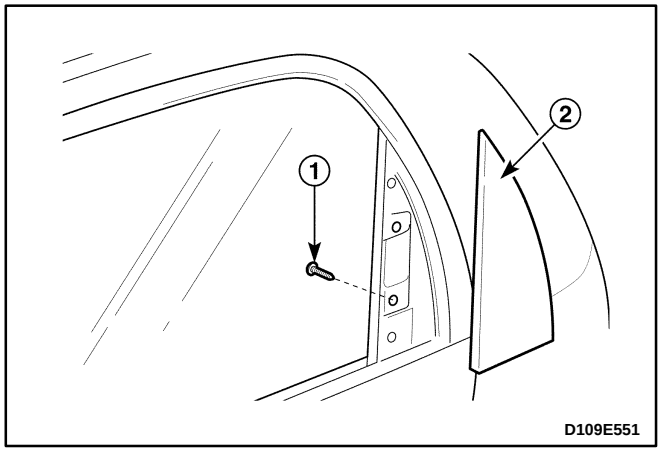
Removal Procedure

1. Pry off interior garnish molding.
   - Pry off the garnish molding caps (1).



Installation Procedure

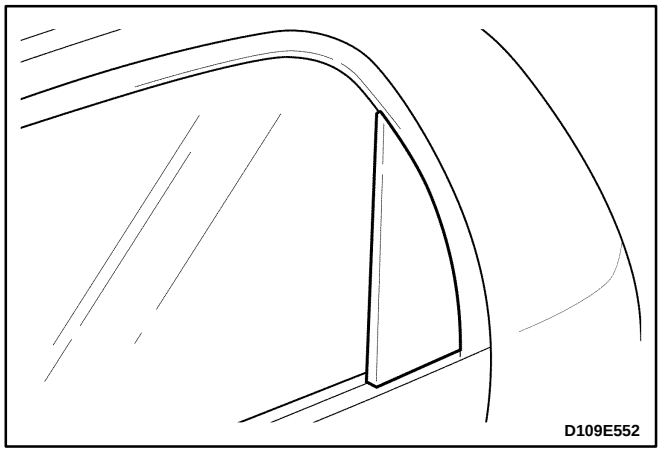
1. Install the interior garnish molding.



REAR DOOR EXTERIOR GARNISH MOLDING

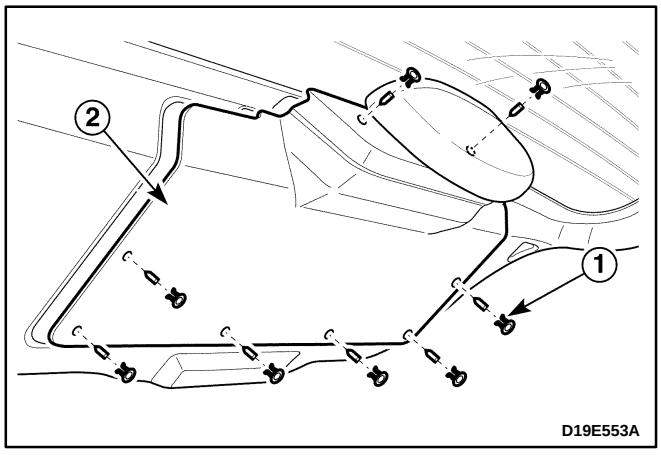
Removal Procedure

1. Pry off the interior garnish molding. Refer to “Rear Door Interior Garnish Molding” in this section.
2. Pry off the exterior garnish molding.
   - Remove the screw (1).
   - Pry off exterior garnish molding (2).



Installation Procedure

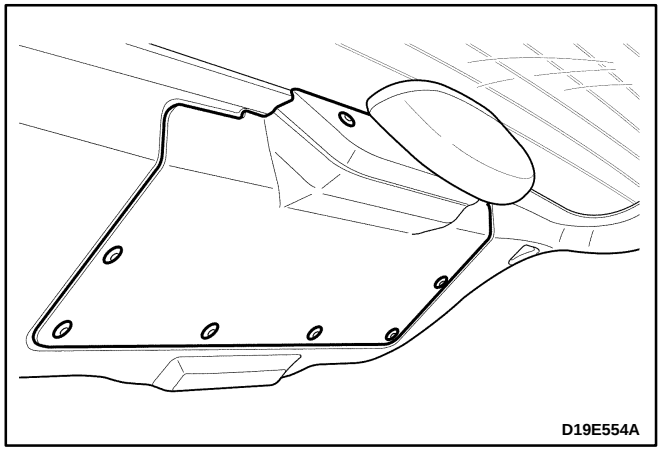
1. Install the exterior garnish molding with the screw.
2. Install the interior garnish molding. Refer to “Rear Door Interior Garnish Molding” in this section.



TAILGATE TRIM PANEL

Removal Procedure

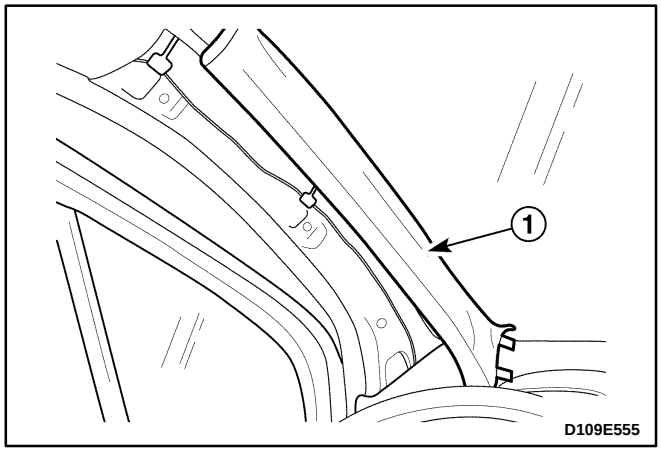
1. Open the tailgate.
2. Remove the trim from the tailgate.
   - Remove the clips by pushing the center of the clip (1).
   - Remove the trim (2).



Installation Procedure

1. Install the trim to the tailgate.

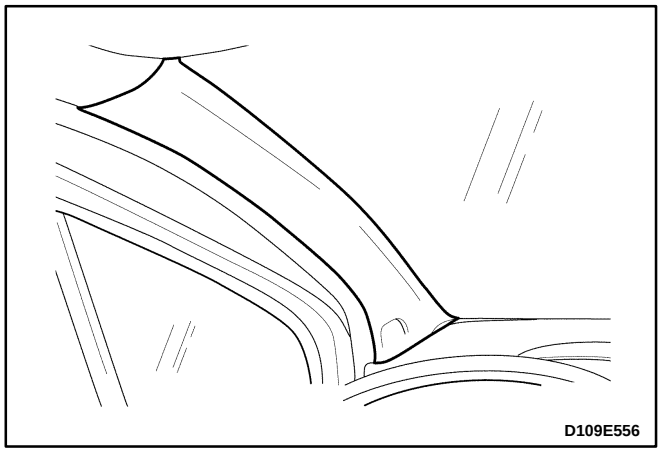
Notice: In case of the loose clips, replace the clips with the new ones.



A–PILLAR TRIM PANEL

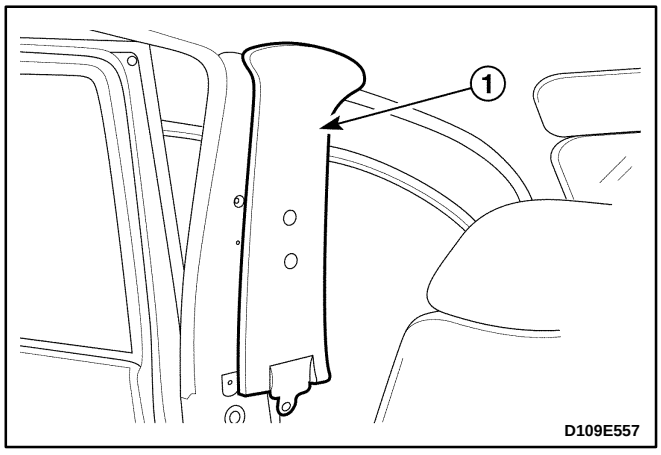
Removal Procedure

1. Pry off the A–pillar trim panel (1).



Installation Procedure

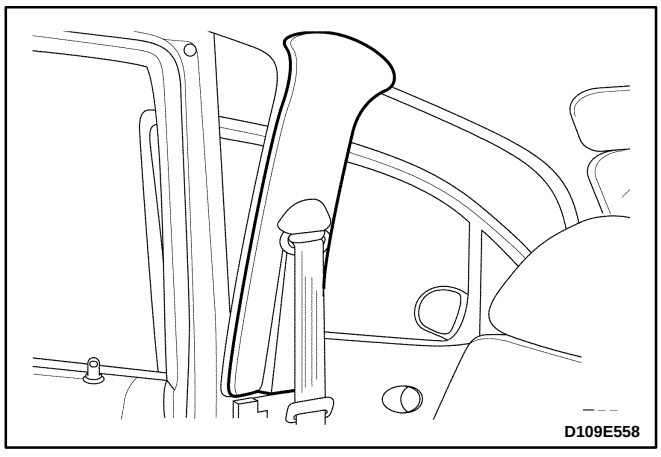
1. Install the A–pillar trim panel.



UPPER B–PILLAR TRIM PANEL

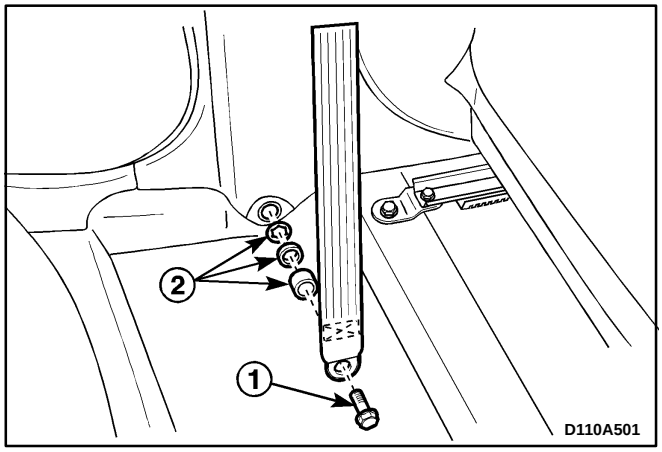
Removal Procedure

1. Remove the bolt on the upper B–pillar trim panel. Refer to *Section 8A, Seat Belts.*
2. Pry off the upper B–pillar trim panel.
   - Pry off the upper B–pillar trim panel by hands (1).



Installation Procedure

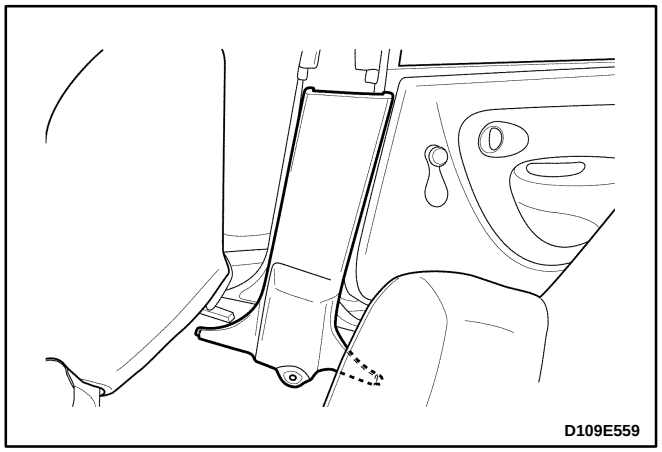
1. Install the upper B–pillar trim panel.
2. Install the bolt on the upper B–pillar trim panel. Refer to *Section 8A, Seat Belts.*



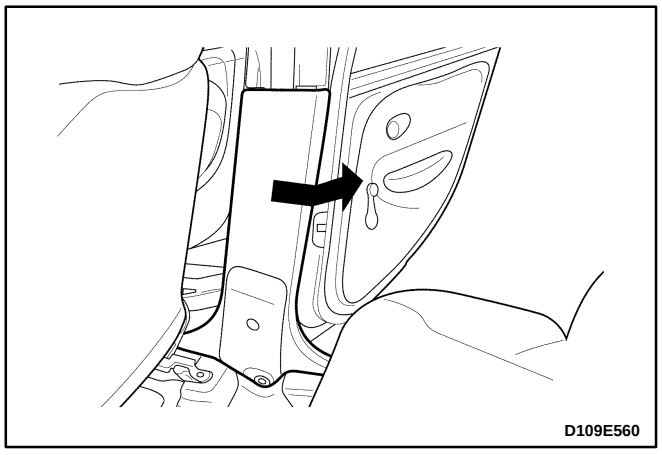
LOWER B–PILLAR TRIM PANEL

Removal Procedure

1. Remove the bolt on the lower B–pillar trim panel.
   - Remove the bolt (1).
   - Remove the spacer and the spring washer (2).
   - Remove the plastic protector from the seat belt anchor.

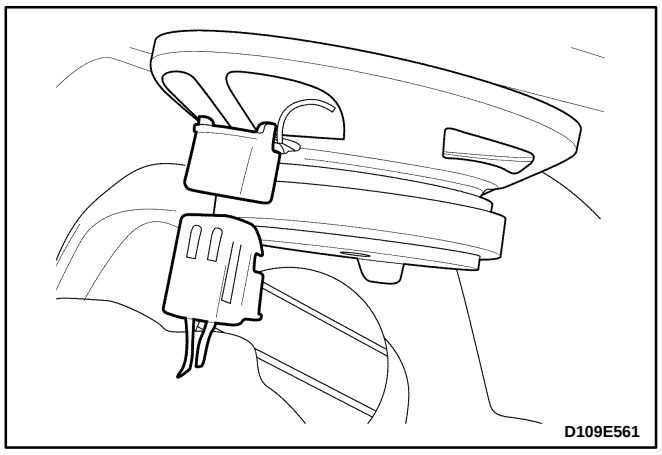


2. Pry off the lower B–pillar trim panel.



Installation Procedure

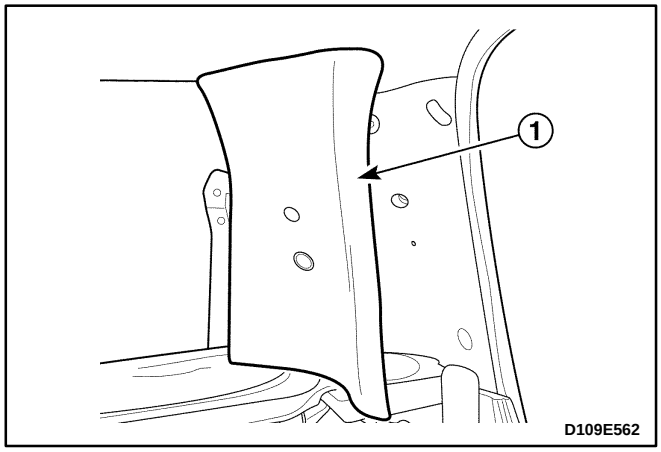
1. Install the lower B–pillar trim panel.
2. Install the bolt on the lower B–piller trim panel. Refer to *Section 8A, Seat Belts.*



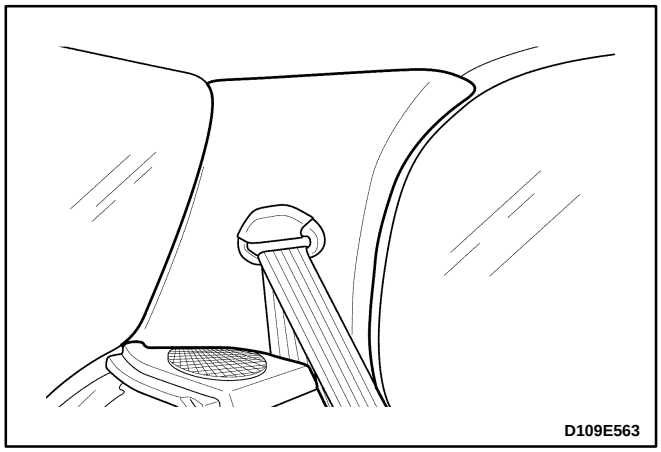
C–PILLAR TRIM PANEL

Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Disconnect the rear speaker electrical connector.

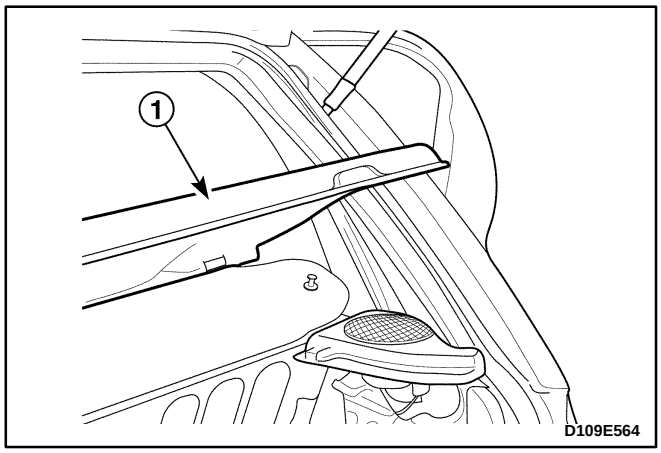


4. Remove the rear parcel side shelf. Refer to “Rear Parcel Side Shelf” in this section.
5. Remove the rear seatback.
6. Remove the rear seat belt bolt on the C–pillar trim panel. Refer to *Section 8A, Seat Belts.*
7. Pry off the C–pillar trim panel.
   - Pry off the C–pillar trim panel by hands (1).



Installation Procedure

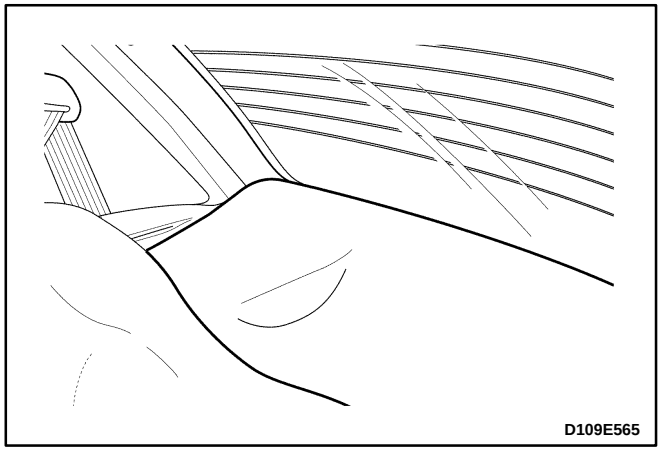
1. Install the C–pillar trim panel.
2. Install the rear seat belt bolt on the C–pillar trim panel. Refer to *Section 8A, Seat Belts.*
3. Install the rear seatback.
4. Install the rear parcel side shelf. Refer to “Rear Parcel Side Shelf” in this section.
5. Connect the rear speaker connector.
6. Connect the negative battery cable.



REAR PARCEL SHELF

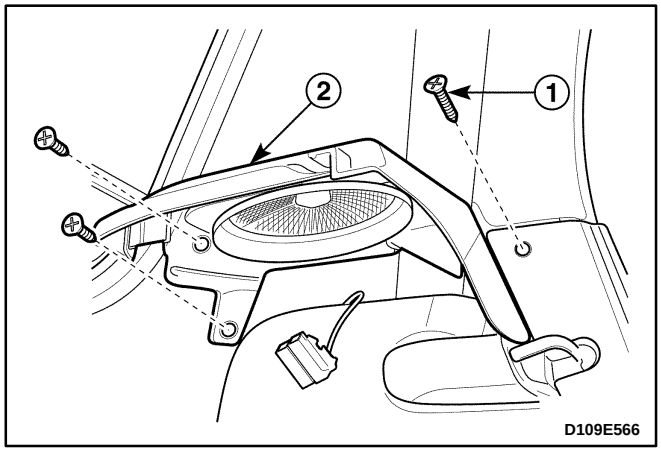
Removal Procedure

1. Open the tailgate.
2. Remove the rear parcel shelf (1).



Installation Procedure

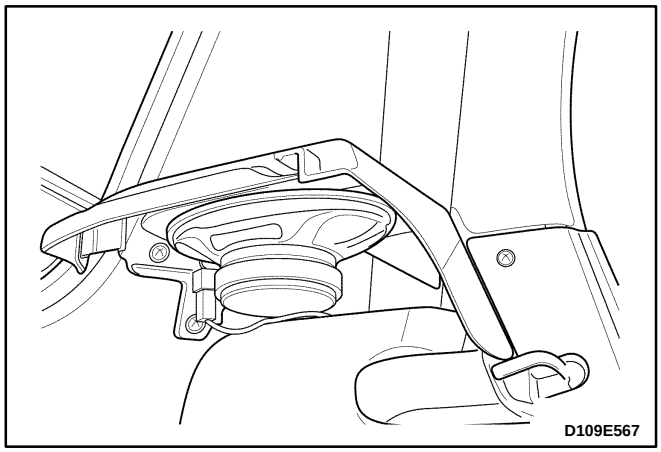
1. Install the rear parcel shelf.



REAR PARCEL SIDE SHELF

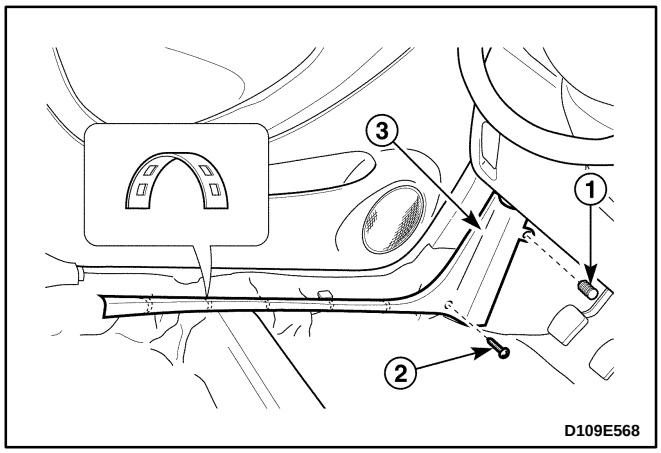
Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Remove the seatback.
4. Remove the rear seat parcel shelf. Refer to “Rear Parcel Shelf” in this section.
5. Remove the rear speaker from the rear parcel shelf. Refer to *Section 9F, Audio Systems*.
6. Remove the rear parcel side shelf.
   - Remove the screws (1).
   - Remove the rear parcel side shelf (2).



Installation Procedure

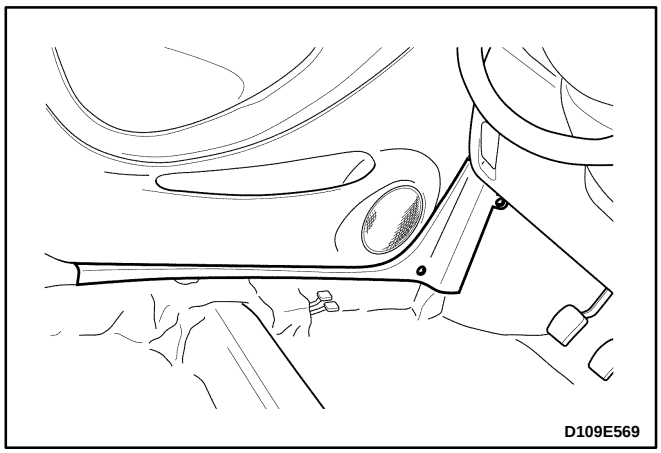
1. Install the rear parcel side shelf with the screw.
2. Install the rear speaker to the rear parcel shelf. Refer to *Section 9F, Audio Systems.*
3. Install the rear parcel shelf. Refer to “Rear Parcel Shelf” in this section.
4. Install the seatback.
5. Connect the negative battery cable.



FRONT ROCKER TRIM PANEL

Removal Procedure

1. Pry off the rocker trim panel.
   - Remove the clip (1).
   - Remove the screw (2).
   - Pry off the rocker trim panel (3).

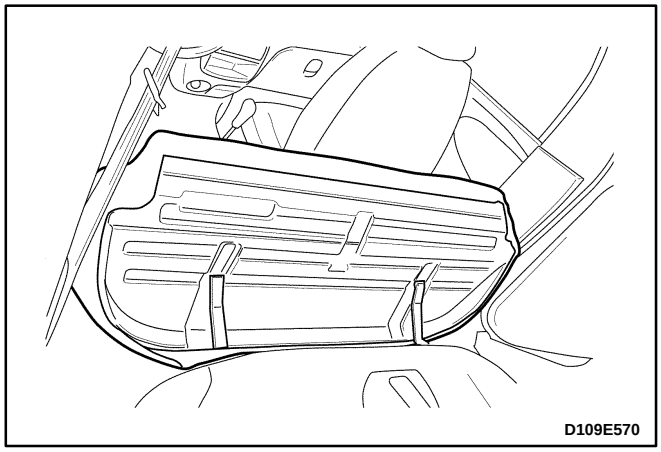


Installation Procedure

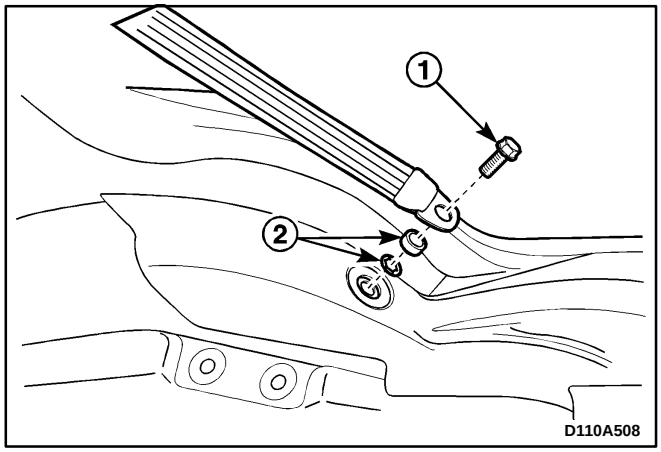
1. Install the rocker trim panel with the clip and the screw.

REAR ROCKER TRIM PANEL

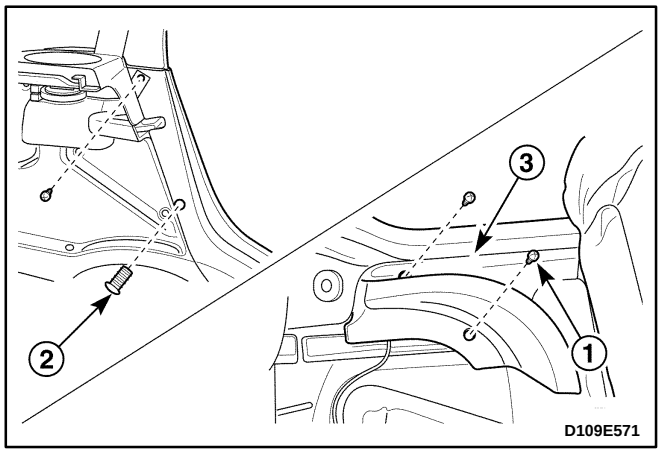
Removal Procedure



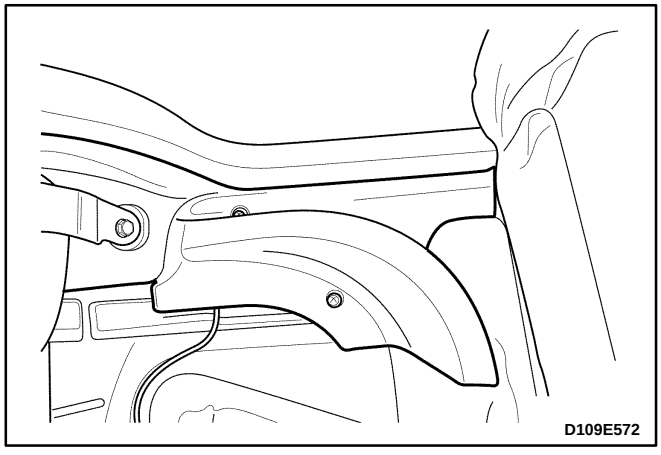
1. Remove the rear seat cushion.



2. Remove the rear seat belt bolt on the floor.
   - Remove the bolt (1).
   - Remove the spacer and the spring washer (2).
   - Remove the plastic protector from the seat belt anchor.

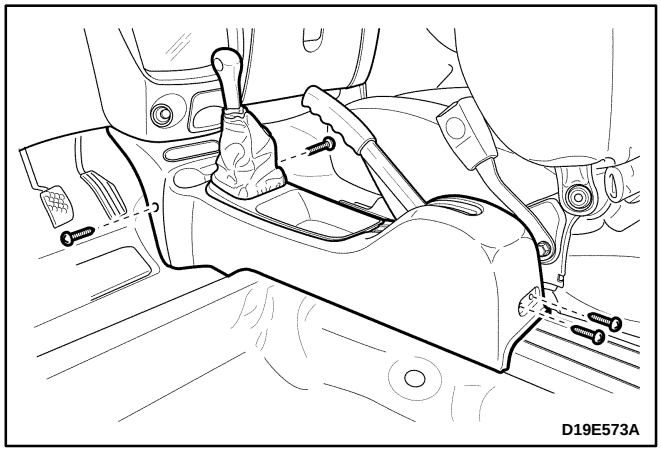


3. Pry off the rear rocker trim panel.
   - Remove the screws securing the rear rocker trim panel (1).
   - Remove the clip (2).
   - Pry off the rear rocker trim panel (3).



Installation Procedure

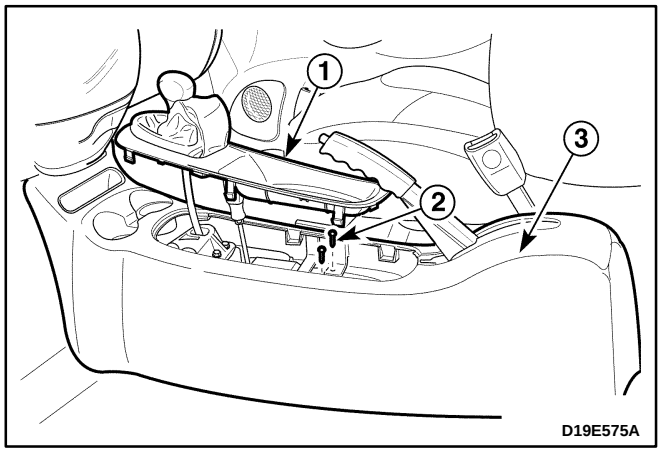
1. Install the rear rocker trim panel with the screws and the clip.
2. Install the rear seat belt bolt on the floor.
3. Install the rear seat cushion.



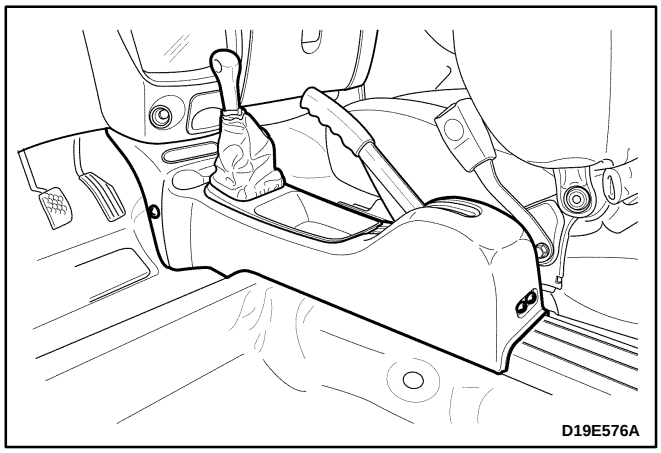
FLOOR CONSOLE

Removal Procedure

1. Remove the floor console screws.

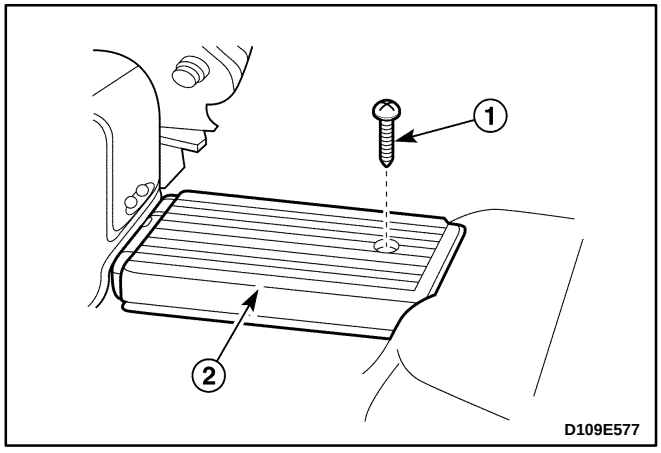


2. Remove the gear shift lever boot cover and the floor console.
   - Remove the gear shift lever boot cover (1).
   - Remove the screws (2).
   - Remove the floor console (3).



Installation Procedure

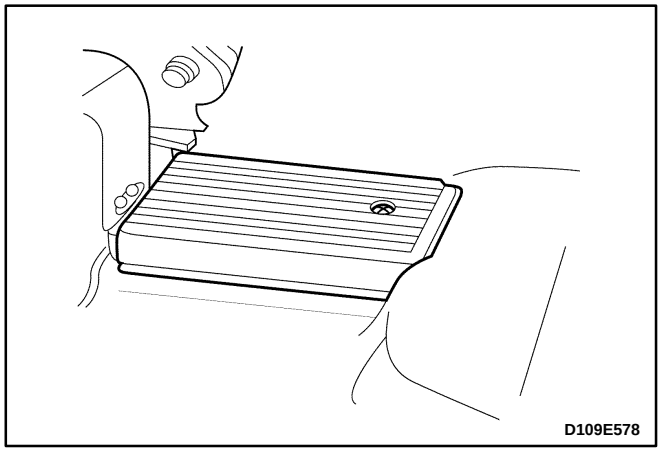
1. Install the floor console.
2. Install the gear shift lever boot cover to the floor console.
3. Tighten the floor console screws.



PARKING BRAKE CABLE COVER

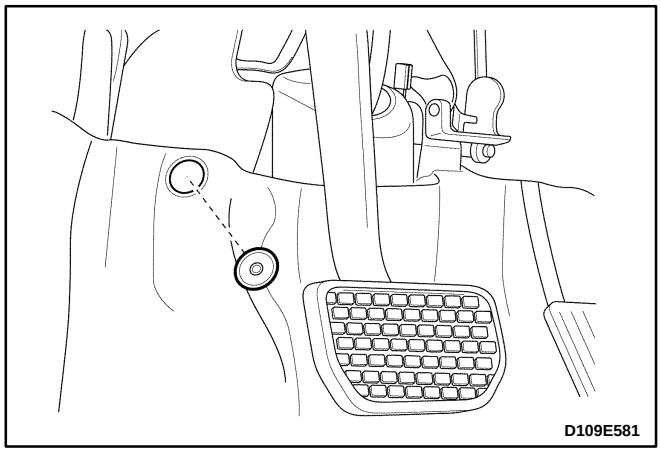
Removal Procedure

1. Remove the parking brake cable cover.
   - Remove the screw (1).
   - Remove the cable cover (2).



Installation Procedure

1. Install the parking brake cable cover with the screw.

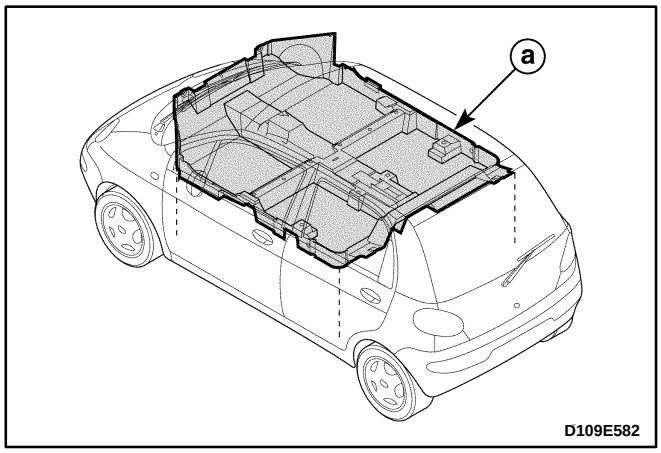


FLOOR CARPET

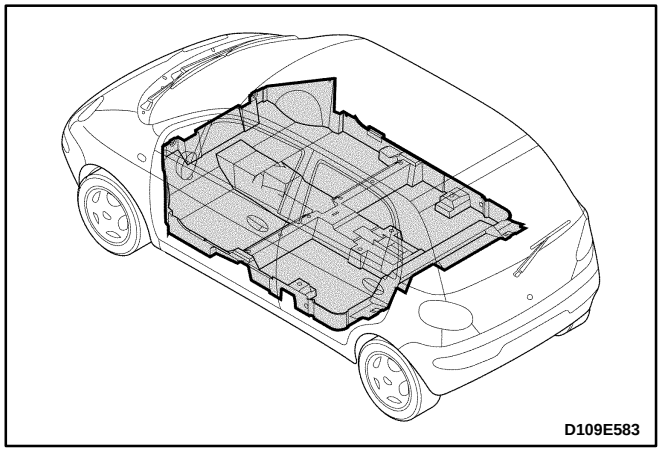
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the front seats. Refer to *Section 9H, Seats.*
3. Remove the rear seat cushion. Refer to *Section 9H, Seats.*
4. Remove the floor console. Refer to “Floor Console” in this section.
5. Pry off the front rocker trim panel. Refer to “Front Rocker Trim Panel” in this section.
6. Pry off the rear rocker trim panel. Refer to “Rear Rocker Trim Panel” in this section
7. Pry off the lower B–pillar trim panel. Refer to “Lower B–pillar Trim Panel” in this section.
8. Remove the parking brake cable cover. Refer to “Parking Brake Cable Cover” in this section.
9. Remove the clips under the front seats.

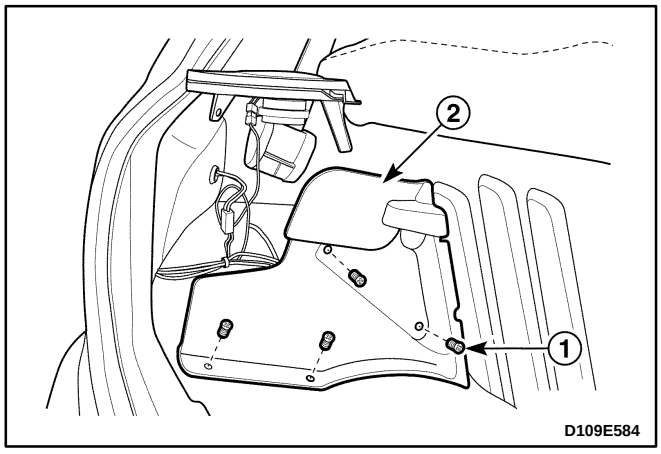


11. Remove the floor carpet.
    a. Floor carpet.


D109E583

Installation Procedure

1. Install the floor carpet.
2. Install the clips.
3. Install the parking brake cable cover. Refer to “Parking Brake Cable Cover” in this section.
4. Install the lower B–pillar trim panel. Refer to “Lower B–pillar Trim Panel” in this section.
5. Install the rear rocker trim panel. Refer to “Rear Rocker Trim Panel” in this section.
6. Install the front rocker trim panel. Refer to “Front Rocker Trim Panel” in this section.
7. Install the floor console. Refer to “Floor Console” in this section.
8. Install the rear seat cushion. Refer to *Section 9H, Seats.*
9. Install the front seats. Refer to *Section 9H, Seats.*
10. Connect the negative battery cable.

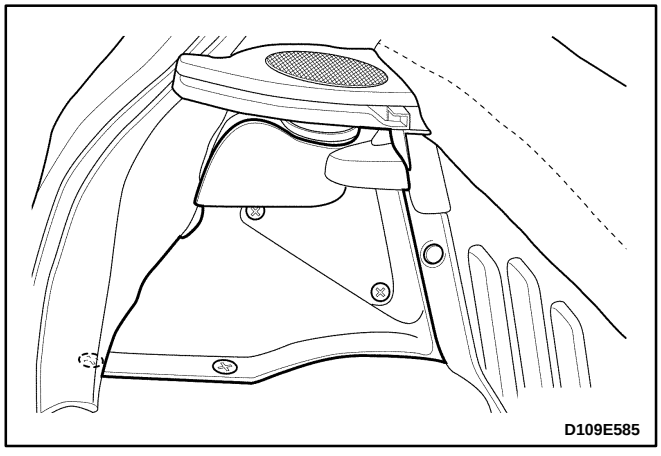


D109E584

LUGGAGE COMPARTMENT WHEELHOUSE TRIM PANEL

Removal Procedure

1. Pry off the luggage compartment wheel house trim panel.
   - Remove the screws (1).
   - Pry off the trim panel (2).

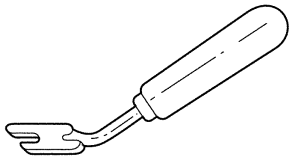

D109E585

Installation Procedure

1. Install the luggage compartment wheelhouse trim panel with the plastic screws.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D109E101	**KM-475-B Trim Remover**

SECTION 9H

SEATS

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.

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Specifications 9H-13
Fastener Tightening Specifications 9H-13

DESCRIPTION AND OPERATION

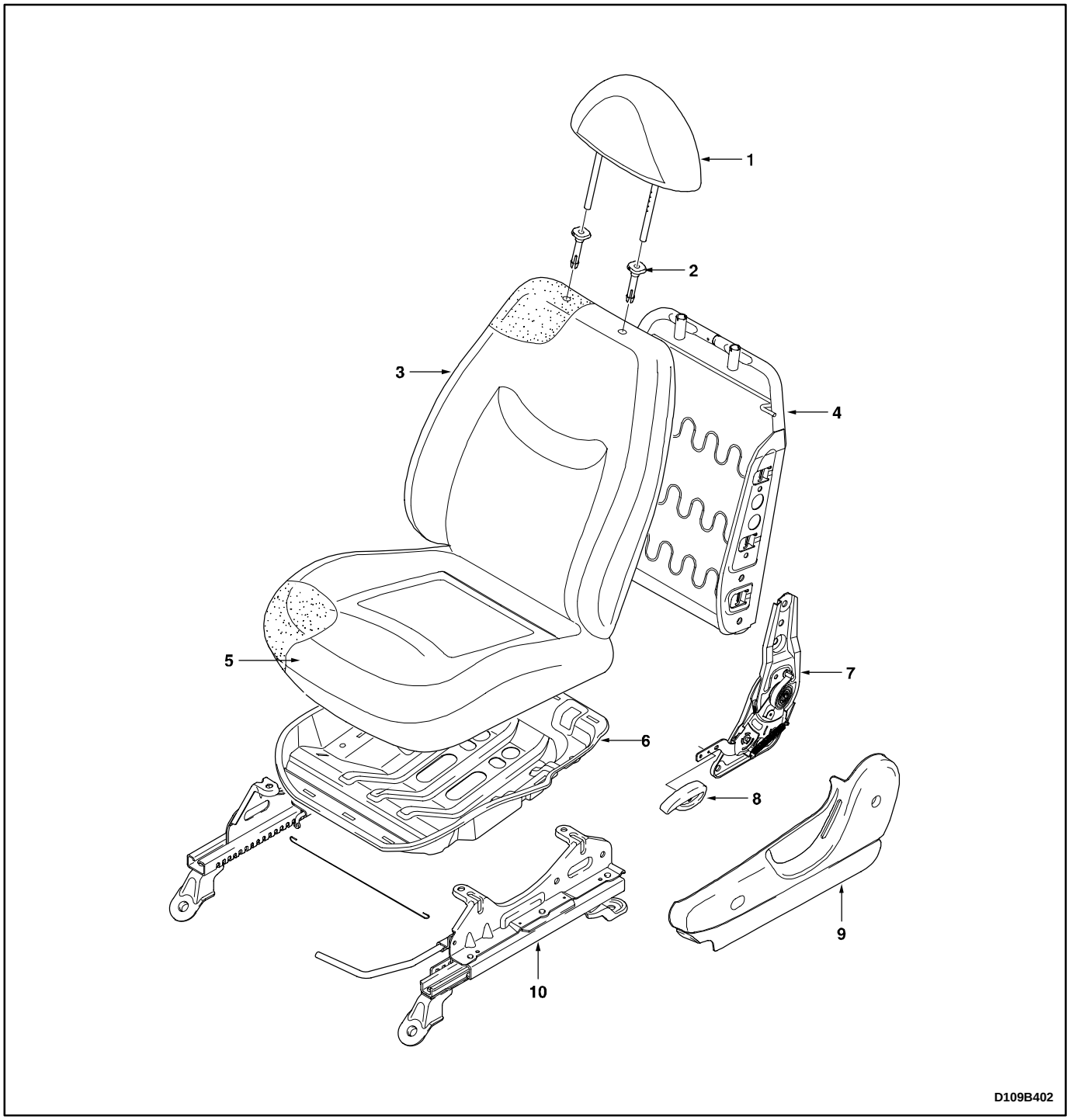
SEATS

Important: Do not attempt to change the designed seat position by altering the designed seat adjuster-to-floor pan anchor provisions or the seat adjuster-to-seat frame anchor provisions. Changing the seat position could affect the performance of the seat system.

This vehicle is equipped with low-backed front seats with separate head restraints and a three-passenger folding rear seat. Split folding rear seat is optional. Seats cushions and seatbacks have formed foam pads, which fit the contours of the full–panel seatback frame assembly and the designed contour of the seat cushion frame. There are no front seat forward or rearward relocation provisions provided at either the seat adjuster–to–seat frame or the seat adjuster–to–floor pan anchor attachments.

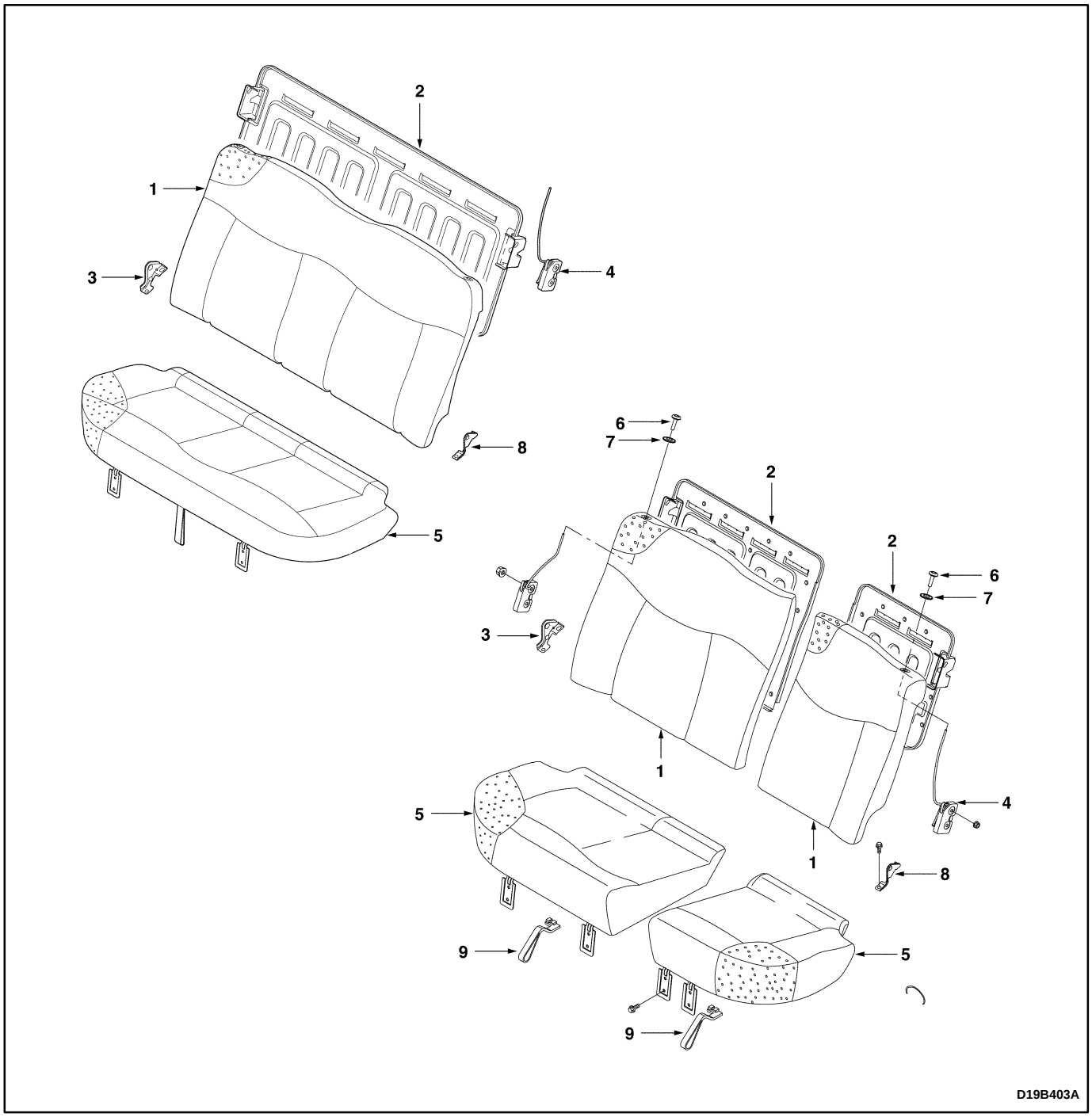
COMPONENT LOCATOR

FRONT SEAT



1. Head Restraint
2. Guide Sleeve
3. Seatback
4. Seatback Frame
5. Seat Cushion
6. Seat Cushion Frame
7. Recliner
8. Recliner Knob
9. Seat Side Cover
10. Guide Rail

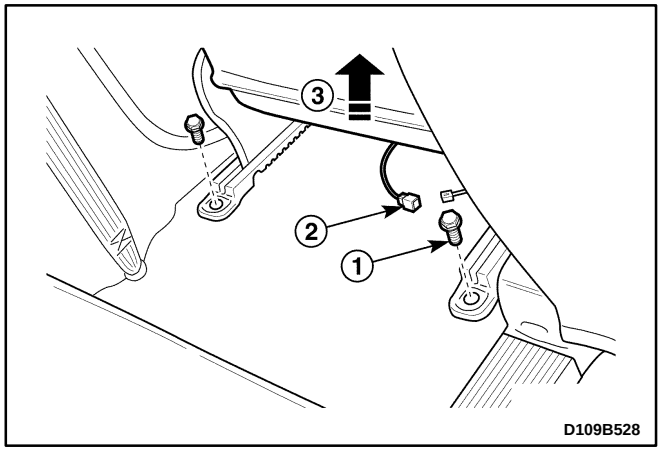
REAR SEAT



1. Rear Seatback Cushion
2. Rear Seatback Frame
3. Rear Seat Hinge
4. Rear Seat Lock
5. Rear Seat Cushion
6. Seat Release Knob
7. Eyelet
8. Seat Back Hinge
9. Rear Cushion Pull Loop

REPAIR INSTRUCTIONS

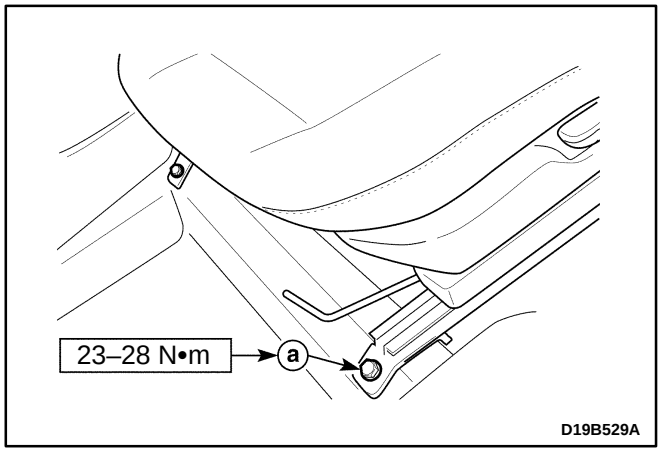
ON–VEHICLE SERVICE



FRONT SEATS

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the front seat.
   - Remove the bolts (1).
   - Disconnect the seat belt warning lamp connector (2).
   - Remove the seat (3).



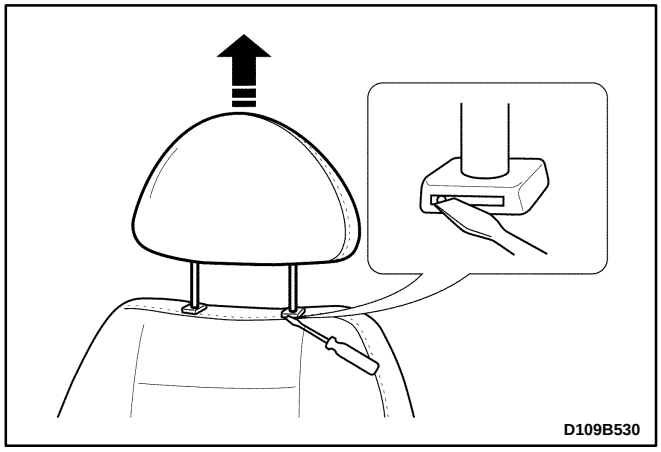
Installation Procedure

1. Connect the seat belt warning lamp connector.
2. Install the front seat with the bolts.

   Tighten

   Tighten the seat bolt to 23–28 N•m (17–21 lb-ft).

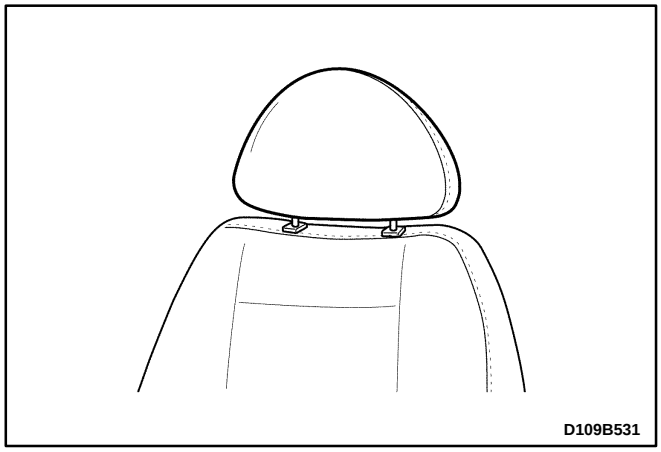
   a. Seat bolt.
3. Connect the negative battery cable.



HEAD RESTRAINT

Removal Procedure

1. Pull the head restraint up to the stop position.
2. Insert a small flathead screwdriver in the notch in the left guide sleeve and pull up the head restraint by pushing the head restraint left.



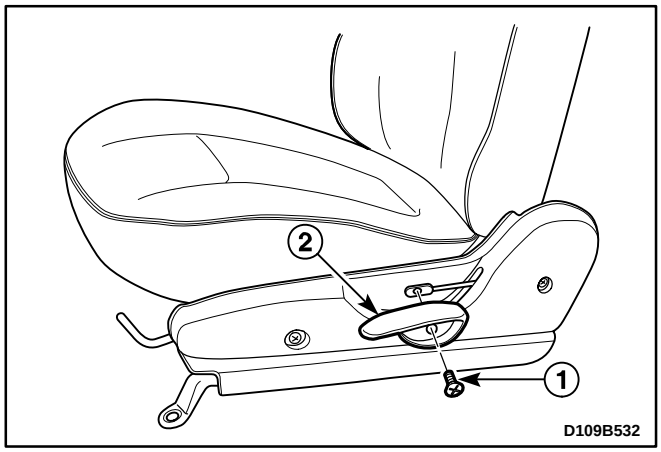
Installation Procedure

1. Install the head restraint into the guide sleeves. Press down in order to engage the stop pin.

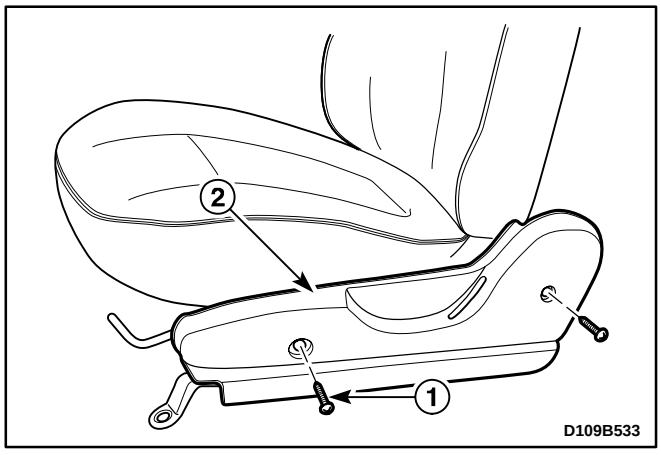
FRONT SEATBACK

Removal Procedure

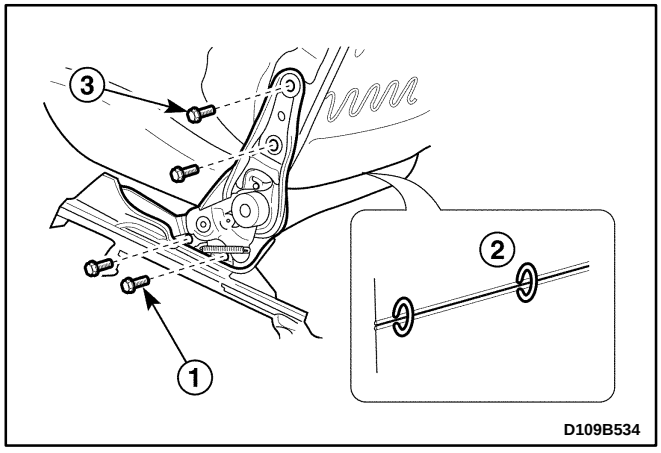
1. Disconnect the negative battery.
2. Remove the front seat assembly. Refer to “Front Seats” in this section.
3. Remove the recliner knob from the front seat.
   - Remove the screw (1).
   - Remove the recliner knob (2).

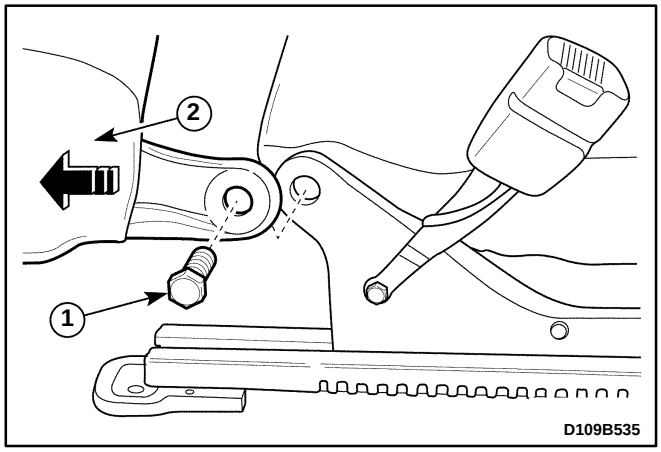


4. Remove the recliner cover from the front seat.
   - Remove the screws (1).
   - Remove the recliner cover (2).

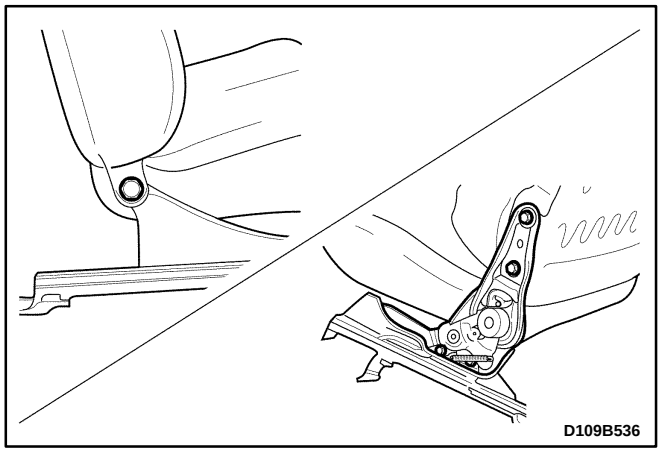


5. Remove the recliner from the front seat.
   - Remove the bolts on the seat cushion (1).
   - Remove the seatback cover hog rings.
   - Remove the seatback cover (2).
   - Remove the bolts on the seatback (3).



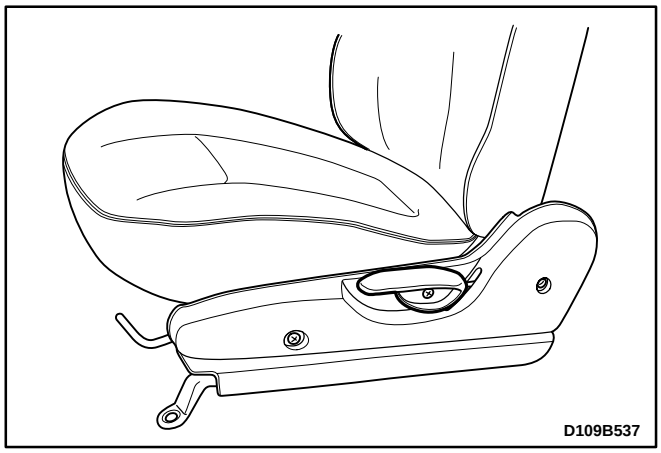


6. Remove the seatback bolt from the seat cushion (1).
7. Remove the seatback assembly (2).

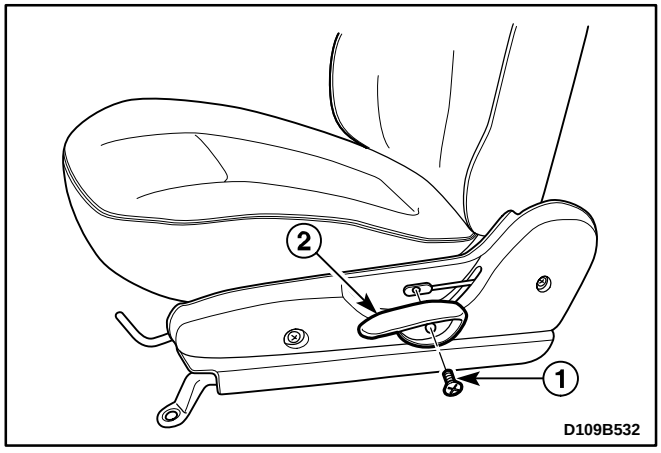


Installation Procedure

1. Install the seatback assembly with the bolt.
2. Install the recliner with the bolts
3. Install the seatback cover with the hog rings.



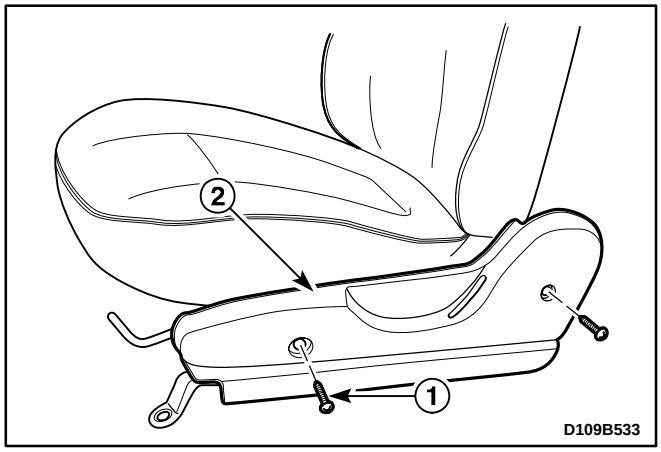
4. Install the recliner knob and the cover with the screws.
5. Install the front seat assembly. Refer to “Front Seat” in this section.
6. Connect the negative battery cable.



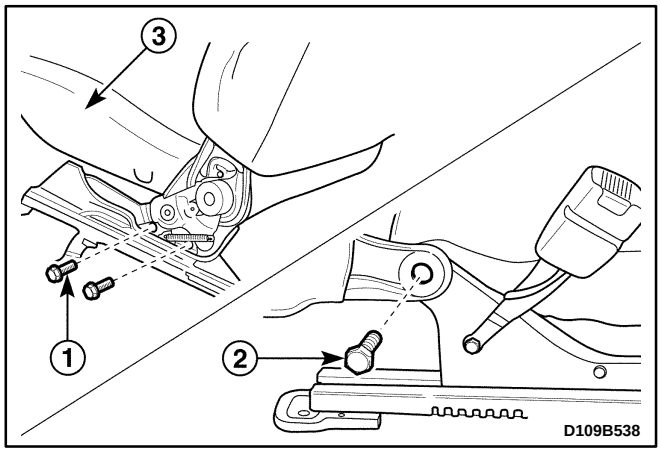
FRONT SEAT CUSHION

Removal Procedure

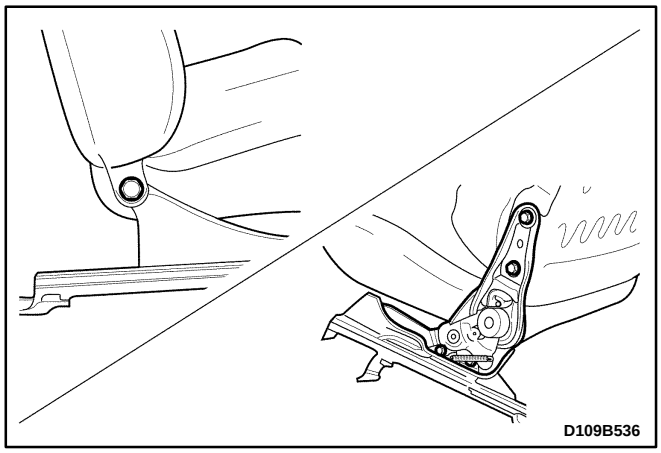
1. Disconnect the negative battery cable.
2. Remove the front seat assembly. Refer to “Front Seat” in this section.
3. Remove the seat belt buckle. Refer to *Section 8A, Seat Belts.*
4. Remove the recliner knob.
   - Remove the screw (1).
   - Remove the recliner knob (2).



5. Remove the recliner cover.
   - Remove the screws (1).
   - Remove the recliner cover (2).

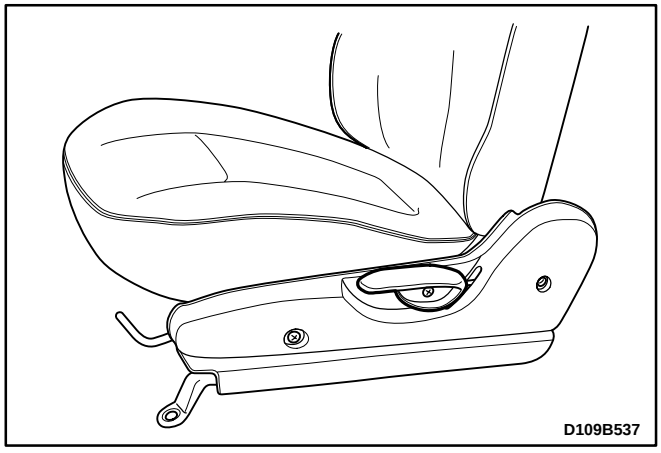


6. Remove the seat cushion.
   - Remove the recliner bolts on the seat cushion (1).
   - Remove the seatback bolt (2).
   - Remove the seat cushion (3).

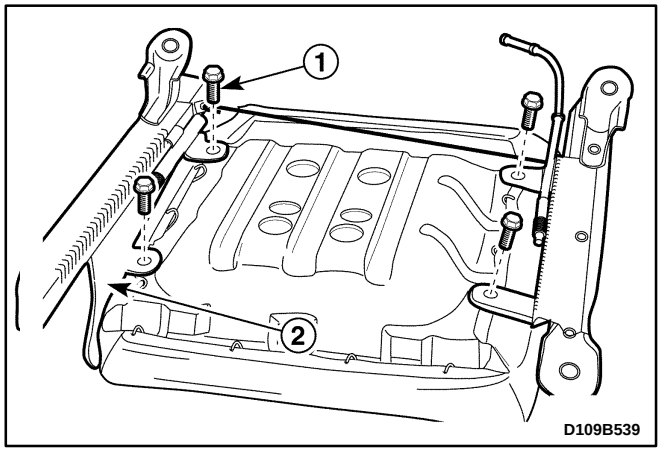


Installation Procedure

1. Install the seat cushion with the seatback bolt and the recliner bolts.



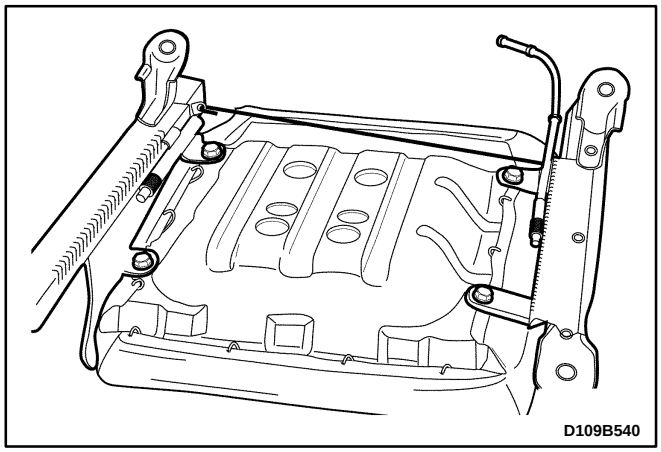
2. Install the recliner cover and the recliner knob with the screws.
3. Install the seat belt buckle. Refer to *Section 8A, Seat Belts.*
4. Install the front seat assembly. Refer to “Front Seats” in this section.
5. Connect the negative battery cable.



FRONT SEATS GUIDE RAIL

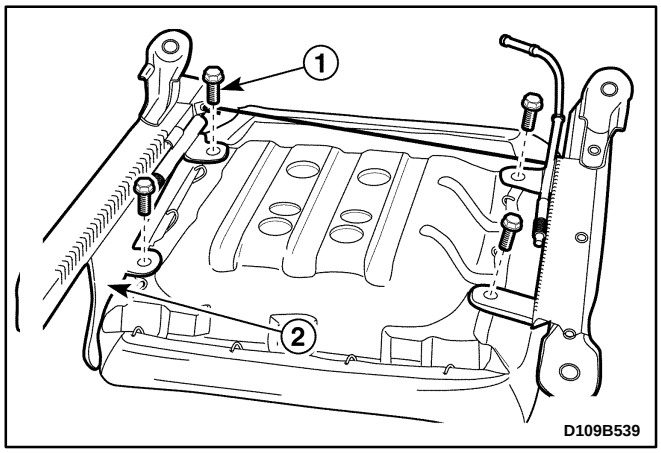
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the front seat assembly. Refer to “Front Seats” in this section.
3. Remove the guide rail from the seat.
   - Remove the bolts (1).
   - Remove the guide rail (2).



Installation Procedure

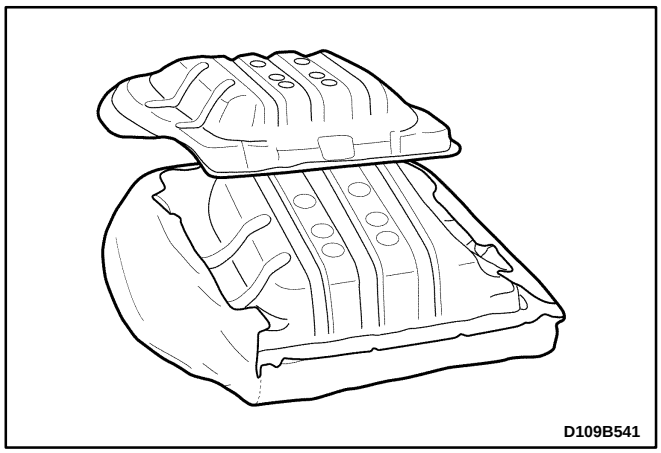
1. Install the guide rail to the seat with the bolts.
2. Install the front seat assembly. Refer to “Front Seat” in this section.
3. Connect the negative battery cable.



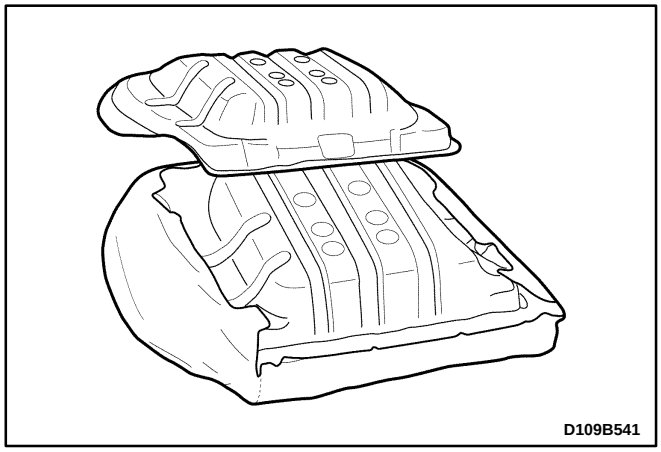
FRONT SEAT CUSHION FRAME

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the front seat cushion. Refer to “Front Seat Cushion” in this section.
3. Remove the guide rail.
   - Remove the bolts (1).
   - Remove the guide rail (2).

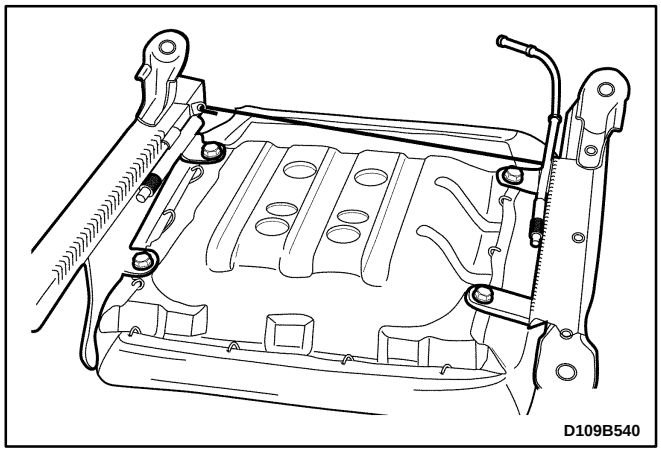


4. Remove the seat cushion cover.
   - Remove the hog rings.
5. Remove the seat cushion frame.

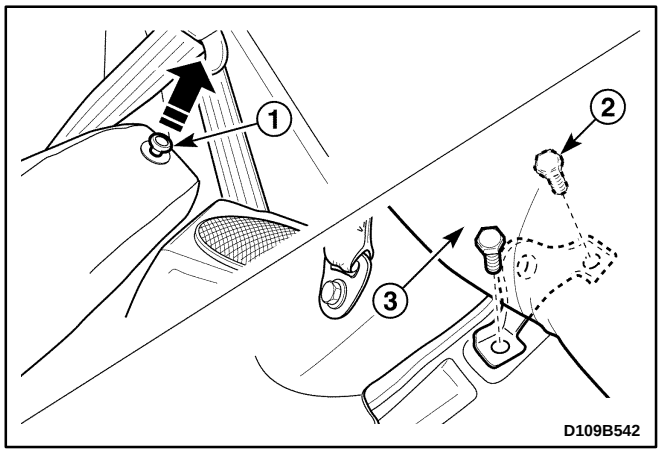


Installation Procedure

1. Install the seat cushion cover with the hog rings.



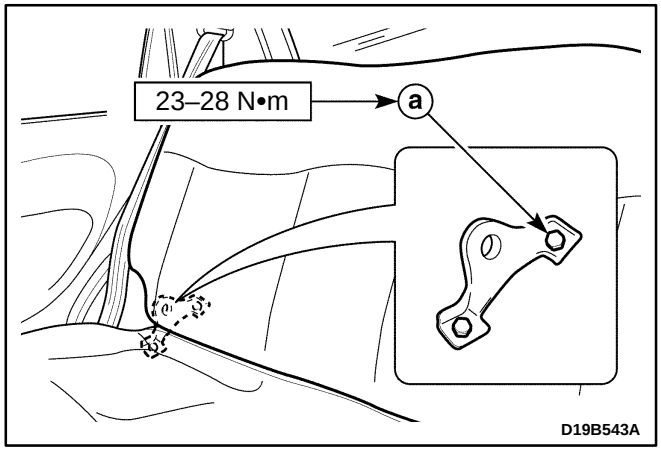
2. Install the guide rail with the bolts.
3. Install the front seat cushion. Refer to “Front Seat Cushion” in this section.
4. Connect the negative battery cable.



REAR SEATBACK

Removal Procedure

1. Remove the rear seatback.
   - Remove the rear seatback lock by pulling the lock knob upward (1).
   - Remove the seatback hinge bolts (2).
   - Remove the rear seatback (3).



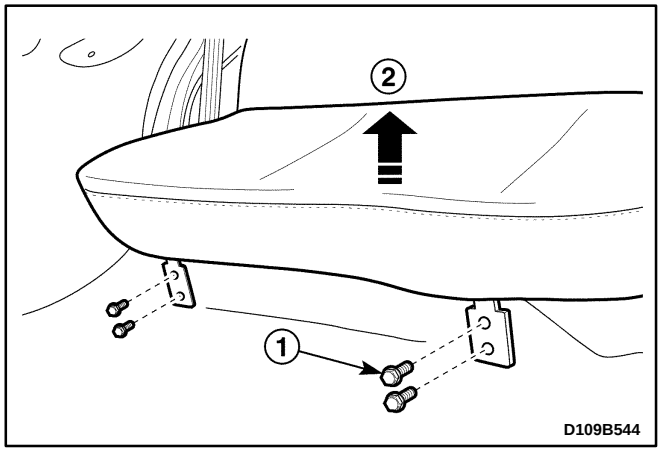
Installation Procedure

1. Install the rear seatback with the hinge bolts.

   Tighten

   Tighten the hinge bolts to 23–28 N.m (17–21 lb-ft).

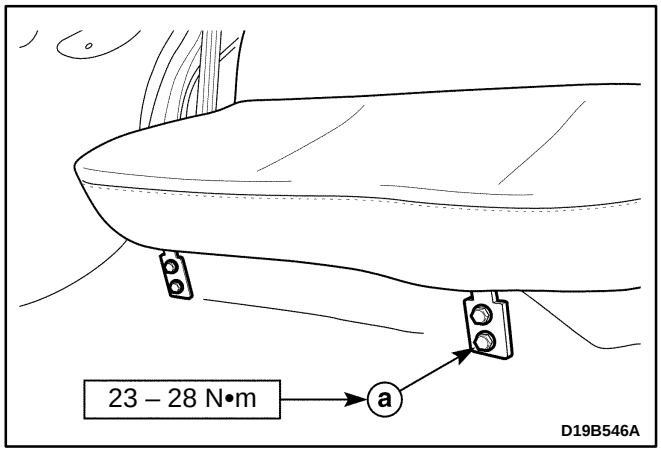
   a. Rear seatback hinge bolt.
2. Press the lock knob.



REAR SEAT CUSHION

Removal Procedure

1. Remove the rear seat cushion.
   - Remove the bolts (1).
   - Lift and remove the rear seat cushion (2).



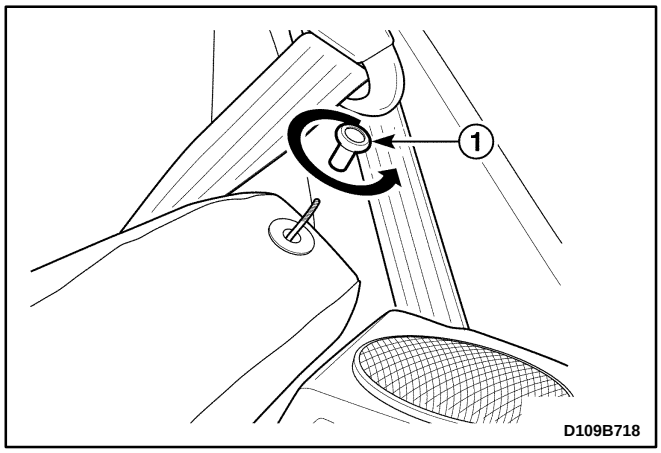
Installation Procedure

1. Install the rear seat cushion with the bolts.

   Tighten

   Tighten the rear seat cushion bolt to 23–28 N.m (17–21 lb–ft).

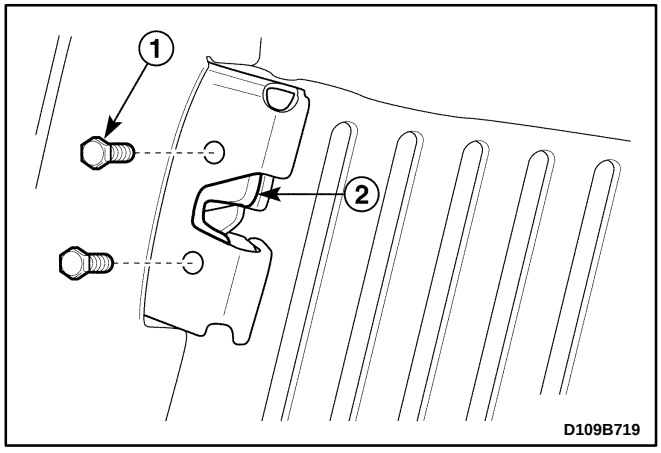
   a. Rear seat cushion bolt.



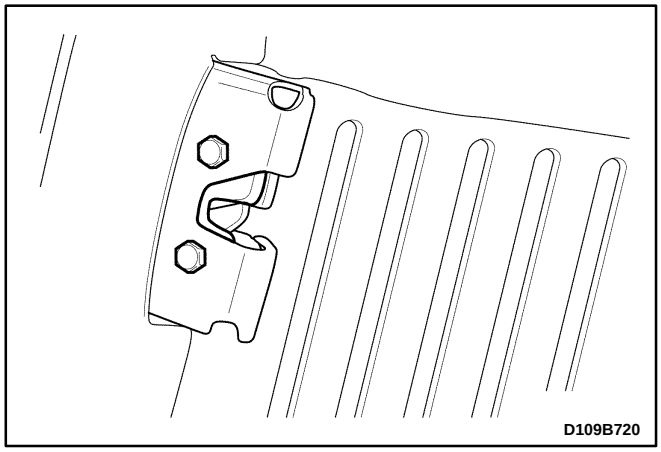
REAR SEATBACK LATCH

Removal Procedure

1. Remove the rear seatback assembly. Refer to “Rear Seatback” in this section.
2. Remove the lock knob from the seatback.
   - Remove the lock knob by twisting it (1).

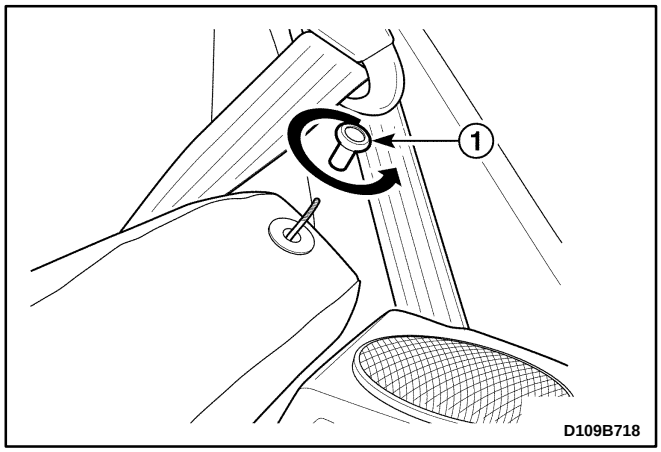


3. Remove the rear seatback cover from the seatback frame.
4. Remove the lock from the seatback frame.
   - Remove the bolts (1).
   - Remove the lock (2).



Installation Procedure

1. Install the lock to the seatback frame with the bolts.
2. Install the rear seatback cover to the seatback frame.

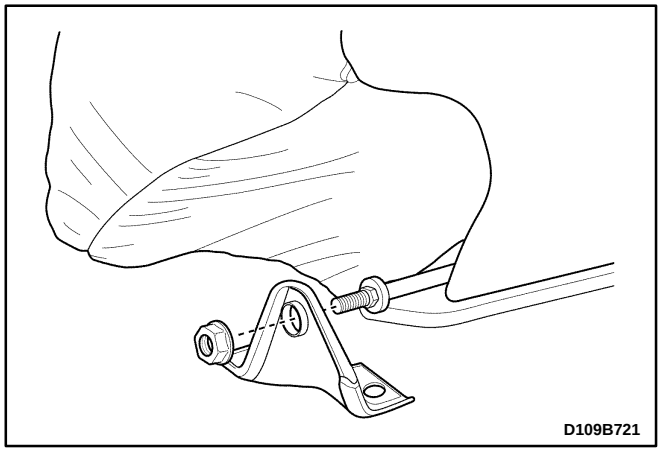


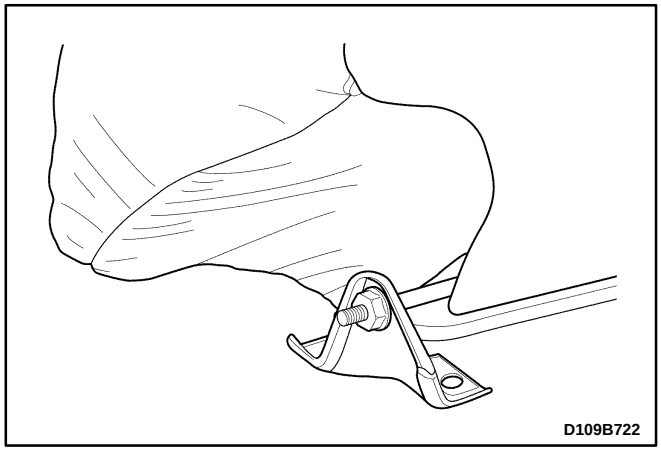
3. Install the lock knob to the seatback.
4. Install the rear seatback assembly. Refer to “Rear Seatback” in this section.

REAR SEATBACK HINGE

Removal Procedure

1. Remove the rear seatback assembly. Refer to “Rear Seatback” in this section.
2. Remove the hinge from the seatback.
   - Remove the nut.
   - Remove the hinge.





Installation Procedure

1. Install the hinge to the seatback with the nut.
2. Install the rear seatback assembly. Refer to “Rear Seatback” in this section.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Front Seat Bolts (Both)	23 – 28	17 – 21	–
Rear Seat Cushion Bolts	23 – 28	17 – 21	–
Rear Seatback Bolts	23 – 28	17 – 21	–

SECTION 9I

WATERLEAKS

TABLE OF CONTENTS

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Recommended Materials for Waterleak Repairs 9I-7
Watertest Stand Specifications 9I-7

DIAGNOSTIC INFORMATION AND PROCEDURES

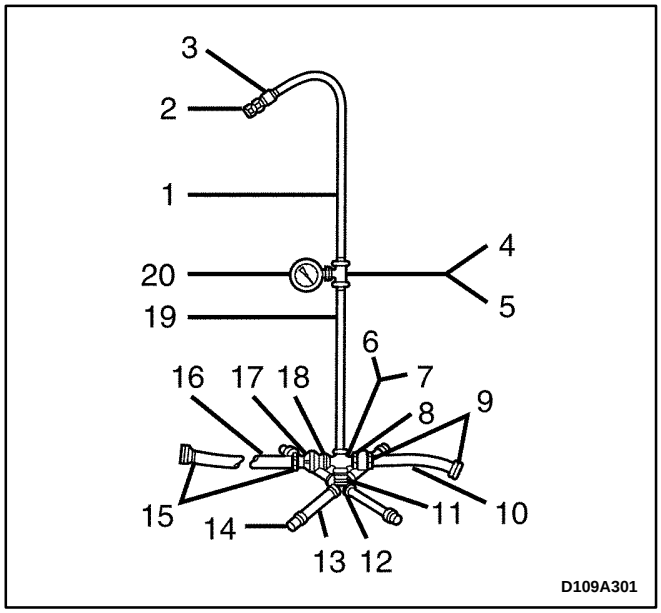
WATERLEAK DIAGNOSIS

The repair of waterleaks in the body requires proper testing and diagnosis. Repair waterleaks by adjusting the misaligned parts and using the proper repair materials. First, determine what conditions cause the leak. For example, the leak may occur only when the vehicle is parked on an incline, or water may appear only in the spare tire compartment. Second, test the area for the source of the leak using the following testing methods. If the general leak area is found, determine the exact entry point of the leak by using a water hose or an air hose. If the general leak area is not obvious, use the watertest stands to determine the area of the leak. It may be necessary to remove some interior trim panels or some parts in order to locate the leaks.

Important: It is necessary to find the origin of all the leaks before making any repairs. Random repairs may stop the leak only temporarily and may make future repairs more difficult. Continue localized testing in the general area in order to ensure that all leaks are found.

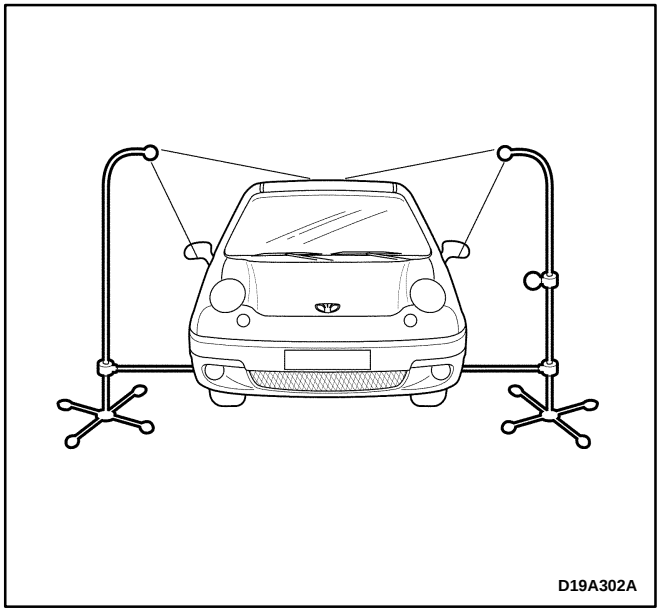
Generalized Testing

1. Set up the watertest stands.

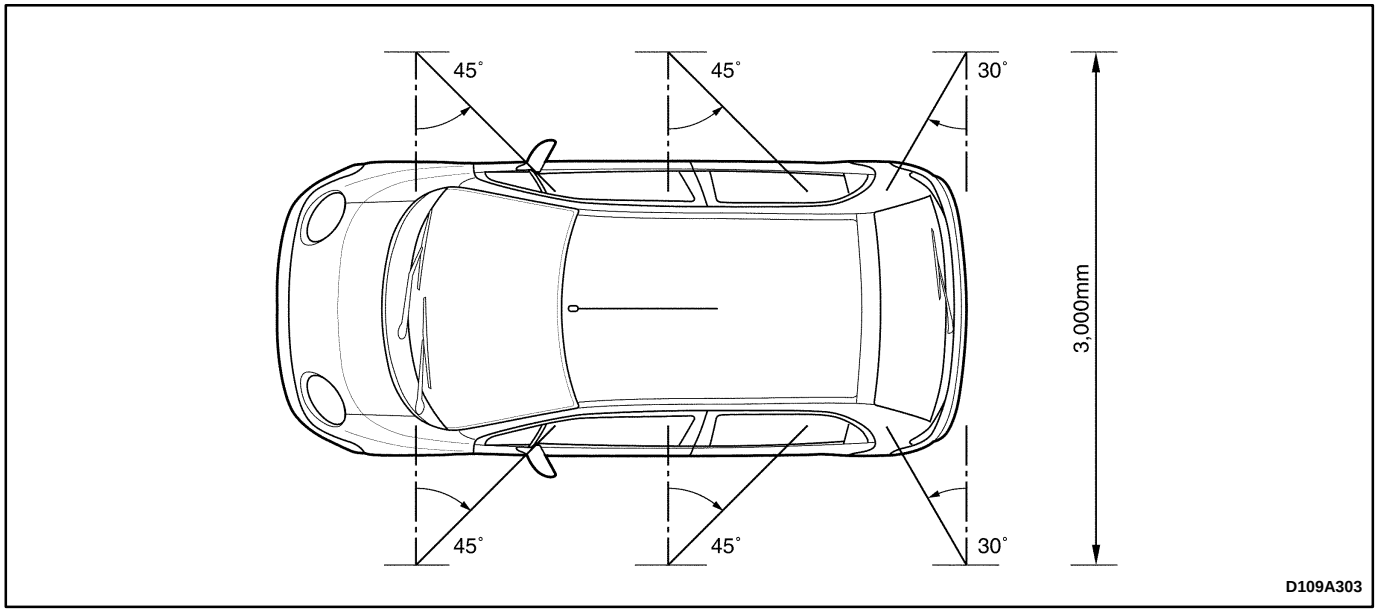


1 1/2-inch by 36-inch Pipe
2 Full-jet Spray Nozzle #1/2 GG-25 or Equivalent Nozzle Height at 1,600 mm to the Floor
3 1/2-inch Coupling
4 1/2-inch by 1/2-inch by 1/4-inch Reducing T (Right Only)
5 1/2-inch Coupling (Left Only)
6 1/2-inch Cross (Right Only)
7 1/2-inch Tee (Left Only)
8 1/2-inch Pipe-to-Hose Nipple (Right Only)
9 5/8-inch Female Hose Coupling
10 5/8-inch Input Hose (2 Feet Long, Right Only)
11 1/2-inch Close Nipple
12 1/2-inch Cross with Weld-on 1/2-inch Cap
13 1/2-inch by 12-inch Nipple
14 1/2-inch Cap
15 5/8-inch Female Hose Coupling
16 5/8-inch Cross Hose (12 Feet Long)
17 5/8-inch Hose Quick Connect
18 1/2-inch Pipe-to-Hose Nipple
19 1/2-inch by 30-inch Pipe (Straight)
20 1/4-inch Water Pressure Gauge (Right Only)

2. Set up the watertest stand leak test.



3. Perform the watertest stand leak test. Refer to “Watertest Stand Specifications” in this section.
4. If the local water pressure does not allow the required water pressure of 155 kPa (22.5 psi), move both stands closer to the vehicle so that the water spray overlaps.

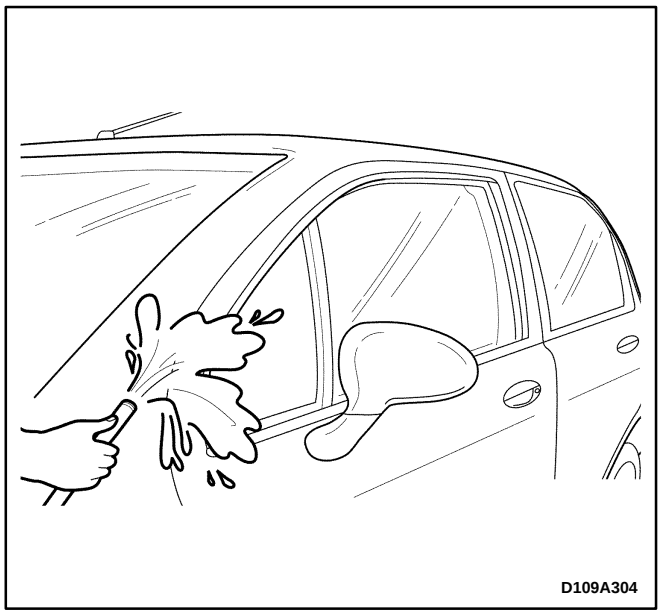


Localized Testing (Spot Test)

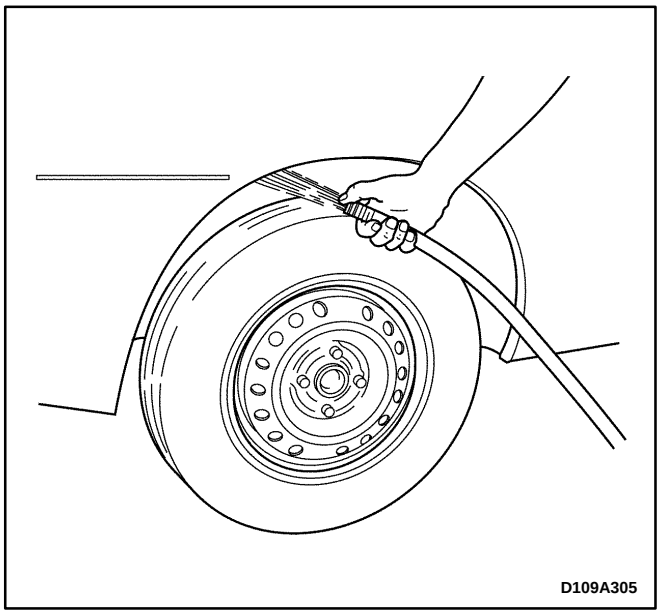
1. Do localized testing with a water hose or an air hose.
2. Begin testing by spraying the air or the water at the base of the suspected leak area. Continue spraying the air or the water upward until the leak is found.

Water Hose Test

1. Place another person inside the vehicle in order to detect the location of the leak.
2. Use a water hose without a nozzle.

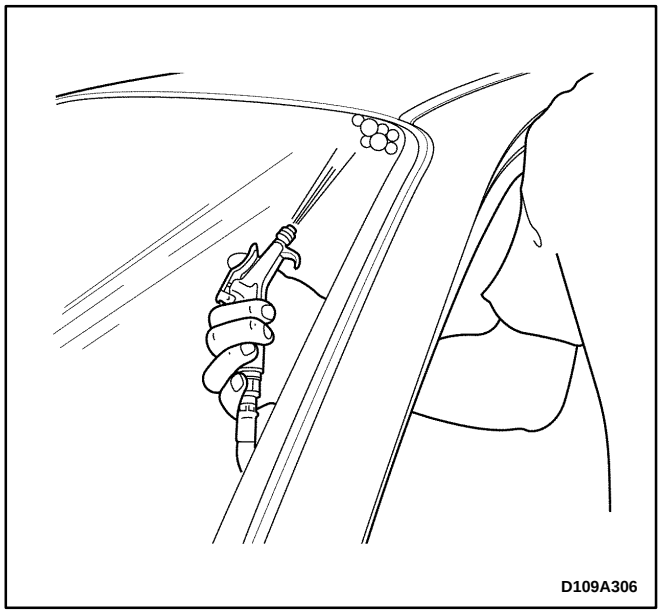


3. Begin spraying the water at the base of the suspected leak area. Continue spraying the water upward until the leak is found.



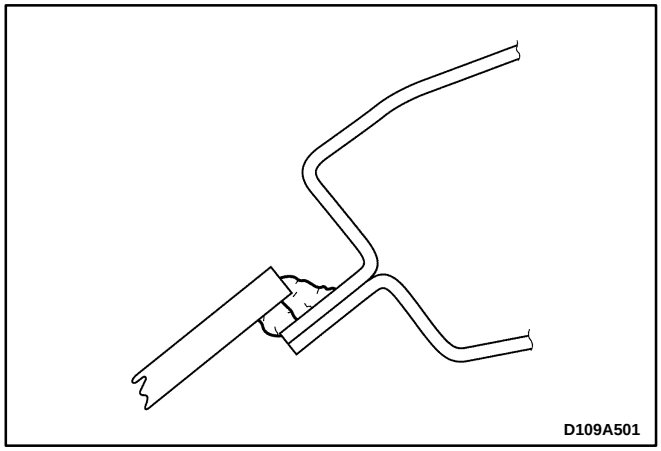
Air Hose Test

1. Apply soapy water to the outside of the vehicle in the suspected leak area.
2. Blow air from inside the vehicle. The air pressure should not exceed 205 kPa (29.7 psi).
3. Determine the location of the leaks from the bubbles formed in the soapy water.



REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE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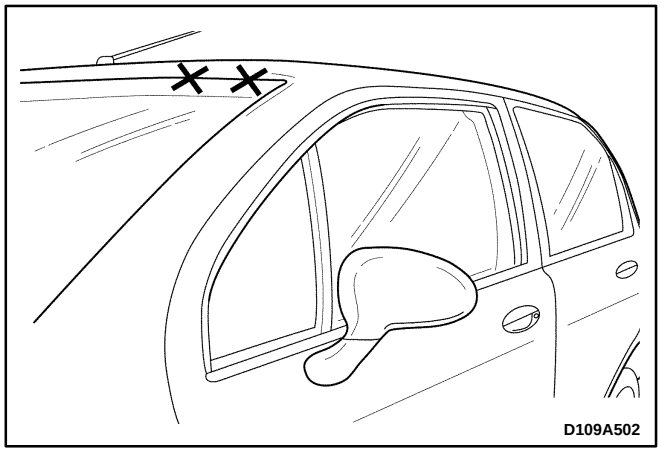
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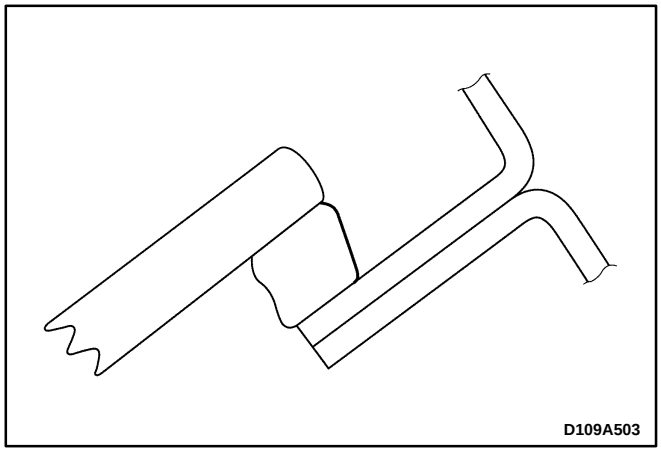
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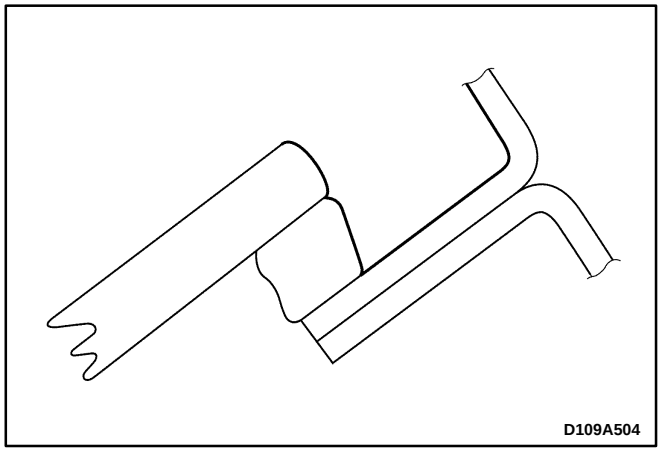
WATERLEAK REPAIR

Some waterleaks around the glass can be repaired without removing the glass.

Important: This type of repair may be used only for urethane–installed glass.

1 Remove the reveal molding in the area of the leak. It may be necessary to remove the garnish molding or the trim strip lace in order to locate the leak.
2. While spraying water over leak area, carefully push the glass outward in order to determine the size of the leak.
3. Mark the location of the leak.
4. Use water to clean any dirt frame the area. Dry the area with an air hose.
5. Using a sharp knife, trim off the uneven edges of the adhesive caulking material around the leak for a distance of 75 to 100 mm (3 to 4 inches) on both side of the leak.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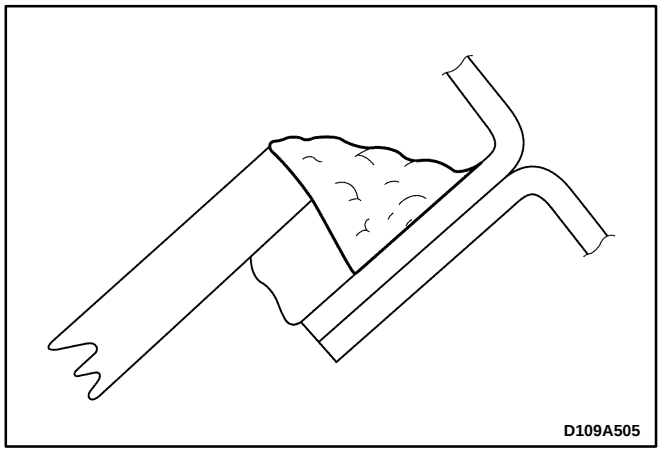
6. Prime the trimmed area with the primer.
7. Using a sharp knife, trim off the uneven edges of the adhesive material around the leak 75 to 100 mm (3 to 4 inches) on both sides of the leak.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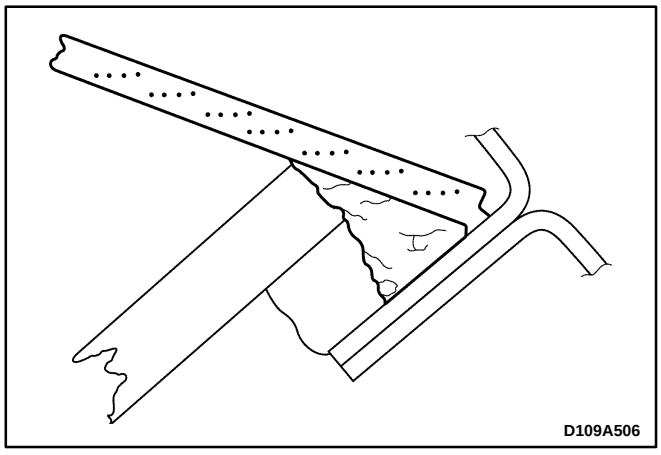
8. Allow the primer to dry for 5 minutes.
9. Apply the adhesive over the leak and for a distance of 75 to 100 mm (3 to 4 inches) on both sides of the leak.


D109A506

10. Immediately after applying the adhesive, use a flat stick or a similar tool to work the adhesive into the leak area and into the joint between the original material and the vehicle body in order to ensure a watertight seal.
11. Spray warm or hot water over the repaired area in order to determine if the leak was repaired. Do not run a heavy stream of water directly on the freshly applied adhesive.
12. Install the trim strip lace if it was removed.
13. Install the garnish molding if it was removed.
14. Install the reveal molding.

D109A304

Important: After the completion of any waterleak repair, re–test the area using the watertest stands. Do not use localized testing procedures on the newly–repaired areas, as the repair material may dislodge under abnormal pressure.

SPECIFICATIONS

RECOMMENDED MATERIALS FOR WATERLEAK REPAIRS

Leak Areas	Repair Materials
Windshield, back window	Urethane adhesive, caulking kit, or the equivalent
Metal joints	Brushable seam sealer which can be painted
Ventilation ducts	3M™ Auto Bedding and Glazing Compound or the equivalent
Small cracks and pin holes	3M™ Drip-Check Sealer or the equivalent
Large holes	3M™ Automotive Joint and Seam Sealer
Weatherstrips	3M™ 08011 Weatherstrip Adhesive or the equivalent
Bolts, studs, and screws	Strip caulk

WATERTEST STAND SPECIFICATIONS

Application	Description
Nozzle Type	Full jet spray nozzle #1/2 GG-25 or equivalent with a 60° included angle
Nozzle Height	Approximately 1,600 mm (63.0 in.) from the floor
Volume of Flow	14L (3.7 gal) per minute
Pressure	155 kPa (22.5 psi) measured at the nozzle
Windshield and A-Pillar Test Stand Position	Approximately 30° down, 45° toward the rear, and aimed at the corner of the windshield
B-Pillar Test Stand Position	Approximately 30° down, 45° toward the rear, and aimed at the center of the rear door
Back Window and tailgate Test Stand Position	Approximately 30° down, 45° toward the front and aimed approximately 610 mm (24.0 in.) from the corner of the back window

SECTION 9J

WINDNOISE

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On-Vehicle Service 9J-2
Windnoise Repair 9J-2

DIAGNOSTIC INFORMATION AND PROCEDURES

WINDNOISE DIAGNOSIS

Caution: An assistant should drive the vehicle while the technician checks for the location of the windnoise, in order to prevent personal injury or vehicle damage.

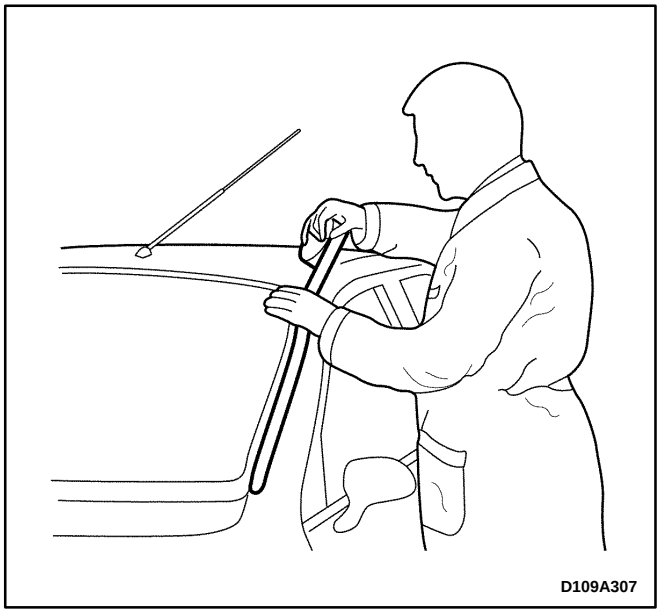
A test drive in the vehicle is necessary to accurately determine the location of the windnoise. Often there is a primary leak and secondary leaks. Failure to repair all leaks will only reduce the windnoise, not eliminate it.

During the test drive the technician should bring the following items to aid in determining the location of the windnoise.

- A mechanics stethoscope or vacuum hose
- Masking tape
- Strip caulk
- A china marking pencil
- A screwdriver

Perform the following steps in order to conduct the road test:

1. Choose a route that includes smooth straight streets that run in all four directions (north, south, east, and west).
2. Choose streets with little traffic or noise that would interfere with the test.
3. Drive the vehicle at the speeds at which the noise was noticed by the customer or until the noise is produced. Do not exceed legal speed limits.
4. The windnoise is external if any of the following conditions occur:
   - The windnoise is caused by the wind.
   - The windnoise can be heard with the door glass lowered and while the vehicle is being driven.
   - The windnoise is eliminated when tape is placed over various moldings and gaps.
5. Internal windnoise is air leaving the vehicle and should be repaired in the following manner.
   - In order to locate the leak, tape off the body lock pillar pressure relief valves. This will cause air pressure to build up inside the vehicle and enhance the windnoise.
   - Use a stethoscope or a vacuum hose to locate the leak.
   - Temporarily repair the leak with masking tape.



   - Continue testing in order to determine if the noise has been eliminated or if other leaks exist.
   - When all leaks have been found, return to the shop and make permanent repairs with the proper alignment techniques and sealing materials.

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE

WINDNOISE REPAIR

Windnoise leak repairs are very similar to waterleak repairs. Refer to *Section 9I, Waterleaks.* The actual procedure depends on the type of seal being repaired. Leaks around the door opening weatherstrips do not always indicate a faulty weatherstrip. A door or window adjustment may resolve the condition. Refer to *Section 9L, Glass and Mirrors.*

SECTION 9K

SQUEAKS AND RATTLES

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DIAGNOSTIC INFORMATION AND PROCEDURES

SQUEAK AND RATTLE DIAGNOSIS

Condition	Probable Cause	Correction
Rattle Coming From the Side Rail	• Improperly connected brake lines.	• Tap lightly on the brake lines and listen for a rattle. • Install plastic tie straps to secure the brake lines tightly together.
Rattle Under Vehicle at Higher RPM	• The heat shield contacts with the underbody.	• Raise the vehicle and perform a visual inspection. • Bend the heat shield slightly to gain clearance from the underbody.
Squeak From the Front of the Vehicle in Cold Weather	• Poor front stabilizer shaft insulators taping.	• While the vehicle is cold, perform a test drive and achieve full front suspension travel by driving through a dip in the road. • Remove the insulators and wrap teflon tape around the stabilizer shaft. Reinstall the insulators over the tape.
Thump From Rear of Vehicle on Bumps	• Improperly secured spare tire in the rear compartment.	• Open the rear compartment and perform a visual inspection of the spare tire and the tools. • Tightly secure the spare tire and all tools. • Perform a road test to verify that the noise is eliminated.
Glass Knock Coming From the Rear of the Vehicle When Driving Over Bumps	• An out-of-adjustment hatchback latch.	• Test drive the vehicle in order to verify this condition. • Loosen the latch nuts and adjust the latch downward.
Rattle Coming From Door	• The door lock solenoid is loose.	• Remove the door trim panel and check if the solenoid is loose. • Tighten the solenoid bolts.
	• Rattling electrical connectors inside the door trim panel.	• Tap on the trim panel and listen for a rattle. • Remove the trim panel and wrap foam padding around the connectors as required.
Squeak When Operating Doors	• A lack of lubrication of the door hinge pins.	• Operate the doors and listen for squeaks. • Lubricate the door hinge pins with light oil and coat with lithium grease.
	• A lack of lubrication of the door hold open link arm.	• Lubricate the door hold open link arm with light oil and coat with lithium grease.

SQUEAK AND RATTLE DIAGNOSIS (Cont'd)

Condition	Probable Cause	Correction
Squeak Coming From Console When Shifting Manual Transaxle (Condition Occurs In Cold Weather with a Cold Engine)	● The faulty manual transaxle control lever lower boot.	● Move the control lever between gears and listen for squeaks. ● Remove the floor console and replace the lower shift boot or apply talcum powder to the lower shift boot.
Squeak Coming From Instrument Cluster Trim Plate	● Rubbing of the cluster trim plate on the instrument panel.	● Test drive the vehicle in order to verify this condition. ● Remove the instrument cluster trim plate and install felt tape to the edges.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

SQUEAK AND RATTLE REPAIR

Squeaks and rattles are caused by the unwanted movement between parts of a vehicle. There are three means to prevent squeaks or rattles.

- Attach the parts securely so that there is no relative motion during the operation of the vehicle.
- Separate the parts so that there is no contact during operation.
- Insulate the parts so that no squeaks or rattles occur with the movement of the parts. Low uniform friction surfaces can be used to eliminate “stick–slip” motion.

SECTION 9L

GLASS AND MIRRORS

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.

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DESCRIPTION AND OPERATION

STATIONARY GLASS

Stationary glass consists of all the glass on the vehicle which is immovable within its frame, such as the windshield glass, the back glass, and the inside rearview mirror.

INSIDE REARVIEW MIRROR

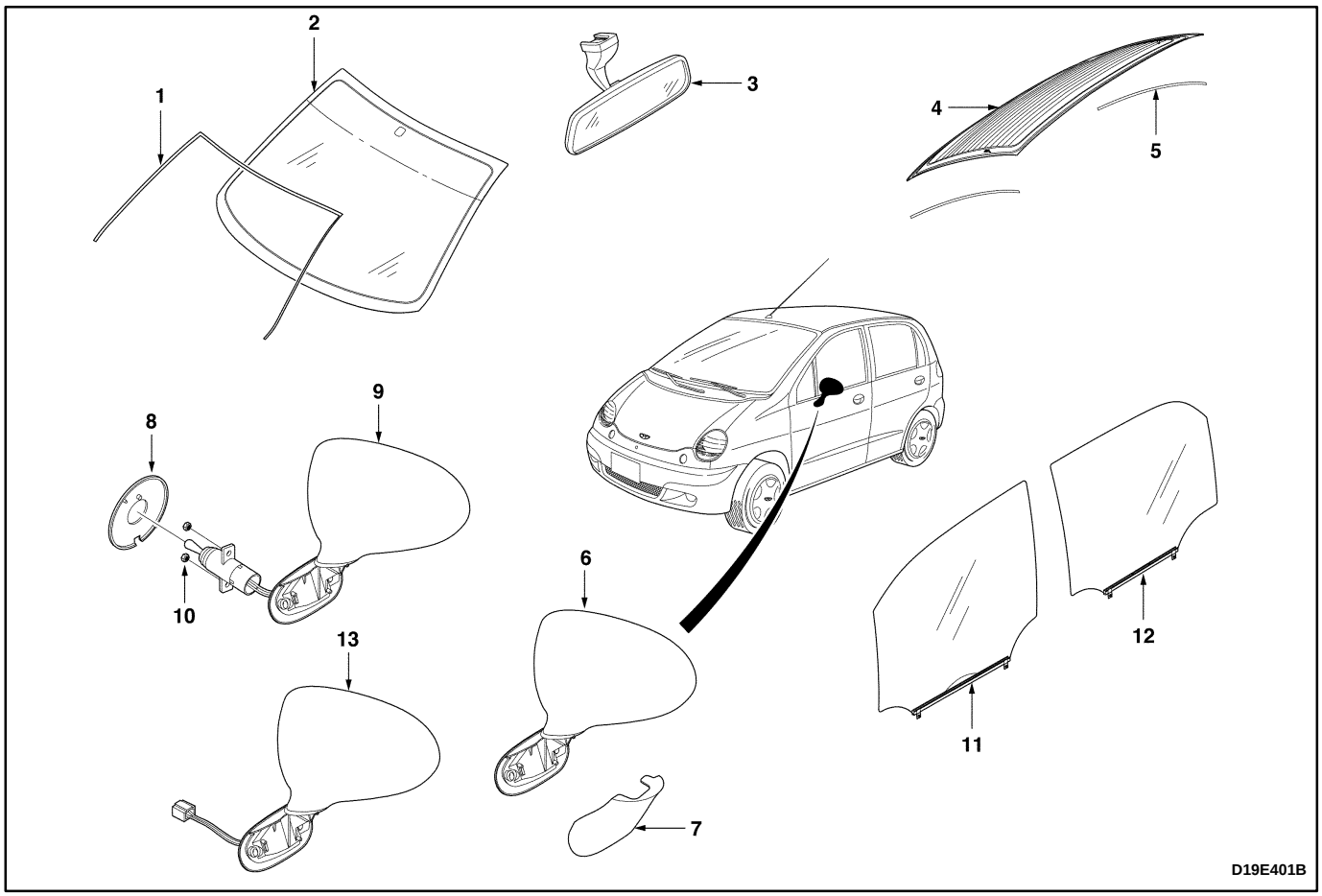
The inside rearview mirror can be manually adjusted up/down, fore/aft, and left/right. The rearview mirror pivots in two places: the ball-and-socket mirror pivot and the up/down hinge lever at the mirror support.

OUTSIDE REARVIEW MIRRORS

Three types of outside rearview mirrors are available. The outside rearview mirrors are adjusted by hand which is standard. The remote control and the electric outside rearview mirrors are optional. The outside rearview mirrors are installed on the front doors.

COMPONENTS LOCATOR

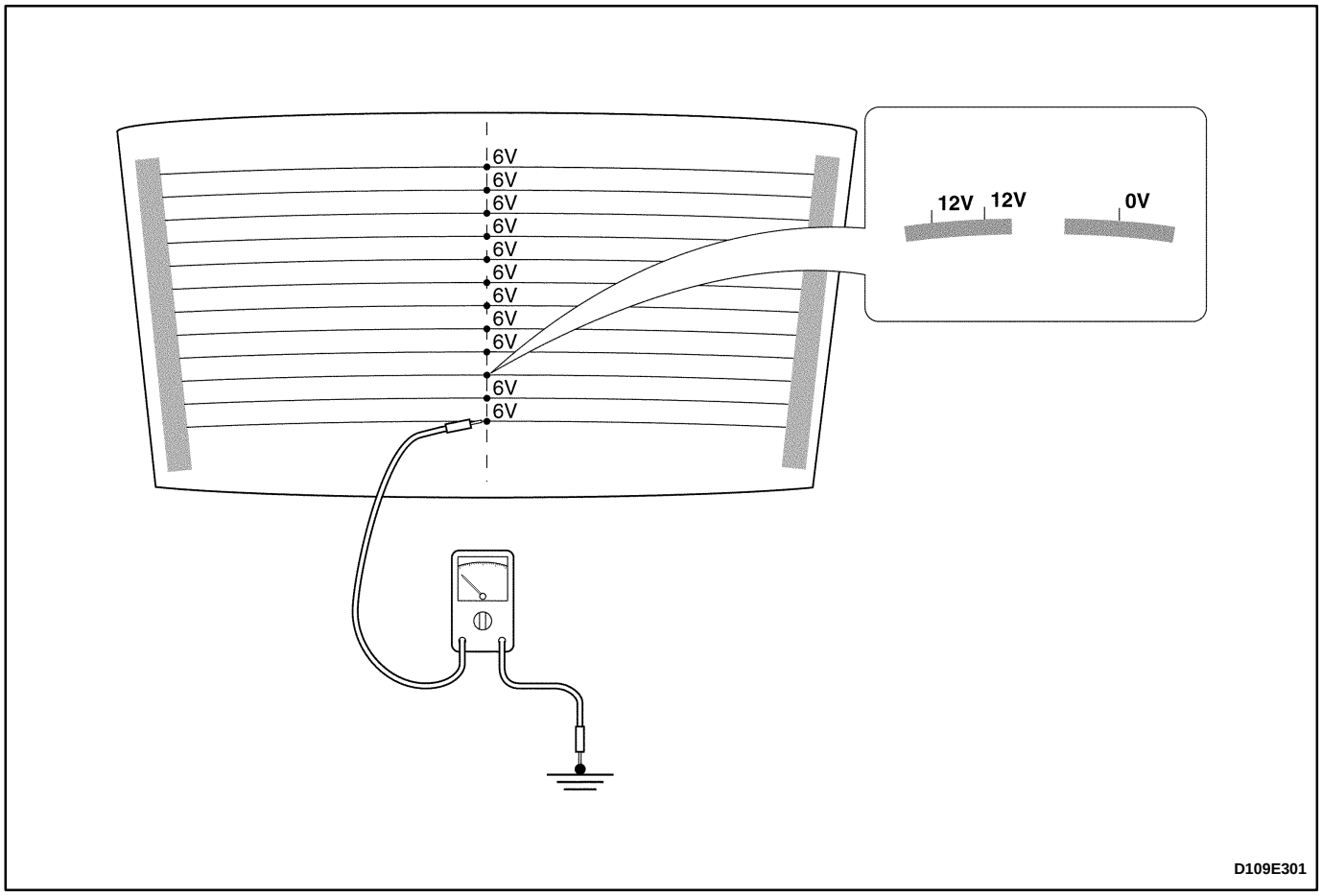
GLASS AND MIRROR



1. Windshield Molding
2. Windshield
3. Inside Rearview Mirror
4. Rear Window Glass
5. Rear Window Glass Damping
6. Outside Rearview Mirror (Manual)
7. Outside Rearview Mirror Cover
8. Outside Rearview Mirror Trim Cover
9. Outside Rearview Mirror (Cable)
10. Nuts
11. Front Door Glass
12. Rear Door Glass
13. Outside Rearview Mirror (Electric)

DIAGNOSTIC INFORMATION AND PROCEDURES

TESTING REAR WINDOW DEFOGGER GRID LINE



If it has been observed during use that a grid line is inoperative, the following procedure can be used to find the break. If none of the grid lines is operating, a full system diagnosis should be completed before attempting to repair the grid lines.

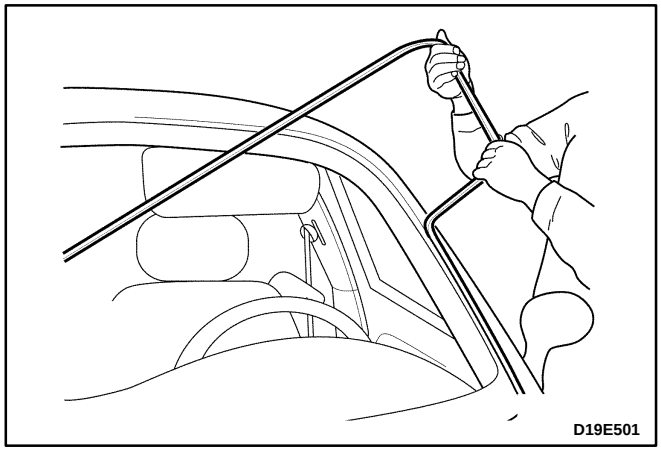
1. Turn the ignition ON.
2. Turn on the rear window defogger.

Notice: Use care when touching the voltmeter terminals to a grid line. If the terminals are roughly applied, the grid line may be scratched, resulting in an open circuit.

3. From the inside of the vehicle, connect a voltmeter to each end of a grid line. The voltmeter will indicate battery voltage if the grid line is open.
4. If a grid line is found to be open, move a voltmeter terminal from one side of the grid line and retest at a point nearer to the other side of the window. Continue to retest, each time bringing one of the voltmeter terminals closer to the opposite side of the window from where it was originally connected. The break in the grid line is at the point where the voltmeter begins reading 0 volts instead of battery voltage.
5. Use a marking crayon to lightly mark the break point on the rear window. Mark the glass instead of marking directly on the grid line, and make the mark far enough from the grid line so that the mark can easily be removed without disturbing the repair.
6. Use a grid line repair kit to fix the break in the grid line. Refer to “Rear Window Defogger Grid Line Repair” in this section.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE



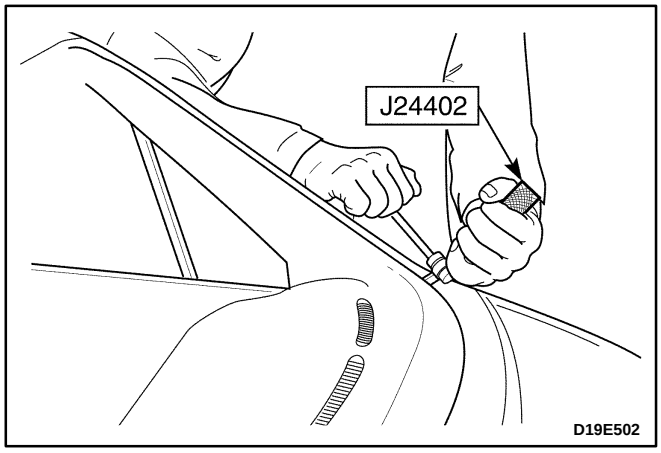
WINDSHIELD

Tool Required

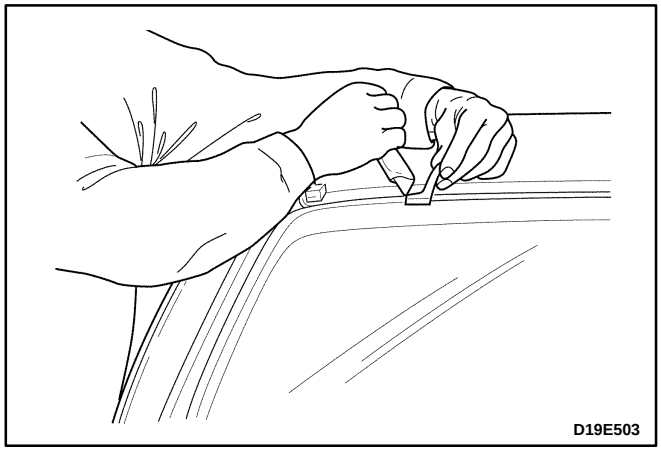
J–24402 Glass Sealant Remover

Removal Procedure

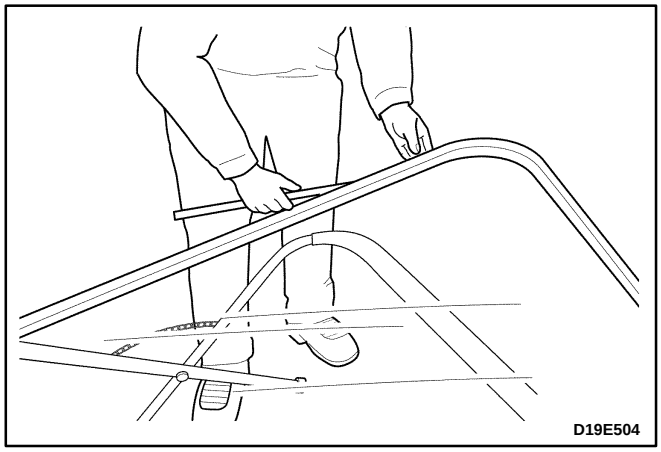
1. Remove the cowl vent grille. Refer to *Section 9R, Body Front End.*
2. Remove the inside rearview mirror. Refer to “Inside Rearview Mirror” in this section.
3. Remove the weatherstrip around the windshield.



4. Using the glass sealant remover J–24402, cut the adhesive around the windshield.



5. Remove the windshield from the vehicle.
6. Using a knife, remove the adhesive from the windshield.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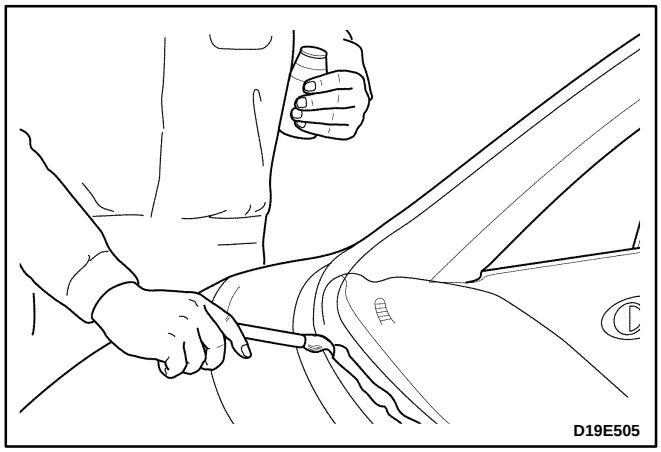
Installation Procedure

1. Install the new weatherstrip to the windshield.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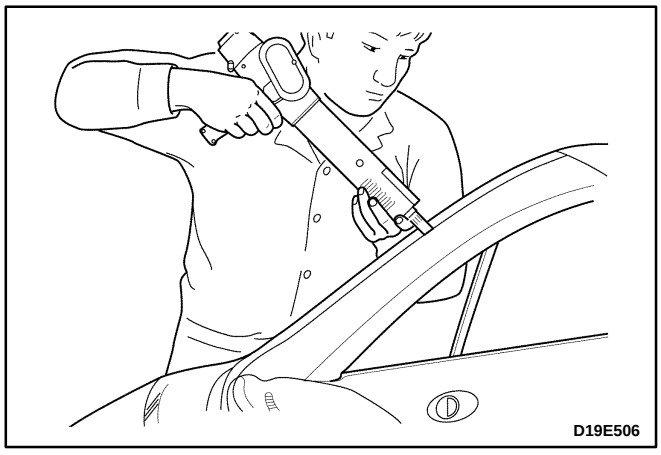
2. Apply tape to the new weatherstrip and the windshield to hold the weatherstrip in place.
3. Apply adhesive primer to the windshield frame and the perimeter of the windshield.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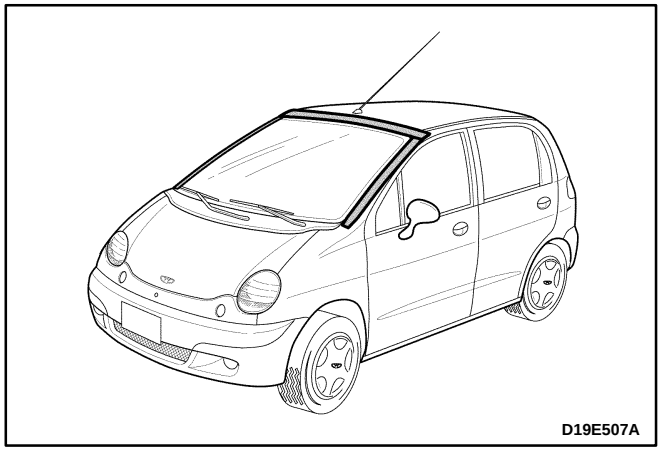
4. Apply glass adhesive to the windshield frame.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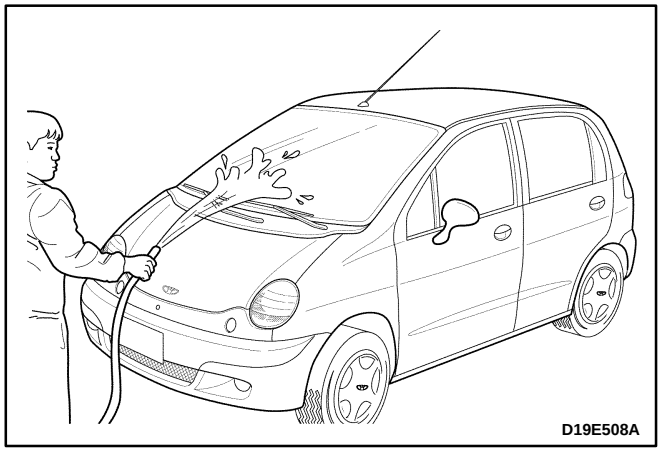
5. Install the windshield into the windshield frame.
6. Reposition the tape over the weatherstrip, the windshield and the windshield frame to hold the windshield in place.
7. Let the adhesive dry for 24 hours.
8. Remove the tape.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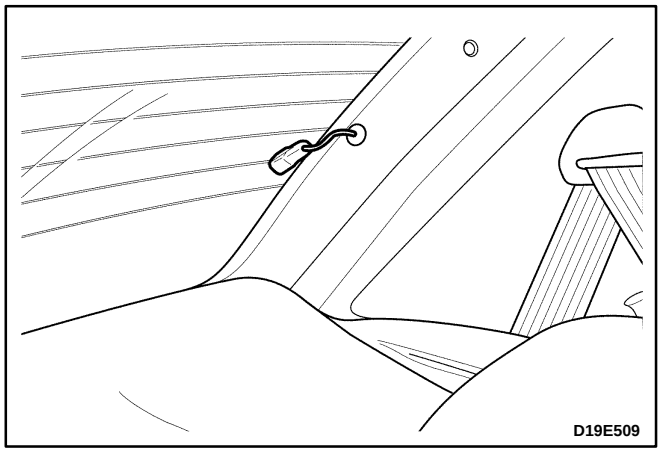
9. Check for waterleaks by pouring water on the windshield. If a leak is found, dry the windshield and fill the area that leaks with adhesive. If the leak persists, remove the windshield and repeat the entire procedure.
10. Install the inside rearview mirror. Refer to “Inside Rearview Mirror” in this section.
11. Install the cowl vent grille. Refer to *Section 9R, Body Front End.*

REAR WINDOW GLASS

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the rear window defogger electrical connectors.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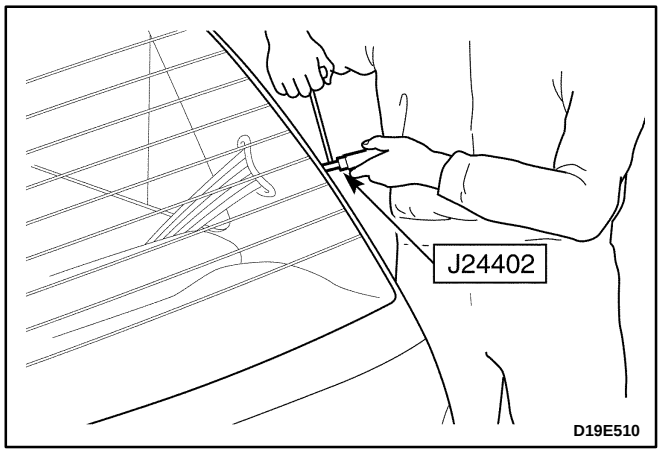

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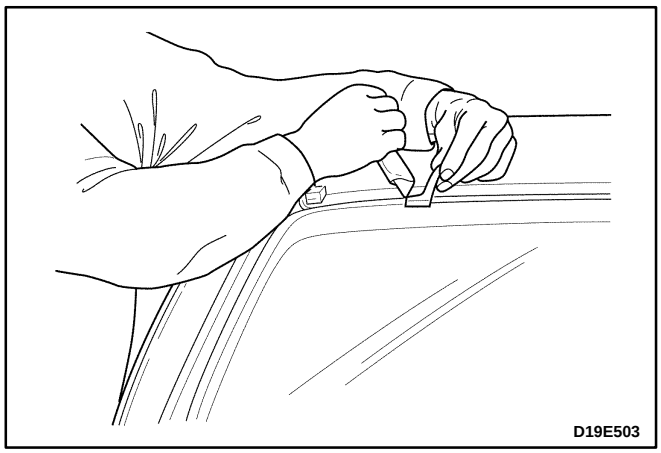
3. Using the glass sealant remover J–24402, cut the adhesive around the rear window glass.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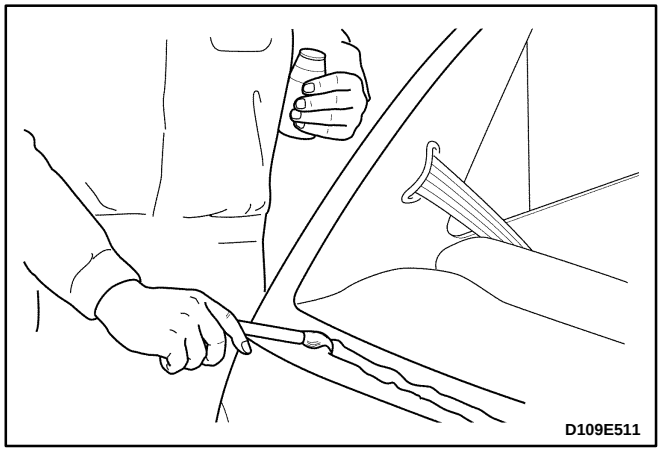
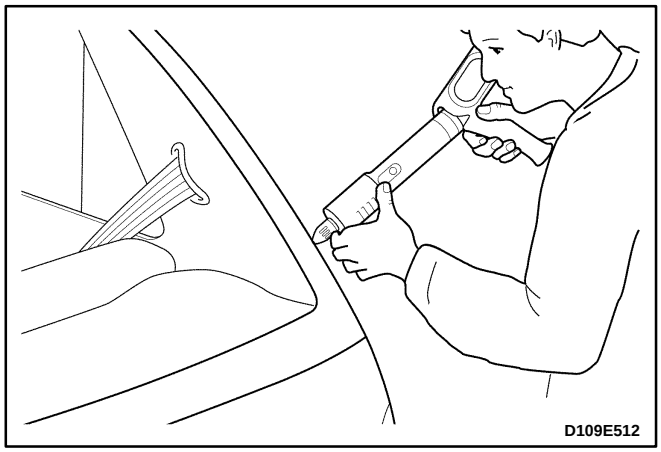
4. Remove the rear window glass from the vehicle.
5. Using a knife, remove the adhesive from the rear window glass.
6. Using a knife, remove the adhesive from the rear window frame.

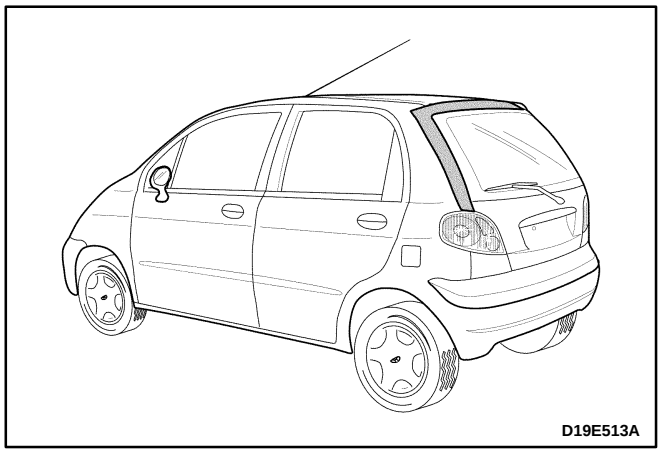


Installation Procedure

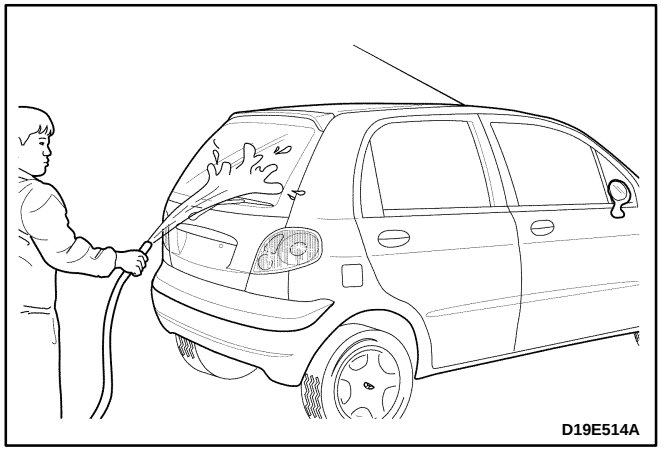
1. Apply tape to the new weatherstrip and the rear window to hold the weatherstrip in place.
2. Apply adhesive primer to the rear window frame and the perimeter of the rear window.



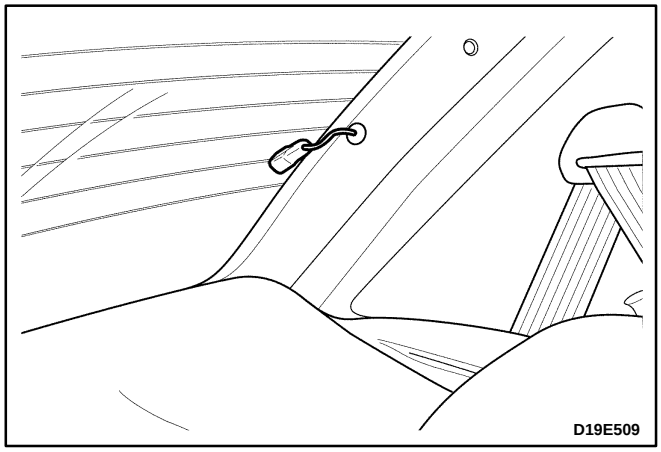
3. Apply glass adhesive to the rear window frame.



4. Install the rear window into the rear window frame.
5. Reposition the tape over the weatherstrip, the rear window and the rear window frame to hold the rear window in place.
6. Let the adhesive dry for 24 hours.
7. Remove the tape.

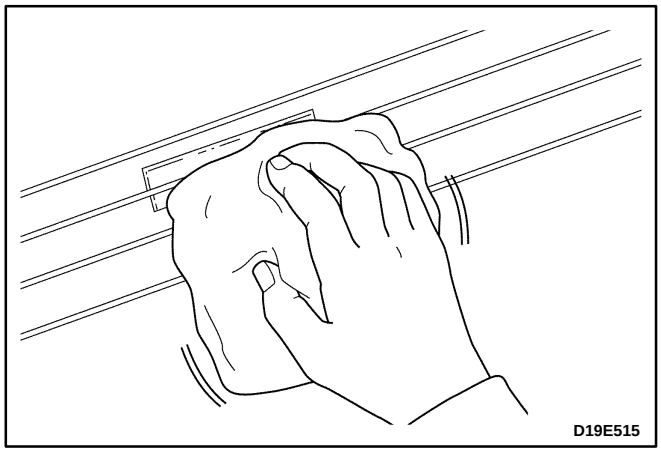


8. Check for waterleaks by pouring water on the rear window. If a leak is found, dry the window and fill the area that leaks with adhesive. If the leak persists, remove the rear window and repeat the entire procedure.
9. Connect the rear window defogger electrical connector.
10. Connect the negative battery cable.

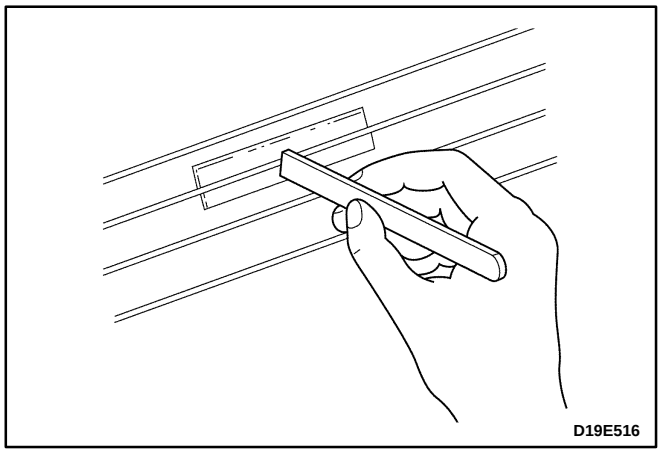

D19E509

REAR WINDOW DEFOGGER GRID LINE REPAIR

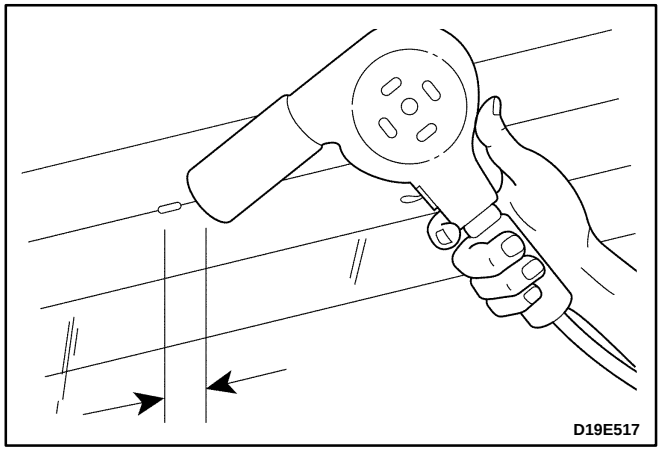
1. Disconnect the negative battery cable.
2. Disconnect the rear window defogger electrical connector.


D19E515

3. Inspect the rear window defogger grid lines.
4. Use steel wool to buff the grid lines that are to be repaired. Wipe the lines clean using a cloth dampened with alcohol. Buff and clean about 6 mm (0.25 inch) beyond each side of the break in the grid line.

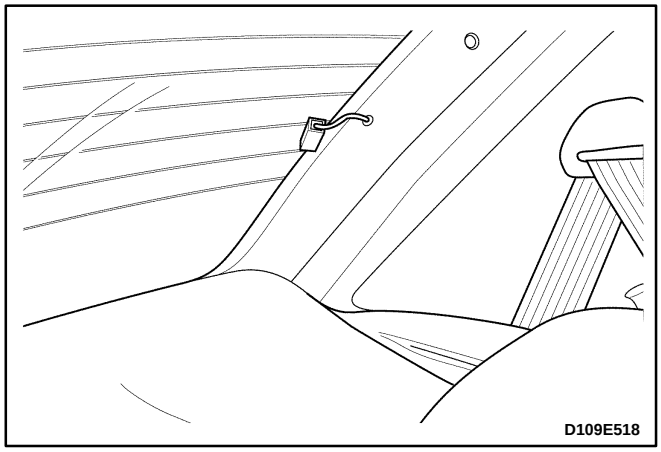

D19E516

5. Attach a grid line repair decal or two strips of tape above and below the repair areas.
   - A repair decal or tape must be used in order to control the width of the repair areas.
   - If a decal is used, the die–cut metered slot must be the same width as the grid line.
6. Apply the grid repair material to the repair area using a small wooden stick or a spatula. The grid repair material should be at room temperature.
7. Carefully remove the decal or the tape.


D19E517

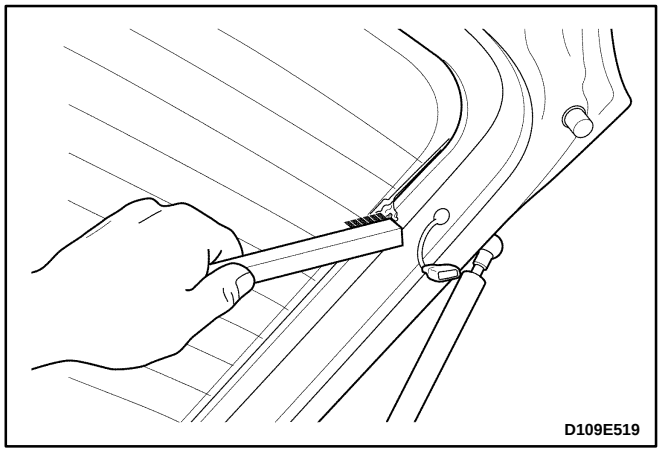
Notice: The grid line repair material must be cured with heat. In order to avoid heat damage to the interior trim, protect the trim near the repair area where heat will be applied.

8. Heat the repair area for 1 to 2 minutes.
9. Hold the heat gun nozzle 25 mm (1 inch) from the surface. A minimum temperature of 149°C (300°F) is required.



10. Inspect the grid line repair area. If the repair appears discolored, apply a coating of tincture of iodine to the area using a pipe cleaner or a line brush. Allow the iodine to dry for about 30 seconds. Carefully wipe off the excess iodine with a lint-free cloth.
11. Test the operation of the rear window defogger in order to verify that the repair was successful.

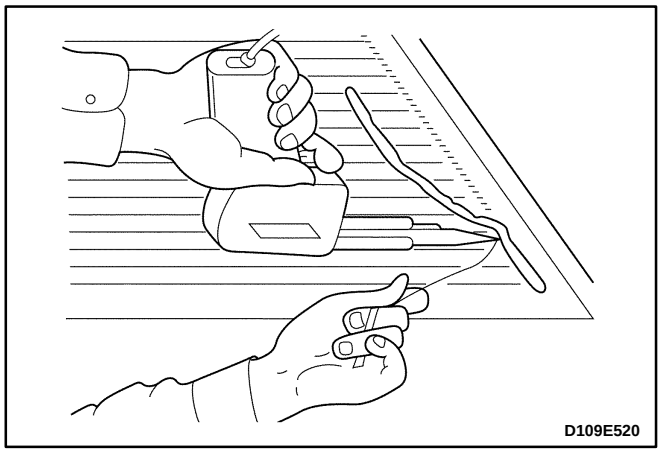
Important: At least 24 hours is required for complete curing of the repair materials. The repair area should not be physically disturbed until after that time.



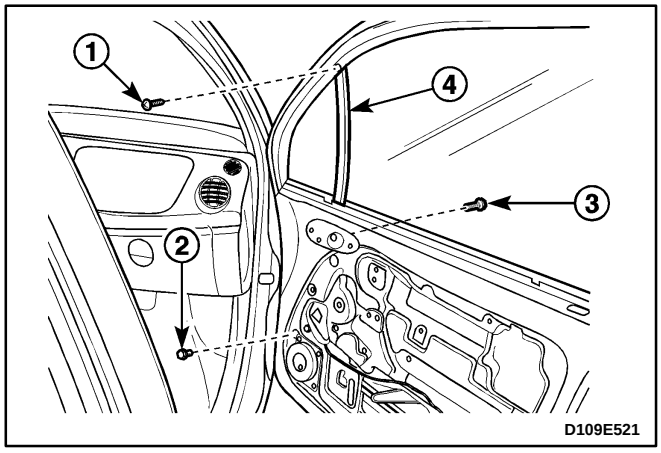
REAR WINDOW DEFOGGER BRAIDED LEAD WIRE REPAIR

The rear window defogger bus lead wire or the terminal can be reattached by resoldering. Use a solder containing 3 percent silver and a rosin flux paste.

1. Disconnect the negative battery cable.
2. The repair area should be buffed with fine steel wool before soldering the bus lead wire.
3. Apply the paste–type rosin flux in small quantities to the wire lead and the bus lead wire repair area using a brush.



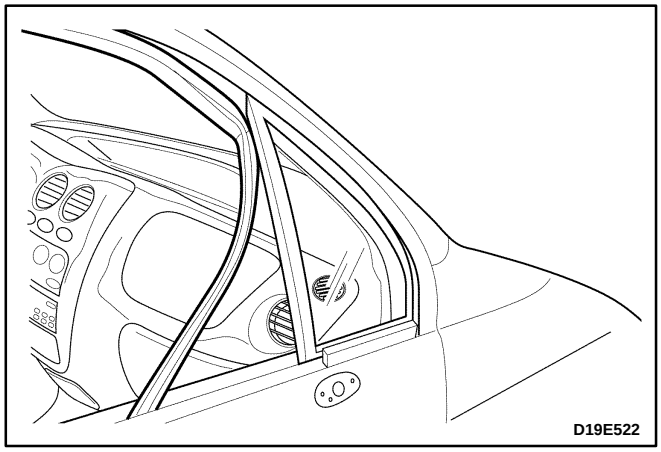
4. Coat the soldering iron tip with solder use only enough solder to ensure a complete repair.
5. Use only enough heat to melt the solder. Do not overheat the wire when resoldering to the bus lead wire.



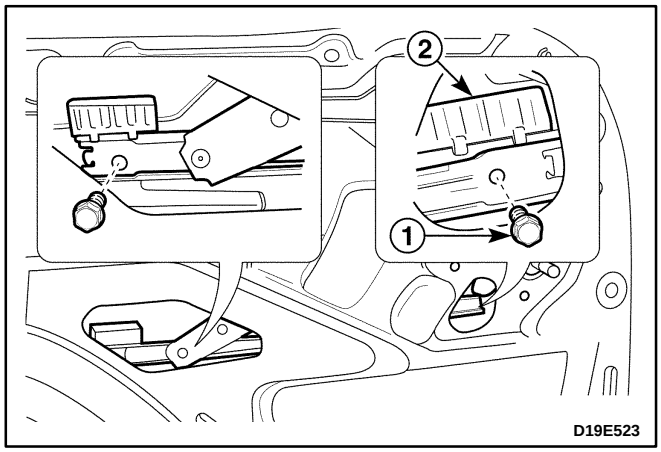
FRONT DOOR GLASS

Removal Procedure

1. Remove the front door seal trim. Refer to *Section 9P, Doors.*
2. Remove the outside rearview mirror from the front door. Refer to “Glass and Mirrors” in this section.
3. Remove the division bar.
   - Remove the screw (1).
   - Remove the inside bolt (2).
   - Remove the outside bolt (3).
   - Remove the division bar (4).

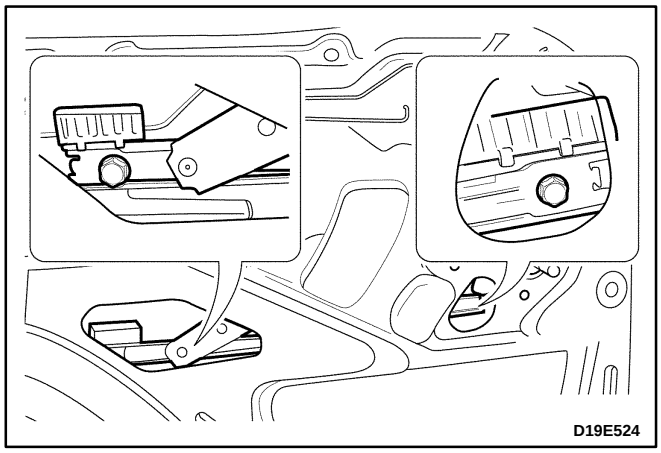


4. Remove the glass run from the front door.



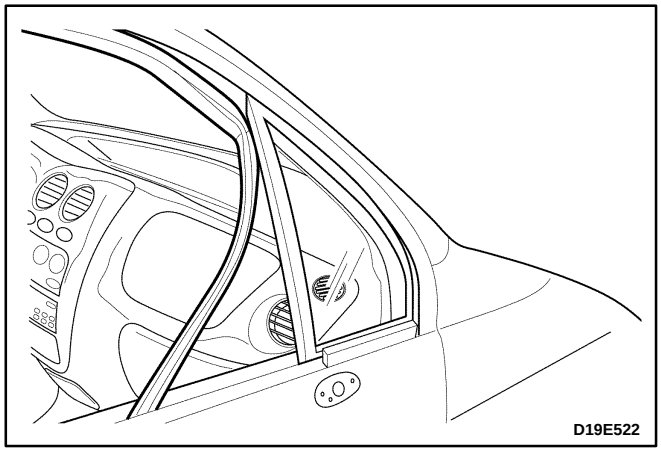
5. Remove the glass from the front door.
   - Remove the glass retaining bolts (1).
   - Remove the glass (2).

Notice: Make sure not to contact the glass with the body to prevent the paint damage.

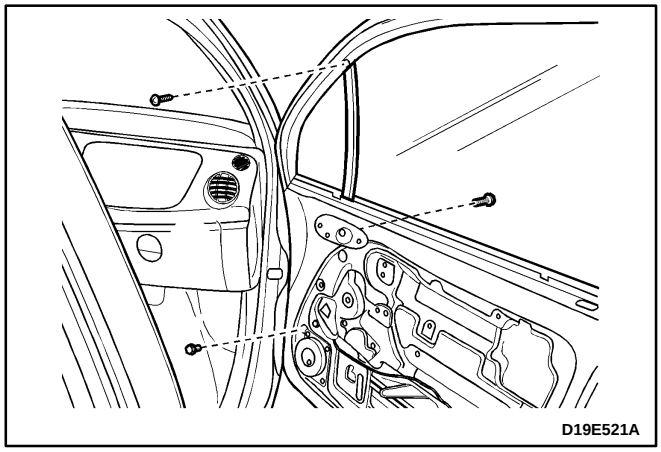


Installation Procedure

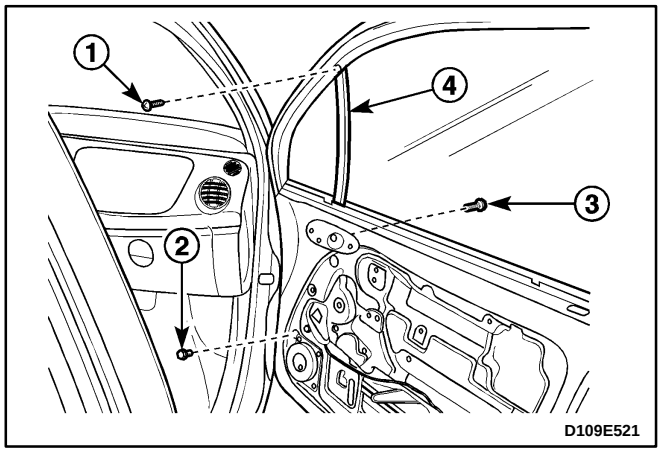
1. Install the front door glass with the bolts.



2. Install the front door glass run.


D19E521A

3. Install the division bar with the guide rail inside bolt, the guide rail outside bolt and the guide rail screw.
4. Install the outside rearview mirror. Refer to “Glass and Mirrors” in this section.
5. Install the front door seal trim. Refer to *Section 9P, Doors.*

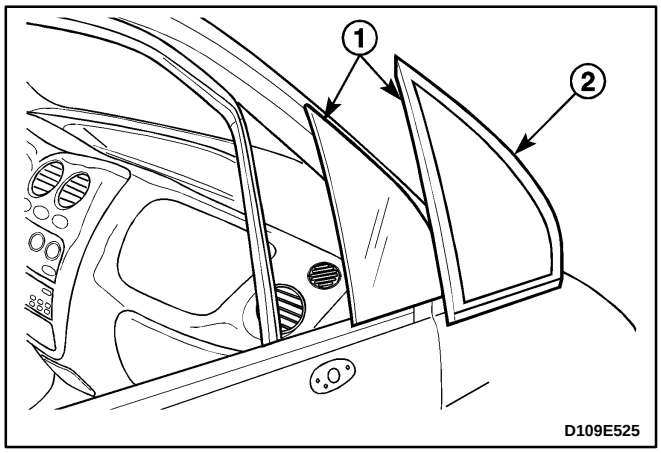


D109E521

FRONT DOOR QUARTER GLASS

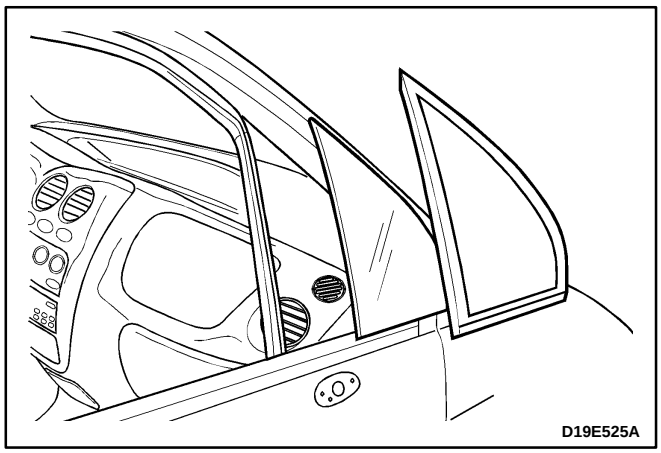
Removal Procedure

1. Remove the front door seal trim. Refer to *Section 9P, Doors.*
2. Remove the outside rearview mirror. Refer to “Outside Rearview Mirror” in this section.
3. Remove the guide rail.
   - Remove the screw (1).
   - Remove the inside bolt (2).
   - Remove the outside bolt (3).
   - Remove the division bar (4).



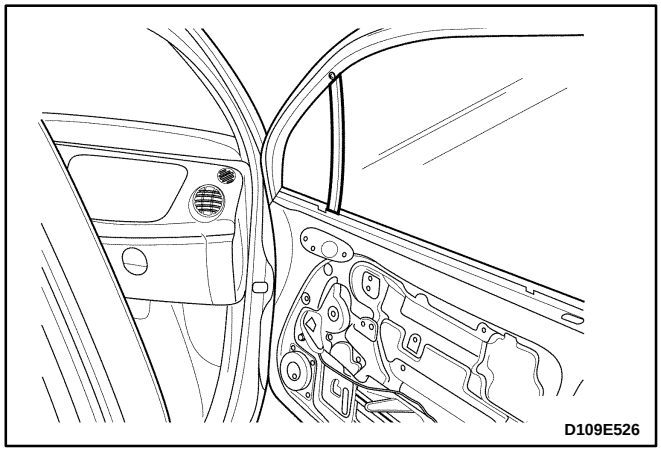
D109E525

4. Remove the quarter glass from the front door.
   - Remove the quarter glass assembly (1).
   - Remove the quarter glass run (2).

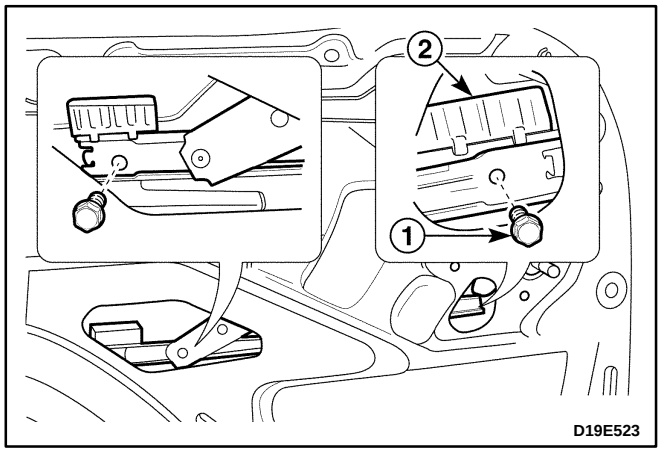

D19E525A

Installation Procedure

1. Install the quarter glass with the quarter glass run.


D109E526

2. Install the division bar with the guide rail inside bolt, the guide rail outside bolt and the guide rail screw.
3. Inside the outside rearview mirror. Refer to “Outside Rearview Mirror” in this section.
4. Install the front door seal trim. Refer to *Section 9P, Doors.*



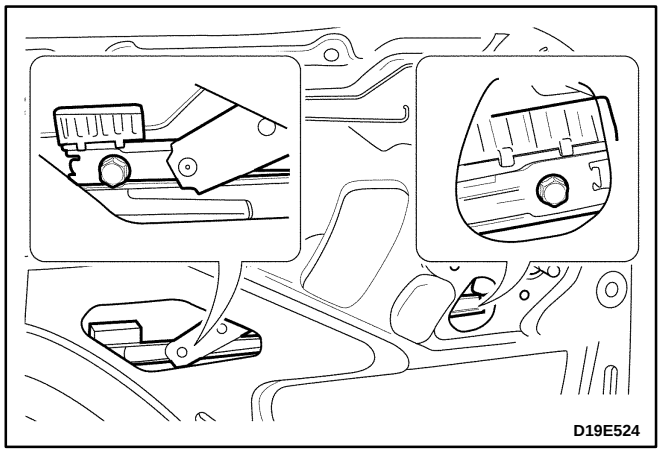
D19E523

REAR DOOR GLASS

Removal Procedure

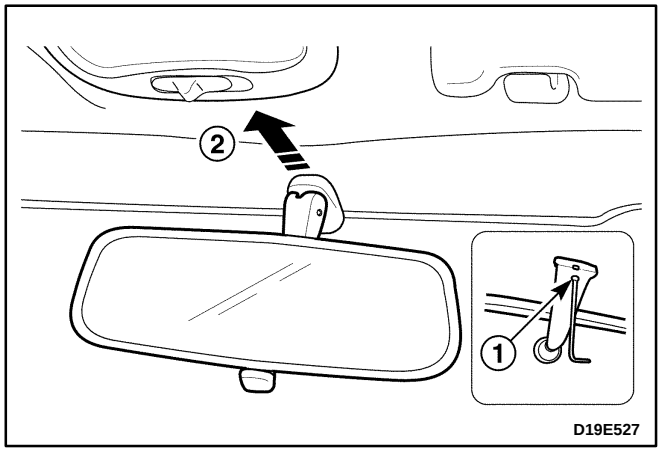
1. Remove the glass run. Refer to *Section 9P, Doors.*
2. Remove the glass.
   - Remove the bolts (1).
   - Remove the glass (2).

Notice: Make sure not to contact the glass with the body to prevent the paint damage.


D19E524

Installation Procedure

1. Install the glass with the bolts.
2. Install the glass run. Refer to *Section 9P, Doors.*

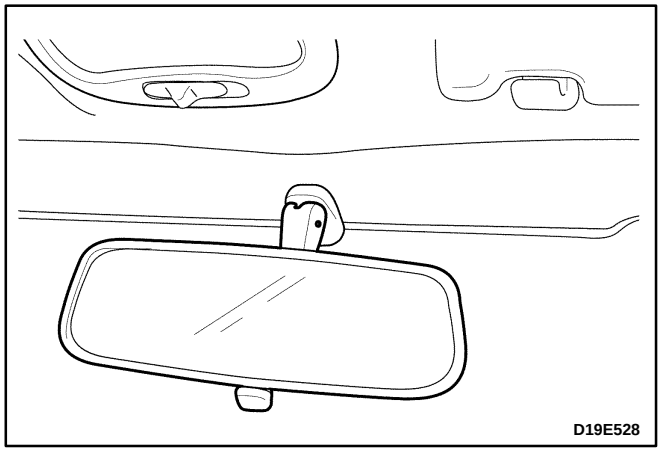


D19E527

INSIDE REARVIEW MIRROR

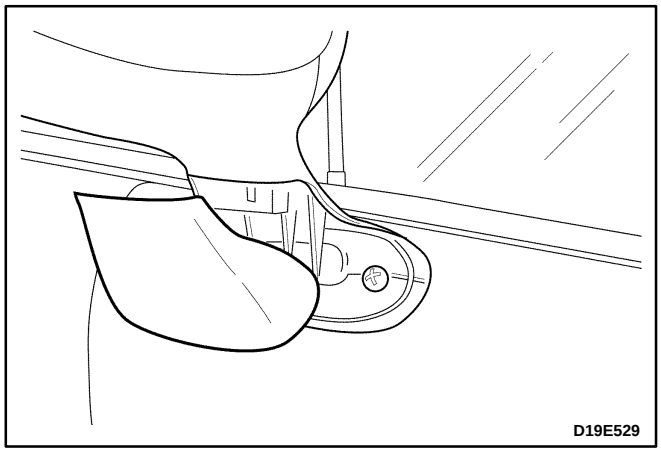
Removal Procedure

1. Remove the inside rearview mirror.
   - Remove the screw (1).
   - Remove the inside rearview mirror (2).



Installation Procedure

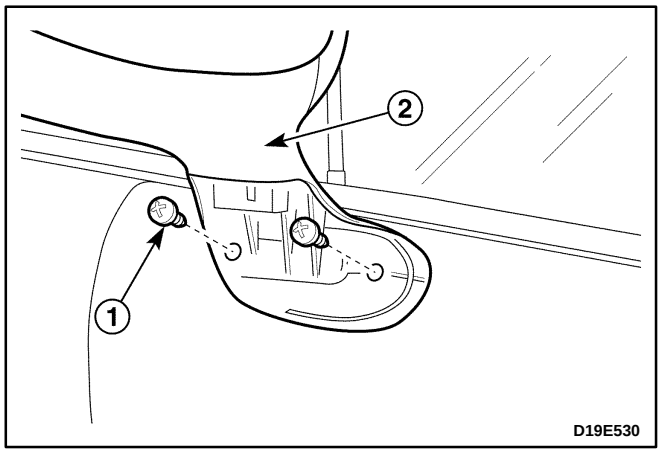
1. Install the inside rearview mirror with the screw.



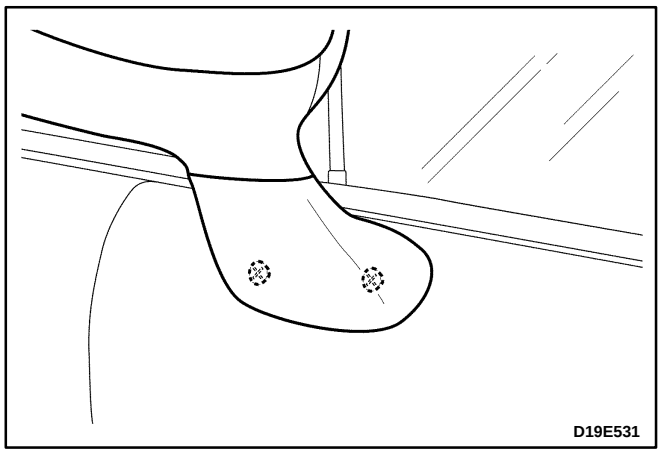
OUTSIDE REARVIEW MIRROR (MANUAL)

Removal Procedure

1. Remove the outside rearview mirror cover from the outside rearview mirror.

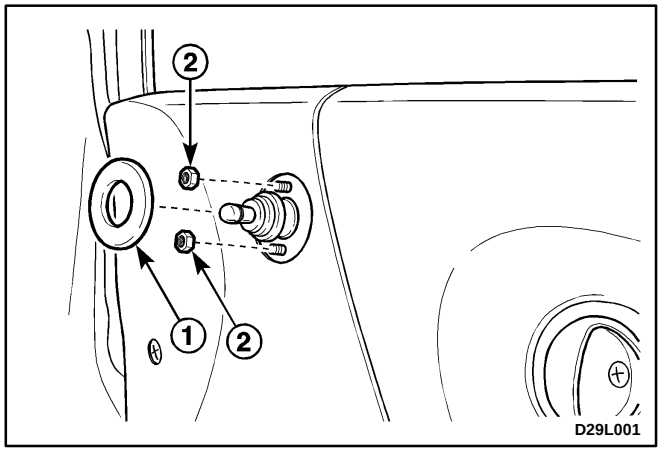


2. Remove the outside rearview mirror.
   - Remove the screws (1).
   - Remove the outside rearview mirror (2).



Installation Procedure

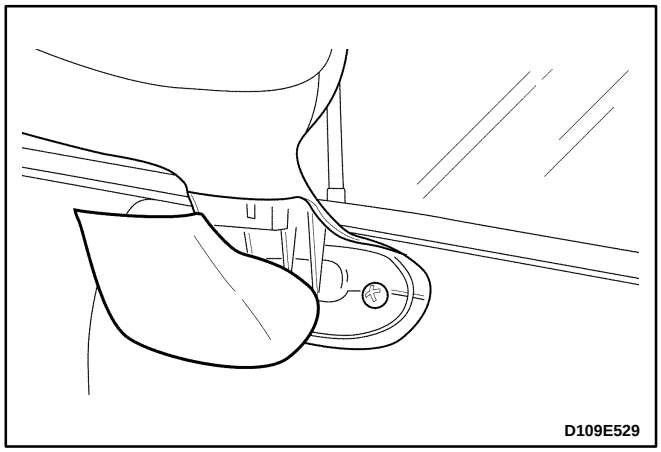
1. Install the outside rearview mirror with the screws.
2. Install the outside rearview mirror cover.



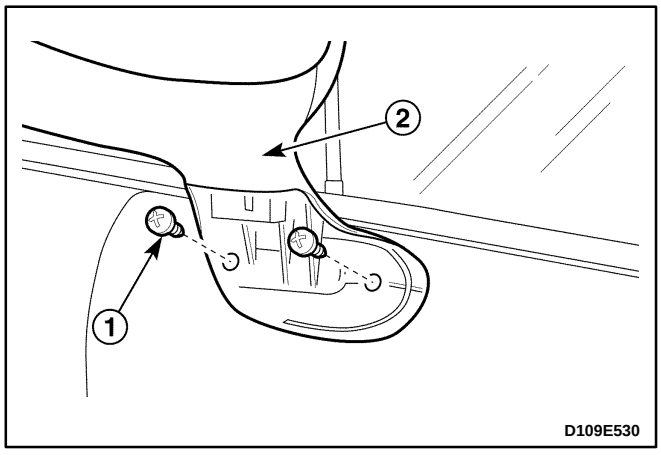
OUTSIDE REARVIEW MIRROR (CABLE)

Removal Procedure

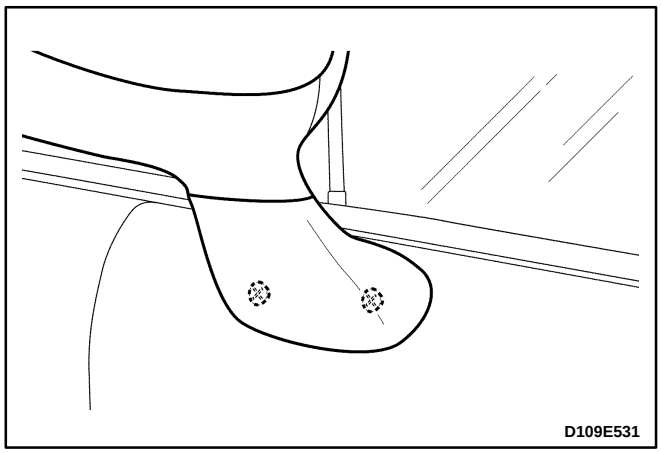
1. Pry off the outside rearview mirror inside trim cover (1).
2. Remove the mirror adjusting lever mounting nuts (2).



3. Remove the outside rearview mirror cover from the outside rearview mirror.

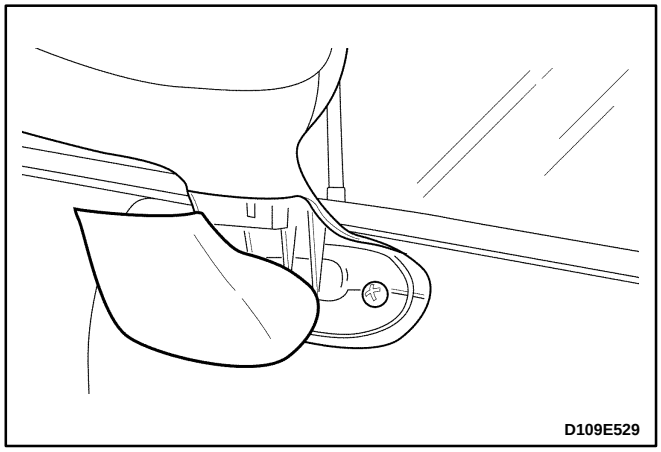


4. Remove the outside rearview mirror.
   - Remove the screws (1).
   - Remove the outside rearview mirror (2).



Installation Procedure

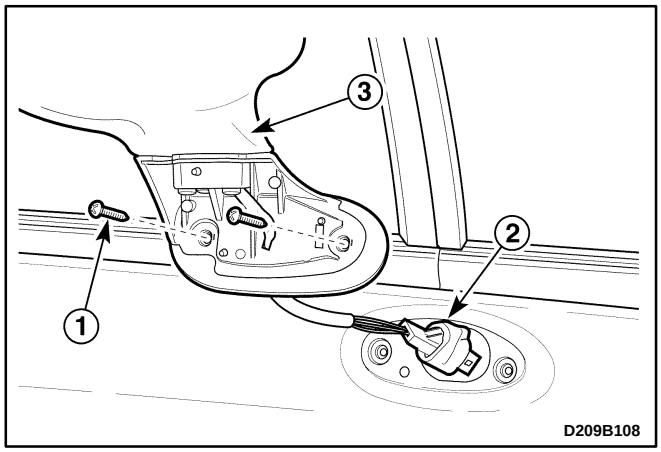
1. Install the outside rearview mirror with the screws.
2. Install the outside rearview mirror cover.
3. Install the mirror adjusting lever with the nuts.
4. Install the outside rearview inside trim cover.


D109E529

OUTSIDE REARVIEW MIRROR (ELECTRIC)

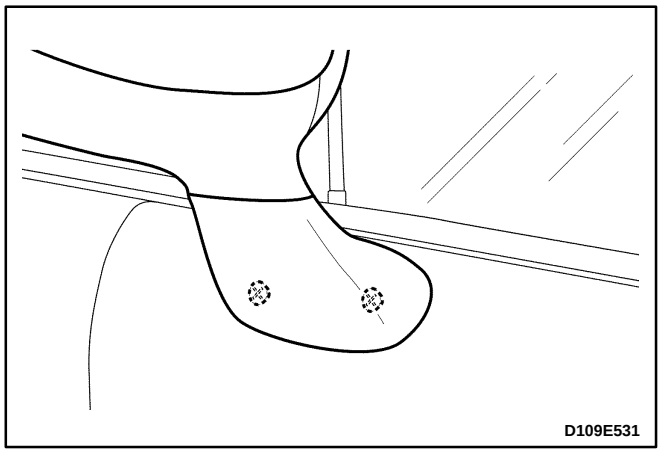
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the outside rearview mirror cover from the outside rearview mirror.



D209B108

3. Remove the outside rearview mirror.
   - Remove the screws (1).
   - Disconnect the electrical connector (2).
   - Remove the outside rearview mirror (3).

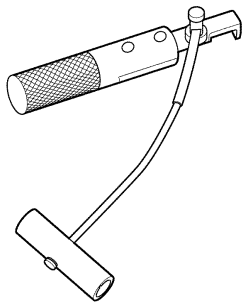

D109E531

Installation Procedure

1. Connect the outside rearview mirror.
2. Install the outside rearview mirror with the screws.
3. Install the outside rearview mirror cover.
4. Connect the negative battery cable.

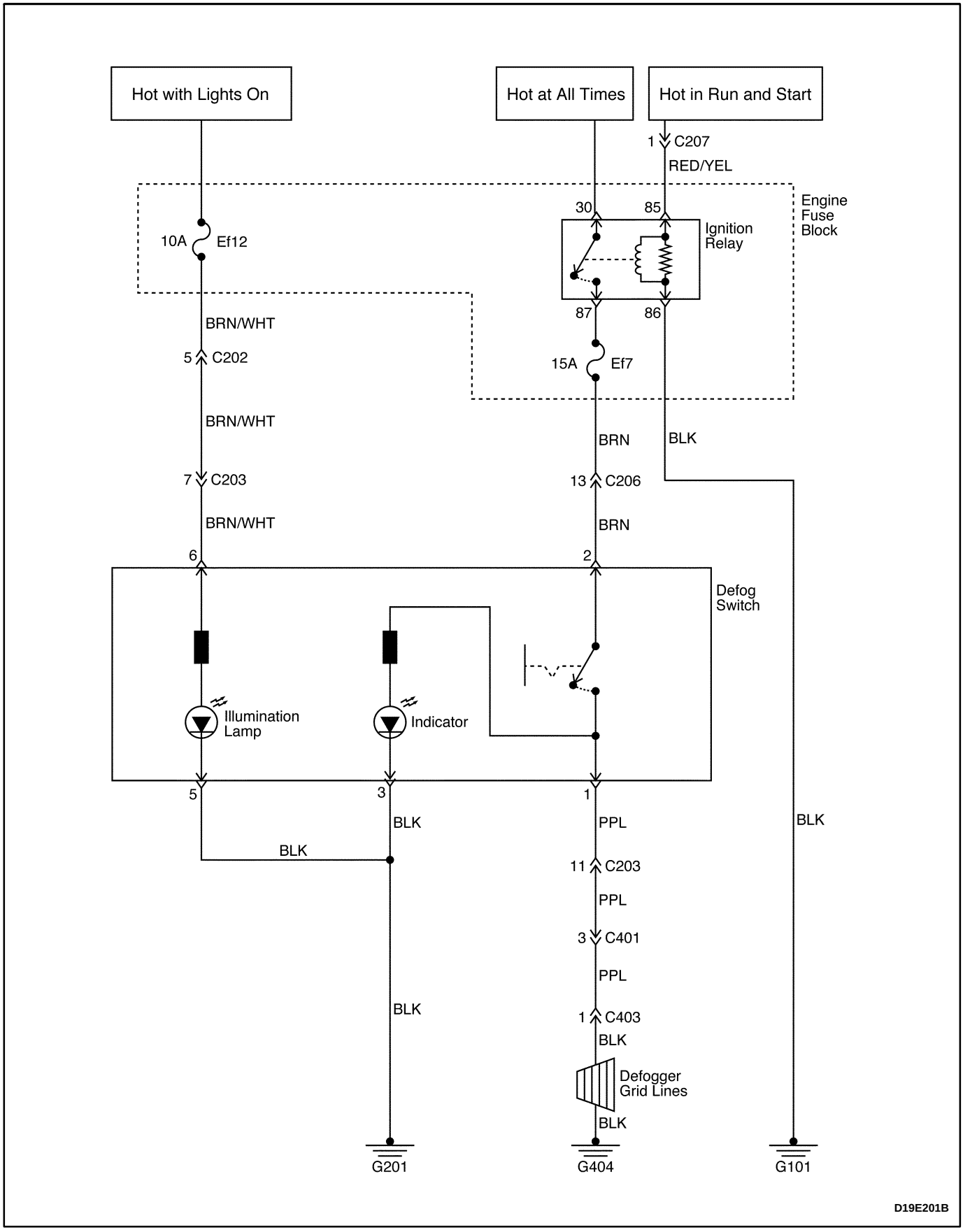
SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS TABLE

 D109E102	**J-24402** **Glass Sealant Remover**

SCHEMATIC AND ROUTING DIAGRAMS

REAR WINDOW DEFOGGER



SECTION 9M

EXTERIOR TRIM

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DESCRIPTION AND OPERATION

EMBLEMS AND LETTERING

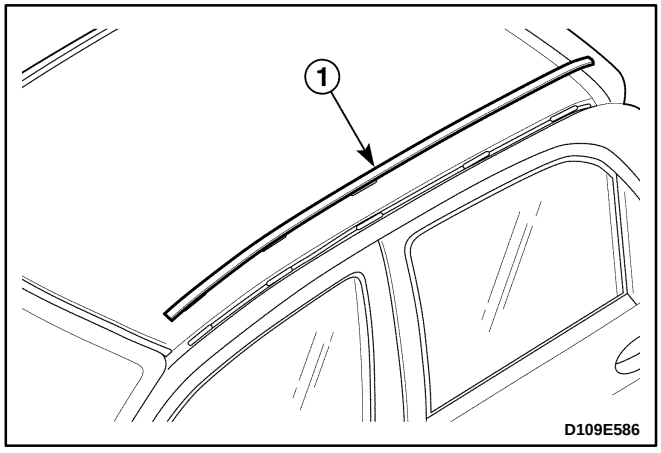
The emblems and lettering on the vehicle are attached by adhesive. The company emblem appears on the hood. The lettering, which appears in several places on the body of the vehicle, features the model, the grade, and the company name.

MUD GUARDS

Front and rear mud guards are optional equipment on all models. Mud guards will help prevent an excessive buildup of mud on the body.

REPAIR INSTRUCTIONS

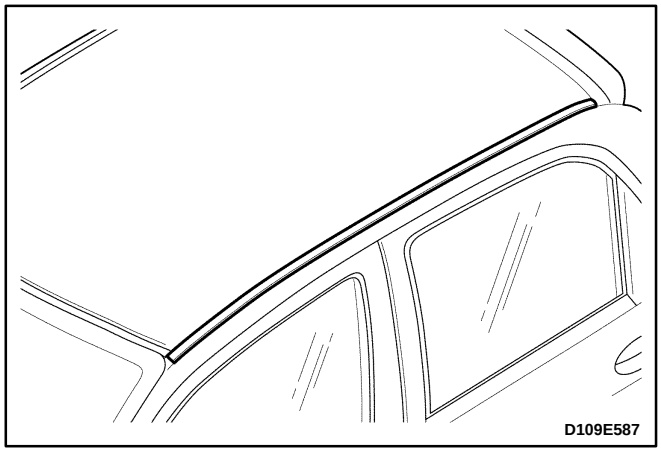
ON–VEHICLE SERVICE



ROOF MOLDING

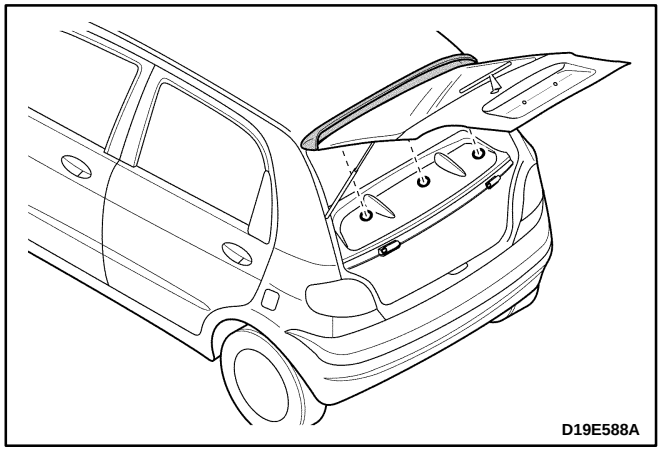
Removal Procedure

1. Remove the roof molding from the plastic clips (1).



Installation Procedure

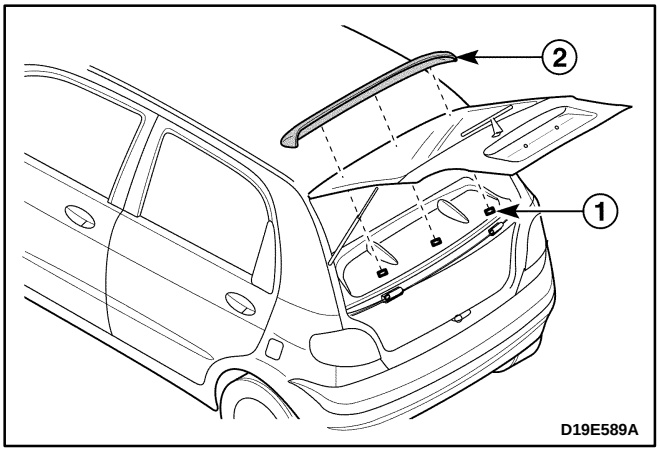
1. Press the roof molding onto the plastic clips.



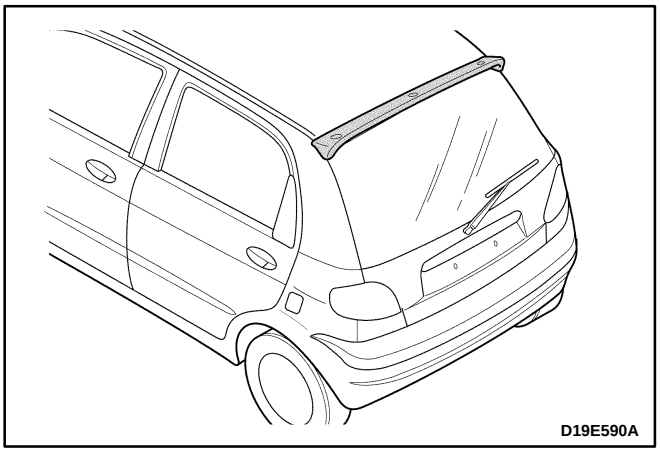
REAR SPOILER

Removal Procedure

1. Open the tailgate.
2. Remove the spoiler seals.



3. Remove the rear spoiler from the tailgate.
   - Remove the nuts (1).
   - Remove the rear spoiler (2).



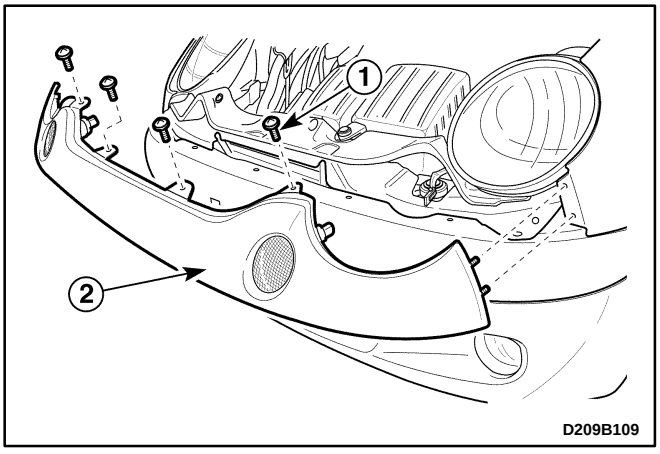
Installation Procedure

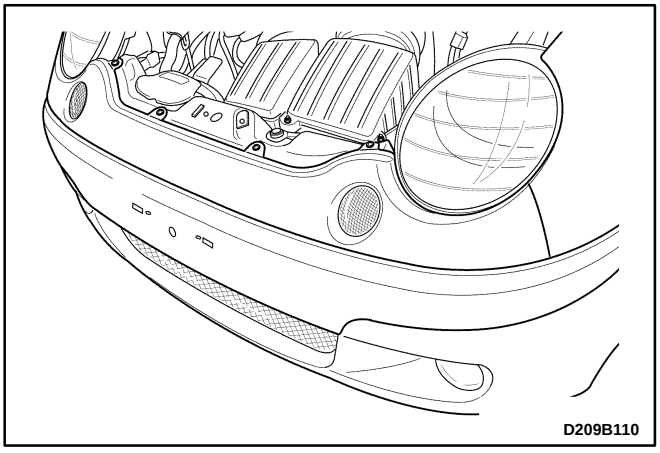
1. Install the rear spoiler on the tailgate with the nuts.
2. Install the spoiler seals.

FRONT BUMPER SPACER

Removal Procedure

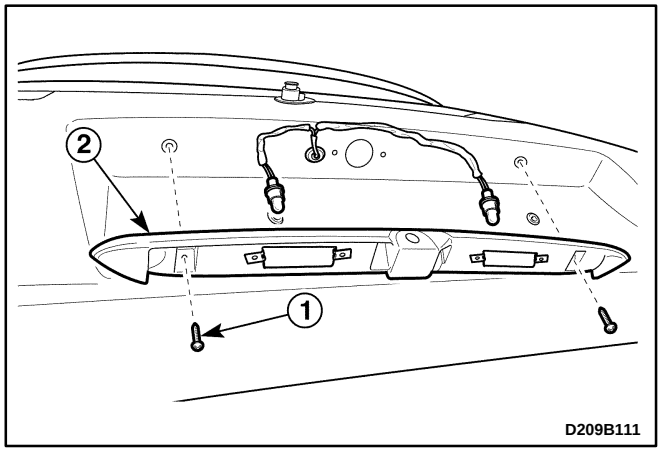
1. Support the hood suitably.
2. Disconnect the negative battery cable.
3. Remove the front bumper spacer.
   - Remove the bolts (1).
   - Remove the front bumper spacer from the bumper fascia (2).
4. Remove the turn signal lamps. Refer to *Section 9B, Lighting Systems.*

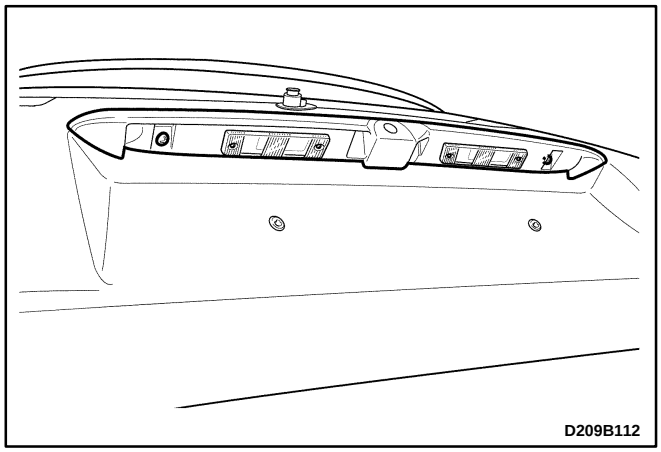




Installation Procedure

1. Install the turn signal lamps. Refer to *Section 9B, Lighting Systems.*
2. Install the front bumper spacer with the bolts.
3. Connect the negative battery cable.





TAILGATE HANDLE

Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Remove the tailgate lock cylinder. Refer to *Section 9P, Doors.*
4. Remove the license plate lamps. Refer to *Section 9B, Lighting Systems.*
5. Remove the tailgate handle.
   - Remove the screws (1).
   - Remove the tailgate handle (2).

Installation Procedure

1. Install the tailgate handle with the screws.
2. Install the license plate lamps. Refer to *Section 9B, Lighting Systems.*
3. Remove the tailgate lock cylinder. Refer to *Section 9P, Doors.*
4. Connect the negative battery cable.

SECTION 9N

FRAME AND UNDERBODY

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Underbody Dimensions 9N-4

DESCRIPTION AND OPERATION

GENERAL BODY CONSTRUCTION

This vehicle is constructed with a unitized body which incorporates integral front and rear frame side rails.

The front suspension lower control arms are bolted to and retained by supports, one each on the right and left sides. The front suspension lower control arm supports are attached to the underbody with three bolts at two locations. The engine is bolted to the integral front side rails. The suspension strut towers must be dimensionally correct in relation to the remainder of the underbody in order to maintain specified suspension strut and caster/camber angles.

Since the individual underbody parts contribute directly to the overall strength of the body, it is essential to observe proper welding techniques during service repair operations. The underbody parts should be properly sealed and rustproofed whenever body repair operations destroy or damage the original sealing and rustproofing. When rustproofing critical underbody parts, use a good-quality type of air-dry primer, such as a corrosion-resistant chromate or an equivalent material. Combination-type primer/surfacers are not recommended.

TRANSAXLE UNDER COVER

The transaxle under cover is one piece of steel that serve as shields for the underside of the transaxle. The covers help protect the engine from small rocks, gravel and other objects that would otherwise come into contact with the transaxle during normal driving conditions.

REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE

ALIGNMENT CHECKING

An accurate method of determining the alignment of the underbody uses a measuring tram gauge. The tram gauge set used to perform the recommended measuring checks must include a vertical pointer able to reach 457 mm (18 inches).

Two types of measurements can be made with a tram gauge: direct point-to-point measurements and measurements calculated on a horizontal plane (datum line) parallel to the underbody. Point-to-point measurements are generally taken on steering and suspension engine compartment parts and simply require the vertical pointers to be set equally.

For horizontal plane measurements, the vertical pointers must be set as specified for each point to be measured.

Dimensions-to-gauge holes are measured to the center of the holes and flush to the adjacent surface metal unless otherwise specified. It is recommended that the diagonal dimensions to the cross-body be checked on both sides in order to verify the dimensional accuracy of the vehicle underbody.

FLOOR PAN INSULATORS

The floor pan insulators have been designed for the higher floor pan temperatures that result from the use of the catalytic converter in the exhaust system. Therefore, when servicing a vehicle, it is essential that any insulators that may have been disturbed or removed be reinstalled in the original sequence and location. Also, if an insulator needs to be replaced, use only the insulation specified for that location on the floor pan.

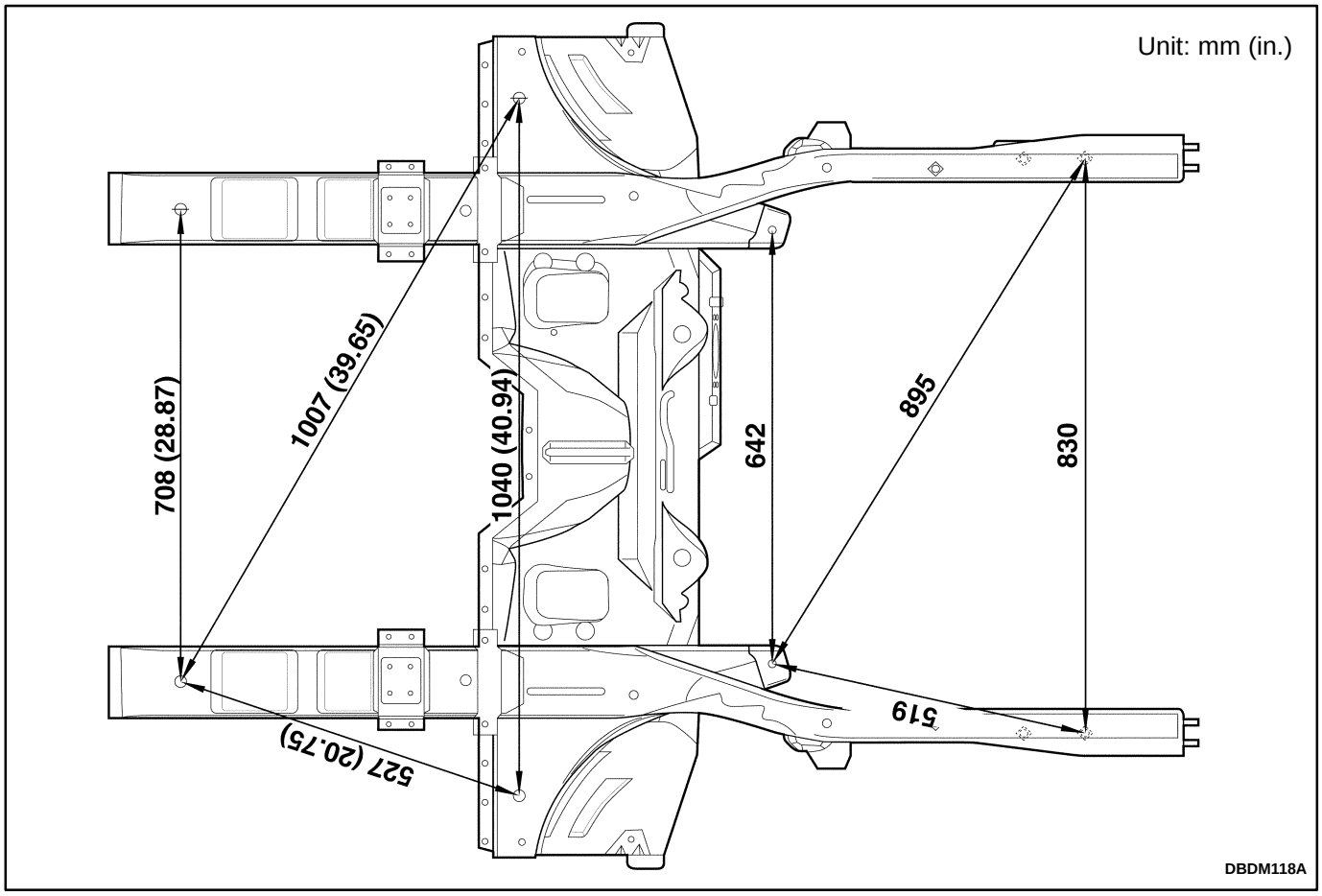
When servicing or replacing interior insulators, observe the following instructions.

- Install the insulators in the original position and sequence. Butt the pieces together in order to avoid gapping or overlapping.
- If it is necessary to replace an insulator, use only the specified insulation.
- Use the original part to determine the amount of replacement material required and as a template for cutting and fitting the new piece to the floor pan.
- When installing the insulator, do not enlarge any cutouts or holes that are used for the attachment of interior parts such as the instrument panel or the floor console.
- Route the cross-body harness for interior parts over the floor pan insulators. Clip it in the original location.
- Do not apply spray-on deadeners or trim adhesives to the top of the floor pan at the area directly over the catalytic converter or the muffler.

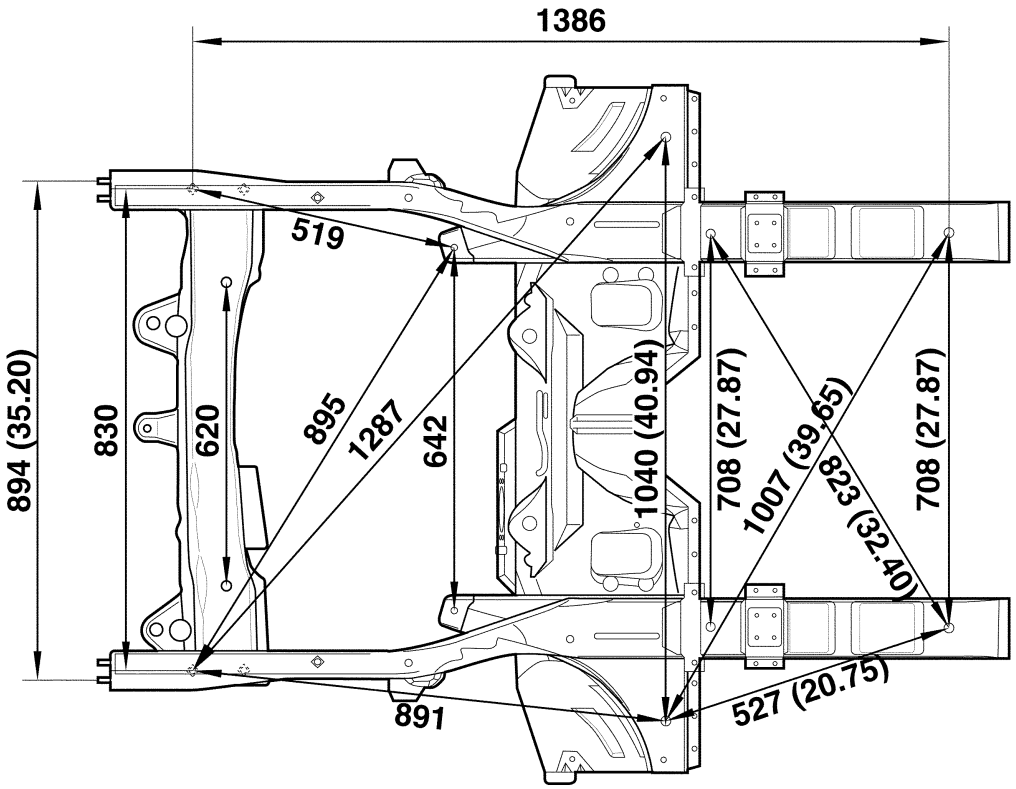
Any insulator service repair or replacement should be the same thickness, size, and location as the original installation in the vehicle.

SPECIFICATIONS

UNDERBODY DIMENSIONS



Unit: mm (in.)



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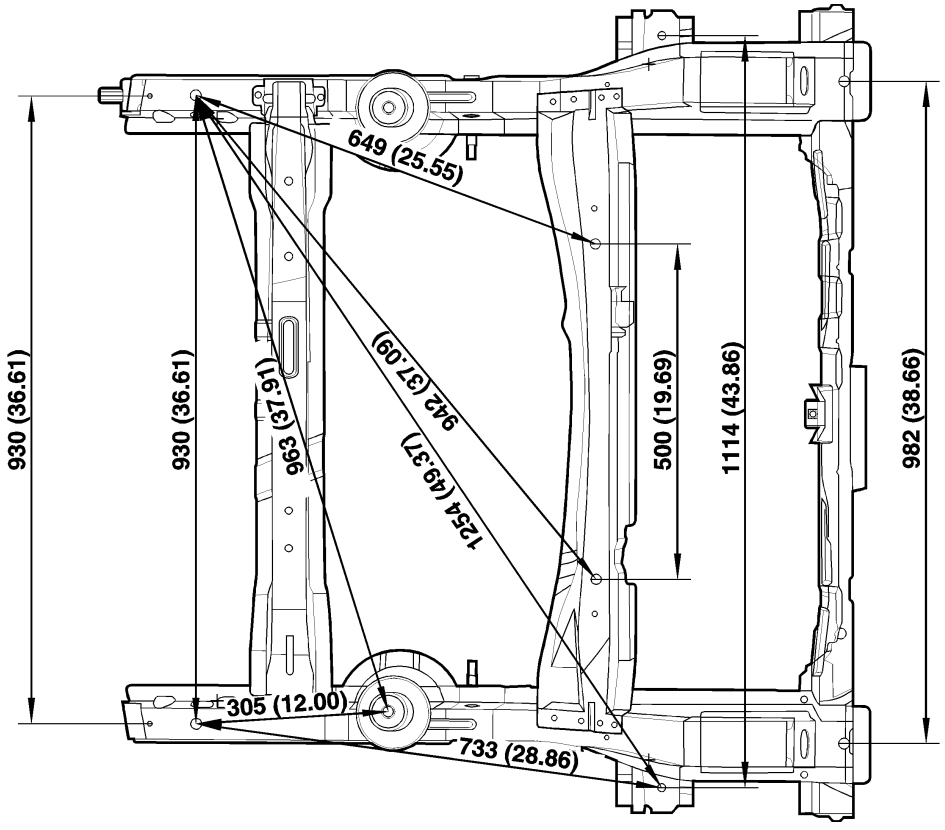
Unit: mm (in.)



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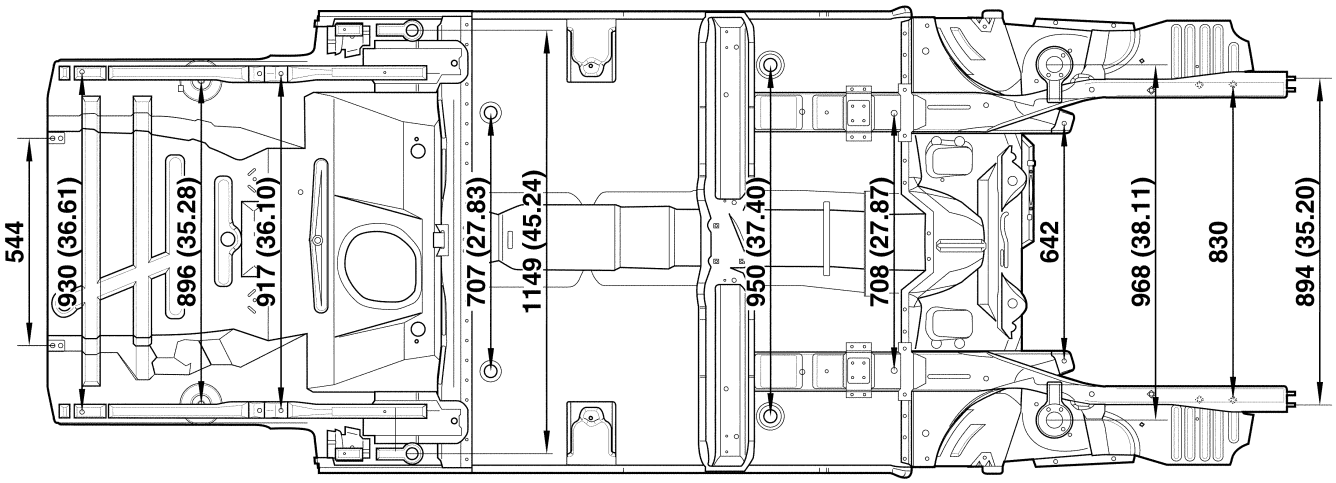
Unit: mm (in.)



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SECTION 9O

BUMPERS AND FASCIAS

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Front Bumper Fascia 9O-4
Front Bumper Impact Bar 9O-5
Rear Bumper Fascia 9O-6
Rear Bumper Bracket 9O-8

DESCRIPTION AND OPERATION

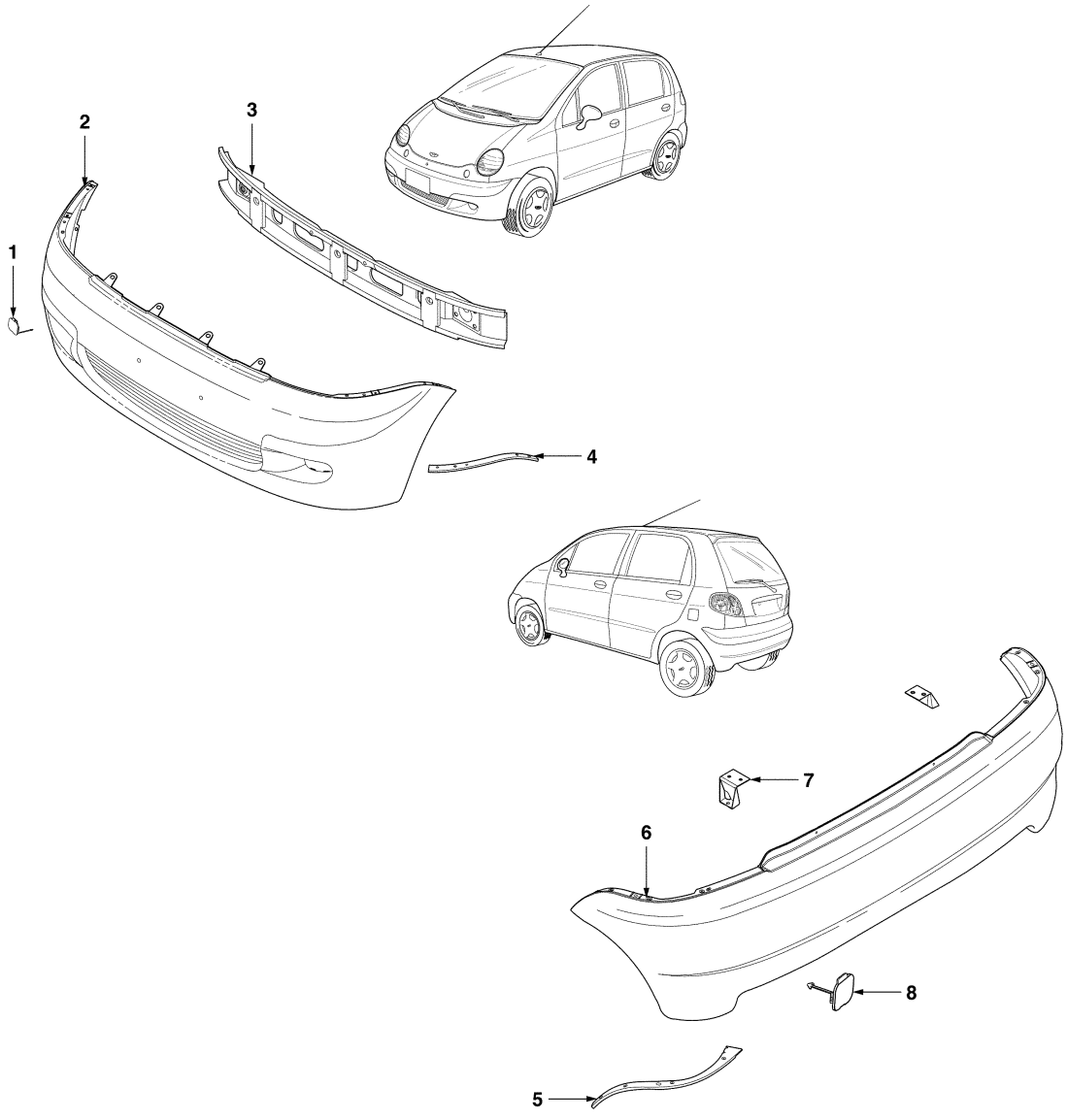
BUMPERS

The bumper systems are installed with the body color bumper and the general bumper according to the vehicle grade.

The bumper systems are designed to sustain a collision into a fixed barrier at 4 km/h (2.5 mph) without damage. After absorbing the energy of a collision, these bumper systems restore themselves to their original position. Both the front and the rear bumpers feature an internal foam energy absorber and a polymer fascia cover. The front bumper consists of the bumper fascia and the impact bar. Remove the fascia before removing the impact bar. The rear bumper consists of the bumper fascia and the bracket. Removal of rear bumper brackets can be possible without removing the bumper fascia.

COMPONENT LOCATOR

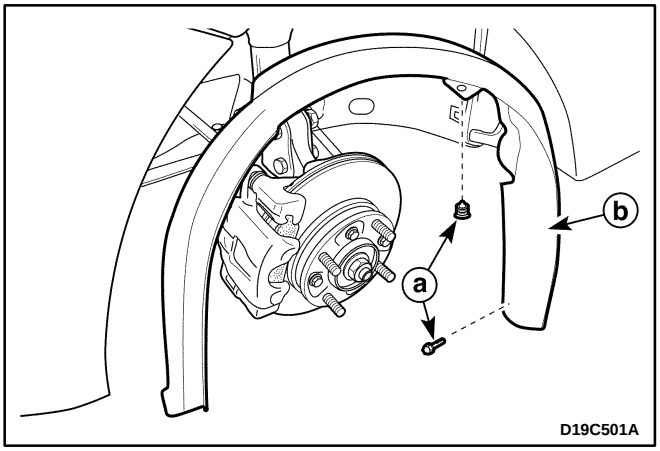
BUMPERS AND FASCIAS



1. Front Towing Cover
2. Front Bumper
3. Front Bumper Impact Beam
4. Front Bumper Reinforcement
5. Rear Bumper Reinforcement
6. Rear Bumper
7. Rear Bumper Bracket
8. Rear Towing Cover

REPAIR INSTRUCTIONS

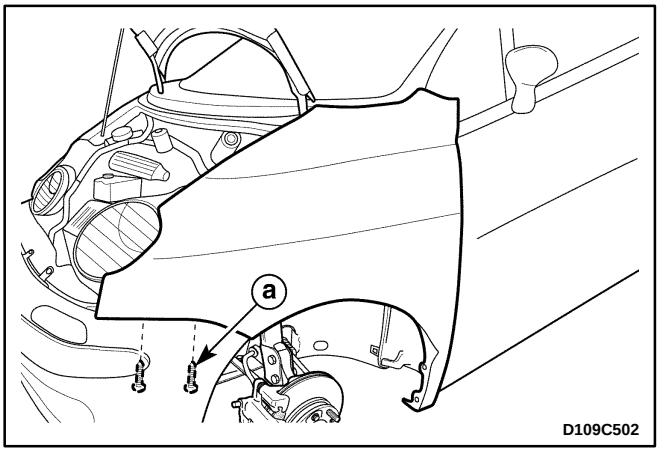
ON–VEHICLE SERVICE



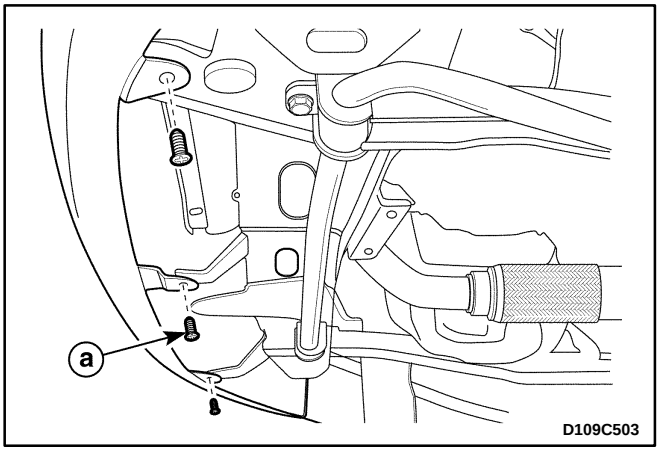
FRONT BUMPER FASCIA

Removal Procedure

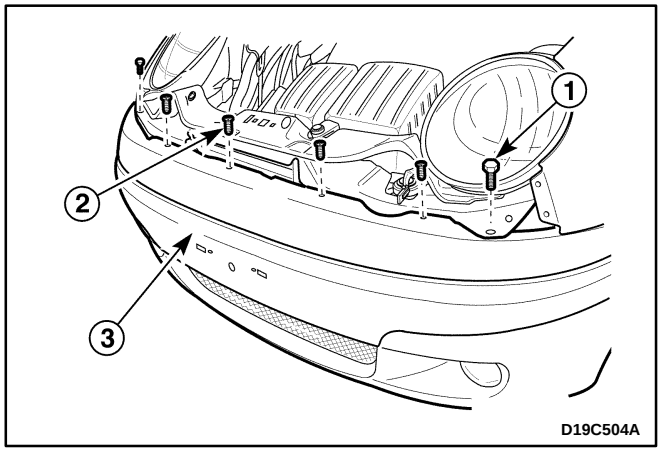
1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the front wheels.
4. Remove the front wheel house splash shields.
   - Remove the clip and bolts.
     a. Bolt and clip.
   - Remove the wheel house splash shield.
     b. Splash shield.



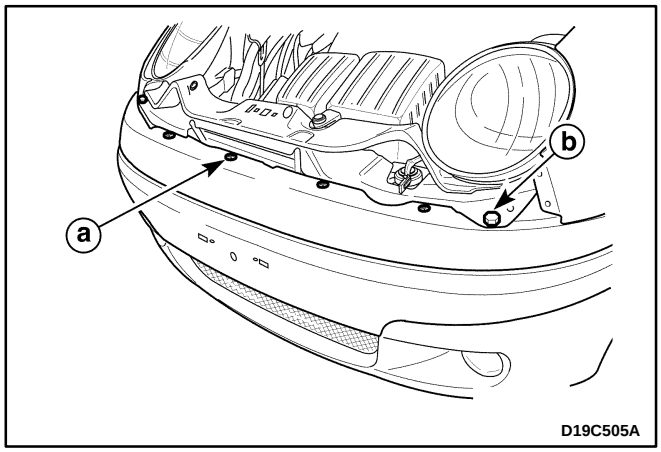
5. Remove the bolts on the both side of the fascia.
   a. Bolt.



6. Remove the clips under the fascia.
   a. Clip.



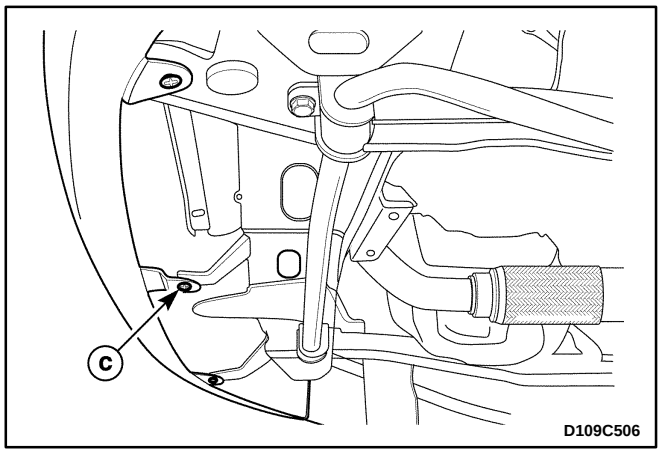
7. Lower the vehicle.
8 Remove the front bumper spacer from the bumper. Refer to *Section 9M, Exterior Trim.*
9. Remove the front bumper fascia.
   - Remove the bolts (1).
   - Remove the clips (2).
   - Remove the front bumper fascia (3).
10 Remove the front fog lamps. Refer to *Section 9B, Lighting Systems.*



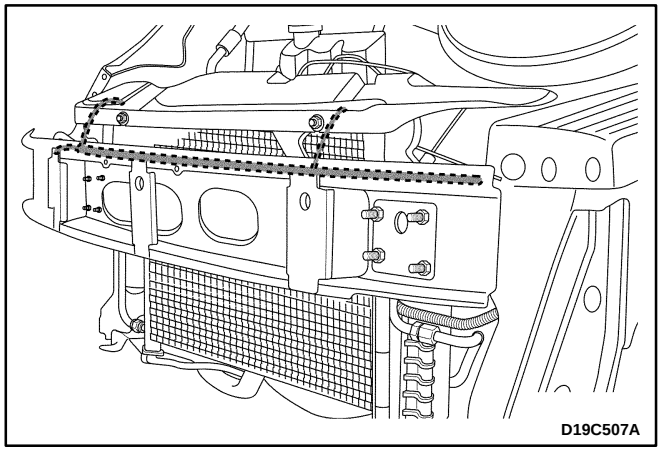
Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install the front fog lamps. Refer to *Section 9B, Lighting Systems.*
2. Install the bumper fascia.
3. Install the clips on the top of the fascia.
   a. Fascia upper clip.
4. Install the bolts on the top of the fascia.
   b. Fascia upper bolt.
5. Install the front bumper spacer. Refer to *Section 9M, Exterior Trim.*



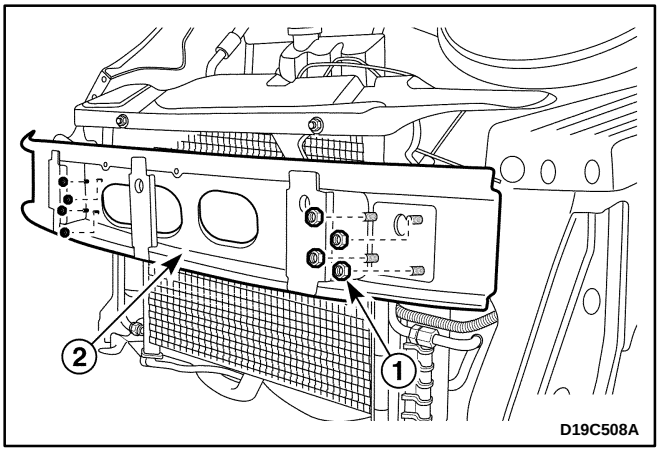
6. Raise and suitably support the vehicle.
7. Install the clips under the fascia.
   c. Fascia lower clip.
8. Install the bolts on the both side of the fascia.
9. Install the front wheelhouse splash shields with the clips and the bolts.
10. Install the front wheels.
11. Lower the vehicle.
12. Connect the negative battery cable.



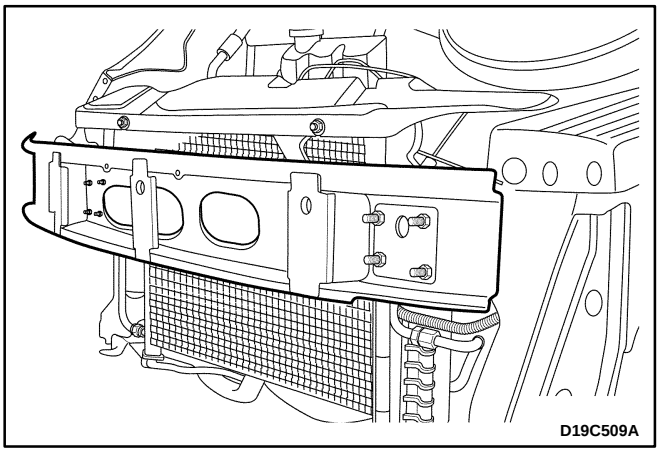
FRONT BUMPER IMPACT BAR

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the front bumper fascia. Refer to “Front Bumper Fascia” in this section.
3. Remove the front wiring harness retaining clip from the impact bar.



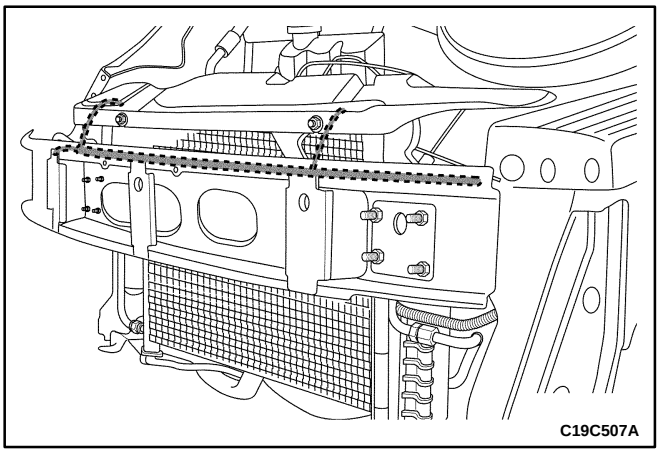
3. Remove the impact bar.
   - Remove the nuts (1).
   - Remove the impact bar (2).



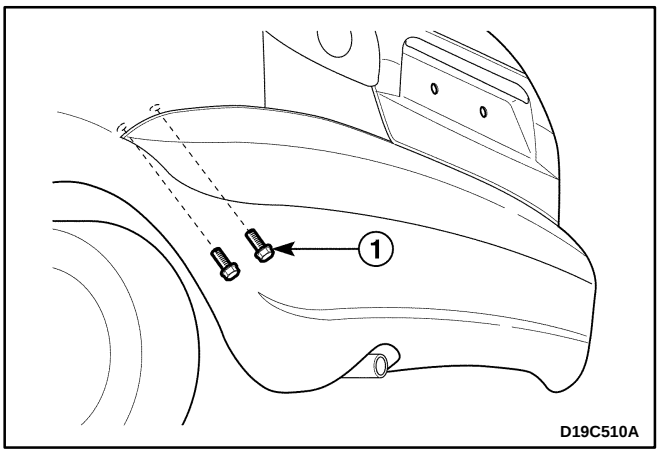
Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install the impact bar with the nuts.



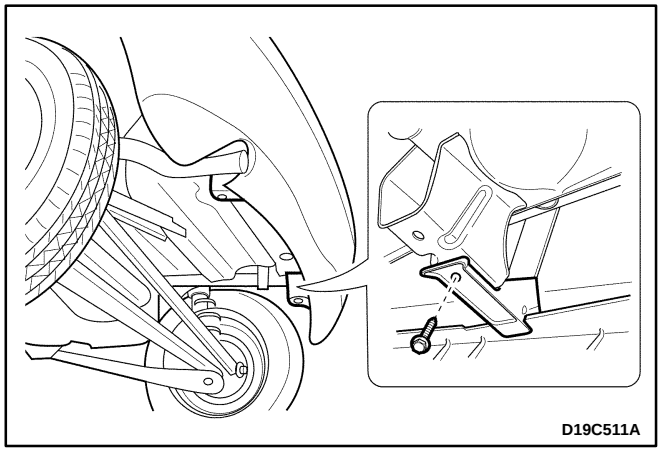
2. Install the front wiring harness retaining clip to the impact bar.
3. Install the front bumper fascia. Refer to “Front Bumper Fascia” in this section.
4. Connect the negative battery cable.



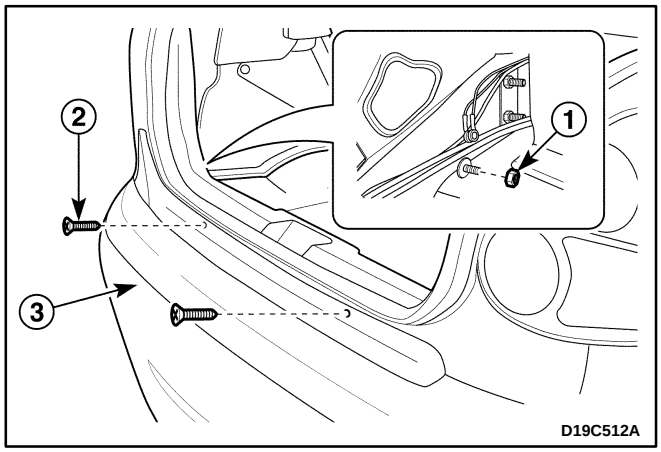
REAR BUMPER FASCIA

Removal Procedure

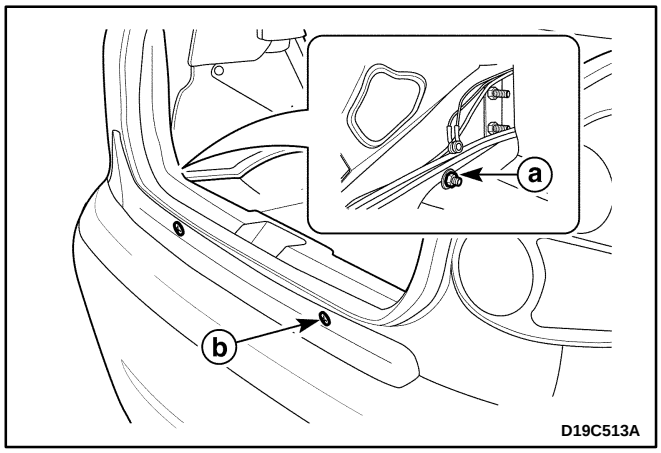
1. Raise and suitably support the vehicle.
2. Remove the bolts underneath the fascia.
   - Remove the bolts (1).



3. Remove the fascia bolts from the rear bumper bracket.



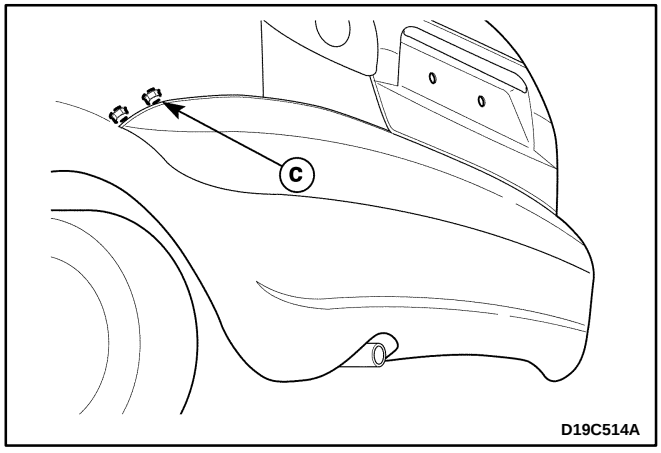
4. Lower the vehicle.
5. Remove the fascia.
   - Remove the nuts in the luggage compartment (1).
   - Remove the screws (2).
   - Remove the fascia (3).



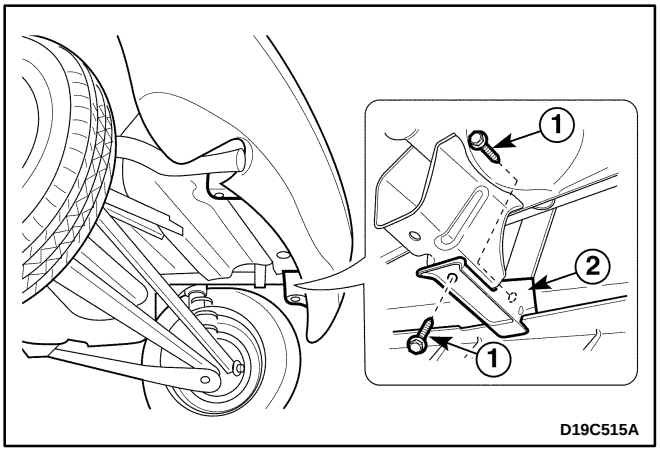
Installation Procedure

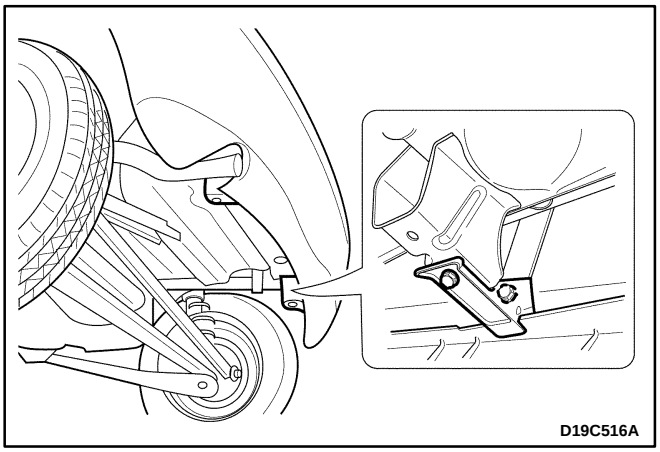
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install the fascia.
2. Install the fascia upper nut.
   a. The fascia upper nut.
3. Install the fascia upper screws
   b. The fascia upper screws.



4. Raise and suitably support the vehicle.
5. Install the fascia lower bolts.
   c. The fascia lower bolts.
6. Lower the vehicle.





REAR BUMPER BRACKET

Removal Procedure

1. Raise and suitably support the vehicle.
2. Remove the rear bumper bracket.
   - Remove the bolts (1).
   - Remove the bracket (2).

Installation Procedure

1. Install the rear bumper bracket with the bolts.
2. Lower the vehicle.

SECTION 9P

DOORS

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.

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DESCRIPTION AND OPERATION

DOOR LOCK STRIKER

The front and the rear door lock strikers each consist of a striker with two screws threaded into a floating cage plate in the B-pillars and C-pillars. The door is secured in the closed position when the door lock fork snaps over and engages the striker.

CHILDPROOF REAR DOOR LOCK

The childproof rear door locks help prevent passengers, especially children, from opening the rear doors of the vehicle from the inside.

In order to activate these locks, move the levers of both rear doors to the lock position. Then, close both doors. Rear passengers will be unable to open the doors from the inside of the vehicle.

In order to deactivate the childproof rear door lock, unlock the door from the inside of the vehicle and open the door from the outside. Move the lever to the unlock position. The rear door will now work normally.

POWER DOOR LOCKS

The power door locks use a solenoid that is contained in each door lock assembly. The door locks are activated by the actuator on the inside door handle or by the lock cylinder on the driver door only. When the driver door is locked or unlocked by the actuator or lock cylinder, all doors are locked or unlocked accordingly.

POWER WINDOWS

The power windows are controlled by electrical switches on the front door tirm and operated by a motor at each window regulator. The windows are lowered by pressing the switch and raised by pulling up on the switch. The window will stop movement when the switch is released or when the window is completely open or closed.

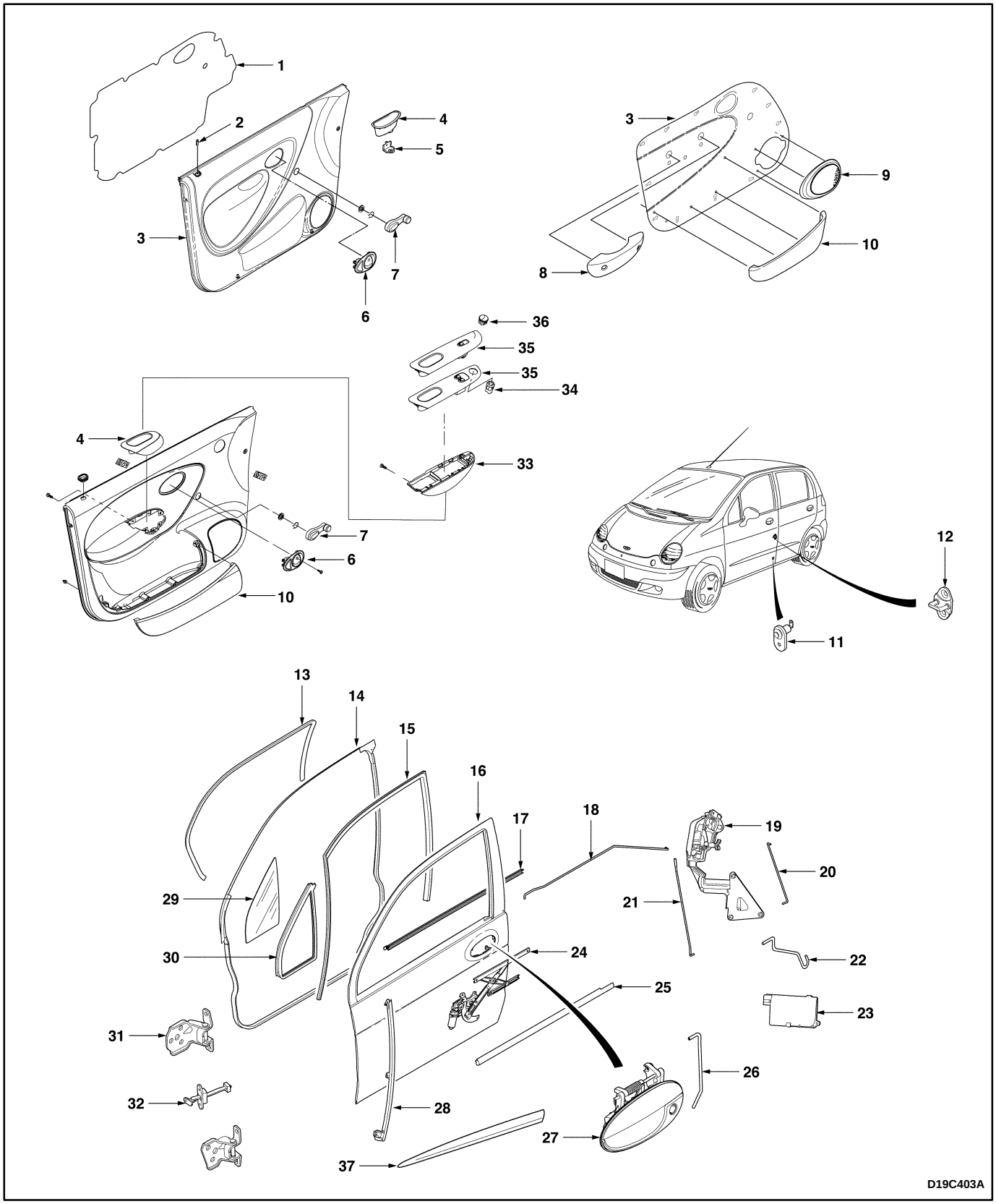
TAILGATE STRUT

This vehicle is equipped with the gas struts. The struts support the tailgate suitably when opening the tailgate.

The strut contained the high pressure compressed gas. Therefore, be careful not to take apart, puncture, apply heat or fire bacause the strut may explode.

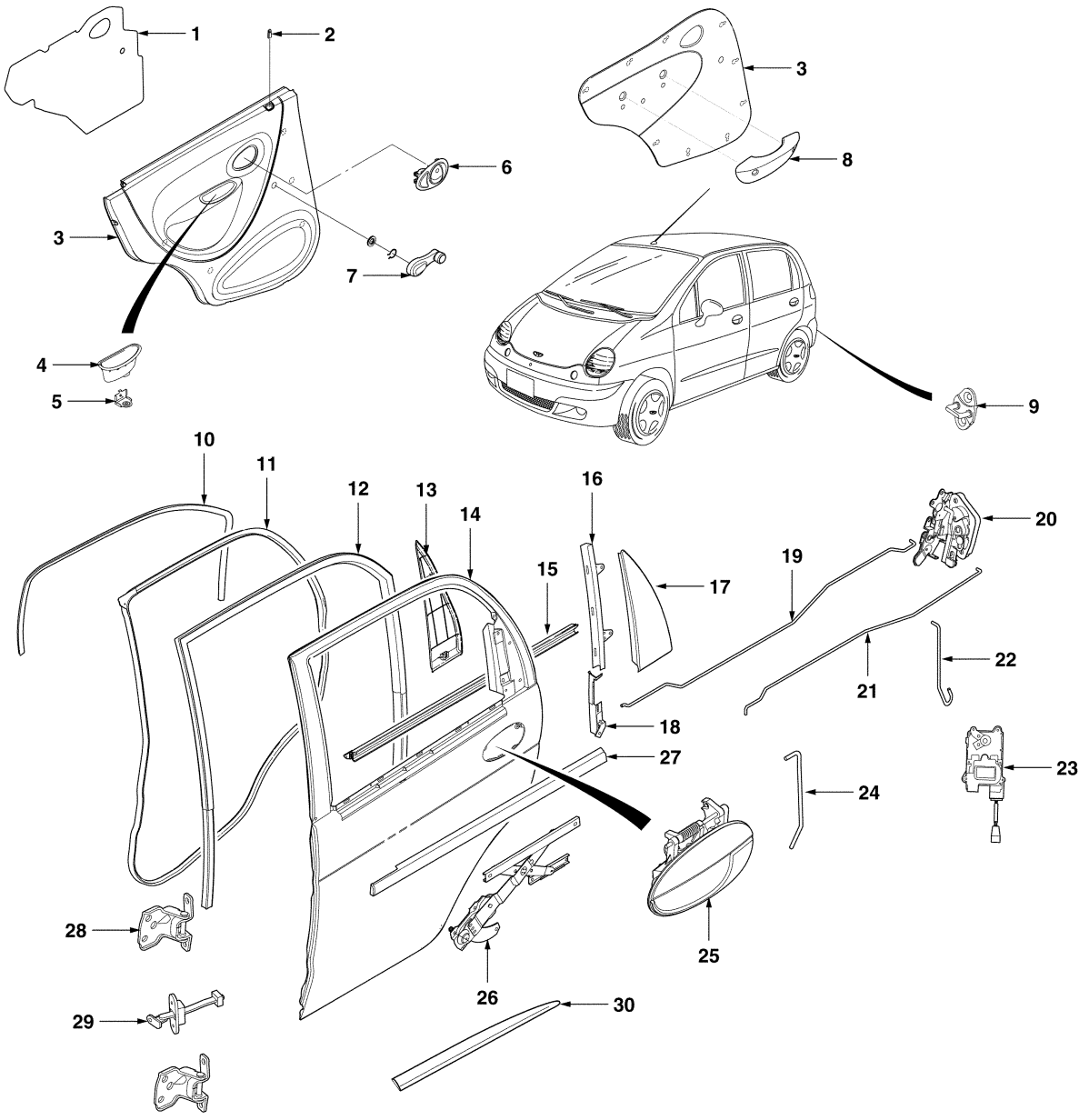
COMPONENT LOCATOR

FRONT DOOR



1. Seal Trim
2. Lock Button
3. Trim Panel
4. Pocket Handle (Deluxe Type)
5. Pocket Handle Bracket (Deluxe Type)
6. Inside handle
7. Manual Regulator Handle
8. Pocket Handle (Standard Type)
9. Door Speaker Cover
10. Map Pocket
11. Contact Switch
12. Striker
13. Opening Weatherstrip
14. Door Weatherstrip
15. Glass Run
16. Front Door
17. Inside Channel Weatherstrip
18. Inside Handle Rod
19. Door Lock
20. Door Lock Cylinder Rod
21. Lock Rod
22. Actuator Rod
23. Actuator
24. Window Regulator
25. Outside Channel Weatherstrip
26. Outside Handle Rod
27. Outside Handle
28. Division Bar
29. Quarter Glass
30. Quarter Glass Run
31. Door Hinge
32. Door Hold Open Link
33. Power Window Switch Cover
34. Mirror Switch
35. Power Window Switch Assembly
36. Mirror switch Blank
37. Door Side Molding

REAR DOOR



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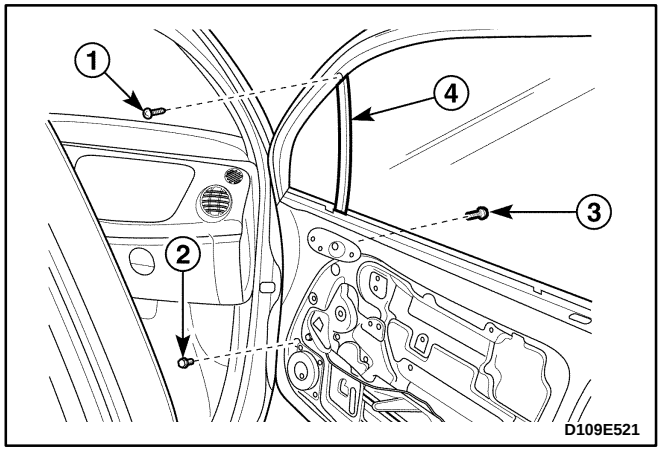
1. Seal Trim
2. Lock Button
3. Trim Panel
4. Pocket Handle (Deluxe Type)
5. Pocket Handle Bracket (Deluxe Type)
6. Inside handle
7. Manual Regulator Handle
8. Pocket Handle (Standard Type)
9. Striker
10. Opening Weatherstrip
11. Door Weatherstrip
12. Glass Run
13. Interior Garnish Molding
14. Rear Door
15. Inside Channel Weatherstrip
16. Upper Guide Rail
17. Exterior Garnish Molding
18. Lower Guide Rail
19. Lock Rod
20. Door Lock
21. Inside Handle Rod
22. Actuator Rod
23. Actuator
24. Outside Handle Rod
25. Outside Handle
26. Window Regulator
27. Outside Channel Weatherstrip
28. Door Hinge
29. Door Hold Open Link
30. Door Side Molding

REPAIR INSTRUCTIONS

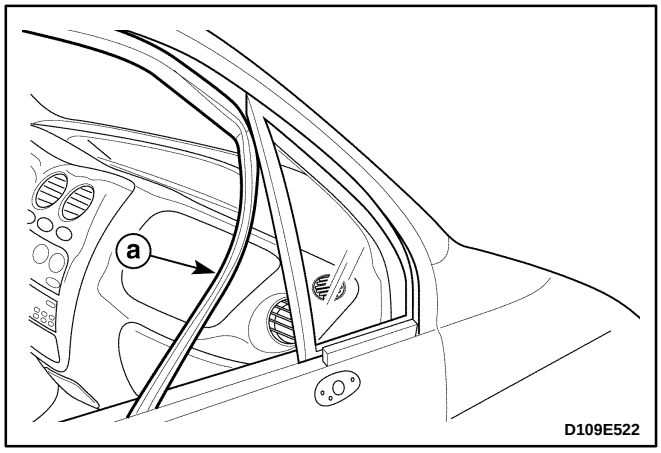
ON–VEHICLE SERVICE



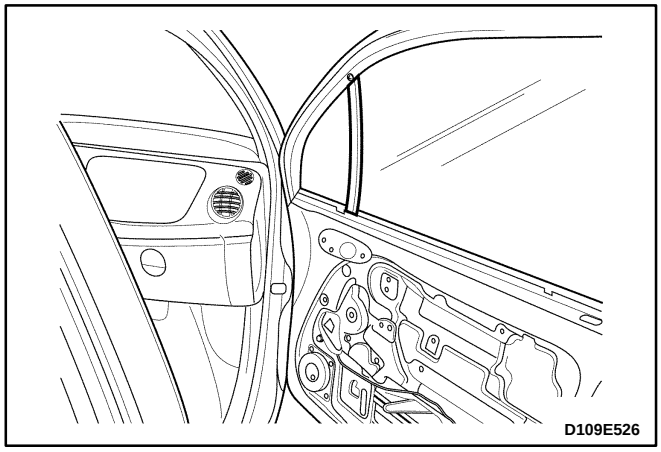
FRONT DOOR GLASS RUN

Removal Procedure

1. Remove the front door seal trim from the front door. Refer to “Door Seal Trim” in this section.
2. Remove the outside rearview mirror from the front door. Refer to *Section 9L, Glass and Mirrors.*
3. Remove the guide rail from the door.
   - Remove the screws (1).
   - Remove the inside bolts (2).
   - Remove the outside bolts (3).
   - Remove the division bar (4).

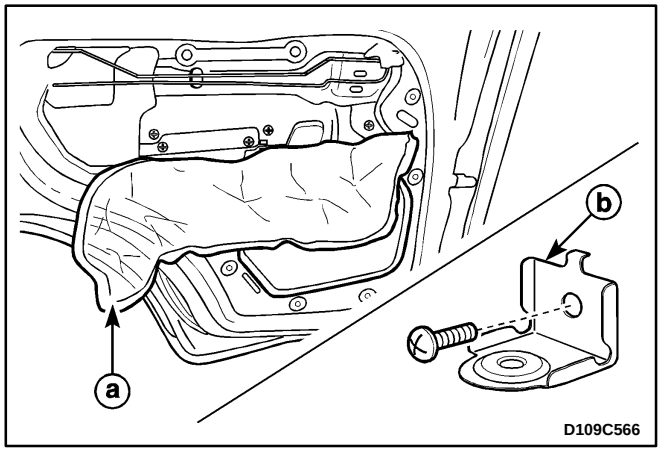


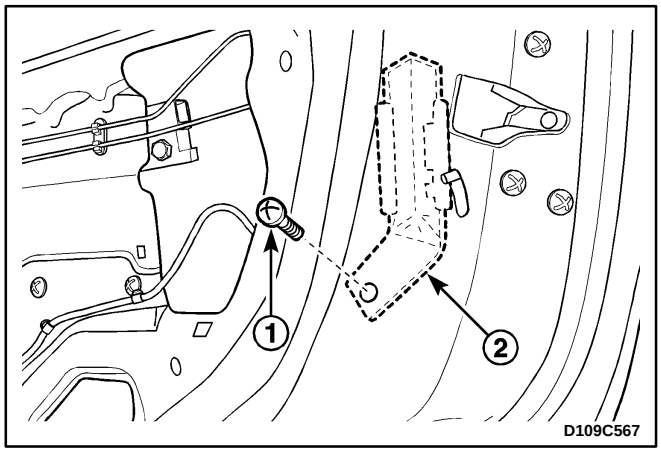
4. Remove the glass run.
   a. Glass run.

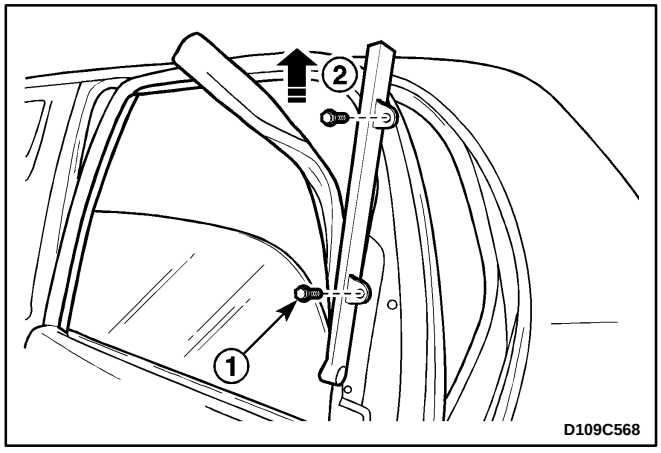


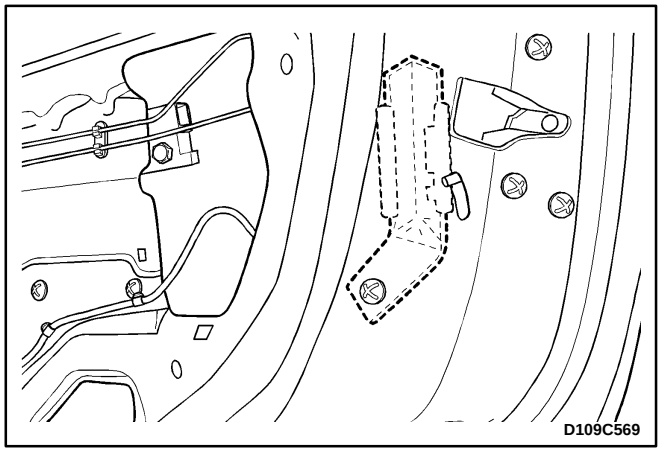
Installation Procedure

1. Install the glass run.
2. Install the division bar with the bolts and the screws.
3. Install the outside rearview mirror. Refer to *Section 9L, Glass and Mirrors*.
4. Install the front door seal trim. Refer to “Door Seal Trim” in this section.









REAR DOOR GLASS RUN

Removal Procedure

1. Remove the inside channel weatherstrip from the rear door. Refer to *Section 9G, Interior Trim.*
2. Remove the outside channel weatherstrip from the rear doors. Refer to *Section 9G, Interior Trim.*
3. Remove the rear door trim panel. Refer to *Section 9G, Interior Trim.*
4. Remove the rear door seal trim.
   a. Door seal trim.
   b. Door pocket handle bracket.

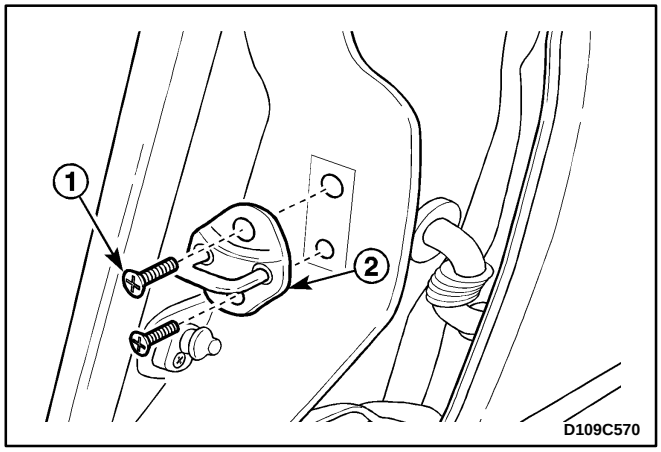
Important: In case of the deluxe type, remove the seal trim after removing the door pocket handle bracket.

5. Remove the guide piece.
   - Remove the screw (1).
   - Remove the guide piece (2).

6. Remove the upper guide rail and the glass run.
   - Remove the bolts (1).
   - Lift up and remove the upper guide rail and the glass run simultaneously (2).

Installation Procedure

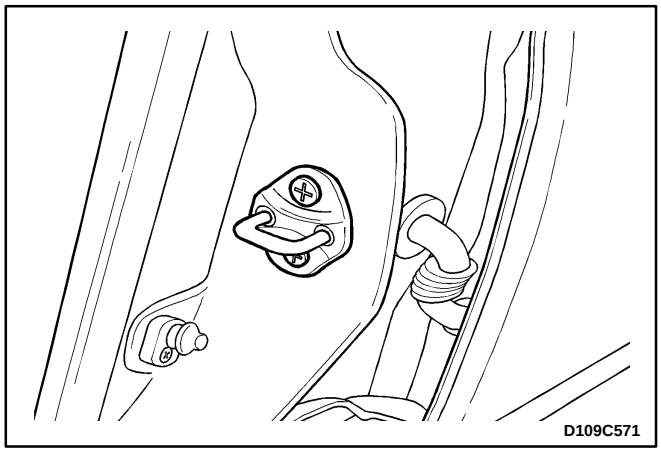
1. Install the upper guide rail and the rear door glass run.
2. Install the guide piece with the screw.
3. Install the rear door seal trim.
4. Install the rear door trim panel. Refer to *Section 9G, Interior Trim*.
5. Install the outside channel weatherstrip to the rear door. Refer to *Section 9G, Interior Trim*.
6. Install the inside channel weatherstrip to the rear door. Refer to *Section 9G, Interior Trim*.



DOOR LOCK STRIKER

Removal Procedure

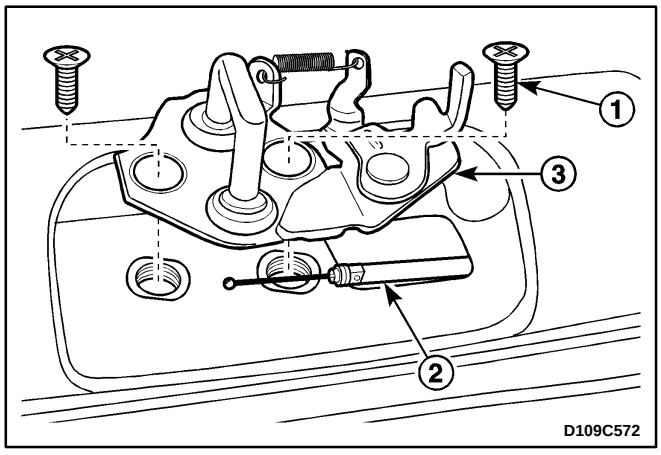
1. Remove the door lock striker.
   - Remove the screws (1).
   - Remove the door lock striker (2).



Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

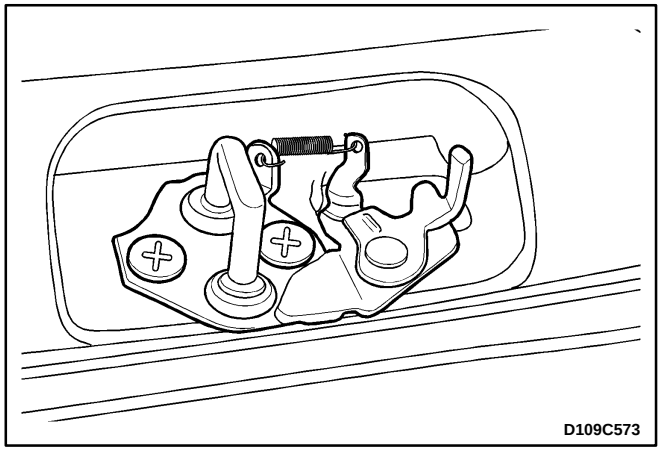
1. Install the door lock striker with the screws.



TAILGATE LOCK STRIKER

Removal Procedure

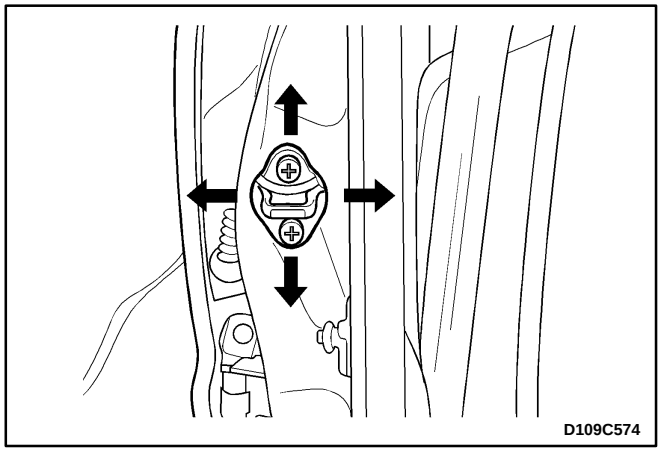
1. Open the tailgate and suitably support it.
2. Remove the tailgate lock striker.
   - Remove the screws (1).
   - Disconnect the cable (2).
   - Remove the striker (3).



Installation Procedure

Notice: Dissimilar metal in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

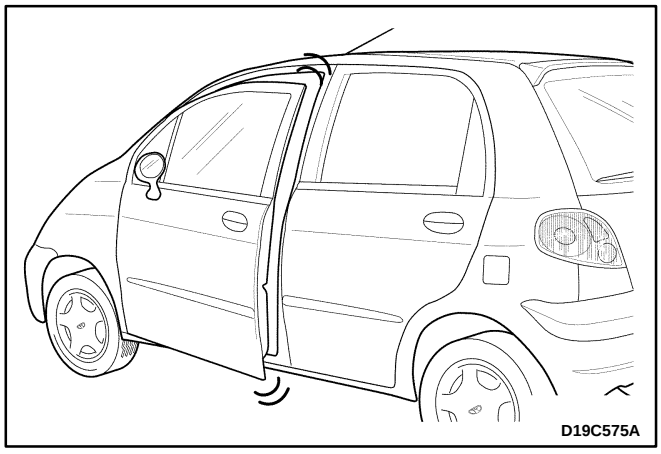
1. Connect the cable.
2. Install the tailgate lock striker with the screws.


D109C574

DOOR LOCK STRIKER ADJUSTMENT

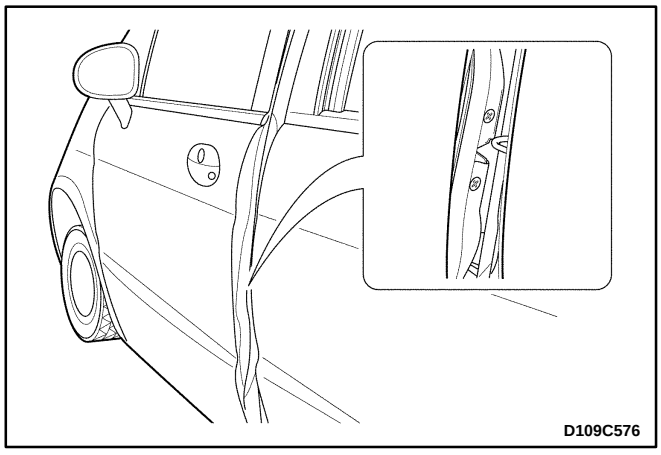
Notice: The door lock striker is an important attaching part that can affect the performance of vital components and systems and can cause major repair expenses. If replacement becomes necessary, the door lock striker must be replaced by one with the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or of a substitute design. The specified torque values must be used during reassembly in order to ensure the proper retention of the part.

The door lock striker consists of a striker with two screws that are threaded into a tapped, floating cage plate located in the appropriate body pillar. This floating cage plate allows the striker to be easily adjusted in or out and up or down. The door is secured in the closed position when the door lock fork snaps over and engages the striker.

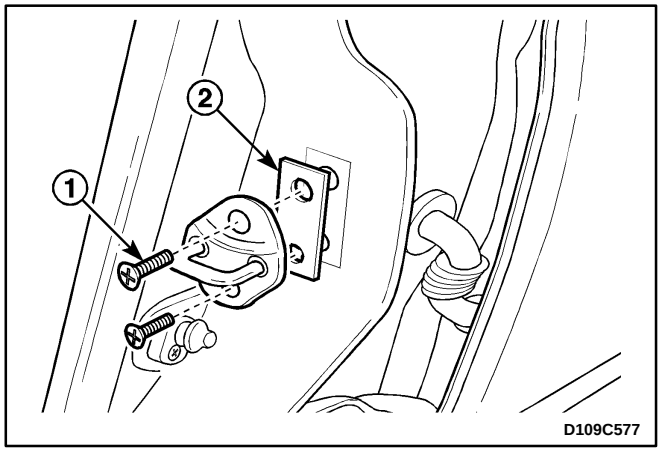

D19C575A

Fore/Aft Adjustment

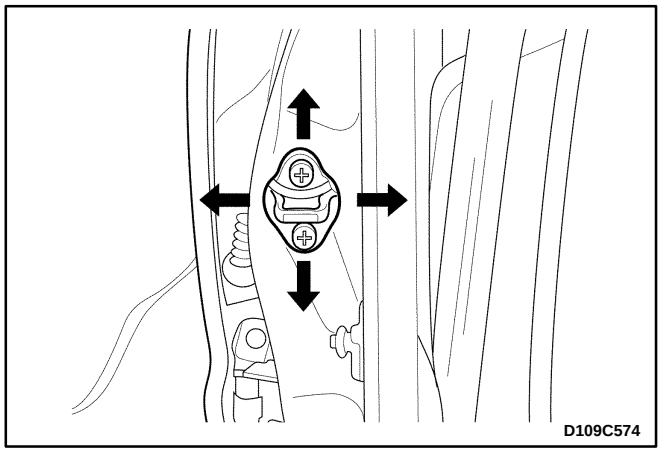
1. The door must be properly aligned.
2. Close the door until the lock fork contacts the striker.
3. Stand next to the door opening and move the door slowly in and out, just touching the striker each time.


D109C576

4. The alignment of the lock fork and the striker can be easily seen. The lock fork should be perpendicular to and fall near the middle of the striker. The lock fork should fall near the middle of the striker between the B-pillar and the end of the striker.



5. If a fore or aft adjustment is required, use the following steps:
   - Remove the striker screws (1).
   - Remove the spacer in order to move the striker toward the rear of the vehicle (2).
   - Add a 2 mm (0.08 inch) spacer in order to move the striker toward the front of the vehicle.
   - Install the striker screws.
6. Perform the up/down or the in/out adjustment. Refer to "Up/Down or In/Out Adjustment" in this section.



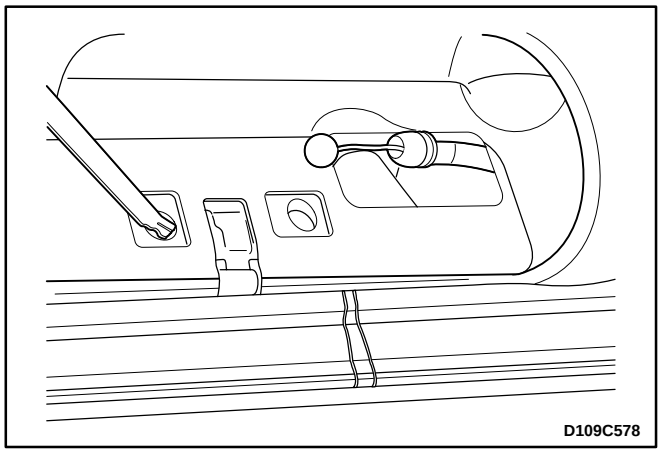
Up/Down or In/Out Adjustment

An adjustment of the striker in the up and down or in and out directions may be necessary for a number of reasons: vehicle frame damage as the result of a collision, installation of new door weatherstripping, customer complaints of excessive windnoise, or difficulty in opening or closing the door. In order to adjust the door striker in an up and down or in and out direction, perform the following procedure:

1. The door must be properly aligned.
2. Loosen the striker screws.
3. The floating cage plate can be moved slightly using the ends of the striker screws. Move the floating cage plate to the desired position.

Notice: It is important to use a flat-end rotary file in order not to damage the tapped floating cage plate. The striker screws and the tapped floating cage plate are important attaching parts that could affect the performance of vital components and systems.

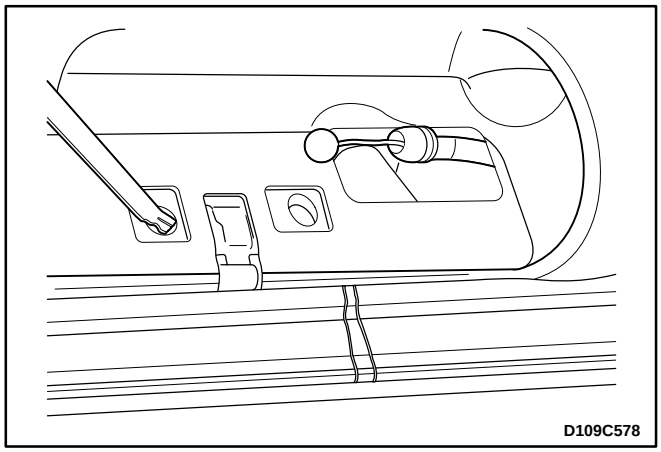
4. If proper adjustment requires that the floating cage plate be moved more than is possible, use an electric hand drill and a 3/8- inch rotary file with a flat head in order to enlarge the body opening in the direction required.
5. Tighten the striker screws to the correct position.



TAILGATE LOCK STRIKER ADJUSTMENT

Notice: The tailgate lock striker is an important attaching part that can affect the performance of vital components and systems and can cause major repair expenses. If replacement becomes necessary, the tailgate lock striker must be replaced by one with the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or of a substitute design. The specified torque values must be used during reassembly in order to ensure the proper retention of the part.

The tailgate lock striker consists of a striker with two screws that are threaded into a tapped, floating cage plate located in the appropriate body pillar. This floating cage plate allows the striker to be easily adjusted in or out and up or down. The tailgate is secured in the closed position when the tailgate lock fork snaps over and engages the striker.

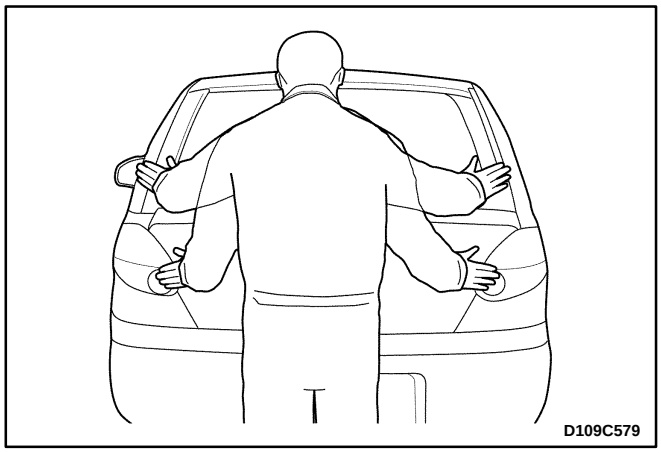

D109C578

Fore/Aft or In/Out Adjustment

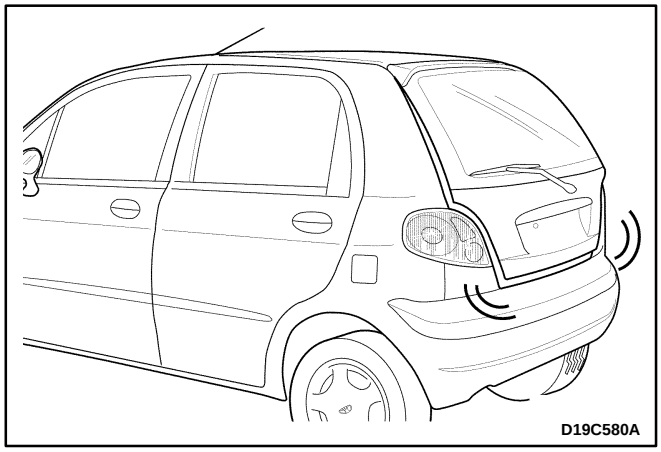
An adjustment of the striker in the fore and aft or in and out directions may be necessary for a number of reasons: vehicle frame damage as the result of a collision, installation of new tailgate weatherstripping, customer complaints of excessive windnoise, or difficulty in opening or closing the tailgate. In order to adjust the tailgate striker in an fore and aft or in and out direction, perform the following procedure:

1. The tailgate must be properly aligned.
2. Loosen the striker screws.
3. The floating cage plate can be moved slightly using the ends of the striker screws. Move the floating cage plate to the desired position.

Notice: It is important to use a flat-end rotary file in order not to damage the tapped floating cage plate. The striker screws and the tapped floating cage plate are important attaching parts that could affect the performance of vital components and systems.

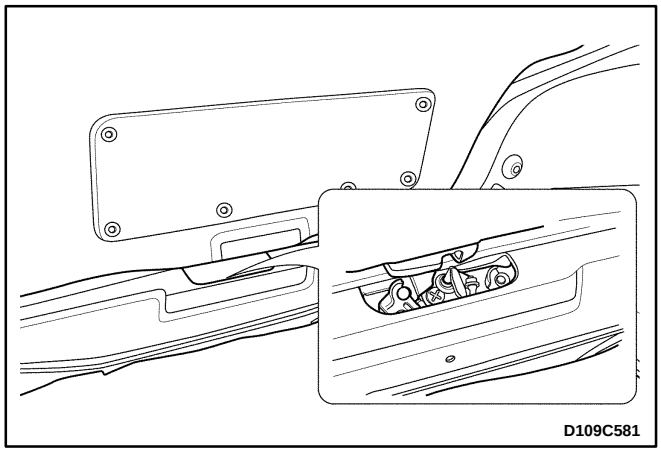

D109C579

4. If proper adjustment requires that the floating cage plate be moved more than is possible, use an electric hand drill and a 3/8- inch rotary file with a flat head in order to enlarge the body opening in the direction required.
5. Tighten the striker screws to the correct position.
6. Perform the up/down adjustment. Refer to “Up and Down Adjustment” in this section.

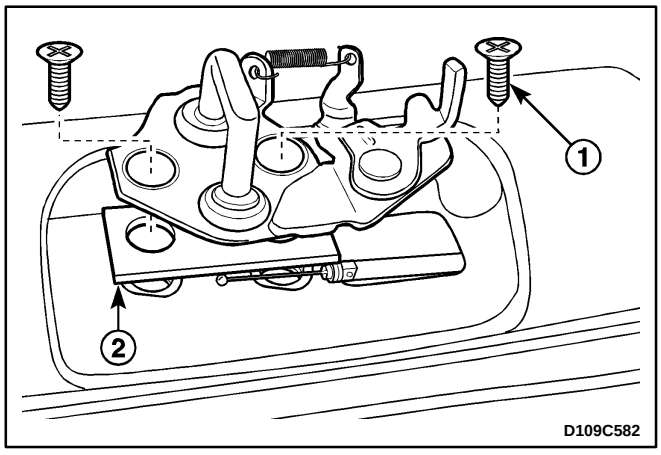

D19C580A

Up and Down Adjustment

1. The tailgate must be properly aligned.
2. Close the tailgate until the lock fork contacts the striker.
3. Stand next to the tailgate opening and move the tailgate slowly up and down, just touching the striker each time.

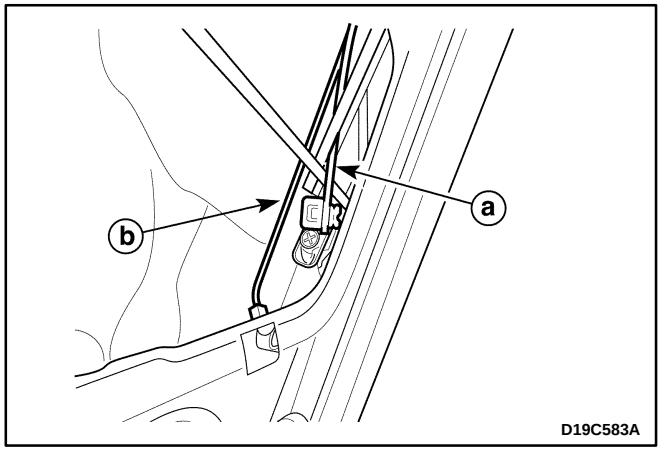

D109C581

4. The alignment of the lock fork and the striker can be easily seen. The lock fork should be perpendicular to and fall near the middle of the striker. The lock fork should fall near the middle of the striker between the rear body pillar and the end of the striker.



D109C582

5. If a up and down adjustment is required, use the following steps:
   - Remove the striker screws (1).
   - Remove the spacer in order to move the striker toward the down of the vehicle (2).
   - Add a 2 mm (0.08 inch) spacer in order to move the striker toward the up of the vehicle.
   - Install the striker screws.

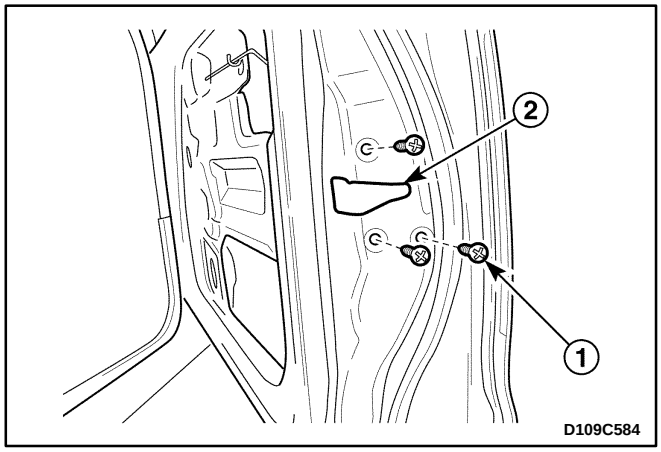


D19C583A

FRONT DOOR LOCK

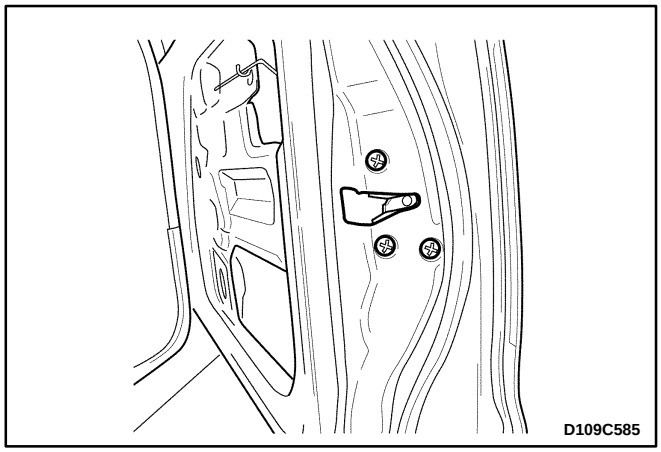
Removal Procedure

1. Disconnect the negative battery cable if equipped with the central door lock system.
2. Remove the seal trim. Refer to “Door Seal Trim” in this section.
3. Disconnect the outside door handle rod from the door lock.
   a. Outside door handle rod.
   b. Key rod.



4. Remove the front door lock.
   - Remove the screws (1).
   - Remove the front door lock (2).

Important: Disconnect the actuator connector, if equipped with the central door lock system.



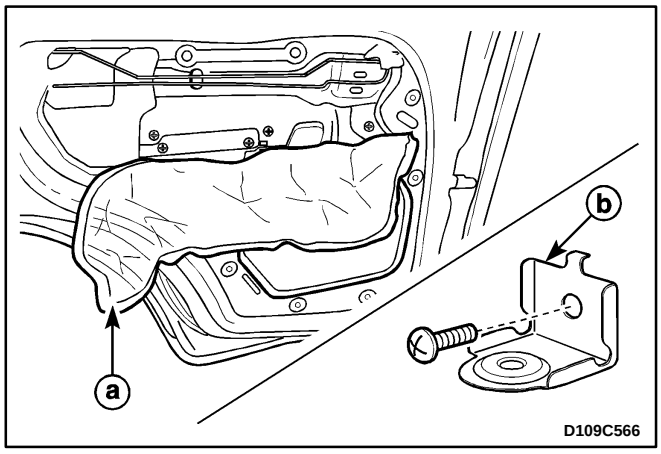
Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install the front door lock with screws.

Important: Connect the actuator connector if equipped with the central door lock system.

2. Connect the outside door handle rod and the key rod to the door lock.
3. Install the seal trim. Refer to “Door Seal Trim” in this section.
4. Connect the negative battery cable, if equipped with the central door lock system.

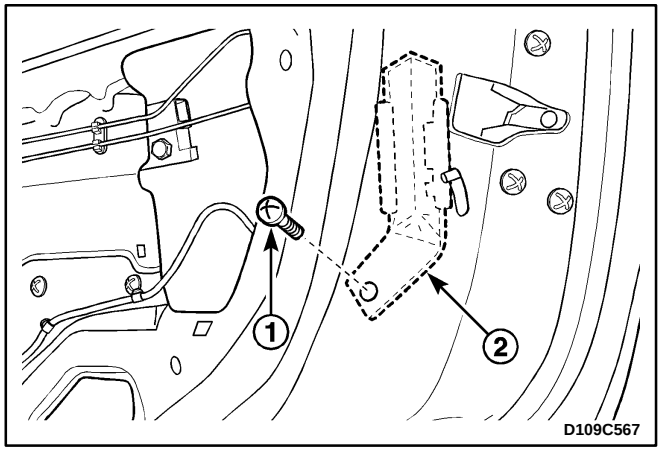


CHILDPROOF REAR DOOR LOCK

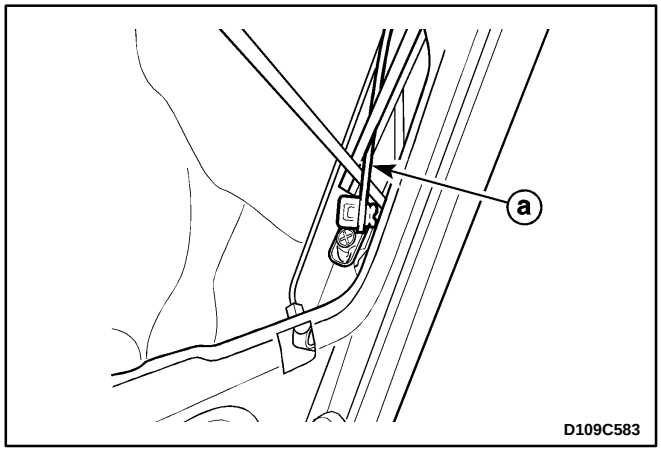
Removal Procedure

1. Disconnect the negative battery cable if equipped with the central door lock system.
2. Remove the door trim panel. Refer to *Section 9G, Interior Trim*.
3. Remove the door seal trim. Refer to “Door Seal Trim” in this section.
   a. Door seal trim.
   b. Door pocket handle bracket.

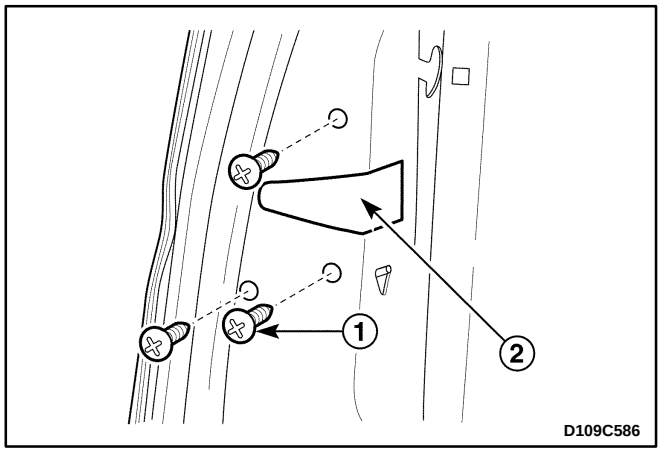
Important: In case of the deluxe type, remove the seal trim after removing the door pocket handle bracket.



4. Remove the guide piece.
   - Remove the screw (1).
   - Remove the guide piece (2).

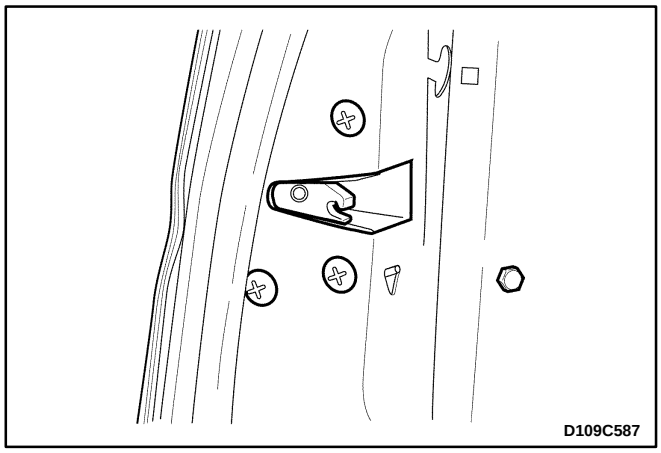


5. Disconnect the outside door handle rod from the door lock.
   a. Outside door handle rod.



6. Disconnect the door lock from the vehicle.
   - Remove the screws (1).
   - Remove the door lock (2).

Important: Disconnect the actuator connector if equipped with the central door lock system.



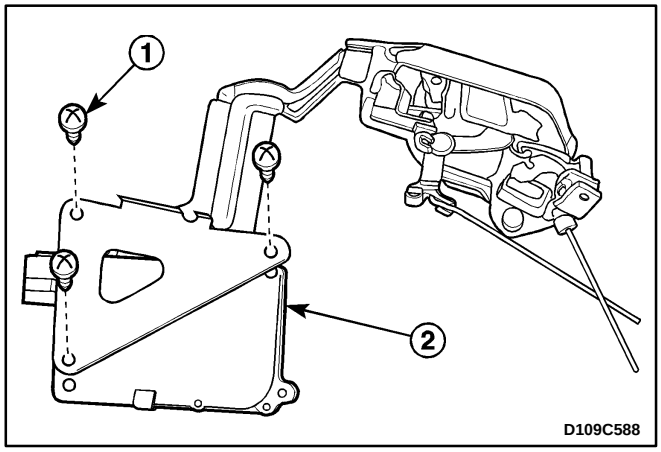
Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

1. Install the rear door lock with the screws.

Important: Connect the actuator connector if equipped with the central door lock system.

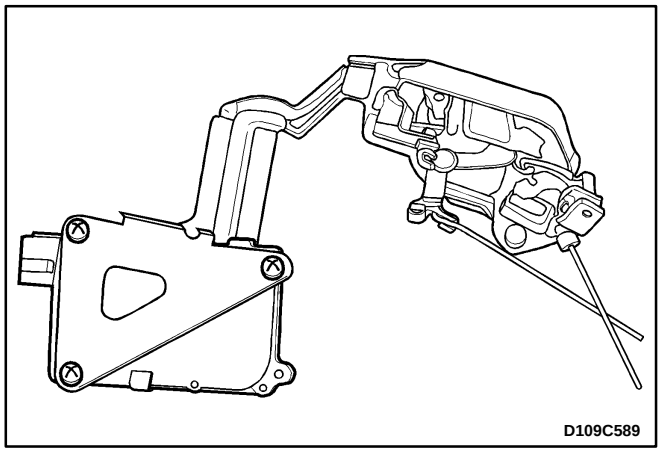
2. Connect the outside door handle rod to the door lock.
3. Install the guide rail with the screw.
4. Install the seal trim. Refer to “Door Seal Trim” in this section.
5. Install the door trim panel. Refer to *Section 9G, Interior Trim*.
6. Connect the negative battery cable if equipped with the central door lock system.



CENTRAL DOOR LOCK ACTUATOR

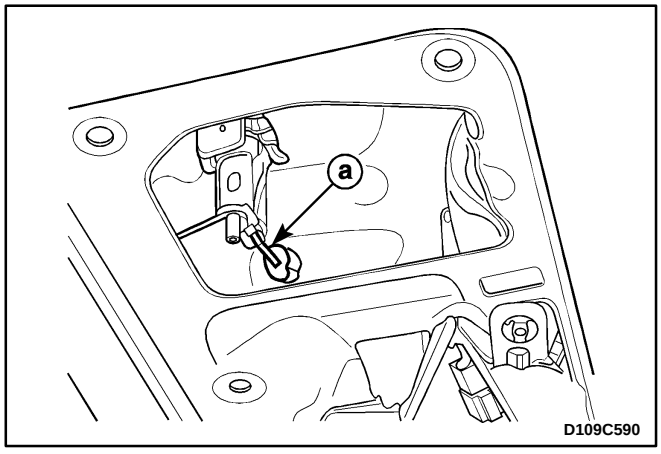
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the door seal trim. Refer to “Door Seal Trim” in this section.
3. Remove the door lock assembly. Refer to “Door Lock” in this section.
4. Remove the actuator from the door lock assembly.
   - Remove the screws (1).
   - Remove the actuator (2).



Installation Procedure

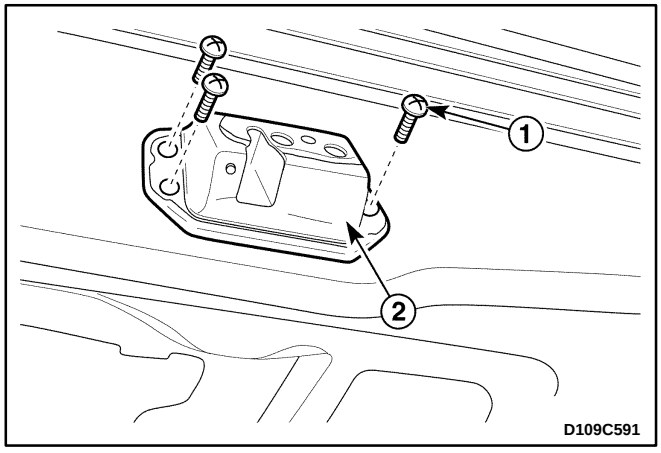
1. Install the door lock actuator to the door lock assembly with the screws.
2. Install the door lock assembly to the vehicle. Refer to “Door Lock” in this section.
3. Install the door seal trim. Refer to “Door Seal Trim” in this section.
4. Connect the negative battery cable.



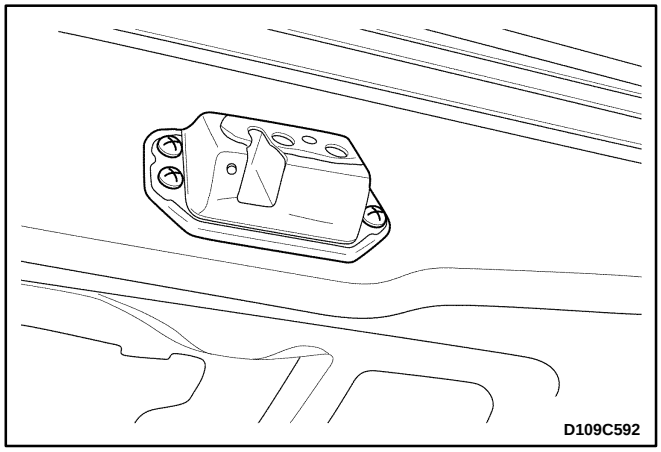
TAILGATE LOCK

Removal Procedure

1. Remove the tailgate trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the lock rod from the tailgate lock cylinder.
   a. Lock rod.



3. Remove the tailgate lock.
   - Remove the screws (1).
   - Remove the tailgate lock (2).



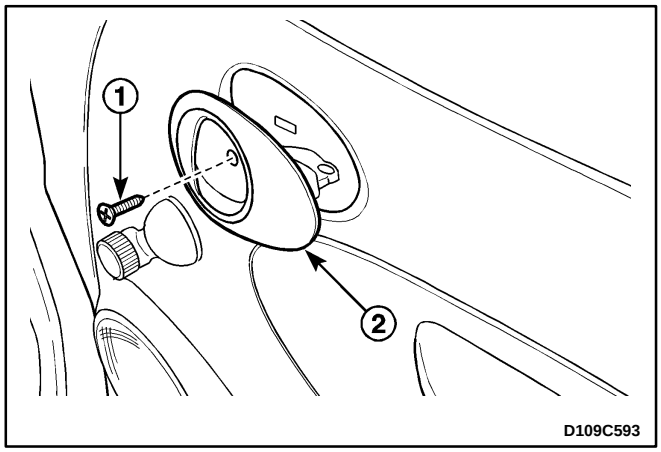
Installation Procedure

1. Install the tailgate lock with the screws.
2. Install the lock rod to the tailgate lock cylinder.
3. Install the tailgate trim panel. Refer to *Section 9G, Interior Trim*.

INSIDE DOOR HANDLE

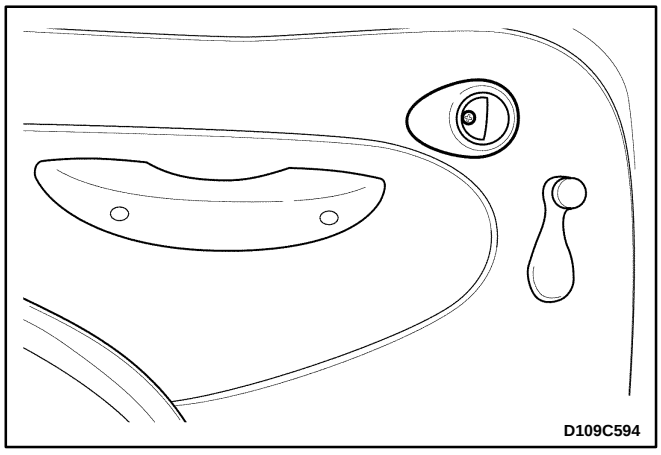
Removal Procedure

1. Removal the inside door handle.
   - Remove the screw (1).
   - Remove the inside door handle (2).



Installation Procedure

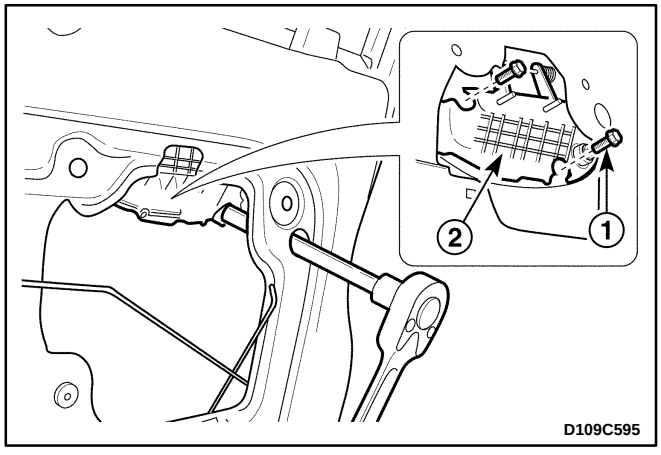
1. Install the inside door handle with the screw.

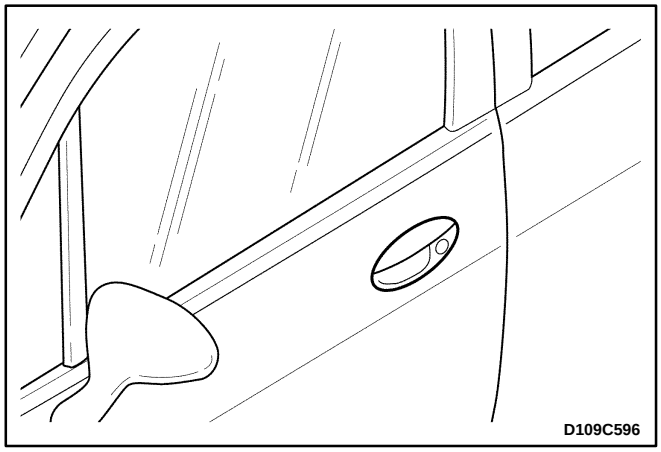


OUTSIDE FRONT DOOR HANDLE

Removal Procedure

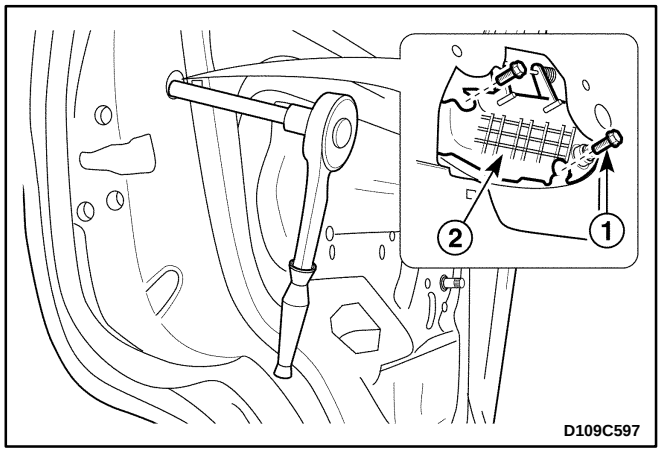
1. Disconnect the negative battery cable.
2. Remove the front door lock rods.
3. Remove the outside front door handle.
   - Remove the bolts (1).
   - Remove the outside front door handle (2).





Installation Procedure

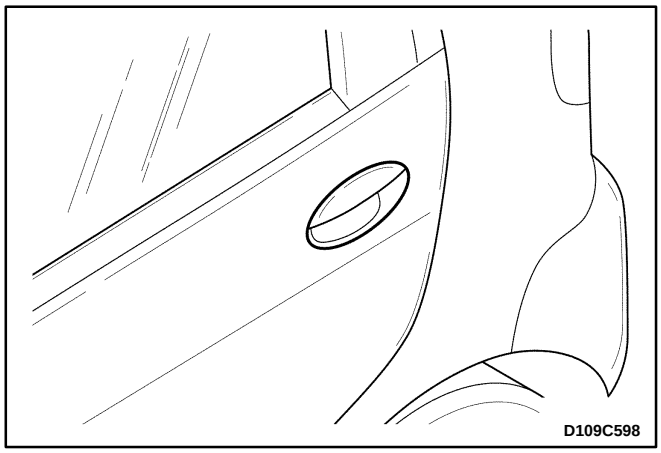
1. Install the outside front door lock handle with the bolts.
2. Install the front door lock rods.
3. Connect the negative battery cable.



OUTSIDE REAR DOOR HANDLE

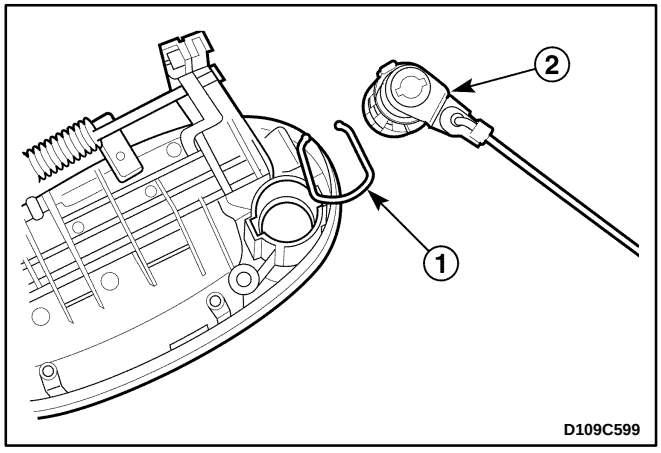
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the rear door lock. Refer to “Childproof Rear Door Lock” in this section.
3. Remove the outside rear door handle.
   - Remove the bolts (1).
   - Remove the outside rear door handle (2).



Installation Procedure

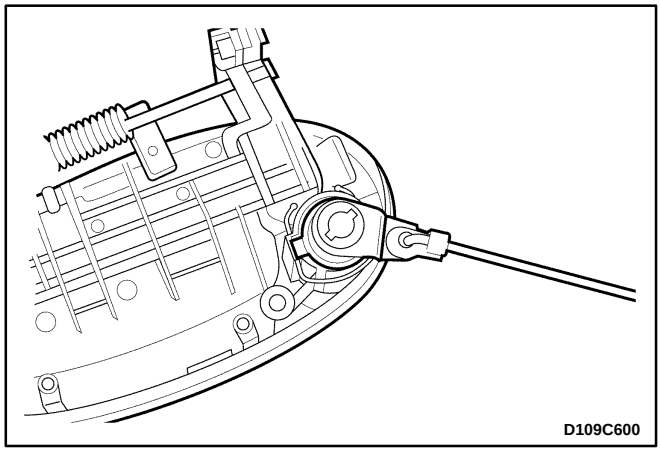
1. Install the outside rear door handle with the bolts.
2. Install the rear door lock. Refer to “Childproof Rear door Lock” in this section.
3. Connect the negative battery cable.



DOOR LOCK CYLINDER

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the outside door handle. Refer to “Outside Front Door Handle” in this section.
3. Remove the door lock cylinder from the outside door handle.
   - Remove the clip (1).
   - Remove the door lock cylinder (2).



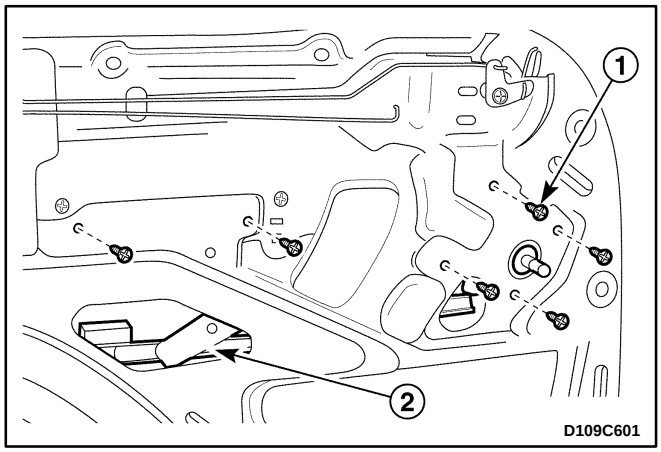
Installation Procedure

1. Install the door lock cylinder with the clip.
2. Install the outside door handle. Refer to “Outside Front Door Handle” in this section.
3. Connect the negative battery cable.

MANUAL WINDOW REGULATOR

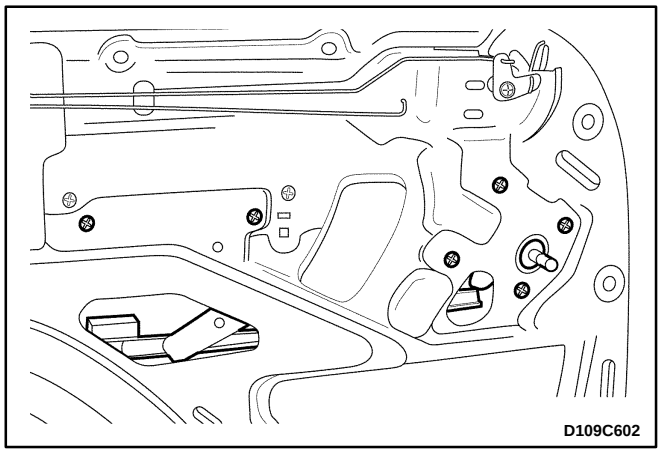
Removal Procedure

1. Remove the glass. Refer to *Section 9L, Glass and Mirrors.*
2. Remove the window regulator.
   - Remove the screws (1).
   - Remove the regulator (2).



Installation Procedure

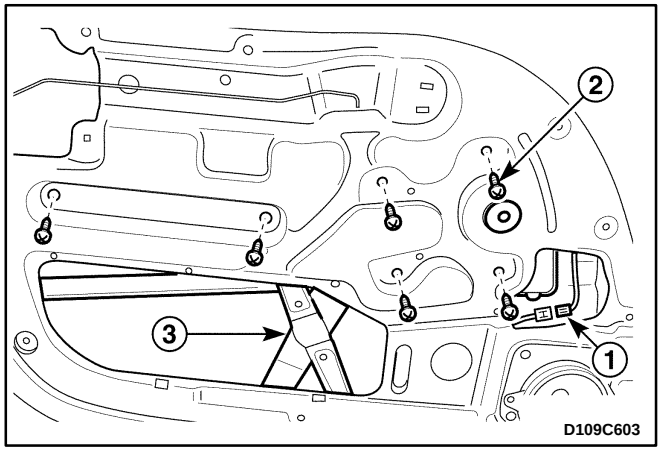
1. Install the regulator with the screws.
2. Install the glass. Refer to *Section 9L, Glass and Mirrors.*

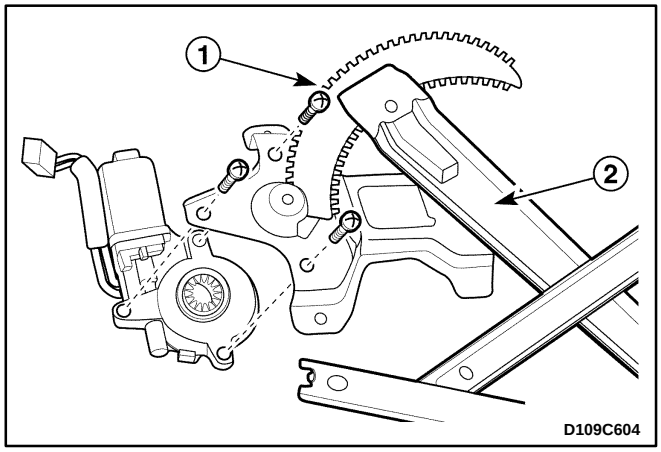


POWER FRONT WINDOW REGULATOR

Removal Procedure

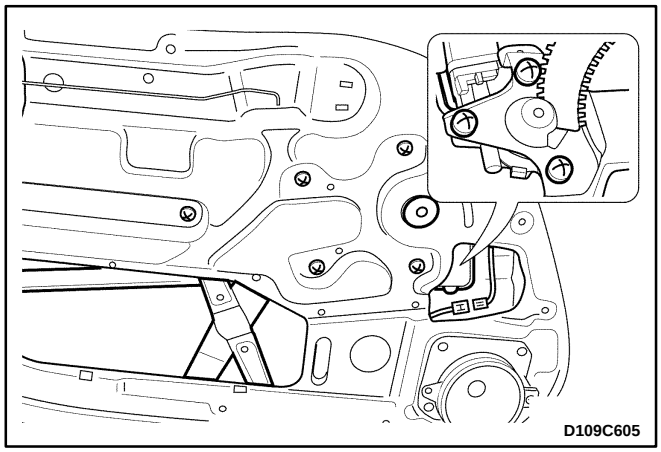
1. Disconnect the negative battery cable.
2. Remove the glass. Refer to *Section 9L, Glass and Mirrors.*
3. Remove the window regulator assembly.
   - Disconnect the window motor electrical connector (1).
   - Remove the screws (2).
   - Remove the window regulator assembly (3).





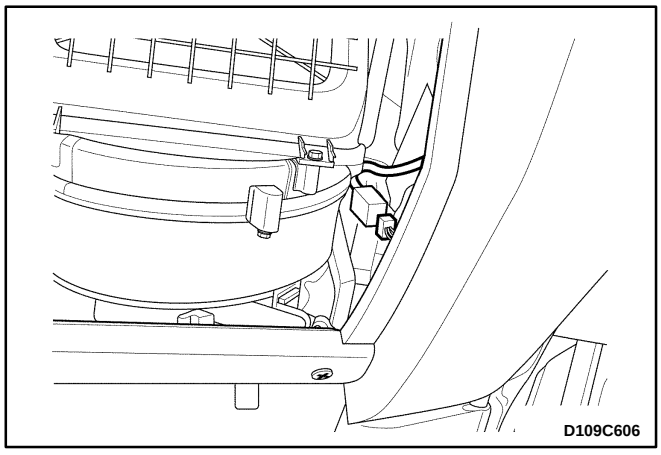
4. Remove the window motor from the window regulator.
   - Remove the screws (1).
   - Remove the window regulator (2).

Caution: Be careful what you are doing when separating the window motor and the window regulator. You may be hurt.



Installation Procedure

1. Install the window motor to the window regulator with the screws.
2. Install the window regulator assembly with the screws.
3. Connect the window motor electrical connector.
4. Install the glass. Refer to Se*ction 9L, Glass and Mirrors.*
5. Connect the negative battery cable.

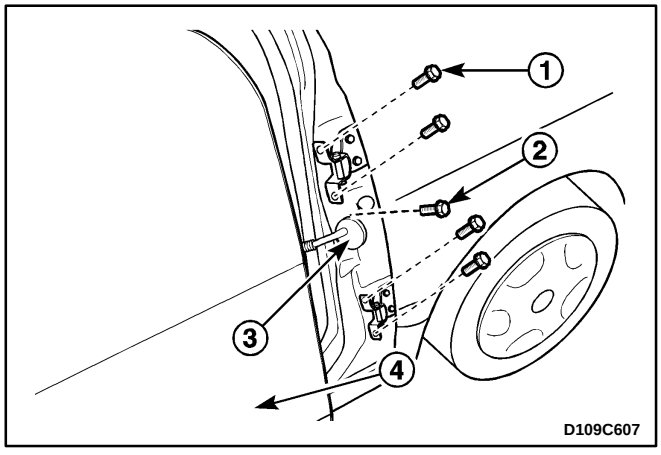


FRONT DOOR ASSEMBLY

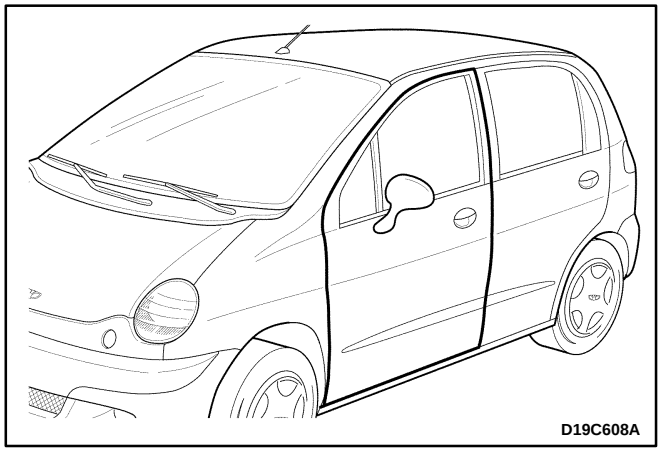
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector under the instrument panel.

Important: In case of the front passenger door, remove the glove box in advance.



3. Remove the fender. Refer to *Section 9R, Body Front End*.
4. Remove the front door assembly.
   - Remove the door hinge bolts (1).
   - Remove the door hold open bolt (2).
   - Disconnect the body–to–door rubber grommet (3).
   - Remove the front door assembly (4).


D19C608A

Installation Procedure

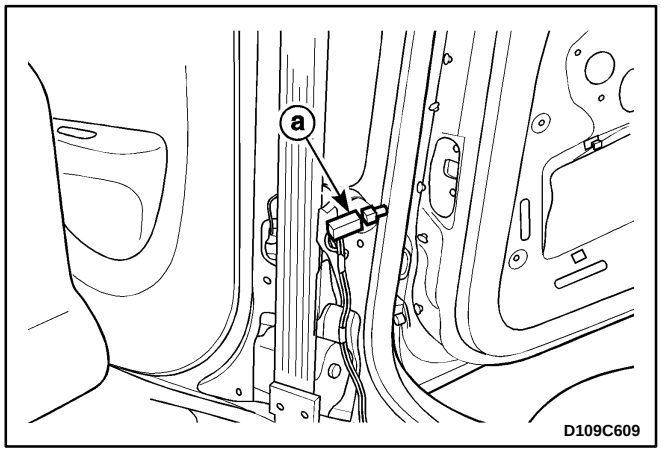
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fastener to prevent premature corrosion.

1. Connect the body–to–door rubber grommet.
2. With the aid of another technician, lightly secure the front door with the bolts.
3. Adjust the door for proper fit.
4. Tighten the hinge–to–body bolts.
5. Install the door hold open link with the bolt.
6. Install the fender. Refer to *Section 9R, Body Front End*.
7. Connect the electrical connector.
8. Connect the negative battery cable.
9. Perform the waterleak test. Refer to *Section 9I, Waterleak.*
10. Check for windnoise. Refer to *Section 9J, Windnoise.*

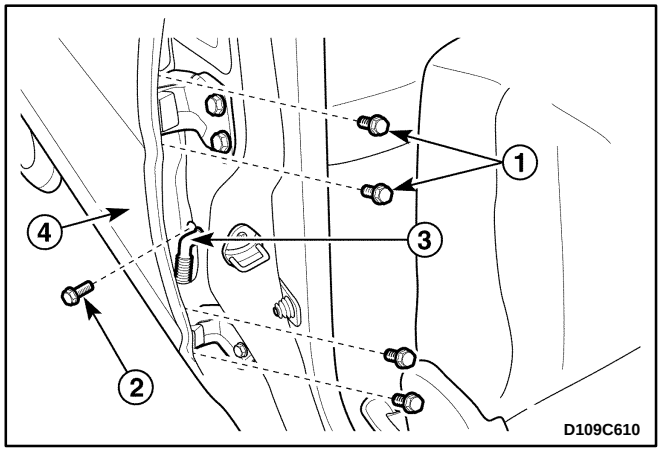
REAR DOOR ASSEMBLY

Removal Procedure

1. Disconnect the negative battery cable.
2. Pry off the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim.*
3. Disconnect the rear door electrical connector.
   a. Rear door electrical connector.

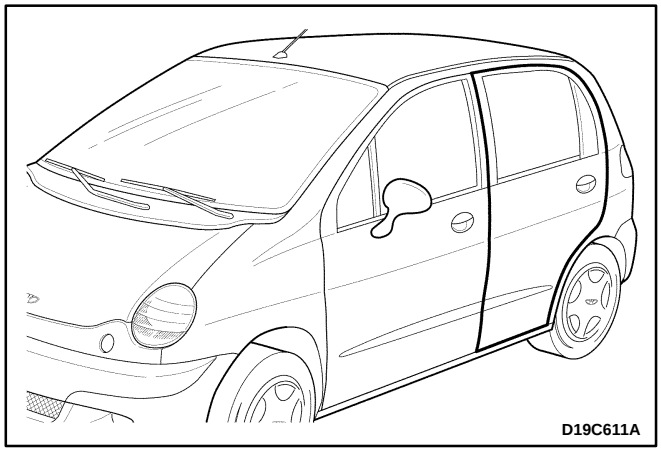


D109C609



D109C610

4. Remove the rear door assembly.
   - Remove the door hinge bolts (1).
   - Remove the door hold open link bolt (2).
   - Disconnect the body–to–door rubber grommet (3).
   - Remove the rear door assembly (4).


D19C611A

Installation Procedure

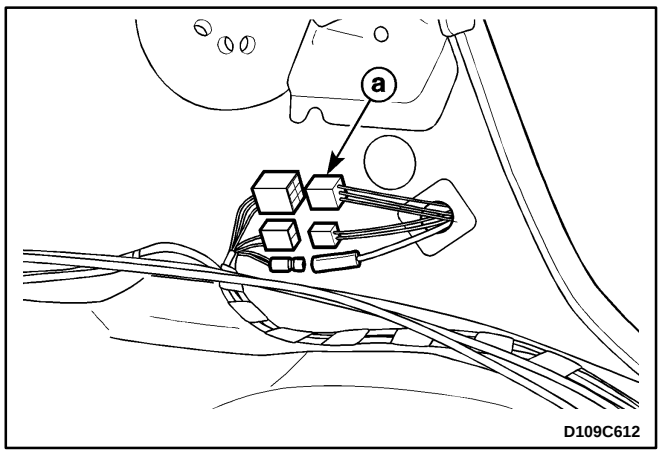
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fastener to prevent premature corrosion.

1.Connect the body–to–door rubber grommet.
2. With the aid of another technician, lightly secure the rear door with the bolts.
3. Adjust the door for proper fit.
4. Install the door hold open link with the bolt.
5. Connect the rear door electrical connector.
6. Connect the negative battery cable.
7. Perform the waterleak test. Refer to *Section 9I, Waterleaks.*
8. Check for windnoise. Refer to *Section 9J, Windnoise.*

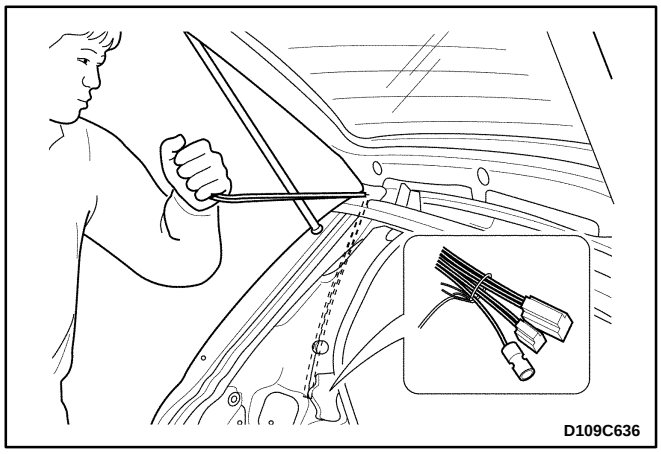
TAILGATE

Removal Procedure

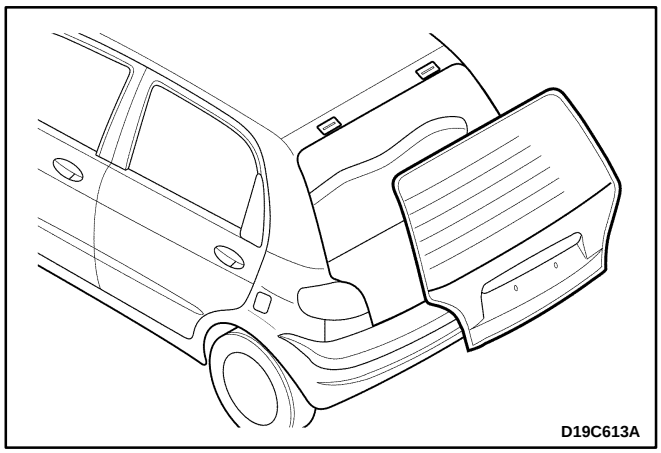
1. Disconnect the negative battery cable.
2. Remove the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
3. Disconnect the tailgate electrical connector.
   a. Tailgate electrical connector.

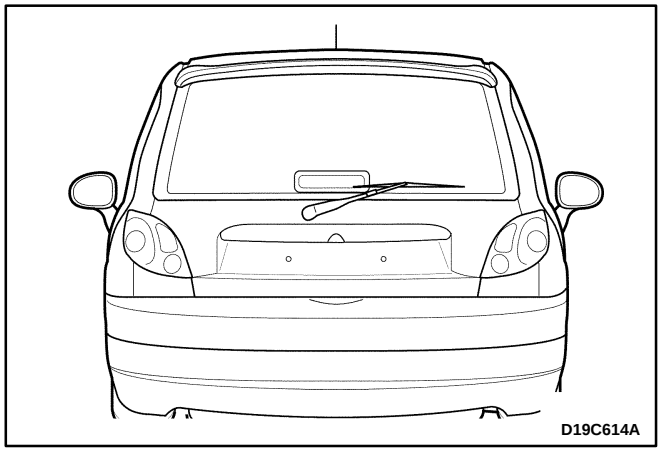


D109C612


D109C636

4. Remove the tailgate strut. Refer to “Tailgate Strut” in this section.
5. Remove the tailgate.
   - Remove the hinge bolts.
   - Disconnect the body–to–tailgate rubber grommet.
   - Remove the tailgate.


D19C613A



Installation Procedure

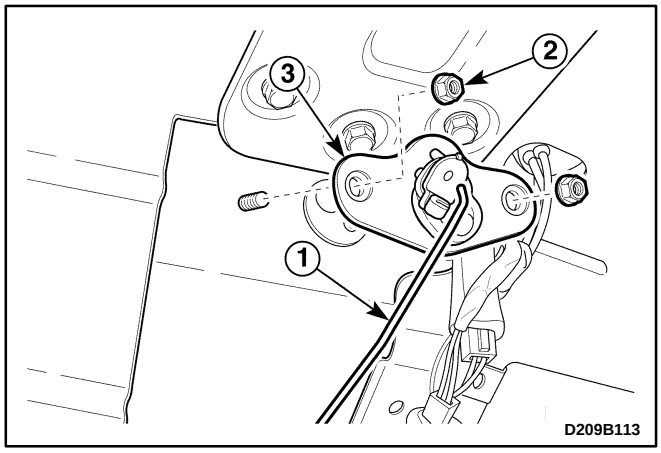
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fastener to prevent premature corrosion.

1. Connect the body–to–tailgate rubber grommet.
2. With the aid of another technician, lightly secure the tailgate with the bolts.
3. Adjust the tailgate for proper fit.
4. Install the tailgate strut. Refer to “Tailgate Strut” in this section.
5. Connect the tailgate electrical connector.
6. Install the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
7. Connect the negative battery cable.

TAILGATE LOCK CYLINDER

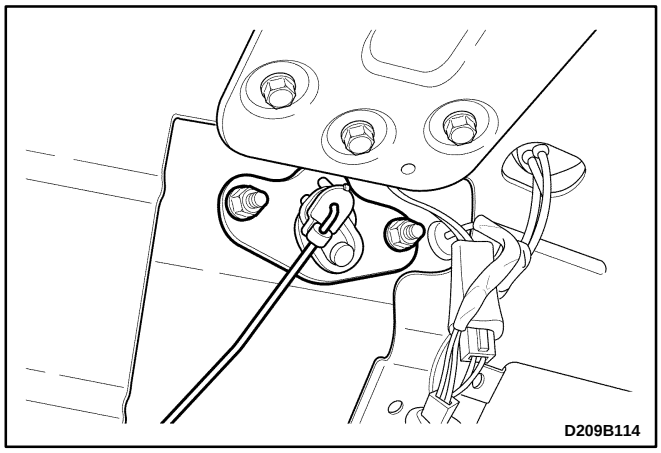
Removal Procedure

1. Disconnect the negative battery cable.
2. Open the tailgate.
3. Remove the rear window wiper motor assembly. Refer to *Section 9D, Wipers/Washer Systems.*
4. Remove the tailgate lock cylinder.
   - Disconnect the tailgate lock rod (1).
   - Remove the nuts from the tailgate lock cylinder (2).
   - Remove the tailgate lock cylinder (3).



Installation Procedure

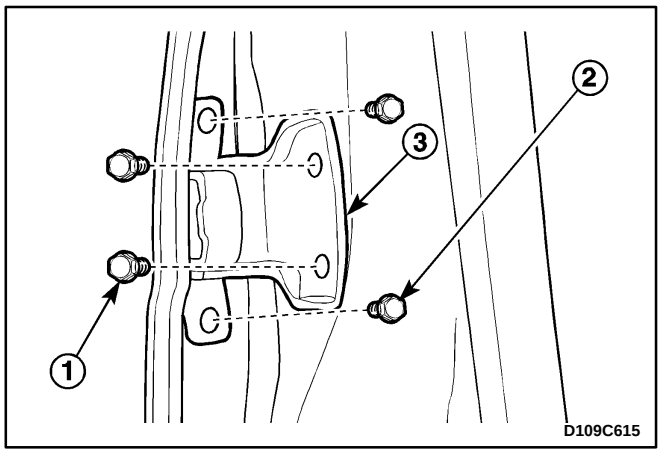
1. Install the tailgate lock cylinder.
2. Install the rear window wiper motor assembly. Refer to *Section 9D, Wipers/Washer Systems.*
3. Connect the negative battery cable.

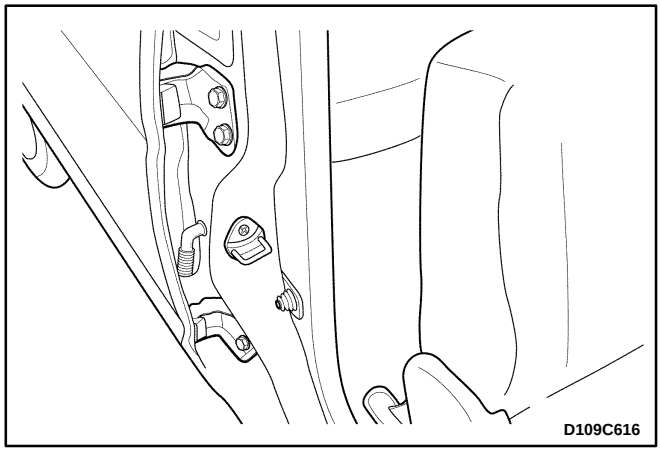


DOOR HINGE

Removal Procedure

1. With the aid of another technician, remove the door hinge.
   - Remove the hinge–to–body bolts (1).
   - Remove the hinge–to–door bolts (2).
   - Remove the door hinge (3).





Installation Procedure

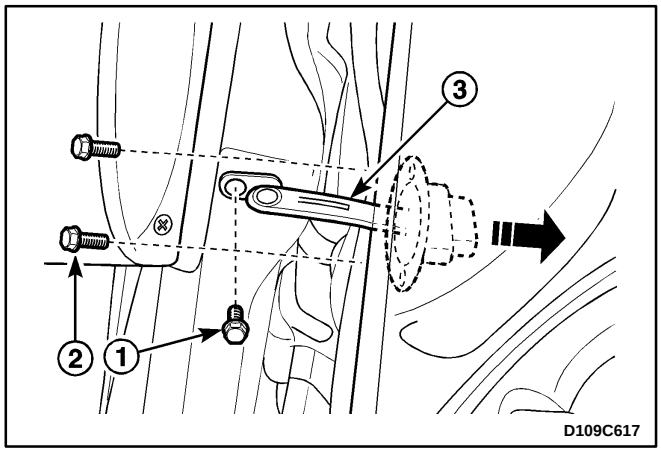
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fastener to prevent premature corrosion.

1. With the aid of another technician, install the hinge to the door and the body with the bolts.

DOOR HOLD OPEN LINK

Removal Procedure

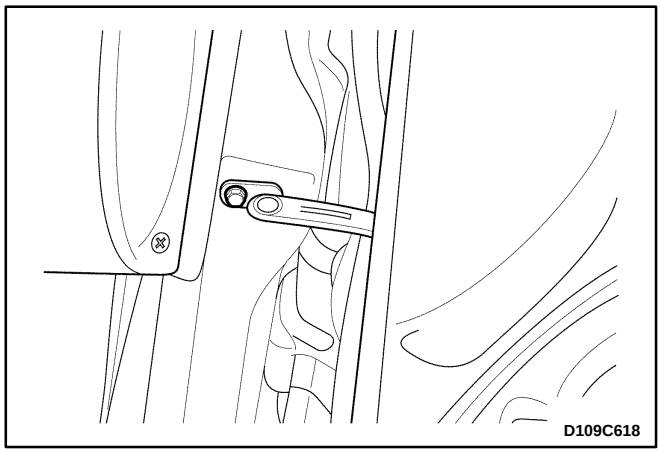
1. Remove the door seal trim. Refer to “Door Seal Trim” in this section.
2. Remove the door hold open link.
   - Remove the hinge–to–body bolt (1).
   - Remove the hinge–to–door bolts (2).
   - Remove the door hold open link (3).



Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fastener to prevent premature corrosion.

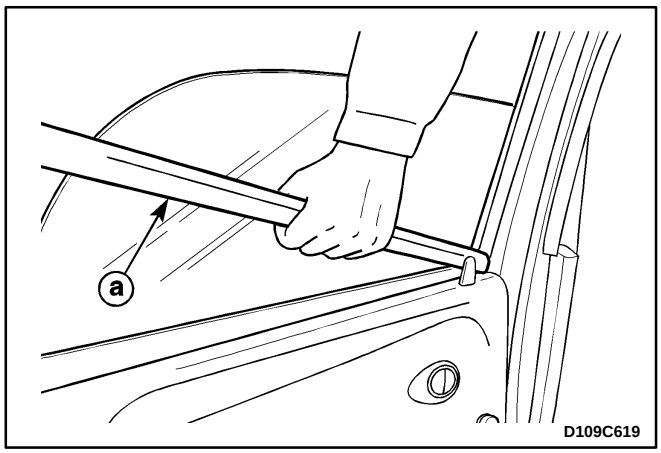
1. Install the door hold open link to the door and the body with the bolts.
2. Remove the door seal trim. Refer to “Door Seal Trim” in this section.

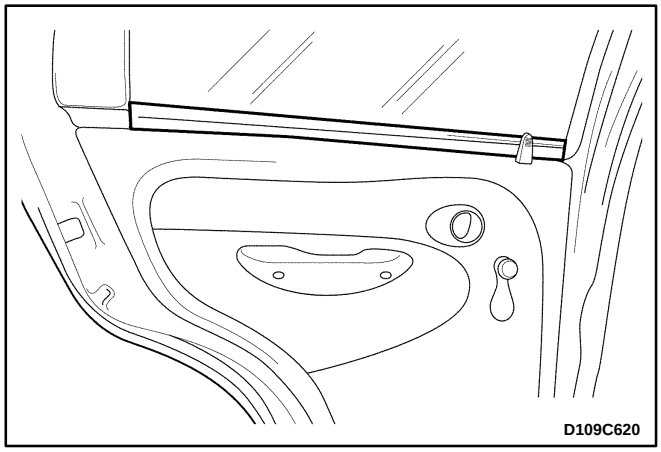


INSIDE CHANNEL WEATHERSTRIP (STANDARD)

Removal Procedure

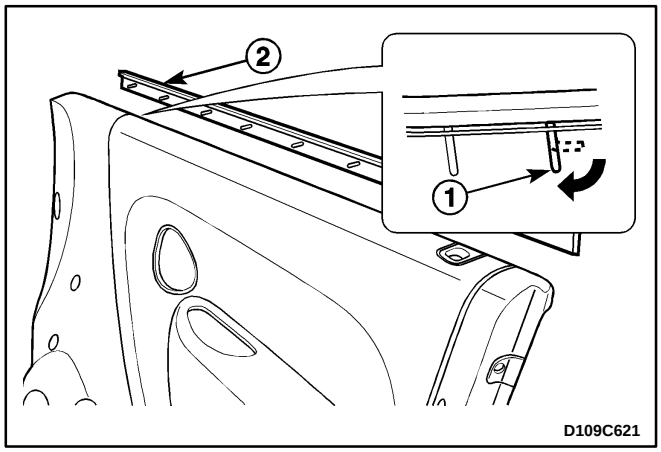
1. Remove the channel weatherstrip.
   a. Weatherstrip.





Installation Procedure

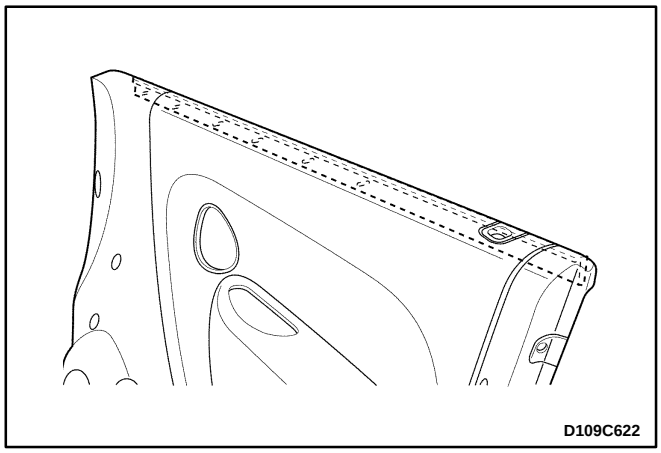
1. Install the channel weatherstrip.



INSIDE CHANNEL WEATHERSTRIP (DELUXE)

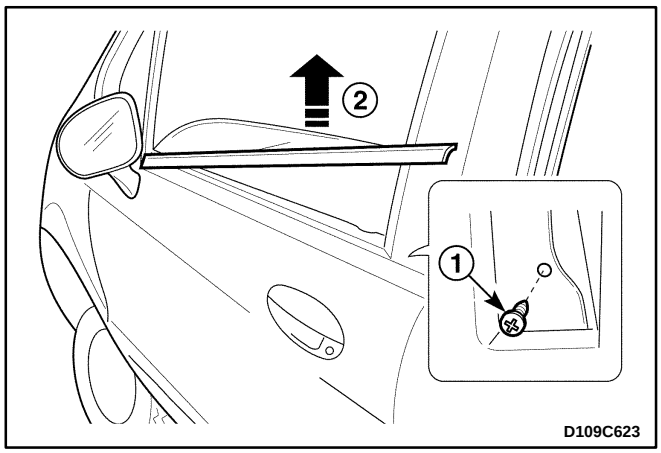
Removal Procedure

1. Remove the door trim. Refer to *Section 9G, Interior Trim.*
2. Remove the channel weatherstrip from the door trim.
   - Straighten the retaining tabs (1).
   - Remove the channel weatherstrip (2).



Installation Procedure

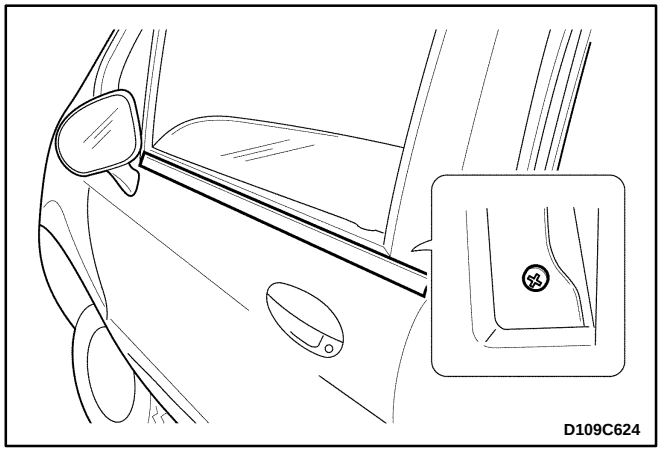
1. Install the channel weatherstrip onto the door trim panel.
2. Bend the retaining tabs to secure the channel weatherstrip to the door trim panel.
3. Install the door trim panel. Refer to *Section 9G, Interior Trim*.



DOOR OUTSIDE CHANNEL WEATHERSTRIP

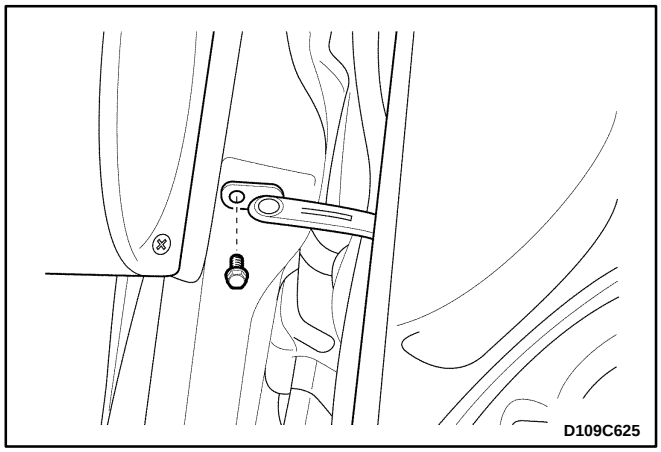
Removal Procedure

1. Remove the channel weatherstrip.
   - Remove the screw (1).
   - Lift off the outside channel weatherstrip (2).



Installation Procedure

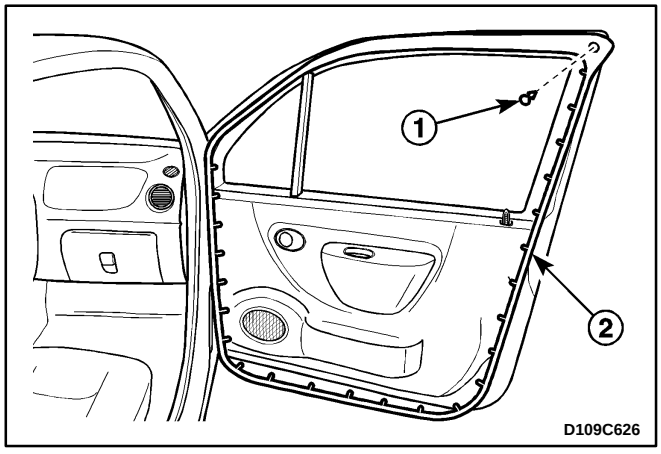
1. Press the outside channel weatherstrip onto the door.
2. Install the weatherstrip screw.



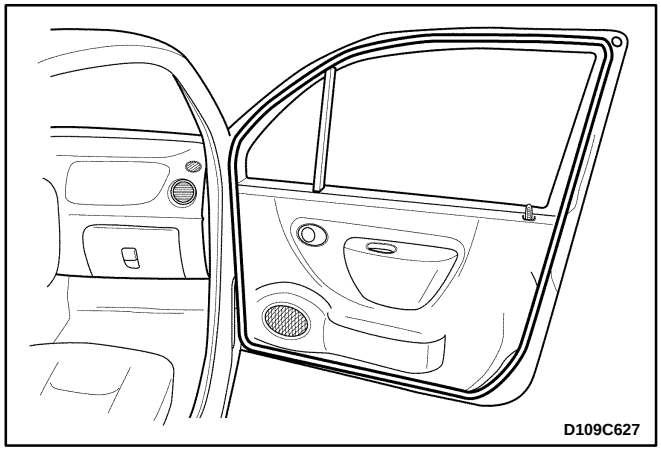
DOOR WEATHERSTRIP

Removal Procedure

1. Remove the door hold open link bolt.

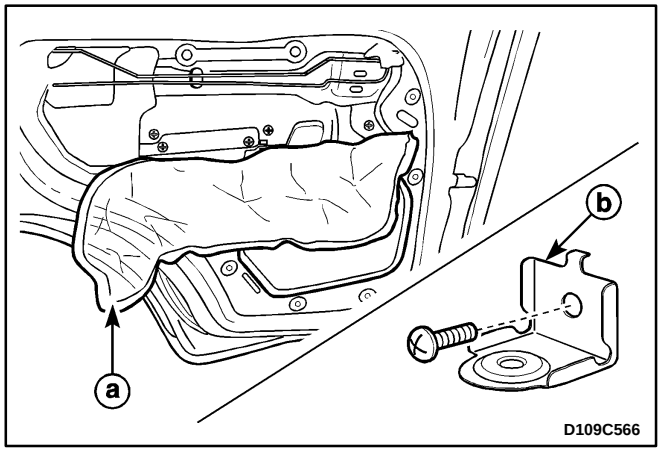


2. Remove the door weatherstrip.
   - Remove the clip (1).
   - Remove the weatherstrip pins (2).



Installation Procedure

1. Install the door weatherstrip with the clip and the pins.
2. Install the door hold open link bolt.

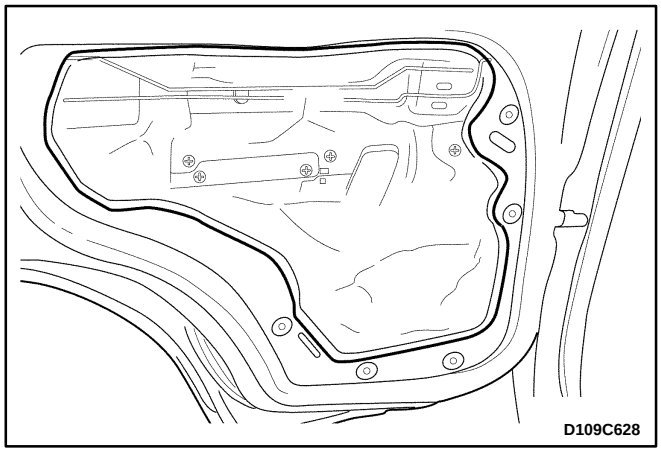


DOOR SEAL TRIM

Removal Procedure

1. Remove the door trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the door seal trim.
   a. Door seal trim.
   b. Door pocket handle bracket.

Important: In case of the deluxe trim, remove the door pocket handle bracket in advance.



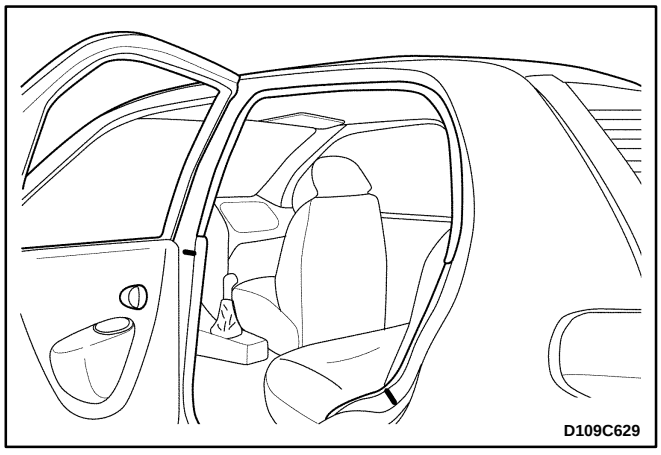
Installation Procedure

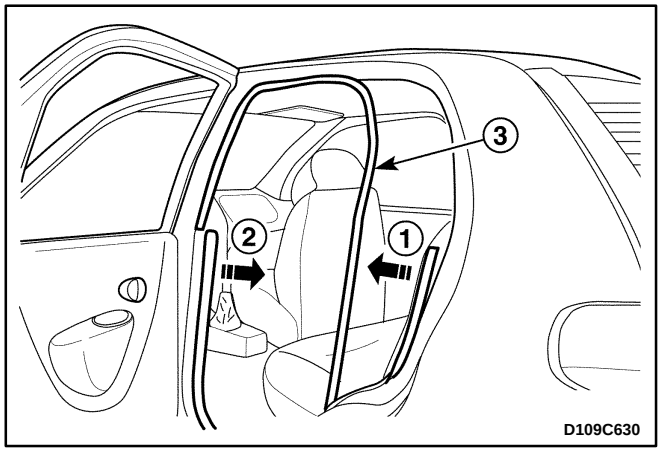
1. Install the door seal trim.
2. Install the door pocket handle bracket for the deluxe trim.
3. Install the door trim panel. Refer to *Section 9G, Interior Trim.*

DOOR OPENING WEATHERSTRIP

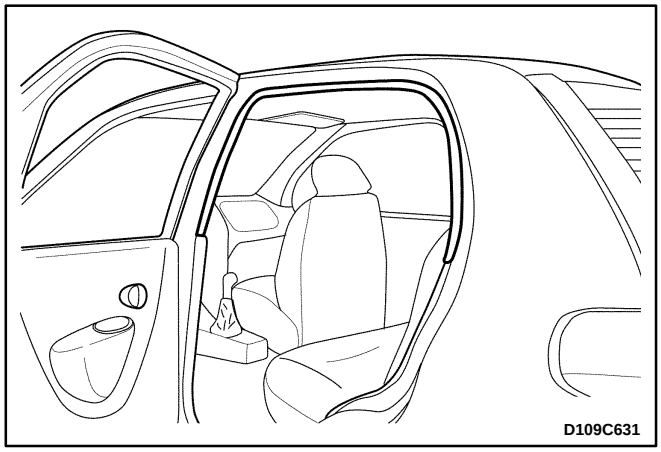
Removal Procedure

1. Mark the door opening weatherstrip edge by a soluble pen.



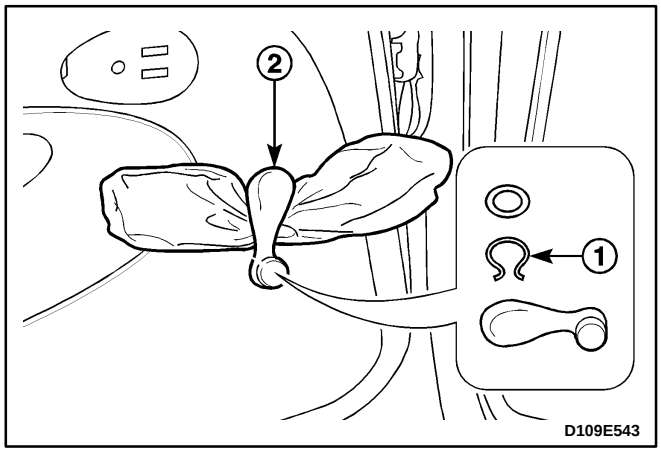


2. Remove the door opening weatherstrip.
   - Take off the rocker trim panel partially (1).
   - Take off the lower B–pillar trim panel partially (2).
   - Remove the door opening weatherstrip (3).



Installation Procedure

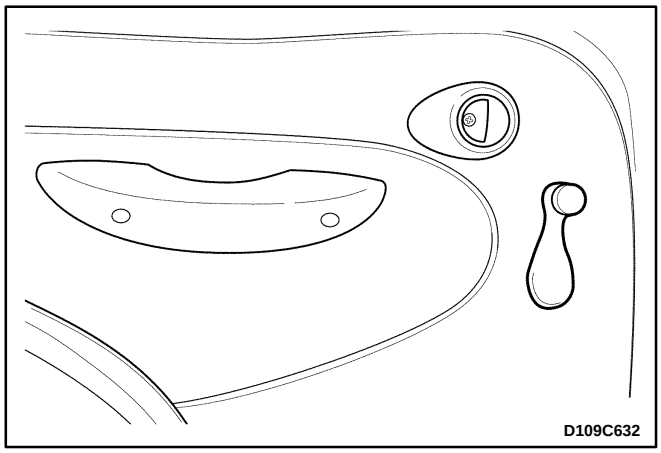
1. Install the door opening weatherstrip to match the marking.
2. Install the rocker panel trim and the lower B–pillar panel trim.



MANUAL WINDOW REGULATOR HANDLE

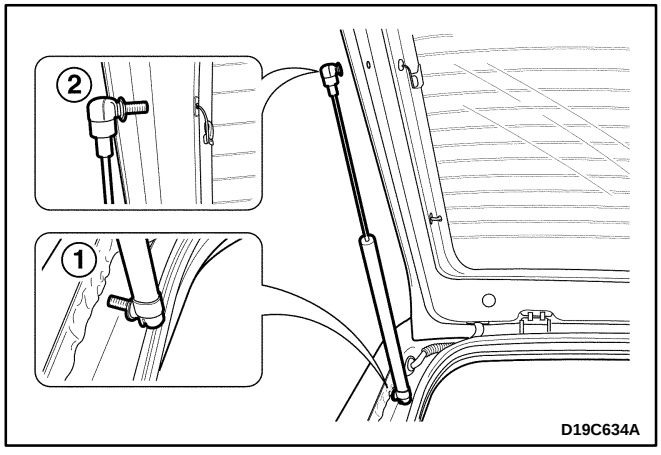
Removal Procedure

1. Remove the window regulator handle.
   - Using a cloth, pull out the clip (1).
   - Remove the window regulator handle (2).



Installation Procedure

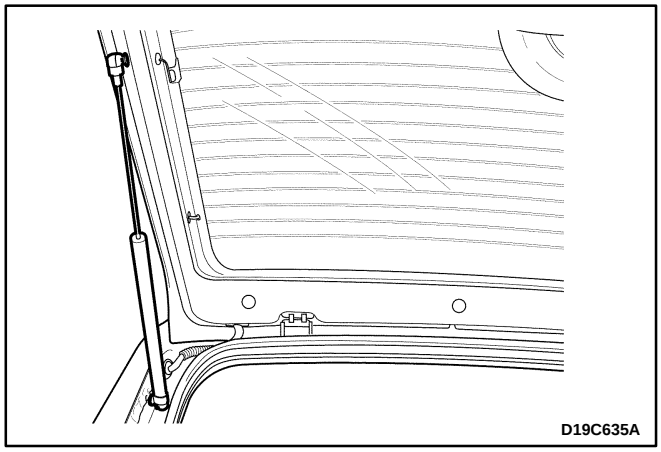
1. Install the window regulator handle with the clip.



TAILGATE STRUT

Removal Procedure

1. Open the tailgate and suitably support it.
2. Remove the tailgate strut assembly.
   - Remove the end fitting nut from the ball studs (rear body) (1).
   - Removethe end fitting nut from the ball studs (tailgate) (2).

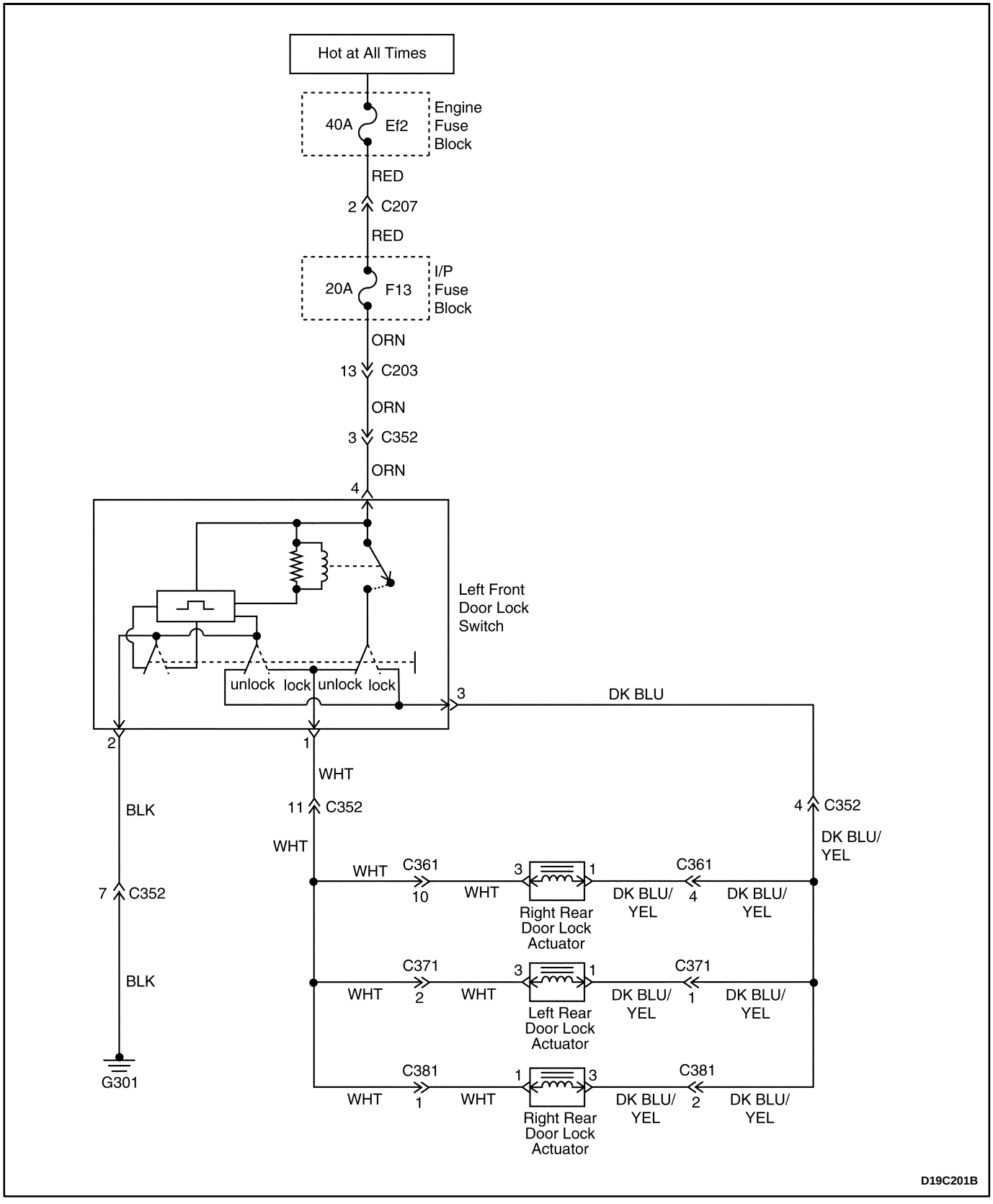


Installation Procedure

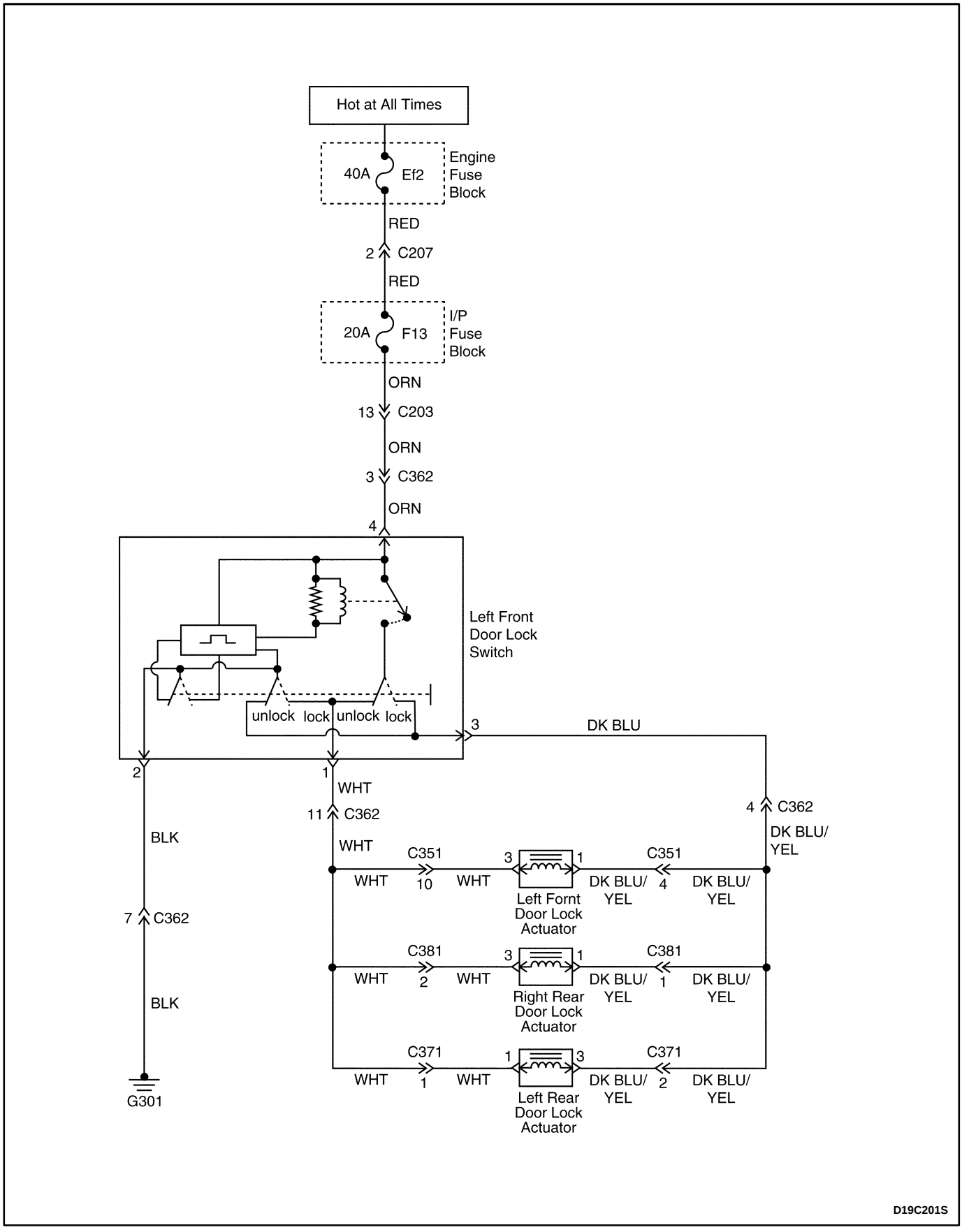
1. Install the tailgate strut with the ball studs.

SCHEMATIC AND ROUTING DIAGRAMS

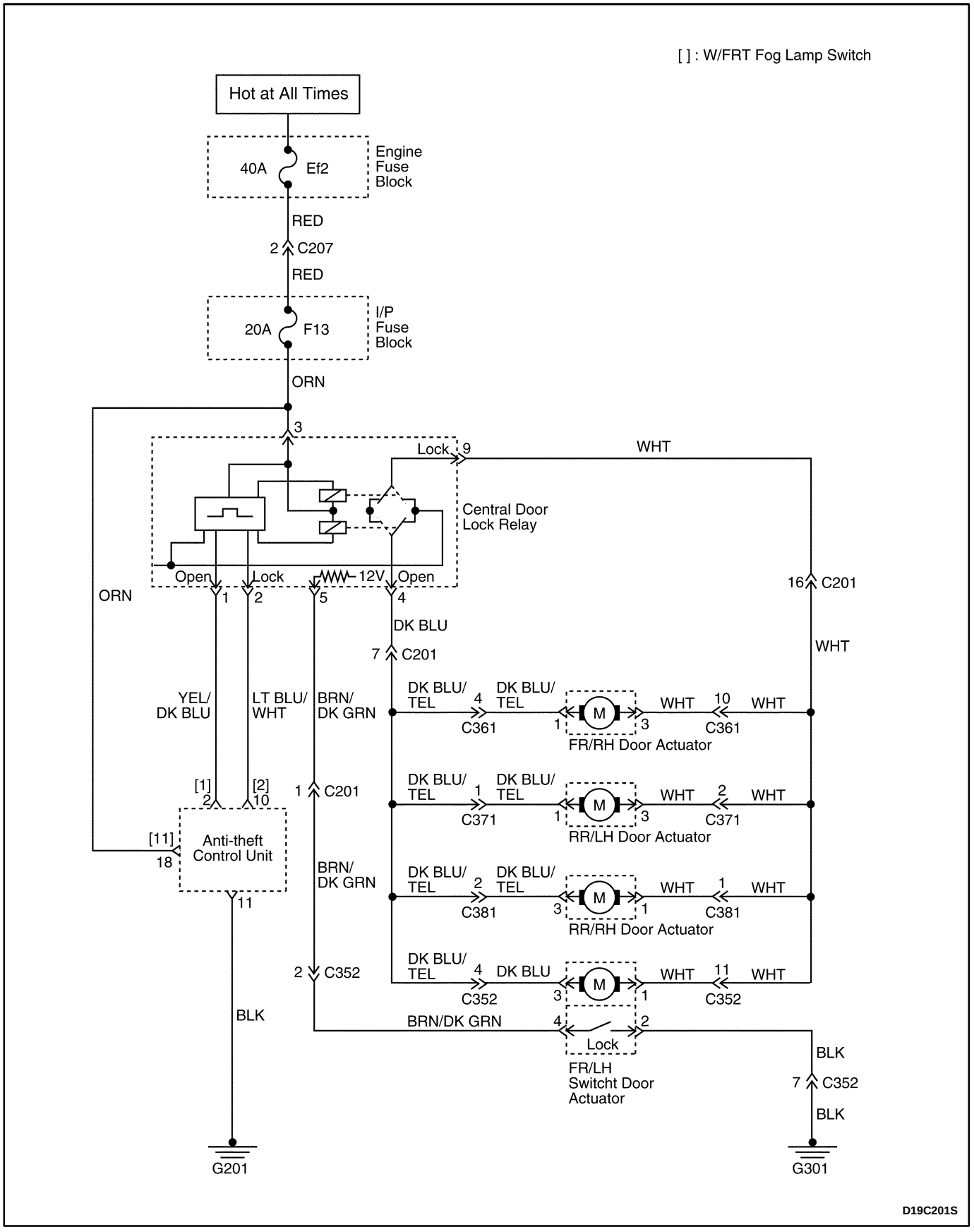
POWER DOOR LOCKS (LEFT–HAND DRIVE)



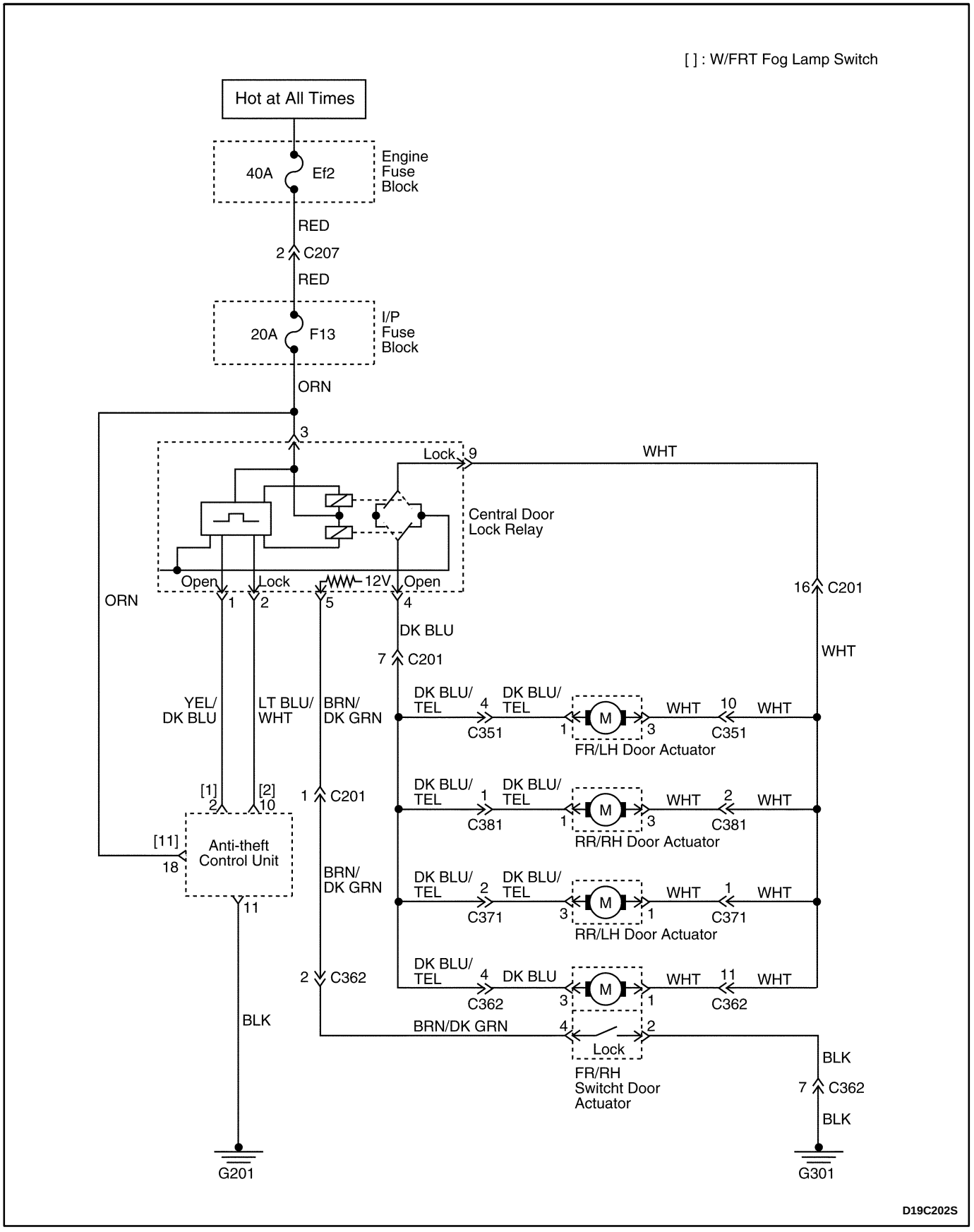
POWER DOOR LOCKS
(RIGHT–HAND DRIVE)



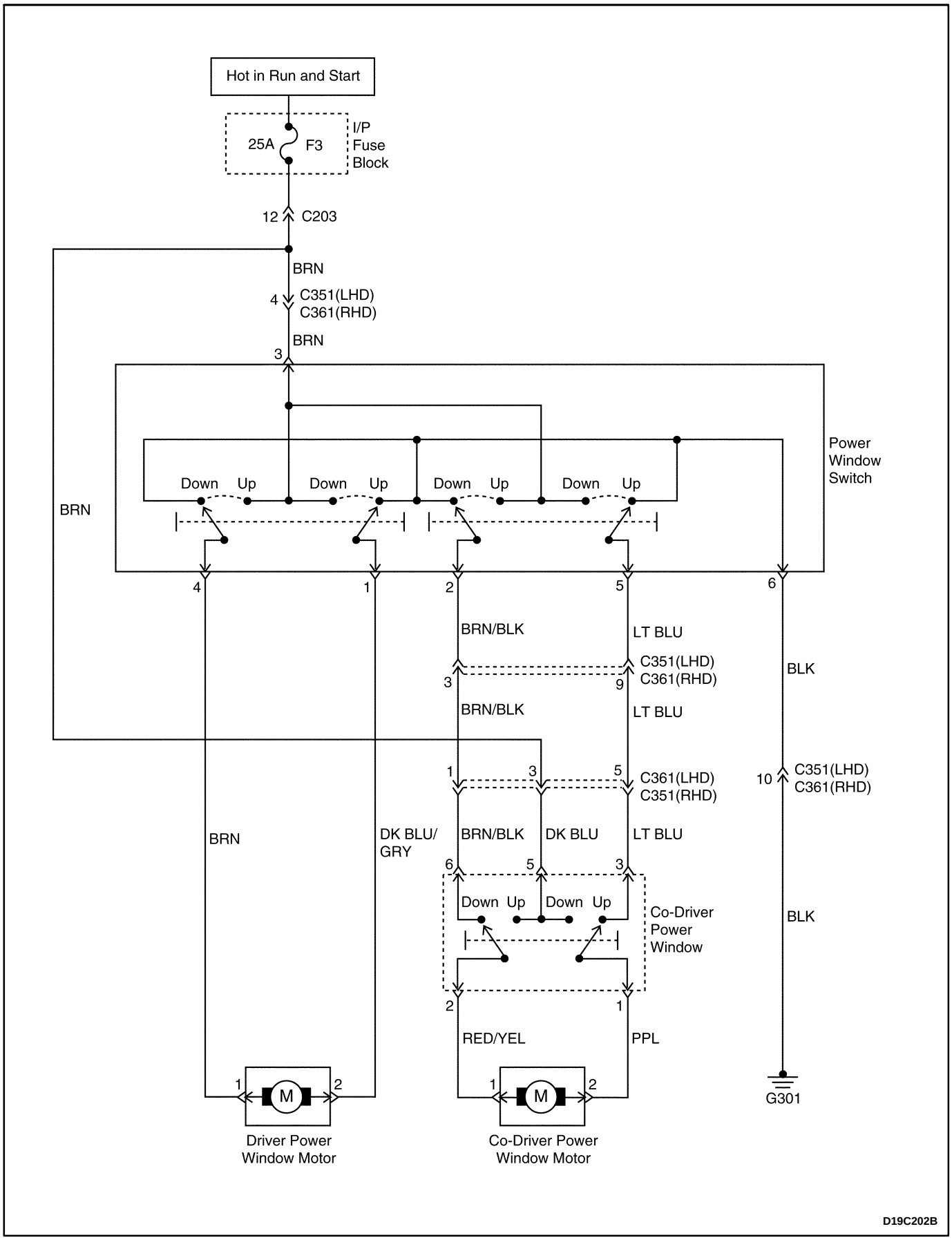
POWER DOOR LOCKS
(W/ ANTI–THEFT CONTROL : LHD)



POWER DOOR LOCKS
(W/ ANTI–THEFT CONTROL : RHD)



POWER WINDOWS (FRONT ONLY)



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SECTION 9Q

ROOF

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Roof 9Q-3
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Passenger Assist Handle and the Coat Hook 9Q-6
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Fastener Tightening Specifications 9Q-8

DESCRIPTION AND OPERATION

ROOF

The roof is a one-piece painted metal unit which incorporates a single, solid headliner and two moldings, one on each side of the vehicle's roof.

The moldings, which enclose and hide the roof rail seams, are serviceable as individual units.

The one-piece formed headliner, common to both the notchback and the hatchback, consists of a molded substrate covered with a foam-backed cloth facing. The one-piece construction requires servicing the headliner as a complete assembly.

MANUAL SUNROOF

The sunroof is

- Intended to provide light and air through the roof of the vehicle during the driving.
- Built into the roof.
- Made of glass.

SUN VISORS

The sun visors swing down or side in order to block out glare. They also swing to the side when they are released from the support.

PASSENGER ASSIST HANDLE

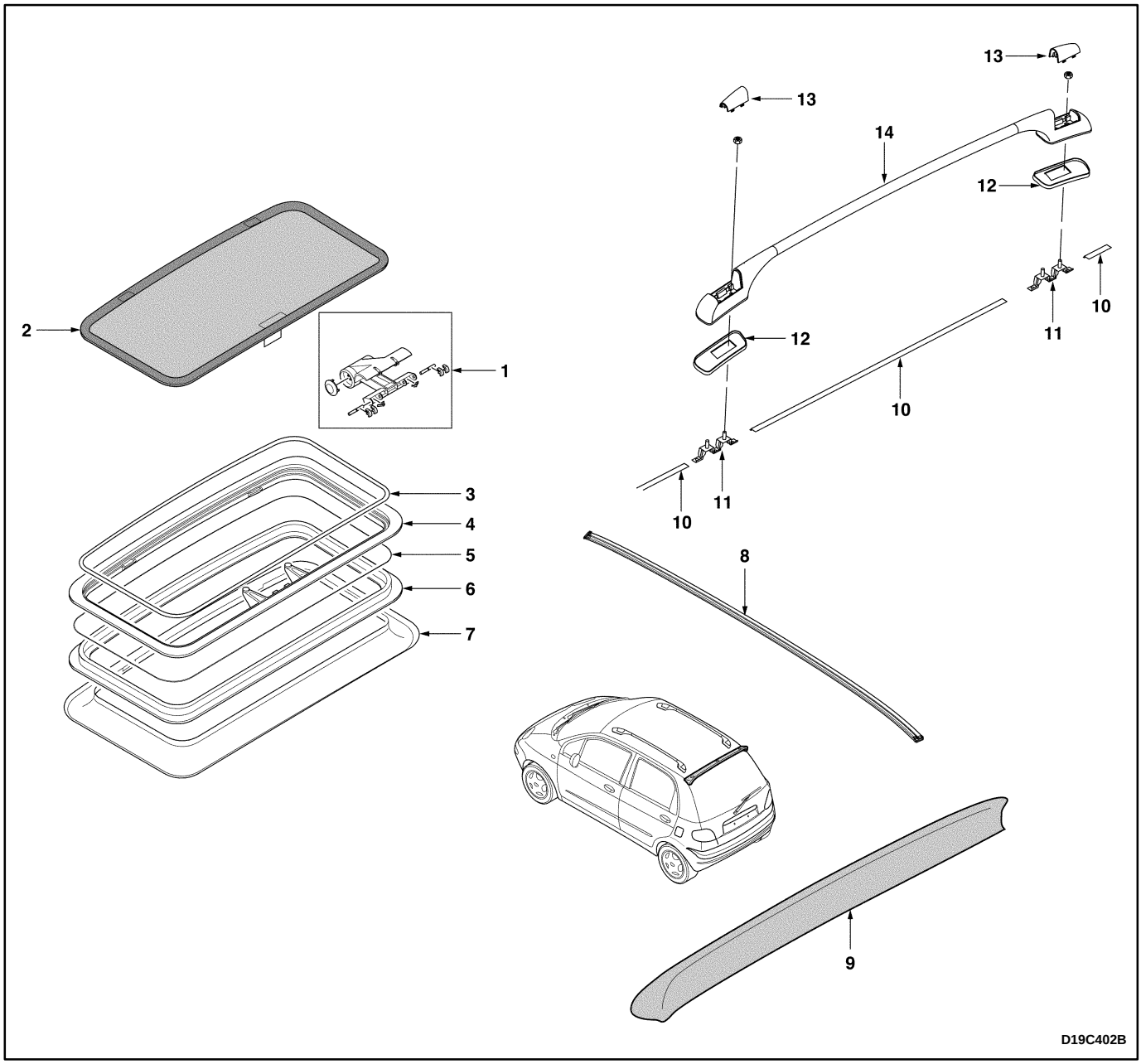
There is a passenger assist handle for the front passenger seat. Passengers can use these handles to assist in keeping their balance over rough roads or during sharp turns.

COAT HOOK

The coat hook is fastened to the headliner above the left-hand rear passenger seat for Left–Hand Drive or right hand rear passenger seat for Right–Hand Drive. This position has a coat hook in the place of a passenger assist handle.

COMPONENT LOCATOR

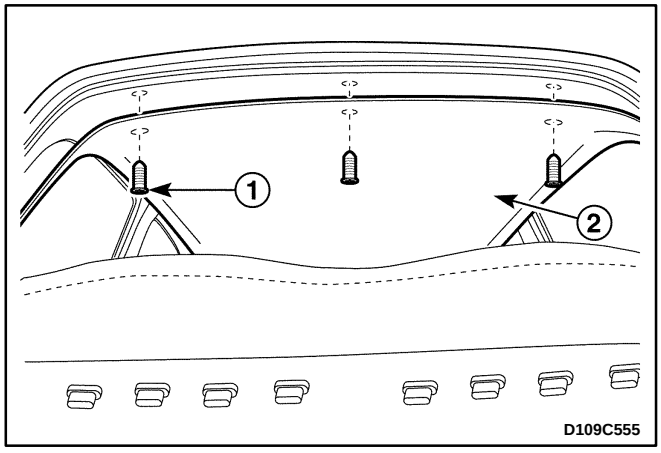
ROOF



1. Sunroof Handle
2. Sunroof Screen
3. Sunroof Screen Seal
4. Sunroof Upper Frame
5. Roof Seal
6. Sunroof Lower Frame
7. Sunroof Cover
8. Roof Rail
9. Rear Spoiler
10. Roof Molding
11. Roof Rack Bracket
12. Roof Rack Pad
13. Cap
14. Roof Rack

REPAIR INSTRUCTIONS

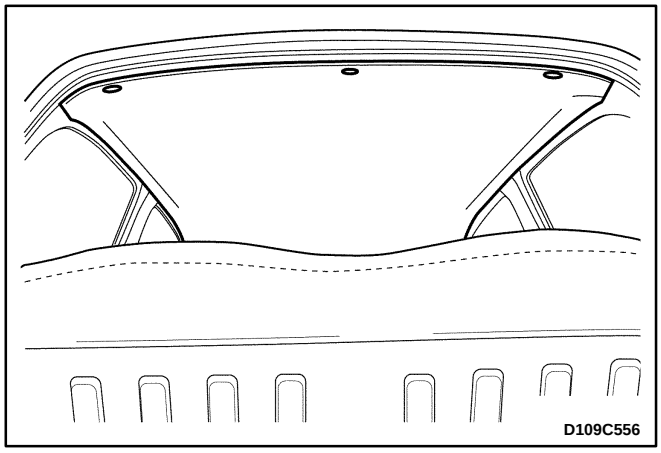
ON–VEHICLE SERVICE



FORMED HEADLINER

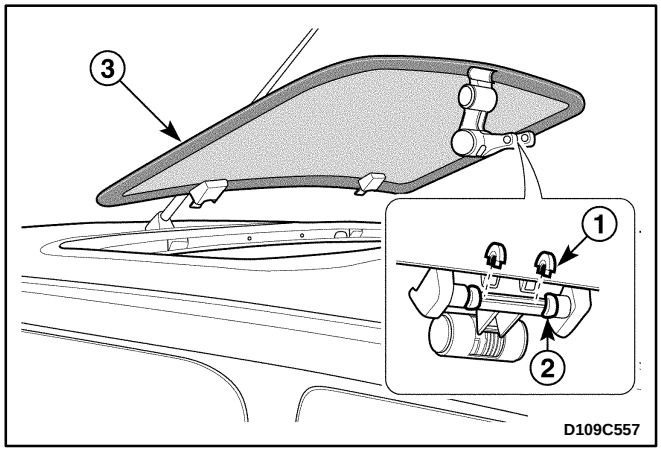
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the sun visors. Refer to “Sun Visors” in this section.
3. Remove the interior courtesy lamp. Refer to *Section 9B, Lighting Systems.*
4. Pry off the A–pillar trim panel. Refer to *Section 9G, Interior Trim.*
5. Pry off the upper B–pillar trim panel. Refer to *Section 9G, Interior Trim.*
6. Pry off the C–pillar trim panel. Refer to *Section 9G, Interior Trim.*
7. Remove the passenger assist handle and the coat hook. Refer to “Passenger Assist Handle and The Coat Hook” in this section.
8. Remove the sunroof molding, if equipped with. Refer to “Manual Sunroof” in this section.
9. Take off the tailgate opening weatherstrip. Refer to *Section 9P, Doors.*
10. Remove the headliner.
    - Remove the clips (1).
    - Remove the headliner (2).



Installation Procedure

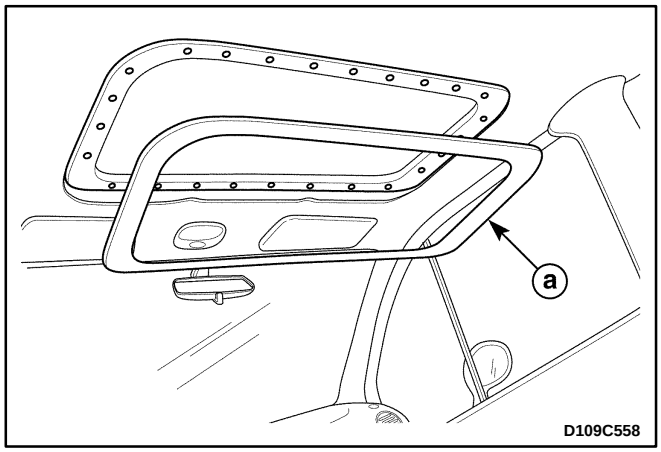
1. Install in the reverse order of removal.



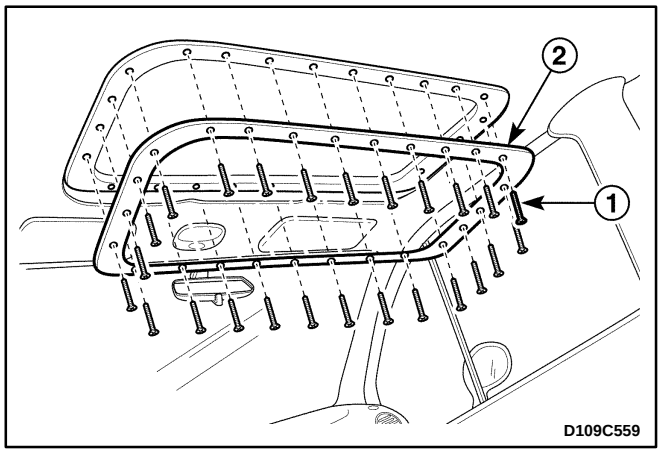
MANUAL SUNROOF

Removal Procedure

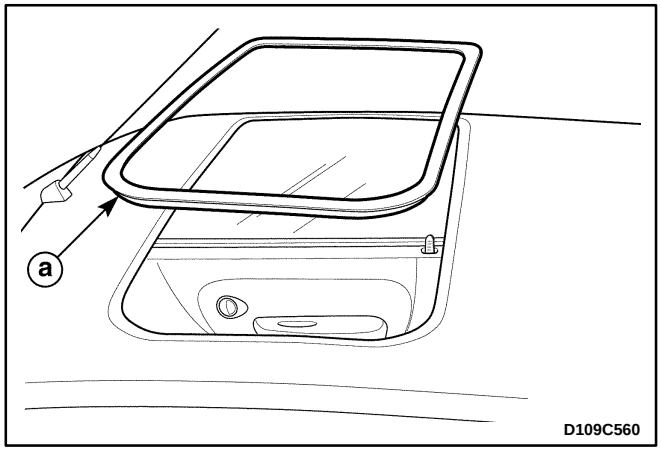
1. Remove the sunroof screen.
   - Remove the clips (1).
   - Remove the lock (2).
   - Remove the screen (3).



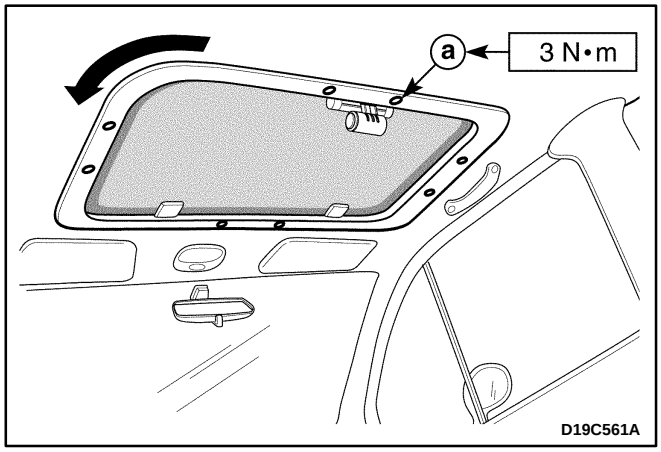
2. Remove the inside sunroof molding in the passenger compartment.
   a. Inside sunroof molding.



3. Remove the lower sunroof frame.
   - Remove the screws (1).
   - Remove the lower sunroof frame (2).



4. Remove the upper sunroof frame.
   a. Upper sunroof frame.



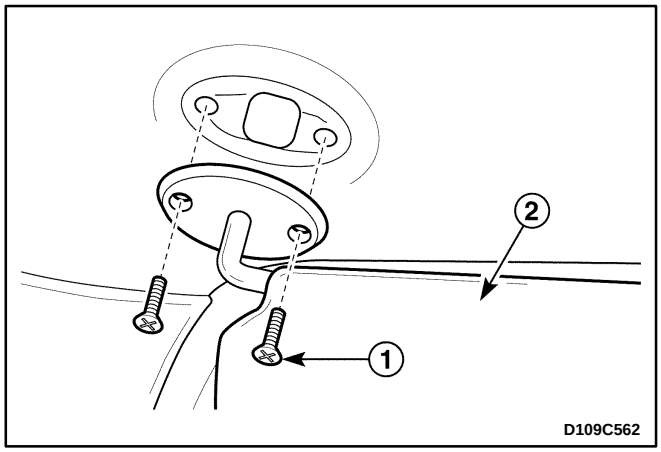
Installation Procedure

1. Install the upper sunroof frame.
2. Install the lower sunroof frame with the screws (a).
3. Install the inside sunroof molding.
4. Install the screen with the clips and the lock.

Tighten

Tighten the screws to 3 N•m (27 lb-in).

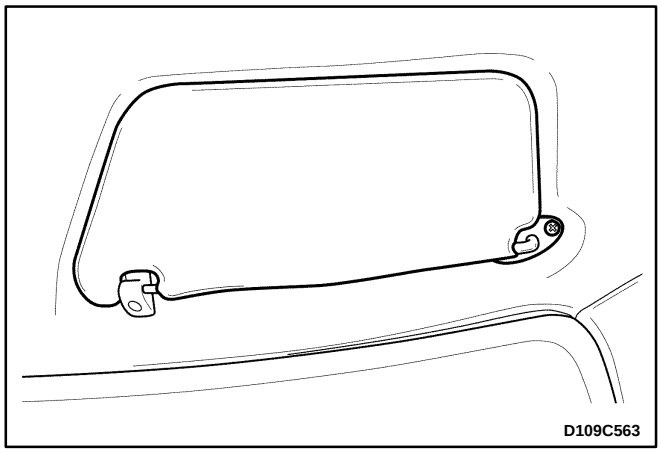
Notice: When installing the lower sunroof frame, make sure to tighten the screws previously as shown the figure and tighten all the screws.



SUN VISORS

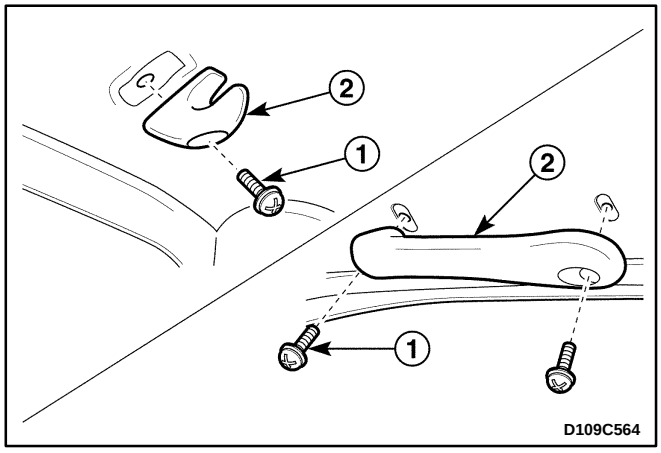
Removal Procedure

1. Remove the sun visors.
   - Remove the screws (1).
   - Remove the sun visors (2).



Installation Procedure

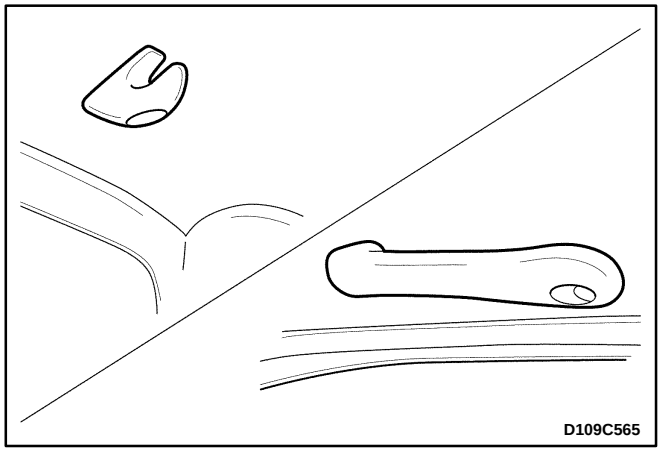
1. Install the sun visors with the screws.



PASSENGER ASSIST HANDLE OR THE COAT HOOK

Removal Procedure

1. Remove the passenger assist handle or the coat hook from the headliner.
   - Remove the screws (1).
   - Remove the coat hook or the assist handle (2).



Installation Procedure

1. Install the passenger assist handle or the coat hook to the headliner with the screws.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Sunroof Frame Screws	3	–	27

SECTION 9R

BODY FRONT END

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Hood Latch 9R-7
Hood Latch Release Lever 9R-8
Hood Latch Release Cable 9R-9
Fender 9R-9

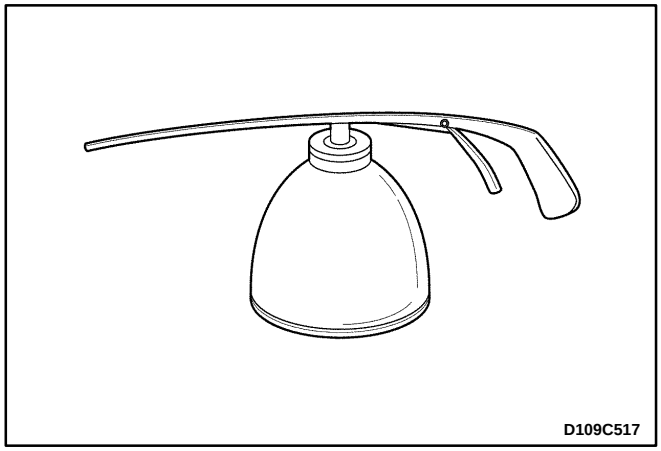
DESCRIPTION AND OPERATION

BODY FRONT END

This vehicle has a unitized body with a frame assembly supporting the engine and the transaxle. The fender panels and the radiator support are also integral parts of the body.

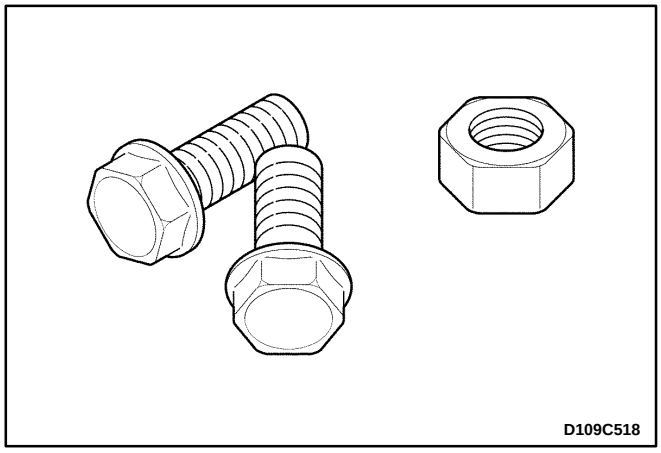
REPAIR INSTRUCTIONS

ON–VEHICLE SERVICE


D109C517

LUBRICATION

The hood hinges and the locking mechanisms require periodic lubrication for proper operation. Refer to *Section 0B, General Information* for the specific types and intervals of lubrication.


D109C518

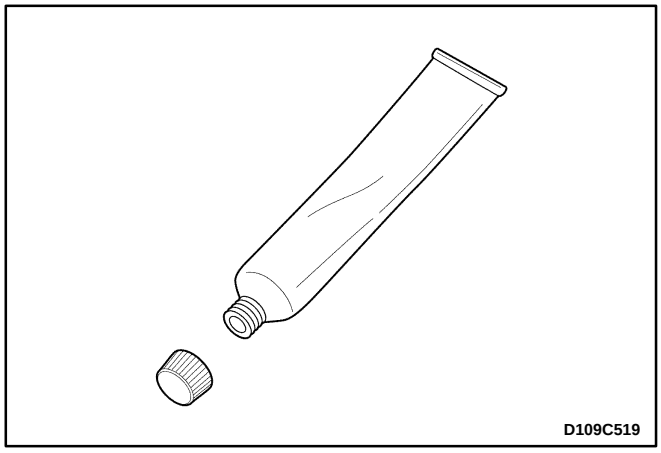
FASTENERS

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

Many aluminum components are used on current models. Aluminum in contact with steel may corrode rapidly if it is not protected by special finishes or isolators.

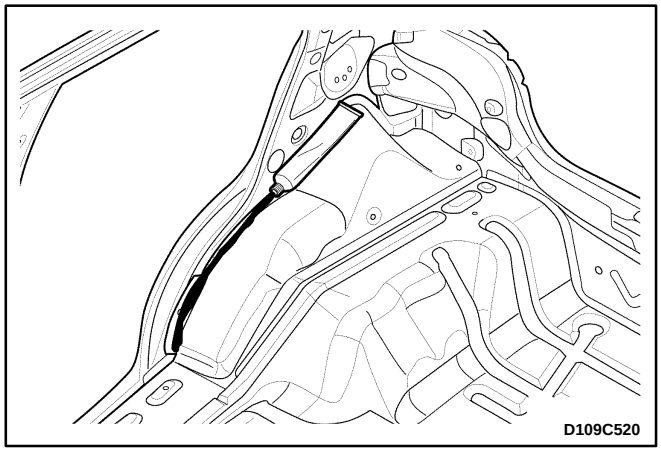
The fasteners used have a special finish which provides adequate protection from corrosion. These special fasteners differ in color in order to easily identify them from the standard metric fasteners, which are medium blue in color.

When replacing fasteners, avoid substituting otherwise similar fasteners in the same location.


D109C519

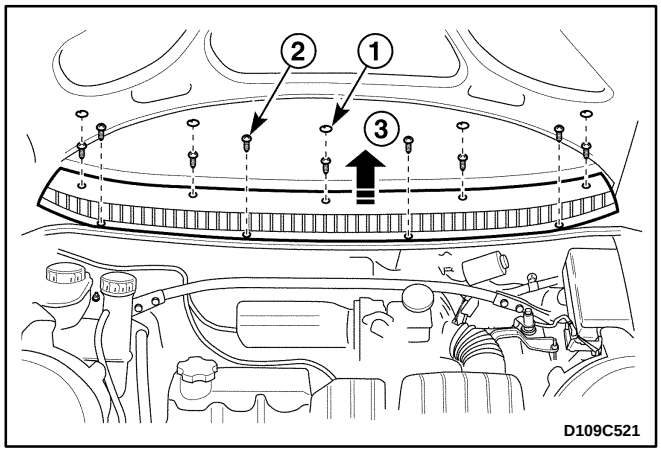
ANTICORROSION MATERIALS

In order to provide rust resistance, anticorrosion materials have been applied to the interior surfaces of most of the metal panels. When you service these panels, properly re-coat them with a service-type anticorrosion material if any of the original material has been disturbed.


D109C520

FRONT END SEALING

All locations where waterleaks may occur are sealed during production with high quality, durable sealers. If it becomes necessary to reseal specific areas, use a high quality sealer of medium-bodied consistency which will retain its flexible characteristics after curing and can be painted if necessary.



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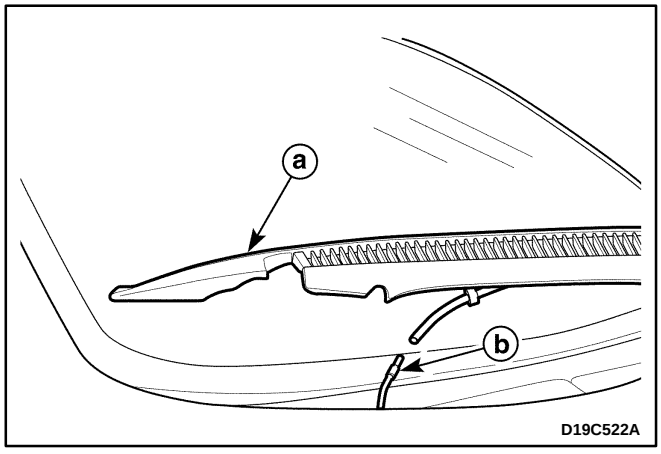
COWL VENT GRILLE

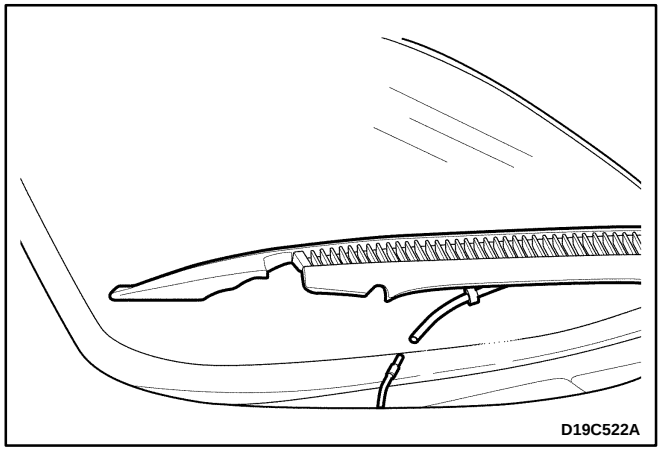
Removal Procedure

1. Remove the wiper arm assembly. Refer to *Section 9D, Wiper/Washer Systems.*
2. Remove the cowl vent grille screws and the clips.
   - Remove the screws after removing the upper cap (1).
   - Remove the lower retaining plastic clips (2).
   - Close the hood.
   - Lift up the cowl vent grille (3).



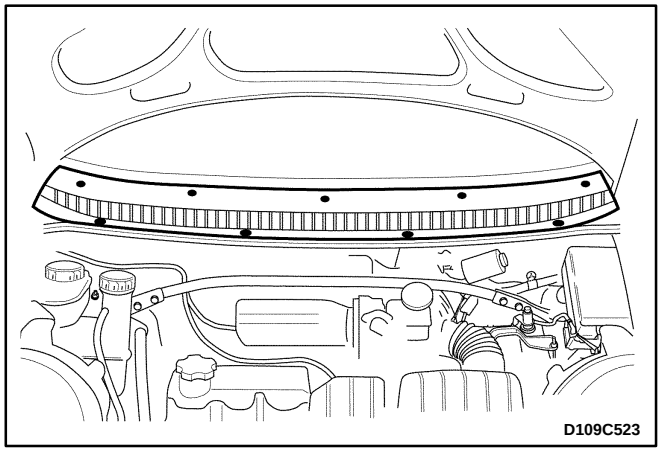
D19C522A

3. Remove the cowl vent grille.
   - Disconnect the front washer hose connector.
   - Remove the cowl vent grille.
     a. Cowl vent grille.
     b. Front washer hose connector.

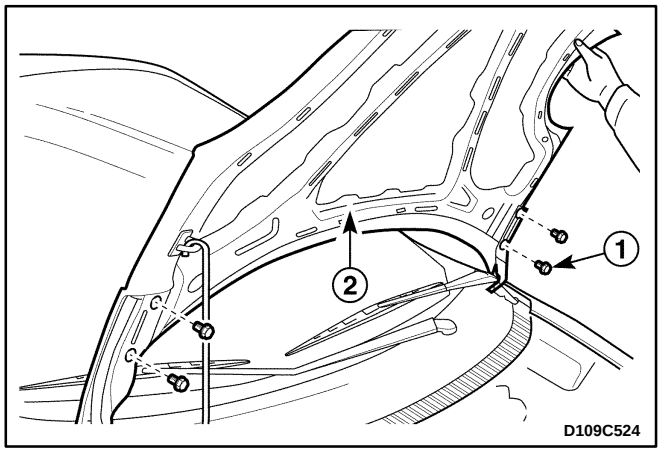

D19C522A

Installation Procedure

1. Connect the front washer hose connector.



2. Install the cowl vent grille with the screws and the clips.
3. Install the wiper arm assembly. Refer to *Section 9D, Wiper/Washer Systems.*

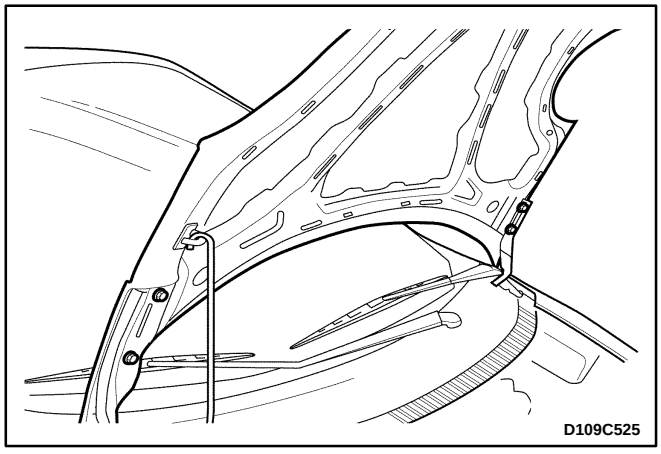


HOOD

Removal Procedure

Important: Install the protective coverings over the fenders and the windshield in order to prevent damage to the paint, the glass and the moldings when you are removing and installing the hood.

1. Raise and support the hood.
2. Remove the hood.
   - Remove the bolts (1).
   - Remove the hood (2).



Installation Procedure

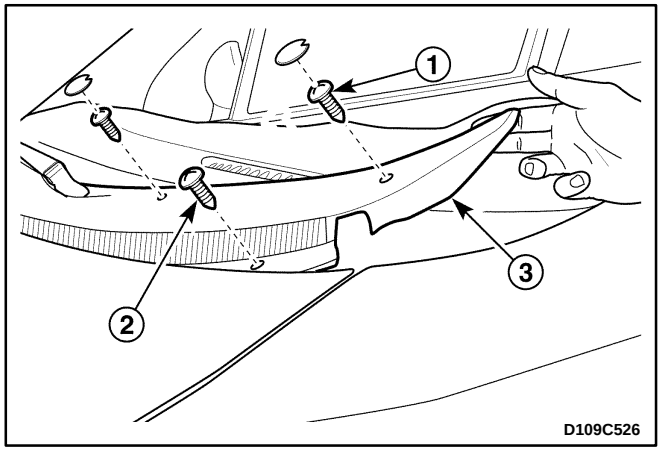
Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

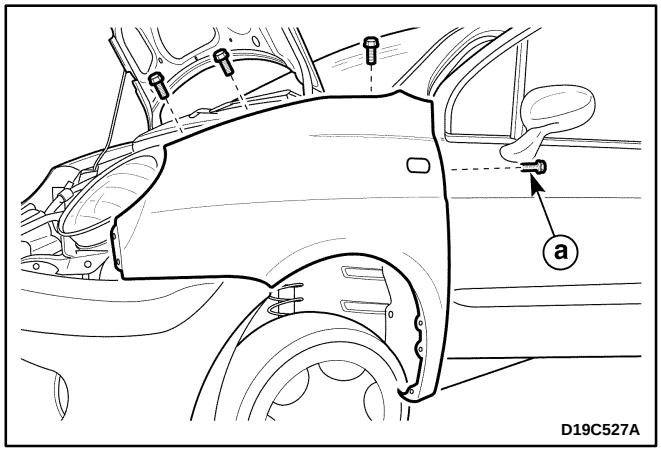
1. Install the hood with the bolts.
2. Inspect the hood for proper alignment.

HOOD HINGE

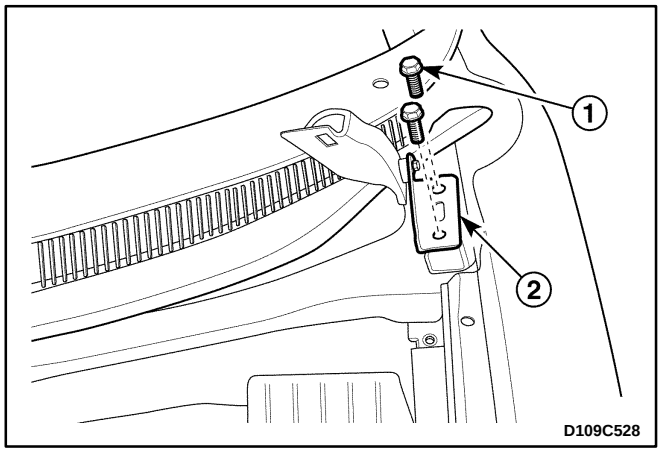
Removal Procedure

1. Remove the hood. Refer to “Hood” in this section.
2. Take off the cowl vent grille.
   - Remove the screws after removing the upper caps (1).
   - Remove the retaining screw on the cowl vent grille (2).
   - Take off the cowl vent grill (3).

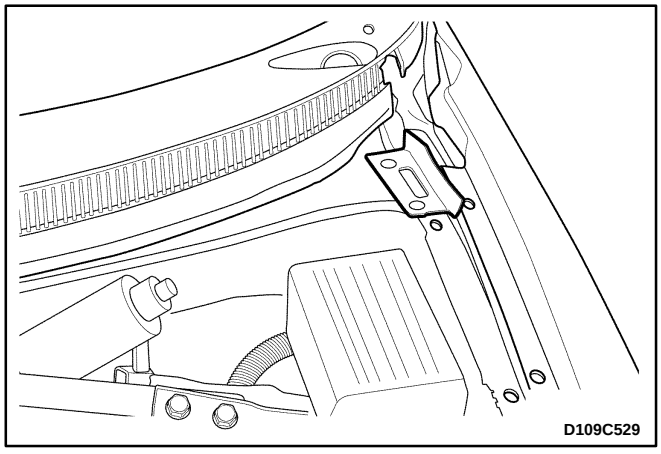




3. Remove the bolts on the top of the fender.
   a. Fender upper mounting bolt.



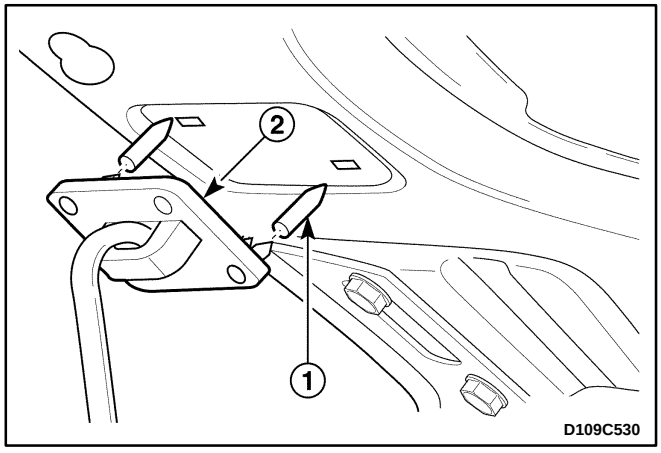
4. Remove the hood hinge.
   - Remove the bolts (1).
   - Remove the hood hinge (2).



Installation Procedure

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

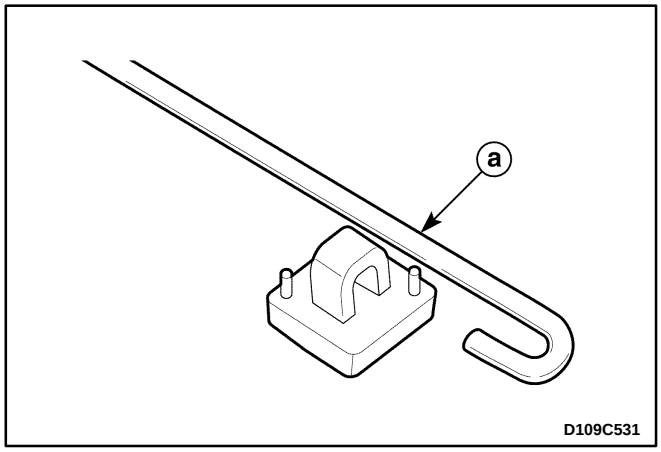
1. Install the hood hinge with the bolts.
2. Install the bolts along the top of the fender.
3. Install the cowl vent grille with the screws and the caps.
4. Install the hood. Refer to “Hood” in this section.



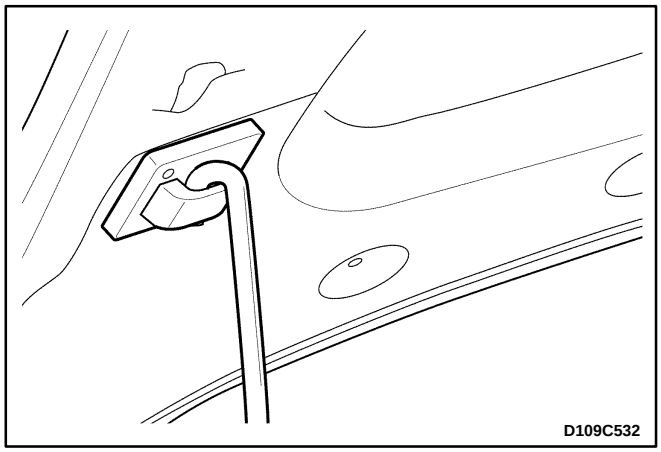
HOOD PROP ROD

Removal Procedure

1. Support the hood in the open position.
2. Remove the hood prop from the hood.
   - Using a sharp gimlet, press the pins (1).
   - Remove the hood prop (2).



3. Remove the hood prop rod from the hood prop.
   a. Hood prop rod.



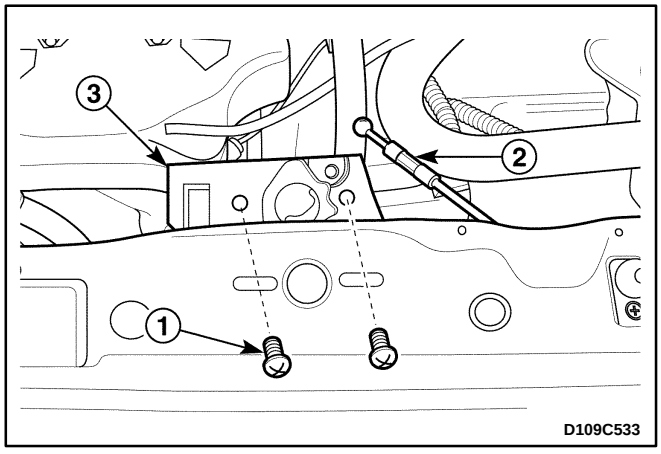
Installation Procedure

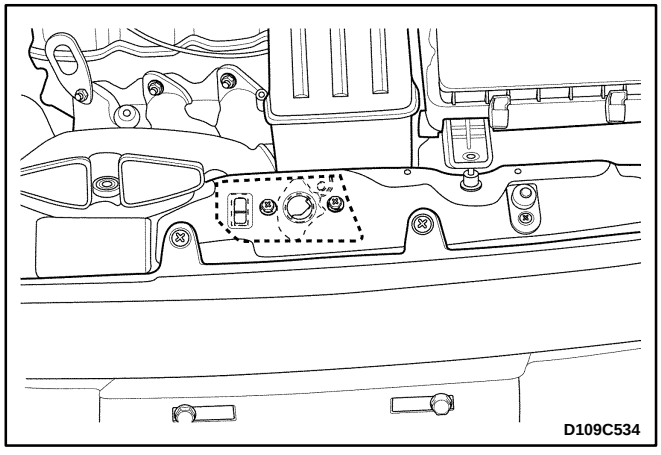
1. Install the hood prop rod to the hood prop.
2. Install the hood prop to the hood with the pins.

HOOD LATCH

Removal Procedure

1. Open the hood.
2. Remove the hood latch.
   - Remove the screws (1).
   - Disconnect the hood latch release cable (2).
   - Remove the hood latch (3).



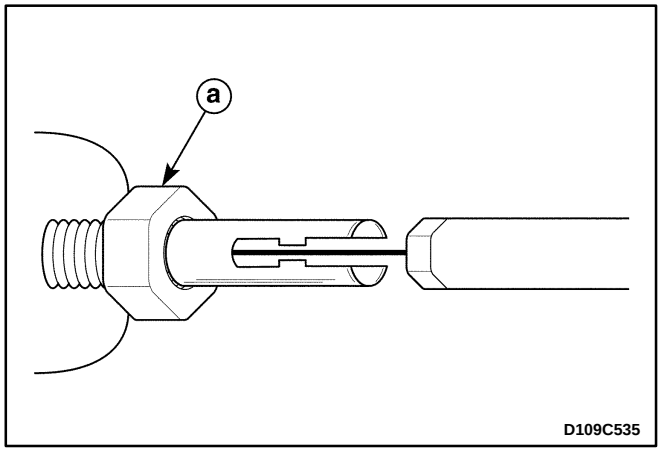


Installation Procedure

1. Connect the hood latch release cable to the latch.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

2. Install the hood latch with the screws.

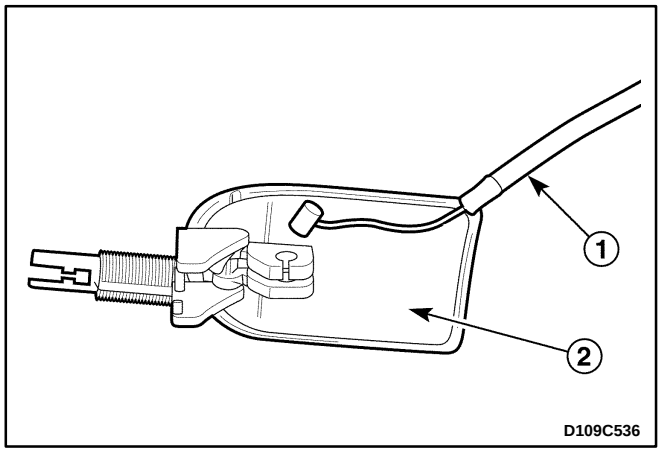


HOOD LATCH RELEASE LEVER

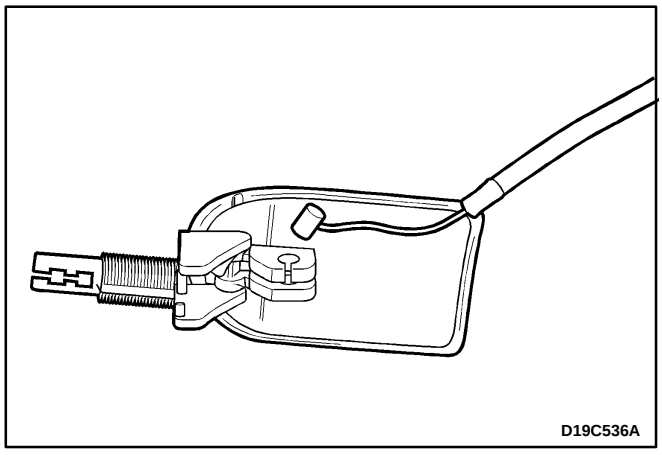
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

1. Remove the hood latch nut into the instrument panel.
   a. Hood latch nut.

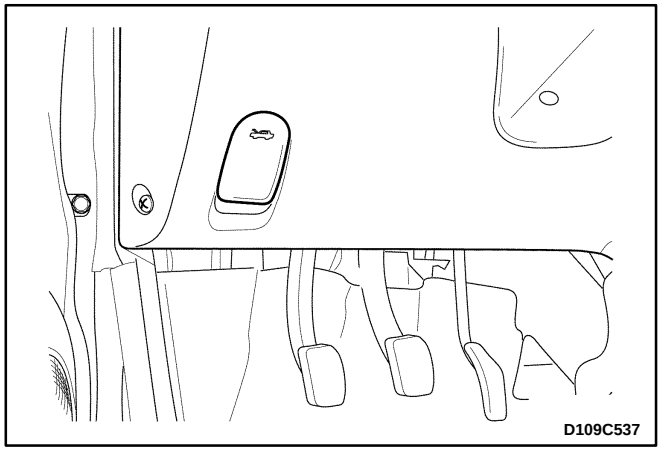


2. Remove the hood latch release lever.
   - Disconnect the cable (1).
   - Remove the hood latch release lever (2).



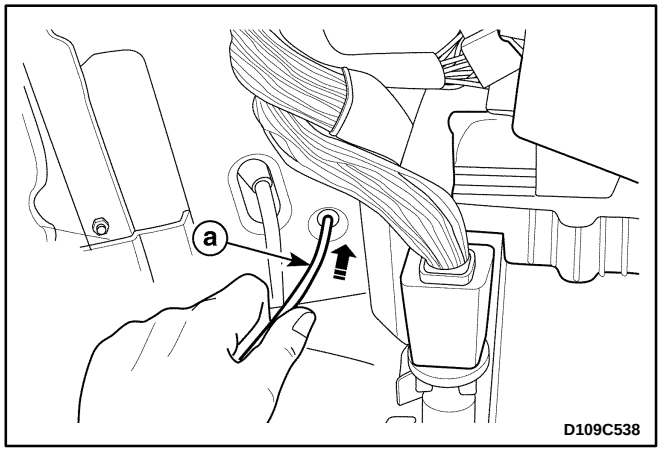
Installation Procedure

1. Connect the hood latch release cable to the hood latch lever.



Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

2. Install the hood latch lever release to the instrument panel with the hood latch nut.

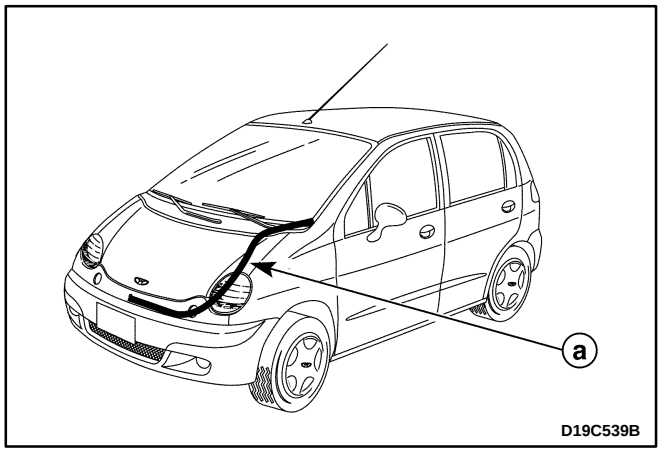


HOOD LATCH RELEASE CABLE

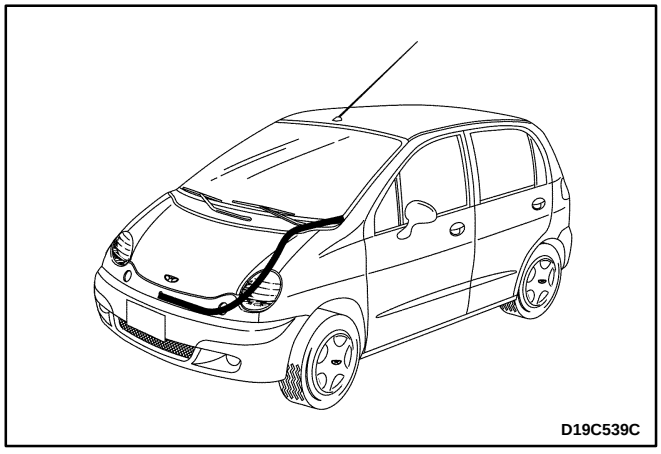
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

1. Remove the hood latch release cable from the instrument panel. Refer to “Hood Latch Release Lever” in this section.
2. Push the cable toward the engine compartment through the body hole.
   a. Hood latch lever cable.

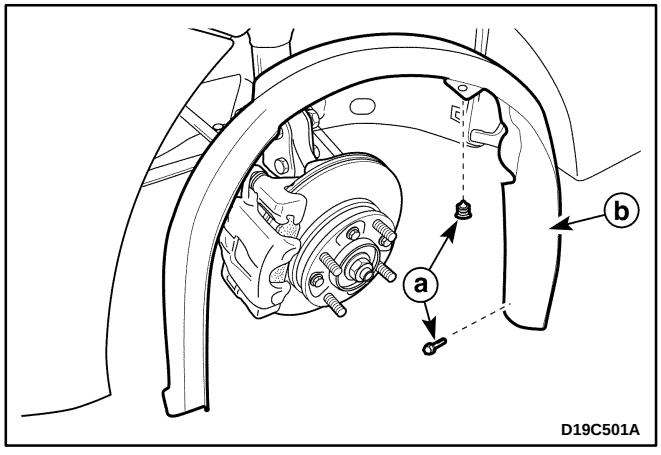


3. Open and suitably support the hood.
4. Disconnect the hood latch release cable from the hood latch. Refer to “Hood Latch” in this section.
5. Remove the hood latch release cable after removing the plastic strip.
   a. Hood latch release cable.



Installation Procedure

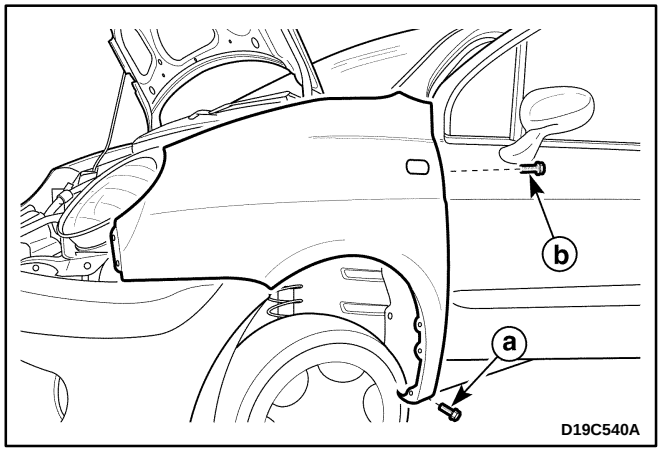
1. Connect the hood latch release cable to the hood latch. Refer to “Hood Latch” in this section.
2. Arrange the hood latch release cable with the plastic strip.
3. Push the cable toward the passenger compartment through the body hole.
4. Connect the hood latch release cable to the hood latch release lever. Refer to “Hood Latch Release Lever” in this section.



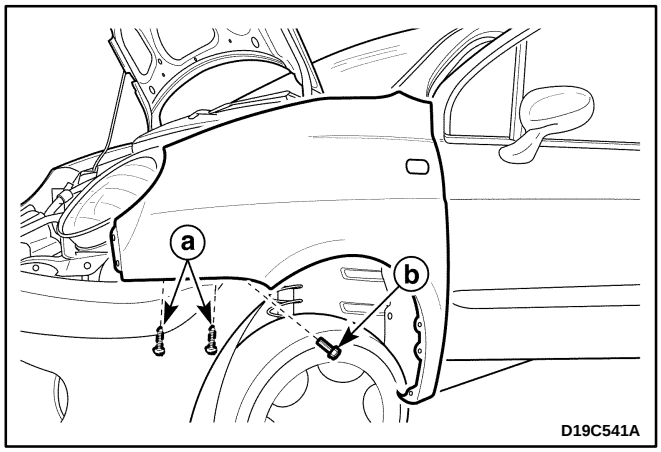
FENDER

Removal Procedure

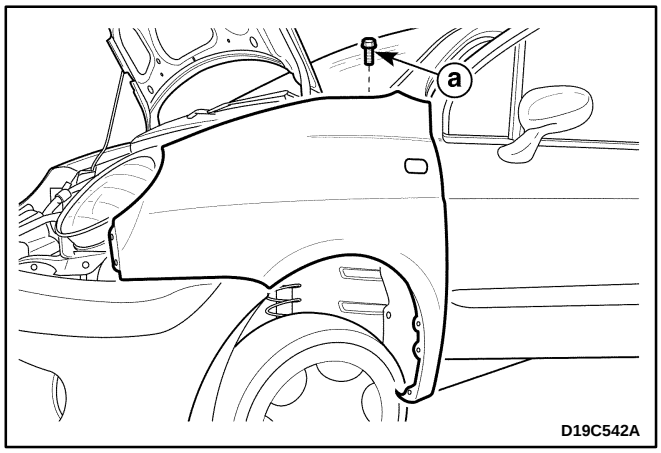
1. Raise and suitably support the vehicle.
2. Remove the wheelhouse splash shield.
   - Remove the clip and the bolt.
     a. Clip and bolt.
   - Remove the wheel house splash shield.
     a. Wheel house splash shield.



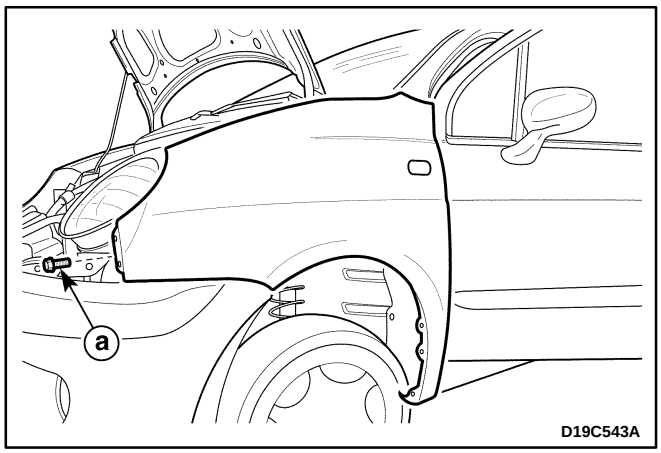
3. Remove the bolt at the base of the fender.
   a. Fender mounting lower bolt.
4. Open the front door. Remove the bolt on the A–pillar.
   b. Fender mounting bolt.



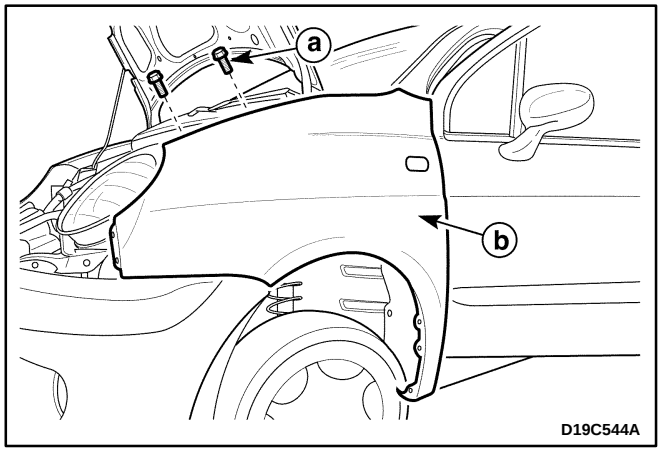
5. Remove the screws on the side of the front bumper fascia.
   a. Bumper fascia side bolts.
6. Remove the bolt under the fender.
   b. Fender mounting bolt.



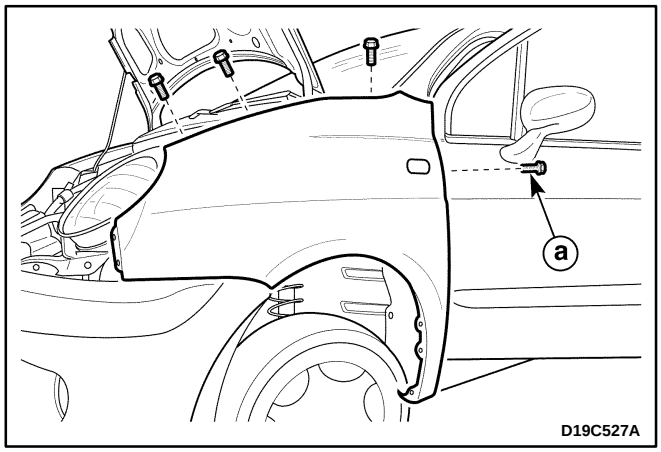
7. Lower the vehicle.
8. Take off the cowl vent grille. Remove the bolt on the top of the fender.
   a. Fender mounting bolt.



9. Remove the front bumper spacer. Refer to *Section 9M, Exterior Trim.*
10. Remove the fender front bolt.
    a. Fender front bolt.



11. Remove the bolts along the top of the fender.
    a. Bolt.
12. Remove the fender.
    b. Fender.

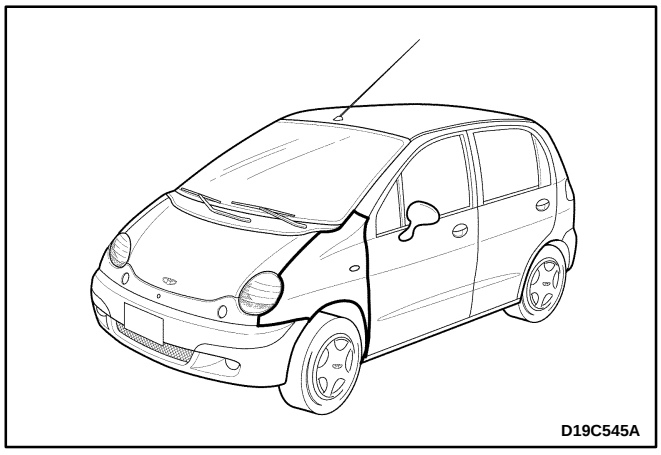


Installation Procedure

1. Install the fender.

Notice: Dissimilar metals in direct contact with each other may corrode rapidly. Make sure to use the correct fasteners to prevent premature corrosion.

2. Install the bolts along the top of the fender.



3. Install the front bumper spacer.
4. Install the cowl vent grille.
5. Raise and suitably support the vehicle.
6. Install the bolts under the fender.
7. Install the screws on the side of the front bumper fascia.
8. Open the front door Install the bolt on the A–pillar.
9. Install the bolt at the base of the fender.
10. Install the wheelhouse splash shield with the screws.
11. Lower the vehicle.

SECTION 9S

BODY REAR END

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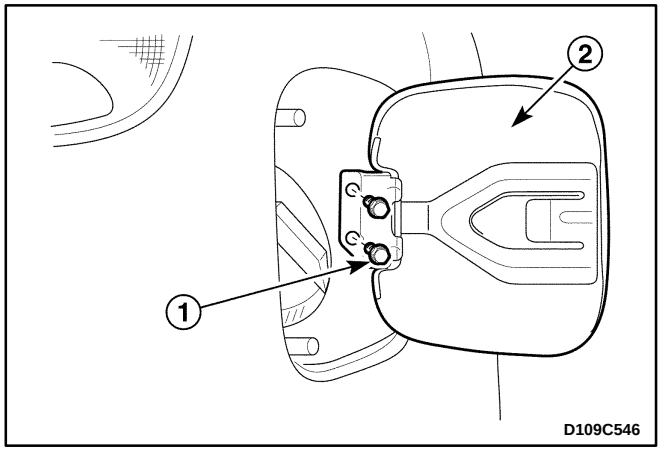
DESCRIPTION AND OPERATION

FUEL FILLER DOOR

The fuel filler door attaches to the fuel tank pocket on the right side of the vehicle.

REPAIR INSTRUCTIONS

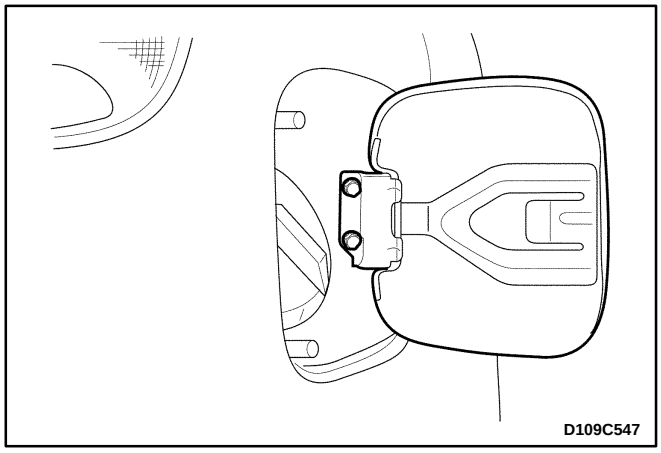
ON–VEHICLE SERVICE



FUEL FILLER DOOR

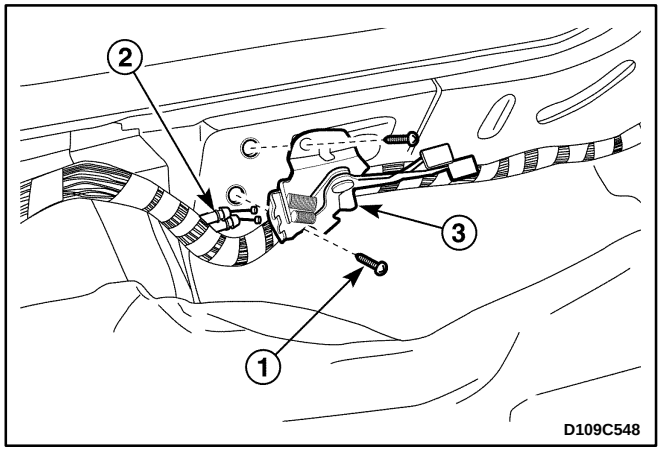
Removal Procedure

1. Pull the fuel filler door opening lever and open the fuel filler door.
2. Remove the fuel filler door.
   - Remove the bolts (1).
   - Remove the fuel filler door (2).



Installation Procedure

1. Install the fuel filler door with the bolts.

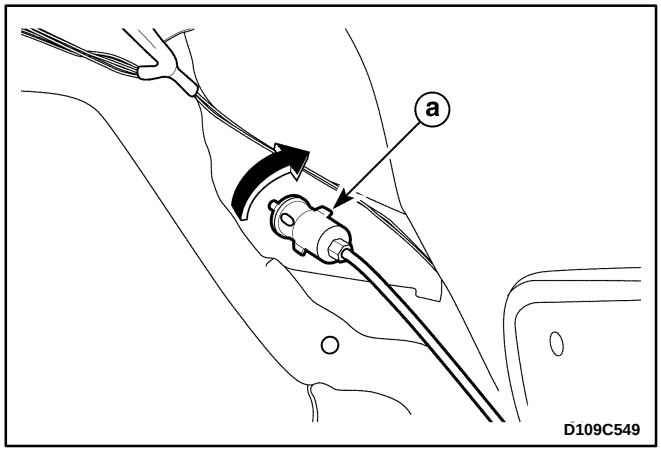


FUEL FILLER DOOR REMOTE CABLE AND HANDLE

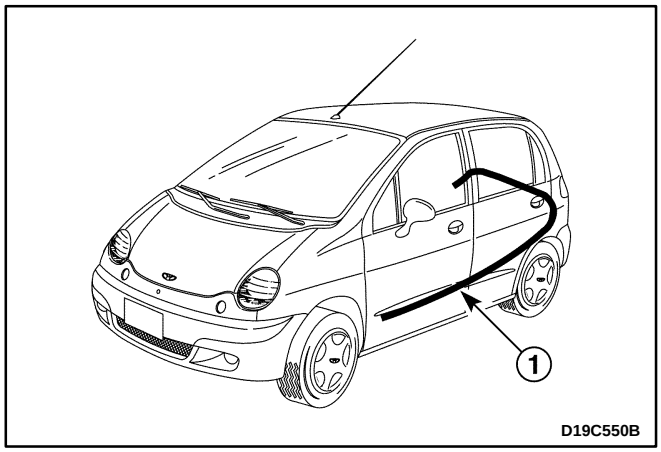
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

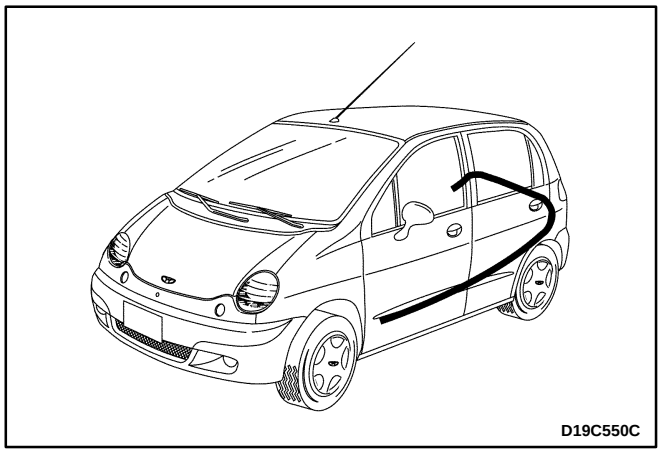
1. Pry off the front rocker trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the fuel filler door remote handle.
   - Remove the screws (1).
   - Disconnect the cable (2).
   - Remove the fuel filler door remote handle (3).



3. Pry off the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim.*
4. Pry off the rear rocker trim panel. Refer to *Section to 9G, Interior Trim.*
5. Pry off the luggage compartment wheelhouse trim panel. Refer to *Section to 9G, Interior Trim.*
6. Remove the lock striker of the fuel filler.
   - Remove the lock striker by turning it rectangularly.
     a. Lock striker

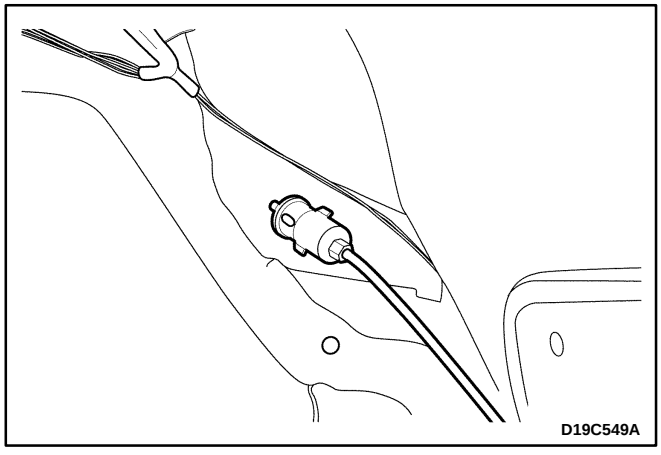


7. Remove the fuel filler door remote cable.
   - Remove the cable retaining strip.
   - Disconnect the fuel filler door remote cable (1).

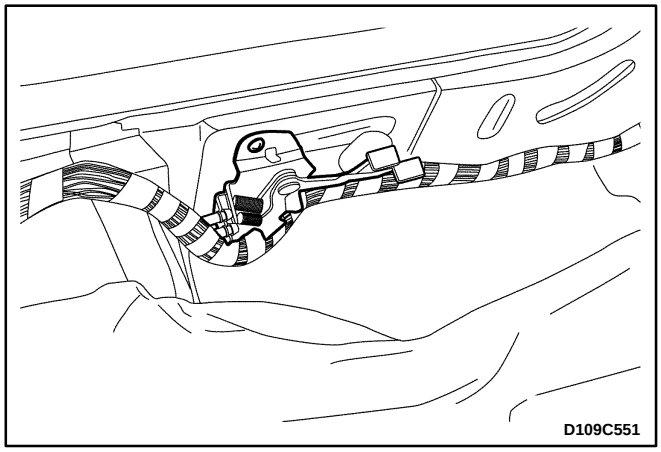


Installation Procedure

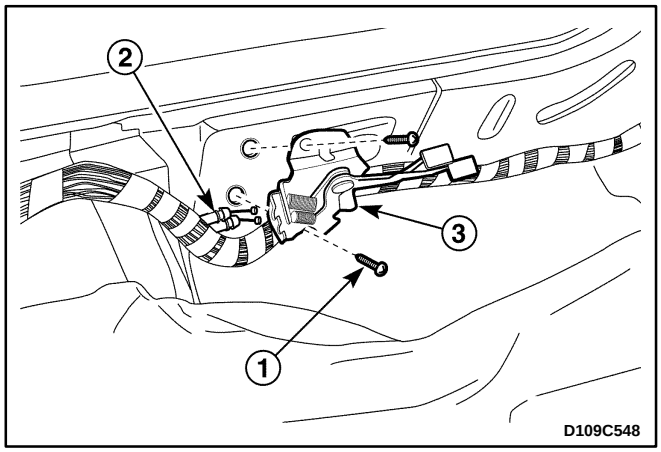
1. Connect the fuel filler door remote cable to the fuel filler door.
2. Retain the cable with the strip.



3. Install the lock striker of the fuel filler.
4. Install the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
5. Install the rear rocker trim panel. Refer to *Section 9G, Interior Trim.*
6. Install the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim.*



7. Connect the fuel filler door remote cable to the handle.
8. Install the fuel filler door remote handle with the screws.

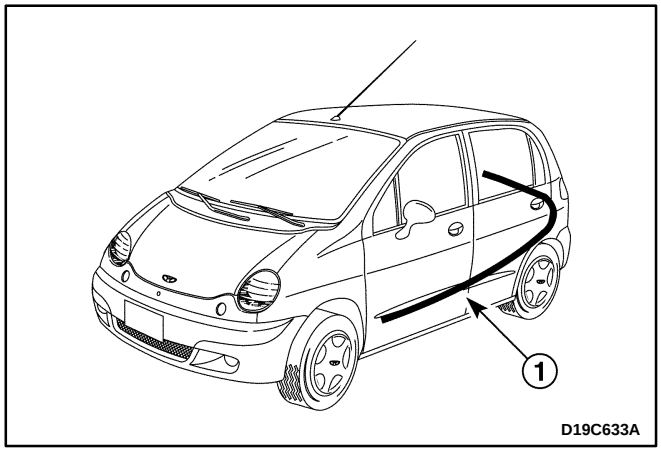


TAILGATE REMOTE CABLE AND HANDLE

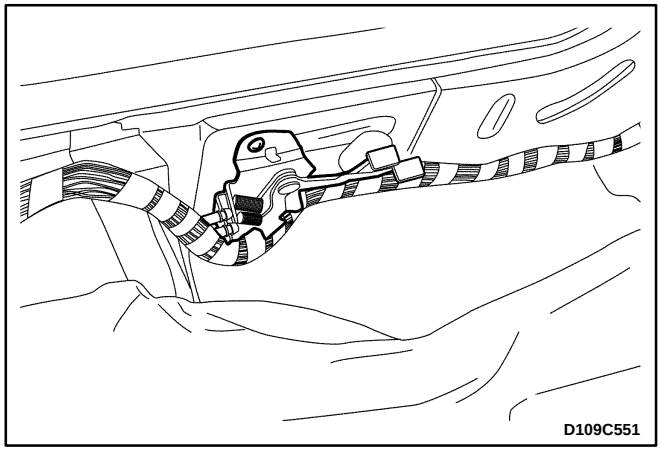
(Left–Hand Drive Shown, Right–Hand Drive Similar)

Removal Procedure

1. Pry off the front rocker trim panel. Refer to *Section 9G, Interior Trim.*
2. Remove the tailgate remote handle.
   - Remove the screws (1).
   - Disconnect the cable (2).
   - Remove the tailgate remote handle (3).



3. Pry off the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim.*
4. Pry off the rear rocker trim panel. Refer to *Section 9G, Interior Trim.*
5. Pry off the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
6. Disconnect the cable from the tailgate lock striker. Refer to *Section 9P, Doors.*
7. Remove the tailgate remote cable.
   - Remove the cable retaining strip.
   - Disconnect the tailgate remote cable (1).



Installation Procedure

1. Connect the tailgate remote cable to the tailgate lock striker.
2. Retain the cable with the strip.
3. Install the luggage compartment wheelhouse trim panel. Refer to *Section 9G, Interior Trim.*
4. Install the rear rocker trim panel. Refer to *Section 9G, Interior Trim.*
5. Install the lower B–pillar trim panel. Refer to *Section 9G, Interior Trim.*
6. Connect the tailgate remote cable to the handle.
7. Install the tailgate remote handle with the screws.

SECTION 9T

REMOTE KEYLESS ENTRY AND ANTI-THEFT SYSTEM

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SECTION 9T

REMOTE KEYLESS ENTRY AND ANTI-THEFT SYSTEM

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.

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DESCRIPTION AND OPERATION

REMOTE KEYLESS ENTRY AND ANTI-THEFT SYSTEM

The remote keyless entry and anti-theft system can perform the following functions:

- Remotely lock and unlock the vehicle doors with a hand-held high-frequency transmitter.
- Sense intrusion into the vehicle through the doors, the tailgate, or the hood.
- Activate a warning to signal an intrusion.
- Help the driver find the vehicle in a parking area.
- Automatically re-lock the doors if a door or the trunk is not opened within 30 seconds after the vehicle has been unlocked by the remote keyless entry.
- Communicate serial data to a scan tool to help diagnose system faults.

The remote keyless entry and anti-theft system consists of the following components:

- Keyless entry and anti-theft control module/receiver.
- Security indicator.
- Tailgate open switch.
- Door open switches.
- Central locking unit.
- Flashing turn signal lamps.
- Siren.
- Hood open switch.

REMOTE LOCKING AND UNLOCKING

The hand-held transmitter locks and unlocks the vehicle doors by sending radio waves to the control module/receiver in the vehicle. The effective range of the transmitter varies between 5 and 10 meters (approximately 16 to 32 feet), depending on whether or not objects such as other vehicles are blocking the path of the radio waves.

The transmitter has a LOCK button and an UNLOCK button which only function when the ignition is OFF. Pressing the UNLOCK button has the following effects:

- The doors are unlocked.
- The turn signal lamps flash twice.
- The control module is disarmed.

Pressing the LOCK button has the following effects:

- The doors are locked.
- The turn signal lamps flash once.
- The control module is armed.

The transmitter has a replaceable battery. The battery is designed to last at least two years before replacement is necessary.

SECURITY INDICATOR

There is a security indicator on the instrument panel. After the LOCK button of the transmitter is pressed, the module is placed in the armed mode, and the security indicator flashes. The security indicator turns ON for 1/8 second and OFF for 7/8 second. It then flashes at that frequency until the control module/receiver is disarmed.

INTRUSION SENSING

The anti-theft function is armed if the transmitter sends the LOCK message to the control module/receiver when the ignition is OFF.

When the hood, the door, or the tailgate is opened, the hood open switch, the door open switch, or the tailgate open switch will change its input to ground. The alarm will be activated if the hood open sensor, the door open sensor, or the tailgate open sensor changes its input to ground before either of the following conditions occurs:

- An UNLOCK message is received from the transmitter.

SIREN

The remote keyless entry system is armed when the LOCK message is received from the transmitter when the ignition is OFF. When the system is armed, it will activate the siren and flash the turn signals for 28 seconds if any of the following conditions occurs:

- A door is opened (front door open switch input is changed to ground).
- The tailgate is opened (tailgate open switch input is changed to ground).
- The hood is opened while the anti-theft system is armed (hood open switch input is changed to ground).

The siren is disarmed when any of the following conditions occurs:

- The ignition switch is turned ON with the key.
- The UNLOCK button or the LOCK button on the remote transmitter is pressed.

VEHICLE LOCATOR

The remote keyless entry system assists the driver in locating the vehicle. When the vehicle is unlocked with the remote control, the turn signals flash twice to indicate the location of the vehicle. The duration of the flashes and the length of time between flashes is used to indicate certain vehicle conditions. Refer to “Fault or Alarm Indication” in this section.

AUTOLOCKING (SAFETY LOCK)

The remote keyless entry system features an autolocking control. If the doors are unlocked with the remote transmitter when the control module/receiver is in the armed mode, the doors are automatically re-locked after 30 seconds unless any of the following events occur:

- The door is opened.
- The ignition switch is turned ON.
- The tailgate is opened.
- The hood is opened.

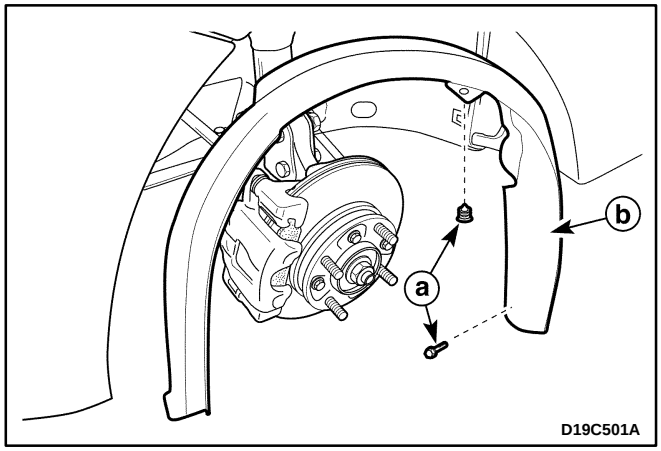
CONTROL MODULE/RECEIVER

The remote keyless entry control module/receiver is contained in the tie-bar center. The module/receiver processes signals from the remote transmitter and the intrusion sensors, and it activates the alarm if an intrusion is detected.

The control module/receiver will not communicate with transmitters from other vehicles because there are over four billion possible electronic password combinations, and passwords are not duplicated. The control module/receiver has an attached antenna to detect signals from the transmitter.

REPAIR INSTRUCTIONS

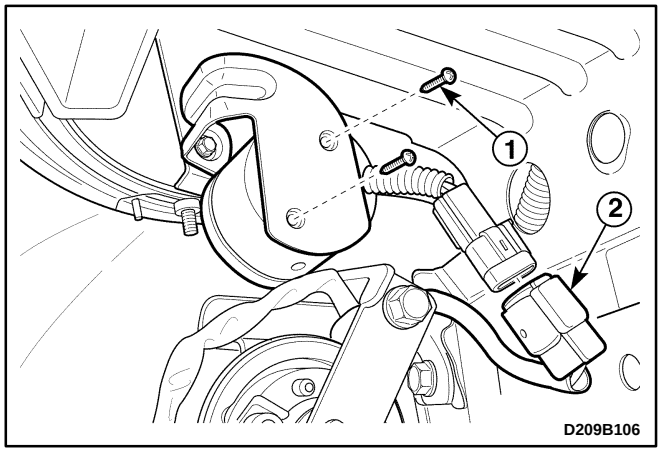
ON-VEHICLE SERVICE



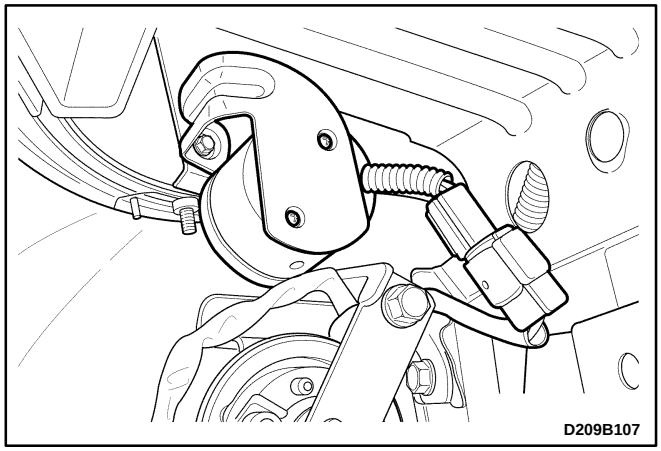
SIREN

Removal Procedure

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle.
3. Remove the front wheels.
4. Remove the front wheel house splash shield.
   - Remove the clip and bolts.
     a. Bolts and clips.
   - Remove the wheel house splash shield.
     b. Splash shield.



5 Remove the siren.
   - Remove the screws (1).
   - Disconnect the electrical connector (2).



Installation Procedure

1. Install the siren with the screws.
2. Connect the electrical connector.
3. Install the front wheel house splash shield with the clips and the bolts.
4. Install the front wheels.
5. Lower the vehicle.
6. Connect the negative battery cable.

PASSWORD PROGRAMMING

If a transmitter is lost or damaged, the control module/receiver must be re-programmed to communicate with a new transmitter. The passwords recorded in the control module/receiver should not be deleted when power is off in the control module/receiver.

Each control module/receiver should be able to record five passwords. The following method is used to record new passwords in the control module/receiver:

1. Connect the scan tool to the data link connector (DLC) connector.
2. Send the programming mode message to the control module/receiver.
3. Press any button of the transmitter to generate a data code including a password which will be recorded by the control module/receiver. The control module/receiver sends a response message to the scan tool to indicate that the first password has been recorded.
4. Press any button of the transmitter three more times until the control module/receiver has responded that the third, fourth, and fifth passwords have been recorded.
5. Disconnect the scan tool.

The control module/receiver leaves the programming mode automatically and switches to the normal operating mode when either of the following conditions occurs:

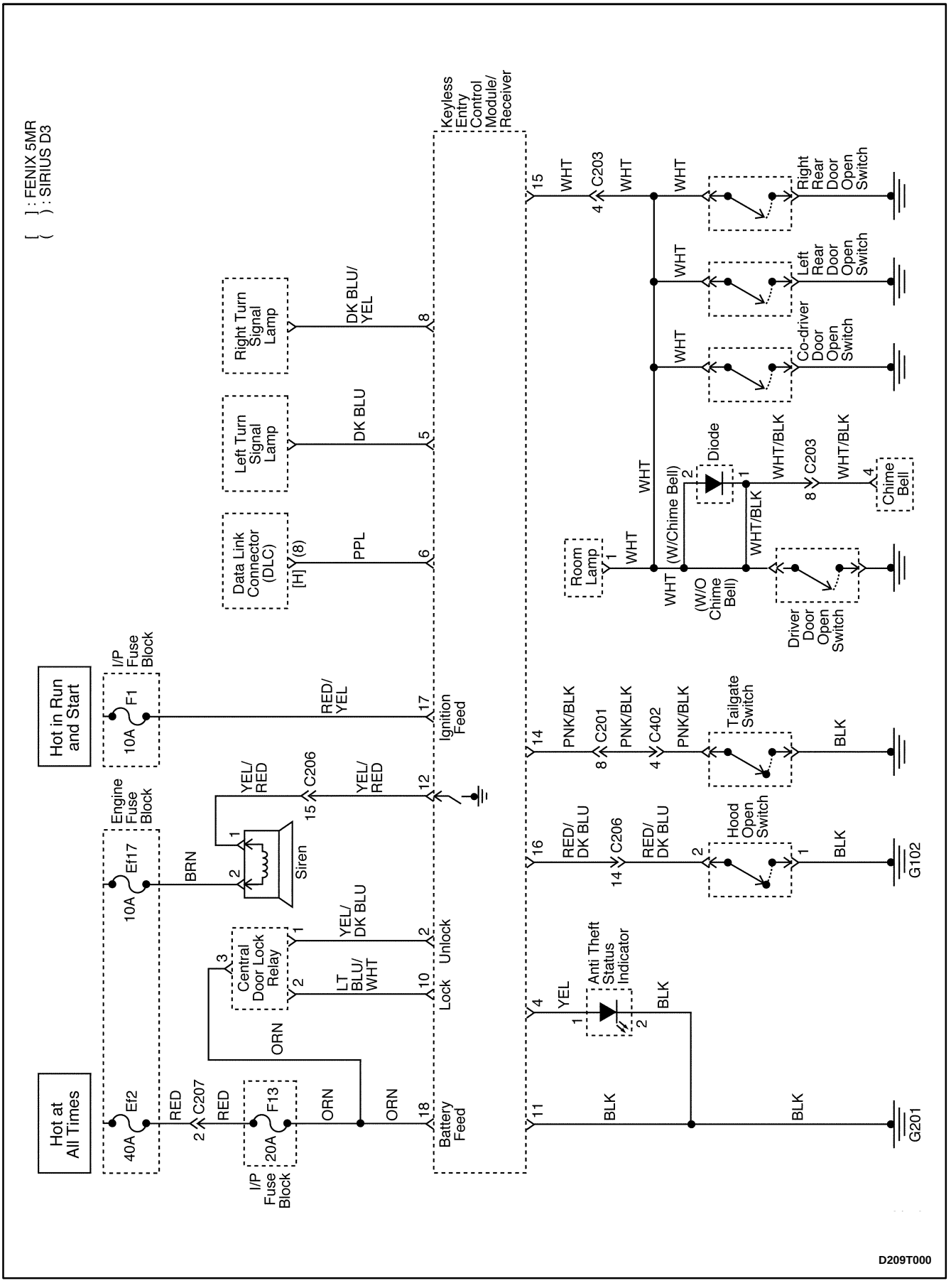
- The scan tool is disconnected from the DLC.
- Five passwords are recorded in the control module/receiver.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Hood Open Switch Mounting Screw	8	–	71
Siren Bracket Mounting Bolt	22	16	–
Siren Mounting Screws	8	–	71

SCHEMATIC AND ROUTING DIAGRAMS



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SECTION 9T

IMMOBILIZER ANTI-THEFT SYSTEM

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.

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DESCRIPTION AND OPERATION

IMMOBILIZER SYSTEM

The purpose of the Immobilizer system is to provide additional theft deterrence to the vehicle in which it is installed and to prevent it from being stolen or driven by unauthorized users.

The verification of the user authorization is done by an ignition key with integrated transponder.

The external LED displays the Immobilizer status and has an additional theft deterrence function.

To secure the communication, the status is exchanged between the Immobilizer and the ECM in a 5 byte of encoded data.

These 5 bytes are composed by a mixture of random data and two types of fixed code

- a vehicle model identification number : MIN
- a vehicle specific identification : VIN

The MIN is known from the first supply of the system.

The VIN is realized by ICU on the special order from the key coding (reading of transponder code and storing it as valid key code in Immobilizer EEPROM).

A different random data is computed at each key transition.

All the immobilization communication between the ECM and ICU is made on K-line (K line : Serial data line '7').

Due to the learning of the Vehicle specific identification Number, both ICU and ECM can stay in 3 stable modes

- Virgin mode (VIN not learnt)
- Learnt mode (VIN learnt)
- Neutral mode (for a new VIN learning)

In case of using valid key, the release message communication with the ECM take place and the LED displays the Immobilizer status valid key In case of using invalid key, the ECM disables the fuel injector circuit with coded intervention and sets DTC(Diagnostic Trouble Code)

The above conditions are maintained until the ignition is switched off.

An ECM without an immobilizer control unit cannot be interchanged for an ECM that is used with an immobilizer control unit system. The Immobilizer control unit and ECM must have a matching ID code. ID coding and key coding are accomplished by using Scanner–100

The Immobilizer system consists of

- a maximum or 5 ignition keys with integrated transponder
- the toroidal coil (Detection coil) for energizing and reading the transponder mounted at the ignition lock.
- the Immobilizer control unit(ICU) with :
  - power supply
  - ignition input circuit
  - transponder modulation and demodulation unit
  - EEPROM
  - driver electronic for the external status LED
  - serial data link hardware
- the external status LED for displaying the Immobilizer status
- the serial data link between Immobilizer and ECM

ELECTRONICALLY CODED KEYS

Each valid ignition key has an internal transponder which is a read /write transponder.

The transponder contains an implementation of a crypto-algorithm with 96 bits of user configurable s cret-key contained in EEPROM and transmits data to the ICU by modulating the amplitude of the ele tromagnetic field, and receives data and commands in a similar way.

DETECTION COIL

The toroidal coil is mounted at the ignition lock in front of the key barrel.

It is connected to the ICU with a four terminal connector fixed at the body of the coil.

The length of the connection between coil and Immobilizer is restricted to 50cm. The correct placement on the ignition lock and the exact electrical data is very important for the reading distance of transponder.

The toroidal coil and receiving coil inside the transponder built a transformer. During the readingprocess the coil induces energy into the transponder. The transponder charges the field and generates an amplitude modulated signal with the manchester coded data. This charge of the field is demodulated inside the Immobilizer.

The Immobilizer contains the coil driver hardware for direct connection of the toroidal coil.

IMMOBILIZER CONTROL UNIT

The function of the Immobilizer System is shared between the ICU and the ECM.

The task of the Immobilizer Electronic Control unit (ICU) are:

- Reading of the input information “ignition ON/OFF”
- Controlling the states LED
- Controlling the transponder read/write process (modulation, demodulation, decoding, comparison of the read code with the code of the valid keys).
- Communication with the ECM after ignition ON (receiving of the ECM-request and transmission of release message).
- Special functions for calculation and handling of the VIN-code.

The VIN code is calculated by the Immobilizer using a random generator.

The VIN code is transmitted from the Immobilizer in the release message communication only incase of using an authorized key. Without an authorized key it is not possible to getthe system VIN code.In case of ECM internal state is in Virgin mode or neutral mode the ECM learns the system VIN code automatically after receiving the first release response message.

To get a synchronized Immobilizer system (same VIN-code in Immobilizer and ECM,authorized key) the DLC test equipment has to be used for authorization of the keys(first key coding). The usage of this test equipment is restricted to authorized persons.

- Communication with the DLC-test equipment. Main functions are the key coding procedure, the VIN-code handling and the support for system test functions.
- Handling of the software watchdog

Operation

In the active mode of immobilizer (engine OFF, IG key OFF) the status LED is blinking as mode A. When ignition is turned ON, the system wakes up and tries to read out the transponder.

In case of the detection of a valid key , The release message communication with the ECM takes place. The status LED displays the Immobilizer state “valid key”.

After turning off the ignition(ignition OFF detection similar to the ECM ignition OFF detection), the Immobilizer changes to the active mode. The status LED is blinking as Mode A.

Data Link Connector (DLC) Mode

When the ignition is on, a scan tool can switch the immobilizer control unit to the DLC mode for diagnostics, key coding and ID coding.

- The status LED is turned off during DLC-mode
- The Immobilizer will answer all correct messages, which are defined as Immobilizer messages.

ID Code Handling

One of 65,535 VIN codes is stored in the immobilizer EEPROM.

The VIN code can be erased by using “Reset VIN code” command of the scan tool.

When the immobilizer control unit calculates a new VIN code, ECM VIN code should be reset to get identical with the immobilizer control unit’s.

During diagnostic procedures, the VIN code can be read for comparison with the ECM VIN code by using the scan tool’s “Read immobilizer control unit VIN code” command.

SERIAL DATA LINK

Serial data can be exchanged between a scan tool and the ECM and the Immobilizer control unit. The scan tool connection is the data link connector (DLC).

ELECTRONIC CONTROL MOUDLE (ECM)

- ECM in Virgin mode

  In this mode, the ECM knows only the model vehicle identifier code.

  The engine can be locked/unlocked.

  ECM requests to ICU the VIN number. As soon as the ECM receives two correct consecutive communication frames with the same VIN code the ECM learns it.

  The VIN code will be stored in non-volatile memory at the end of power latch phase. ECM enters in Learnt mode.

- ECM in Learnt mode

  In such a state, ECM checks on every communication, the correct encoding of the ICU.

  If the code received is not correct, then the vehicle is immobilized.

  The coded 5 bytes of data emitted by ECM are a mixture of MIN code and random.

  The coded 5 bytes of data emitted by ICU are a mixture of VIN code and random.

- ECM in Neutral mode

  This mode is a special intermediate mode, used for ICU replacement or immobilizer option installation.

  ECM request to ICU the VIN number. As soon as the ECM receives two correct consecutive communication frames with the same VIN code the ECM learns it. The VIN code will be stored in non-volatile memory at the end of power latch phase. ECM enters in Learnt mode.

- After turning on the ignition the ECM will control the engine in a normal way for starting and running while waiting for a valid release response message from the Immobilizer.

1. After receiving a response message including the information “ICU in learnt mode” and the correct system VIN-code

   → the ECM enters the release state, which allows to continue the running of the engine.

2. After receiving a response message including the information “ICU in learnt mode” and a wrong system VIN-code

   → the ECM does not send a new request and enters the blocked state, which causes the activation of the immobilization actions of the engine.

3. If the ECM doesn't receive a response message within a defined time from beginning of the release time period or the ECM receives a no release answer

→ the ECM enters the blocked state, which causes the activation of the immobilization actions of the engine.

- The inactive state of the Immobilizer (valid key/invalid key) ends with turning off the ignition.

SECURITY INDICATOR

There is a security indicator on the instrument panel.

Status LED

An external LED displays the immobilizer system status. The immobilizer contains the LED driver hardware for direct connection of one LED.

Status LED Modes

Status LED	Immobilizer System Status	Note
Blinking	Active	– Ignition OFF
Blinking	Active	– Invalid key detected – Ignition ON
OFF	Inactive	– Valid key detected – Ignition ON
Blinking	Active	– VIN-code is different between ICU and ECM in learnt state – Ignition ON
ON	Active	– Transponder reading error – Ignition ON
Blinking	Active	– Reader exciter ASIC error – Ignition OFF

DIAGNOSTIC INFORMATION AND PROCEDURES

IMMOBILIZER SYSTEM (FENIX 5MR)

The immobilizer anti-theft system requires diagnosis when it is not possible to start the engine. If the no-start condition occurs because of the immobilizer system, a diagnostic trouble code (DTC) 1600, 1601 or 1602 should be set.

The immobilizer control unit monitors the detection and the reading of the ignition key. The self-test capacity is limited to those functions. Faults are communicated to a scan tool during diagnosis, but they are not stored in the immobilizer control unit's memory.

Unauthorized use of a scan tool could be a method of defeating the immobilizer anti-theft system, so certain scan tool procedures require the use of a password. The following functions are password protected:

- Coding of an additional key.
- Deleting all key codes.
- Deletion of the immobilizer identification (ID) code.
- Deletion of the electronic control module (ECM) ID code.

The following functions do not require a password:

- Reading an ignition key to determine if the transponder is working or if a key is authorized.
- Reading the immobilizer ID code to verify that it matches the ECM ID code.

IMMOBILIZER SYSTEM (SIRIUS D3)

The immobilizer anti-theft system requires diagnosis when it is not possible to start the engine. If the no-start condition occurs because of the immobilizer system, a diagnostic trouble code (P) 1628, 1629 should be set.

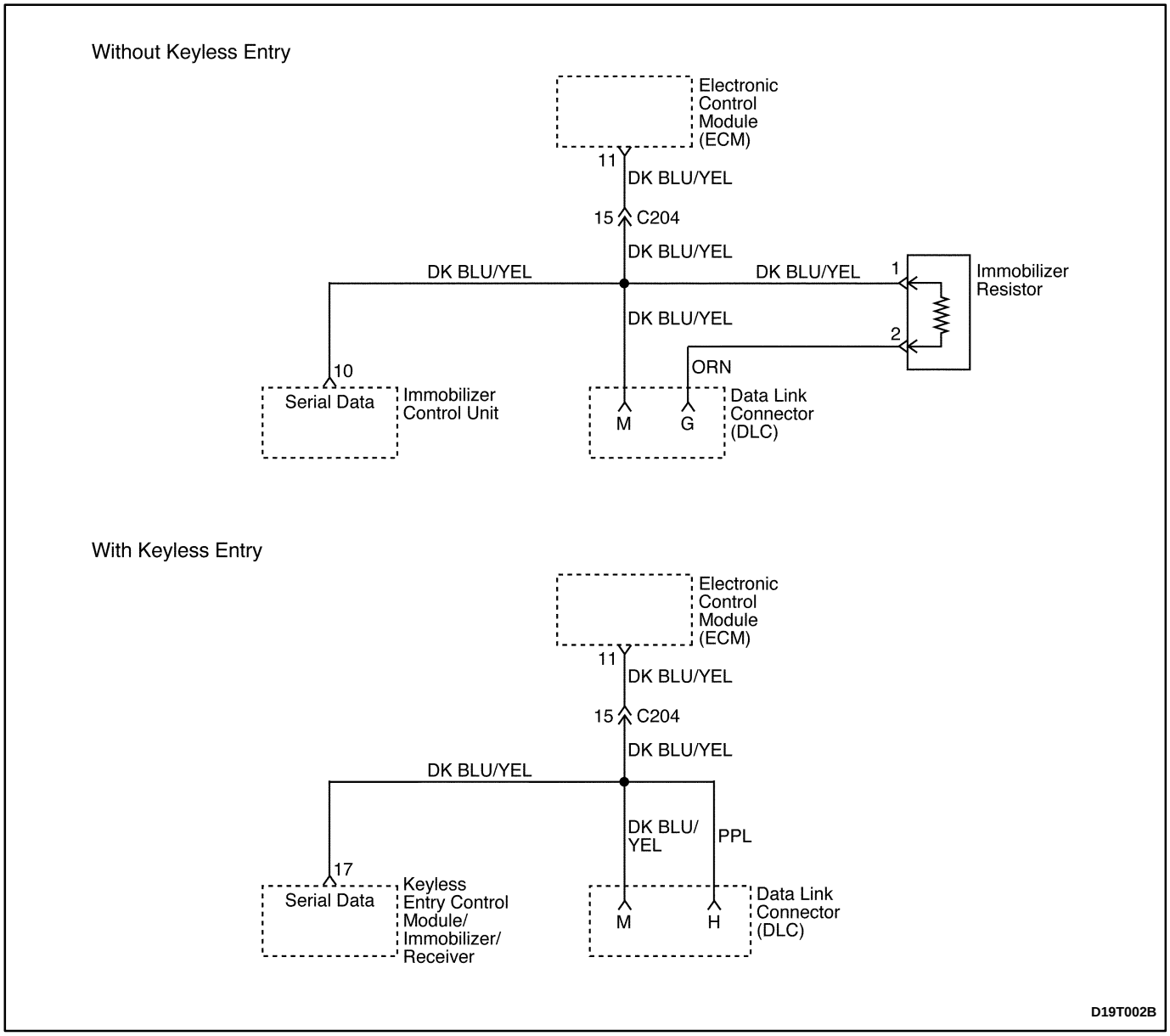
The immobilizer control unit monitors the detection and the reading of the ignition key. The self-test capacity is limited to those functions. Faults are communicated to a scan tool during diagnosis, but they are not stored in the immobilizer control unit's memory.

Unauthorized use of a scan tool could be a method of defeating the immobilizer anti-theft system, so certain scan tool procedures require the use of a password. The following functions are password protected:

- Coding of an additional key.
- Deleting all key codes.

The following functions do not require a password:

- Reading an ignition key to determine if the transponder is working or if a key is authorized.
- Reading the immobilizer ID code to verify that it matches the ECM ID code.



DIAGNOSTIC TROUBLE CODE (DTC) 1600 ECM IMMOBILIZER ERROR (NO ANSWER)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and 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 electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.
- Disables the fuel pump circuit.
- Disables the ignition coil.

DTC Will Set When

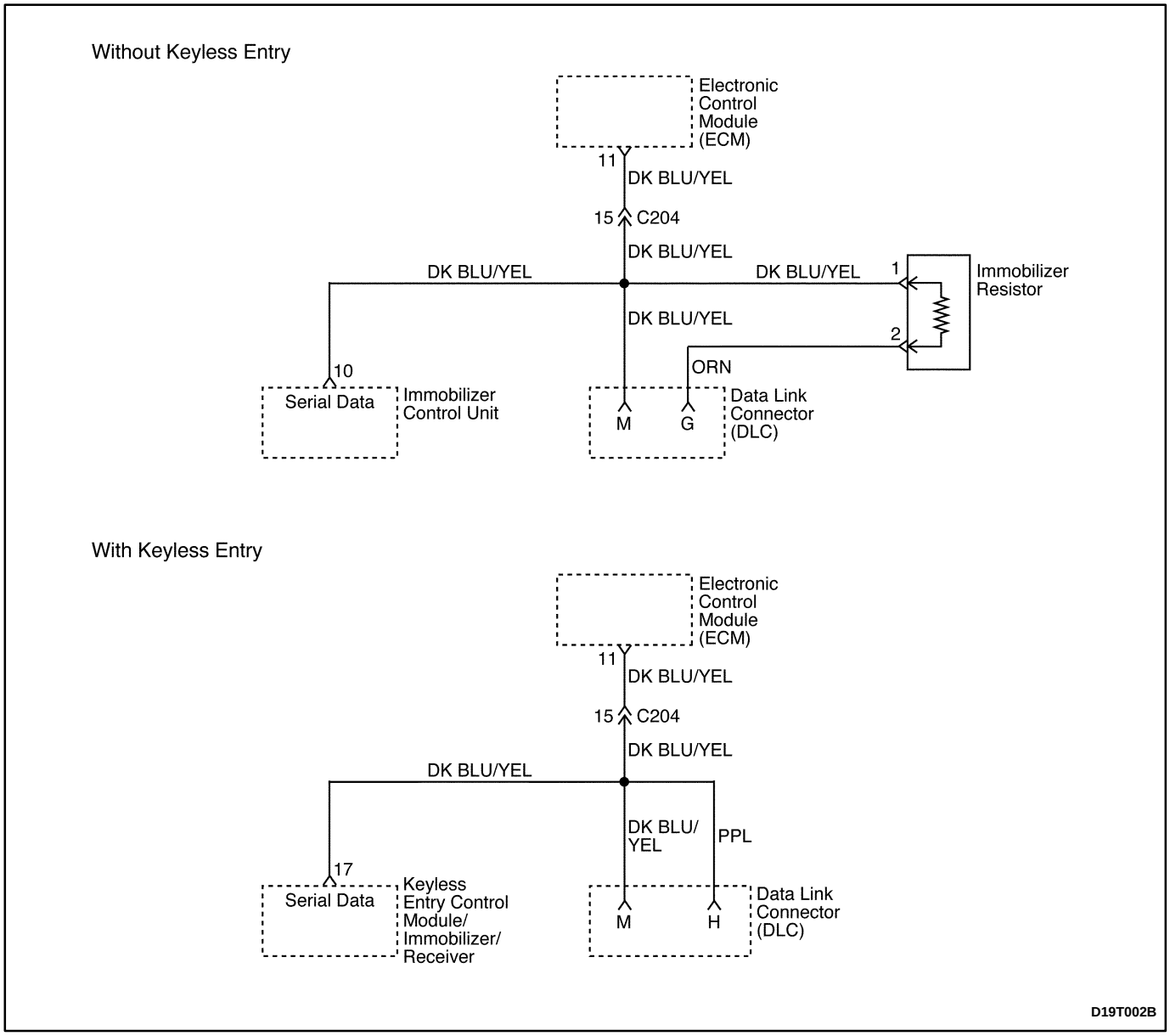
- The ECM does not receive the signal from the immobilizer control module when the ignition is turned on.
- The above conditions are maintained until the ignition is switched OFF.

DTC 1600 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

DTC 1600 – ECM Immobilizer Error (No Answer)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF position. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	Select CURRENT KEY STATUS from the scan tool menu. Did the STATUS OF CURRENT KEY message indicate "KEY IS WRONG"?	–	Go to "Key Status Errors"	Go to *Step 3*
3	Read the IMMO & ECM ID CODE message that was displayed after requesting DIAGNOSIS. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 4*
4	Check for an open serial data wire between the immobilizer control unit and the ECM. Was the circuit open?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	–	System OK	–
6	1. Replace the ECM. 2. Reprogram the identification (ID) code. Refer to "Identification (ID) Code Reprogramming" in this section. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 1601
ECM IMMOBILIZER ERROR (INCORRECT ANSWER)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and 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 electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.
- Disables the fuel pump circuit.
- Disables the ignition coil.

DTC 1601 Will Set When

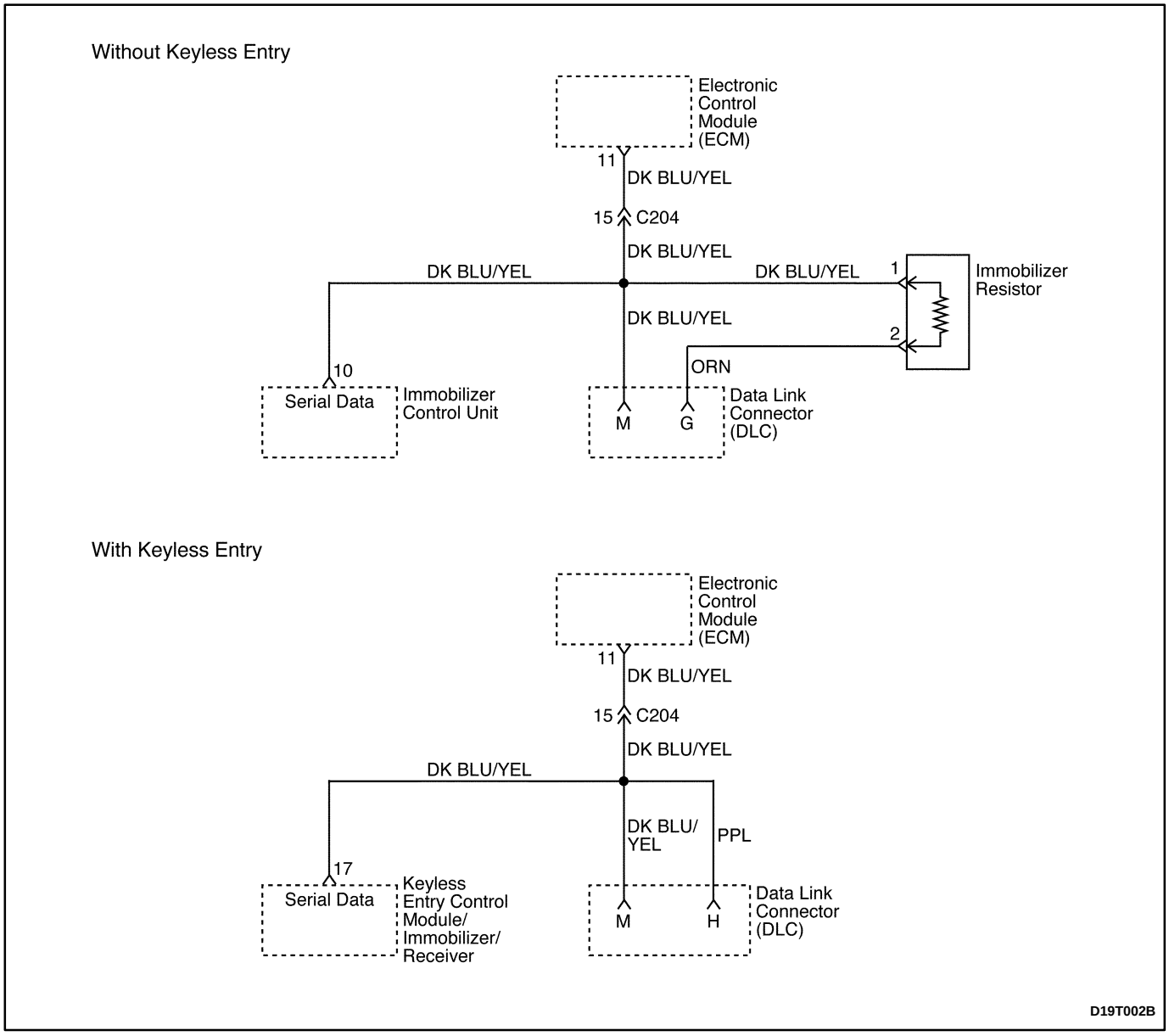
- The ECM receives an incorrect release message from the immobilizer control unit more than five times.

DTC 1601 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

DTC 1601 – ECM Immobilizer Error (Incorrect Answer)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	1. Select CURRENT KEY STATUS from the scan tool menu. 2. Read the STATUS OF CURRENT KEY message. Does the KEY STATUS message indicate "KEY IS WRONG"?	–	Go to "Key Status Errors"	Go to *Step 3*
3	1. Select DIAGNOSIS from the scan tool menu. 2. Read the IMMO & ECM ID CODE (immobilization and electronic control module identification code) message. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 4*
4	Check for an open serial data wire between the immobilizer control unit and the electronic control module (ECM). Was the circuit open?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	–	System OK	–
6	1. Replace the ECM. 2. Reprogram the ID code. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (DTC) 1602 ECM IMMOBILIZER ERROR (ECM LOCKED)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and 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 electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.
- Disables the fuel pump circuit.
- Disables the ignition coil.

DTC 1602 Will Set When

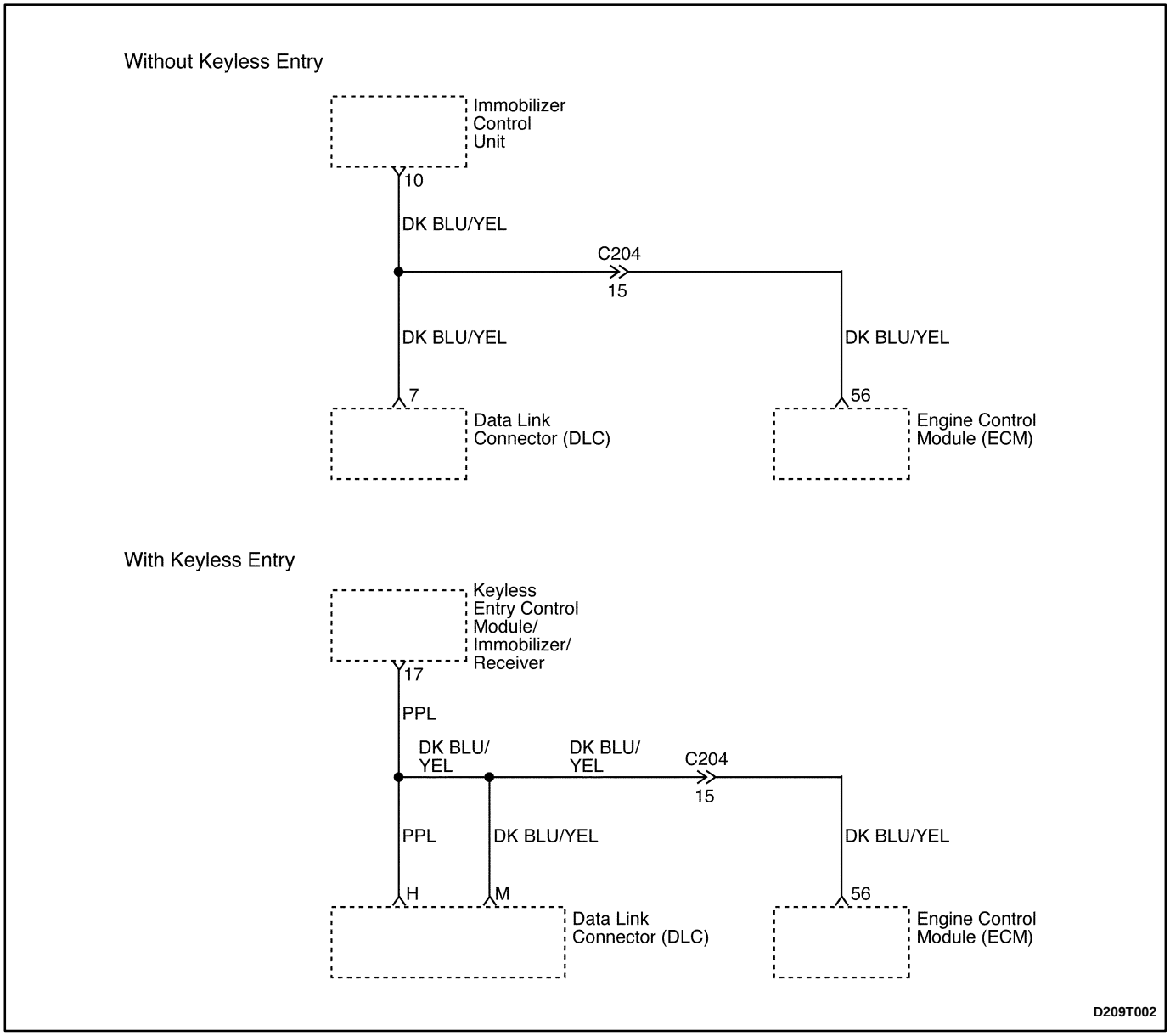
- The immobilizer control unit does not learn and store the codes of valid keys.

DTC 1602 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

DTC 1602 – ECM Immobilizer Error (ECM Locked)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	1. Select CURRENT KEY STATUS from the scan tool menu. 2. Read the STATUS OF CURRENT KEY message. Does the KEY STATUS message indicate "KEY IS WRONG"?	–	Go to "Key Status Errors"	Go to *Step 3*
3	1. Select DIAGNOSIS from the scan tool menu. 2. Read the IMMO & ECM ID CODE (immobilization and electronic control module identification code) message. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 4*
4	Check for an open serial data wire between the immobilizer control unit and the electronic control module (ECM). Was the circuit open?	–	Go to *Step 5*	Go to *Step 6*
5	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	–	System OK	–
6	1. Replace the ECM. 2. Reprogram the ID code. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (P) 1628 (SIRIUS D3) ECM IMMOBILIZER ERROR (NO SUCCESSFUL COMMUNICATION)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and 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 electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.

P 1628 Will Set When

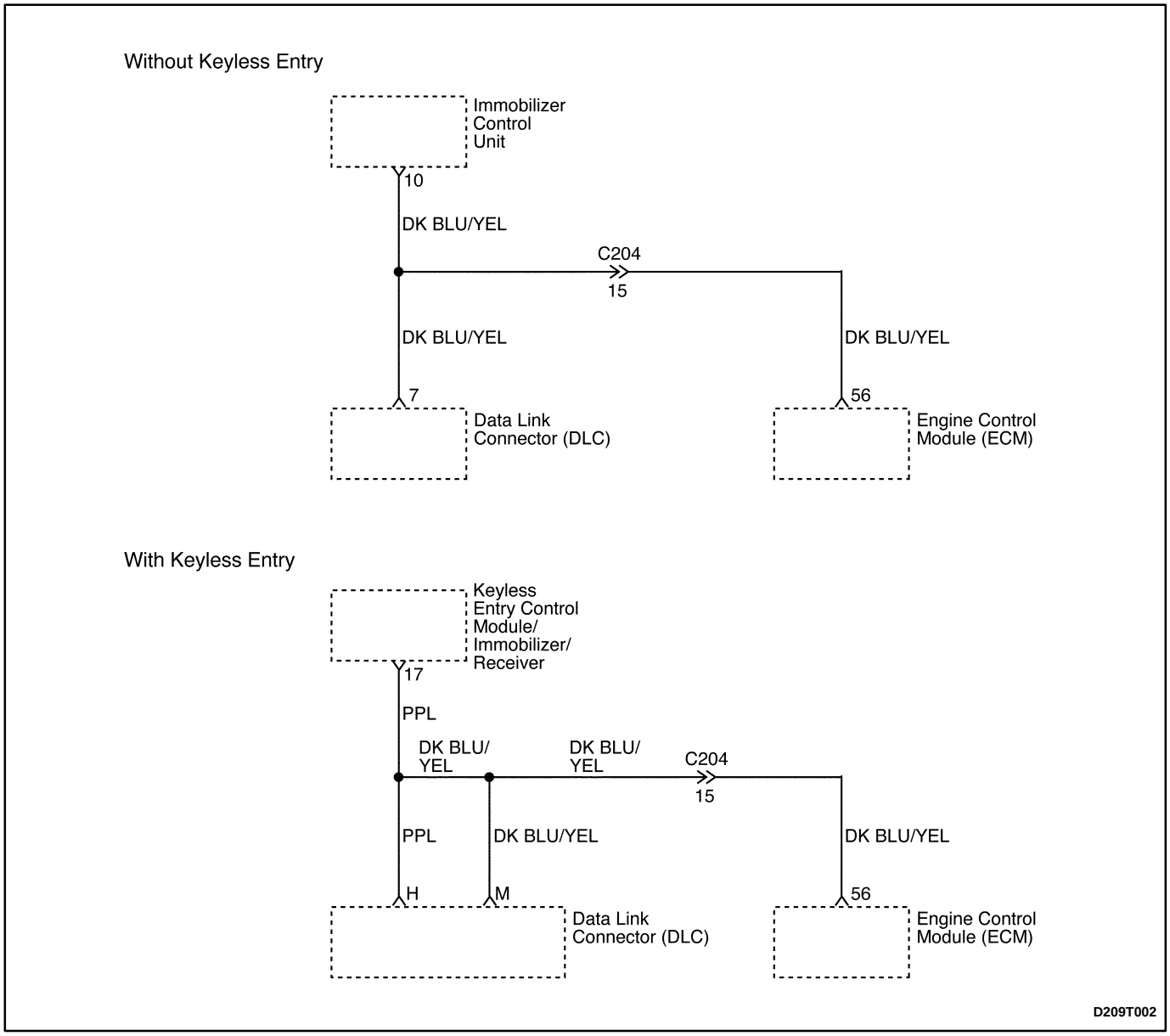
- The ECM does not receive the signal from the immobilizer control module within 1.260 seconds after the ignition is turned on.
- The above conditions are maintained until the ignition is switched OFF.

P 1628 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

P 1628 – ECM Immobilizer Error (No Successful Communication)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF position. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Select immobilizer mode on the scan tool. 6. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	Read the IMMO & ECM ID CODE message that was displayed after requesting DIAGNOSIS. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 3*
3	Check for an open serial data wire between the immobilizer control unit and the ECM. Was the circuit open?	–	Go to *Step 4*	Go to *Step 5*
4	Repair the open serial data wire between the ECM and the immobilizer control unit. Is the repair complete?	–	System OK	–
5	1. Replace the immobilizer. 2. Reprogram the identification (ID) code. Refer to "Identification (ID) Code Reprogramming" in this section. Is the repair complete?	–	System OK	– Go to *Step 6*
6	1. Replace the ECM. 2. Turn the ignition ON, OFF for more than 4 seconds. 3. Turn the ignition ON. Is the repair complete?	–	System OK	–



DIAGNOSTIC TROUBLE CODE (P) 1629 (SIRIUS D3) ECM IMMOBILIZER ERROR (INCORRECT ANSWER)

Circuit Description

When the ignition is turned ON, the key is tested by the immobilizer anti-theft system. While the key code is being read by the immobilizer control unit, the engine can start and 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 electronic control module (ECM). Included in the release message is an identification (ID) code which assures that neither the immobilizer control unit nor the ECM has been substituted to defeat the system. If the ECM receives an invalid release message, the ECM performs the following actions:

- Disables the fuel injector circuit.

P 1629 Will Set When

- The ECM receives an incorrect release message from the immobilizer control unit more than five times.

P 1629 Will Clear When

- The ignition switch is turned OFF or the scan tool TROUBLE CODE CLEAR command is issued.

P 1629 – ECM Immobilizer Error (Incorrect Answer)

Step	Action	Value	Yes	No
1	Connect the scan tool using the following procedure: 1. Insert the cartridge into the scan tool. 2. Turn the ignition switch to the OFF. 3. Connect the scan tool to the data link connector (DLC). 4. Connect the scan tool's power cord to the cigar lighter socket. 5. Turn the ignition ON, but do not start the engine. Is communication established between the scan tool and the immobilizer control unit?	–	Go to *Step 2*	Go to "Communication Between Immobilizer and Test Equipment"
2	1. Select DIAGNOSIS from the scan tool menu. 2. Read the IMMO & ECM ID CODE (immobilization and electronic control module identification code) message. Did the message differ from normal message? Normal Message – ECM MODE: LEARNT IMMO. MODE: LEARNT VIN CODE: SAME	–	Go to "Identification (ID) Code Reprogramming"	Go to *Step 3*
3	1. Replace the ECM. 2. Reprogram the ID code. Is the repair complete?	–	System OK	– Go to *Step 4*
4	1. Replace the ECM. 2. Turn the ignition ON, OFF for more than 4 seconds. 3. Turn the ignition ON. Is the repair complete?	–	System OK	–

KEY STATUS ERRORS (FENIX 5MR)

The following KEY STATUS messages may be shown on the scan tool after commanding FIRST KEY CODING and KEY ADD:

- IGNITION OFF STATUS. This message informs the technician that the ignition is OFF during the key coding process. Turn the ignition ON during key coding, but do not start the engine.
- KEY IS OCCUPIED. Only five keys may be coded. If a new key is desired, the previous key codes must be deleted. Up to five keys may then be authorized.
- ALREADY AUTHORIZED. Key coding is being attempted with a key that is already authorized.
- ERROR NO. A3, A4, A5. There is no communication between the transponder in the ignition key and the detection coil. Follow the steps below to diagnose the problem:
    1. Try a different key. If a different key works, the problem is in the original key.
    2. If trying a different key results in the same error message, replace the detection coil.
- INVALID KEY. The communication between the immobilizer control unit and the key transponder has not validated the key. Follow the steps below to diagnose the problem:
    1. Code the key. Refer to “Key Coding Procedure” in this section.
    2. If the same message is received after key coding, check the connection of the detection coil.
    3. If the detection coil is okay, replace the immobilizer. Refer to “Immobilizer Control Unit” in this section.
- NO TRANSPONDER DETECTED. The fault may be in ignition key transponder, the detection coil, or the immobilizer. Follow the steps below to diagnose the problem:
    1. Try a different key. If a different key works, the problem is in the original key.
    2. If trying a different key results in the same error message, check the connection of the detection coil.
    3. If the connection of the detection coil is okay, disconnect the detection coil and use an ohmmeter to check for an open detection coil.
    4. If the detection coil is not open, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

KEY STATUS ERRORS (SIRIUS D3)

The following KEY STATUS messages may be shown on the scan tool after commanding FIRST KEY CODING and KEY ADD:

- IGNITION OFF STATUS. This message informs the technician that the ignition is off during the key coding process. Turn the ignition ON during key coding, but do not start the engine.
- KEY IS OCCUPIED. Only five keys may be coded. If a new key is desired, the previous key codes must be deleted. Up to five keys may then be authorized.
- ALREADY AUTHORIZED. Key coding is being attempted with a key that is already authorized.
- ERROR NO. A3, A4, A5. There is no communication between the transponder in the ignition key and the detection coil. Follow the steps below to diagnose the problem:
    1. Try a different key. If a different key works, the problem was in the original key.
    2. If trying a different key resulted in the same error message, replace the detection coil.
- INVALID KEY. The communication between the immobilizer control unit and the key transponder has not validated the key. Follow the steps below to diagnose the problem:
    1. Code the key. Refer to “Key Coding Procedure” in this section.
    2. If the same message is received after key coding, check the connection of the detection coil.
    3. If the detection coil is okay, replace the immobilizer. Refer to “Immobilizer Control Unit” in this section.
- NO TRANSPONDER DETECTED. The fault may be in ignition key transponder, the detection coil, or the Immobilizer. Follow the steps below to diagnose the problem
    1. Try a different key. If a different key works, the problem was in the original key.
    2. If trying a different key resulted in the same error message, check the connection of the detection coil.
    3. If the connection of the detection coil is okay, disconnect the detection coil and use an ohmmeter to check for an open detection coil.
    4. If the detection coil was not open, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

COMMUNICATION BETWEEN IMMOBILIZER CONTROL UNIT AND TEST EQUIPMENT (FENIX 5MR)

1. Connect the test equipment as described in the *Scan Tool Equipment Manual*.
2. If communication between the scan tool and the test equipment was unsuccessful, wait 30 seconds and try again.
3. If communication was not successful on the second try, turn the ignition OFF and check the wire and connectors between the immobilizer control unit terminal 10 (17) and the data link connector (DLC) terminal M.
4. If the wire and connectors between the DLC and the immobilizer control unit are okay, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

Notice: Install the resistor cover in the DLC connector after remove the scan tool. Because ECM Immobilizer Error Problem may exist.

COMMUNICATION BETWEEN IMMOBILIZER CONTROL UNIT AND TEST EQUIPMENT (SIRIUS D3)

1. Connect the test equipment as described in the *Scan Tool Equipment Manual*.
2. If communication between the scan tool and the test equipment was unsuccessful, wait 30 seconds and try again.
3. If communication was not successful on the second try, turn the ignition OFF and check the wire and connectors between the immobilizer control unit terminal 10 and the data link connector (DLC) terminal 7 (8).
4. If the wire and connectors between the DLC and the immobilizer control unit are okay, replace the immobilizer control unit. Refer to “Immobilizer Control Unit” in this section.

REPAIR INSTRUCTIONS

ON-VEHICLE SERVICE

KEY CODING PROCEDURE

1. Install the immobilizer control unit cartridge in the scan tool.
2. Turn the ignition OFF
3. Connect the scan tool.
4. Turn the ignition ON with the key to be coded.
5. Enter the four-digit password that enables service personnel to use the scan tool for coding keys.
6. A lost key can be deleted only by deleting all keys and reauthorizing the remaining keys as new keys. If a key is lost, go to the next step. If no keys have been lost but an additional key is desired, go to Step 8.
7. Use the scan tool command DELETE ALL KEY CODES.
8. Use the scan tool command AUTHORIZE ONE ADDITIONAL KEY.
9. Repeat Steps 4, 5, and 6 until the immobilizer control unit has recorded all of the new keys or, after a deletion, has reauthorized all of the remaining keys. The immobilizer control unit can record a maximum of five keys.
10. Return the system to the normal mode.
11. Turn OFF the ignition.
12. Turn ON the ignition.
13. Crank to start the engine.

ID CODE REPROGRAMMING

Reprogram the identification (ID) code in the following situations:

- An immobilizer control unit has been replaced.
- An electronic control module (ECM) has been replaced.

If a valid key has been lost, refer to “Key Coding Procedure” in this section.

Reprogramming Procedure

1. Turn the ignition OFF. Reprogramming is not allowed while the engine is running.
2. Insert the immobilizer control unit cartridge into the scan tool.
3. Do not start the vehicle, but turn the ignition ON.
4. Enter the four-digit password that enables service personnel to use the scan tool for ID code reprogramming.
5. Use the scan tool to command RESET ID CODE.

6. Turn the ignition OFF and ON again, but do not crank or start the engine. The ECM will reset the ECM ID code to match the new ID code that was calculated and sent by the immobilizer control unit when the ignition was first turned ON after the reset command.
7. Return the system to the normal mode.
8. Turn OFF the ignition.
9. Turn ON the ignition.
10. Start the engine.

After reprogramming the ID code, the scan tool SYSTEM DIAGNOSIS command can verify that the ECM ID code matches the immobilizer control unit ID code.

If the reprogramming procedure does not result in matching ID codes, check the electrical connectors for the serial data wire between the immobilizer control unit and the ECM.

TRANSPONDER

Each valid ignition key has an internal transponder which is a read /write transponder.

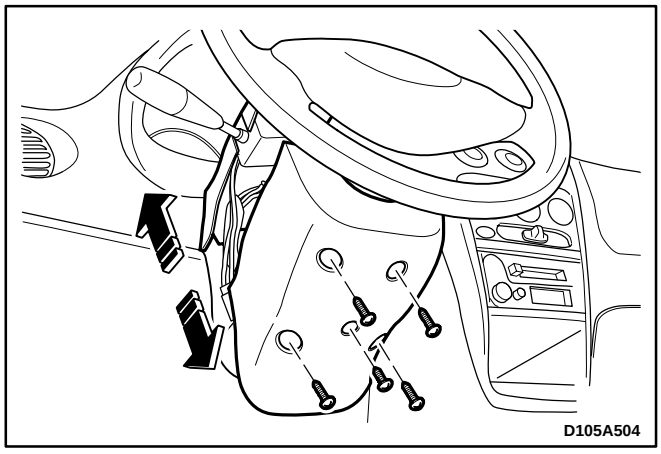
The transponder contains an implementation of a crypto-algorithm with 96 bits of user configurable secret-key contained in EEPROM and transmits data to the ICU by modulating the amplitude of the electromagnetic field, and receives data and commands in a similar way.

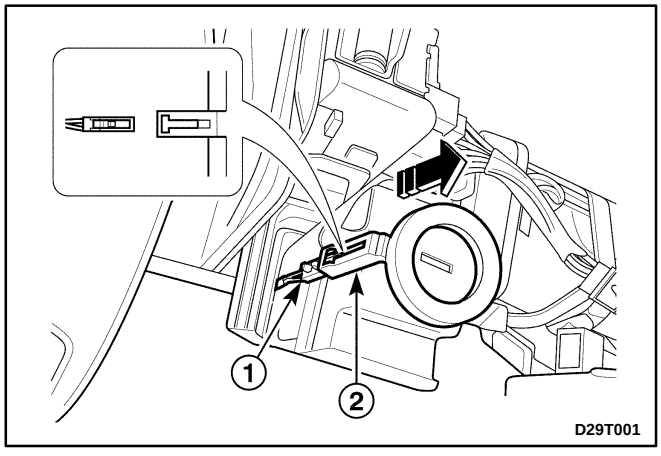
DETECTION COIL

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

Removal Procedure

1. Remove the steering column covers. Refer to *Section 6E, Steering Wheel and Column.*

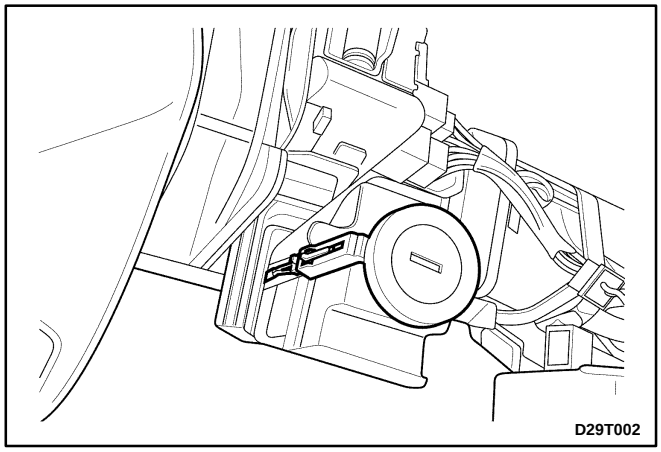

D105A504



D29T001

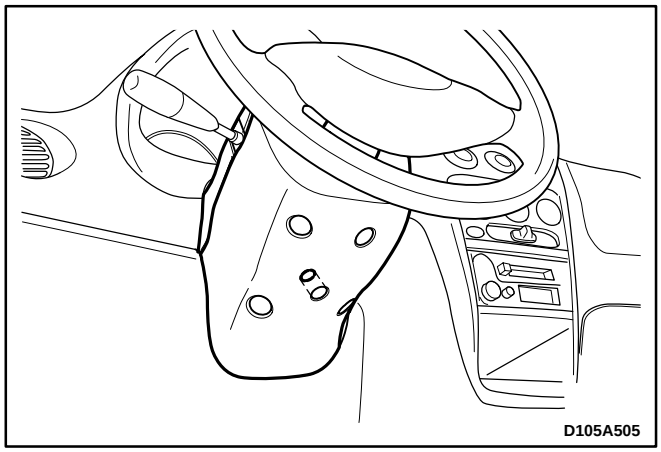
2. Remove the detection coil.
   - Disconnect the two-pin connector from the detection coil (1).
   - Pry the detection coil away from the lock cylinder (2).

Important: If the detection coil will be replaced with a new one, it does not matter if the key position trim ring is damaged during removal. A new trim ring is part of the new detection coil.

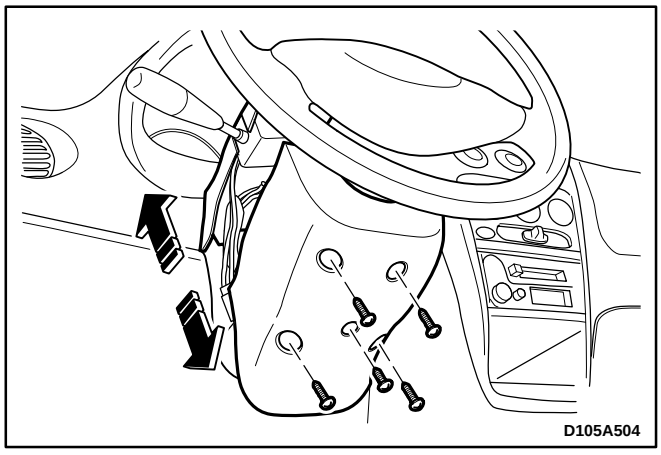

D29T002

Installation Procedure

1. Install the detection coil by pressing it onto the lock cylinder until it snaps in place.
2. Connect the two-pin connector to the immobilizer.


D105A505

3. Install the steering column covers with the screws. Refer to *Section 6E, Steering Wheel and Column.*

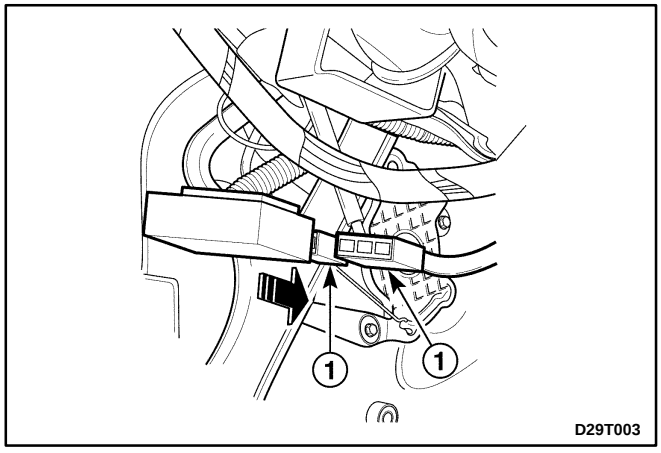

D105A504

IMMOBILIZER CONTROL UNIT

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

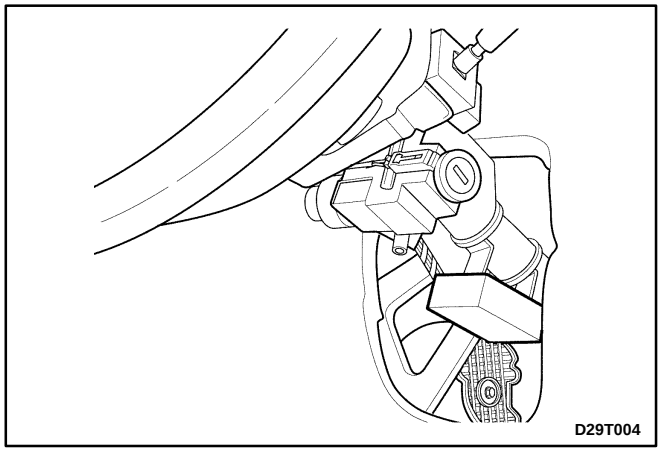
Removal Procedure

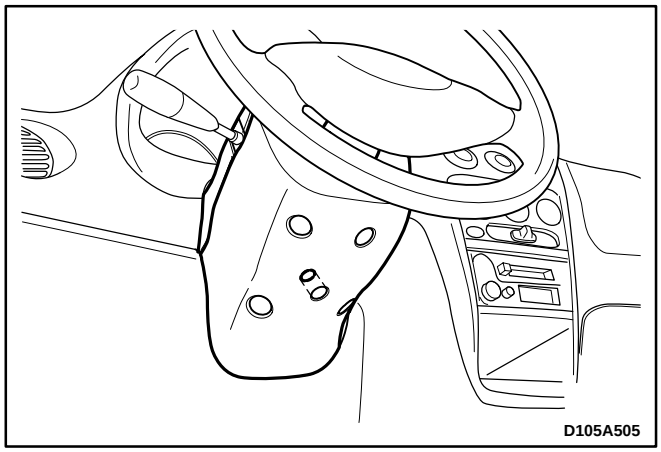
1. Disconnect the negative battery cable.
2. Remove the steering column covers. Refer to *Section 6E, Steering Wheel and Column.*



D29T003

3. Slide the immobilizer control unit toward steering wheel until it slides off its mounting bracket.
4. Disconnect the electrical connectors from the immobilizer control unit (1).


D29T004


D105A505

Installation Procedure

After replacing the immobilizer control unit, the keys must be re-authorized using the key coding procedure. Refer to “Key Coding Procedure” in this section. Also, the electronic control module (ECM) identification (ID) code must be reset. Refer to “Identification (ID) Code Reprogramming” in this section.

1. Connect the electrical connectors to the immobilizer control unit.
2. Slide the immobilizer control unit onto its mounting bracket.
3. Install the steering column covers. Refer to *Section 6E, Steering Wheel and Column.*
4. Connect the negative battery cable.

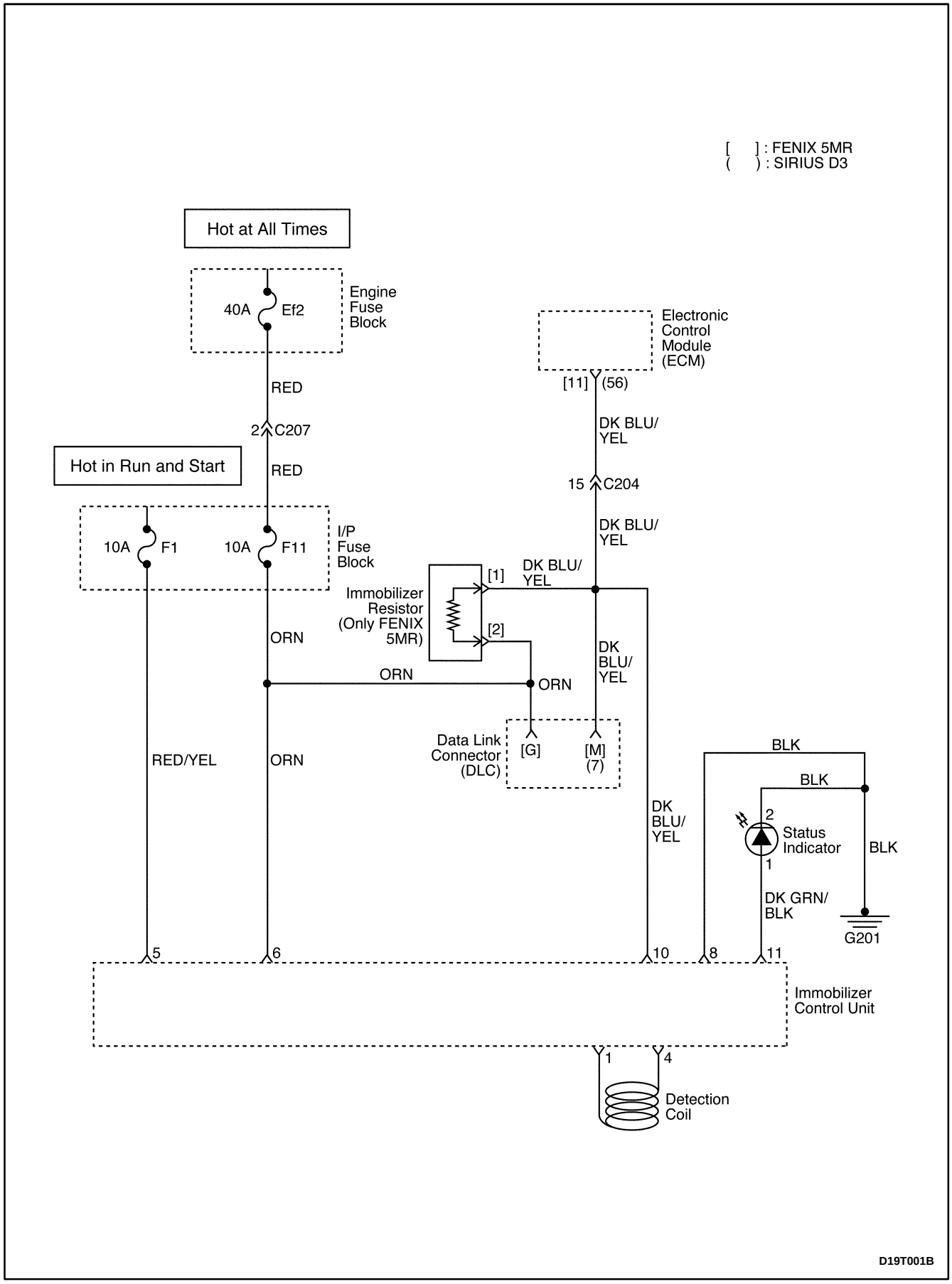
SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Immobilizer Control Unit Mounting Bolts	4	–	35

SCHEMATIC AND ROUTING DIAGRAMS

IMMOBILIZER ANTI-THEFT SYSTEM



SCHEMATIC AND ROUTING DIAGRAMS